The London School of Economics and Political Science

Venture Capital investments, exits and post-IPO performance

Milan Martinovic

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Declaration

I certify that the thesis I have presented for examination for the MPhil/PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

I declare that my thesis consists of 34395 words.

Statement of conjoint work

I confirm that Chapter 1 was jointly co-authored with Professor Axelson and I contributed 50% of this work.

Abstract

Chapter 1. We examine the determinants of success in venture capital transactions using the largest deal-level data set to date, with special emphasis on comparing European to US transactions. Using survival analysis, we show that for both regions the probability of exit via initial public offering (IPO) has gone down significantly over the last decade, while the time to IPO has gone up – in contrast, the probability of exit via trade sales and the average time to trade sales do not change much over time. Contrary to perceived wisdom, there is no difference in the likelihood or profitability of IPOs between European and US deals from the same vintage year. However, European trade sales are less likely and less profitable than US trade sales. Venture success has the same determinants in both Europe and US, with more experienced entrepreneurs and venture capitalists being associated with higher success. The fact that repeat or 'serial' entrepreneurs are less common in Europe and that European VCs lag US VCs in terms of experience completely explains any difference in performance between Europe and the US. Also, contrary to perceived wisdom, we find no evidence of a stigma of failure for entrepreneurs in Europe.

Chapter 2. Association of insiders' selling decision of VC-backed initial public offerings (IPOs) with the post-IPO long-run performance is analyzed. I find that the selling decision by insiders, measured as a fraction of shares sold by the selling stockholders to total shares sold in the offering, has significant positive association with the long-run profitability and negative association with the risk after the IPO. Furthermore, when venture capitalists sell shares in the IPO there is positive concave parabolic association between the selling decision and the post-IPO long-run market performance. However, venture capitalists selling of over-allotted shares and stock redemptions are not associated with superior post-IPO performance. Evidence on selling decision of venture capitalists confirms the importance of reputation as a factor affecting insiders' selling decisions.

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European Venture Capital: Myths and Facts

Ulf Axelson
London School of Economics
Milan Martinovic
London School of Economics

Abstract

We examine the determinants of success in venture capital transactions using the largest deal-level data set to date, with special emphasis on comparing European to US transactions. Using survival analysis, we show that for both regions the probability of exit via initial public offering (IPO) has gone down significantly over the last decade, while the time to IPO has gone up – in contrast, the probability of exit via trade sales and the average time to trade sales do not change much over time. Contrary to perceived wisdom, there is no difference in the likelihood or profitability of IPOs between European and US deals from the same vintage year. However, European trade sales are less likely and less profitable than US trade sales. Venture success has the same determinants in both Europe and US, with more experienced entrepreneurs and venture capitalists being associated with higher success. The fact that repeat or 'serial' entrepreneurs are less common in Europe and that European VCs lag US VCs in terms of experience completely explains any difference in performance between Europe and the US. Also, contrary to perceived wisdom, we find no evidence of a stigma of failure for entrepreneurs in Europe.

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I. Introduction

Entrepreneurial activity is key for long term growth, yet financing start-up firms is wrought with challenges. Not only does a potential entrepreneur need to have the skills, the ideas, and the courage to start a new venture, but maybe most critically, also needs to be able to convince outside investors to provide the necessary funds. Because of the information problems and inherent riskiness of new ventures, successfully financing start-up companies requires actively involved expert investors. Furthermore, getting a decent return on investments into start-up firms within a reasonable time frame requires that capital markets are developed enough to allow for exits either through an initial public offering (IPO) or trade sale.

There is a widely held perception among both investors and policy makers that Europe is lagging behind the US in most dimensions with respect to the financing of entrepreneurship. The pool of potential entrepreneurs is perceived to be smaller, maybe because of a "stigma of failure" (Landier (2006)). [1] The level of expertise amongst venture capitalists in Europe has also been criticised (see Kaplan, Martel, and Stromberg (2007)), and Hege, Palomino, and Schwienbacher (2005)). Finally, exit opportunities are purported to be less favorable. These are not wholly unfounded perceptions; previous research shows a significant underperformance of European venture capital (see, for example, Hege, Palomino, and Schwienbacher (2005), who study a small sample of European deals from 1997 to 2003 on which return data is available).

Our goal in this paper is to evaluate how successful European venture capital is relative to US venture capital using the most extensive deal-level data set developed to date, Dow Jones' Venture Source, and to analyse the main determinants of performance at

[1] This perception of a European stigma of failure is expressed in the following Communication by the European Commission from 1998: "In Europe, a serious social stigma is attached to bankruptcy. In the USA bankruptcy laws allow entrepreneurs who fail to start again relatively quickly and failure is considered to be part of the learning process. In Europe those who go bankrupt tend to be considered as "losers". They face great difficulty to finance a new venture."

the deal level. Due to both the long investment horizon and the private nature of the venture market, measuring performance at the deal level is challenging. Venture Source has cash flow information for a subset of deals, and wherever possible we complement the data with information from public sources. Still, for a significant number of deals we do not have exact return information due to either a lack of reported data or due to the fact that many deals in the data are yet to be exited. We therefore initially follow the extant literature (Bottazzi, Da Rin, and Hellman (2007), Sorensen (2007) and Gompers, Kovner, Lerner and Scharfstein (2006)) and measure success as either a successful exit through an IPO or a trade sale. We complement the exit analysis with return measures where feasible. We are also interested in the time it takes to exit, and how this has developed over time and across regions. In contrast to the studies mentioned above, we use survival analysis, which is the most natural econometric way to handle data of this sort.

Our dataset covers 35,798 companies that received VC investments between 1980 and 2011. 12,315 of these are in Europe (where the first year we use data from is 1995) and 23,483 in the US. We first confirm that US venture capital has indeed been substantially more successful on aggregate; a fraction of 38.8% had a successful exit over the entire period in the US compared to 25.3% in Europe.

We start by investigating the extent to which this difference depends purely on variables that have little to do with the relative merits of European vs. US venture capital, but purely depends on the timing, industry, and stage of investments. We show that much of the difference in success rates is due to differences in the timing of investments. Once we compare success rates between investment done in the US and in Europe in the same year, the estimated difference in probability of success between the US and Europe goes down from 16.6% to 9.1%. If we define success purely as exiting through an IPO, the difference between the US and Europe disappears completely once we control for the year of the investment – the entire difference is due to a lower probability of trade sales in Europe. Although success rates differ depending on the industry and life-cycle stage of the company at the time of the investment, differences in industry composition or stage of investment between the US and Europe explain none of the difference in success rates.

We also describe the general trend in exit probabilities and time to exit for the two regions. Perhaps not surprisingly for observers of the venture capital industry, there has been a remarkable shift downward in the probability of exit via IPOs in both regions, and contingent on doing an IPO, a significant shift upward in the average time to exit. What we find more surprising is that the process for trade sales is very stable over time, with little change in either the probability of exit or the time to exit.

We next go on to investigate the extent to which entrepreneurial characteristics and venture capitalist characteristics influence success rates. Similarly to Gompers et al (2010), we find that serial entrepreneurs, and in particular previously successful serial entrepreneurs, tend to do better on average in both regions. This explains part of the remaining difference in success rates between Europe and the US, since serial entrepreneurs account for only about 15% of deals done in Europe, but 35% of deals done in the US. For the subsample of companies with founders that are serial entrepreneurs, there is no difference in success between the two regions. We also find that a previously unsuccessful entrepreneur has at least as high a chance of getting financing for a new venture in Europe as in the US – hence, at least on this limited metric, we find no evidence for a ”stigma of failure” in Europe. We also find that female entrepreneurs and entrepreneurs with higher education (PhD or MD) tend to underperform.

We go on to relate success to the characteristics of venture capitalists. The experience of the venture capitalists on the board of the company – as measured by how many deals they have done relative to other VCs – is strongly related to success, and once we control for VC experience there is no difference in performance between the US and Europe. Since VC experience in Europe has gone up in the last couple of years, this is good news looking forward. We also find that having a VC represented on the board, having a VC that is specialized in the industry of the firm, using preferred shares, and syndicating deals are all features related to better performance, and that these variables have the same effect in the US and Europe.

We complement the exit analyses by investigating the profitability of deals conditional on exits. IPOs are more profitable than trade sales, but there is no difference in profitability conditional on exit between Europe and the US in the subset of deals

where profitability can be measured. However, there is evidence of a positive selection bias in the set of European trade sales – the set of trade sales for which we have no profitability information tend to have smaller buyers, which typically is a sign of lower profitability, Adjusting for the selection bias, European trade sales appear to be 5-7% less profitable than US trade sales.

After conditioning on exit type, VC experience has no effect on profitability, while entrepreneurial experience does seem to increase profitability. Having a VC on the board is associated with lower profitability conditional on exit, which together with the fact that VC board representation significantly increases the likelihood of a successful exit is consistent with VCs being able to push a larger set of marginal firms to successful exits when they have board power.

We corroborate the findings above by performing an analyses where we impute return measures for deals where we have no return information, so that we directly can analyse determinants of returns without having to condition on successful exits. Although this exercise requires a number of judgement calls that may decrease the level of trust one has in the results, it is comforting that the results are completely consistent with our survival analysis.

Finally, we find that the effects noted above seem quite uniform across different European countries. There is some evidence of difference in performance across European countries, with the UK performing the best and Germany and the Benelux countries performing the worst.

The remainder of the paper is structured as follows. In the next section we describe our data sources, provide some general descriptive statistics, and perform our initial examination of exit rates. Section III investigates the effects of entrepreneurial and venture capitalist characteristics. Section IV concludes.

II. Data description and initial analysis

Our core data comes from Dow Jones' Venture Source (previously called Venture One). Venture Source, established in 1987, collects data on firms that have obtained venture capital financing. Firms that have received early-stage financing exclusively from individual investors, federally chartered Small Business Investment Companies, and corporate development groups are not included in the database. The companies are initially identified from a wide variety of sources, including trade publications, company Web pages, and telephone contacts with venture investors. Venture Source then collects information about the businesses through interviews with both venture capitalists and entrepreneurs. The data include the identity of the key founders, as well as the industry, strategy, employment, financial history, and revenues of the company. Data on the firms are updated and validated through monthly contacts with investors and companies.[2]

Venture Source has quite good coverage of European deals since at least the year 2000. Table 1 describes the number of deals in the US and Europe covered by Venture Source, relative to the number of deals reported by the North American Capital Association (NVCA) for US and the European Venture Capital Association (EVCA) for Europe. The EVCA, in particular, pools together many later-stage buyout investments in their definition of venture capital, which explains the large numbers they report from 2001 to 2005. Venture Source does not suffer from this type of misclassification. It is clear from the table that the Venture Source coverage for Europe is somewhat spotty before the end of the 90's. The internet boom around 2000 and the following bust is evident for both samples. Figure 1 shows the number of distinct firms in our sample over time and across regions.

For most of the analysis we will disregard European deals done before 1995, a period in which Venture Source covers less than 100 deals per year and a very small fraction relative to the coverage in the EVCA data. We leave these deals out because of a

[2] The description in this paragraph of Venture Source is borrowed from Gompers, Lerner, and Scharfstein (2010).

concern that these earlier European deals are not representative of the full sample. In particular, although the fraction of exits in these early cohorts is quite high (see Table 4), a very large proportion of exits happen after more than 10 years after the initial investment – leading to a concern that only deals with successful and late exits were picked up in the dataset.

Table 2 reports the split-up of firms in our sample across industries and stages of investment. The industry compositions are remarkably similar across the two regions, with the largest industry being Internet and Computer which represents 40% of all deals in both regions, followed by Biotech and Healthcare which represents around 20% of all deals. Early stage investment is more common in the US, whereas European venture capitalists invest more in revenue-generating businesses – revenue generating and profitable businesses represent 59% of all first-time investments in Europe, and 43% in the US. Table 3 gives the size of the initial investment by VCs, and, for the subsample in which we have this data, the post-money valuations at the time of the first investment. The initial ownership stake of VCs is the amount invested divided by the post-money valuation. Both amounts invested and valuations are higher in the US than in Europe; the average amount invested in the US is $5.7 million while it is $3.1 million in Europe, and the average post-money valuation in the US is $18 million while it is $11 million in Europe (all in 2005 dollars). Initial ownership stakes by VCs in both regions are around 30%.

Table 4 reports the number of IPOs and trade sales for Europe and the US by vintage year (defined as the year of the first investment by a venture capitalist). The total fraction of successful exits over the whole period for Europe is 25.0% (4.7% for IPOs and 20.3% for trade sales), where the corresponding number for the US is 37.4% (9.2% for IPOs and 28.2% for trade sales). The differences in success rates are highly statistically significant; Europe is clearly underperforming the US according to this metric.

The difference in successful exit probability between Europe and the US appears big, but is misleading due to the difference in distribution over time of the deals made in the two regions. Figure 2 plots the fraction of IPOs and trade sales over vintage years for the two regions (with bands of one standard error of the mean above and below

indicated); the average difference in success rates looks much smaller once time effects are taken into account. In fact, for IPOs, there is no statistical difference in success rates between the two regions. Trade sales, however, are more common in the US than in Europe even controlling for the year of the investment.

It is also apparent from Figure 2 that success rates go down over time. A large part of this pattern can be explained by the fact that the final outcome for the investments made in the later part of the sample are still uncertain – many may still be exited successfully given enough time. Using survival analysis, we can modify our estimates of success probabilities to take this into account. A survival model assumes that a firm has a certain probability of going to IPO, being subject to a trade sale, or being liquidated at every point in time that it is still "alive", so that a firm that has an earlier investment year is subject to more chances of exit over time. More precisely, we do this by modelling the "hazard rate" $h_{j,i}(t)$ for type of exit i (IPO or trade sale) at time t since first VC financing for firm j. The hazard rate can be interpreted as the probability of exit during one unit of time conditional of not having exited up to time t. We use a competing risk Cox proportional hazard model (see Cleves et al (2010) and Cameron and Trivedi (2005)), in which the hazard rates evolve according to:

$$h_{j,i}(t) = h_{0,i}(t) * exp(\boldsymbol{\beta}_{0,i} + \boldsymbol{x}_{j,i,t}\boldsymbol{\beta}_{x,i}),$$

where $h_0(t)$ is a non-parametric "base rate" to be estimated, $\boldsymbol{x}_{j,i,t}$ is a vector of potentially time-varying explanatory variables, and $\boldsymbol{\beta}_{0,i}$ and $\boldsymbol{\beta}_{x,i}$ are coefficients to be estimated. Once we have estimated hazard rates, we can calculate probabilities of exit and expected time to exit.

We start by non-parametrically estimating hazard rates without any explanatory variables for the two regions. The estimated cumulative density functions for IPOs and trade sales combined across the two regions are plotted in Figure 3a, while Figures 3b and 3c give the cumulative density for IPOs and trade sales separately. The estimation takes into account the fact that later deals may not have had time to exit yet. The total probability of exiting via an IPO is estimated to be 13.1% in the US and 6.2% in Europe, while for trade sales the corresponding numbers are 43.7% for the US and 34.0% for Europe. (These numbers can be read off the graphs in Figures 3b and 3c and are also reported in Table 5.) Exits tend to occur at the most intensive rate

between months 10 and 90, although a surprisingly large fraction of exits (almost 20%) occur more than 10 years after the initial investment. The median time to exit is four years (Table 5, Panel B).

Figure 3 hides important calendar time variation in the data, as it pools together all deals regardless of the year of investment. In figure 4, we provide cumulative density functions for exit for each cohort year from 1995 to 2010. Splitting up the sample across different vintage years provides several takeaways:

1. As noted above, the difference in success rates between the US and Europe goes down significantly (although it does not disappear) once we compare deals of the same vintage year. This is because European deals are relatively more prevalent in the later part of the sample, where success rates are lower globally.
2. Certain periods are related to higher exit rates for all cohorts and regions, especially the years 1999-2000.
3. US and European cumulative density functions look proportional.
4. Success rates have gone down more or less uniformly across time, and time to exit appears to have gone up across time.

In Figure 5, we separate between IPOs and trade sales. In both regions, IPO intensity is the highest between 1998 and 2000 and virtually dies out after this period, while trade sales happen more continuously through time. Finally, Europe and the US are much more similar in terms of the IPO process than the trade sales process. Europe does not seem to be underperforming with respect to IPOs once we control for the vintage year whereas Europe definitely underperforms with respect to trade sales.

We also note that for European trade sales, the earlier years (1995-1998) have a peculiar tendency for a large fraction of late exits. There is a concern that this might be due to misrepresentative data (old firms with late exits have a higher probability of being back-filled into the data.) Our results are robust to exluding these deals from the analysis.

Table 5 summarizes exit probabilities calculated with our hazard model for different time periods, regions, and exit types. IPO probabilities at all horizons have gone down by at least two thirds since the 90s, and conditional on an IPO, the time to exit has gone up. In contrast, both probability of exit and time to exit for trade sales stay remarkably constant throughout the sample.

Using these insights, we next estimate a model where we control for time explicitly. We do this by pooling observations across regions, adding yearly calendar time dummies, and a European dummy. The idea behind the calendar time dummies is that market conditions in a given year affect the probability of exit in that year for all cohorts of "live" firms in a proportional way. Table 8 reports the results from this regression. Specifications 1 to 3 combines IPOs and trade sale exits, specifications 4 to 6 look only at IPOs, while specifications 7 to 9 look only at trade sale exits. For each type of exit, we use three sets of explanatory variables: First, a Europe dummy only (specifications 1, 4, and 7); second, calendar time dummies (specifications 2, 5, and 8), and third, both time, industry, stage, and round fixed effects (specifications 3, 6, and 9).

We note that IPOs and trade sales have very different characteristics. Calendar time variation is much more important for IPOs. All of the difference in IPO rates between the US and Europe are explained by time variation, whereas none of the difference with respect to trade sales is. Combining IPOs and trade sales, the coefficient on the European dummy in Specification 3 (which includes all fixed effects) is negative 0.265. Interpreted in probability terms, this means that European deals have 9.1 percentage points lower probability of exiting, while the corresponding number without controlling for time fixed effects is 16.6 percentage points.

Also, in unreported regressions we confirm that controlling for the vintage year of the investment does not add much once calendar time dummies are introduced, and clustering by vintage year does not change the qualitative nature of the results. The results also remain qualitatively the same if we restrict ourselves to deals done 1999 or later.

Figure 6 plots the time dummies for IPOs and trade sales separately. This figure illustrates the volatility of the IPO market relative to the trade sales market, and the decline in IPOs in the last decade.

IIB: Public Market Equivalent Measures of Profitability

We measure deal performance using the public market equivalent (PME) measure suggested by Kaplan and Schoar (2005). The PME compares an investment in a venture deal to an investment in a broad stock market index made during the same time period. We use the CRSP NYSE/Amex/NASDAQ Value-Weighted Market Index as the benchmark public index. We implement the PME calculation by discounting (or investing) the exit value to venture capitalists in a deal using the CRSP index total return and comparing the resulting value to the discounted value of the cash investments made by venture capitalists into the deal, again using the total return to the CRSP index. Using this approach, a deal with a PME greater than one has outperformed the CRSP index gross of fees. Under the assumption that the representative investor holds the market and has log utility, Jagannathan and Sorensen (2013) show that the PME measure represents an estimate of the risk-adjusted excess return.

Table 4 shows the coverage in our data of cash flow information necessary to calculate the PME of a deal. Note that failed deals have a PME of zero (or a return of -100%), so no cash flow information is necessary for failed deals. For IPOs, we have return information for the majority of deals (77% in Europe and 91% in the US), while a smaller fraction of trade sales have return information (33% in Europe and 50% in the US). For some tests, we resort to a rougher measure of performance for trade sales without return information by checking whether the buyer was big, medium, or small, and imputing the PME for these categories. Table 7 shows the distribution of buyer types in trade sales across the two regions and median PMEs within buyer types. PMEs are increasing in buyer size. As can be seen in Table 6, European trade sales where we lack return information more commonly have small buyers than in the US, which introduces an upward selection bias in reported European trade sale returns. We try to remedy this problem for some tests by including imputed returns where information is missing.

Table 6 shows descriptive statistics on PMEs over time for the two regions conditional on IPOs or trade sales, including only deals for which we have return information. A pooled PME, in contrast to a deal-level PME, is calculated by adding all the cash flows of a group of deals together in a portfolio and calculating a PME for the portfolio. If one pools all European IPOs over all time periods, the portfolio has a PME of 3.18, while a portfolio of US IPOs has a PME of 3.12. This difference flips if one compares pooled vintage year PMEs for the two regions (reported in the first two columns, and plotted in Figure 11). In an average year, the pooled PME for US IPOs is 0.62 higher than the pooled PME for European IPOs, but the difference is not statistically significant. When comparing deal-level PMEs (columns 3 and 4, and plotted in Figure 12), and controlling for vintage year, the difference again flips – European deal-level PMEs are on average .46 higher than US deal-level PMEs, but the difference is not statistically significant. Overall, our conclusion is that IPO PMEs are similar for the two regions after controlling for the vintage year.

Columns 5 to 8 of Table 6 report pooled and deal-level PMEs for trade sales, and here European trade sales are uniformly lower, but the difference is close to zero and insignificant. However, these numbers are not corrected for the positive selection bias of European trade sales for which we have return data. The regressions in Table 8b illustrates the bias. Columns 7 to 9 regresses trade sales PMEs including imputed PMEs where return information is missing, and shows that trade sale PMEs in Europe are about 7% lower than in the US even after controlling for vintage year. We also try to push the PME analysis one step further by directly measuring PMEs for all deals rather than conditioning on successful exits. This requires a few extra leaps of faith. First, since we have little direct evidence about whether deals are dead or still have some chance of a successful exit, we have to make a judgement call in designating dead deals (which are included in the analysis as deals with a PME of zero). We assume that of all deals not exited or directly classified as dead by 2006, those deals who did not have a future financing round by 2011 are dead. Also, in order to keep the balance of successful exits the same in Europe and the US, we have to impute PMEs for all IPOs and trade sales for which we do not have return information. For trade sales, we do this by assuming the PME for a trade sale without return information is the same as for the median PME with the same buyer type in the same region (numbers

reported in Table 7). For IPOs, we assume the IPO had the same PME as the median IPO in the same year in the same region. Average PMEs using this procedure are plotted in Figure 18 for the two regions, together with upper and lower quartile bands. The average can be misleading as it is sensitive to outliers, but the median is uninteresting as it is typically zero.

Column 1 of Table 12c shows that this "total PME" measure is about 20% lower in Europe than in the US if one does not control for time, consistent with the result on exit probabilities. Column 2 of Table 12c includes year, industry, stage, and round fixed effects, which increases the European dummy from -0.19 to -0.09, but it is still highly significant. This reflects the lower probability and profitability of trade sales in Europe.

III. Entrepreneurial and Venture Capitalist Variables

We now go on to investigate the role of the entrepreneurial climate and the sophistication of VCs for success rates.

IIIA. Entrepreneurial variables

Having a large pool of good potential entrepreneurs is obviously important for a successful entrepreneurial climate, as is the capability of separating the good entrepreneurs from the bad when financing decisions are made. Using the Venture Source data for US firms financed up to 2003, Gompers et al (2010) have shown evidence of persistent skill differences between entrepreneurs, and evidence that venture capitalists are able to identify these skills in their financing decisions. More specifically, they provide three insights. First, entrepreneurs that get financing for a second venture are more likely to have been successful in their first venture than the total population of entreprenurs, showing that venture capitalists do believe that success is a signal of persistent skill (or, alternatively, that entrepreneurs who have been successful are more eager to start a second venture than other entrepreneurs). Secondly, these entrepreneurs are more successful on average in their second venture

than the general population, showing that VCs appear to have been justified in their belief that success predicts success. Finally, they show that entrepreneurs who were unsuccessful in their previous venture but still get financing for a second venture perform no worse than the average entrepreneur. This last finding is consistent with VCs screening properly when financing previously unsuccessful entrepreneurs.

The results in Gompers et al (2010) also suggest that the existence of a pool of serial entrepreneurs may be important for the success of the venture industry. First, this pool of proven entrepreneurs can be dipped into when financing new ventures. Second, it may be that experience itself (whether positive or negative) can build skill for future ventures. The existence of such a pool may be threatened if society attaches a high "stigma of failure" to failed entrepreneurs (see Landier (2006)), and several people have argued that Europe is in the "bad equilibrium" where potential entrepreneurs are discouraged from trying out new ventures from a fear of the consequences of failure.

We extend the analysis in Gompers et al (2010) to also cover European entrepreneurs, and make some preliminary investigation into the existence of a stigma of failure in Europe. Venture Source tracks the identity and some characteristics of founders in entrepreneurial firms. We classify an entrepreneur as being experienced if Venture Source indicates him or her as having been a founder of a previous venture. This may involve ventures that are not covered in the database. When a previous venture of an entrepreneur is covered in the database, we can also measure whether the venture had a successful exit or not. For a venture with several founders, we classify the firm as having experience if one of the founders has experience, and we classify a previous venture as being successful if one of the founders had a successful experience.

The proportion of firms with a founder with an entrepreneurial background is reported in Figure 7. Since 1995, this proportion is around 35% in the US and around 15% in Europe, with fairly small yearly variations. Hence, we confirm that venture capitalists in the US seem to be able to dip into a deeper pool of experienced entrepreneurs.

In Figure 8 we investigate the stigma of failure by looking at how many of the repeat entrepreneurs getting financing were unsuccessful in their previous venture. Using this measure, there is no evidence for a larger stigma of failure in Europe relative to

the US – in fact, the proportion of firms with entrepreneurs who previously failed is larger in Europe than the US.

Figure 9 shows success rates (combining IPOs and trade sales) for first time entrepreneurs and serial entrepreneurs in the two regions. Success rates are somewhat higher for repeat entrepreneurs (in their later ventures) both in Europe and in the US. The figures also show that the first venture of entrepreneurs who later become repeat entrepreneurs do much better on average than other first ventures. This is not surprising, as unsuccessful first time entrepreneurs are less likely to get financing for a second venture. The pattern looks similar in Europe and the US, and is consistent with a story in which venture capitalists rationally update their beliefs about the talent of entrepreneurs after observing their first venture.

We go on to examine the extent to which entrepreneurial characteristics can explain the difference in success rates between the US and Europe in a regression framework. Table 9 reports the results. Note that we have to restrict the analysis to the subset of data where we have enough information about founders, which reduces the set of firms from 35,798 to 34,887. Although the set of firms without founder data have lower success rates on average, dropping these observations does not seem to affect our general results.

In Specification 1, we include experience of the founders of a firm, and, for the set of firms that have founders that are serial entrepreneurs and where data availability allows, whether previous ventures where successful or not. Founder experience is strongly related to success. For the observations where we have data on the success on previous ventures, we confirm the result in Gompers et al (2010) that the better performance of serial entrepreneurs is mostly driven by the previously successful serial entrepreneurs. Including the entrepreneurial variables partly explains the difference between the US and Europe (the coefficient on the Europe dummy goes from negative 0.265 in Specification 3 of Table 8 to negative 0.229, which corresponds to a decrease in the difference in success rates from 9.1 percentage points to 8.3 percentage points).

In Specifications 2 and 3, we split the sample into the set of firms with experienced founders (Specification 2) and inexperienced founders (Specification 3). For the set of firms with experienced founders, there is no difference in success rates between Europe and the US. The difference comes entirely from the set of firms with inexperienced founders, where Europe does significantly worse.

In Specification 4, we introduce other characteristics of entrepreneurs, as well as interaction terms on explanatory variables with the European dummy to investigate whether entrepreneurial characteristics have the same effect in Europe as in the US. Founders with a PhD or an MD degree are associated with lower success rates, especially in Europe. Female founders are also associated with significantly lower success rates. This is consistent with venture capitalists being more willing to finance marginal ventures backed by highly educated or female founders than other founders. Founder experience is significantly more strongly associated with success in Europe than in the US. Finally, in Specifications 5 and 6, we run competing risk models for exit via IPO and trade sales separately. Here, we use as a measure for success on previous venture only exits via IPOs in Specification 5 and only exit via trade sales in Specification 6. As before, IPOs are no less likely in Europe than in the US, whereas trade sales are less likely in Europe. For IPOs, the main differences to the regressions on aggregate exits are that all experience and success measures seem more significant, and that having a founder with a PhD or MD is now significantly positively related to success. For trade sales, the opposite seems to hold.

Table 9b reports the results when we regress IPO and trade sale PMEs on the same explanatory variables. The European dummy is very close to zero when we use specifications with actual returns, while it remains negative when imputed trade sales are included. Experience of the entrepreneur seems to have a positive effect on performance also conditional on a successful exit, while previous success does not. Hence, previous success seems mostly important for increasing the likelihood of a successful exit, not for increasing performance conditional on a successful exit.

Column 4 of Table 12c shows a regression of total PMEs on entrepreneurial characteristics. All variables have the same effect as for exit probabilities, and the

European dummy increases from -0.0891 to -0.0685 when entrepreneurial characteristics are included, consistent with our exit analysis.

IIIB. Venture capitalist and contracting variables

It has been shown in several studies that venture capitalist experience is related to the success of ventures (see Sorensen (2007), Gompers et al (2010), Gompers, Kovner, and Lerner (2009), and Hochberg, Ljungquist, and Lu (2007)). This could be either because of influence (experienced VCs are better at bringing firms to exit through value-added advice, monitoring, or resources) or sorting (experienced VCs are better at picking good firms to invest in, or the good firms choose to go with the more experienced VCs). For our main purpose, which is to check the extent to which the degree of VC sophistication can explain differences in success rates between the US and Europe, it is not crucial to distinguish between the influence and the sorting channel.

We follow Gompers et al (2010) and define experience for a particular VC with board representation at a company as the log of one plus the number of prior companies in which the VC has invested minus one plus the average number of previous investments undertaken by venture capital firms in the year of the investment. If there is more than one venture capital firm represented on the board, we define VC experience for that firm as the maximum of the experience amongst the different VCs. We also create an individual-specific measure of experience for the particular partner of the VC firm represented on the board to investigate whether VC firm experience or particular partner experience seems more important.

Following Gompers, Kovner, and Lerner (2009), we also measure the extent to which VC or partner specialisation is related to success. We measure specialisation as the fraction of previous deals done by the venture capitalist or partner in the same industry as the current company, out of all deals done by the venture capitalist or partner previously. If there are several VCs / partners represented on the board, we take the maximum across these. We require that a VC / partner has done at least 5 / 3 deals previously in total, otherwise we set specialisation to zero.

We also measure whether a firm is financed by a syndicate or not, as syndication has been related to success in previous studies (see e.g. Hege, Palomino, and Schwienbacher (2009), and Bottazzi, Da Rin, and Hellmann (2008)). Finally, Venture Source sometimes has information about whether VCs use preferred shares or not. Kaplan, Martel, and Strömberg (2007) argue that what they term "US style contracts", which prominently includes relying on convertible preferred securities rather than straight equity for the venture capitalist, is a better way of contracting and leads to higher success rates. We do not know exactly what type of contracts are captured by Venture Source's classification of "preferred shares", and this information is also missing for a large set of companies, but our results (see below) are in line with the findings in Kaplan, Martel, and Strömberg.

Table 10 shows the number of distinct venture capital organisations represented in our dataset across the two regions and across time in our dataset, as well as the number of deals associated with each organisations. Note that we only have this information for VCs that are represented on the board of companies. In total, 5,131 distinct US VC organisations and 2,388 European VC organisations were active during some part of the period covered by our data.

Figure 10 shows the median VC experience measure over time for the two regions, as well as the interquartile range. The US has on average higher experience, but the difference has become smaller over time. Still, in 2010, the median experience for European VCs was as small as the 25^{th} percentile of US VCs, whereas the 75^{th} percentile European VC was no more experienced than the median US VC.

Table 11 shows the results of a multivariate regression of success including VC characteristics as explanatory variables. One problem is that we can only calculate VC characteristics when we have board data, and this information is missing for 8,940 out of our 35,798 portfolio companies. To investigate whether the remaining observations constitute a biased sample, we first run a regression over the whole sample including a dummy for whether we have board data or not (Specification 1 of Table 11). The observations without board data have significantly lower success rates. Furthermore, once we control for whether we have board data or not, the European dummy goes up significantly (from negative 0.265 to negative 0.226). This is partly

due to the fact that proportionately more of the European deals have missing board data. However, we also show that Europe seems to be doing proportionately worse on these deals relative to the deals with board data. In Specification 2 we run the same regression on only the observations with board data, and here the European dummy goes up to negative 0.178 but is still highly significant. In Specification 3 we run the same regression for the subsample without board data, where the European dummy goes down to negative 0.492. Columns 3 and 5 of Table 12c show the same pattern in total PMEs; firms with board data tend to have higher PMEs and Europe has fewer firms with board data. To summarise, this means that our investigation of the subsample with board data is likely to underestimate the difference between Europe and the US in the total sample. Bearing this in mind, we go on to investigate the explanatory power of venture capitalist variables for success rates.

Specification 4 of Table 11 shows our main result, which is that once we control for whether the VC has a seat on the board or not, and if so, how experienced the VC is, there is no difference in success rates between Europe and the US. Having VC board representation and VC experience are both associated with success, and as is obvious from Figure 10, European venture capitalists have lower experience on average than US VCs.

Specification 5 introduces VC specialisation, which is also positively related to success. Specification 6 uses experience and specialisation measures for the individual partners sitting on the board instead of the VC firm they represent. The results are qualitatively the same; partner experience and specialisation are positively related to success. When we run both VC and partner variables together (Specification 7), it appears that VC firm experience is more important than partner experience, whereas partner specialisation is more important than VC firm specialisation. In the remaining tests we therefore keep these two explanatory variables. In unreported regressions, we interact all variables with the European dummy, but these interaction variables are insignificant, indicating that explanatory variables have the same effect in Europe and the US.

In Table 12, Specification 1, we also include our entrepreneurial variables. Although the direction of all variables is the same as before, the European dummy becomes

significantly positive once we control for both VC and entrepreneurial experience. This is even more so in Specification 2, where we also introduce dummies for whether the deal is syndicated and whether preferred shares are used (both variables are significantly related to success). Specifications 3 and 4 do the same analysis for IPOs only. European deals very strongly outperform with respect to IPOs once we control for VC and entrepreneurial experience. However, as is shown in Specifications 5 and 6, Europe still underperforms with respect to trade sales.

Table 12b reports the effect the venture capitalist variables have on PMEs conditional on successful exits. What stands out here is that VC board representation and VC experience if anything have a negative effect on conditional performance, as opposed to the positive effect these variables have on the probability of a successful exit. This is not necessarily puzzling. It is possible that VC experience and board representation will make more marginal firms attain a successful exit, which can pull down performance conditional on exit even if the net effect on firms is beneficial. This hypothesis is corroborated in our regression of total PME measures on VC characteristics in Columns 6 and 7 of Table 12c, where all variables have the same impact as they have on successful exit probabilities. These specifications also show that the European dummy becomes significantly positive (at around 0.07) once VC experience is controlled for in the PME regressions.

Finally, in Table 13, we introduce country fixed effects into the regression to see whether there are significant differences across different regions of Europe and whether accounting for these changes any of our previous conclusions. The answer to both these questions is no; the coefficient on most country dummies stay close to the previously estimated coefficient on the European dummies, and all other variables have virtually the same coefficients. The difference we do find is that the UK appears to do better than the median country in Europe, while Germany and the Benelux countries appear to do worse in most specifications. However, Germany does extremely well when we look at IPOs only, perhaps related to the Neue Markt.

IV. Conclusions

We examine the determinants of success in venture capital transactions using the largest deal-level data set to date, with special emphasis on comparing European to US transactions. Using survival analysis, we show that for both regions the probability of exit via initial public offering (IPO) has gone down significantly over the last decade, while the time to IPO has gone up – in contrast, the probability of exit via trade sales and the average time to trade sales do not change much over time. Contrary to perceived wisdom, there is no difference in the likelihood or profitability of IPOs between European and US deals from the same vintage year. However, European trade sales are less likely and less profitable than US trade sales. Venture success has the same determinants in both Europe and US, with more experienced entrepreneurs and venture capitalists being associated with higher success. The fact that repeat or 'serial' entrepreneurs are less common in Europe and that European VCs lag US VCs in terms of experience completely explains any difference in performance between Europe and the US. Also, contrary to perceived wisdom, we find no evidence of a stigma of failure for entrepreneurs in Europe.

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Table 1: VC investment amount per year (Million US dollars)

The table shows current US dollar amounts (in millions) invested by venture capitalists in a given year, as captured by Venture Source, the European Venture Capital Association (EVCA), and the North American Venture Capital Association (NVCA).

	Europe		United States	
Year	Venture Source	EVCA	Venture Source	NVCA
1980			7	
1981	0		74	
1982			267	
1983	9		1498	
1984	0		1711	
1985	3		1996	
1986	8		1967	
1987	7		2123	
1988	17		2072	
1989	13	2336	2409	
1990	21	2980	2727	
1991	10	3417	2729	
1992	29	3146	3480	
1993	53	2443	3833	
1994	60	3089	4654	
1995	136	3390	6703	7313
1996	334	3952	9664	10568
1997	562	4618	12941	14137
1998	1444	6703	17413	19780
1999	5567	11369	48058	51329
2000	18270	18140	91903	99158
2001	9043	10912	35702	38065
2002	4870	9255	21779	20850
2003	3842	9470	19369	18614
2004	4868	12776	22447	22355
2005	4808	15791	23806	22946
2006	5656	21677	29730	26594
2007	6378	8491	32023	30826
2008	6927	10087	30879	30546
2009	4750	5748	23969	19746
2010	6210	4978	29511	23263
2011	4153		22730	28425
Total	88048	174767	510172	484516

Table 2: Industry and Stage composition across regions

The table shows fraction of deals across regions that fall into different industries and into different stages of investments.

	Europe		US		Europe & US	
Industry Group	# of deals	% of total	# of deals	% of total	# of deals	% of total
Biotech and health care	2,251	18.1%	4,881	20.8%	7,132	19.8%
Business services	1,260	10.1%	2,052	8.7%	3,312	9.2%
Business/industrial	638	5.1%	596	2.5%	1,234	3.4%
Communications and electronics	1,660	13.3%	4,404	18.7%	6,064	16.9%
Consumer	873	7.0%	1,266	5.4%	2,139	5.9%
Energy	395	3.2%	404	1.7%	799	2.2%
Financial services	303	2.4%	671	2.9%	974	2.7%
Internet and computer	5,011	40.2%	9,156	39.0%	14,167	39.4%
Other	66	0.5%	76	0.3%	142	0.4%
Total	12,457	100.0%	23,506	100%	35,963	100.0%
Stage of investment						
Startup	1,864	15.0%	3,940	16.8%	5,804	16.1%
Product Development	3,111	25.0%	7,748	33.0%	10,859	30.2%
Product In Beta Test	143	1.1%	693	2.9%	836	2.3%
Generating Revenue	6,965	55.9%	9,257	39.4%	16,222	45.1%
Profitable	371	3.0%	914	3.9%	1,285	3.6%
Restart	3	0.0%	50	0.2%	53	0.1%
N/A	0	0.0%	904	3.8%	904	2.5%
Total	12,457	100.0%	23,506	100.0%	35,963	100.0%

Table 3: Investment amounts and valuations across regions (2005 million US dollars)

The top panel shows the amount invested by VCs in the first round of financing by VCs in 2005 US dollars (millions). The bottom panel shows post-money valuations, where available, at the first round of VC financing.

Panel A: Funds invested at the time of the first VC financing round (in millions 2005 USD)

	Europe					US				
	percentile				# of	percentile				# of
Stage of investment	25th	50th	75th	mean	deals	25th	50th	75th	mean	deals
Startup	0.30	0.75	1.85	2.38	1472	0.61	1.32	3.26	2.84	3500
Product Development	0.52	1.28	3.14	3.34	2458	1.41	3.45	6.87	6.15	7118
Product In Beta Test	0.46	1.30	3.07	3.05	101	1.74	3.10	5.51	4.34	632
Generating Revenue	0.55	1.34	3.11	3.11	4960	1.67	3.55	7.19	6.49	8088
Profitable	0.80	1.94	4.39	3.98	313	2.34	5.07	10.53	10.10	839
Restart	0.27	1.88	1.89	1.35	3	1.19	2.25	5.19	3.76	48
N/A					0	0.93	2.24	4.39	3.32	788
Total	0.49	1.24	2.95	3.09	9307	1.29	3.06	6.32	5.72	21013

Panel B: Valuations at the time of the first VC financing round (in millions 2005 USD)

	Europe					US				
	percentile				# of	percentile				# of
Stage of investment	25th	50th	75th	mean	deals	25th	50th	75th	mean	deals
Startup	1.08	2.63	5.79	7.05	711	2.37	4.56	8.77	7.83	1234
Product Development	1.92	4.34	10.07	9.11	979	5.27	9.63	16.75	15.25	2886
Product In Beta Test	1.75	4.22	9.12	9.96	33	5.26	9.99	17.55	13.31	239
Generating Revenue	2.30	5.34	11.93	12.07	2032	6.38	12.24	24.28	23.24	2928
Profitable	3.69	8.43	18.42	26.86	162	8.77	17.55	41.58	36.73	367
Restart	5.40	5.40	5.40	5.40	1	3.23	4.75	10.53	6.89	27
N/A					0	3.78	7.09	13.55	12.75	88
Total	1.90	4.53	10.45	11.01	3918	4.92	9.65	18.42	17.98	7769

Table 4: Success rates across regions and years

The table shows fraction of deals for a given investment year that subsequently underwent an IPO or a trade sale, and the fraction of IPOs and trade sales for which we can calculate PME measures. The last two columns tests the difference in means between Europe and the US for IPOs and trade sales, respectively. A positive (negative) t-statistic with absolute value larger than 2 means that Europe has a higher (lower) success rate at the 95% significance level. The t-tests in the last row is for difference in means for total success rates across times.

	Europe					US					t-test of means	
Year	# deals	IPO	Trade Sales	%IPO w. PME	%Trade Sales w. PME	# deals	IPO	Trade Sales	%IPO w. PME	%Trade Sales w. PME	IPO	Trade Sales
<1980	1	0.0%	100.0%		0.0%	23	69.6%	26.1%	5.9%	0.0%	.	.
1980	1	100.0%	0.0%			18	83.3%	5.6%	46.7%	0.0%	.	.
1981	2	0.0%	100.0%		0.0%	54	38.9%	22.2%	52.4%	60.0%	-1.108	2.913
1982	0					141	29.1%	34.8%	50.0%	43.8%		
1983	3	0.0%	33.3%	0.0%	0.0%	340	20.3%	34.7%	62.1%	39.4%	-0.871	0.025
1984	1	0.0%	100.0%		0.0%	328	22.6%	41.8%	63.9%	37.7%	.	.
1985	4	100.0%	0.0%	33.3%	100.0%	324	25.3%	34.9%	78.2%	29.4%	3.425	-1.400
1986	4	0.0%	25.0%		100.0%	278	29.9%	35.6%	89.2%	34.8%	-1.300	-0.341
1987	3	33.3%	0.0%	0.0%	0.0%	278	30.9%	37.1%	88.4%	45.5%	0.089	-1.294
1988	8	50.0%	37.5%	50.0%	66.7%	248	40.3%	35.5%	92.0%	45.6%	0.547	0.336
1989	14	42.9%	35.7%	33.3%	0.0%	260	37.3%	38.5%	92.6%	42.7%	0.416	0.025
1990	11	27.3%	18.2%	100.0%	50.0%	269	27.5%	39.0%	91.7%	50.0%	-0.017	-1.215
1991	12	25.0%	25.0%	0.0%	0.0%	249	39.8%	36.5%	94.6%	60.2%	-1.022	-0.652
1992	20	30.0%	30.0%	66.7%	0.0%	341	31.1%	43.4%	95.1%	59.3%	-0.102	-1.003
1993	24	37.5%	25.0%	66.7%	40.0%	367	28.6%	38.4%	98.0%	66.4%	0.927	-0.986
1994	34	11.8%	47.1%	33.3%	21.4%	417	27.8%	39.6%	97.3%	73.4%	-2.042	1.026
1995	71	18.3%	32.4%	75.0%	40.0%	561	23.5%	42.2%	97.7%	59.3%	-0.985	-1.428
1996	116	19.0%	36.2%	50.0%	35.1%	808	22.5%	45.5%	98.8%	70.7%	-0.864	-1.523
1997	241	14.9%	31.1%	86.7%	32.4%	911	16.2%	45.0%	98.6%	69.1%	-0.493	-3.661
1998	520	12.9%	39.6%	77.0%	34.8%	1,073	12.6%	44.4%	97.8%	66.2%	0.170	-1.401

1999	1,170	11.2%	34.7%	82.1%	41.2%	2,086	5.8%	42.1%	98.3%	52.9%	5.553	-4.011
2000	2,539	5.0%	29.7%	85.2%	31.0%	2,897	2.9%	37.1%	98.8%	47.8%	4.009	-5.778
2001	1,201	3.3%	26.8%	88.4%	27.6%	1,101	4.2%	36.1%	97.6%	46.7%	-1.071	-4.204
2002	606	4.3%	28.2%	88.9%	35.3%	715	4.8%	34.4%	100.0%	50.2%	-0.404	-2.359
2003	522	4.6%	24.5%	70.8%	37.0%	691	2.5%	34.9%	94.4%	53.4%	2.041	-3.684
2004	556	4.0%	18.5%	80.0%	42.9%	867	3.3%	29.4%	93.5%	45.2%	0.606	-4.217
2005	586	1.5%	16.7%	55.6%	27.8%	984	1.7%	22.0%	100.0%	43.3%	-0.288	-2.442
2006	739	1.8%	11.8%	54.5%	33.3%	1,168	1.5%	21.7%	100.0%	46.6%	0.519	-5.197
2007	943	0.5%	10.7%	16.7%	30.4%	1,399	0.9%	12.9%	71.4%	34.3%	-0.916	-1.555
2008	786	0.8%	4.2%	83.3%	17.1%	1,400	0.2%	9.9%	100.0%	36.9%	1.925	-4.654
2009	611	0.7%	2.3%	100.0%	28.6%	994	0.2%	7.5%	100.0%	33.3%	1.445	-4.364
2010	649	0.2%	1.5%	0.0%	33.3%	1,059	0.4%	2.7%	50.0%	34.6%	-0.830	-1.733
2011	459	0.0%	0.0%			857	0.0%	0.6%		0.0%	.	-1.640
total	12,457	4.7%	21.0%	77.4%	33.2%	23,506	9.2%	29.6%	90.6%	52.0%	-15.342	-17.532

Table 5: Summary success rates and exit times across regions and years

Panel A shows estimated probability of exit within a certain time frame from first round of VC financing. Probabilities are estimated using a Kaplan-Meier estimator for each specific region and time frame. Panel B shows median exit times in months conditional on exit within a certain time frame, together with the interquartile range (25th percentile and 75th percentile).

Panel A

		IPO probability				Trade Sale probability			
		US		Europe		US		Europe	
		Prob.	st.error	Prob.	st.error	Prob.	st.error	Prob.	st.error
Ever:	Whole sample	13.1%	(0.31%)	6.2%	(0.30%)	43.7%	(0.52%)	34.0%	(1.35%)
Within 10	Whole sample	11.0%	(0.24%)	5.6%	(0.24%)	35.8%	(0.37%)	27.9%	(0.50%)
years:	1995-1999 vintages	12.5%	(0.45%)	12.2%	(0.71%)	40.0%	(0.66%)	32.2%	(1.01%)
	2000-2003 vintages	3.1%	(0.24%)	4.4%	(0.30%)	35.5%	(0.66%)	27.8%	(0.65%)
Within 5	Whole sample	6.9%	(0.18%)	3.5%	(0.18%)	21.2%	(0.29%)	14.8%	(0.35%)
years:	1995-1999 vintages	10.2%	(0.41%)	8.3%	(0.60%)	26.3%	(0.60%)	14.4%	(0.76%)
	2000-2003 vintages	1.4%	(0.16%)	2.9%	(0.24%)	20.9%	(0.55%)	17.1%	(0.54%)
	2004-2007 vintages	1.2%	(0.18%)	1.7%	(0.24%)	18.3%	(0.61%)	12.5%	(0.65%)
Within 2	Whole sample	2.3%	(0.10%)	1.7%	(0.12%)	7.0%	(0.17%)	4.0%	(0.18%)
years:	1995-1999 vintages	4.8%	(0.29%)	5.1%	(0.48%)	10.5%	(0.42%)	4.2%	(0.44%)
	2000-2003 vintages	0.2%	(0.06%)	1.2%	(0.15%)	6.9%	(0.35%)	4.9%	(0.31%)
	2004-2007 vintages	0.1%	(0.06%)	1.1%	(0.19%)	5.0%	(0.33%)	3.5%	(0.34%)
	2008-2011 vintages	0.2%	(0.08%)	0.5%	(0.17%)	6.1%	(0.46%)	2.2%	(0.36%)

Panel B

		IPO time to exit (months)				Trade Sale time to exit (months)			
		US		Europe		US		Europe	
		Med.	(25;75)	Med.	(25;75)	Med.	(25;75)	Med.	(25;75)
Ever:	Whole sample	46	(26;73)	37	(18;70)	49	(27;78)	52	(30;78)
Within 10	Whole sample	43	(25;66)	36	(17;66)	45	(26;70)	50	(29;74)
years:	1995-1999 vintages	32	(18;49)	30	(14;73)	45	(24;73)	65	(38;89)
	2000-2003 vintages	62	(48;83)	51	(24;66)	52	(29;76)	50	(30;74)
Within 5	Whole sample	32	(21;44)	24	(12;39)	32	(20;45)	34	(21;46)
years:	1995-1999 vintages	25	(15;38)	21	(12;31)	30	(18;44)	36	(22;48)
	2000-2003 vintages	46.5	(34;55)	36	(15;51)	33	(20;47)	35	(22;47)
	2004-2007 vintages	43	(31;53)	22	(12;33)	36	(22;46)	33	(22;44)
Within 2	Whole sample	16	(11;22)	13	(7;19)	17	(12;20)	16	(11;20)
years:	1995-1999 vintages	15	(10;20)	13	(9;19)	16	(11;20)	16	(12;20)
	2000-2003 vintages	23	(15;23)	9.5	(3;19.5)	17	(12;20)	16	(11;21)
	2004-2007 vintages	8.5	(7;11)	14	(9;22)	17	(12;20)	15.5	(11;20)
	2008-2011 vintages	10	(10;19)	18	(7.5;20)	17	(11;20)	17	(9;20)

Table 6: PME descriptive statistics

The table shows pooled and deal level PMEs for IPOs and trade sales across the two regions.

	IPOs				Trade Sales			
	Pooled		Deal level (median)		Pooled		Deal level (median)	
vintage	Europe	US	Europe	US	Europe	US	Europe	US
bef1980		1.31		1.31				
1980		0.91		1.40				
1981		0.95		0.96		1.81		1.79
1982		1.90		1.20		1.23		1.01
1983		1.65		1.41		0.56		0.48
1984		1.48		1.26		0.97		0.64
1985	0.87	1.82	0.87	1.67		1.07		0.78
1986		2.07		1.89		2.26		1.13
1987		2.13		1.70		1.09		0.83
1988	3.05	2.03	2.18	1.92		1.36		1.00
1989	11.94	2.42	42.88	2.34		1.13		0.75
1990	1.60	2.67	1.60	2.72	1.52	1.79	1.52	1.30
1991		2.77		2.73		1.33		0.97
1992	1.39	2.61	3.51	2.20		2.55		1.43
1993	7.89	2.97	10.26	2.46	0.08	1.55	1.34	1.10
1994	5.40	3.64	5.40	2.41	0.08	1.50	0.06	0.98
1995	7.05	3.39	3.80	3.08	1.00	1.55	0.84	1.08
1996	7.07	4.31	5.00	3.82	0.74	1.83	0.73	1.23
1997	3.68	5.21	4.21	4.22	2.56	3.01	1.10	1.52
1998	3.54	5.87	3.20	4.34	0.76	2.66	0.61	1.41
1999	3.09	4.27	3.18	3.03	1.82	1.44	1.20	0.97
2000	2.51	2.77	2.30	2.54	1.25	1.30	0.90	0.82
2001	1.74	3.42	2.41	2.74	1.84	1.78	1.29	1.23
2002	1.73	2.35	2.39	2.52	3.68	1.73	1.69	1.36
2003	2.20	3.53	2.00	2.27	1.27	2.21	1.15	1.53
2004	4.28	2.75	2.38	2.68	1.24	1.96	1.21	1.25
2005	1.32	2.47	2.57	2.17	2.76	2.61	1.94	1.96
2006	4.38	8.20	1.50	1.47	0.96	1.71	1.37	1.30
2007	2.47	5.01	2.47	5.79	1.84	2.05	1.67	2.16
2008	1.26	7.28	1.36	5.63	1.68	3.73	2.26	2.72
2009	0.96	1.46	1.33	1.46	2.08	3.04	2.12	2.78
2010		0.62		0.62	2.79	5.57	0.96	5.06
2011								
Total pooled:	3.18	3.12			1.59	1.74		
Difference Europe vs. US:		-0.62		0.46		-0.15		-0.06
t-stat:		-1.41		0.46		-0.73		-0.64

Table 7: Trade sales buyer types

The table shows the distribution of buyer types in trade sales, the fraction of deals for which we have PME measures, and summary statistics for PMEs within buyer categories.

	Europe						US					
				PME percentile						PME percentile		
Buyer Type	#deals	% of total	Has PME	25th	50th	75th	#deals	% of total	Has PME	25th	50th	75th
Tiny buyer	43	1.7%	18.6%	0.04	0.11	0.77	66	1.0%	25.8%	0.12	0.18	0.48
Small buyer	762	30.8%	47.8%	0.23	0.76	1.68	1,787	27.3%	59.1%	0.18	0.49	1.25
Medium buyer	528	21.3%	46.6%	0.76	1.71	3.42	2,055	31.3%	71.1%	0.60	1.49	3.15
Big buyer	235	9.5%	44.7%	0.91	2.21	4.32	1,239	18.9%	55.4%	1.12	2.41	5.58
Seems dead	159	6.4%	0.0%	.	.	.	191	2.9%	0.5%	0.01	0.01	0.01
No info	20	0.8%	0.0%	.	.	.	155	2.4%	0.6%	0.00	0.00	0.00
Still VC owned	149	6.0%	10.1%	0.17	0.74	1.60	394	6.0%	11.2%	0.09	0.26	0.60
VC chain success	104	4.2%	13.5%	0.31	0.47	1.12	405	6.2%	15.3%	0.11	0.38	0.77
Management	399	16.1%	9.0%	0.13	0.36	0.97	109	1.7%	7.3%	0.02	0.05	0.36
Big PE	47	1.9%	46.8%	1.67	2.97	7.18	97	1.5%	49.5%	1.10	2.01	4.41
Other PE	30	1.2%	40.0%	0.38	0.79	1.97	58	0.9%	41.4%	0.26	0.91	2.52
	Europe after 1996						US after 1996					
				PME percentile						PME percentile		
Buyer Type	#deals	% of total	Has PME	25th	50th	75th	#deals	% of total	Has PME	25th	50th	75th
Tiny buyer	42	1.8%	19.0%	0.04	0.11	0.77	42	0.9%	16.7%	0.12	0.41	1.91
Small buyer	733	30.9%	48.3%	0.23	0.76	1.68	1,161	25.2%	56.0%	0.15	0.42	1.19
Medium buyer	509	21.4%	46.8%	0.79	1.72	3.42	1,431	31.1%	71.1%	0.58	1.49	3.18
Big buyer	226	9.5%	45.1%	0.91	2.23	4.32	952	20.7%	56.9%	1.23	2.53	5.80
Seems dead	153	6.4%	0.0%	.	.	.	153	3.3%	0.7%	0.01	0.01	0.01
No info	20	0.8%	0.0%	.	.	.	8	0.2%	12.5%	0.00	0.00	0.00
Still VC owned	143	6.0%	10.5%	0.17	0.74	1.60	346	7.5%	11.0%	0.07	0.26	0.62

VC chain success	99	4.2%	12.1%	0.32	0.55	1.18	330	7.2%	10.9%	0.09	0.34	0.91
Management	380	16.0%	8.7%	0.17	0.38	1.07	69	1.5%	8.7%	0.03	0.16	0.43
Big PE	43	1.8%	46.5%	1.67	2.56	5.14	66	1.4%	45.5%	1.51	2.11	4.81
Other PE	27	1.1%	33.3%	0.47	0.56	1.51	43	0.9%	34.9%	0.14	0.33	1.70

Table 8: Regression of exit hazard with time, industry, and deal type fixed effects

The table shows regressions using a Cox proportional hazard model. The dependent variable is the hazard rate of IPO or trade sale exit. The unit of observation is the firm-year to reflect the possibility that the firm can potentially exit in any year. *Europe* is a dummy equal to one for European deals. Year fixed effects are controlled by respective dummies. Industry and stage classifications are reported in Table 2. Round fixed effects refer to the round number of financing when VC invested for the first time. Standard errors are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	IPOs & Trade sales	IPOs & Trade sales	IPOs & Trade sales	IPOs	IPOs	IPOs	Trade sales	Trade sales	Trade sales
Europe	-0.447***	-0.274***	-0.265***	-0.695***	0.102*	0.131**	-0.335***	-0.360***	-0.359***
	(0.021)	(0.022)	(0.022)	(0.048)	(0.052)	(0.053)	(0.023)	(0.024)	(0.024)
Calendar year fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry, stage, and round fixed effects	No	No	Yes	No	No	Yes	No	No	Yes
Observations	273,212	273,212	273,212	273,212	273,212	273,212	273,212	273,212	273,212
Log likelihood	-120896	-119985	-119723	-27212	-25675	-25456	-94815	-94663	-94447
Chi squared	494.2	2315	2839	209.8	2689	3395	212.5	502.9	906.9
Number of deals	35798	35798	35798	35798	35798	35798	35798	35798	35798
Number of exits	12221	12221	12221	2697	2697	2697	9524	9524	9524

Table 8b: Regression of PMEs with time, industry, and deal type fixed effects

The table shows OLS regressions with the log of the public market equivalent (PME) measure as dependent variable. PMEs are conditional on IPO (columns 1-3) or trade sale (columns 4-6). Columns 7-9 use imputed PMEs for trade sales where we do not have a PME measure, by taking the median PME for the buyer category of the trade sale in Table I. Year fixed effects are controlled by respective dummies. Industry and stage classifications are reported in Table 2. Round fixed effects refer to the round number of financing when VC invested for the first time. Standard errors are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Log IPO PME	Log IPO PME	Log IPO PME	Log Trade sale PME	Log Trade sale PME	Log Trade sale PME	Log imputed T.S. PME	Log imputed T.S. PME	Log imputed T.S. PME
Europe	0.0925**	0.0272	0.00465	-0.00792	-0.000902	-0.00474	-0.0764***	-0.0712***	-0.0679***
	(0.0378)	(0.0422)	(0.0416)	(0.0295)	(0.0306)	(0.0309)	(0.0146)	(0.0153)	(0.0155)
Calendar year fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry, stage, and round fixed effects	No	No	Yes	No	No	Yes	No	No	Yes
Observations	2,326	2,326	2,326	4,232	4,232	4,232	9,032	9,032	9,032
R-squared	0.003	0.105	0.154	0.000	0.031	0.041	0.003	0.028	0.038

Table 9: Entrepreneurial experience and characteristics: Exits

The table shows regressions using a Cox proportional hazard model. The dependent variable is the hazard rate of IPO or trade sale exit. The unit of observation is the firm-year to reflect the possibility that the firm can potentially exit in any year. *Europe* is a dummy equal to one for European deals. *Founder experience* is a dummy equal to one if any of the firm's founders founded another business. *Data on previous venture* is a dummy equal to one if any of the firm's founders founded a VC-funded venture that is recorded by Venture Source. *Success on previous venture* is a dummy equal to one if a previously VC-funded venture was successful. *PhD or MD Founder* is a dummy equal to one if any of the firm's founders has a doctorate degree. *Female founder* is a dummy equal to one if any of the firm's founders is a female. Year fixed effects are controlled by respective dummies. Industry and stage classifications are reported in Table 2. Round fixed effects refer to the round number of financing when VC invested for the first time. Standard errors are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	IPOs & Trade sales	IPOs & Trade sales	IPOs & Trade sales	IPOs & Trade sales	IPOs	Trade sales
Europe	-0.229***	-0.0671	-0.277***	-0.248***	0.0951	-0.360***
	(0.0228)	(0.047)	(0.026)	(0.028)	(0.0693)	(0.03)
Founder experience	0.196***			0.160***	0.405***	0.0141
	-0.0233			(0.0263)	(0.0544)	(0.0303)
Data on previous venture	-0.165**	-0.162**		-0.153**	-0.478***	-0.0603
	(0.0664)	(0.0672)		(0.0733)	(0.113)	(0.0608)
Success on previous venture	0.179**	0.191***		0.184**	0.746***	0.169**
	(0.0728)	(0.0732)		(0.0792)	(0.153)	(0.0735)
PhD or MD Founder				-0.0386	0.225***	-0.131***
				(0.0304)	(0.0581)	(0.0347)
Female founder				-0.113**	-0.216**	-0.0816*
				(0.0441)	(0.108)	(0.0479)
Europe*Founder experience				0.193***	0.494***	0.108*
				(0.0559)	(0.116)	(0.0647)
Europe*Data on previous venture				-0.0616	-0.0959	-0.0981
				(0.172)	(0.298)	(0.174)

Europe*Success on previous venture				0.0259	-0.289	0.197
				(0.215)	(0.56)	(0.232)
Europe*PhD or MD Founder				-0.115**	-0.148	-0.0586
				(0.0543)	(0.113)	(0.0609)
Europe*Female founder				0.0559	-0.0659	0.0564
				(0.0844)	(0.224)	(0.0912)
Year, Industry, stage, and round fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	262138	65679	196459	262138	262138	262138
Log likelihood	-116825	-29498	-80064	-116810	-92308	-24643
Chi squared	3001	826.9	2151	3031	903.8	3612
Number of deals	34887	9297	25590	34887	34887	34887

Table 9b: Entrepreneurial experience and characteristics: PMEs

The table shows OLS regressions with the log of the public market equivalent (PME) measure as dependent variable. PMEs are conditional on IPO (columns 1-3) or trade sale (columns 4-6). Columns 7-9 use imputed PMEs for trade sales where we do not have a PME measure, by taking the median PME for the buyer category of the trade sale in Table I. *Europe* is a dummy equal to one for European deals. *Founder experience* is a dummy equal to one if any of the firm's founders founded another business. *Data on previous venture* is a dummy equal to one if any of the firm's founders founded a VC-funded venture that is recorded by Venture Source. *Success on previous venture* is a dummy equal to one if a previously VC-funded venture was successful. *PhD or MD Founder* is a dummy equal to one if any of the firm's founders has a doctorate degree. *Female founder* is a dummy equal to one if any of the firm's founders is a female. Year fixed effects are controlled by respective dummies. Industry and stage classifications are reported in Table 2. Round fixed effects refer to the round number of financing when VC invested for the first time. Standard errors are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Log IPO PME	Log IPO PME	Log IPO PME	Log Trade sale PME	Log Trade sale PME	Log Trade sale PME	Log imputed T.S. PME	Log imputed T.S. PME	Log imputed T.S. PME
Europe	-0.0108	-0.0104	-0.0109	-0.00411	-0.00511	-0.0350	-0.059***	-0.06***	-0.082***
	(0.0434)	(0.0433)	(0.0575)	(0.0313)	(0.0313)	(0.0392)	(0.0159)	(0.0159)	(0.0192)
Founder experience	0.100***	0.106***	0.114***	0.0582**	0.0576**	0.0350	0.061***	0.059***	0.0364*
	(0.0331)	(0.0331)	(0.0369)	(0.0285)	(0.0285)	(0.0314)	(0.0168)	(0.0168)	(0.0189)
Data on previous venture	-0.215*	-0.197	-0.292**	-0.0193	-0.0195	-0.00496	-0.0408	-0.0440	-0.0277
	(0.128)	(0.128)	(0.144)	(0.0832)	(0.0832)	(0.0874)	(0.0457)	(0.0457)	(0.0504)
Success on previous venture	0.201	0.189	0.285*	-0.0505	-0.0513	-0.0529	0.0223	0.0232	0.0180
	(0.135)	(0.135)	(0.150)	(0.0895)	(0.0895)	(0.0935)	(0.0503)	(0.0503)	(0.0546)
PhD or MD Founder		-0.125***	-0.129***		-0.000688	0.00969		0.0373**	0.0392*
		(0.0374)	(0.0414)		(0.0319)	(0.0347)		(0.0185)	(0.0210)
Female founder		0.0143	-0.000693		-0.0456	-0.0863*		-0.0577**	-0.070***
		(0.0604)	(0.0678)		(0.0464)	(0.0506)		(0.0237)	(0.0271)
Europe*Founder experience			-0.0442			0.116			0.105**
			(0.0838)			(0.0746)			(0.0409)
Europe*Data on previous venture			0.463			-0.0586			-0.0829

			(0.317)			(0.286)			(0.119)
Europe*Success on previous venture			-0.527			0.00442			0.0652
			(0.383)			(0.324)			(0.149)
Europe*PhD or MD Founder			0.0191			-0.0450			-0.00550
			(0.0803)			(0.0722)			(0.0388)
Europe*Female founder			0.0835			0.240*			0.0490
			(0.151)			(0.127)			(0.0560)
Year, Industry, stage, and round fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,305	2,305	2,305	4,219	4,219	4,219	8,974	8,974	8,974
R-squared	0.160	0.164	0.165	0.043	0.043	0.044	0.040	0.041	0.041

Table 10: Number of VC organization and deals per VC organization

The table shows the number of distinct VC organizations active on the board in the year of the first round of VC financing in each region where Venture Source has data on boards. For each active VC firm the total number of previous deals in which it was active on the board was computed and the mean and median statistics are reported for all VC firms active in a given year for both regions. The total number of active VC firms represents the set of distinct VC organizations that were active at least once in our dataset.

	US			Europe		
		# previous deals by VC			# previous deals by VC	
Year	# VCs active	Mean	Median	# VCs active	Mean	Median
1980	34	0.1764706	0	1	0	0
1981	66	0.3636364	0	0	.	.
1982	134	0.4402985	0	0	.	.
1983	212	0.9622642	0	0	.	.
1984	263	1.81749	1	0	.	.
1985	304	2.414474	1	4	4.25	2
1986	311	3.33119	2	2	14.5	14.5
1987	367	3.749319	2	0	.	.
1988	374	4.713904	2.5	10	0.1	0
1989	395	5.177215	3	10	0.5	0
1990	393	6.312977	3	8	1.25	0
1991	410	7.063415	4	7	0.2857143	0
1992	534	6.544944	3	16	0.4375	0
1993	539	7.187384	3	22	1.454545	0
1994	657	7.022831	2	53	3.264151	0
1995	783	7.366539	2	59	1.508475	0
1996	1144	6.541958	2	130	2.569231	0
1997	1333	7.042011	2	258	3.003876	0
1998	1471	7.906186	3	513	4.081871	1
1999	2029	7.648103	2	805	4.73913	1
2000	2399	9.025427	3	1253	6.261772	2
2001	1391	16.20489	7	809	8.490729	4
2002	1076	20.65149	10	494	12.58502	5
2003	995	23.02714	10	370	14.92703	7
2004	1051	23.86965	11	341	17.74487	8
2005	1029	24.90379	11	310	21.53871	9
2006	1022	25.96771	11	352	21.41193	9
2007	966	26.89234	10	364	23.6456	8
2008	800	31.3475	13	221	20.83258	9
2009	619	37.02908	14	186	20.87097	8
2010	567	38.3157	15	178	18.85393	7
2011	343	47.7551	19	92	38.02174	15.5
Total VCs	5,131			2,388		

Table 11: Venture capitalist experience and characteristics: Exits

The table shows regressions using a Cox proportional hazard model. The dependent variable is the hazard rate of IPO or trade sale exit. The unit of observation is the firm-year to reflect the possibility that the firm can potentially exit in any year. *Europe* is a dummy equal to one for European deals. *Has board date* is a dummy equal to one if the firm's board data is present. *VC board representation* is a dummy equal to one if the firm has at least one VC board member. *VC experience* is the difference between the log of one plus the number of active investments made by the venture capital organization prior to year t and the average in year t of the log of one plus the number of active investments made by all organizations prior to year t. *Partner experience* is the difference between the log of one plus the number of board seats in different VC-funded ventures prior to year t and the average in year t of the log of one plus the number of board seats in different VC-funded ventures by all partners prior to year t. *VC specialization* is a fraction of past active VC investments done in the same industry as the industry of the current investment. *Partner specialization* is the fraction of past board seats that were in the same industry as the industry of the current investment. Year fixed effects are controlled by respective dummies. Industry and stage classifications are reported in Table 2. Round fixed effects refer to the round number of financing when VC invested for the first time. Standard errors are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Hazard for IPOs & Trade sales	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Europe	-0.226***	-0.178***	-0.492***	0.0325	0.0338	0.00179	0.0403
	(0.0227)	(0.0251)	(0.0527)	(0.0276)	(0.0276)	(0.0282)	(0.0285)
Has board data	0.213***						
	(0.0269)						
VC board representation				0.129***	0.109***	0.181***	0.105**
				(0.0410)	(0.0421)	(0.0414)	(0.0425)
VC experience				0.148***	0.139***		0.133***
				(0.00858)	(0.00975)		(0.0120)
Partner experience						0.116***	-0.00209
						(0.0149)	(0.0179)
VC specialization					0.0878**		0.0185
					(0.0410)		(0.0483)
Partner specialization						0.165***	0.110**
						(0.0368)	(0.0428)

Year, Industry, stage, and round fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	273,212	215,175	58,037	215,175	215,175	215,175	215,175
Log likelihood	-119700	-99739	-14839	-99563	-99561	-99623	-99557
Chi squared	2886	2346	631.4	2696	2701	2577	2708
Number of deals	35798	26858	8940	26858	26858	26858	26858

Table 11b: Venture capitalist experience and characteristics: PMEs

The table shows OLS regressions with the log of the public market equivalent (PME) measure as dependent variable. PMEs are conditional on IPO (columns 1-3) or trade sale (columns 4-6). Columns 7-9 use imputed PMEs for trade sales where we do not have a PME measure, by taking the median PME for the buyer category of the trade sale in Table I. *Europe* is a dummy equal to one for European deals. *VC board representation* is a dummy equal to one if the firm has at least one VC board member. *VC experience* is the difference between the log of one plus the number of active investments made by the venture capital organization prior to year t and the average in year t of the log of one plus the number of active investments made by all organizations prior to year t. *Partner experience* is the difference between the log of one plus the number of board seats in different VC-funded ventures prior to year t and the average in year t of the log of one plus the number of board seats in different VC-funded ventures by all partners prior to year t. *VC specialization* is a fraction of past active VC investments done in the same industry as the industry of the current investment. *Partner specialization* is the fraction of past board seats that were in the same industry as the industry of the current investment. Year fixed effects are controlled by respective dummies. Industry and stage classifications are reported in Table 2. Round fixed effects refer to the round number of financing when VC invested for the first time. Standard errors are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Log IPO PME	Log IPO PME	Log IPO PME	Log Trade sale PME	Log Trade sale PME	Log Trade sale PME	Log imputed T.S. PME	Log imputed T.S. PME	Log imputed T.S. PME
Europe	-0.00720	-0.0101	-0.00692	-0.0499	-0.0507	-0.0411	-0.0207	-0.0202	-0.0139
	(0.0500)	(0.0499)	(0.0514)	(0.0354)	(0.0355)	(0.0364)	(0.0194)	(0.0194)	(0.0200)
VC board representation	-0.0837	-0.0553	-0.0521	-0.238***	-0.231***	-0.226***	-0.0207	-0.0265	-0.0228
	(0.0659)	(0.0668)	(0.0679)	(0.0604)	(0.0617)	(0.0621)	(0.0296)	(0.0305)	(0.0308)
VC experience	0.0115	0.0277*	0.0248	-0.0191*	-0.0167	-0.0262*	0.0185***	0.0160**	0.00979
	(0.0135)	(0.0149)	(0.0187)	(0.0106)	(0.0116)	(0.0142)	(0.00612)	(0.00687)	(0.00844)
Partner experience		-0.137**	-0.136**		-0.0260	-0.0455		0.0243	0.0100
		(0.0545)	(0.0641)		(0.0506)	(0.0588)		(0.0309)	(0.0358)
VC specialization			0.00761			0.0200			0.0129
			(0.0277)			(0.0213)			(0.0127)
Partner specialization			-0.00592			0.0173			0.0136
			(0.0604)			(0.0500)			(0.0306)

Year, Industry, stage, and round fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,259	2,259	2,259	3,826	3,826	3,826	7,547	7,547	7,547
R-squared	0.159	0.161	0.161	0.052	0.052	0.052	0.042	0.042	0.042

Table 12: Venture capitalist experience and characteristics, part 2: Exits

The table shows regressions using a Cox proportional hazard model. The dependent variable is the hazard rate of IPO or trade sale exit. The unit of observation is the firm-year to reflect the possibility that the firm can potentially exit in any year. *Europe* is a dummy equal to one for European deals. *VC board representation* is a dummy equal to one if the firm has at least one VC board member. *VC experience* is the difference between the log of one plus the number of active investments made by the venture capital organization prior to year t and the average in year t of the log of one plus the number of active investments made by all organizations prior to year t. *Partner specialization* is a fraction of past board seats that were in the same industry as the industry of the current investment. *Founder experience* is a dummy equal to one if any of the firm's founders founded another business. *Data on previous venture* is a dummy equal to one if any of the firm's founders founded a VC-funded venture that is recorded by Venture Source. *Success on previous venture* is a dummy equal to one if a previously VC-funded venture was successful. *Preferred Shares* is a dummy equal to one if preferred shares were issued in the first VC financing round. *Syndicated* is a dummy equal to one if more than one VC organization invested in the first round. Year fixed effects are controlled by respective dummies. Industry and stage classifications are reported in Table 2. Round fixed effects refer to the round number of financing when VC invested for the first time. Standard errors are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	(1) IPOs & Trade sales	(2) IPOs & Trade sales	(3) IPOs	(4) IPOs	(5) Trade sales	(6) Trade sales
Europe	0.0557**	0.136***	0.597***	0.768***	-0.167***	-0.114***
	(0.0279)	(0.0305)	(0.0599)	(0.0644)	(0.0305)	(0.0331)
VC board representation	0.104**	0.0727	-0.0115	-0.0158	0.218***	0.180***
	(0.0415)	(0.0451)	(0.0903)	(0.0999)	(0.0494)	(0.0535)
VC experience	0.130***	0.119***	0.184***	0.181***	0.0778***	0.0646***
	(0.00970)	(0.0105)	(0.0214)	(0.0232)	(0.0108)	(0.0117)
Partner specialization	0.111***	0.0775**	0.0565	0.0355	0.0456	0.00765
	(0.0335)	(0.0359)	(0.0651)	(0.0699)	(0.0397)	(0.0425)
Founder experience	0.154***	0.140***	0.419***	0.415***	-0.00743	-0.0211
	(0.0245)	(0.0263)	(0.0495)	(0.0531)	(0.0285)	(0.0304)
Data on previous venture	-0.176**	-0.185**	-0.549***	-0.530***	-0.107*	-0.0984
	(0.0705)	(0.0753)	(0.106)	(0.113)	(0.0601)	(0.0637)

Success on previous venture	0.122	0.135	0.727***	0.758***	0.164**	0.122
	(0.0769)	(0.0819)	(0.147)	(0.152)	(0.0732)	(0.0777)
Preferred Shares		0.404***		0.651***		0.273***
		(0.0303)		(0.0614)		(0.0322)
Syndicated		0.106***		0.00166		0.151***
		(0.0219)		(0.0457)		(0.0251)
Year, Industry, stage, and round fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	215,175	188,471	212,158	185,539	212,158	185,539
Log likelihood	-99537	-86612	-22909	-19632	-75905	-66271
Chi squared	2750	2583	3295	3077	780.2	805.4
Number of deals	26858	23472	26614	23239	26614	23239

Table 12b: Venture capitalist experience and characteristics, part 2: PMEs

The table shows OLS regressions with the log of the public market equivalent (PME) measure as dependent variable. PMEs are conditional on IPO (columns 1 and 4) or trade sale (columns 2 and 5). Columns 3 and 6 uses imputed PMEs for trade sales where we do not have a PME measure, by taking the median PME for the buyer category of the trade sale in Table I. *Europe* is a dummy equal to one for European deals. *VC board representation* is a dummy equal to one if the firm has at least one VC board member. *VC experience* is the difference between the log of one plus the number of active investments made by the venture capital organization prior to year t and the average in year t of the log of one plus the number of active investments made by all organizations prior to year t. *Partner specialization* is a fraction of past board seats that were in the same industry as the industry of the current investment. *Founder experience* is a dummy equal to one if any of the firm's founders founded another business. *Data on previous venture* is a dummy equal to one if any of the firm's founders founded a VC-funded venture that is recorded by Venture Source. *Success on previous venture* is a dummy equal to one if a previously VC-funded venture was successful. *Syndicated* is a dummy equal to one if more than one VC organization invested in the first round. Year fixed effects are controlled by respective dummies. Industry and stage classifications are reported in Table 2. Round fixed effects refer to the round number of financing when VC invested for the first time. Standard errors are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Log IPO PME	Log Trade sale PME	Log imputed T.S. PME	Log IPO PME	Log Trade sale PME	Log imputed T.S. PME
Europe	-0.0119	-0.0414	-0.0107	-0.0395	-0.0228	0.00224
	(0.0509)	(0.0358)	(0.0197)	(0.0543)	(0.0381)	(0.0210)
VC board representation	-0.0447	-0.252***	-0.0296	-0.0476	-0.244***	-0.0261
	(0.0691)	(0.0620)	(0.0305)	(0.0753)	(0.0684)	(0.0329)
VC experience	0.0178	-0.0222*	0.0139**	0.0190	-0.0213*	0.0159**
	(0.0149)	(0.0117)	(0.00680)	(0.0160)	(0.0125)	(0.00730)
Partner specialization	-0.0633	0.0154	0.0271	-0.0806	0.0162	0.0220
	(0.0474)	(0.0396)	(0.0241)	(0.0506)	(0.0423)	(0.0257)
Founder experience	0.102***	0.0724**	0.0615***	0.109***	0.0749**	0.0676***
	(0.0333)	(0.0289)	(0.0178)	(0.0356)	(0.0306)	(0.0191)
Data on previous venture	-0.209	-0.0160	-0.0312	-0.201	-0.0349	-0.0450
	(0.128)	(0.0827)	(0.0489)	(0.137)	(0.0885)	(0.0523)
Success on previous venture	0.199	-0.0370	0.00311	0.211	-0.0265	0.00492

	(0.135)	(0.0890)	(0.0534)	(0.144)	(0.0951)	(0.0570)
Syndicated				-0.0827***	-0.0350	-0.00033
				(0.0310)	(0.0263)	(0.0158)
Year, Industry, stage, and round fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,245	3,818	7,520	1,956	3,396	6,663
R-squared	0.164	0.054	0.044	0.173	0.054	0.044

Table 12c: Venture capitalist experience and characteristics, part 2: PMEs

The table shows OLS regressions with the log of the public market equivalent (PME) measure as dependent variable. PMEs are actual PMEs for IPOs and Trade Sales where we have the data, imputed PMEs for IPOs and Trade Sales where the data is missing (imputed IPO PMEs are median actual IPO PMEs for corresponding vintage year and region), and zero for deals considered to be failures (no financing round in the last 5 years or Venture Source explicitly states that the firm is out of business). *Europe* is a dummy equal to one for European deals. *Has board date* is a dummy equal to one if the firm's board data is present. *VC board representation* is a dummy equal to one if the firm has at least one VC board member. *VC experience* is the difference between the log of one plus the number of active investments made by the venture capital organization prior to year t and the average in year t of the log of one plus the number of active investments made by all organizations prior to year t. *VC specialization* is a fraction of past active VC investments done in the same industry as the industry of the current investment. *Partner experience* is the difference between the log of one plus the number of board seats in different VC-funded ventures prior to year t and the average in year t of the log of one plus the number of board seats in different VC-funded ventures by all partners prior to year t. *Partner specialization* is a fraction of past board seats that were in the same industry as the industry of the current investment. *Founder experience* is a dummy equal to one if any of the firm's founders founded another business. *Data on previous venture* is a dummy equal to one if any of the firm's founders founded a VC-funded venture that is recorded by Venture Source. *Success on previous venture* is a dummy equal to one if a previously VC-funded venture was successful. Year fixed effects are controlled by respective dummies. Industry and stage classifications are reported in Table 2. Round fixed effects refer to the round number of financing when VC invested for the first time. Standard errors are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Table 8b:1	Table 8b:3		Table 9b:1	Table 11:1	Table 11b:3	Table 12b:1	Table 12b:1
Europe	-0.191***	-0.0891***	-0.0547***	-0.0685***	-0.0607***	0.0636***	0.0697***	0.0301**
	(0.00925)	(0.00982)	(0.0118)	(0.0101)	(0.0100)	(0.0132)	(0.0130)	(0.0125)
Has board data					0.144***			
					(0.0114)			
VC board representation						0.0356**	0.0379**	0.0212
						(0.0181)	(0.0176)	(0.0178)
VC experience						0.0634***	0.0676***	
						(0.00589)	(0.00460)	
VC local experience								0.0999***
								(0.00563)
VC specialization						0.0335		

						(0.0245)		
Partner experience						0.0136		
						(0.00898)		
Partner specialization						0.0603***	0.0830***	
						(0.0219)	(0.0170)	
Founder experience				0.133***			0.114***	0.116***
				(0.0113)			(0.0123)	(0.0123)
Data on previous venture				-0.128***			-0.135***	-0.136***
				(0.0309)			(0.0340)	(0.0340)
Success on previous venture				0.146***			0.113***	0.125***
				(0.0346)			(0.0377)	(0.0378)
Year, Industry, stage, and round fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,543	22,543	18,068	22,378	22,543	18,068	17,993	17,993
R-squared	0.019	0.086	0.080	0.093	0.093	0.103	0.108	0.105

Table 13: Country fixed effects: Exits

The table shows regressions using a Cox proportional hazard model. The dependent variable is the hazard rate of IPO or trade sale exit. The unit of observation is the firm-year to reflect the possibility that the firm can potentially exit in any year. "Corresponding specification" refers to the same regression using the European dummy instead of country fixed effects. We do not report coefficients and standard errors for explanatory variables other than country fixed effects, as these are virtually unchanged relative to the corresponding specifications. Year fixed effects are controlled by respective dummies. Industry and stage classifications are reported in Table 2. Round fixed effects refer to the round number of financing when VC invested for the first time. Standard errors are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Corresponding specification	IPOs & Trade sales Table 8:3	IPOs & Trade sales Table 9:1	IPOs & Trade sales Table 11:4	IPOs & Trade sales Table 12:2	IPOs Table 12:3	Trade Sales Table 12:5
European dummy from corresponding specification	*-0.265*** (0.022)*	*-0.229*** (0.0228)*	*0.0325 (0.0276)*	*0.136*** (0.0305)*	*0.597*** (0.0599)*	*-0.167*** (0.0305)*
Country fixed effects:						
Austria, Liechtenstein , Switzerland	-0.235***	-0.198**	0.0335	0.118	0.463**	-0.142
	(0.0884)	(0.0889)	(0.102)	(0.111)	(0.227)	(0.115)
Belgium , Luxembourg , Netherlands	-0.428***	-0.399***	-0.166*	-0.0586	0.334	-0.328***
	(0.0722)	(0.0725)	(0.0907)	(0.0958)	(0.207)	(0.0991)
Germany	-0.450***	-0.420***	-0.0697	-0.00828	0.906***	-0.402***
	(0.0463)	(0.0469)	(0.0586)	(0.0631)	(0.109)	(0.0689)
France, Monaco	-0.213***	-0.175***	0.0912*	0.210***	0.844***	-0.168***
	(0.0456)	(0.0459)	(0.0541)	(0.0569)	(0.114)	(0.0598)
Sweden	-0.227***	-0.188***	-0.0621	0.0818	0.360**	-0.183**
	(0.0599)	(0.0604)	(0.0676)	(0.0715)	(0.158)	(0.0737)
Denmark, Finland, Iceland , Norway	-0.161***	-0.121**	0.0427	0.141**	0.388**	-0.107

	(0.0543)	(0.0548)	(0.0632)	(0.0670)	(0.157)	(0.0675)
Italy, Malta, Portugal, Spain	-0.381***	-0.312***	-0.0503	0.111	0.665***	-0.304**
	(0.0858)	(0.0859)	(0.108)	(0.113)	(0.246)	(0.121)
Ireland, United Kingdom	-0.173***	-0.142***	0.128***	0.224***	0.494***	-0.0379
	(0.0357)	(0.0361)	(0.0409)	(0.0444)	(0.0953)	(0.0442)
Other	-0.325**	-0.255*	-0.000323	0.159	0.661*	-0.229
	(0.137)	(0.138)	(0.176)	(0.181)	(0.362)	(0.201)
Observations	273,212	262,138	215,175	185,539	212,158	212,158
Log likelihood	-119713	-116806	-99554	-85615	-22899	-75890
Chi squared	2860	3040	2715	2632	3305	802.5
Number of deals	35798	34887	26858	23239	26614	26614

Table 13b: Country fixed effects: PMEs

The table shows OLS regressions with the log of the public market equivalent (PME) measure as dependent variable. PMEs are conditional on IPO (columns 1 and 2) or trade sale (columns 3 and 4). Columns 5 and 6 uses imputed PMEs for trade sales where we do not have a PME measure, by taking the median PME for the buyer category of the trade sale in Table I. "Corresponding specification" refers to the same regression using the European dummy instead of country fixed effects. We do not report coefficients and standard errors for explanatory variables other than country fixed effects, as these are virtually unchanged relative to the corresponding specifications. Year fixed effects are controlled by respective dummies. Industry and stage classifications are reported in Table 2. Round fixed effects refer to the round number of financing when VC invested for the first time. Standard errors are in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Corresponding specification	Log IPO PME	Log Trade sale PME	Log imputed T.S. PME	Log IPO PME	Log Trade sale PME	Log imputed T.S. PME
	Table 8b:3	Table 8b:6	Table 8b:9	Table 12b:1	Table 12b:2	Table 12b:3
European dummy from	*0.00465*	*-0.00474*	*-0.0679****	*-0.0119*	*-0.0414*	*-0.0107*
corresponding specification	*(0.0416)*	*(0.0309)*	*(0.0155)*	*(0.0509)*	*(0.0358)*	*(0.0197)*
Country fixed effects:						
Austria, Liechtenstein , Switzerland	0.286*	-0.185	-0.151**	0.173	-0.206	-0.128*
	(0.149)	(0.130)	(0.0615)	(0.157)	(0.140)	(0.0714)
Belgium , Luxembourg , Netherlands	-0.275*	0.402***	-0.00396	-0.278*	0.447***	0.0795
	(0.142)	(0.115)	(0.0474)	(0.150)	(0.133)	(0.0615)
Germany	0.210**	0.0868	-0.0626*	0.244***	-0.000659	0.0147
	(0.0826)	(0.0803)	(0.0333)	(0.0915)	(0.0929)	(0.0439)
France, Monaco	-0.0459	-0.00350	-0.0289	-0.0442	-0.0181	0.0174
	(0.0787)	(0.0633)	(0.0315)	(0.0851)	(0.0716)	(0.0384)
Sweden	-0.279**	0.00266	-0.125***	-0.223*	-0.0344	-0.0540
	(0.123)	(0.0928)	(0.0413)	(0.133)	(0.0958)	(0.0472)
Denmark, Finland, Iceland , Norway	-0.0619	0.0657	-0.122***	-0.0925	-0.0346	-0.0828*

	(0.106)	(0.0939)	(0.0368)	(0.114)	(0.103)	(0.0437)
Italy, Malta, Portugal, Spain	0.245	-0.148	-0.179***	0.257	-0.0295	-0.0648
	(0.167)	(0.130)	(0.0582)	(0.173)	(0.148)	(0.0741)
Ireland, United Kingdom	-0.0390	-0.0810*	-0.0491**	-0.0963	-0.108**	0.00299
	(0.0622)	(0.0447)	(0.0245)	(0.0728)	(0.0483)	(0.0287)
Other	0.628***	0.450*	0.0956	0.870***	0.318	0.163
	(0.235)	(0.238)	(0.0950)	(0.269)	(0.259)	(0.121)
Observations	2,326	4,232	9,032	2,245	3,818	7,520
R-squared	0.165	0.046	0.039	0.176	0.059	0.045

Figure 1: Number of deals per year per region

Figure 1 shows the number of venture deals over time and across regions covered in our sample.

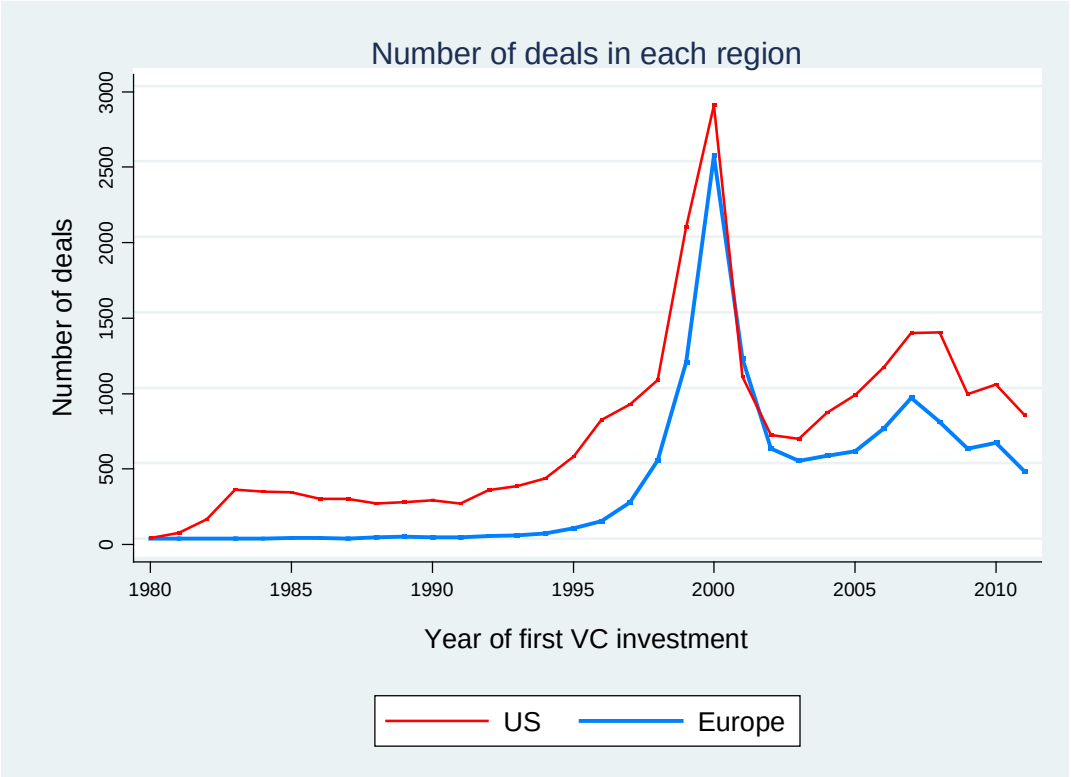


Figure 2: IPO and Trade Sales success rates per region.

Figure 2 shows the time series of IPO and Trade sale exit rates across years of the first VC investment for the two regions.

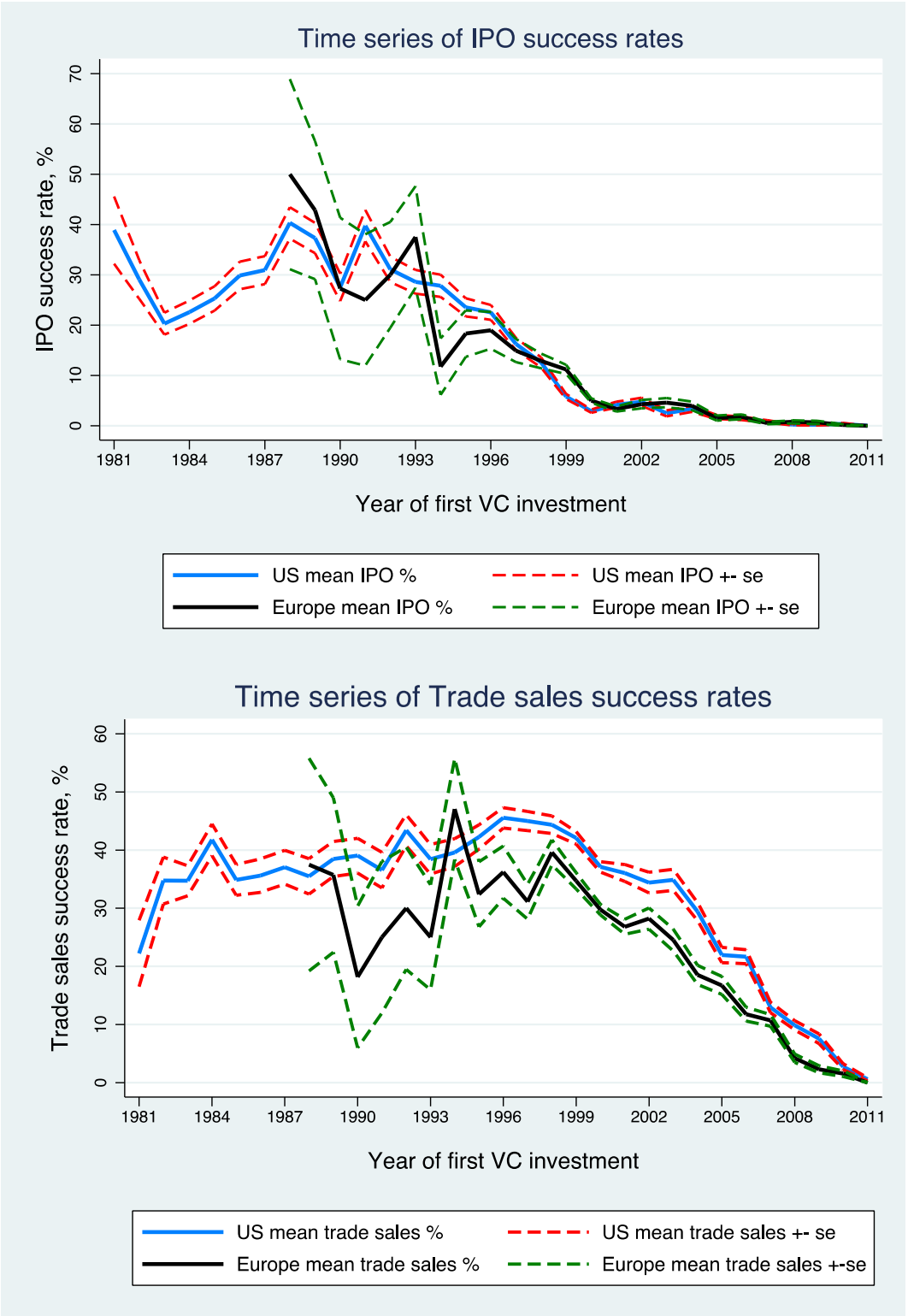


Figure 3: Estimated cumulative density of exits per region

Figure 3a shows the Kaplan-Meier estimator of the cumulative density of exits (IPOs or trade sales) for the US (blue line) and Europe (red line). Below each graph the Number at risk table shows for different time periods the total number of deals that could potentially exit. Time period is in months from the time when the firm received the first round of VC financing. Confidence bands represent 95% confidence intervals of the Kaplan-Meier estimator. Figures 3b and 3c show the estimated cumulative incidence function for IPOs and trade sales, respectively. Cumulative incidence functions were computed treating the alternative exit route as a competing risk, i.e. they represent cumulative density functions for a particular exit route allowing for the existence of the alternative exit route. 95% confidence intervals are plotted as dotted lines. The unconditional estimated exit probability within 200 months from the first round of VC financing is 40% for Europe and 56% for the US.

Figure 3a

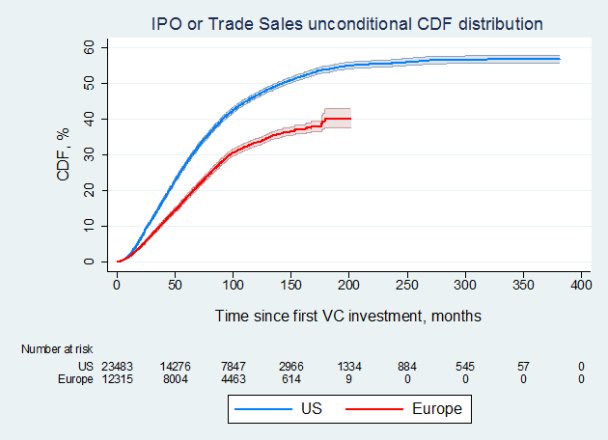


Figure 3b

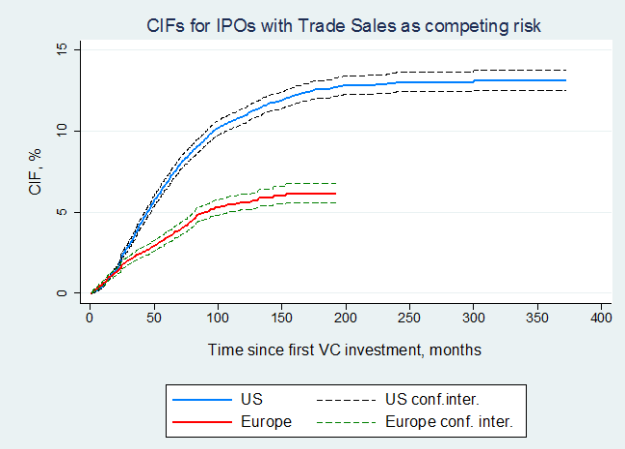


Figure 3c

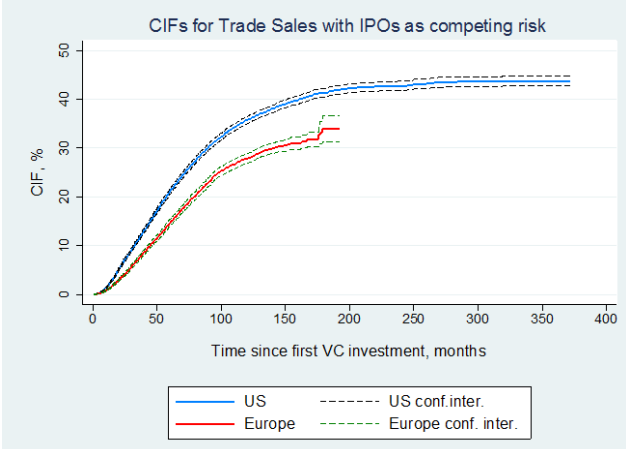
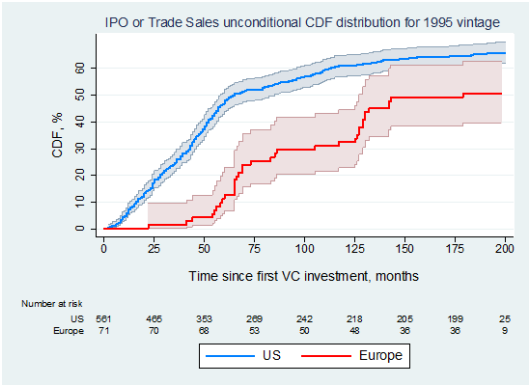
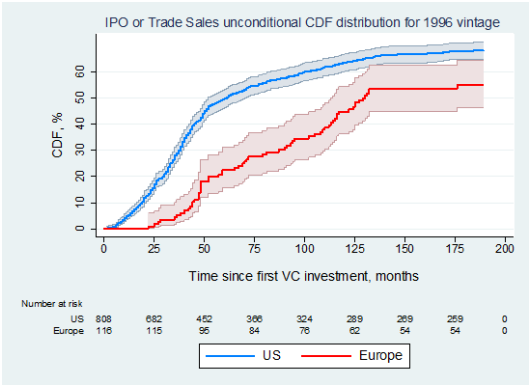
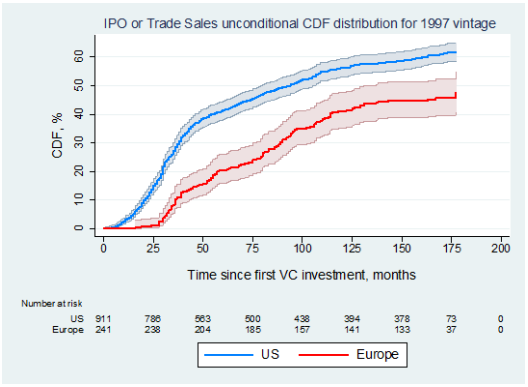


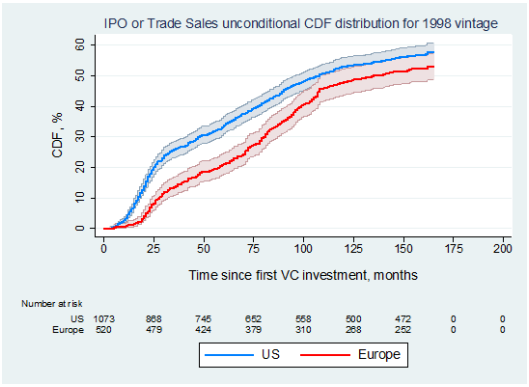
Figure 4: Estimated cumulative density of exits per region per year

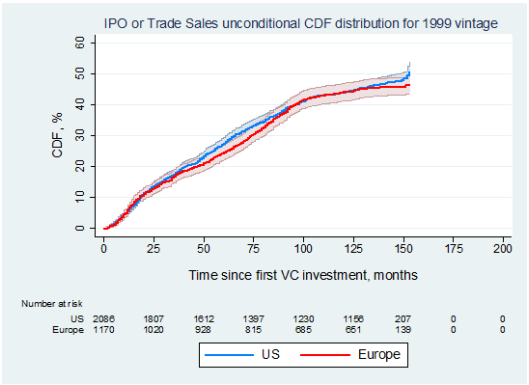
Figure 4 shows the Kaplan-Meier estimator of the cumulative density of exits (IPOs or trade sales) for the US (blue line) and Europe (red line), for each vintage year from 1996 to 2006. 95% confidence intervals are also plotted.











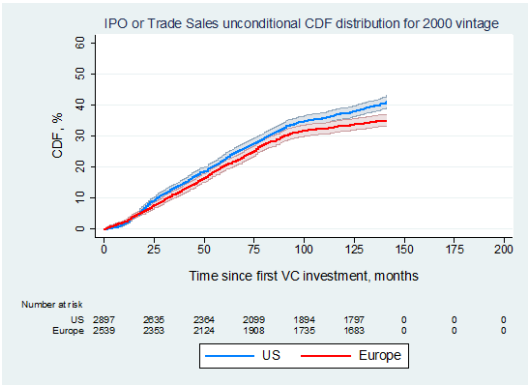
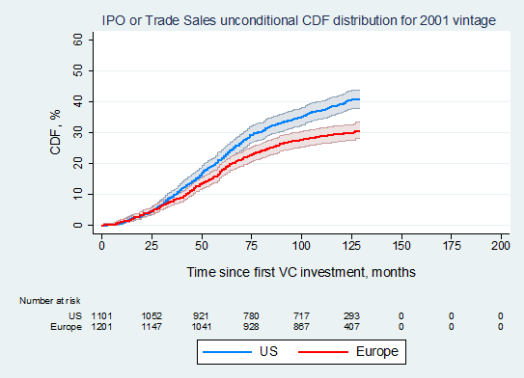
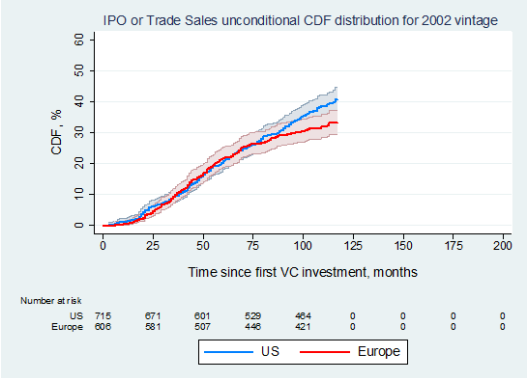
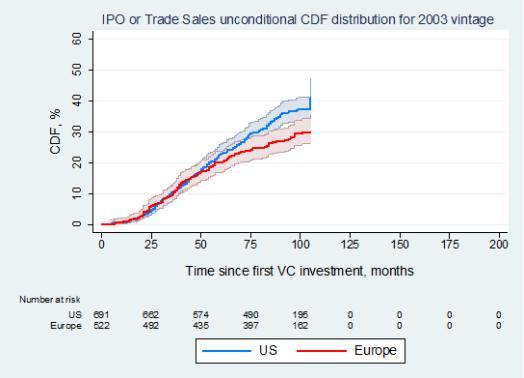
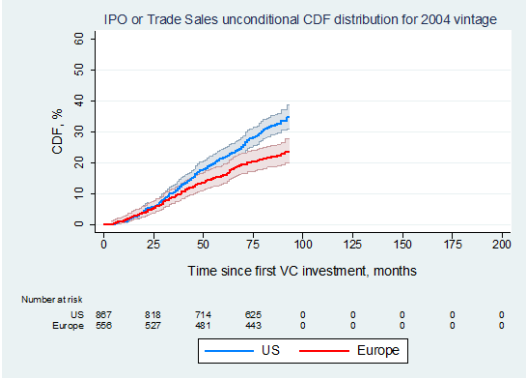


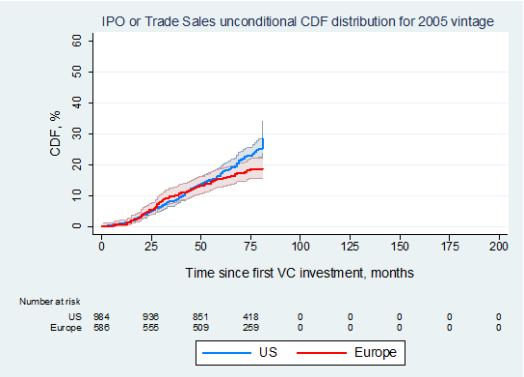
Figure 4, continued: Estimated cumulative density of exits per region per year











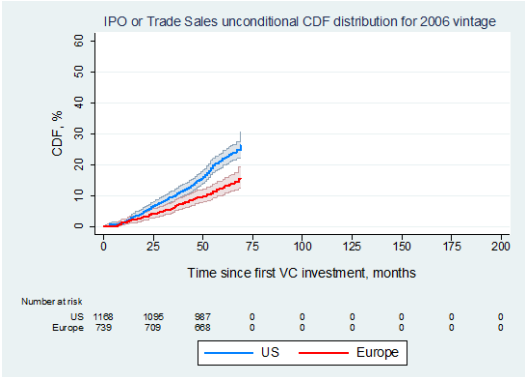
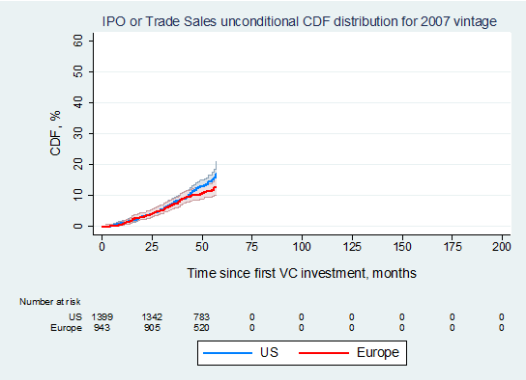
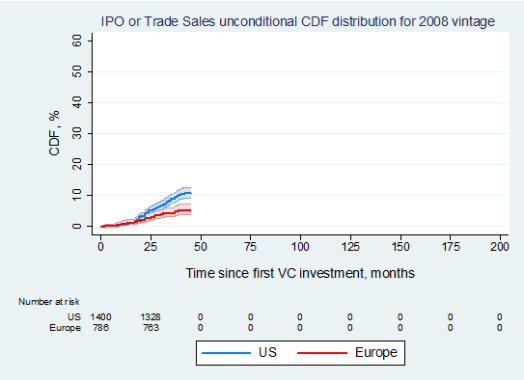
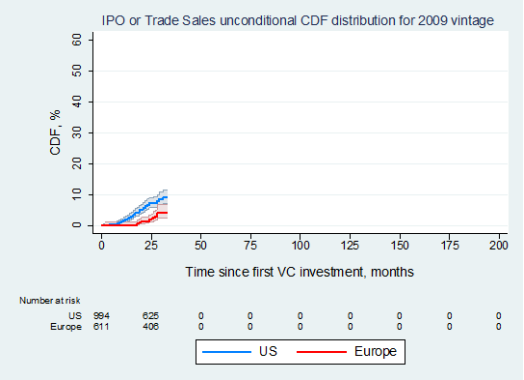


Figure 4, continued: Estimated cumulative density of exits per region per year







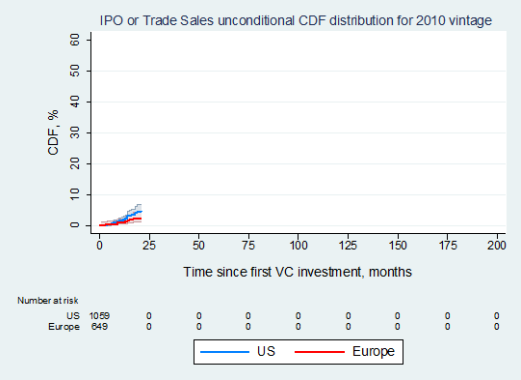
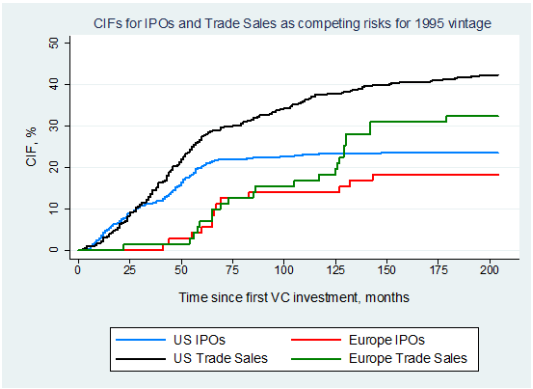
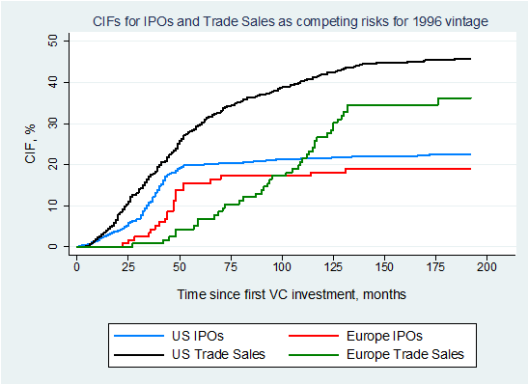
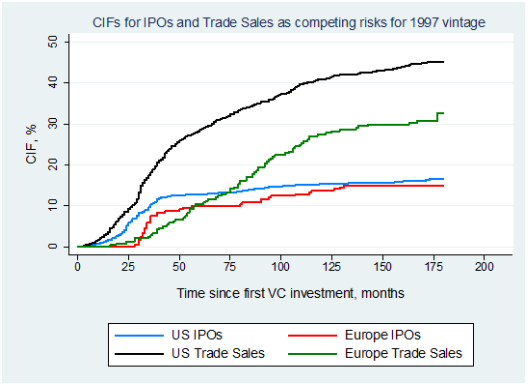


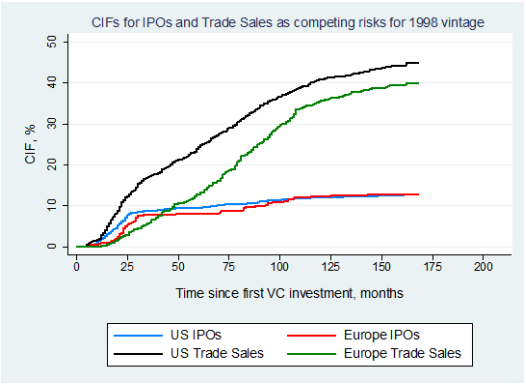
Figure 5: Estimated cumulative density of exits per region per year

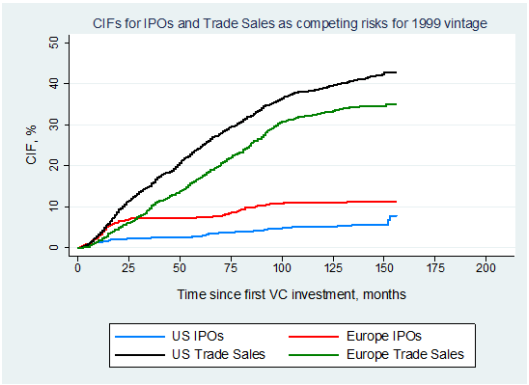
Figure 5 shows the estimated cumulative incidence function for IPOs and trade sales for both regions separately. Cumulative incidence functions were computed treating the alternative exit route as a competing risk, i.e. they represent cumulative density functions for a particular exit route allowing for the existence of the alternative exit route.











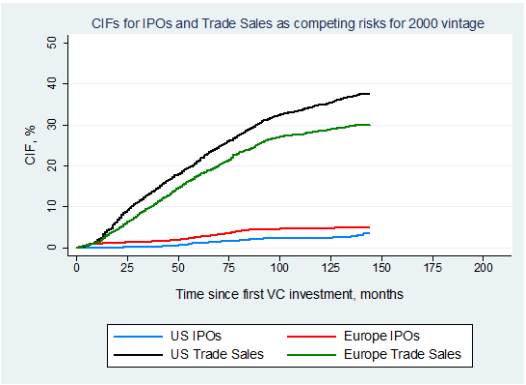
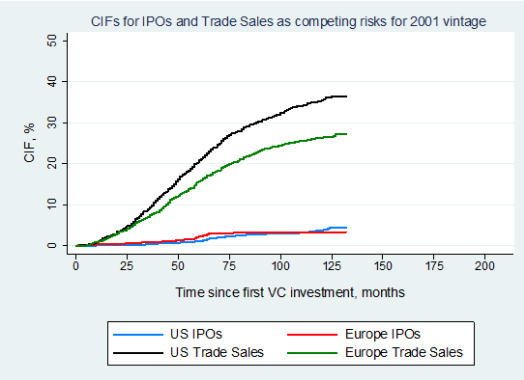
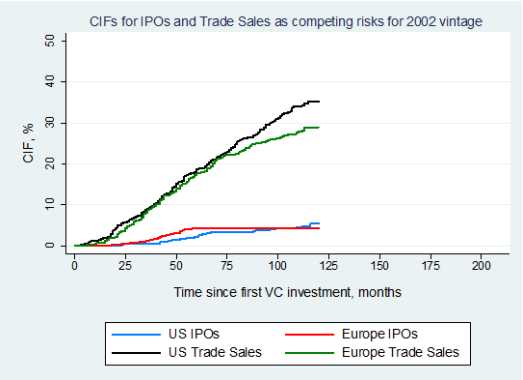
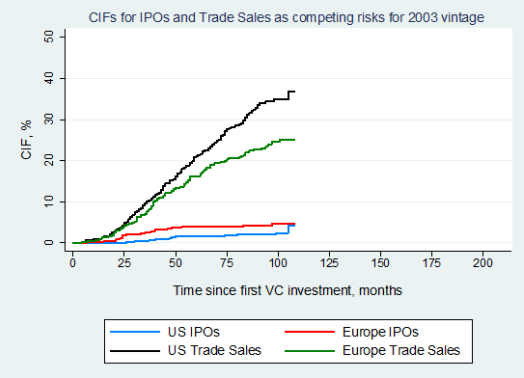
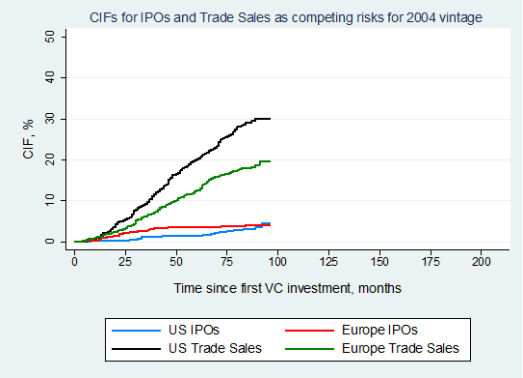


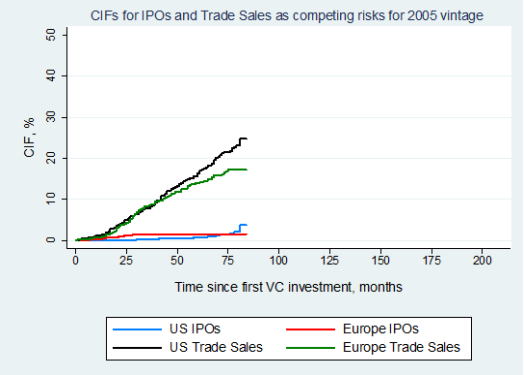
Figure 5 continued: Estimated cumulative density of exits per region per year











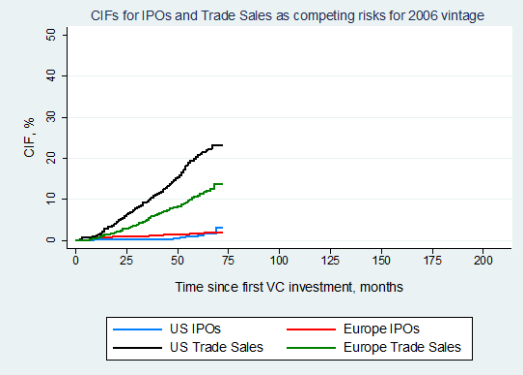
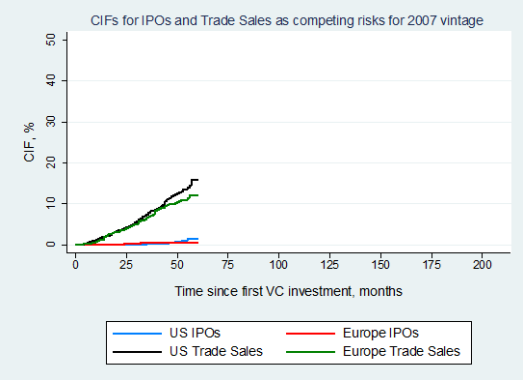
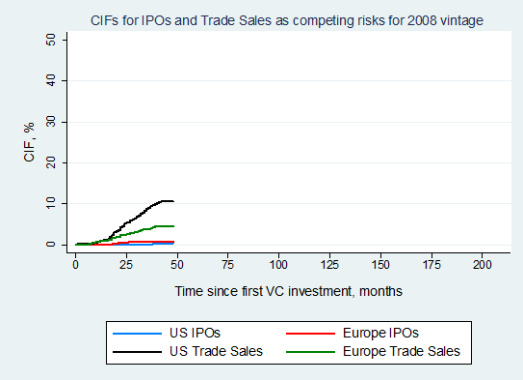
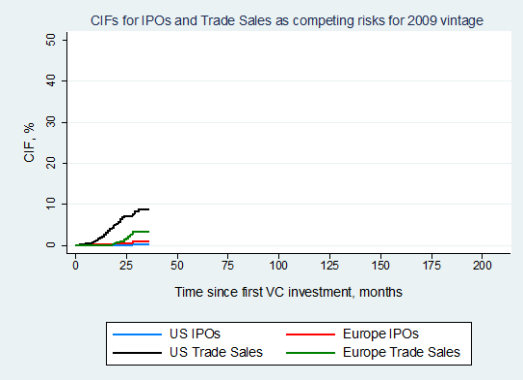


Figure 5 continued: Estimated cumulative density of exits per region per year







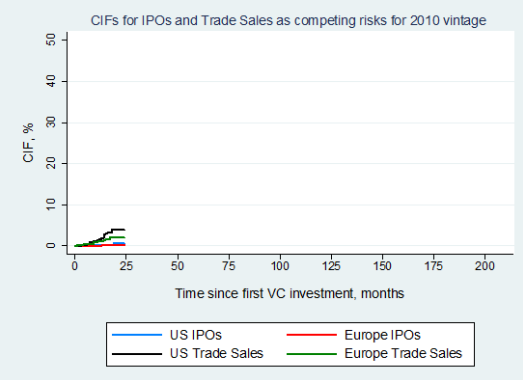


Figure 6: Calendar year dummies for IPO and Trade sale hazard rates

Figure 6 shows the calendar year dummy coefficients from Specifications (5) and (8) in Table 8.

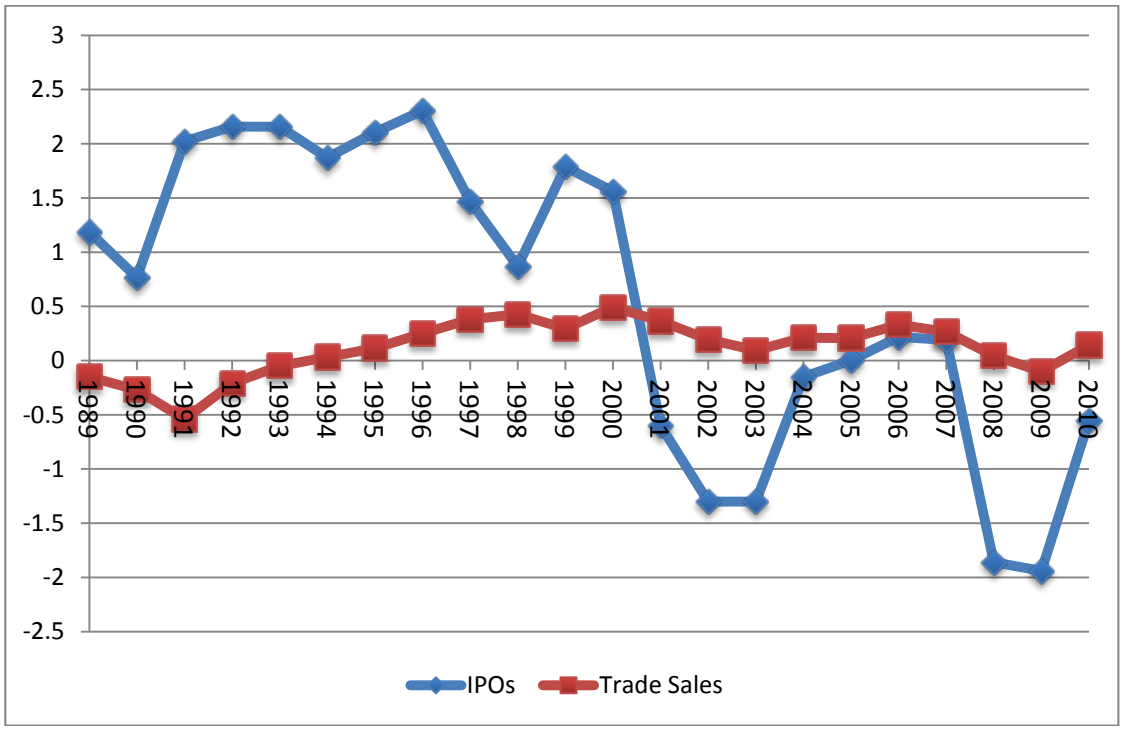


Figure 7: Serial entrepreneurship

Figure 7 shows the fraction out of all firms receiving their first round of VC financing in year t that has at least one founder with previous entrepreneurial experience. Entrepreneurial experience is identified by information in Venture Source about the background of entrepreneurs.

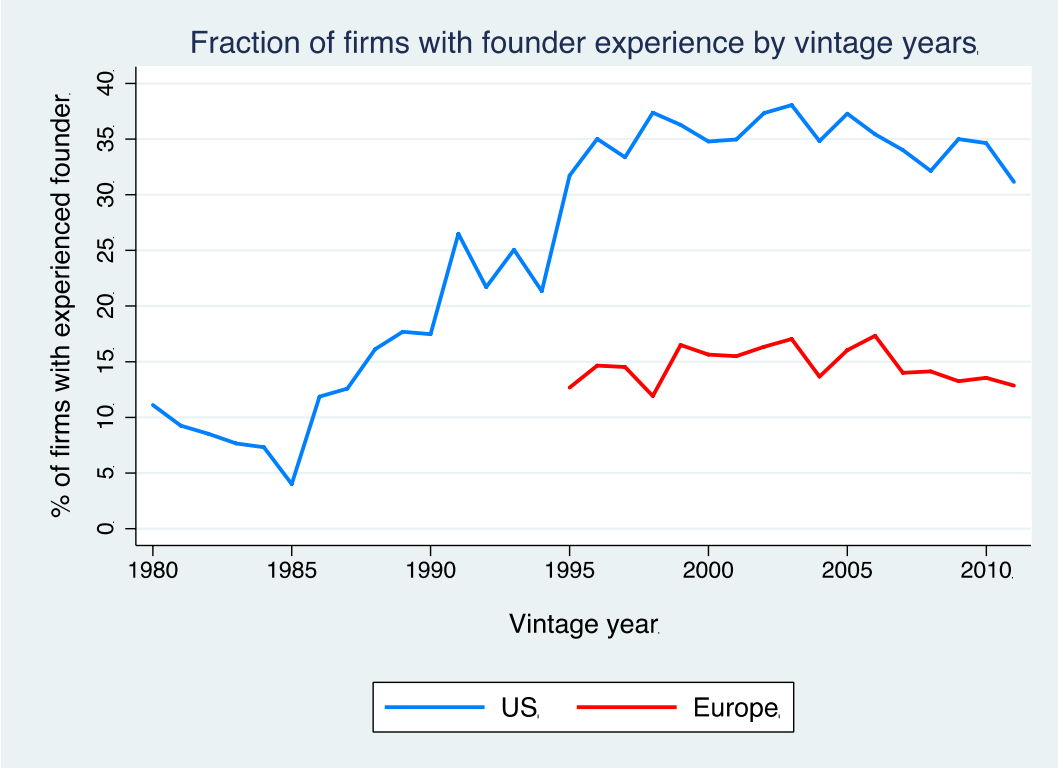


Figure 8: Stigma of failure

Figure 8 shows by the first year of VC financing the fraction of firms with founder(s) who founded a VC-backed venture before without successful exit (IPO or Trade Sale) out of all firms with at least one founder who founded a VC-backed venture before.

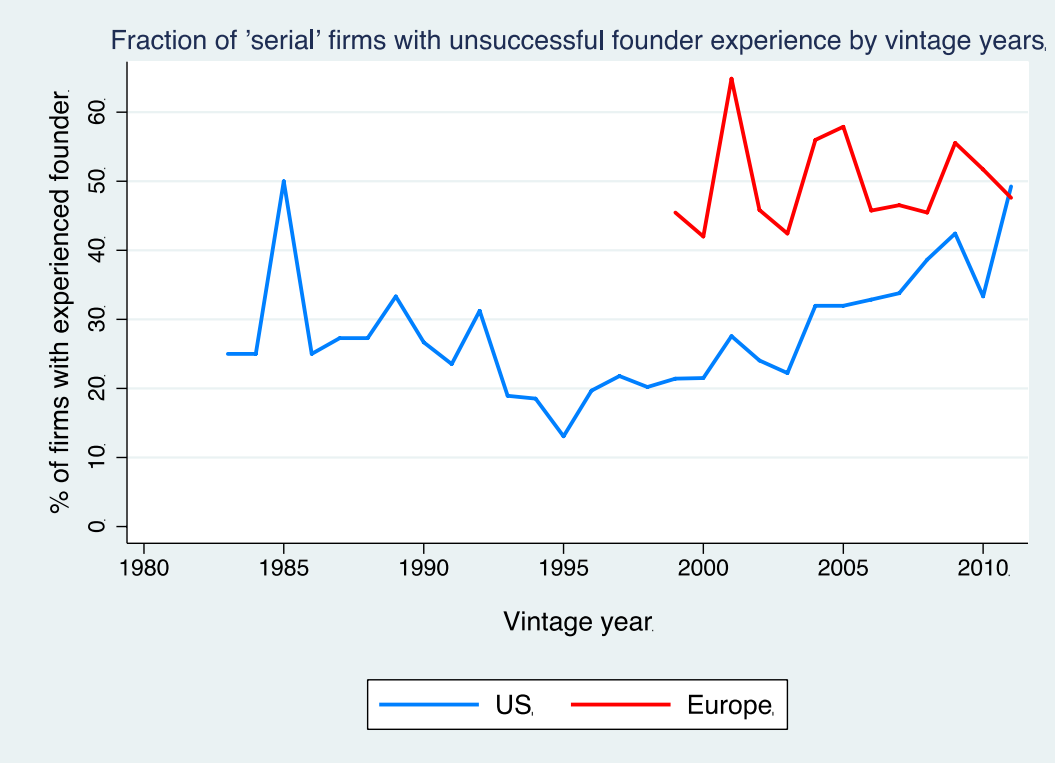


Figure 9: Success of serial entrepreneurs

Figure 9 shows for the two regions time series of success rates (IPO or Trade Sale) by year of first VC financing for different types of firms. The red line represents firms with no founders who founded a VC-backed venture before and who never founded another VC-backed venture in the future. The blue line represents firms with no founders who founded a VC-backed venture before but at least one of the founders founded another VC-backed venture in the future. The black line represents firms with at least one founder who founded VC-backed venture before.

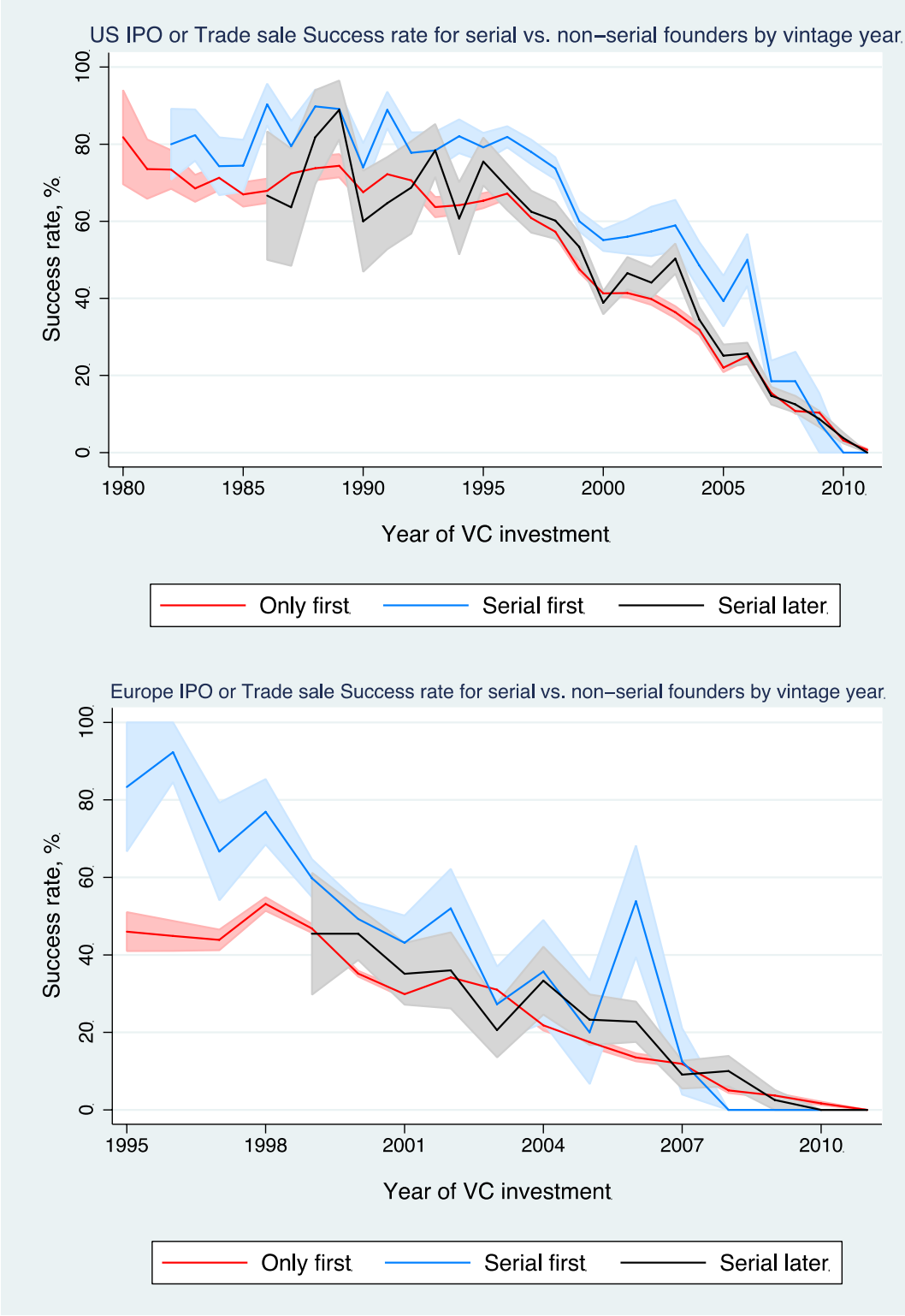


Figure 10: Experience of Venture Capitalists in US vs. Europe

Figure 10 shows the time series of VC experience by year of first VC financing. VC experience is the difference between the log of one plus the number of active investments made by a venture capital organization prior to year t and the average in year t of the log of one plus the number of active investments made by all organizations prior to year t.

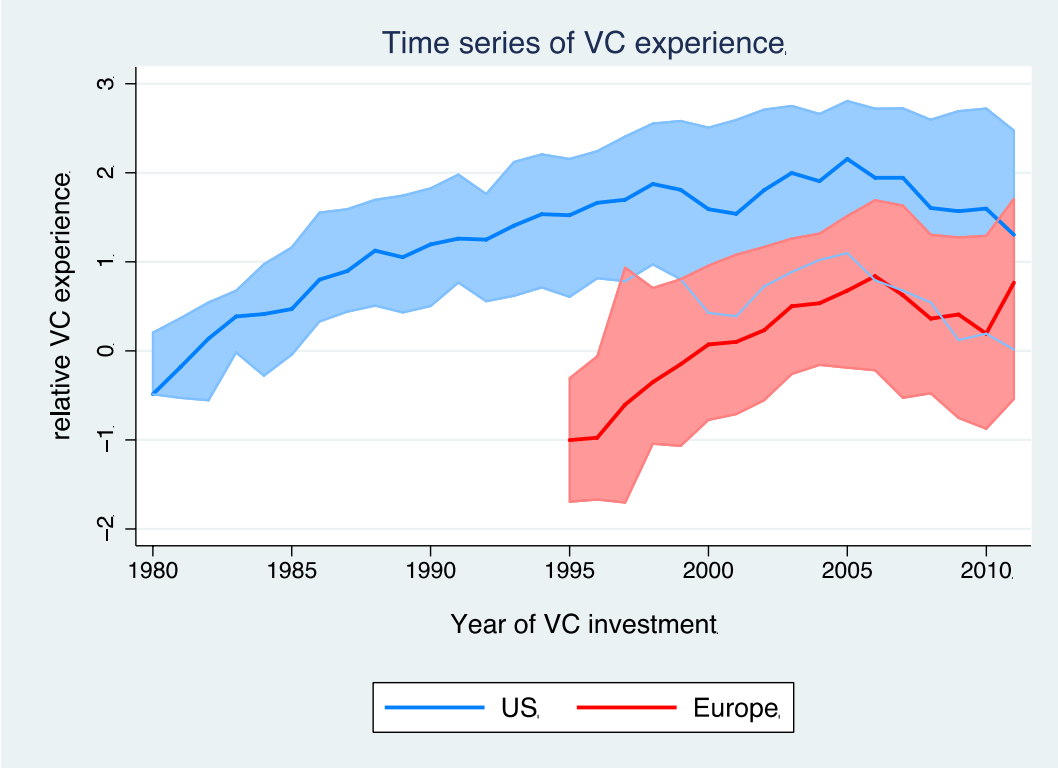


Figure 11: Pooled IPO PMEs

The figure shows the PME of the portfolio of deals in each vintage year and region that went IPO. Gray lines are number of IPOs in each vintage year and region.

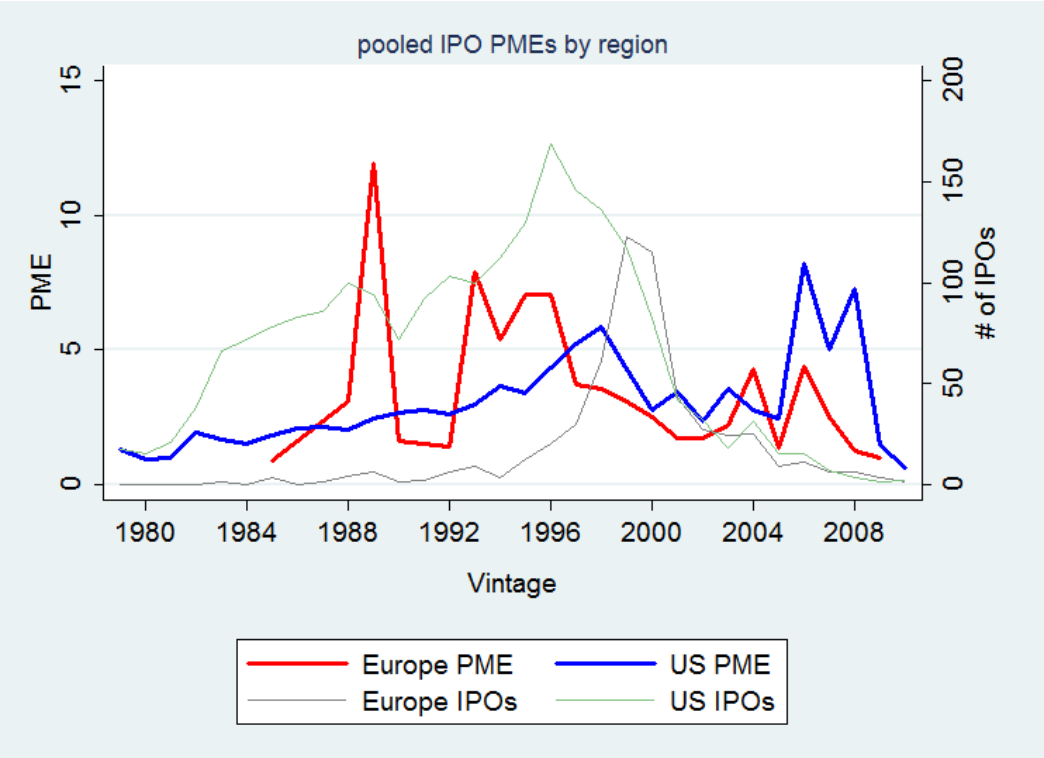


Figure 12: Deal level IPO PMEs

The figure shows median, upper quartile, and lower quartile PMEs for deals in each region and vintage year that subsequently went IPO.

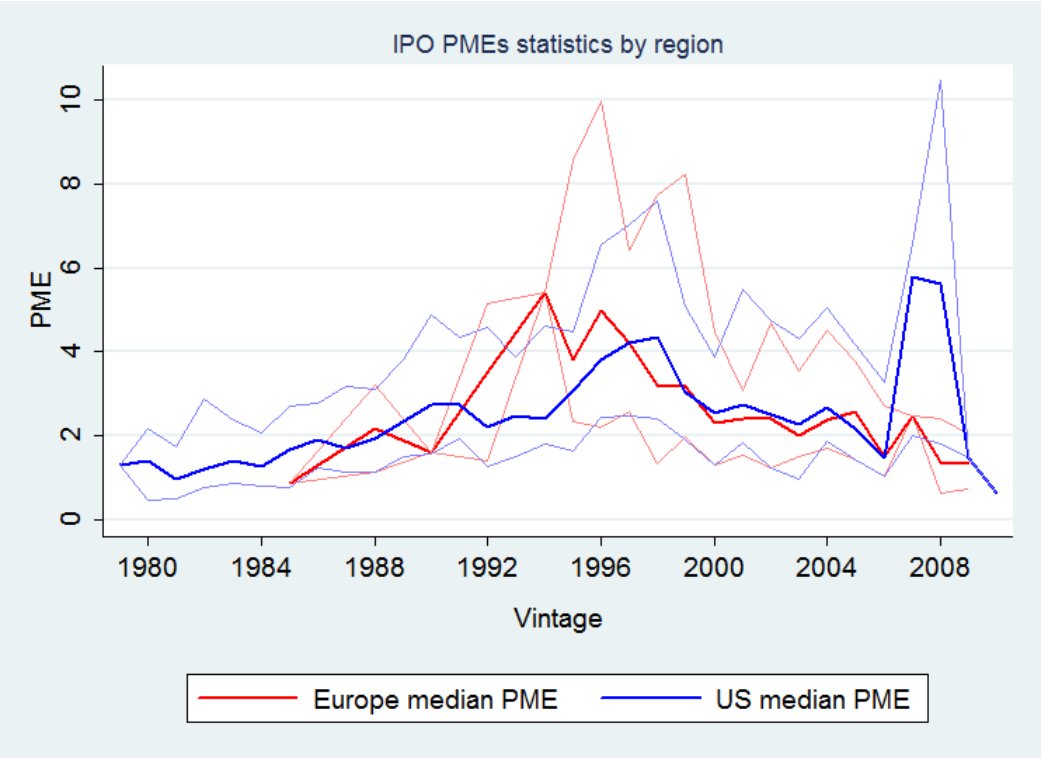


Figure 13: Deal level IPO IRRs and Alphas

The figure shows median, upper quartile, and lower quartile IRRs (upper panel) and alphas (lower panel) for deals in each region and vintage year that subsequently went IPO. Alphas are calculated by taking the yearly addition to market returns that sets PMEs to 1.

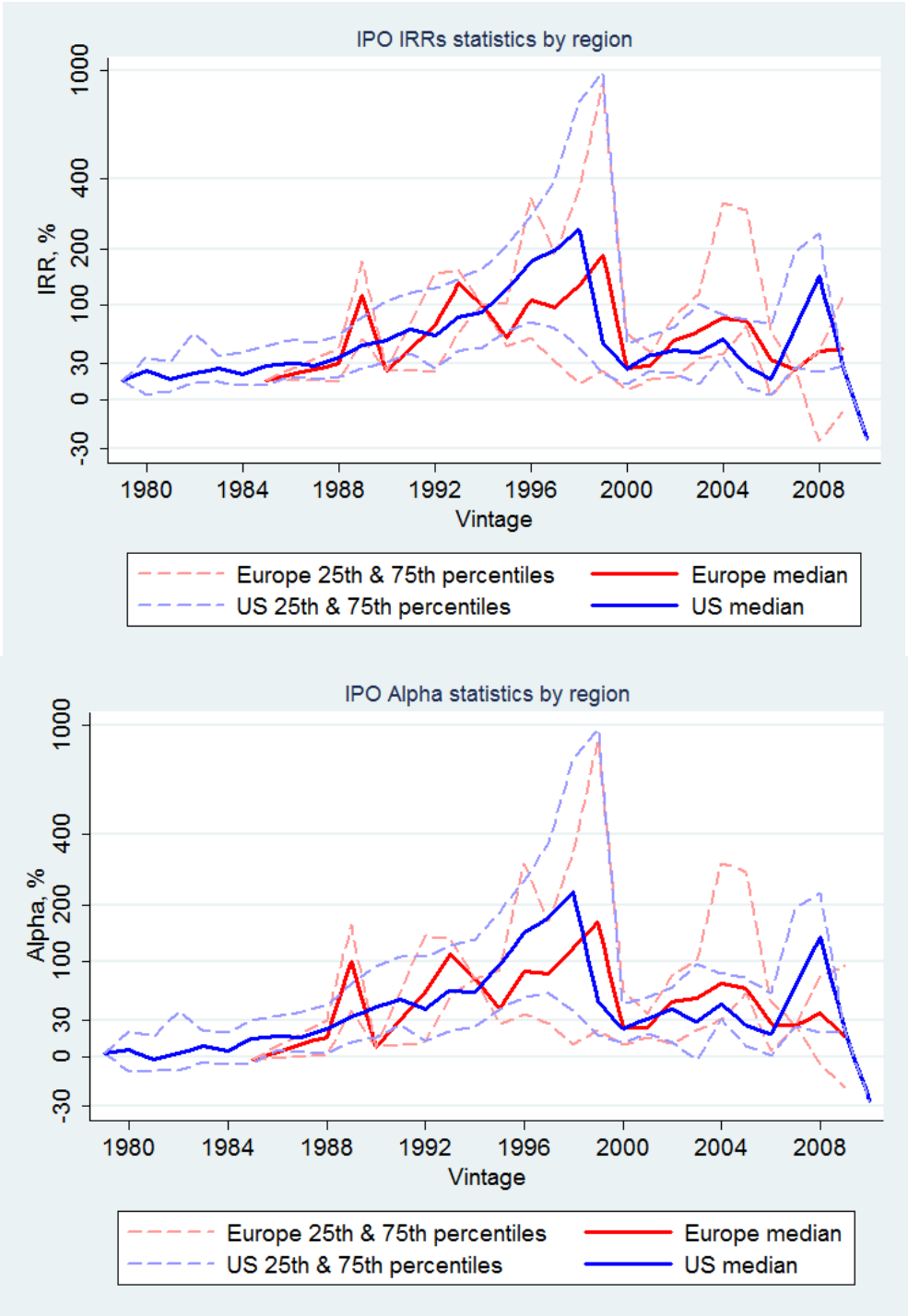


Figure 14: Pooled Trade sale PMEs

The figure shows the PME of the portfolio of deals in each vintage year and region that subsequently resulted in a trade sale. Gray lines are number of trade sales in each vintage year and region.

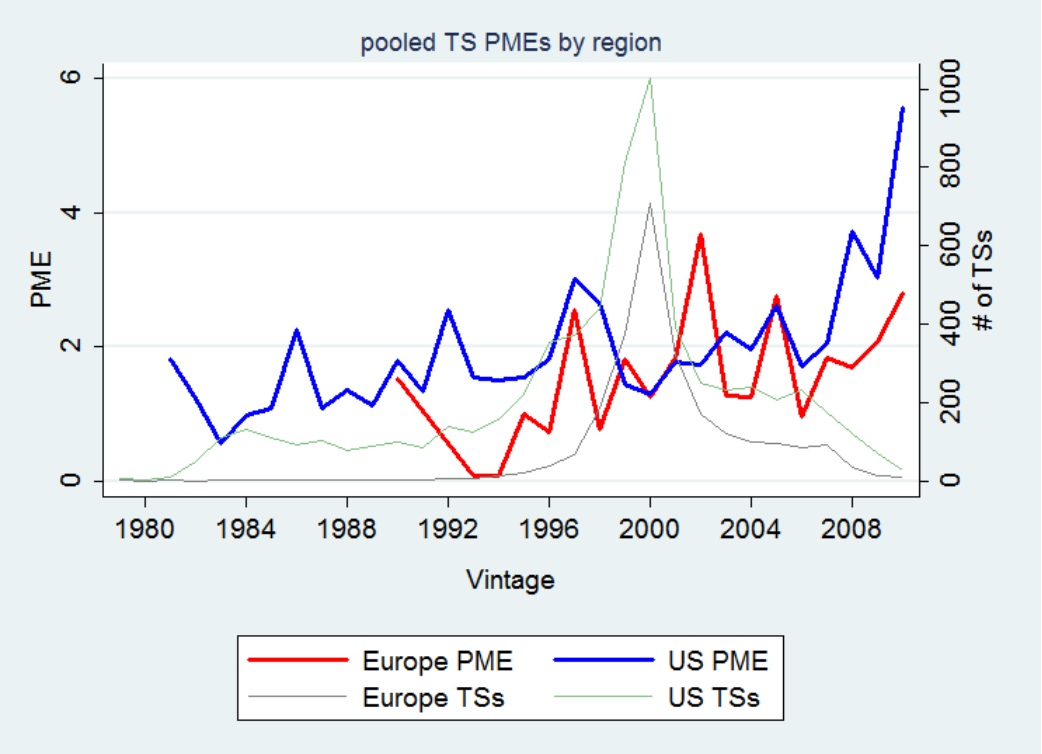


Figure 15: Deal level Trade sale PMEs

The figure shows median, upper quartile, and lower quartile PMEs for deals in each region and vintage year that subsequently resulted in a trade sale.

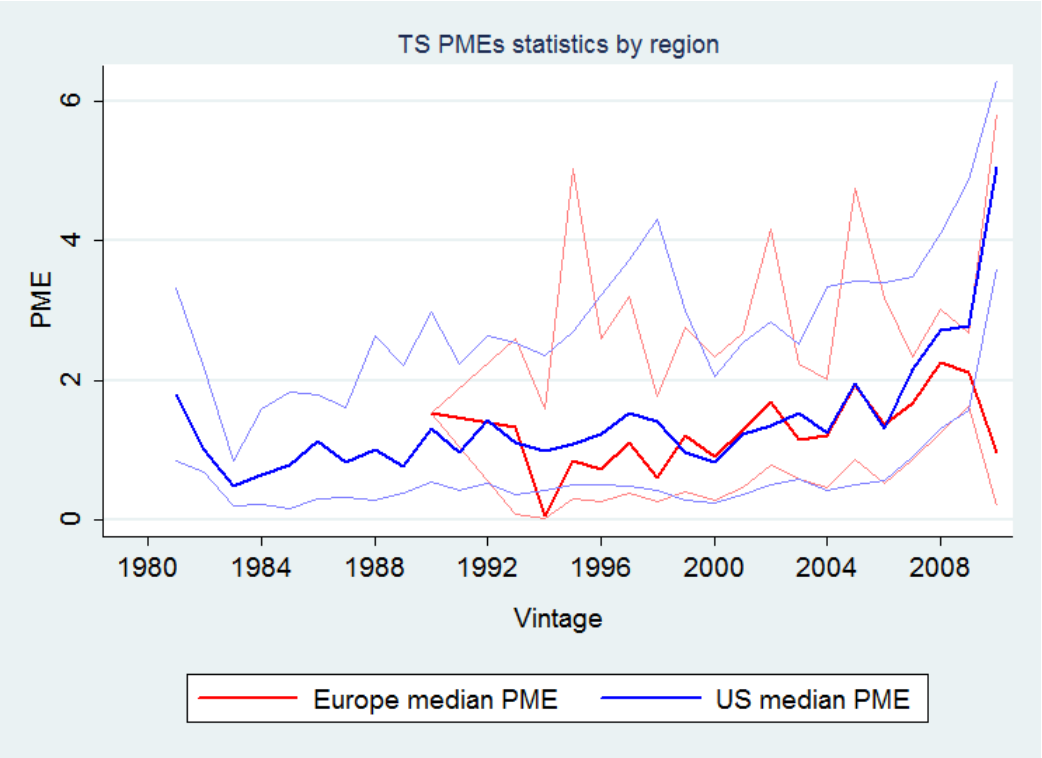
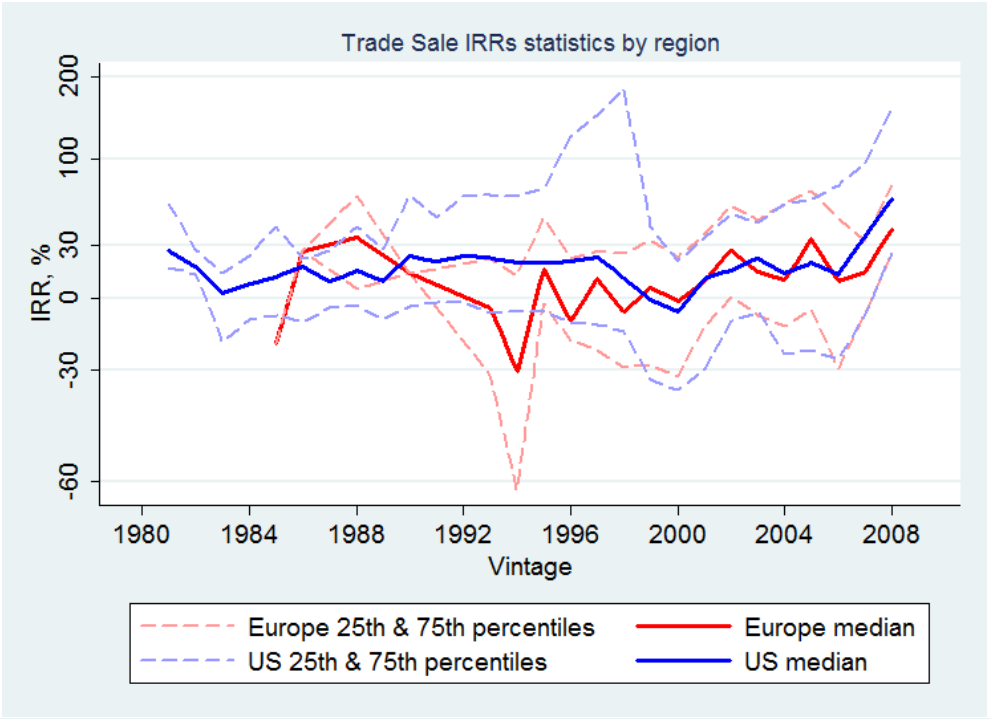


Figure 16: Deal level Trade Sale IRRs and Alphas

The figure shows median, upper quartile, and lower quartile IRRs (upper panel) and alphas (lower panel) for deals in each region and vintage year that subsequently resulted in a trade sale. Alphas are calculated by taking the yearly addition to market returns that sets PMEs to 1.



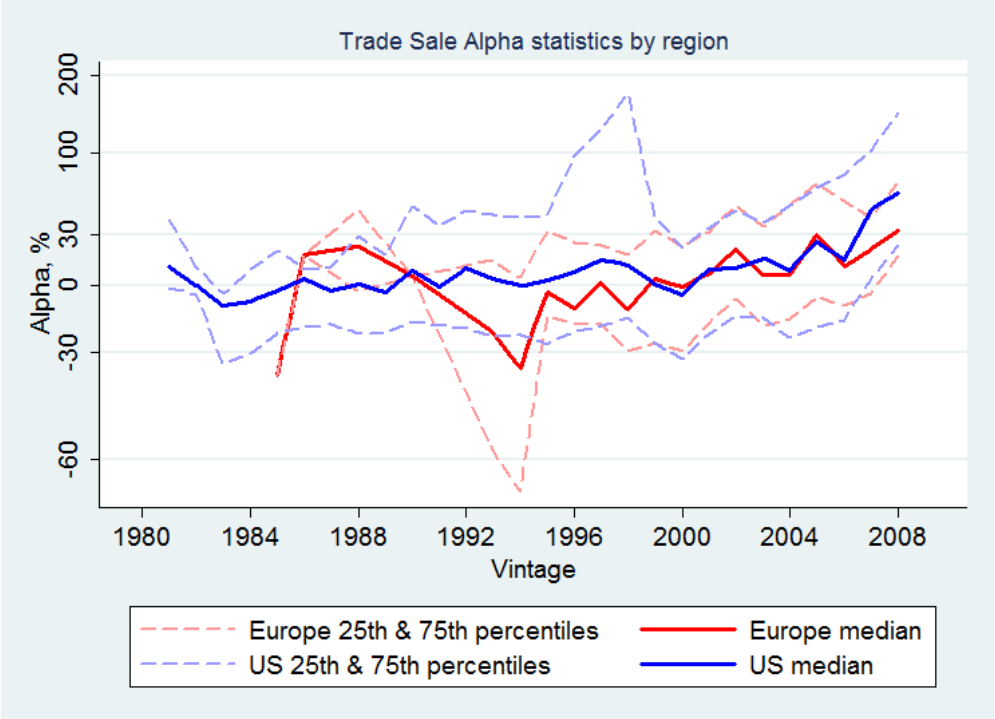


Figure 17: PMEs by buyer type

The figure shows median PMEs for IPOs and for different size buyers in trade sales.

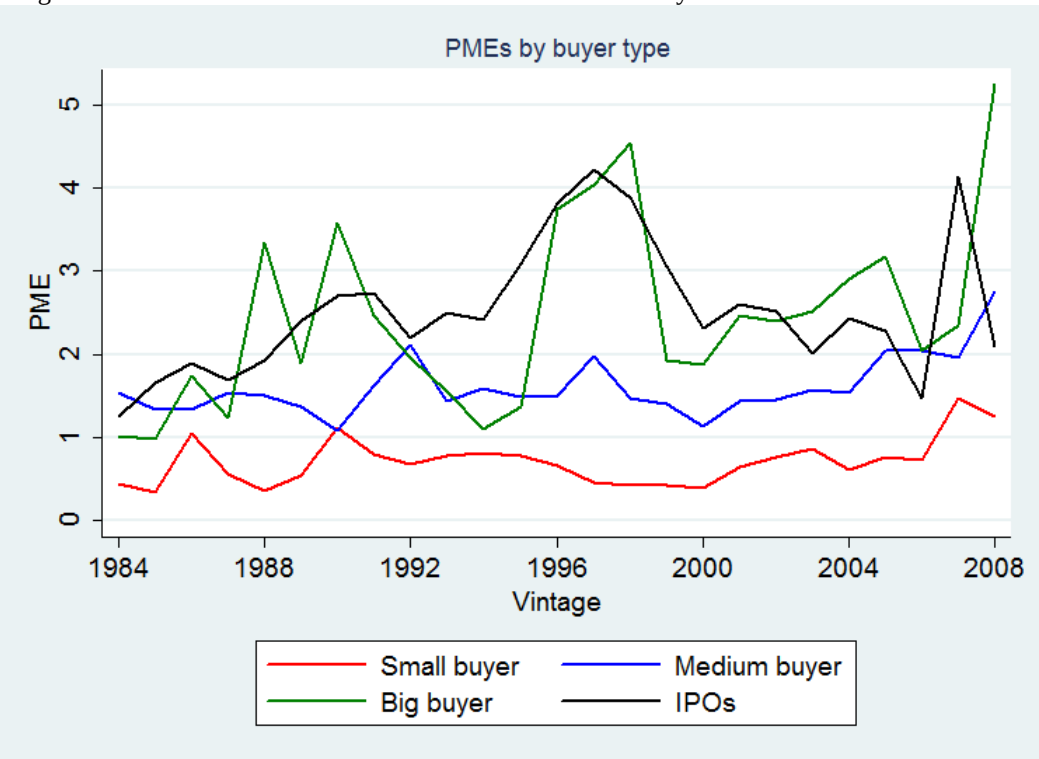
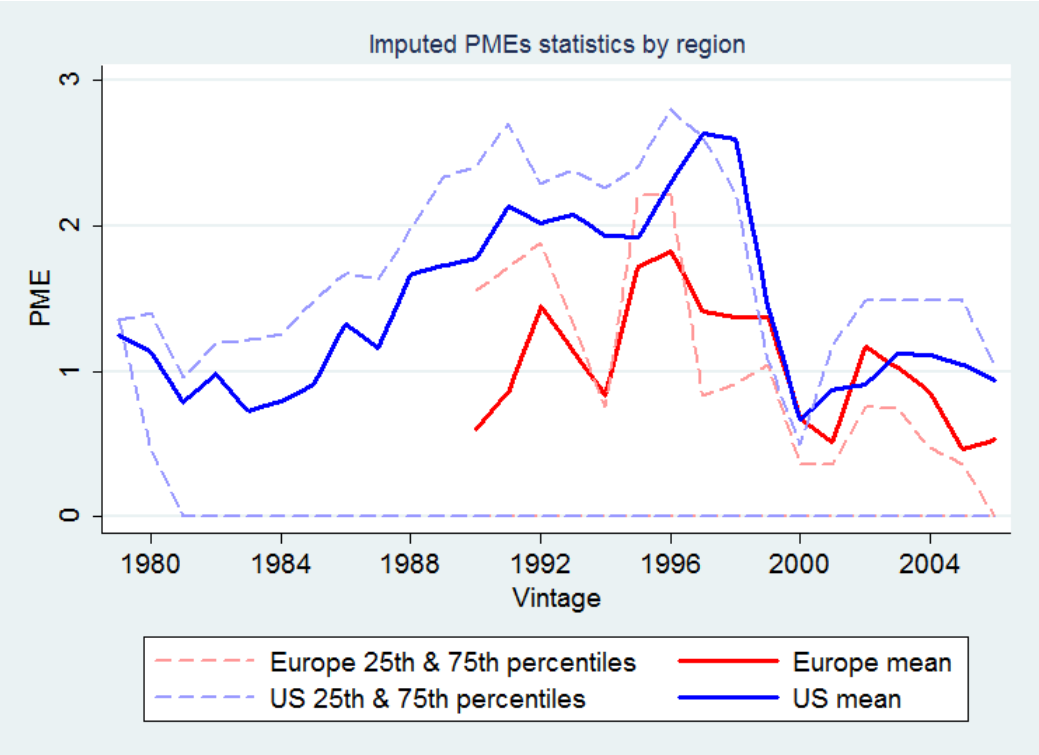


Figure 18: Average PMEs by region

The figure shows average PMEs by region, together with upper and lower quartile PMEs. For IPOs and trade sales where we do not have cash flow information, PMEs are imputed as described in the text. Failed deals have a PME of zero. For deals that are not reported as failed by 2006, we designate them as failed if no other round of financing had happened by 2011.



Insiders' selling decision of VC-backed IPOs and long-run post-IPO performance

Milan Martinovic

London School of Economics

September 2015

Abstract

Association of insiders' selling decision of VC-backed initial public offerings (IPOs) with the post-IPO long-run performance is analyzed. I find that the selling decision by insiders, measured as a fraction of shares sold by the selling stockholders to total shares sold in the offering, has significant positive association with the long-run profitability and negative association with the risk after the IPO. Furthermore, when venture capitalists sell shares in the IPO there is positive concave parabolic association between the selling decision and the post-IPO long-run market performance. However, venture capitalists selling of over-allotted shares and stock redemptions are not associated with superior post-IPO performance. Evidence on selling decision of venture capitalists confirms the importance of reputation as a factor affecting insiders' selling decisions.

I. Introduction

Secondary shares sales of insiders during the initial public offerings (IPOs) convey a signal to market participants regarding the true value of underlying assets. Both theory and evidence suggest that due to asymmetric information market participants seek premium when trading with insiders. Even if insiders have to disclose in advance their selling decision, such as in public offerings, information asymmetry concerns reduce their ability to sell, even when insiders are not acting opportunistically. For example, prior IPO studies have shown that insider selling decision and ownership structure affect the magnitude of underpricing (Ljungqvist and

Wilhelm (2003)). Ritter (1991) and Lougrhan and Ritter (1995) argue that the sale of secondary shares indicate that existing shareholders behave opportunistically by selling overpriced shares. To the extent that such information asymmetry costs are possible to mitigate, there are incentives to design appropriate institutional structures.

In this paper, I focus on insiders selling during IPOs of Venture Capital (VC) backed issuers, particularly on secondary sales by VC investors and company founders. Venture capitalists are early investors and insiders that typically have a board representation in their portfolio companies and thereby provide monitoring and advisory services. In deciding whether to sell in the IPO, venture capitalists balance the costs of continued ownership against the adverse market reaction to selling[1]. Costs of adverse market reaction to selling are particularly high for venture capitalists who are identifiable insiders and repeat players in the IPO market. As Megginson and Weiss (1991) show, institutional holdings of equity after an IPO are significantly higher for VC-backed IPOs vs non-VC-backed IPOs, increasing the importance of VC reputation on selling decision due to a repeated game between venture capitalists and institutional investors. Therefore, venture capitalists will seek to limit the impact of adverse reaction of selling on their reputation. Such reputation contributes to the ability of the venture capitalists to redeploy capital repeatedly and successfully participate in future IPOs of its portfolio companies. On the other hand, continued ownership interest of venture capitalists restrains their abilities to redeploy capital and advisory talent, as partners are limited in committing their talent. Moreover, venture capitalists preference for liquidating their stake in the IPO is motivated by their fund performance. By selling shares in the IPO, venture capitalists can return the capital back to their limited partners sooner, thereby generating higher IRR (internal rate of return) for the investment and the fund[2]. Given that the fund's IRR is positively associated with future fund raisings, repeated interaction between venture capitalists and their limited partners incentivizes them to liquidate their stakes early. Finally, negative private signal regarding future business prospects, or alternatively,

[1] Even if VC investors are not selling shares in the IPO they can influence the selling decision of other insiders.

[2] For venture capital investments that go IPO IRRs are significantly higher than the average public market returns, therefore earlier exit from the investment will generate higher IRR. A simple example can illustrate this: for median IPO deal (3.9 years investment period) IRR of venture investment is 78% (assuming full stake liquidation at the IPO), however liquidating the stake 1 year (2 years) after the IPO reduces the IRR to 62% (52%), assuming 10% annual stock return.

overpricing by the market, could influence the selling decision as well. As Lin and Smith (1998) point out, in discussions venture capitalists indicate that they prefer to sell as much of their position as possible in the IPO since remaining shares cannot be traded for several months[3]. Therefore, the selling decision depends on the interaction of several factors.

My primary goal is to investigate the association between secondary sales of venture capitalists during the IPOs and long-run performance measure of VC-backed IPOs. I also consider venture capitalists sales of over-allotted shares and stock redemptions during the IPO, which I refer to as the additional selling. There is an ample of evidence that VC-backed IPOs outperform non-VC-backed IPOs (Brav and Gompers (1997), Lin and Smith (1998), Brau et al. (2007), Krishnan et al. (2011)), hence impact of the secondary sales on the post-IPO long-run performance for VC-backed IPOs only is of interest. Particularly, due to high reputation concerns of venture capitalists, the selling decision during the IPOs and the post-IPO performance of VC-backed issuers has an impact on selling shareholders, which is less profound in non-VC-backed issuers. Moreover, the post-IPO long-run performance is important not only to IPO investors, but to venture capitalists as well, that typically hold stock beyond the lock-up period (Field and Hanka (2001)) and to limited partners who frequently receive shares after the IPO as distribution from the VC fund they invested in. Therefore, selling by venture capitalists in the IPO provides comprehensive understanding of the motivation for IPO secondary share sales and can be extended to any setting with significant reputation concerns. In addition, the analysis improves our understanding of relations between venture capitalists and their limited partners, institutional investors and underwriters.

In summary, the motivation for the secondary share sales in the IPOs gives rise to following testable hypotheses regarding the relationship between secondary share sales and post-IPO performance:

1. Secondary share sales are associated with poor post-IPO performance since selling stockholders are able to sell overpriced shares.

[3] Except for sales during the offering, underwriting agreements typically include lock-up agreement that prevents sale or distribution of shares by insiders for usually 180 days, but sometimes up to 2 years, after the offering.

2. The sale of secondary shares is not associated with poor post-IPO performance as selling is driven by motivations other than overpricing, e.g. liquidity or diversification.
3. Venture capitalists balance their reputation against selling by offering shares in IPO issuers with higher likelihood of future superior performance. Moreover, venture capitalists' reputation has an indirect effect on selling decision of other stockholders.
4. Sales of over-allotted shares and stock redemptions have lower reputation impact as they conceal the selling. Venture capitalists sell over-allotted shares in IPO issuers that do not have superior post-IPO performance. .

The evidence confirms the importance of reputation as a factor affecting the selling decision of venture capitalists. Although, most venture capitalists do not sell shares in the IPO, I find that selling secondary shares by venture capitalists is positively associated with long-run performance measure. Moreover, I provide evidence of positive association between long-run post-IPO performance and selling decision of company founders. However, sales of over-allotted shares and stock redemptions during the IPO are not associated with superior post-IPO performance and there is some evidence that venture capitalists behave opportunistically by selling short-term overpriced shares. The result that secondary sales is positively associated with long-run performance is in contrast with prior research (Brau et al., (2007)). Brau et al. (2007) analyze all US IPOs (not only VC backed) from 1980-2001 and show that secondary sales have no impact on long-run post-IPO performance, moreover selling by insiders (founders, directors and managers) has a negative impact on the long-run post-IPO performance. Brau et al. (2007) conclude that: It is secondary shares sales by information-advantaged insiders, and not secondary shares sales in general, that appear to be opportunistic. The tendency of insiders for secondary sales may be motivated by simple diversification and liquidity needs, due to selling restrictions on the secondary market post IPO. Kahl et al. (2003) argue that holding restricted shares increases shareholder portfolio risk and generally reduces portfolio value. To the extent that tendencies of non-VC insiders to sell shares is homogeneous across VC and non-VC backed IPOs, my results indicate that venture capitalists exert influence on selling decision of other insiders, supporting secondary sales for those issues that have higher probability of superior performance. Therefore, given the reputation

concerns of venture capitalists[4] of adverse market reaction to opportunistic behavior, venture capitalists mitigate opportunism by selling secondary shares in IPO issuers with superior post-IPO performance.

For IPO issuers with more than one VC investor I examine selling decision by lead venture capitalist as well as all other venture capitalists. Following Lin and Smith (1998), Hochberg et al. (2007) and Krishnan et al. (2011), I define a lead venture capitalist as having the largest stake in the issuing firm among all venture capitalists. Following Lin and Smith (1998), selling decision is defined as a fraction of shares sold to total shares sold in the offering. However, I consider alternative specifications of selling decision: a fraction of shares to total shares held before the IPO by the seller or as a dummy variable. Although, alternative specifications of selling variable produce similar results, they are not as robust as for the fraction of shares sold in the offering. The rationale of using this measure over alternative is that the size of the IPO is determined by demand. Brau et al. (2007) results show that secondary share sales are often revised depending on the IPO demand. Consequently, total capital raised in the IPO is the limiting factor and therefore share of new liquidity that is absorbed by selling stockholders seems as a better selling decision measure.

I examine the association of selling decision with issuing company's long-run performance measures after going public, using the following performance standards: i) industry-adjusted return on assets (ROA) (Krishnan et al. (2011); ii) excess returns over Fama-French 4 factor model (Field and Karpoff (2002), Gompers, Ishii, and Metrick (2003)); iii) long-run risk of IPO issuers; iv) public market equivalent (PME) (Kaplan and Schoar (2005)). I find that the selling decision by venture capitalists as well as other shareholders has positive association with return on assets and negative association with risk after controlling for observable IPO characteristics and VC experience. Moreover, selling decision by venture capitalists is positively associated with market performance measures, i.e. excess return and PME, albeit the relationship is non-linear. Separate analysis for dotcom bubble years (1999 and 2000) shows that the positive association between venture capitalists selling and post-IPO performance is not observed during the dotcom bubble. However, this is not surprising given that there was very little selling by venture capitalists during this period. Thus, I conclude

[4] Reputation of venture capitalists is indirectly associated with selling decision of other insiders, i.e. even if venture capitalists refrain from selling they might exert influence over other insiders.

that secondary sales during the IPO is a decision that conveys positive private information regarding the issuer. Venture capitalists make the selling decision when their private information regarding future prospects is positive, thereby mitigating adverse market reaction to behavioral opportunism.

My focus on insiders' selling during the IPO (venture capitalist, founders, other insiders and other shareholders) is different from the focus of Gompers and Lerner (1998), who examine venture capitalists distribution of shares after the IPO to their limited partners. They provide evidence of market inefficiency: venture capitalists time distributions and market underreacts to distributions (which are private transactions). My paper is closely related to Lin and Smith (1998), who examine determinants of selling decision of venture capitalists and their reputation (measured by experience). Their data sample consists of all US VC-backed and non-VC-backed IPOs from 1979-1990. Their main findings are that more reputable VCs engage in secondary sales and that VCs do not exhibit opportunism, i.e. secondary sales by more reputable VCs are associated with higher underpricing. In my work, I do not find evidence of higher underpricing if venture capitalists decide to sell secondary shares nor do I find association between secondary sales and venture capitalists experience (our samples do not overlap, which could explain the difference in findings). Although, Lin and Smith do not focus on post-IPO long-run performance nor do they examine it for non-VC secondary sales, Table 10 in their work indicates that, regardless of reputation secondary sales by venture capitalists are associated with better long-run post-IPO performance 1 year after the IPO. My work is also related to Krishnan et al. (2011), who examine association of a VC firm's reputation with the post-IPO long-run performance. They examine all US VC-backed and non-VC-backed IPOs from 1993-2004 period and find evidence that VC reputation (as measured by IPO market share) is positively associated with 4 distinct post-IPO long-run performance measures. I do not replicate their findings that VC reputation measure is positively associated with post-IPO long-run performance measure. My results show that VC reputation, as measured by past IPO market share, is not associated with any post-IPO long-run performance measure. Our samples cover different periods, however, which could explain the difference.

A strand of literature examines the association between secondary sales during seasoned equity offerings (SEOs) and post-IPO performance. Mikkelson et al. (1997)

find that the operating performance is unrelated to the ownership of directors and management within the first ten years of public trading. Jain and Kini (1994) show that the post-IPO performance is positively associated with the equity stake retained by company's founders. Clarke et al. (2004) find negative association between long-run returns and secondary share sales only when insiders are selling. Seasoned equity offerings literature generally finds that secondary sales are not positively associated with long-run performance measure. Moreover, insiders selling is negatively associated with long-run performance. Finally, Brau et al. (2007) examine secondary sales during IPO for all US IPOs (without specifically focusing on VC-backed IPOs) and find evidence that secondary sales do not have an impact on post-IPO long-run performance. Moreover, insiders selling is negatively associated with long-run performance.

My work is also related to broader venture capital literature and determinants of venture capital exits. Furthermore, I contribute to the post-IPO long-run performance literature by introducing performance measure which is the extension of public market equivalent measure (Kaplan and Schoar (2005)), named total PME. Total PME is a ratio of company's stock total holding period return, from the IPO date, and the market holding period return[5]. Given that more than half of VC-backed IPOs in my sample were acquired or merged before the end of observation period, holding period return should be corrected for acquisitions that involve shares of the acquiring firm. Therefore, I define total issue holding period return as the augmented standard holding period return by the holding period return of the acquiring firm.

The remainder of the paper is organized as follows: Section II describes the data. Section III provides descriptive statistics. Section IV analyzes the association between secondary sales and long-run IPO performance measures. Section V performs robustness checks. Section VI concludes.

[5] Holding period return is a buy and hold return for an IPO investor from the IPO data until the end of the observation period.

II. Data

A. IPO sample

My sample consists of all US-domiciled VC-backed IPOs completed during the 1997-2011 period in the US. Information on issuing firms and venture capitalists comes from Dow Jones' Venture Source (previously called Venture One). Venture Source, established in 1987, collects data on firms that have obtained venture capital financing. Firms that have received early-stage financing exclusively from individual investors, federally chartered Small Business Investment Companies, and corporate development groups are not included in the database. The companies are initially identified from a wide variety of sources, including trade publications, company Web pages, and telephone contacts with venture investors. Venture Source then collects information about the businesses through interviews with both venture capitalists and entrepreneurs. The data include the identity of the key founders, as well as the industry, strategy, employment, financial history, and revenues of the company. Data on the firms are updated and validated through monthly contacts with investors and companies[6]. Venture Source claims to have complete coverage of US venture capital activity from 1993 onward. My sample starts from 1997 because in computing VC reputation measures (experience and IPO market share) I use at least 3 years prior data on previous VC financing deals and VC-backed IPOs. I end my sample in 2011 in order to allow enough time to evaluate post-IPO long-run performance measures, which are measured 3 years after the IPO. This leaves me with a sample of 1074 US-domiciled VC-backed IPOs. From this set, I exclude the following: i) 32 non-US IPOs, i.e. VC-backed firm is domiciled in the US, however, the IPO was conducted oversees, e.g. 15 were listed in London on AIM or LSE; ii) 2 issues not listed on NYSE/NASDAQ/AMEX; iii) 1 reverse-merger issue. After these exclusions, there are 1039 IPOs left in the sample. Certain IPO issuer characteristics, e.g. age, come from the Venture Source database. I complement Venture Source database of venture

[6] The description in this paragraph of Venture Source is borrowed from Gompers, Lerner, and Scharfstein (2010)

capitalists with CapitalIQ database by linking distinct entities in Venture Source database if they belong to the same corporate parent[7].

IPO prospectuses are hand collected from SEC and NASDAQ websites and each prospectus is manually processed. The following information is collected from each prospectus from the corresponding section: i) Summary (IPO price, ticker, exchange, underwriter, underwriting discount, buying by existing shareholders, over-allotment option (primary and secondary)); ii) The Offering (primary and secondary shares offered, number of shares outstanding, outstanding options and warrants and other equity-type instruments and their corresponding strike prices); iii) Use of Proceeds (net proceeds to the issuer, amount of proceeds used to retire existing shares); iv) Principal Stockholders (number of shares held before the offering, number of shares sold in the offering, number of shares sold if over-allotment option is exercised – these numbers are recorded for each investor that is present in Venture Source database, for company founders and for directors and officers as a group); v) Shares eligible for future sales (lockup period, number of shares eligible for sale immediately after the IPO and 90 days after the IPO).

Each issuer is linked to Center for Research in Security Prices (CRSP) and CompuStat databases based on Company Name and IPO date. I use CRSP Daily Stock file for daily closing prices, daily returns, daily volume and shares outstanding. CRSP data is complemented with CRSP/CompuStat merged database of daily prices. I complement CRSP with CRSP/CompuStat in order to have the latest available price (which is necessary for PME computation) for an issue even after it has been delisted from a major exchange. Quarterly financial data of IPO issuers comes from CompuStat.

I use CapitalIQ and SEC filings for details of mergers and acquisitions of IPO issuers. Type of acquisition is recorded and the composition of payment. Acquiring firm is linked to CRSP and CompuStat databases and its PME is computed.

[7] This is particularly the case for Corporate Venture Capital and Financial Institutions, e.g. Intel and Intel Capital are treated as separate entities in Venture Source database, however IPO prospectuses typically only report Intel as a shareholder.

B. Post-IPO long-run performance measures

First post-IPO long-run performance measure is industry-adjusted return on assets (ROA). ROA is defined as the ratio of the trailing 12 months net income to total assets. Following Krishnan et al. (2011), each IPO issuer is matched to a sample of non-equity issuers based on the issuer's 4-digit Standard Industrial Classification (SIC) code, if there are less than 5 matches, IPO issuer is matched based on 3-digit (or 2-digit) SIC codes so that there are at least 5 matches. The median ROA of the matched sample is subtracted from the ROA of the IPO issue. Industry-adjusted return on assets is measured at the end of the third year following the IPO. If the IPO issuer does not survive for 3 years after the IPO the latest available quarter is used. Industry-adjusted ROA is winsorized at the 1% and 99% levels to reduce the effects of outliers.

Second post-IPO long-run performance measure is long-run abnormal market return. Following the existing IPO literature (e.g. Brav and Gompers (1997), Krishnan et al. (2011)), long-run abnormal market return is defined as 4-factor-adjusted abnormal stock return measured over 3 years from the IPO date or until delisting, whichever comes first. The factors used are the 3 Fama and French (1992) factors and the Carhart (1997) momentum factor[8]. Due to strong size and book-to-market effects in returns of IPO issuers (Brav and Gompers (1997)) it is important to adjust returns for the corresponding factors. I compute long-run stock returns using weekly data that are computed by compounding daily returns. I choose weekly returns in order to have enough observations for all IPO issuers (23% are delisted within 3 years after the IPO) and to avoid daily volatility in low liquid securities[9]. Following Cochrane (2005), abnormal stock returns are computed using logarithmic market model due to particularly high skewness in returns of IPO issuers. Logarithmic alphas are converted to arithmetic alphas for the ease of interpretation. I use the following logarithmic market model when computing long-run abnormal returns:

[8] Daily factor returns are obtained from Ken French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data library.html

[9] Results using daily returns instead of weekly are qualitatively the same.

$$\ln(R_{it}) - \ln(R_{ft}) = \gamma_i + \delta_{i,m}(\ln(R_{mt}) - \ln(R_{ft})) + \delta_{i,smb}\ln(1 + smb_t) + \delta_{i,hml}\ln(1 + hml_t) + \delta_{i,mom}\ln(1 + mom_t) + \nu_{it} \quad (1)$$

where R_{it}, R_{mt}, R_{ft} represent gross return of issue i, gross return of the market and gross return of the risk-free rate over period t respectively; smb_t, hml_t, mom_t are size, value and momentum factors over period t respectively. Arithmetic intercepts are reported as continuous time limits of the discreet market model in levels[10].

Third post-IPO performance measure is the long-run risk of the IPO issuer. I define long-run risk of the IPO issuer as either total risk measured by volatility of the IPO issuer returns or as idiosyncratic risk measured by standard deviation of the error term from equation (1). Arithmetic analogs of above describe logarithmic long-run risk measure are identical in the case of continuous time limits of the discreet market model in levels.

Fourth post-IPO performance measure is the ratio of the holding period return of the IPO issue to the holding period return of the benchmark over different horizons. I use 3 year, 5 years, 7 years and the end of observation period horizons. In Brav and Gompers (1997) the ratio is called Wealth Relative and they show that the choice of the benchmark[11] over the 5-year horizon for cross-sectional analysis is irrelevant. Similarly, Brau et al. (2007) show that the choice of benchmark is irrelevant over the 3-year horizon period; however, their post-IPO long-run performance variable is the difference in holding period returns and not the ratio. I use NASDAQ as the benchmark for two reasons: i) almost 95% of IPO issues are listed on NASDAQ; ii)

[10] The model in levels is defined as:

$$R_{it} - R_{ft} = \alpha_i + \beta_{i,m}(R_{mt} - R_{ft}) + \beta_{i,smb}\, smb_t + \beta_{i,hml} hml_t + \beta_{i,mom} mom_t + \epsilon_{it}$$

In continuous time limit case, parameters of the model in levels are found using the following relationship: $\beta = \delta, \sigma_\epsilon = \sigma_\nu$

$$\alpha = \gamma + \frac{1}{2}\delta_m(\delta_m - 1)\sigma_m^2 + \frac{1}{2}\delta_{smb}(\delta_{smb} - 1)\sigma_{smb}^2 + \frac{1}{2}\delta_{hml}(\delta_{hml} - 1)\sigma_{hml}^2 + \frac{1}{2}\delta_{mom}(\delta_{mom} - 1)\sigma_{mmom}^2 + \frac{1}{2}\sigma_\nu^2$$

[11] Brav and Gompers (1997) consider the following benchmarks: CRSP value-weighted index, NASDAQ or size and book-to-market adjusted

NASDAQ has similar loadings on 4-factor market model to most IPO issues. Kaplan and Schoar (2005), who term the ratio Public Market Equivalent (PME), use it to analyze private equity fund performances. In this paper, I will refer to the ratio as the PME.

Since 23% and 39% of all IPO issues are delisted within the first 3 years and 5 years respectively, and given that majority of delisting is due to merger or acquisition activity, for IPO issuer shareholders post-IPO long-run performance measure should take into account the performance of the acquiring firm if the acquisition is financed by acquiring firm's stocks. Taking into account performance of the acquiring firm is relevant because very often newly issued shares of the acquiring firm are restricted and IPO issuer shareholders could not easily liquidate them. Therefore, I define total PME long-run performance measure of the IPO issuer as the weighted average of the PME performance measure of the acquiree (i.e. IPO issuer) and acquirer:

$$Total\ PME_{acquiree} = cash(\%) \times PME_{acquiree} + \big(1 - cash(\%)\big) \times PME_{acquirer} \quad (2)$$

where $cash(\%)$ is the cash proportion of the merger or acquisition transaction. Cash proportion of the transaction is obtained from CapitalIQ and SEC filings. PME of the acquiring firm is computed as defined above.

C. Selling Decision

I define the selling decision variable as the fraction of total shares sold by selling shareholders' group to the total shares sold in the offering. Although, I do consider alternative selling variable specifications, including fraction of shares sold to total shares held prior to the IPO and a dummy variable, preference for the former is supported by the inelasticity of the IPO size to supply. Prior literature on selling shares during the IPO is based on secondary shares sales only. However, there are two additional forms of selling shares during the IPO that are of interest. Firstly, almost all IPOs involve over-allotment option (in my sample only 5 IPOs are without such option). Over-allotment option is a free option granted to underwriters by the IPO

issuer or the selling stockholders. The option, typically granted for 30 days, allows underwriters to buy 10-15% more shares than the initial offering at the IPO price. Although widely considered as a price-stabilizing mechanism, over-allotment option is another way for existing shareholders to sell their shares in the IPO. In my dataset, more than 20% of all IPOs involve selling over-allotted shares by the existing shareholders. Secondly, existing shareholders could sell their shares back to the IPO issuer (which would then be retired) concurrently with the IPO offering. Although, technically those redemptions are not part of the IPO, in most cases IPO proceeds are used to finance share redemptions. To the extent that the redemptions are performed on the same terms as the IPO, for the selling stockholders they are no different from the secondary share sale. For each IPO I record the use of proceeds and in case when the proceeds are used to finance the redemption, I record the identity of the selling stockholder. Therefore, I expand the definition of selling by existing shareholders in the IPO by adding over-allotment selling and IPO financed redemptions to the secondary share sales. Throughout the paper, I perform analysis with the "narrower", i.e. only secondary sales, and "broader", i.e. secondary sales, over-allotment sales and redemptions, definitions of shares sales.

D. Control Variables

I control for the effects of observable issue characteristics on the post-IPO long-run performance measures. To the extent that these observable issue characteristics affect selling decision, marginal effect of the selling decision on post-IPO long-run performance should primarily capture unobservable issue characteristics that I will broadly define as issuer's quality.

Previous studies find that VC reputation[12] measure affects selling decision and post-IPO performance. Lin and Smith (1998) find that VC selling decision is more likely when the VC has established reputation and Krishnan et al. (2011) find that VCs that are more reputable are associated with higher post-IPO long-run performance. Following previous studies, I use two VC reputation measures: i) IPO market share computed as VC's dollar market share of all venture-backed IPOs in the preceding 3

[12] Here I refer to VC reputation as a specific measure of the VC reputation used in the literature.

calendar years (Krishnan et al. (2011) or from the beginning of the sample until the IPO year (Nahata (2008)); ii) VC experience computed as the difference between the log of the number of investments made by venture capital organization prior to the IPO year and the log of the average number of investments made by all venture capital organizations prior to the IPO year (Gompers et al. (2009)).

Previous studies find that lead underwriter reputation effects post-IPO long-run performance measure (Carter, Dark, and Singh (1998)). If venture capitalists decide to sell the shares in the IPO, hiring more reputable underwriter in order to mitigate asymmetric information concerns and behavioral opportunism seems very plausible. Therefore, it is necessary to control for the lead underwriter reputation. I use modified Carter and Manaster ranking of underwriters that is maintained by Jay Ritter[13].

I use the following IPO issuer and IPO issue characteristics to control for observables. More established and financially stronger firms have larger IPOs (Carter et al. (1998)), thus IPO proceeds should be a control. Another proxy for more established firms is the age of the IPO issuer at the time of the IPO. Lin and Smith (1998) control for more established firms and size by controlling for total assets and the ratio of revenue to assets. I order to reduce skewness due to outliers, I use log transformation of these controls. Additional set of controls is suggested in the literature (see Krishnan et al. (2011)) that control for IPO issuer's quality: i) underpricing, defined as the first day return; ii) IPO issuer market capitalization, defined as the offer price multiplied by the total number of shares outstanding; iii) IPO issuer's book-to-market ratio, which measures firm's growth opportunities. I also control for industry and year-fixed effects. Following Gompers et al. (2006) I use broad group of 8 industries that is standard in venture capital literature. The industry groups are: i) Internet and Computers, ii) Communications and Electronics, iii) Business and Industrial, iv) Consumer Products, v) Energy, vi) Biotech and Healthcare, vii) Financial Services, and viii) Business Services.

Finally, I control for profitability measures of existing stockholders. Venture source data claims to have close to 100% coverage of all venture capital financing rounds in the US since 1993. I use round to round information to compute venture

[13] The ranking is available from the Jay Ritter's website: http://bear.warrington.ufl.edu/Ritter/rank.pdf

capital PME from the date of the first VC investment until the IPO date (Axelson and Martinovic (2015), working paper). The venture capital PME measures how profitable is the investment for the VC. If venture capitalists behave opportunistically, prior investment profitability might influence selling decision. By selling shares in their most profitable investments, VC would show good fund performance to their limited partners, which influences VC's ability to raise a new fund. Additionally, I control for how profitable is the investment for all existing stockholders at the IPO date. The information on the average price per share paid for existing stockholders is in the Dilution section of the IPO prospectus. Higher profitability of initial investment might translate to less diversification of a shareholder (since more wealth is concentrated in the investment). If insider's selling decision is driven by diversification, then profitability could influence insider's selling decision.

III. Descriptive Statistics and Univariate Analysis

A. IPO issuer characteristics

My sample of VC-backed US IPOs spans from 1997-2011, including two recessions with very low level of IPO activity. Table 1 reports the IPO frequency distribution over time for the full sample and subsamples. I consider 4 subsamples depending on the identity of the selling shareholders. In particular, I analyze selling by: i) lead venture capitalist; ii) any venture capitalist; iii) IPO issuer founders; iv) selling by any shareholder. Depending on the definition of the selling decision, i.e. "narrower" (secondary sales only) or "broader" (secondary sales, over-allotment sales or redemptions), each subsample has two specifications. Two years of highest activity during the dotcom bubble, 1999 and 2000, account for 44.1% of all IPOs and four years preceding the dotcom bubble burst in 2001 account for 61.6% of all IPOs.

VC selling frequency significantly varies over time. Only 1.3% of all IPOs (5.5% in the "broader" selling definition sense) involve selling by the lead VC during the dotcom bubble period and 15.8% (21.7%) otherwise. This shift in selling during the dotcom bubble is not unique to venture capitalists, as it is present in the selling pattern of IPO issuer's founders and any shareholders, albeit the shift is less

pronounced. For example, percent of VC-backed IPOs involving selling of any shareholders in the "broader" definition increases from 20.1% during the dotcom bubble to 44.9% outside the bubble. Since many dotcom bubble IPOs performed poorly in the long-run and selling is more prevalent in the non-dotcom period, it is important to control for the dotcom bubble effect.

Table 2 compares the characteristics of IPO issuers without and with secondary offering conditional on the selling shareholders identity. Table 2 is based on the "narrower" definition of the secondary offering, i.e. includes only secondary sales. Consistent with prior research, IPO issuers with secondary offerings (regardless of the identity of the selling shareholders) are older and more established firms. Average IPO issuer with secondary offering is around 10 years old at the time of the IPO, whereas average IPO issuer with primary offering only is almost 4 years younger. Average trailing 12 month revenue leading up to the IPO for secondary offerings is more than 3 times higher than for primary offerings. Total assets of IPO issuers with secondary offerings are double the assets of IPO issuers with primary offerings and book-to-market for secondary offerings is 50% higher than for primary offerings. IPO issuers with secondary offerings are older firms, with more assets and higher revenue, however with less growth potential. Lower growth potential translates to lower fund needs, as evidenced by lower IPO proceeds for secondary offerings. There is no apparent difference in market capitalization between primary and secondary offerings, confirming that main difference between primary and secondary IPO issuers is the growth potential. Moreover, underpricing, i.e. the first trading day return after the IPO, is significantly higher for primary IPO issuers. Higher underpricing could be attributed to higher asymmetric information in growth firms vs value firms. Alternatively, higher underpricing could be attributed to behavioral opportunism of selling stockholders, i.e. stockholders are selling shares only when they are relatively overpriced, i.e. underpricing is lower. However, as shown in Table 1, cyclicality of primary/secondary IPO offerings distribution, especially pronounced during the dotcom bubble, is a caveat in univariate analysis. For example, it is well documented that IPO underpricing was particularly pronounced during the dotcom bubble, therefore mechanically increasing the underpricing for primary IPO issuers.

Venture capital experience, measured as IPO market share 3 years before the IPO date, in general, is not significantly different between primary and secondary IPO

offerings, and it is only marginally lower when lead venture capital investors sell shares. Lin and Smith (1998) report that in their sample venture capital experience is strongly associated with selling decision of lead venture capitalist, however I do not find this association in my dataset[14]. Their dataset ends in 1990 and mine starts in 1997, i.e. we are covering different periods over which venture capital industry has experienced significant changes. Venture capital industry during 80s was just starting to emerge with number of funds dramatically increasing towards the end of the decade. Prominence of the venture capital industry came during the dotcom bubble with many new funds incepted. Among other factors, change in venture capital industry landscape could explain the change in association between selling decision and experience of venture capital firms.

Interestingly, there is no significant difference in profitability of venture capital investments, measured by Venture capital PME (results not reported), between primary and secondary IPO issuers. However, for all existing shareholders, secondary IPOs are significantly more profitable than primary IPOs. 1 dollar invested in a secondary IPO issuer by existing shareholders returns on average more than 10 dollars at the time of the IPO vs 7 dollars for primary IPOs. Finally, there is no significant difference in underwriter's reputation between primary and secondary IPOs, indicating that selling shareholders are not trying to mitigate adverse reaction to the selling decision by hiring more reputable underwriter. However, since the highest underwriter's ranking is 9.1 and the average underwriter's ranking for both groups of IPOs is above 8.1 (which is the second highest underwriter ranking possible), VC-backed IPOs are hiring the most reputable underwriters regardless of the selling decision. Most VC-backed IPOs are underwritten by a handful of underwriters: top 3 underwriters (Goldman Sachs, Morgan Stanley and Credit Suisse) account for 1/3 of all IPOs and top 10 account for 2/3.

Table 3 compares the same IPO issue characteristics as in Table 2, however for the "broader" definition of selling decision, i.e. selling includes secondary sales, over-allotment sales and redemptions. Qualitatively results in Table 3 are very similar to Table 2, i.e. variables that were significantly different between No selling and various selling identities are still significantly different for the "broader" definition of

[14] IPO market share measure is different from Lin and Smith (1998) VC experience measure, however the results are virtually unchanged if I use VC experience measure.

selling. However, comparison of IPO issuer characteristics between two selling groups (results not reported) reveals that IPO proceeds are significantly higher for the "broader" group. Trailing 12 month revenues and assets are smaller for the "broader" group, whereas underpricing is slightly higher. In general, these changes in IPO characteristics between the "broader" selling group and the "narrower" selling group suggest that IPO characteristics of issuers with over-allotment sales and/or stock redemptions are closer to issuers with primary offerings only. Given that the over-allotment selling and stock redemptions do not constitute direct selling to outside investors (in over-allotment, existing shareholders sell their shares to underwriters; in stock redemptions, shares are sold back to the IPO issuer), market's adverse reaction to these selling decisions might be less negative compared to the secondary sales. Therefore, behavioral opportunism is less of a concern for selling stockholders and they are willing to sell shares in less established companies.

B. Univariate analysis of long-run performance measures

To fully analyze long-run post-IPO performance, I consider operational (industry-adjusted ROA) as well as market performances (return and risk over a 3-year horizon and PME over a range of horizons). Table 4 presents univariate results of IPO issuers' long-run performance without and with secondary offering conditional on the selling shareholders identity. Industry-adjusted return on assets is significantly higher for secondary offerings compared to primary offerings. For secondary offerings, average ROA is from 3-8 percentage points below the industry median, depending on the selling identity group, whereas for primary offerings only ROA is on average more than 50 percentage points below the industry median. Alpha from the logarithmic market model is significantly higher for the secondary offerings compared with the primary offering. Alpha is the highest when lead venture capitalist sells shares. However, higher logarithmic alphas do not translate into higher arithmetic alphas. There is no statistical difference between primary and secondary offerings arithmetic alpha. Arithmetic alphas for primary offerings are high because idiosyncratic risk is high – average annualized idiosyncratic risk of primary offerings is above 100%, significantly higher than the idiosyncratic risk of secondary offerings. Average factor loadings of primary and secondary offerings (results not reported) are

not significantly different. Loadings have expected signs and magnitude: i) average loadings on the market and smb factors are slightly higher than unity, indicating that VC-backed IPO firms are smaller firms with average market exposure; ii) hml and momentum loadings are negative, implying that IPO issuers are growth companies and are not momentum play. Public market equivalent long-run measures are significantly higher for secondary offerings compared to primary offerings. The highest PME is observed when lead venture capitalists are selling shares. Total PME measure confirms that primary offerings preform significantly worse compared to secondary offerings. Compared to PME, total PME has lower estimates of the public market equivalent for all groups, implying that acquiring firms on average underperform the market if the acquisition is equity financed. Interestingly, by increasing time horizon from 3 to 7 years total PME declines substantially for primary offerings and slightly changes for secondary offerings, implying that primary offerings underperformance increases through time.

Table 5 repeats the analysis from Table 4, however for the "broader" definition of selling. Primary offerings have significantly lower industry adjusted return on assets, logarithmic alpha, volatility and PMEs. Arithmetic alphas are not significantly different between primary and secondary offerings due to significantly higher idiosyncratic risk of primary offerings. As in the Table 4, total PME declines through time rather quickly for primary offerings and there is almost no change in total PME for secondary offerings. Comparison of long-run performance measures between two selling groups ("narrower", Table 4 and "broader", Table 5) shows that return on assets, logarithmic alpha and PMEs are higher for the "narrower" selling group. Conversely, IPO issuers of the "broader" selling group have long-run performance measures closer to the primary offerings IPOs, implying that over-allotment sales and/or stock redemptions are associated with less establishes firms.

However, as Tables 2 and 3 show, IPO issues with primary offerings only have different characteristics than IPO issues with secondary offerings. Moreover, primary offerings are overrepresented during the dotcom bubble period. Therefore, higher risk and underperformance of primary offerings possibly could be explained by differences in firm characteristics and timing only. In order to investigate whether marginally selling decision is associated with better long-run performance and lower risk I turn to multivariate analysis.

IV. Multivariate Analysis

A. Selling decision determinants

Analysis from the previous sections shows that decision to sell shares in the IPO is presumably related to observable firm characteristics. To assess this relationship I use the following Tobit regression specification across my sample of VC-backed IPO issuers:

$$\begin{aligned}\text{Selling}^{*} = {} & a_0 + a_1\,\text{IPO Market Share} + a_2\text{Age} + a_3\text{Sales/Assets} \\ & + a_4\text{IPO Proceeds} + a_5\text{Book to Market} + a_6\text{Ranking} \\ & + a_7\text{Multiple}_{\text{existing}} + a_8\text{Dotcom} + \mathbf{b}_{\text{industry}} + \epsilon\end{aligned} \tag{3}$$

$$\text{Selling} = \max(\text{Selling}^{*}, 0)$$

where Selling is the fraction of total shares sold by selling shareholders' group to the total shares sold in the offering, IPO Market Share is 3-year measure of VC experience; Age, Sales/Assets, IPO Proceeds, Book to Market are IPO issuer characteristics in logs; Ranking is modified Carter and Manaster underwriters' ranking; $\text{Multiple}_{\text{existing}}$ is the ratio of the IPO price and the average price paid by existing shareholders and Dotcom is a dummy equal to one if IPO year is 1999 or 2000; $\mathbf{b}_{\text{industry}}$ is the vector of industry fixed effects to control for differences across industries. Table 6 reports results for different selling shareholders' identities and for two specifications of selling decision – "narrower" (only secondary sales) and "broader" (secondary sales, over-allotment sales or stock redemptions). The table reports coefficients estimates and t-statistics based on standard errors robust to heteroscedasticity and industry clustering. For the period from 1997-2011 VC experience is negatively associated with the selling decision of lead venture capitalists and weakly negative associated with the selling decision of other shareholders. The negative relation between VC selling decision and experience is particularly strong for the non-bubble period (results not reported), i.e. less experienced venture capitalists tend to sell more shares as a fraction of the IPO offering. IPO issuer age, sales to assets ratio and book-to-market ratio, i.e. proxies for firm's development stage, have

statistically significant positive association with the selling decision in all specifications, confirming the univariate findings, i.e. venture capitalists and other insiders are selling more shares in established firms. IPO proceeds are negatively associated with the selling decision, however the relation is not robust in all specifications. Underwriters' ranking is weakly positively associated with the selling decision of founders and other shareholders but not with the selling of venture capitalists. Venture capitalists do not perceive underwriters' certification role as a mechanism to reduce adverse market reaction and refrain from marginally selling more shares when underwriters are more reputable. Interestingly, profitability of existing shareholders at the IPO, measured as the ratio of the IPO price to the average price paid by all pre-IPO shareholders, is significantly positively associated with the selling decision in all specifications, however profitability of venture capitalists is not associated with the selling decision[15]. The results show that hen investment profitability of existing shareholders as a group at the IPO is high they sell more shares in the IPO, regardless of the profitability of any subgroup, i.e. venture capitalists. Finally, as observed in frequency distributions, selling was significantly less prevalent during the dotcom bubble period as confirmed by highly significant negative coefficient on the dotcom bubble dummy.

B. Underpricing

Underpricing, defined as the first day return after the IPO, is an immediate indicator of under- or over-pricing of the IPO. Univariate analysis shows that underpricing is significantly higher of primary offerings only, however in order to properly control for time effects and other observable characteristics I consider the following specification:

[15] PME of venture capital investments, a measure of profitability, is not included in the regression specification because in 18 IPO issuers PME is not computed due to lack of data. However, as previously stated, PME of venture capital investments is not significantly different between selling and no selling group in any specification.

$$\begin{aligned}\text{Undepricing} = a_0 + a_1\,\text{Selling} + a_2\,\text{IPO Market Share} + a_3\text{Age} \\ + a_4\text{Sales/Assets} + a_5\text{IPO Proceeds} \\ + a_6\text{Book to Market} + a_7\text{Ranking} \\ + a_8\text{Multiple}_{\text{existing}} + a_9\text{Dotcom} + \mathbf{b}_{\text{industry}} + \epsilon\end{aligned} \quad (4)$$

where underpricing is measured in logs and all other variables are the same as in (3). Table 7 reports results for different selling shareholders' identities and for two specifications of selling decision – "narrower" (only secondary sales) and "broader" (secondary sales, over-allotment sales or stock redemptions). Selling decision by venture capitalists is not associated with underpricing, however there is weakly significant negative association with the selling decision when founders are selling shares. These two results imply that venture capitalist tend to sell shares in established firms that are not overpriced, i.e. when underpricing is not low. On the other hand, founders are less concerned and sell shares in somewhat overpriced firms, i.e. when underpricing is low. However, in the dotcom bubble subsample (results not reported) there is some evidence of lower underpricing when venture capitalists sell shares, i.e. venture capitalists behaved opportunistically by selling overpriced shares, although very few were selling during the dotcom bubble. The results generally confirm the hypothesis that venture capitalists have reputation concerns and tend to mitigate market's adverse reaction to behavioral opportunism by not selling overpriced shares.

IPO issuer age is significantly negatively associated with the underpricing in all specifications, whereas sales-to-assets and book-to-market ratios, although negatively associated, are not statistically significant. As expected from the univariate analysis, more established IPO issuers have lower underpricing since information asymmetry is less profound. The size of the offering is significantly positively related to the underpricing, i.e. larger deals require bigger discount in order to be completed. Underwriters' ranking is not associated with underpricing and VC experience, although positively associated with underpricing, is not statistically significant. Profitability of existing stockholders is significantly positively associated with underpricing, indicating that, although very profitable for early investors, these IPO issues are still undervalued by underwriters. As expected, the underpricing was particularly high during the dotcom bubble period as evidenced by statistically significant estimates for the dotcom bubble dummy.

C. Return on assets

Information contained in the selling decision of existing shareholders should manifest itself in post-IPO long-run performance measure, if there is one. I assess the power of the selling decision to predict long-run performance by using the following regression specification:

$$\begin{aligned} \mathrm{P} = a_0 + a_1 \mathrm{Selling} + a_2\ \mathrm{IPO\ Market\ Share} + a_3 \mathrm{Age} \\ + a_4 \mathrm{Sales/Assets} + a_5 \mathrm{IPO\ Proceeds} \\ + a_6 \mathrm{Book\ to\ Market} + a_7 \mathrm{Underpricing} + a_8 \mathrm{Ranking} \\ + a_9 \mathrm{Multiple}_{\mathrm{existing}} + a_{10} \mathrm{Dotcom} + \mathbf{b}_{\mathrm{industry}} + \epsilon \end{aligned} \tag{5}$$

where P is one of the long-run performance measures: industry adjusted return on assets, logarithmic excess return, idiosyncratic risk, or total PME; Selling is the fraction of total shares sold by selling shareholders' group to the total shares sold in the offering; other explanatory variables are identical as in equation (3). In all specifications, standard errors are robust to heteroscedasticity and adjusted for industry clustering. I consider 4 selling shareholder's groups (selling by lead VC, any VC, Founders and Any shareholder) and within each group there are two specifications depending on the definition of the selling variable, i.e. "narrower" or "broader".

Ex ante, there is no reason to believe that long-run performance measure and selling decision are linearly related, therefore I consider the following non-linear regression specification:

$$\begin{aligned} \mathrm{P} = a_0 + a_1 \mathrm{Selling} + b_1 \mathrm{Selling}^2 + a_2\ \mathrm{IPO\ Market\ Share} + a_3 \mathrm{Age} \\ + a_4 \mathrm{Sales/Assets} + a_5 \mathrm{IPO\ Proceeds} \\ + a_6 \mathrm{Book\ to\ Market} + a_7 \mathrm{Underpricing} + a_8 \mathrm{Ranking} \\ + a_9 \mathrm{Multiple}_{\mathrm{existing}} + a_{10} \mathrm{Dotcom} + \mathbf{b}_{\mathrm{industry}} + \epsilon \end{aligned} \tag{6}$$

where a_1 and b_1 are parameters of interest that describe non-linear relationship between the selling decision and the long-run post-IPO performance. For each specification,

Panel A corresponds to linear model and Panel B corresponds to non-linear model. Other explanatory variables are the same as in equation (5).

Table 8 Panel A reports cross-sectional regression of industry adjusted return on assets. The selling decision variable has statistically significant positive association with return on assets in all specifications. The association is strongest when IPO issuer's founders are selling the shares. Economically, the magnitude of the association is significant as well: when lead VC, any VC, founders or any shareholders as a group decide to sell secondary shares on average they sell 14%, 16%, 7% and 25% of the total offering, respectively. This average selling, conditional on keeping other control variables fixed, translates into increasing industry adjusted return on assets from -50% to -40%, -39%, 41%, and -35% respectively, i.e. selling is associate with lowering return on assets underperformance of IPO issues relative to their industry peers by 20% on average.

Examining other control variables, IPO market share as a measure of VC experience is not significant in any specification. IPO issuer characteristics: age, asset turnover ratio (i.e. sales-to- assets ratio), IPO proceeds and book-to-market are all statistically significant and positively associated with return on assets, as previously reported. Underpricing is not associated with return on assets measure and underwriters' ranking is weakly positively associated. As expected, the dotcom period is significantly negatively associated with the return on assets, a mere reflection of the bubble burst. Finally, profitability of existing stockholders is positively related to post-IPO return on assets, proving that not only were these issues very profitable for early investors but they continue to provide superior performance up to 3 years after the IPO.

Panel B of Table 8 reports estimates of non-linear specification. The linear term is statistically significant and positively associated with return on assets with magnitudes comparable to the linear specification. The quadratic term although negative, is not statistically significant in all specifications except when founders sell shares. When founders are selling shares in the IPO there is non-linearity in relationship between return on assets and founders' selling decision. At the mean level of the selling variable when founders' sell shares (7%) the effect of the quadratic term is small compared to the linear term. The maximum relation of founders' selling

decision on return on assets is when founders sell $-a_1/2b_1$ =25% of the total offering. More selling by founders is associated with lower post-IPO return on assets. Other explanatory variables are virtually unchanged compared with the linear specification.

D. Risk and return measures

Table 9 Panel A reports regression estimates and t-statistics of annualized logarithmic excess returns, measured 3 years after the IPO or until delisting, whichever comes first. Contrary to the results from return on assets measure, there is no statistically significant difference in any specification when shareholders are selling shares in the IPO. The univariate difference in logarithmic excess returns from Tables 4 and 5 is explained by control variables, leaving no statistical power for the selling decision. Although, the direction of the coefficient estimates for the Selling decision is positive, the magnitude is small. VC experience is also not associated with higher logarithmic alphas, however other control variables are. IPO issuer's age and book-to-market are weakly positively related to excess returns, whereas asset turnover ratio is significantly positively associated, implying that more established firms outperform less established ones and indicating a certain level of market inefficiency. IPO proceeds is negatively related to excess returns in all specifications, implying that larger IPO deals, keeping other controls fixed, underperform. As expected, underpricing is strongly positively associated with excess returns, however this relationship is partly mechanical since large first day return can influence long-term excess return. Underwriters' ranking and existing shareholders' profitability are strongly positively associated with excess returns. Underwriters' certification role has a profound positive effect on post-IPO price performance. On the other hand, high investment returns for existing shareholders is not impediment for future performance, issues that were highly profitable for early investors continue to outperform their peers. Finally, dotcom dummy, as expected, is strongly negatively associated with excess returns. Predictability of post-IPO excess returns 3 years after the IPO by pre-IPO issuer characteristics constitutes violation of market efficiency in semi-strong form. It is a puzzle that merits further research; however, it remains to be seen whether it is possible to take advantage of the mispricing since short selling IPOs is not possible and typically, short selling is very costly for newly listed equity issues immediately following the IPO.

Panel B of Table 9 reports estimates of the non-linear specification of log excess return regression. No association between excess return and selling decision reported in Panel A translates to quadratic relationship. In all specifications with secondary selling, except when founders sell, the relationship is parabolic which initially increases with more selling, reaches a peak and then decreases. The maximum association is at the following levels of the selling variable: 28%, 29%, and 34% for lead VC selling, any VC selling, and any shareholders selling respectively. These levels are above the average level of the selling decision variable of 14%, 16%, and 25% respectively; however, the values are relatively close, implying that the average association of selling and excess return is positive and close to theoretical maximum. The magnitude of the association at the average level of selling is around 10% improvement of the excess return for all three selling groups, which is economically significant compared to the average excess return of more than -40% when there is no selling. The quadratic relationship between market performance and selling decision implies that private information contained in the selling decision is not priced by the market. IPO issuers in which existing shareholders sell shares outperform IPO issuers without selling, conditional on selling not being excessive. Remaining control variables in Table 9 Panel B preserve their relationship with excess return observed in Panel A.

Univariate analysis shows that IPO issuers are very risky stocks, with average idiosyncratic risk close to 100% annually. High idiosyncratic risk is of interest on its own as it complements analysis of excess returns. Table 10 Panel A estimates the relation between annualized idiosyncratic risk and selling decision for linear specification and Panel B for non-linear specification. There is statistically strong negative association between the idiosyncratic risk and the selling decision for all selling groups. At the average level of selling, the impact of selling decision on the reduction in idiosyncratic risk is 8%, 9%, 4%, and 11% for lead VC selling, any VC selling, founder selling, and any shareholder selling, respectively. These correspond to around 10% reduction in idiosyncratic risk compared to the no selling group. All 4 IPO issue characteristics (age, sales-to-assets, book-to-market and IPO size) are also strongly negatively associated with the idiosyncratic risk implying that more established firms are less risky. Underpricing and the dotcom bubble period, as expected, are strongly positively associated with the idiosyncratic risk. This is not

surprising given that many dotcom bubble stocks were very volatile. It is worth noting that predictability of idiosyncratic risk of VC-backed IPO issues is very strong with adjusted-R square close to 50% in all specifications. This should not come as a surprise given that predictability of risk is well documented in the literature, nevertheless it is intriguing to see highly predictable risk model.

Panel B of Table 10 reports estimates for the non-linear specification of the idiosyncratic risk regression. Although, not in all selling groups, there is parabolic quadratic relationship between the selling decision and the idiosyncratic risk. The relationship is negative and for small levels of selling decision it declines further until the minimum is reached at the levels of selling variable of 63% and 75% for lead VC and any VC selling[16], which are well above the average level of the selling decision variable of 14% and 16% respectively. Therefore, the average level of the selling decision variable if far from the optimal level for maximizing reduction in idiosyncratic risk. Estimated economic impact of the average selling decision is reduction of the idiosyncratic risk by around 12% for both VC selling groups, in line with the linear specification. Relationships and significances of other control variables is virtually unchanged between linear and non-linear specifications.

E. Total PME measure

Table 11 Panels A and B report estimates of the final post-IPO long-run performance measure – total PME measured relative to Nasdaq benchmark 3 years after the IPO date or until delisting, whichever comes first. Panel A estimates show that there is no statistically significant relationship between the selling decision and the total PME in linear specification. Sales-to-assets ratio and underwriters' ranking, two variables that were good predictors of excess returns, are statistically significant and positively associated with the total PME. The dotcom bubble, as expected, is significantly negatively associated with the total PME measure, indicating that the underperforming IPO issuers are overrepresented in the dotcom period. Other control variables are not statistically significant, although respective signs point in the same direction in all specifications.

[16] For founders and any shareholders selling the quadratic term is not statistically significant.

Results from Panel B confirm previous finding that the relationship between the selling decision and post-IPO PME measure is non-linear. Quadratic relationship is similar to the quadratic relationship from excess return regressions – relationship is positive and for small levels of the selling decision variable it is increasing until the maximum is reached, after which there is a decline in relationship. Quadratic relationship is statistically significant when venture capitalists are selling secondary shares only (specifications (1) and (3) from Panel B) and is not significant when founders sell shares. The level of the selling variable at which the maximum level of relationship between the selling decision and the total PME is reached is 39% and 43% for lead VC and any VC selling, respectively. These levels are above the average selling levels of 14% and 16% for lead VC and any VC selling, respectively, which correspond to increment of the total PME by 0.10 and 0.12 points, respectively. Economically, these increments are equivalent to improving the total PME by around 15% relative to the no selling group. Of the remaining explanatory variables, only asset turnover and underwriters' ranking are statistically significant and positively associated with the total PME. The dotcom bubble dummy, as expected, is statistically significant and negatively associated with the total PME.

Univariate analysis showed that through time the total PME for primary issues declines, whereas no such trend is observed for secondary issues. Table 11 Panel C repeats the total PME non-linear cross-sectional regression estimates when the dependent variable is the total PME 7 years after the IPO or until delisting, whichever comes first. As suspected from the univariate analysis, the relationship between 7-year total PME and the selling decision variable is stronger than for 3-year case. Except for founders selling, selling by lead VC, any VC or any shareholder has strong quadratic relationship with 7-year total PME. The relationship increases for lower levels of selling decision and reaches a peak at the following levels of the selling decision variable: 34%, 37% and 42% respectively. At the average level of selling of secondary sales the impact on 7-year total PME is around 0.11 points in all three specifications. This represents economically significant 15% increase of base 7-year total PME when no selling occurs.

F. Over-allotment sales

Analysis of VC-backed post-IPO long-run performance shows that, although there is positive association between the selling decision in the "broader" sense and post-IPO performance measures, the relationship is weaker relative to the "narrower" definition of the selling decision. In order to test the relationship between the over-allotment selling and redemptions only, i.e. the additional selling relative to the regular secondary sales, and post-IPO long-run performance I redefine the selling variable to reflect only additional sales when there is no secondary sales. Additional sales only constitute selling by insiders through over-allotment option or redemption of stock when there is no direct secondary selling in the IPO. The number of IPO issuers with additional sales is approximately 1/2 of the number of deals with secondary sales only, i.e. the frequency of additional selling is high enough to make statistical inferences regarding the relationship between the additional selling and post-IPO performance.

Table 12 repeats estimates from Tables 6-11 when lead venture capitalists sells[16]. The association between the additional selling and IPO issue characteristics of established firms, i.e. age, sales-to-assets and book-to-market, is positive and statistically significant. Venture capital experience is negatively associated with the additional selling, whereas IPO size and underwriters' reputation is not associated with the additional selling. Profitability of existing stockholders has positive relationship with the additional selling, i.e. more profitable investments for early investors induces more additional selling by lead venture capitalists. The estimate of the dotcom bubble dummy confirms that the additional selling is less pronounced during the dotcom bubble. In general, the additional selling determinants are very similar to the secondary selling determinants reported in Table 6.

Post-IPO performance analysis, however, reveal the differences in association between post-IPO performance measures and the selling or additional selling decisions. Underpricing is negatively associated with the additional selling, implying that lead venture capitalists sell more when the IPO issue is relatively overpriced. This is in contrast to the absence of association between the underpricing and the secondary sales by lead venture capitalists. Moreover, there is no relationship between any long-run post-IPO performance measure and the additional selling of the lead venture capitalists. Market performance coefficient estimates, albeit not statistically

significant, have even the opposite sign. The results show that the additional selling is not associated with better post-IPO performance and there is even evidence that lead venture capitalists behave opportunistically by additionally selling overpriced shares. However, the result is not contradicting prior findings, since the additional selling is different from the secondary sales. Given that the over-allotment selling and stock redemptions do not constitute direct selling to outside investors, market's adverse reaction to these selling decisions is less negative compared to the secondary sales. Therefore, venture capitalists reputation concerns are lower and they behave somewhat opportunistically by selling relatively overpriced shares in the IPO issuers that are long-term not outperforming their peers.

V. Robustness Analysis

A. Alternative selling variables

The choice of the selling variable is supported by the inelasticity of the IPO size to supply. However, I consider alternative selling variable definitions in order to check that the results are not driven only by the choice of the selling variable. I redefine the selling variable as the fraction of shares sold in the offering to total shares held prior to the IPO by the selling stockholders. Table 13 revisits regression estimates of Tables 6-11 with redefined selling variable when lead venture capitalists sell secondary shares only[17]. Similarly as reported previously, selling is associated positively with IPO issue characteristics of established firms, i.e. age, sales-to-assets and book-to-market ratios. It is positively associated with the profitability of existing stockholders and negatively with the dotcom bubble. There is no association between the selling decision and underpricing. The selling variable is significantly positively associated with the return on assets of the IPO issuer, however quadratic term, although negative, is not statistically significant. There is strong quadratic convex relationship between the selling variable and the idiosyncratic risk, replicating the results from Table 10B. Not only is the relationship between the selling decision and return on assets and idiosyncratic risk similar between different specifications of the selling decision variable, but the magnitude of the relationship is similar as well. The

[17] Results when any VC, founders or any shareholder sells shares are qualitatively the same.

average level of the alternative selling decision variable is 19% when lead venture capitalists sell secondary shares and the magnitude of coefficient estimates are comparable between the two specifications, implying that the economic impact is similar. However, there is no statistically significant relationship between the alternative selling definition variable and two market post-IPO long-run performance measures, excess return and total PME. Although, the signs of the relationship between the alternative selling variable and the total PME is correct, there is not enough statistical power.

These results show that although alternative selling decision variable is associated with some long-term post-IPO performance measures it is the fraction of shares sold in the IPO to total shares offered in the IPO that is consistently positively associated with the post-IPO performance measures.

B. Additional time controls

In all regression specifications, the dotcom bubble dummy captures specific time component of the analyzed period. I consider an alternative approach by splitting the sample into two – the dotcom bubble period, which covers 2 years (1999 and 2000) and 44% of all IPOs in the sample, and the non-dotcom bubble period. Given that there were only 6 cases of lead venture capitalists selling during the dotcom bubble period, which constitutes only 1.3% of all VC-backed IPO deals during this period, it is no surprise that there is no relationship between the selling decision and any post-IPO long-run performance measure. Table 14 presents the results for the complementary period of the dotcom bubble. The results are revisiting regression estimates of Tables 6-11 when lead venture capitalists sell secondary shares only. Selling is negatively associated with the venture capitalists experience, as previously reported for the full sample, and positively with the IPO issue characteristics that capture firm establishment (age, sales-to-assets and book-to-market). Profitability of existing shareholders also has statistically significant and positive association with the selling decision.

Full sample results on the relationship between post-IPO performance measures and the selling decision variable are confirmed in the subsample. There is

no relationship between underpricing and lead venture capitalists selling in the subsample. The association between lead venture capitalists selling and long-run return on assets is statistically significant and positive. The idiosyncratic risk is negatively related to the selling decision with positive and significant quadratic term. Finally, both market-based post-IPO measures, excess returns and total PME, are statistically significant and positively related to the selling decision with negative quadratic term. Moreover, the magnitudes of the coefficient estimates are comparable to the full sample results, implying that the economic significance of selling on post-IPO long-run performance measures are replicated in the non-dotcom bubble subsample.

Results from the subsample analysis confirm that the positive association between venture capitalists selling and post-IPO performance measures is not driven by the dotcom bubble period that has disproportionately more underperforming IPO issuers and almost no venture capital selling.

C. Other controls

First, I assess whether selling decision continues to be significantly positively associated with the post-IPO long-run performance measure if I do not winsorize dependent variables: return on assets, excess return and idiosyncratic risk. In unreported results, I find that selling decision continues to have strong positive association with the return on assets and strong negative association with the idiosyncratic risk at 1% level in linear specifications. The selling decision has quadratic relationship with non-winsorized excess returns similar to the one reported in Table 10 Panel B. I conclude that mitigating the effect of outliers by winsorizing long-run performance measures does not qualitatively change the results.

Second, IPO market share is one possible measure of venture capital expertise. I replicate the analysis by using alternative venture capital experience measure defined as the difference between the log of the number of investments made by venture capital organization prior to the IPO year and the log of the average number of investments made by all venture capital organizations prior to the IPO year. This alternative VC

experience measure does not change the results since in all specifications VC experience measure continues to be statistically not significant.

VI. Conclusion

Presence of market frictions impedes the unwinding of equity positions in the IPO. Adverse market reaction to insiders' selling and behavioral opportunism limit the exit of equity positions by venture capitalist due to reputation concerns. I examine the impact of the selling decision by venture capitalists and other insiders during the IPO on post-IPO long-run performance.

First, venture capitalists and other insiders sell shares in more established IPO issuers that are easier to evaluate, thereby limiting behavioral opportunism.

Second, selling decision is positively associated with future profitability measured by industry adjusted return 3 years after the IPO and negatively associated with future idiosyncratic risk. The association is non-linear with excessive selling reducing the magnitude of the relationship.

Third, market performance measured by excess returns and public market equivalent, are non-linearly associated when venture capitalists sell shares. Moreover, increasing the holding period increases the strength of the relationship. Average level of selling has positive association with market performance. However, excessive selling has lower or even negative association.

Fourth, selling by founders has no impact on post-IPO long-run market performance.

Fifth, over-allotment sales and redemption of stock with IPO proceeds is not associated with long-run post-IPO performance measures. Moreover, there is some evidence that venture capitalists behave opportunistically by selling overpriced shares.

Overall, I conclude that the selling decision in the IPO conveys private information that is not fully reflected in market prices when venture capitalists sell and is a good predictor of future profitability and riskiness.

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TABLE 1
IPO Frequency by Year

Table 1 reports the frequency of IPOs by year in the sample of VC backed IPOs from 1997 until 2011 (total of 1039) and the frequency of IPOs in which lead VC, any VC, founders or any shareholders are selling their shares. Two forms of selling are defined: i) Secondary Selling as directly selling in the form of secondary offering during the initial public offering; ii) Any type of selling as either selling in the secondary offering, through the underwriters' over-allotment option or retiring shares by using the IPO proceeds.

Year	All IPOs	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
		Secondary	Any	Secondary	Any	Secondary	Any	Secondary	Any
1997	112	15	25	23	34	15	25	34	47
1998	70	7	11	10	15	16	27	24	34
1999	254	5	18	12	27	22	38	36	65
2000	204	1	7	1	9	3	18	7	27
2001	23	0	1	0	1	1	2	2	3
2002	20	4	7	4	7	1	4	5	8
2003	22	3	5	5	6	3	4	7	8
2004	71	8	10	17	18	9	12	21	24
2005	42	8	10	10	12	10	12	14	17
2006	48	5	10	12	16	10	12	16	20
2007	75	13	15	20	25	19	28	31	39
2008	8	3	3	4	4	1	2	6	7
2009	10	4	5	6	7	6	7	7	9
2010	46	14	14	22	23	18	20	23	24

2011	34	8	10	14	16	16	17	20	21
Total	1039	98	151	160	220	150	228	253	353

TABLE 2
IPO issuer characteristics

Comparison of VC backed IPOs with and without selling by lead VC, any VC, Founder and any shareholder (means and standard deviations in parenthesis). Selling shares is defined as directly selling in the form of secondary offering during the initial public offering. The data is based on the sample of 1039 VC-backed IPOs completed in 1997-2011 period. Issue Proceeds, Trailing 12 months revenue, Total Assets and Issuer Market Cap are reported in 2005 USD. All variables are winsorized at 1% and 99% levels. *, **, and *** denote significant difference in the means between No selling and corresponding group at the 10%, 5%, and 1% levels, respectively.

Variable	No selling	Lead VC investor sells	Any VC investor sells	Founder sells	Any shareholder sells
Issue Proceeds (millions of US$)	74.85 (54.49)	58.40*** (47.38)	59.01*** (46.88)	66.05* (51.41)	62.03*** (45.79)
Number of Years from incorporation to the IPO	6.41 (4.15)	11.73*** (5.80)	10.91*** (5.41)	9.33*** (5.09)	9.82*** (5.60)
Trailing 12 months revenue (millions of US$)	34.38 (65.66)	117.97*** (109.52)	122.58*** (121.06)	104.48*** (105.78)	103.63*** (112.74)
Total Assets (millions of US$)	66.49 (110.43)	137.45*** (187.09)	125.91*** (174.39)	102.57*** (143.52)	105.59*** (152.50)

Issuer Market Cap (millions of US$)	470.98 (502.91)	445.10 (491.71)	459.99 (526.15)	503.22 (515.25)	452.46 (480.86)
Book-to-Market	.0604 (.0878)	.100*** (.119)	.0965*** (.106)	.0787** (.0962)	.0856*** (.101)
Venture capital experience	2.12	1.50**	1.94	2.10	1.89
3 years IPO market share (%)	(2.49)	(1.89)	(2.52)	(2.54)	(2.36)
Underpricing (%)	53.15 (80.32)	23.55*** (30.64)	23.85*** (31.20)	30.79*** (34.35)	31.16*** (39.40)
IPO price relative to average price paid by existing shareholders	7.90 (10.00)	11.99*** (17.83)	10.39** (15.73)	11.06*** (14.73)	10.71*** (15.09)
Underwriters' Ranking	8.34 (1.32)	8.15 (1.39)	8.29 (1.26)	8.55* (0.91)	8.38 (1.14)
N	786	98	160	150	253

TABLE 3
IPO issuer characteristics

Comparison of VC backed IPOs with and without selling by lead VC, any VC, Founder and any shareholder (means and standard deviations in parenthesis). Selling shares is defined as either selling in the secondary offering, through the underwriters' over-allotment option or retiring shares by using the IPO proceeds. The data is based on the sample of 1039 VC-backed IPOs completed in 1997-2011 period. Issue Proceeds, Last 12 months revenue, Total Assets and Issuer Market Cap are reported in 2005 USD. All variables are winsorized at 1% and 99% levels. *, **, and *** denote significant difference in the means between No selling and corresponding group at the 10%, 5%, and 1% levels, respectively.

Variable	No selling	Lead VC investor sells	Any VC investor sells	Founder sells	Any shareholder sells
Issue Proceeds (millions of US$)	75.32 (56.38)	65.18** (46.99)	64.34*** (47.23)	65.61** (47.66)	64.74*** (44.18)
Number of Years from incorporation to the IPO	6.10 (3.87)	11.62*** (6.19)	10.69*** (5.73)	9.14*** (5.17)	9.44*** (5.54)
Trailing 12 months revenue (millions of US$)	29.41 (56.16)	112.94*** (114.81)	112.00*** (118.31)	94.39*** (111.81)	93.67*** (111.58)
Total Assets (millions of US$)	66.07 (112.84)	122.02*** (166.11)	117.99*** (163.05)	91.13*** (129.62)	95.32*** (139.03)
Issuer Market Cap (millions of US$)	484.03 (525.86)	439.11 (468.14)	448.32 (499.14)	457.26 (457.65)	432.35 (435.71)

Book-to-Market	.0599	.0916***	.0872***	.0777***	.0795***
	(.0848)	(.115)	(.107)	(.101)	(.103)
Venture capital experience	2.13	1.63**	1.91	2.12	1.94
3 years IPO market share (%)	(2.51)	(1.84)	(2.34)	(2.52)	(2.35)
Underpricing (%)	52.55	29.10***	29.02***	39.17**	38.57***
	(79.37)	(46.48)	(44.69)	(57.54)	(58.06)
IPO price relative to average price paid by existing shareholders	7.17	12.68***	11.40***	11.73***	11.32***
	(8.73)	(17.58)	(16.32)	(15.23)	(15.19)
	8.33	8.25	8.30	8.48	8.37
Underwriters' Ranking	(1.36)	(1.27)	(1.20)	(1.00)	(1.10)
N	686	151	220	228	353

TABLE 4
Post-IPO long-run performance measures statistics

Comparison of post-IPO long-run performance measures for VC backed IPOs with and without selling by lead VC, any VC, Founder and any shareholder (means and standard deviations in parenthesis). Selling shares is defined as directly selling in the form of secondary offering during the initial public offering. The data is based on the sample of 1039 VC-backed IPOs completed in 1997-2011 period. Return on Assets, Arithmetic excess return and multiples are winsorized at 1% and 99% levels. Excess returns are annualized. *, **, and *** denote significant difference in the means between No selling and corresponding group at the 10%, 5%, and 1% levels, respectively.

Variable	No selling	Lead VC investor sells	Any VC investor sells	Founder sells	Any shareholder sells
Return on Assets	-.513	-.0356***	-.0538***	-.0695***	-.0795***
3 years after the IPO	(1.05)	(.336)	(.371)	(.387)	(.405)
Logarithmic excess return (%)	-.429	-.0292***	-.0885***	-.118***	-.115***
3 years after the IPO	(.738)	(.448)	(.539)	(.557)	(.58)
Arithmetic excess return (%)	.244	.227	.194	.254	.25
3 years after the IPO	(.629)	(.405)	(.417)	(.454)	(.484)
Total risk (%)	1.11	.668***	.699***	.795***	.795***
3 years after the IPO	(0.39)	(.276)	(.3)	(.349)	(.355)
Idiosyncratic risk (%)	1.02	.616***	.645***	.726***	.728***
3 years after the IPO	(0.35)	(.254)	(.284)	(.324)	(.328)

PME, Nasdaq	.888	1.37***	1.33***	1.30***	1.40***
3 years after the IPO	(1.41)	(1.49)	(1.53)	(1.53)	(1.78)
PME, Nasdaq	.833	1.28***	1.19***	1.24***	1.27***
until delisting	(1.46)	(1.35)	(1.27)	(1.48)	(1.60)
Total PME, Nasdaq	.785	1.24***	1.23***	1.22***	1.24***
3 years after the IPO	(1.19)	(1.11)	(1.21)	(1.31)	(1.40)
Total PME, Nasdaq	.735	1.29***	1.25***	1.20***	1.22***
5 years after the IPO	(1.11)	(1.28)	(1.29)	(1.34)	(1.38)
Total PME, Nasdaq	.703	1.23***	1.18***	1.16***	1.15***
7 years after the IPO	(1.08)	(1.12)	(1.11)	(1.25)	(1.23)
N	786	98	160	150	253

TABLE 5
Post-IPO long-run performance measures statistics

Comparison of post-IPO long-run performance measures for VC backed IPOs with and without selling by lead VC, any VC, Founder and any shareholder (means and standard deviations in parenthesis). Selling shares is defined as either selling in the secondary offering, through the underwriters' over-allotment option or retiring shares by using the IPO proceeds. The data is based on the sample of 1039 VC-backed IPOs completed in 1997-2011 period. Return on Assets, Arithmetic excess return and multiples are winsorized at 1% and 99% levels. Excess returns are annualized. *, **, and *** denote significant difference in the means between No selling and corresponding group at the 10%, 5%, and 1% levels, respectively.

Variable	No selling	Lead VC investor sells	Any VC investor sells	Founder sells	Any shareholder sells
Return on Assets	-.546	-.112***	-.122***	-.0956***	-.139***
3 years after the IPO	(1.08)	(.479)	(.484)	(.399)	(.551)
Logarithmic excess return (%)	-.451	-.124***	-.144***	-.132***	-.161***
3 years after the IPO	(.757)	(.539)	(.544)	(.553)	(.583)
Arithmetic excess return (%)	.242	.213	.199	.288	.254
3 years after the IPO	(.642)	(.443)	(.435)	(.483)	(.5)
Total risk (%)	1.13	.758***	.768***	.859***	.855***
3 years after the IPO	(0.39)	(.324)	(.326)	(.369)	(.367)
Idiosyncratic risk (%)	1.04	.7***	.709***	.782***	.784***
3 years after the IPO	(0.36)	(.3)	(.303)	(.336)	(.336)

PME, Nasdaq 3 years after the IPO	.863 (1.37)	1.22*** (1.37)	1.20*** (1.42)	1.29*** (1.64)	1.30*** (1.76)
PME, Nasdaq until delisting	.808 (1.45)	1.22*** (1.48)	1.16*** (1.46)	1.16*** (1.46)	1.19*** (1.58)
Total PME, Nasdaq 3 years after the IPO	.767 (1.17)	1.11*** (1.11)	1.12*** (1.16)	1.17*** (1.35)	1.15*** (1.38)
Total PME, Nasdaq 5 years after the IPO	.699 (1.06)	1.21*** (1.31)	1.17*** (1.29)	1.14*** (1.36)	1.15*** (1.37)
Total PME, Nasdaq 7 years after the IPO	.672 (1.07)	1.17*** (1.19)	1.12*** (1.17)	1.08*** (1.22)	1.09*** (1.21)
N	686	151	220	228	353

TABLE 6
Selling Decision determinants

Table 6 presents cross-sectional Tobit regression estimates and t-statistics (in parenthesis) that are robust to heteroscedasticity and adjusted for industry clustering (8 industry groups). Dependent variable is the Selling Decision. The Selling is defined as the fraction of total shares sold by selling shareholders' group to the total shares sold in the offering. Two forms of selling are defined: i) Secondary Selling as directly selling in the form of secondary offering during the initial public offering (specification number is odd); ii) Any type of selling as either selling in the secondary offering, through the underwriters' over-allotment option or retiring shares by using the IPO proceeds (specification number is even). *, **, and *** denote level of significance at the 10%, 5%, and 1% levels, respectively.

	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3-year IPO market share	-2.01***	-1.34***	-0.64	-0.65	-0.37	-0.20	-1.10*	-0.81*
	(-3.02)	(-2.78)	(-1.23)	(-1.56)	(-1.40)	(-1.01)	(-1.75)	(-1.79)
Log Age	0.13***	0.15***	0.14***	0.16***	0.019	0.027***	0.13***	0.15***
	(4.81)	(5.98)	(5.87)	(7.09)	(1.53)	(2.66)	(5.37)	(7.39)
Log Sales/Assets	0.075*	0.094***	0.10***	0.10***	0.081***	0.067***	0.21***	0.17***
	(1.83)	(2.98)	(2.85)	(3.39)	(3.38)	(3.66)	(4.75)	(5.42)
Log IPO Proceeds	-0.059	-0.024	-0.076**	-0.039	-0.014	-0.015*	-0.099***	-0.064***
	(-1.51)	(-0.71)	(-2.53)	(-1.50)	(-1.36)	(-1.78)	(-3.58)	(-2.70)
Log Book-to-Market	0.43***	0.41***	0.44***	0.38***	0.23**	0.23***	0.71***	0.62***
	(3.16)	(3.16)	(3.53)	(3.13)	(2.21)	(2.70)	(5.28)	(5.55)

Underwriters' Ranking	0.0016	-0.0011	0.014	0.0076	0.016**	0.0074	0.031**	0.017*
	(0.13)	(-0.092)	(1.22)	(0.75)	(2.33)	(1.46)	(2.46)	(1.70)
Log Existing Shareholders Multiple	0.063***	0.056***	0.048***	0.050***	0.025***	0.030***	0.070***	0.080***
	(3.74)	(3.51)	(3.42)	(3.62)	(3.12)	(4.45)	(4.62)	(5.98)
Dotcom Bubble Dummy	-0.26***	-0.14***	-0.25***	-0.17***	-0.097***	-0.065***	-0.26***	-0.18***
	(-5.05)	(-4.72)	(-6.94)	(-6.64)	(-5.34)	(-5.16)	(-7.90)	(-7.78)
Log-likelihood	-122	-158	-149	-177	-89.1	-48.2	-265	-251
N	1039	1039	1039	1039	1039	1039	1039	1039

TABLE 7
Underpricing determinants

Table 7 presents cross-sectional regression estimates and t-statistics (in parenthesis) that are robust to heteroscedasticity and adjusted for industry clustering (8 industry groups). Dependent variable is the Underpricing, defined as the first trading day return following the IPO. The Selling is defined as the fraction of total shares sold by selling shareholders' group to the total shares sold in the offering. Two forms of selling are defined: i) Secondary Selling as directly selling in the form of secondary offering during the initial public offering (specification number is odd); ii) Any type of selling as either selling in the secondary offering, through the underwriters' over-allotment option or retiring shares by using the IPO proceeds (specification number is even). *, **, and *** denote level of significance at the 10%, 5%, and 1% levels, respectively.

	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Selling	-0.038	-0.17	0.055	-0.056	-0.43**	-0.32*	0.048	-0.018
	(-0.32)	(-1.37)	(0.60)	(-0.56)	(-2.30)	(-1.80)	(0.79)	(-0.27)
3-year IPO market share	0.41	0.39	0.41	0.40	0.39	0.40	0.42	0.41
	(1.00)	(0.98)	(1.03)	(1.00)	(0.96)	(0.99)	(1.04)	(1.01)
Log Age	-0.054**	-0.051**	-0.057***	-0.053**	-0.055***	-0.054**	-0.057***	-0.054**
	(-2.57)	(-2.40)	(-2.67)	(-2.49)	(-2.63)	(-2.58)	(-2.69)	(-2.50)
Log Sales/Assets	-0.011	-0.011	-0.011	-0.011	-0.0066	-0.0073	-0.012	-0.010
	(-0.36)	(-0.35)	(-0.35)	(-0.35)	(-0.22)	(-0.24)	(-0.40)	(-0.33)
Log IPO Proceeds	0.089***	0.087***	0.091***	0.088***	0.088***	0.088***	0.092***	0.089***
	(4.69)	(4.67)	(4.75)	(4.70)	(4.72)	(4.73)	(4.79)	(4.70)

Log Book-to-Market	-0.086 (-1.11)	-0.075 (-0.95)	-0.095 (-1.22)	-0.083 (-1.05)	-0.068 (-0.86)	-0.071 (-0.89)	-0.10 (-1.28)	-0.084 (-1.05)
Underwriters' Ranking	0.0047 (0.60)	0.0047 (0.60)	0.0044 (0.56)	0.0048 (0.62)	0.0050 (0.64)	0.0047 (0.61)	0.0041 (0.52)	0.0048 (0.61)
Log Existing Shareholders Multiple	0.095*** (4.95)	0.097*** (4.98)	0.093*** (4.94)	0.095*** (5.00)	0.097*** (5.00)	0.097*** (4.94)	0.093*** (4.87)	0.095*** (4.91)
Dotcom Bubble Dummy	0.21*** (8.33)	0.21*** (8.26)	0.21*** (8.40)	0.21*** (8.26)	0.21*** (8.15)	0.21*** (8.18)	0.21*** (8.40)	0.21*** (8.22)
Adjusted R^2 (%)	33.2	33.2	33.2	33.2	33.3	33.3	33.2	33.2
N	1039	1039	1039	1039	1039	1039	1039	1039

TABLE 8
Return on Assets and Selling Decision

Table 8 presents cross-sectional regression estimates and t-statistics (in parenthesis) that are robust to heteroscedasticity and adjusted for industry clustering (8 industry groups). Dependent variable is industry adjusted return on assets, defined as trailing 12 months net income divided by total assets, measured at 3 years after the IPO date or at delisting, whichever comes first, less SIC industry mean return on assets. Selling decision is defined as the fraction of total shares sold by selling shareholders' group to the total shares sold in the offering. Two forms of selling are defined: i) Secondary Selling as directly selling in the form of secondary offering during the initial public offering (specification number is odd); ii) Any type of selling as either selling in the secondary offering, through the underwriters' over-allotment option or retiring shares by using the IPO proceeds (specification number is even). *, **, and *** denote level of significance at the 10%, 5%, and 1% levels, respectively.

Panel A	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Selling	0.70***	0.54***	0.69***	0.55***	1.21***	1.37***	0.59***	0.51***
	(3.00)	(2.65)	(3.57)	(3.18)	(3.35)	(4.18)	(4.17)	(3.29)
3-year IPO market share	-0.96	-0.98	-0.97	-0.98	-0.97	-1.00	-0.93	-0.94
	(-0.91)	(-0.94)	(-0.93)	(-0.93)	(-0.93)	(-0.96)	(-0.89)	(-0.90)
Log Age	0.12**	0.12**	0.12**	0.11**	0.13**	0.13**	0.11**	0.099*
	(2.34)	(2.27)	(2.19)	(2.10)	(2.55)	(2.46)	(2.00)	(1.84)
Log Sales/Assets	0.42***	0.42***	0.42***	0.41***	0.40***	0.40***	0.40***	0.40***
	(5.16)	(5.13)	(5.15)	(5.12)	(5.01)	(4.98)	(4.99)	(4.96)
Log IPO Proceeds	0.12**	0.12**	0.13**	0.12**	0.11**	0.11**	0.14***	0.13**
	(2.40)	(2.35)	(2.53)	(2.44)	(2.31)	(2.34)	(2.70)	(2.58)

Log Book-to-Market	0.73***	0.74***	0.71***	0.72***	0.73***	0.71***	0.65**	0.65**
	(2.89)	(2.92)	(2.82)	(2.86)	(2.84)	(2.76)	(2.57)	(2.57)
Log Underpricing	-0.046	-0.044	-0.049	-0.045	-0.040	-0.039	-0.051	-0.045
	(-0.44)	(-0.42)	(-0.47)	(-0.43)	(-0.38)	(-0.38)	(-0.49)	(-0.44)
Underwriters' Ranking	0.060*	0.060*	0.057*	0.058*	0.059*	0.060*	0.054*	0.057*
	(1.84)	(1.86)	(1.77)	(1.80)	(1.82)	(1.84)	(1.67)	(1.75)
Log Existing Shareholders Multiple	0.071**	0.071**	0.069**	0.068**	0.072***	0.067**	0.063**	0.059**
	(2.53)	(2.54)	(2.48)	(2.44)	(2.60)	(2.44)	(2.27)	(2.08)
Dotcom Bubble Dummy	-0.29***	-0.29***	-0.28***	-0.28***	-0.29***	-0.29***	-0.26***	-0.26***
	(-4.26)	(-4.31)	(-4.08)	(-4.13)	(-4.28)	(-4.26)	(-3.73)	(-3.74)
Adjusted R^2 (%)	9.89	9.87	10	9.96	9.97	10.1	10.3	10.2
N	1039	1039	1039	1039	1039	1039	1039	1039

TABLE 8 (continued)
Return on Assets and Selling Decision

Panel B. Return on Assets and Selling Decision, non-linear extension

	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Selling	0.83**	0.55	0.75**	0.55*	2.47***	3.00***	0.64**	0.57
	(2.27)	(1.54)	(2.37)	(1.71)	(2.65)	(3.87)	(2.21)	(1.55)
Selling^2	-0.25	-0.031	-0.12	-0.0060	-5.16*	-6.22***	-0.082	-0.12
	(-0.59)	(-0.063)	(-0.28)	(-0.012)	(-1.75)	(-2.76)	(-0.20)	(-0.24)
3-year IPO market share	-0.95	-0.98	-0.97	-0.98	-0.98	-1.04	-0.92	-0.93
	(-0.91)	(-0.94)	(-0.93)	(-0.93)	(-0.94)	(-0.99)	(-0.87)	(-0.89)
Log Age	0.12**	0.12**	0.12**	0.11**	0.13**	0.12**	0.11**	0.098*
	(2.30)	(2.24)	(2.15)	(2.06)	(2.51)	(2.34)	(1.98)	(1.80)
Log Sales/Assets	0.42***	0.42***	0.42***	0.41***	0.40***	0.40***	0.40***	0.39***
	(5.09)	(5.08)	(5.05)	(5.02)	(4.99)	(4.96)	(4.83)	(4.79)
Log IPO Proceeds	0.12**	0.12**	0.13**	0.12**	0.11**	0.12**	0.14**	0.13**
	(2.33)	(2.30)	(2.46)	(2.38)	(2.32)	(2.38)	(2.54)	(2.42)

Log Book-to-Market	0.73***	0.74***	0.71***	0.72***	0.76***	0.74***	0.64**	0.65**
	(2.82)	(2.87)	(2.75)	(2.80)	(2.89)	(2.86)	(2.51)	(2.48)
Log Underpricing	-0.046	-0.044	-0.049	-0.045	-0.039	-0.037	-0.050	-0.045
	(-0.44)	(-0.42)	(-0.47)	(-0.43)	(-0.37)	(-0.36)	(-0.48)	(-0.43)
Underwriters' Ranking	0.060*	0.060*	0.057*	0.058*	0.057*	0.058*	0.055*	0.057*
	(1.85)	(1.85)	(1.77)	(1.80)	(1.74)	(1.76)	(1.68)	(1.76)
Log Existing Shareholders Multiple	0.071**	0.071**	0.069**	0.068**	0.069**	0.062**	0.063**	0.059**
	(2.53)	(2.53)	(2.48)	(2.43)	(2.48)	(2.22)	(2.27)	(2.08)
Dotcom Bubble Dummy	-0.29***	-0.29***	-0.28***	-0.28***	-0.28***	-0.28***	-0.26***	-0.26***
	(-4.25)	(-4.32)	(-4.08)	(-4.13)	(-4.16)	(-4.15)	(-3.71)	(-3.69)
Adjusted R^2 (%)	9.80	9.78	9.92	9.88	9.94	10.2	10.2	10.1
N	1039	1039	1039	1039	1039	1039	1039	1039

TABLE 9
Log Excess Returns and Selling Decision

Table 9 presents cross-sectional regression estimates and t-statistics (in parenthesis) that are robust to heteroscedasticity and adjusted for industry clustering (8 industry groups). Dependent variable is annualized logarithmic excess return from 4 factor models in logs, measured at 3 years after the IPO date or at delisting, whichever comes first. Selling decision is defined as the fraction of total shares sold by selling shareholders' group to the total shares sold in the offering. Two forms of selling are defined: i) Secondary Selling as directly selling in the form of secondary offering during the initial public offering (specification number is odd); ii) Any type of selling as either selling in the secondary offering, through the underwriters' over-allotment option or retiring shares by using the IPO proceeds (specification number is even). *, **, and *** denote level of significance at the 10%, 5%, and 1% levels, respectively.

Panel A	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Selling	0.11	0.061	0.14	0.087	0.40	0.45	0.14	0.12
	(0.31)	(0.22)	(0.62)	(0.43)	(0.91)	(1.22)	(1.04)	(0.92)
3-year IPO market share	0.47	0.46	0.47	0.46	0.47	0.46	0.48	0.48
	(0.64)	(0.63)	(0.64)	(0.64)	(0.65)	(0.64)	(0.66)	(0.65)
Log Age	0.078*	0.079*	0.076*	0.077*	0.080**	0.078**	0.073*	0.071*
	(1.93)	(1.93)	(1.86)	(1.84)	(2.01)	(1.97)	(1.79)	(1.71)
Log Sales/Assets	0.24***	0.24***	0.24***	0.24***	0.24***	0.23***	0.23***	0.23***
	(3.80)	(3.80)	(3.80)	(3.79)	(3.74)	(3.72)	(3.73)	(3.72)
Log IPO Proceeds	-0.12***	-0.12***	-0.12***	-0.12***	-0.12***	-0.12***	-0.11***	-0.12***
	(-3.13)	(-3.19)	(-3.01)	(-3.11)	(-3.19)	(-3.18)	(-2.97)	(-3.03)

Log Book-to-Market	0.38* (1.73)	0.38* (1.76)	0.37* (1.71)	0.38* (1.74)	0.37* (1.70)	0.36* (1.67)	0.36 (1.63)	0.35 (1.63)
Log Underpricing	0.45*** (6.10)	0.45*** (6.10)	0.45*** (6.09)	0.45*** (6.10)	0.45*** (6.13)	0.45*** (6.13)	0.45*** (6.09)	0.45*** (6.10)
Underwriters' Ranking	0.082*** (4.11)	0.082*** (4.12)	0.082*** (4.08)	0.082*** (4.10)	0.082*** (4.10)	0.082*** (4.12)	0.081*** (4.04)	0.081*** (4.08)
Log Existing Shareholders Multiple	0.089*** (3.72)	0.089*** (3.72)	0.088*** (3.71)	0.089*** (3.69)	0.088*** (3.67)	0.086*** (3.60)	0.087*** (3.65)	0.085*** (3.54)
Dotcom Bubble Dummy	-0.51*** (-9.43)	-0.51*** (-9.49)	-0.50*** (-9.35)	-0.50*** (-9.40)	-0.50*** (-9.41)	-0.50*** (-9.45)	-0.50*** (-9.15)	-0.50*** (-9.19)
Adjusted R^2 (%)	21.1	21.1	21.1	21.1	21.1	21.2	21.1	21.1
N	1039	1039	1039	1039	1039	1039	1039	1039

TABLE 9 (continued)
Log Excess Returns and Selling Decision

Panel B. Log Excess Return and Selling Decision, non-linear extension

	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Selling	1.03***	0.73*	0.80**	0.63*	0.0011	0.77	0.71**	0.78**
	(2.59)	(1.74)	(2.36)	(1.67)	(0.00097)	(0.85)	(2.44)	(2.48)
Selling^2	-1.84***	-1.41***	-1.36***	-1.16**	1.65	-1.21	-1.05**	-1.18**
	(-3.99)	(-2.59)	(-2.66)	(-1.96)	(0.43)	(-0.40)	(-2.24)	(-2.48)
3-year IPO market share	0.49	0.48	0.46	0.47	0.48	0.46	0.60	0.59
	(0.67)	(0.65)	(0.64)	(0.64)	(0.65)	(0.63)	(0.82)	(0.81)
Log Age	0.071*	0.071*	0.069*	0.069*	0.081**	0.077*	0.069*	0.064
	(1.76)	(1.73)	(1.68)	(1.66)	(2.04)	(1.94)	(1.69)	(1.53)
Log Sales/Assets	0.23***	0.23***	0.23***	0.23***	0.24***	0.23***	0.22***	0.21***
	(3.62)	(3.61)	(3.58)	(3.55)	(3.74)	(3.71)	(3.40)	(3.24)
Log IPO Proceeds	-0.13***	-0.13***	-0.13***	-0.13***	-0.12***	-0.12***	-0.13***	-0.14***
	(-3.40)	(-3.44)	(-3.21)	(-3.30)	(-3.20)	(-3.16)	(-3.51)	(-3.64)
Log Book-to-Market	0.33	0.35	0.33	0.34	0.36	0.37*	0.31	0.30
	(1.52)	(1.59)	(1.49)	(1.55)	(1.63)	(1.68)	(1.43)	(1.35)

Log Underpricing	0.45*** (6.10)	0.45*** (6.10)	0.45*** (6.09)	0.45*** (6.10)	0.45*** (6.12)	0.45*** (6.12)	0.45*** (6.16)	0.46*** (6.20)
Underwriters' Ranking	0.086*** (4.30)	0.086*** (4.26)	0.085*** (4.22)	0.085*** (4.21)	0.082*** (4.12)	0.082*** (4.09)	0.085*** (4.26)	0.087*** (4.34)
Log Existing Shareholders Multiple	0.090*** (3.79)	0.090*** (3.75)	0.089*** (3.79)	0.089*** (3.76)	0.089*** (3.68)	0.085*** (3.53)	0.087*** (3.72)	0.083*** (3.47)
Dotcom Bubble Dummy	-0.50*** (-9.26)	-0.50*** (-9.38)	-0.49*** (-9.13)	-0.50*** (-9.26)	-0.50*** (-9.34)	-0.50*** (-9.39)	-0.48*** (-8.83)	-0.49*** (-8.95)
Adjusted R^2 (%)	21.3	21.2	21.2	21.2	21.1	21.1	21.3	21.4
N	1039	1039	1039	1039	1039	1039	1039	1039

TABLE 10
Idiosyncratic Risk and Selling Decision

Table 10 presents cross-sectional regression estimates and t-statistics (in parenthesis) that are robust to heteroscedasticity and adjusted for industry clustering (8 industry groups). Dependent variable is annualized logarithmic idiosyncratic risk from 4 factor models in logs, measured at 3 years after the IPO date or at delisting, whichever comes first. Selling decision is defined as the fraction of total shares sold by selling shareholders' group to the total shares sold in the offering. Two forms of selling are defined: i) Secondary Selling as directly selling in the form of secondary offering during the initial public offering (specification number is odd); ii) Any type of selling as either selling in the secondary offering, through the underwriters' over-allotment option or retiring shares by using the IPO proceeds (specification number is even). *, **, and *** denote level of significance at the 10%, 5%, and 1% levels, respectively.

Panel A	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Selling	-0.59***	-0.41***	-0.61***	-0.47***	-0.63***	-0.50***	-0.45***	-0.40***
	(-3.98)	(-3.87)	(-6.17)	(-5.32)	(-3.25)	(-2.96)	(-8.25)	(-7.09)
3-year IPO market share	0.16	0.18	0.16	0.17	0.19	0.21	0.14	0.15
	(0.47)	(0.55)	(0.51)	(0.53)	(0.57)	(0.63)	(0.44)	(0.47)
Log Age	-0.093***	-0.092***	-0.086***	-0.083***	-0.10***	-0.10***	-0.080***	-0.073***
	(-5.68)	(-5.54)	(-5.21)	(-4.96)	(-6.21)	(-6.10)	(-4.90)	(-4.42)
Log Sales/Assets	-0.17***	-0.16***	-0.16***	-0.16***	-0.16***	-0.16***	-0.15***	-0.15***
	(-6.70)	(-6.59)	(-6.71)	(-6.59)	(-6.31)	(-6.33)	(-6.30)	(-6.19)
Log IPO Proceeds	-0.092***	-0.087***	-0.099***	-0.092***	-0.084***	-0.084***	-0.10***	-0.097***
	(-6.22)	(-6.10)	(-6.87)	(-6.55)	(-6.19)	(-6.16)	(-7.61)	(-7.23)

Log Book-to-Market	-0.37*** (-3.74)	-0.38*** (-3.86)	-0.34*** (-3.59)	-0.36*** (-3.72)	-0.38*** (-3.85)	-0.38*** (-3.86)	-0.30*** (-3.17)	-0.30*** (-3.17)
Log Underpricing	0.16*** (5.73)	0.16*** (5.62)	0.16*** (5.83)	0.16*** (5.67)	0.16*** (5.60)	0.16*** (5.61)	0.16*** (5.90)	0.16*** (5.71)
Underwriters' Ranking	-0.0017 (-0.22)	-0.0022 (-0.28)	0.00049 (0.064)	-0.00059 (-0.077)	-0.0017 (-0.22)	-0.0022 (-0.28)	0.0023 (0.30)	0.00058 (0.076)
Log Existing Shareholders Multiple	-0.011 (-1.12)	-0.012 (-1.16)	-0.0095 (-0.96)	-0.0091 (-0.89)	-0.015 (-1.38)	-0.014 (-1.36)	-0.0062 (-0.59)	-0.0022 (-0.21)
Dotcom Bubble Dummy	0.33*** (15.8)	0.34*** (15.9)	0.33*** (15.3)	0.33*** (15.3)	0.34*** (16.0)	0.34*** (16.1)	0.31*** (14.7)	0.31*** (14.6)
Adjusted R^2 (%)	48.8	48.6	49.5	49.2	48.6	48.5	50.2	50
N	1039	1039	1039	1039	1039	1039	1039	1039

TABLE 10 (continued)
Idiosyncratic Risk and Selling Decision

Panel B. Idiosyncratic Risk and Selling Decision, non-linear extension

	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Selling	-0.97***	-0.61***	-0.90***	-0.65***	-1.23***	-1.03***	-0.51***	-0.47***
	(-4.74)	(-3.05)	(-5.47)	(-3.81)	(-2.60)	(-2.58)	(-3.87)	(-3.47)
$Selling^2$	0.77***	0.41*	0.60***	0.38*	2.42	2.04	0.10	0.12
	(3.26)	(1.72)	(2.87)	(1.70)	(1.52)	(1.61)	(0.57)	(0.65)
3-year IPO market share	0.15	0.18	0.17	0.17	0.19	0.22	0.13	0.14
	(0.45)	(0.53)	(0.52)	(0.53)	(0.58)	(0.66)	(0.40)	(0.43)
Log Age	-0.090***	-0.089***	-0.082***	-0.080***	-0.10***	-0.098***	-0.079***	-0.073***
	(-5.52)	(-5.40)	(-5.01)	(-4.78)	(-6.14)	(-5.93)	(-4.88)	(-4.36)
Log Sales/Assets	-0.16***	-0.16***	-0.16***	-0.16***	-0.16***	-0.16***	-0.15***	-0.15***
	(-6.52)	(-6.42)	(-6.48)	(-6.36)	(-6.30)	(-6.31)	(-6.13)	(-5.96)
Log IPO Proceeds	-0.087***	-0.084***	-0.094***	-0.088***	-0.084***	-0.084***	-0.10***	-0.095***
	(-5.92)	(-5.82)	(-6.54)	(-6.24)	(-6.25)	(-6.22)	(-6.89)	(-6.59)

Log Book-to-Market	-0.35***	-0.37***	-0.32***	-0.34***	-0.39***	-0.39***	-0.30***	-0.30***
	(-3.53)	(-3.72)	(-3.33)	(-3.53)	(-3.92)	(-3.92)	(-3.08)	(-3.05)
Log Underpricing	0.16***	0.16***	0.16***	0.16***	0.16***	0.16***	0.16***	0.16***
	(5.74)	(5.61)	(5.83)	(5.66)	(5.58)	(5.56)	(5.86)	(5.65)
Underwriters' Ranking	-0.0035	-0.0032	-0.0012	-0.0017	-0.00091	-0.0014	0.0018	-7.5e-06
	(-0.44)	(-0.40)	(-0.15)	(-0.21)	(-0.12)	(-0.18)	(0.24)	(-0.00097)
Log Existing Shareholders Multiple	-0.012	-0.012	-0.0099	-0.0093	-0.013	-0.013	-0.0063	-0.0020
	(-1.17)	(-1.17)	(-1.00)	(-0.91)	(-1.24)	(-1.15)	(-0.60)	(-0.19)
Dotcom Bubble Dummy	0.33***	0.34***	0.32***	0.33***	0.34***	0.34***	0.31***	0.31***
	(15.5)	(15.7)	(15.0)	(15.1)	(15.7)	(15.9)	(14.3)	(14.3)
Adjusted R^2 (%)	48.9	48.6	49.6	49.2	48.6	48.5	50.2	49.9
N	1039	1039	1039	1039	1039	1039	1039	1039

TABLE 11
Total PME and Selling Decision

Table 11 presents cross-sectional regression estimates and t-statistics (in parenthesis) that are robust to heteroscedasticity and adjusted for industry clustering (8 industry groups). Dependent variable is the log of total PME relative to Nasdaq, measured at 3 years after the IPO date or at delisting, whichever comes first. Selling decision is defined as the fraction of total shares sold by selling shareholders' group to the total shares sold in the offering. Two forms of selling are defined: i) Secondary Selling as directly selling in the form of secondary offering during the initial public offering (specification number is odd); ii) Any type of selling as either selling in the secondary offering, through the underwriters' over-allotment option or retiring shares by using the IPO proceeds (specification number is even). *, **, and *** denote level of significance at the 10%, 5%, and 1% levels, respectively.

Panel A	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Selling	0.32	0.14	0.42*	0.28	0.11	0.16	0.23*	0.20
	(1.08)	(0.62)	(1.92)	(1.60)	(0.30)	(0.48)	(1.68)	(1.59)
3-year IPO market share	0.76	0.74	0.76	0.76	0.73	0.73	0.77	0.76
	(1.11)	(1.08)	(1.12)	(1.10)	(1.07)	(1.07)	(1.12)	(1.11)
Log Age	0.033	0.035	0.026	0.026	0.038	0.037	0.027	0.024
	(0.95)	(0.98)	(0.77)	(0.76)	(1.11)	(1.09)	(0.79)	(0.70)
Log Sales/Assets	0.18***	0.17***	0.18***	0.17***	0.17***	0.17***	0.17***	0.17***
	(3.78)	(3.75)	(3.78)	(3.74)	(3.70)	(3.68)	(3.60)	(3.59)
Log IPO Proceeds	-0.030	-0.033	-0.023	-0.029	-0.035	-0.034	-0.024	-0.027
	(-1.00)	(-1.14)	(-0.76)	(-0.97)	(-1.21)	(-1.20)	(-0.81)	(-0.92)

Log Book-to-Market	0.13	0.14	0.11	0.12	0.15	0.14	0.098	0.099
	(0.61)	(0.67)	(0.52)	(0.58)	(0.70)	(0.68)	(0.48)	(0.48)
Log Underpricing	0.049	0.050	0.048	0.050	0.050	0.050	0.047	0.049
	(1.12)	(1.13)	(1.09)	(1.13)	(1.12)	(1.13)	(1.08)	(1.12)
Underwriters' Ranking	0.041***	0.041***	0.039***	0.040***	0.041***	0.041***	0.039***	0.040***
	(3.17)	(3.21)	(3.01)	(3.10)	(3.21)	(3.22)	(2.98)	(3.07)
Log Existing Shareholders Multiple	0.039	0.041*	0.037	0.037	0.042*	0.042*	0.037	0.035
	(1.61)	(1.66)	(1.54)	(1.55)	(1.75)	(1.69)	(1.50)	(1.39)
Dotcom Bubble Dummy	-0.18***	-0.18***	-0.17***	-0.18***	-0.19***	-0.19***	-0.17***	-0.17***
	(-4.31)	(-4.38)	(-4.10)	(-4.17)	(-4.44)	(-4.44)	(-3.94)	(-3.93)
Adjusted R^2 (%)	8.55	8.48	8.80	8.65	8.46	8.47	8.74	8.69
N	1039	1039	1039	1039	1039	1039	1039	1039

TABLE 11 (continued)
Total PME and Selling Decision

Panel B. Total PME and Selling Decision, non-linear extension

	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Selling	0.89**	0.45	0.98***	0.61*	-0.17	0.44	0.54**	0.59**
	(2.06)	(1.18)	(2.75)	(1.82)	(-0.19)	(0.52)	(2.08)	(2.27)
$Selling^2$	-1.14**	-0.66	-1.14**	-0.70	1.16	-1.07	-0.57	-0.71*
	(-2.41)	(-1.44)	(-2.43)	(-1.44)	(0.38)	(-0.39)	(-1.51)	(-1.90)
3-year IPO market share	0.77	0.75	0.76	0.76	0.74	0.73	0.83	0.83
	(1.13)	(1.09)	(1.12)	(1.11)	(1.07)	(1.06)	(1.22)	(1.21)
Log Age	0.029	0.031	0.020	0.022	0.039	0.036	0.024	0.019
	(0.82)	(0.88)	(0.60)	(0.64)	(1.13)	(1.05)	(0.72)	(0.57)
Log Sales/Assets	0.17***	0.17***	0.16***	0.17***	0.17***	0.17***	0.16***	0.15***
	(3.62)	(3.62)	(3.51)	(3.50)	(3.71)	(3.67)	(3.32)	(3.17)
Log IPO Proceeds	-0.037	-0.039	-0.033	-0.036	-0.035	-0.034	-0.035	-0.041
	(-1.23)	(-1.29)	(-1.05)	(-1.16)	(-1.22)	(-1.18)	(-1.18)	(-1.36)

Log Book-to-Market	0.098	0.12	0.066	0.096	0.14	0.15	0.074	0.064
	(0.47)	(0.59)	(0.32)	(0.47)	(0.66)	(0.70)	(0.36)	(0.31)
Log Underpricing	0.049	0.050	0.048	0.050	0.049	0.050	0.050	0.054
	(1.11)	(1.14)	(1.09)	(1.14)	(1.12)	(1.14)	(1.15)	(1.23)
Underwriters' Ranking	0.043***	0.042***	0.042***	0.042***	0.041***	0.040***	0.041***	0.043***
	(3.35)	(3.31)	(3.20)	(3.22)	(3.21)	(3.17)	(3.16)	(3.34)
Log Existing Shareholders Multiple	0.040*	0.041*	0.037	0.038	0.043*	0.041	0.037	0.034
	(1.66)	(1.68)	(1.61)	(1.58)	(1.75)	(1.63)	(1.54)	(1.36)
Dotcom Bubble Dummy	-0.18***	-0.18***	-0.17***	-0.17***	-0.19***	-0.18***	-0.16***	-0.16***
	(-4.16)	(-4.31)	(-3.87)	(-4.04)	(-4.44)	(-4.40)	(-3.71)	(-3.72)
Adjusted R^2 (%)	8.66	8.46	8.99	8.67	8.38	8.39	8.80	8.84
N	1039	1039	1039	1039	1039	1039	1039	1039

TABLE 11 (continued)
Total PME and Selling Decision

Panel C. 7-year Total PME and Selling Decision, non-linear extension

	Lead VC investor sells		Any VC investor sells		Founder sells		Any shareholder sells	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Selling	1.18***	1.06***	0.87**	0.91***	0.26	0.76	0.66**	0.81***
	(2.94)	(2.85)	(2.51)	(2.74)	(0.27)	(0.88)	(2.49)	(2.95)
Selling^2	-1.74***	-1.52***	-1.19**	-1.26**	0.38	-1.47	-0.79**	-0.98**
	(-3.81)	(-3.04)	(-2.45)	(-2.48)	(0.12)	(-0.56)	(-2.07)	(-2.46)
3-year IPO market share	1.01	1.01	0.98	0.99	0.97	0.96	1.08	1.09
	(1.40)	(1.40)	(1.37)	(1.39)	(1.36)	(1.33)	(1.53)	(1.54)
Log Age	0.042	0.037	0.040	0.033	0.054*	0.051	0.039	0.028
	(1.31)	(1.15)	(1.22)	(1.03)	(1.65)	(1.56)	(1.21)	(0.88)
Log Sales/Assets	0.24***	0.23***	0.23***	0.23***	0.24***	0.24***	0.22***	0.21***
	(5.15)	(5.05)	(5.06)	(4.93)	(5.23)	(5.20)	(4.76)	(4.50)
Log IPO Proceeds	-0.018	-0.019	-0.014	-0.017	-0.010	-0.0094	-0.016	-0.019
	(-0.61)	(-0.66)	(-0.46)	(-0.56)	(-0.36)	(-0.33)	(-0.54)	(-0.66)

Log Book-to-Market	0.18	0.18	0.18	0.17	0.23	0.24	0.16	0.13
	(0.86)	(0.86)	(0.84)	(0.81)	(1.07)	(1.11)	(0.76)	(0.60)
Log Underpricing	0.048	0.051	0.048	0.049	0.050	0.051	0.051	0.055
	(1.12)	(1.18)	(1.11)	(1.15)	(1.16)	(1.18)	(1.18)	(1.29)
Underwriters' Ranking	0.048***	0.048***	0.046***	0.047***	0.044***	0.044***	0.046***	0.047***
	(4.07)	(4.10)	(3.88)	(3.96)	(3.72)	(3.69)	(3.86)	(4.05)
Log Existing Shareholders Multiple	0.034	0.031	0.033	0.031	0.034	0.032	0.031	0.024
	(1.55)	(1.43)	(1.52)	(1.42)	(1.58)	(1.45)	(1.40)	(1.05)
Dotcom Bubble Dummy	-0.12***	-0.12***	-0.12***	-0.12***	-0.13***	-0.13***	-0.11**	-0.10**
	(-2.77)	(-2.80)	(-2.63)	(-2.60)	(-3.00)	(-2.94)	(-2.37)	(-2.22)
Adjusted R^2 (%)	9.94	9.96	9.86	9.99	9.46	9.52	9.97	10.3
N	1039	1039	1039	1039	1039	1039	1039	1039

TABLE 12
Additional selling

Table 12 revisits regressions estimates from Tables 6-11 using the additional selling only as a selling variable. The additional selling is defined as the fraction of over-allotment sales or stock redemptions when there are no secondary sales to total IPO offering. The table presents results when lead venture capitalists sells. Table 6 (1) is a Tobit regression, other regression estimates are OLS.*, **, and *** denote level of significance at the 10%, 5%, and 1% levels, respectively.

	Table 6 (1)	Table 7 (1)	Table 8B (1)	Table 9B (1)	Table 10B (1)	Table 11B (1)	Table 11C (1)
Additional Selling		-0.66**	0.66	-0.21	-0.27	-0.79	0.18
		(-2.02)	(0.69)	(-0.20)	(-0.59)	(-0.95)	(0.19)
Additional Selling^2			-0.90	1.04	-0.052	2.91	2.82
			(-0.30)	(0.35)	(-0.036)	(1.31)	(0.98)
3-year IPO market share	-0.53**	0.41	-1.02	0.45	0.22	0.71	0.93
	(-2.15)	(1.02)	(-0.98)	(0.61)	(0.66)	(1.03)	(1.30)
Log Age	0.092***	-0.046**	0.13**	0.081**	-0.099***	0.042	0.046
	(5.55)	(-2.21)	(2.39)	(1.99)	(-5.87)	(1.21)	(1.43)
Log Sales/Assets	0.054***	-0.0088	0.41***	0.24***	-0.16***	0.18***	0.24***
	(3.20)	(-0.29)	(5.11)	(3.79)	(-6.53)	(3.82)	(5.25)
Log IPO Proceeds	0.0081	0.090***	0.11**	-0.12***	-0.081***	-0.035	-0.013
	(0.68)	(4.90)	(2.21)	(-3.23)	(-5.94)	(-1.23)	(-0.46)

Log Book-to-Market	0.16** (2.25)	-0.078 (-1.00)	0.78*** (3.02)	0.39* (1.80)	-0.41*** (-4.07)	0.16 (0.78)	0.25 (1.15)
Log Underpricing			-0.044 (-0.43)	0.45*** (6.09)	0.16*** (5.65)	0.049 (1.11)	0.053 (1.24)
Underwriters' Ranking	0.0014 (0.23)	0.0043 (0.55)	0.061* (1.86)	0.082*** (4.10)	-0.0025 (-0.32)	0.041*** (3.20)	0.045*** (3.78)
Log Existing Shareholders Multiple	0.025*** (3.29)	0.098*** (4.99)	0.077*** (2.78)	0.091*** (3.78)	-0.017* (-1.68)	0.045* (1.86)	0.033 (1.54)
Dotcom Bubble Dummy	-0.059*** (-3.43)	0.21*** (8.36)	-0.30*** (-4.45)	-0.51*** (-9.57)	0.34*** (16.3)	-0.19*** (-4.52)	-0.13*** (-3.08)
Log-likelihood/Adjusted R^2 (%)	-77.9	33.4	9.69	21.0	48.2	8.42	9.64
N	1039	1039	1039	1039	1039	1039	1039

TABLE 13
Alternative selling variable

Table 13 revisits regressions estimates from Tables 6-11 using alternative selling variable definition. The selling variable is defined as the fraction of shares sold in the IPO to total shares held prior to the IPO by selling stockholders. The table presents results when lead venture capitalists sell secondary shares only. Table 6 (1) is a Tobit regression, other regression estimates are OLS.*, **, and *** denote level of significance at the 10%, 5%, and 1% levels, respectively.

	Table 6 (1)	Table 7 (1)	Table 8B (1)	Table 9B (1)	Table 10B (1)	Table 11B (1)	Table 11C (1)
Selling		-0.081	0.92**	0.12	-0.93***	0.53	0.47
		(-0.69)	(2.23)	(0.25)	(-3.77)	(1.17)	(1.10)
Selling^2			-1.17	0.14	1.36***	-0.67	-0.36
			(-1.46)	(0.14)	(2.92)	(-0.75)	(-0.51)
3-year IPO market share	-2.74***	0.40	-0.94	0.48	0.13	0.78	1.01
	(-3.23)	(0.98)	(-0.89)	(0.66)	(0.40)	(1.14)	(1.41)
Log Age	0.19***	-0.053**	0.12**	0.077*	-0.089***	0.030	0.046
	(5.16)	(-2.56)	(2.25)	(1.87)	(-5.37)	(0.86)	(1.41)
Log Sales/Assets	0.15**	-0.0097	0.42***	0.24***	-0.16***	0.17***	0.24***
	(2.30)	(-0.32)	(5.11)	(3.75)	(-6.69)	(3.76)	(5.24)
Log IPO Proceeds	-0.027	0.089***	0.11**	-0.12***	-0.086***	-0.033	-0.0094
	(-0.94)	(4.86)	(2.29)	(-3.18)	(-6.16)	(-1.13)	(-0.33)

Log Book-to-Market	0.59***	-0.081	0.74***	0.37*	-0.37***	0.12	0.22
	(3.57)	(-1.04)	(2.88)	(1.69)	(-3.71)	(0.59)	(1.02)
Log Underpricing			-0.045	0.45***	0.16***	0.050	0.049
			(-0.43)	(6.11)	(5.68)	(1.14)	(1.15)
Underwriters' Ranking	-0.020	0.0041	0.061*	0.083***	-0.0028	0.042***	0.046***
	(-1.33)	(0.53)	(1.87)	(4.15)	(-0.36)	(3.26)	(3.86)
Log Existing Shareholders Multiple	0.077***	0.095***	0.072**	0.089***	-0.011	0.038	0.032
	(3.90)	(5.15)	(2.53)	(3.66)	(-1.04)	(1.62)	(1.45)
Dotcom Bubble Dummy	-0.35***	0.21***	-0.29***	-0.50***	0.33***	-0.18***	-0.13***
	(-5.33)	(8.35)	(-4.23)	(-9.35)	(15.4)	(-4.19)	(-2.87)
Log-likelihood/Adjusted R^2 (%)	-157	33.2	9.77	21.0	48.8	8.50	9.57
N	1039	1039	1039	1039	1039	1039	1039

TABLE 14
Non-dotcom bubble subsample

Table 14 revisits regressions estimates from Tables 6-11 for the non-dotcom bubble subsample, i.e. years 1999 and 2000 are excluded. The selling variable is defined as the fraction of shares sold in the IPO to total shares offered in the IPO. The table presents results when lead venture capitalists sell secondary shares only. Table 6 (1) is a Tobit regression, other regression estimates are OLS.*, **, and *** denote level of significance at the 10%, 5%, and 1% levels, respectively.

	Table 6 (1)	Table 7 (1)	Table 8B (1)	Table 9B (1)	Table 10B (1)	Table 11B (1)	Table 11C (1)
Selling		-0.081	0.92**	1.08***	-0.89***	0.58	0.96**
		(-0.77)	(2.53)	(2.89)	(-4.56)	(1.27)	(2.33)
Selling^2			0.082	-1.38***	0.56**	-0.44	-0.96**
			(0.20)	(-3.15)	(2.39)	(-0.86)	(-1.97)
3-year IPO market share	-2.06***	0.074	1.07	0.73	0.30	0.87	1.12
	(-2.88)	(0.23)	(1.17)	(0.97)	(0.75)	(0.90)	(1.06)
Log Age	0.14***	-0.028*	0.15**	0.044	-0.12***	0.035	0.039
	(4.59)	(-1.66)	(2.41)	(1.05)	(-5.39)	(0.66)	(0.88)
Log Sales/Assets	0.074	0.030	0.37***	0.13**	-0.14***	0.079	0.22***
	(1.58)	(1.17)	(4.37)	(2.06)	(-4.35)	(1.31)	(3.66)
Log IPO Proceeds	-0.065	0.031**	0.15***	-0.039	-0.11***	0.0024	0.051
	(-1.62)	(2.29)	(2.83)	(-1.04)	(-5.79)	(0.064)	(1.52)

Log Book-to-Market	0.43***	-0.016	0.69***	0.070	-0.26**	-0.11	0.060
	(3.06)	(-0.26)	(2.64)	(0.32)	(-2.47)	(-0.45)	(0.24)
Log Underpricing			0.31**	0.60***	0.15**	0.46***	0.36**
			(2.38)	(4.30)	(2.33)	(3.17)	(2.54)
Underwriters' Ranking	0.0044	0.0093	0.072*	0.073***	-0.0060	0.038**	0.034**
	(0.33)	(1.45)	(1.93)	(3.36)	(-0.64)	(2.44)	(2.55)
Log Existing Shareholders Multiple	0.068***	0.053***	0.0045	0.0027	0.020	-0.017	-0.018
	(2.99)	(4.33)	(0.12)	(0.10)	(1.54)	(-0.56)	(-0.52)
Log-likelihood/Adjusted R^2 (%)	-104	15.2	14.5	13.9	21.4	6.29	10.8
N	581	581	581	581	581	581	581