IPO Underpricing, Wealth Losses and the Curious Role of Venture Capitalists in the Creation of Public Companies [†] [*]

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Abstract

Lower underpricing amongst venture-backed IPOs has been attributed to a certification role for venture capitalists. We argue that differences in underpricing per se are uninformative and possibly misleading when not controlling for differences in entrepreneurs' incentives to control underpricing. Using 1980s and 1990s data, we show that entrepreneurs' wealth losses, a more suitable measure than underpricing, are unaffected by the presence of venture backers. Thus, we find no evidence of venture certification as far as IPO pricing is concerned. We also find possible evidence of a conflict of interest between venture backers and entrepreneurs which could explain why more prestigious underwriters in the 1990s are associated with higher underpricing.

Key words: initial public offerings; underpricing; intermediation; certification; venture capital.

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Abstract

Lower underpricing amongst venture-backed IPOs has been attributed to a certification role for venture capitalists. We argue that differences in underpricing per se are uninformative and possibly misleading when not controlling for differences in entrepreneurs' incentives to control underpricing. Using 1980s and 1990s data, we show that entrepreneurs' wealth losses, a more suitable measure than underpricing, are unaffected by the presence of venture backers. Thus, we find no evidence of venture certification as far as IPO pricing is concerned. We also find possible evidence of a conflict of interest between venture backers and entrepreneurs which could explain why more prestigious underwriters in the 1990s are associated with higher underpricing.

IPO Underpricing, Wealth Losses and the Curious Role of Venture Capitalists in the Creation of Public Companies

The exact role of venture capitalists in the creation of public companies is controversial. Empirically, venture-backed companies appear to suffer less underpricing when going public (Megginson and Weiss 1991, Barry, Muscarella, Peavy and Vetsuypens 1990) and, unlike other IPOs, do not underperform in the next few years (Brav and Gompers 1997). These findings suggest that the presence of venture capitalists confers a real advantage on IPO companies. The literature has suggested two sources of advantage. Focusing on the informational asymmetry between potential public equity investors and IPO companies, Megginson and Weiss (1991) argue that VC certification can lower underpricing and IPO costs: unlike entrepreneurs, venture capitalists bring companies to market repeatedly and can thus establish a reputation for 'objective' pricing. Consistent with this, Lin and Smith (1998) find that more reputable VCs are associated with lower underpricing. Gompers and Lerner (1997a), on the other hand, suggest that venture capitalists help mitigate an informational asymmetry between IPO companies and investment banks. By virtue of their close involvement with investee companies and the monitoring arrangements they typically put in place, venture capitalists facilitate access to high-reputation underwriters at an earlier stage in a firm's life-cycle than would otherwise be feasible. To safeguard their reputation capital, they will screen out companies likely to underperform subsequently. However, Hamao, Packer and Ritter (1998) question whether venture capitalists should be viewed as a beneficial influence. Where VCs are affiliates of the underwriters, conflicts of interest between the venture financing and underwriting functions may result in both higher underpricing and worse long-run performance, as appears to be the case in Japan. Gompers and

Lerner (1997b), however, find no such behavior in the US and suggest that bank-affiliated VCs internalize the potential conflict of interest by backing companies with smaller informational asymmetries.

Much of the empirical evidence in this on-going debate revolves around differences in the degree of underpricing. However, as Habib and Ljungqvist (1998) argue, underpricing is *not* the entrepreneur's primary concern. Entrepreneurs (and their venture backers, if any) will only care about issue costs, choice of underwriter, and ultimately the pricing of an issue to the extent that such choices affect their wealth. If entrepreneurs can take some costly action which reduces underpricing, for instance choose a more prestigious underwriter, they will do so only if the marginal benefit outweighs the marginal cost.[1] This marginal benefit is not the reduction in underpricing *per se*, but the reduction in underpricing-induced wealth losses, which increase in the number of shares sold in the IPO. To see why, imagine a company were to float a single share. However underpriced that share is, the consequences for entrepreneurial wealth would be negligible. The incentives to optimize the pricing of that one share are effectively zero if reducing underpricing entails any cost. More generally, the benefit of optimizing pricing – the reduction in wealth losses – should be an increasing function of the entrepreneur's participation in the offering and the size of any capital increase. Thus, one would expect companies to be highly underpriced when selling few old or new shares. It follows that when testing any hypothesis which makes predictions about underpricing, such as certification, we must control for the incentives to reduce underpricing.

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[1] Carter and Manaster (1990), amongst others, have shown that underwriter quality has a significantly negative impact on underpricing. Though see below for more recent evidence of an apparent reversal in this relationship.

Omitting to control for these incentives may create an empirical bias and lead to incorrect inferences. Consistent with their certification hypothesis, Megginson and Weiss (1991) find that compared to non-venture backed IPOs, venture-backed IPOs in 1983–1987 are significantly less underpriced and involve lower issue costs, even when controlling for ex ante uncertainty about firm value and for the presence of other reputable experts such as underwriters. However, we can impute from their Table III (p. 886) that the venture-backed firms in Megginson and Weiss' sample issued 36% more shares on average than did non-venture backed firms, thus giving them a greater incentive to take costly actions which reduce underpricing. Consistent with this, we will show that venture-backed firms in Megginson and Weiss' sample suffer the same level of wealth losses once we control for differences in the number of shares sold. However, had we neglected to control for incentives we would have had to conclude, erroneously, that venture-backed entrepreneurs enjoyed lower wealth losses.

Gompers and Lerner (1997a) show that the empirical relationship between venture backing and underpricing varies over time: in the five years preceding Megginson and Weiss's sample, venture-backed IPOs were in fact *more* underpriced than non-venture backed ones. Hamao et al. produce similar evidence for the 1990s. However, neither finding on its own can be taken as refutation of the certification hypothesis: without controlling for the incentives to reduce underpricing, which will vary over time as the owners' participation and dilution decisions vary, we cannot determine whether VCs are able to reduce underpricing at the margin. It is therefore important to test the certification and incentives hypotheses not only in Megginson and Weiss' sample, but also in another time period. To do so, we use a new, comprehensive sample of 1990s IPOs, as well as Megginson and Weiss' original data.

Our three principal findings are as follows. First, consistent with the incentives hypothesis entrepreneurs do appear more concerned with wealth losses than with underpricing. They spend more and underprice less the more shares they sell, such that their wealth losses are minimized. This confirms that incentives must be taken into account before testing for certification effects. Second, in neither time period does venture backing lead to lower wealth losses for entrepreneurs. So, venture-backing does not generally lower the costs of going public as the certification hypothesis claims. This is, of course, not to claim that venture capitalists do not perform an economically valuable function: they clearly do finance and indeed nurture many high-risk ventures which would otherwise not, arguably, ever get as far as a stock market flotation. But the venture capitalists' main function appears to be fulfilled well before the company goes public, not at the IPO.

Finally, and perhaps most intriguingly, we find evidence of a possible conflict of interest between certain types of venture backers and entrepreneurs which may help explain recent anomalous evidence of a *positive* effect of underwriter prestige on underpricing (as found by Beatty and Welch 1996 and investigated in Cooney *et al.* 1998). Specifically, we show that the positive effect is concentrated amongst cases where the entrepreneur but not the venture backer sell part of their own shares. We conjecture that VCs in these cases have a lower incentive to reduce underpricing since, as we show, most of the cost of mispricing is borne by the selling shareholders. Perhaps for this reason, VCs put less pressure on the underwriters to price the IPO accurately. The fact that VCs in these cases are more prone to engaging the very top investment banks then leads to a positive correlation between underpricing and underwriter quality.

The remainder of the paper is structured as follows. Section I outlines Habib and Ljungqvist's

(1998) incentives model and formulates the hypotheses and testable implications of the paper. Section II describes the data. Results of the empirical tests are presented in Section III. Section IV concludes.

I. Model and testable hypotheses

Consider an entrepreneur who issues N_n new shares, sells $N_{o,s}$ old shares, and retains $N_{o,r} \equiv N_o - N_{o,s}$ shares, where N_o is the number of shares outstanding before the flotation. For now ignore the possibility of multiple pre-IPO owners (including venture capitalists). We will refer to $n_{o,s} \equiv N_{o,s}/N_o$ and $n_n \equiv N_n/N_o$ as the entrepreneur's participation ratio and dilution factor, respectively. Let P_0 and P_1 denote the offer price and first-day trading price, respectively. Let P^* be the unobservable value of each old share pre-flotation. P^* need not equal P_1 because selling N_n primary shares at $P_0 < P^*$ will lead to dilution of the retained shares. Following Barry (1989),

$$P^* = P_1 + \frac{N_n}{N_o}(P_1 - P_0) \qquad [1]$$

since in an efficient market, the first-day trading price values the firm as the sum of the pre-IPO value plus money raised (ignoring for the moment direct cash costs of going public): $P_1 = (N_o P^* + N_n P_0)/(N_o + N_n)$. By underpricing, the entrepreneur loses $N_{o,s}(P^* - P_0)$ on the shares sold and $N_{o,r}(P^* - P_1)$ in the form of dilution of the value of the retained shares. Her aggregate wealth loss per old share is, therefore, $wl \equiv n_{o,s}(P^* - P_0) + n_{o,r}(P^* - P_1)$. Clearly, wealth losses increase in $n_{o,s}$ and decrease in the offer price. They also increase in the dilution factor n_n, via P^*.

Now assume the entrepreneur can take some costly action that positively affects the offer price

and thus negatively affects underpricing and wealth losses. Let *EXP* be the total cost of such action and let *exp* be the cost per old share: $exp \equiv EXP/N_o$. An example of actions which reduce underpricing and thus wealth losses is the choice of IPO experts such as auditors (Titman and Trueman 1986) or prestigious underwriters (as mentioned in the introduction). We assume the entrepreneur seeks to minimize *total* wealth losses, $twl \equiv wl + costs$. Some costs, namely *exp*, are discretionary and can be used to reduce underpricing. Others are not discretionary. In particular, we assume that underwriting fees are non-discretionary, insofar as they represent compensation to the syndicate for providing underwriting cover. We will argue later that such fees are a function of underlying valuation uncertainty. To avoid confusion, we will refer to *wl* as partial wealth losses and *twl* as total wealth losses. Clearly, it is total wealth losses that entrepreneurs are assumed to minimize.

We now have the following comparative statics. Like partial wealth losses, total wealth losses clearly increase in $n_{o,s}$ and n_n. There is a trade-off between spending more (higher *exp*) and tolerating higher underpricing. At the optimum, the marginal benefit of increasing *exp* to reduce underpricing should equal the marginal cost of doing so, implying that total wealth losses are invariant, at the optimum, to *exp*. Partial wealth losses *wl*, on the other hand, decrease in *exp*, as greater spending leads to lower underpricing and thus lower partial wealth losses. Finally, total wealth losses are increasing in ex ante uncertainty about the value of the firm, σ, since greater uncertainty increases required underpricing.[2]

Hypothesis 1 (incentives): Issuers optimize pricing to minimize their total wealth losses, by

[2] See, for instance, Benveniste and Spindt (1989), Rock (1986), and Welch (1989).

choice of two variables: how much to spend (*exp*) and the quality of the underwriter (*uwrep*). Choosing a higher-quality underwriter directly increases *exp* but may indirectly decrease *exp* if underwriter quality and other costly, underpricing-reducing actions are substitutes. Both choice variables increase in $n_{o,s}$, n_n, and risk σ, because the incentives to take costly actions increase in the entrepreneur's participation and dilution, as well as risk. Higher *exp* and *uwrep* both lead to a higher offer price, which in turn implies less underpricing and lower partial wealth losses. Moreover, if entrepreneurs behave optimally, total wealth losses are invariant, at the margin, to *exp* and *uwrep*. These comparative statics lead to the following predicted signs:

	$\partial n_{o,s}$	∂n_n	$\partial\sigma$	∂exp	$\partial uwrep$
∂UP	–	?	+	–	–
∂twl	+	+	+	0	0

Under Hypothesis 1, the benefit to an issuer of reducing underpricing is not a function of the pre-IPO ownership structure: whether or not a venture capitalist is present, observed underpricing is primarily a function of the intensity of the incentives to reduce underpricing, where the intensity is 'indexed' by the owner's or owners' participation and dilution parameters. Any univariate difference in average underpricing between venture-backed and non-venture backed issuers may thus solely be due to different intensity of incentives, not to the presence or absence of a venture capitalist. Moreover, once we take offering characteristics and uncertainty into account, there may be no difference in total wealth losses for the two types of issuer.

To formulate our certification hypothesis, assume, for simplicity, that there are two types of IPO firms, high value and low value ones, and that venture capitalists are better informed about true firm value than are stock market investors. If venture capitalists are repeat participants in the IPO

market, then (following the Folk Theorem) it is a (non-unique) Nash equilibrium strategy for the venture capitalists to bring only high-value companies to market and for stock market investors to pay a high price. Behaving in this fashion will give the venture capitalist a 'reputation' for backing high-value firms, where his reputation capital is the present discounted value of the future benefits associated with investors responding by paying the high price.

Hypothesis 2 (certification): Venture capitalists can certify information about an IPO company by staking their reputation capital, thus leading to higher offer prices, *ceteris paribus*. Controlling for the incentives outlined in Hypothesis 1, the presence of a venture capitalist lowers the marginal cost of reducing underpricing and hence wealth losses. Thus, a given amount of *exp* leads to a larger reduction in underpricing for venture-backed firms: $\frac{\partial UP}{\partial exp}\Big|_{\text{VC present}} < \frac{\partial UP}{\partial exp}\Big|_{\text{no VC present}} < 0$. A similar prediction can be made about the choice of underwriter quality, *uwrep*. If the marginal benefit of less underpricing is the same in each case, venture-backed IPOs experience lower underpricing, spend less *exp* and enjoy lower total wealth losses, holding uncertainty σ constant. To the extent that there are gradations in the reputation of venture capitalists, the aforementioned effects will be more pronounced, the more valuable the venture capitalist's reputation capital.

Hypothesis 2 effectively suggests that the slope of the relationship between underpricing and *exp* depends on whether a venture capitalist is present: the entrepreneur benefits from certification in

that she can minimize her wealth loss at a lower cost.[3] However, since *exp* is itself endogenous under Hypothesis 1, empirical tests have to control for $n_{o,s}$, n_n and ex ante valuation uncertainty σ. The same applies to *uwrep*. The marginal benefit of reducing underpricing is assumed to be unrelated to the presence of a venture backer, all else equal, effectively ruling out agency conflicts between the venture capitalist and the entrepreneur so that less underpricing benefits both in proportion to their ownership. We will relax this assumption towards the end of section III.

II. Sample and data

A. The 1980s data

Megginson and Weiss' (1991) data set consists of 320 pairs of venture-backed and non-venture backed IPOs floated between January 1983 and September 1987, matched by industry and offer size. We exclude from this data set a real estate investment trust, One Liberty Firestone Properties, because its dilution factor was three orders of magnitude greater than average, twenty times that of the next most diluted offering, and more than 300 standard deviations away from the mean.[4] To keep the sample balanced, we also dropped One Liberty's matching venture-backed firm, Zitel Inc. For the remaining 319 pairs, we supplemented Megginson and Weiss' data with information about the pre-flotation number of shares outstanding, the number of primary and secondary shares sold in the IPO (including over-allotment shares), the non-underwriting

[3] The decision to involve a VC is clearly endogenous, but at the time of the IPO it is already pre-determined in the econometric sense and thus a valid conditioning variable.
[4] Exclusion in fact *weakens* our results, because in line with our predictions, One Liberty combines *extremely* high dilution with minimal underpricing, ensuring near-perfect 'fit' of any regression.

expenses incurred, and the underwriter commission and its breakdown into payment for underwriting cover, management fee and selling concession. We also augmented Megginson and Weiss' information on company age and assets using Standard & Poor's *Register of Corporations*, information gathered from IPO prospectuses and a news search, and Ritter's (1991) database of IPOs from 1975–1984.

B. The 1990s data

Mirroring Megginson and Weiss' procedure, we used *Independent Dealers Digest* (IDD) to identify all 1,456 initial public offerings by US issuers during the 36 months from January 1996 to December 1998, excluding only closed-end funds, REITs, ADRs, unit and best efforts offerings. We then excluded seven firms for which neither a prospectus nor any substitute source of offering information could be found, 13 companies without shares outstanding pre-flotation (mainly newly-formed bank holding companies and mutual-to-stock conversions), eight issuers which had been listed previously but were erroneously classified as IPOs by IDD, and five firms with missing first-day trading prices. Mirroring our treatment of outliers in the 1980s sample, we also excluded two issues with extremely high dilution factors, Apex Mortgage Capital Inc (67,000-fold) and Anworth Mortgage Asset Corp (22,000-fold). The final sample contains 1,421 firms, 513 of which were venture-backed. Following Gompers and Lerner's (1997a) argument that matching is both arbitrary and econometrically inefficient, we proceed with the full non-matched 1990s dataset. In a previous draft, we did match using Megginson and Weiss' criteria (industry and offer size), but the results are unaffected.[5]

[5] The matched-firm results are available upon request.

All company and deal-specific information is manually extracted from the original prospectuses. Whilst this is time-consuming, we found that commercial data vendors frequently record two key variables, shares outstanding and offering expenses, with error. We obtained prospectuses for 1,352 companies from the SEC's Edgar filing service, the companies directly, investment banks and Disclosure Inc. Rather than risking a selection bias, we retain the 69 firms with missing prospectuses in the sample and assemble the necessary information from 10-Qs, Disclosure's corporate database and Standard & Poor's *Daily News*. For all sample firms, we identify the venture capital backers, their at-IPO equity stakes and the level and length of their representation on the board of directors via the "Principal stockholders", "Management" and "Certain transactions" sections of the prospectuses.[6,7] The affiliations of the venture capital funds or individual venture capitalists thus identified are traced using *Pratt's Guide to Venture Capital Sources* and the *Venture Capital Journal* (VCJ). There are a total of 581 unique venture funds, of which 327 back only one IPO firm, 194 back between 2 and 5, and 60 back more than 5 IPOs. We define the VC with the largest equity stake as the lead venture backer, and resolve ties with reference to seniority and length of service on the board of directors. The average IPO has 3.1 venture backers owning 44.6% of the company's equity between them, with lead VCs owning 26.7% on average. At the time of the IPO, the average lead VC had spent 38.3 months on the board, and the average number of VC board members is just under 2. The average lead venture firm has been in business for 18 years, based on information collected from *Pratt's Guide*, the

[6] We do not rely on the *VCJ* to identify which IPOs were venture-backed, since we found that the *VCJ* failed to flag as many as 76 of our 513 venture-backed firms (15%). Whilst more time-consuming, a search of the "Principal stockholders" section of each prospectus is thus a cleaner identification procedure.

VCJ and the venture funds' own web sites. As proxies for reputation capital, we construct two Top 20 league tables of the venture funds in our sample: based on the number of IPO firms backed in 1996–1998 and on the market capitalization of those IPO firms; see Table I. Kleiner Perkins Caufield & Byers was both the most prolific VC, backing 37 IPO firms, and the market leader by IPO market capitalization. We will use these league tables to control for differences in VCs' reputation capital.

First-day trading prices come from the CRSP tapes, the NYSE's Trade and Quote database, and the NASDAQ web-site (which uses CRSP but is updated in a more timely fashion). Information on over-allotment option exercise was gathered from Standard & Poor's *Register of Corporations*, news sources and subsequent 10-Qs and 10-Ks. Three- and four-digit SIC codes are from Standard & Poor's *Register*, as are most incorporation or founding years.

Megginson and Weiss measure underwriter reputation by a bank's contemporaneous market share; we will call this proxy *uwmkt*. We use their estimates of market shares for the 1980s and our own update for the 1990s.[8] However, as Gompers and Lerner (1997a) observe, "it is not necessarily the most active underwriter that is the most reputable" (p. 22). Therefore, we also use

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[7] Eighteen of the 69 missing prospectuses involve venture-backed IPOs. We use the *VCJ* and a news search to identify their venture backers and board service records. Sixteen of the 18 IPOs involve no insider sales, so it is possible to compute the venture capitalists' precise at-IPO stakes from their subsequent Form 3 filings immediately after the IPO.

[8] We update *uwmkt* for our 1990s firms by computing underwriters' market shares during the 5 years ending the quarter before each sample firm goes public. Specifically, we allocate the gross proceeds of each IPO during a 5-year window equally to all banks involved as lead, co- or principal underwriters in that IPO (as listed in the top two segments in tombstone advertisements). We then cumulate these allocated gross proceeds for each bank and divide by the total gross proceeds raised in all IPOs in the 5-year window to obtain each bank's market share. For each IPO in our 1990s sample, *uwmkt* then equals the average market share of its lead underwriters (as listed in the top two tombstone segments). This definition, which mirrors Megginson and Weiss' procedure, therefore takes into account the composition of the underwriter syndicate. Our results are robust to alternative procedures, such as concentrating on the lead underwriter only or computing market shares over three year windows or contemporaneously.

the Carter-Manaster (1990) 'tombstone' underwriter reputation rank variable, denoted *uwrank*.[9] The main drawback of the 'tombstone' measure is that it is unavailable for 23% of the 1990s observations and 15% of the 1980s observations. Whilst many missing underwriters are likely to be low-reputation ones (the likely reason for their omission being that they did not underwrite any IPOs in Carter and Manaster's estimation period), some are not, including Dillon, Read in the 1980s and J.P. Morgan in the 1990s.

C. Descriptive statistics

Tables II*a* and II*b* provide some characteristics of the issuers (Panel A), their offerings (Panel B) and underpricing, associated IPO costs and wealth losses (Panel C), respectively for the 1980s and the 1990s samples.[10] The most notable difference in issuer characteristics is age: venture-backed firms are consistently younger when going public. As regards size, there is no clear pattern: the median book value of assets was significantly greater for venture-backed firms in the 1980s, but significantly smaller in the 1990s. Despite Megginson and Weiss' matching procedure, venture-backed IPOs in the 1980s had significantly higher median gross proceeds ($15.0m versus $8.8m). In part, this is due to their higher median offer prices ($10.5 versus $9.75), but more importantly venture-backed firms sold significantly more shares. As the median participation ratios show, most of the differences are due to venture-backed issuers selling more old shares; in fact, the incidence of issues involving secondary shares is significantly greater

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[9] To avoid using stale data, we use Carter and Manaster's (1990) ranks for our 1980s firms and Carter, Dark and Singh's (1998) updated ranks for the 1990s firms.

[10] A comparison of our Table II*a* and Megginson and Weiss' Table III shows that dropping *One Liberty* from the sample has no effect: the amount offered, offering price, book value of assets and age are all extremely similar, both on average and at the median.

amongst venture-backed firms (*p*-value for χ^2 test of independence = 4.7%). Though no inference can be drawn from this univariate discussion, it does suggest that venture-backed issuers should be more concerned with pricing, as Hypothesis 1 asserts – and underpricing is indeed significantly lower amongst venture-backed issuers in the 1980s (7.1% versus 11.5%). Partial and total wealth losses per old share, on the other hand, are no different, which suggests that venture-backing may be of no real consequence to entrepreneurs' wealth in the IPO process.

In the 1990s sample, the relationships are less clear-cut. Venture-backed issuers no longer raise more money than do non-venture backed ones (the mean being significantly lower, whilst the median gross proceeds are somewhat higher), whilst both participation ratios and dilution factors are now significantly smaller for venture-backed IPOs. In contrast to the 1980s, but consistent with the changes in offering characteristics, venture-backed IPOs in the 1990s are somewhat more underpriced (17.8% versus 16.6%), though the difference is not significant. As before, mean total wealth losses are similar, though median wealth losses are now significantly higher amongst non-venture backed firms, which perhaps is not surprising in view of the very much higher dilution ratios.

III. Empirical results

A. Proxying for ex ante uncertainty

We use two proxies for ex ante uncertainty σ: company age as in Megginson and Weiss (1991) and the underwriting fee as in Joehnk and Kidwell (1984) in the context of bond issues and Booth and Smith (1986) in the context of seasoned equity offerings. The reason we use two proxies is that *age* alone may not fully capture uncertainty: presumably, the value of a two-year-old internet

company is more uncertain than the value of a two-year-old mini steel mill. The reasoning behind using the underwriting fee as a proxy of uncertainty is as follows. Since underwriting provides the issuer with a put option whose value should increase in uncertainty, the price the bank charges for the put, i.e. the underwriting fee *uwfee*, should also increase in σ.[11] Erdal and Ljungqvist (1999) show that *uwfee* does indeed behave like a put option premium and that it covaries with firm characteristics such as age, company size, and earnings uncertainty. Note that the *uwfee* (the underwriting fee in dollars per share sold) is not the same as the 'gross spread' (*total* underwriting compensation *per dollar raised*). The gross spread would be a less useful risk proxy in light of Chen and Ritter's (1999) finding that it has a tendency to be exactly 7% for more than 90 per cent of medium-sized US IPOs in the 1990s.

B. Testing Hypothesis 1: Incentives

To test Hypothesis 1, we regress underpricing and total wealth losses, respectively, on expenses *exp*, the participation ratio $n_{o,s}$, the dilution factor n_n, and the two risk proxies *uwfee* and *age*.[12] The results are in Table III. Throughout, we report standard errors that are adjusted for the presence of heteroskedasticity using White's (1980) heteroskedasticity-consistent covariance matrix. Before we proceed, we need to address an econometric issue. Consistent with Hypothesis 1, Table III shows that issuers spend more *exp*, the greater their incentives to control underpricing (see columns 1 and 4), controlling for risk and offer size to allow for economies of scale in *exp*

[11] The underwriting fee covers not only firm-specific but also market risk, though the latter tends to be low as banks typically lay off their underwriting risk within a day (Muscarella and Vetsuypens 1989).

(see Ritter 1987). This implies that *exp* is endogenous to the right-hand side variables in our underpricing and wealth loss regressions. Normally, this would invalidate the use of OLS, but it can be shown that OLS will still be consistent given the fully-recursive triangular set-up of the model (see Greene 1997, p. 736f.). All that is required is that the errors of the *exp* equation are uncorrelated with those of the underpricing and total wealth loss regressions, respectively. As the triangularity test in Table III shows, this is indeed the case.

With only one exception, all parameter estimates in Table III have the predicted signs, thus confirming the comparative statics predictions of the incentive hypothesis. In particular, underpricing is lower, the higher *exp* and the lower ex ante uncertainty as proxied by either *uwfee* or *age*.[13] Expenses *exp*, in turn, are larger the higher the participation ratio $n_{o,s}$ and dilution factor n_n and risk, holding scale constant. Finally, total wealth losses increase in $n_{o,s}$, n_n and risk. Hypothesis 1 requires that *exp* be chosen optimally, such that total wealth losses are minimized. This implies a non-monotonic relationship between *twl* and *exp*, which we here attempt to capture by including a squared term in *exp*. The insignificant coefficient for *exp* indicates that at the margin, further spending on underpricing reduction would not reduce wealth losses – which indicates optimality. The positive coefficient for exp^2 indicates that the second-order condition for a minimization problem holds.

The only variable not to behave as expected is the participation ratio $n_{o,s}$ in the 1980s: instead of

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[12] Gompers and Lerner (1997a) argue the need to control for time effects, since underpricing has been shown to vary over time. Following their procedure, we define *IPO4mons* to equal the number of IPOs in the four months (122 calendar days) preceding the day of each IPO. *IPO4mons* typically affects underpricing negatively, but our regression results are unaffected. Given the lack of economic rationale for time variation in underpricing, we refrain from controlling for it.

being negative, its effect on underpricing is positive though not significant. We note, however, that the unconditional correlation between underpricing and $n_{o,s}$ is negative as required.

To summarize, the comparative statics and optimality predictions of Hypothesis 1 are supported well in both time periods: firms that are riskier and whose owners participate less in the offerings are generally more underpriced, but spending more can reduce underpricing. *exp* seems to be chosen optimally to minimize total wealth losses.

C. Testing Hypothesis 2: Certification

Holding risk, participation and dilution constant, and controlling for the effect of underwriter quality on underpricing, Hypothesis 2 predicts that venture-backed firms are less underpriced, incur lower issue costs and suffer lower wealth losses. We will investigate these three predictions in turn.

Column (1) of Table IV regresses underpricing simply on the two risk proxies and a 0/1 dummy for venture-backed firms; this ignores the incentive arguments and thus effectively mirrors Megginson and Weiss' analysis. Consistent with their result, venture-backed IPOs in the 1980s are less underpriced by about 5 percentage points, holding risk constant (Panel A). In the 1990s, on the other hand, venture-backed IPOs are *more* underpriced, though not significantly so (Panel B). This is consistent with Gompers and Lerner's (1997a) observation that the 'influence' of venture backing on underpricing varies over time. The next three columns (2)-(4) show what happens when we control for incentives and the effect of spending *exp* on underpricing as in the

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[13] The positive sign for n_n in the 1980s may seem unintuitive, but according to Hypothesis 1, $\partial UP/\partial n_n$ cannot be

previous section. In the 1980s, it remains the case that venture-backed firms suffer significantly lower underpricing when we ignore underwriter choice (column 2) and when we control for underwriter choice using Megginson and Weiss' market-share variable (column 3). When we use the 'tombstone' variable, however, venture-backing is no longer associated with a significant reduction in underpricing (column 4).[14] This suggests that VCs do not necessarily provide any certification over and above that provided by prestigious underwriters. In the 1990s, the VC dummy stays positive but is never significant. Note how the size of the VC dummy coefficient changes from regression to regression, hinting at omitted variable bias.

Curiously, unlike in the 1980s firms underwritten by more prestigious investment banks in the 1990s appear to suffer *greater* underpricing, significantly so when using *uwmkt*. This mirrors Beatty and Welch's (1996) earlier finding and has plagued virtually all IPO research using 1990s data.[15] The reversal in the relationship is economically significant. To illustrate, a move from the 1st quartile to the 3rd quartile of *uwmkt* would have reduced underpricing in the 1980s by 3.3 percentage points; in the 1990s, on the other hand, it increased it by 2.7 percentage points. In the next subsection, we will conjecture that this observation can be explained on the basis of our incentives hypothesis.

According to Hypothesis 2, the marginal effects of *exp* and costly underwriter reputation on underpricing should be greater in magnitude for venture-backed firms. To test this, we interact the *VC* dummy with *exp* and the two underwriter reputation proxies and expect the interaction

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signed (see Habib and Ljungqvist 1998 for the proof).

[14] This result is not driven by the smaller sample size available when using the Carter-Manaster variable.

[15] The same result was recently found by Cooney, Singh, Carter and Dark (1998), who speculate that the bargaining power of underwriters has increased relative to issuers.

terms to be significantly negative. The corresponding regression results are in columns (5)-(7). As required, the marginal effect of *exp* on underpricing is more negative for venture-backed IPOs in either period, irrespective of whether and how we control for underwriter reputation. However, this is only significant in one of the six regressions, namely in the 1990s when we do not control for underwriter reputation.[16] The marginal effect of underwriter reputation, on the other hand, never behaves as predicted: the interaction term is invariably positive, which in the 1980s implies that prestigious underwriters are less effective at lowering underpricing in the presence of a VC! Overall, the general lack of significance for our first interaction term and the incorrect sign for the second lend little support to Hypothesis 2.

Columns (6) and (7) provide further insight into the curious finding that underpricing appears to increase in underwriter quality in the 1990s. As we add the VC–underwriter reputation interaction term, two things change: the VC dummy turns negative and becomes significant at the 6% (column 6) and 2% levels (column 7); and the positive effect of underwriter reputation on underpricing ceases to be significant. The first change implies that Megginson and Weiss' empirical finding survives into the 1990s: as in the 1980s, the direct effect of venture backing is to lower underpricing. However, this direct effect is obscured by the venture capitalists' association with prestigious underwriters, who in light of the significantly positive interaction term seem to underprice more. The total effect of VC backing on underpricing depends, via the interaction term, on the underwriter's reputation: $\frac{\partial UP}{\partial VC} = \hat{\beta}_{VC\ \text{dummy}} + \hat{\beta}_{VC*uwmkt} * uwmkt$, where the

[16] Moreover, if we run the underpricing regression separately for venture and non-venture backed firms, as would be appropriate if we believed the error variance was different for the two types of IPOs, the marginal effect of *exp* is never significantly more negative for venture-backed firms.

$\hat{\beta}$ are the coefficient estimates from Table IV. As the *F*-test shows, this total effect is statistically zero which suggests that there is no overall venture certification effect. The second change suggests that the troubling evidence of a positive association between underpricing and underwriter reputation is not general but specific to venture-backed IPOs. This, of course, is still puzzling, though we will offer a plausible explanation shortly.

The regressions in Table IV implicitly assume that all VCs are equally capable of certifying IPO quality. To relax this assumption, we use the two Top 20 rankings from Table I to distinguish between 'high-quality' and 'low-quality' venture firms in the 1990s. Table V thus adds two dummies to our previous underpricing regressions, one equaling unity if the lead venture firm is in the Top 20, the other equaling unity if it is not. We retain the underwriter-reputation interaction terms and thus effectively rerun regressions (5)-(7) from Table IV, but splitting the VC dummy into two. Under the certification hypothesis, there are two testable predictions. First, underpricing should be significantly lower amongst IPOs backed by 'high-quality' VCs, compared to either no venture backing (*t*-test on the coefficient for Top-20 VCs) or backing by 'low-quality' VCs (*F*-test comparing the two dummies' coefficients). Second, there should be no difference in underpricing between 'low-quality' venture-backed IPOs and non-venture backed IPOs (*t*-test on the coefficient for VCs not in the Top 20), as the former should not be capable of influencing investor perceptions. Neither prediction holds. The overall effect on underpricing is statistically zero for all venture-backed IPOs, whether in or outside the Top 20. Moreover, if anything it is IPOs backed by 'low-quality' VCs which are associated with lower underpricing – though this effect is overwhelmed by the underpricing-increasing presence of prestigious

underwriters, as the interaction terms show.[17] These results contrast with those of Lin and Smith (1998), who find that underpricing is lower the higher VC reputation (as measured by VC age and the number of deals a VC was involved in). The difference could be due to differences in incentives as outlined in Hypothesis 1. Lin and Smith show that lead VCs are more likely to sell some of their own shares the greater their reputation. According to Hypothesis 1, their incentives to reduce underpricing are greater the more they sell, thus generating a negative expected relationship between underpricing and VC reputation, consistent with Lin and Smith's empirical evidence. In our sample, however, Top 20 lead VCs are in fact *less* likely to sell out than are non-Top 20 VCs and thus less concerned with underpricing, consistent with our observation of greater underpricing amongst Top 20-backed IPOs.

If we believe in Habib and Ljungqvist's (1998) argument, the real test of certification is whether entrepreneurs are better off when backed by a venture capitalist, in the sense of suffering lower wealth losses. If we just control for risk the answer, in Table VI, appears to be yes: total wealth losses per share are between 15¢ and 23¢ lower for venture-backed firms (columns 1 and 5). However, if we control for incentives, *exp* and underwriter reputation, the answer changes to no: however we measure underwriter reputation, venture-backed IPOs are not associated with lower total wealth losses. The coefficient for the VC dummy changes sign and magnitude with every addition of further variables, which strongly suggests specification bias: omitting to control for the incentive effects postulated in Hypothesis 1 would result in spurious support for certification.

The effect of underwriter reputation on total wealth losses warrants separate discussion. In the

[17] All results are similar if the dummies reflect whether *any* (as opposed to the lead) venture backer is in the Top 20.

1980s, it is consistently negative and even significant when measured in terms of market share, *uwmkt*. A two-quartile increase in underwriter market share is associated with an 8¢ (9%) reduction in total wealth losses per share, or a $150,000 reduction in absolute wealth losses. This would indicate that entrepreneurs did not fully exploit the scope for reducing their wealth losses, net of banking fees, by engaging more prestigious underwriters.[18] It is little wonder then that top underwriters have gained market share since: the proportion of IPOs underwritten by banks ranked 7 or higher on the Carter-Manaster scale has increased from 57% to 82%, and the median in the 1990s is as high as 8.75. However, this does not seem to have benefited issuers: wealth losses in the 1990s actually increase in underwriter reputation, by a significant 37¢ per share (25%) when moving from the 1st to the 3rd quartile of *uwmkt*: a $5.7m increase in absolute wealth losses![19] This, of course, mirrors the greater underpricing associated with prestigious underwriters which we documented earlier. As the final two columns of Table VI shows, part of this can be attributed, as before, to the interaction between venture backing and underwriter reputation. When we interact the venture dummy with underwriter reputation, the coefficients for *uwmkt* (column 9) and *uwrank* (column 10) both become smaller, though the former remains significantly positive. The interaction terms are in each case significant and positive, suggesting that underwriter reputation has a particularly deleterious effect on the wealth of venture-backed entrepreneurs. We will conjecture an explanation for this in the following sub-section. The direct effect of venture backing is now significantly negative, though this is again overwhelmed by the

[18] Had they chosen underwriter reputation optimally, we would have expected a zero coefficient on *uwmkt*.
[19] About $1m of the increase in absolute wealth losses can be attributed to greater underwriter fees (regressions not reported). The majority, however, is caused by greater underpricing.

interaction term, leaving an overall effect which is statistically zero.[20]

In summary, we find little systematic evidence in favor of the certification hypothesis. Whilst Megginson and Weiss are correct in claiming venture-backed firms are less underpriced in the 1980s, even when taking into account incentives, this is not robust to using a different measure of underwriter reputation. In the 1990s, venture-backed issuers appear, if anything, to be more underpriced, whether or not we control for incentives. Even when we control for the curious propensity of venture-backed firms in the 1990s to engage prestigious underwriters who underprice *more*, we find no evidence that more prestigious venture capitalists are associated with lower underpricing. If anything, it is the less prestigious VCs who are associated with lower underpricing. Nor do venture-backed issuers generally incur lower direct flotation costs or enjoy greater marginal effectiveness of their spending or choice of underwriter. Finally, whatever the evidence regarding differences in underpricing, the differences in wealth losses are solely attributable to differences in offering characteristics and risk, rather than venture backing. Only if we ignore the incentives proposed in Hypothesis 1 do we find that the presence of venture backers appears to lower wealth losses.

D. Conjectures

In the course of our investigations, we have found incidental but anomalous evidence that top underwriters in the 1990s are associated with significant increases in underpricing and that this effect is concentrated amongst venture-backed IPOs, in particular those whose venture backers

[20] Identical results obtain when we split the VC dummy into Top 20 and non-Top 20 and when we include the age of the lead VC or the average age of VC backers as a proxy for VC reputation.

are outside our Top 20 league tables. As a consequence, total wealth losses are significantly higher when venture-backed IPOs are underwritten by the most prestigious investment banks. Venture capitalists are sophisticated financial experts, so why do they choose to engage banks whose pricing is so much worse?

We conjecture that the explanation can be found in our Hypothesis 1. Recall that we assumed that a reduction in underpricing benefits every owner in proportion to her ownership, thus ruling out agency conflicts between the VC and the entrepreneur. However, there is one important class of cases where agency conflicts may arise, which could result in different intensity of incentives to get the pricing right. If no old shares are sold in the IPO, everyone suffers the same total wealth loss per share. But if different shareholders sell different numbers of old shares, they will care differentially about mispricing, even if (underpricing-reduction) costs are allocated pro-rata. The most extreme case is where the entrepreneur sells some shares but the lead VC does not. This is the case in 144 IPOs, representing 28% of the venture-backed companies and just over 10% of all sample firms. We will show that virtually all anomalous underwriter behavior can be traced back to these 144 cases.

First, the 144 cases are associated with significantly higher-ranked underwriters. The average market share of their underwriter syndicates is 2.6%, with a 'tombstone' rank of 8.5, compared to 2.1% and 8.1 where the lead VC also sells. Table VII reports four logit regressions of underwriter choice, using as cut-off points 7, 7½ , 8 and 8½ on the Carter-Manaster scale. For guidance as to the determinants of underwriter choice, we turn to Gompers and Lerner (1997a). Gompers and Lerner suggest that prestigious banks discriminate against younger and riskier issuers, but that venture-backing may ameliorate this effect. We control for risk by including company age and

size (the natural log of pre-IPO assets), and for the 'quality' of venture backing by including the age of the lead VC, the length in months of the lead VC's service on the board, as well as a dummy for venture-backed IPOs. Company age and the length of board service do not behave as expected. Younger companies are in fact more, not less, likely to choose higher-ranked underwriters, at least up to a Carter-Manaster rank of 7½; and companies whose lead VCs have spent longer on the board are less likely to engage prestigious underwriters, perhaps suggesting that board monitoring is a substitute for underwriter reputation. Company size and venture-backing, on the other hand, do significantly increase the probability of choosing higher-ranked underwriters.

To test for conflicts of interest, the logit regressions also include two dummies identifying the 144 cases where someone other than the lead VC sells, and the 80 cases where the lead VC sells also. It is clear from Table VII that VCs have a significantly greater propensity to choose the *very* top-level underwriters when someone else sells old shares: at the lower thresholds the dummy is positive though insignificant but it quadruples in size and becomes significant for the 8 and 8½ thresholds.[21] To illustrate, the probability of hiring a bank with a Carter-Manaster rank of at least 8 or 8½ is 12% greater when someone other than the VC sells old shares. Cases where the lead VC also sells, on the other hand, are associated with an up to 6% smaller probability of choosing prestigious underwriters – which could indicate that in these cases VCs are more concerned to avoid underwriters who underprice more than average.

Second, the 144 cases are considerably more underpriced than any other segment of the sample.

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[21] This result is confirmed in an ordered multinomial logit using the four thresholds simultaneously (not reported).

Their average underpricing is 24%, significantly higher than the 15.2% suffered by the remaining 369 venture-backed IPOs, the 16.6% underpricing encountered in the 80 cases where the lead VC also sells some old shares, or the 16.6% underpricing associated with non-venture backed issues. These differences remain significant in multi-variate regressions. In Table VIII we re-estimate our previous underpricing regressions controlling for potential conflicts of interests by including the two dummies. Column (1) confirms our univariate findings: cases where someone other than the lead VC is selling are associated with significantly higher underpricing. In columns (2)-(4) and (5)-(7) we control for underwriter reputation using the market-share and 'tombstone' variables, respectively. As before, higher-ranked underwriters underprice more, even when we control for the 144 cases of interest (columns 2 and 5). However, once we interact underwriter reputation and VCs not participating in the sale of old shares, it is clear that the anomalous underwriter effect is particular only to the 144 cases: the underwriter reputation variables lose significance whilst the combined effect of the lead VC not selling and the choice of top underwriters is to significantly increase underpricing (columns 3 and 6). The dummy for our 144 cases is itself insignificant, so there is nothing special about VCs not also selling *per se*; instead, the effect works solely through the choice and subsequent pricing behavior of these top banks (columns 4 and 7).

Third, total wealth losses are significantly greater for the 144 cases. The first seven columns of Table IX repeat the analysis of Table VIII, but with total wealth losses as the dependent variable. The results are analogous to our discussion of underpricing:[22] total wealth losses are significantly

[22] With one exception: the market-share based reputation proxy remains significant even when we control for the 144 cases. This implies that some *non*-venture backed firms also were ill-advised to choose top underwriters.

higher where the lead VCs do not participate in insider sales, and this effect works through the interaction term with underwriter reputation.

For a conflict-of-interest story to explain the anomalous underwriter effect, the increase in underpricing must largely be borne by the selling owners rather than the VC. That this is so is immediate from our wealth loss formula: $wl_{\text{VC}} \equiv n_{o,s}(P^* - P_0) + n_{o,r}(P^* - P_1) = P^* - P_1 <$ $wl_{\text{non-VC}} \equiv \frac{N_{o,s}^{non-VC}}{N_o^{non-VC}}(P^* - P_0) + \frac{N_{o,r}^{non-VC}}{N_o^{non-VC}}(P^* - P_1)$ since VCs who don't sell only suffer the dilution effect of underpricing, and dilution factors n_n are invariably low where $n_{o,s} > 0$, at least for our IPOs. Using data on ownership stakes and selling patterns, we can compute the VCs' and entrepreneurs' respective wealth losses. Lead VCs on average lose only \$1.20 per share, whilst the remaining owners lose a highly significantly greater \$1.36. These numbers do not take into account the costs of the IPO. If we assume that the selling shareholders must bear that part of overall costs associated with their private sales, the difference widens by another 20¢ per share.[23] Moreover, not only are the selling shareholders' total wealth losses significantly greater than those of the non-selling VCs, they are also very unusual compared to the rest of the sample, where total wealth losses are a significant 32¢ per share lower on average. The non-selling VCs' total wealth losses, on the other hand, are within 3¢ of the average. These univariate comparisons remain valid when controlling for the determinants of wealth losses. In the final four columns of Table IX, we regress total wealth losses as experienced by the lead VC (columns 8 and 9) and by the other owners (columns 10 and 11) on our usual variables. The dummy identifying the 144

[23] If we simply pro-rate the costs to ownership stakes, the difference in total wealth losses between the two types of owners clearly remains constant (and thus still tilted in favor of the VCs).

cases is significant only in the latter regressions, indicating that total wealth losses are significantly greater only as suffered by the selling shareholders, not the non-selling lead VC.

The final piece of the jigsaw concerns our earlier finding that the underpricing-increasing effect of underwriter reputation was particular to IPOs backed by non-Top 20 VCs. This can be easily explained: the overwhelming majority (67% to 79%) of the 144 cases involve lower-ranked VCs. Consequently, when we repeat the regressions in Table V controlling for the conflict-of-interest cases, the dummy for non-Top 20 VCs loses significance (not reported).

What we have interpreted as conflicts of interest between selling and non-selling shareholders could, conceivably, be driven by 'grandstanding' (Gompers 1996) or internal conflicts of interest at bank-affiliated VCs (Hamao et al. 1998). Gompers shows that firms backed by younger VCs are more underpriced and taken public more quickly, because such 'grandstanding' might help VCs gain a quick reputation with, and raise fresh capital from, institutional investors. However, in our 144 conflict-of-interest cases, the lead VC was in fact significantly older than in the remaining cases, both on average (20 versus 17 years) and in the median (17 versus 15 years). Nor does a bank-affiliation conflict of interest seem likely: only 14 of the 144 cases involve VCs who are formally affiliated to investment banks, a proportion which is no different from that in the rest of the sample.

In summary, our findings suggests that the VC is the driving force behind the choice of underwriter, not the entrepreneur. When VCs don't sell out themselves, they are happy engaging prestigious underwriters whose pricing accuracy – deliberately or otherwise – is poor. Perhaps due to an agency conflict, the VCs then expend sub-optimal effort negotiating a higher offer price on behalf of the other shareholders. It is unclear, though, what prevents entrepreneurs from

insisting on a better deal.

IV. Conclusions

We have argued that an empirical investigation of venture capitalists' ability to certify IPO quality must be conditioned on the incentives that exist to reduce underpricing, and have shown that these incentives matter empirically in the ways conjectured: entrepreneurs minimize their total wealth losses by reducing underpricing more, the more shares they offer in the IPO. Using two samples of IPOs from different decades, the 1980s and the 1990s, we have shown that whilst venture-backed IPOs do sometimes enjoy lower underpricing, they never enjoy lower wealth losses. We have also shown that *not controlling for the incentive effects* results in biased inferences: total wealth losses then appear significantly smaller amongst venture backed companies.

Our results therefore indicate that venture-backed IPOs in the 1980s may have appeared to be less underpriced, not because they were venture-backed, but because their incentives to reduce underpricing were greater. This is not to claim that venture-backing does not matter. Clearly, venture capitalists provide economically valuable services in the start-up and expansion phases. Furthermore, given Brav and Gompers' (1997) long-run performance evidence they may also be credited with screening out bad risks at the IPO stage. But they do not impress IPO investors into paying a higher price at flotation.

In the 1990s, the above results still hold but are obscured by the unexpected finding of a positive effect of underwriter reputation on underpricing. We have conjectured that conflicts of interest between entrepreneurs and their venture backers may account for at least part of the failure to

gain from the association with more prestigious underwriters, but clearly this remains an area for further research.

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Table I.
Top 20 Venture Capitalists in 1996–1998, ranked by IPO volume and market capitalization.

For each of the 513 venture-backed IPOs in 1996–1998, we identify all venture backers via the "Principal stockholders" section of the prospectus or the *Venture Capital Journal* (*VCJ*) where no prospectus is available. We trace ultimate ownership of the venture funds thus identified using *Pratt's Guide to Venture Capital Sources* and the *VCJ*. The 581 venture firms are then ranked according to (i) the number of IPOs they backed and (ii) the market value of these IPO firms, capitalized at the offer price. Ties in the first ranking are resolved by ranking on the total market value of IPOs backed. The second ranking excludes J.P. Morgan Capital Corp, Fund American Enterprises Holdings Inc and Trident Partnership, which would occupy the top three positions by virtue of backing just one company, Travelers/Aetna Property Casualty Corp. The Top-20 venture firms act as lead VC in 150 (by number) and 112 (by market value) of the 513 venture-backed IPOs, respectively.

	Ranked by number of IPOs backed by VC in 1996-1998		Ranked by total market value of IPOs backed by VC in 1996-1998	
Rank	Name	Number	Name	Cum. IPO market value, at P_0 (in $m)
1	Kleiner Perkins Caufield & Byers	37	Kleiner Perkins Caufield & Byers	6,816
2	Sequoia Capital	23	Norwest Venture Capital	4,590
3	Hambrecht & Quist	22	Warburg, Pincus Ventures	3,920
4	Warburg, Pincus Ventures	21	Chase Capital Partners	3,680
5	New Enterprise Associates	21	Weiss, Peck & Greer Venture Partners	3,549
6	Norwest Venture Capital	20	Sequoia Capital	3,306
7	DLJ Venture Capital	20	Providence Equity Partners	3,186
8	Chase Capital Partners	19	Bessemer Venture Partners	3,118
9	Summit Partners	19	InterWest Partners	3,105
10	Advent International	18	Vanguard Venture Partners	2,877
11	Oak Investment Partners	16	Goldman Sachs	2,810
12	Institutional Venture Partners	16	JAFCO America Ventures	2,651
13	Weiss, Peck & Greer Venture Partners	15	The Centennial Funds	2,525
14	Mayfield Fund	15	DLJ Venture Capital	2,464
15	Brentwood Venture Capital	14	Hambrecht & Quist	2,458
16	Accel Partners	14	Charles River Ventures	2,347
17	TA Associates	14	Summit Partners	2,319
18	InterWest Partners	13	Sevin Rosen Funds	2,315
19	Venrock Associates	13	Brentwood Venture Capital	2,301
20	Menlo Ventures	12	US Venture Partners	2,283

Table II*a*.
Descriptive sample statistics, 1980s.

Megginson and Weiss' (1991) dataset consists of 320 venture-capital backed IPOs from 1983–1987 matched to 320 non-VC backed IPOs on the basis of three-digit SIC codes and offer size. We exclude one real estate investment trust (One Liberty Firestone Properties) with a distortingly high dilution factor of 11,249% and its matching venture-backed firm (Zitel Inc). Panel A tabulates three issuer characteristics: the book value of assets (missing for 6 venture-backed and 11 non-venture backed IPOs), the age of the company at the time of the IPO (missing for two non-venture backed IPOs), and the pre-flotation number of shares outstanding. We augmented Megginson and Weiss' information on company age and assets using S&P's *Corporate Register*, information gathered from a news search and IPO prospectuses, and Ritter's (1991) IPO database. Panel B tabulates various offering characteristics. The participation ratio is defined as the fraction of the number of pre-flotation shares outstanding offered in the IPO. The dilution factor is the ratio of new (primary) shares offered in the IPO to pre-IPO shares outstanding. Since the origin of over-allotment shares sold is unknown, such shares were presumed primary unless the IPO included no primary shares to begin with. The fraction of post-flotation capital sold is total shares sold over post-IPO number of shares outstanding. Underwriter market share is Megginson and Weiss' (1991) measure of lead underwriter reputation. 'Underwriter tombstone' refers to Carter and Manaster's (1990) ranking of underwriters, on a scale from 0 to 9. Panel C computes underpricing, offering costs and wealth losses. The partial wealth loss per old share is *wl*, i.e. the sum of wealth losses due to dilution and underpricing. The *total* wealth loss per old share is the partial wealth loss plus non-underwriting cash expenses *exp* and the underwriter spread per old share. Expenses *exp* include auditing, printing, legal and other expenses of the offering paid by the firm, including accountable and non-accountable underwriter expenses, but not the underwriter spread. All $ amounts are in nominal terms. Standard deviations are in italics underneath the sample means. The test for difference in means is a standard *t*-test, allowing for unequal variance. The test for difference in medians is Wilcoxon's rank-sum test. One, two and three asterisks indicate significance at the 5%, 1% and 0.1% level or better, respectively.

Table II*a* (cont'd).
Descriptive sample statistics, 1980s.

	Means			Medians		
	Venture-backed	**Non-VC Backed**	***difference in means***	**Venture-backed**	**Non-VC Backed**	***difference in medians***
Panel A: Issuer characteristics						
Book value of assets, in $m	24.146 *37.901*	26.944 *65.956*	*0.654*	12.900	7.350	*–4.590****
Age of company at IPO	8.3 *10.0*	11.7 *13.1*	*3.653****	5.0	7.0	*3.011***
Pre-flotation number of shares (in '000s)	5,734 *5,431*	5,075 *7,727*	*–1.246*	3,856	2,952	*–4.311****
Panel B: Offering characteristics						
Offer price, in $	11.18 *4.39*	10.10 *4.76*	*–2.994***	10.50	9.75	*4.479****
Nominal gross proceeds, in $m	19.9 *18.9*	13.1 *12.1*	*–5.376****	15.0	8.8	*–6.492****
Number of secondary shares sold (in '000s)	255 *352*	271 *517*	*0.466*	126	0	*–1.363*
Number of primary shares sold (in '000s)	1,535 *1,105*	2,141 *7,404*	*1.445*	1,199	1,000	*–4.087****
Participation ratio, in %	5.77 *7.80*	7.26 *12.30*	*1.830*	2.68	0.00	*–0.156*
Dilution factor, in %	35.64 *21.09*	45.97 *47.00*	*3.584****	31.24	34.39	*2.147**
Fraction of post-flotation capital sold, in %	29.24 *10.32*	33.61 *13.61*	*4.573****	28.12	32.44	*4.363****
Underwriter market share, in %	4.36 *3.80*	2.94 *4.34*	*–4.390****	3.43	0.82	*–6.904****
Underwriter tombstone variable	6.93 *1.89*	5.68 *2.46*	*–6.724****	7.50	6.00	*–5.997****
Panel C: Costs and wealth losses						
Underpricing return (offer to close), in %	7.13 *13.61*	11.47 *23.19*	*2.879***	2.56	3.23	*1.138*
Partial wealth loss per old share, in ¢	38.01 *76.01*	44.65 *93.64*	*0.983*	11.12	9.83	*–0.036*
Total wealth loss per old share, in ¢	83.60 *88.77*	95.24 *111.59*	*1.458*	54.36	59.68	*0.845*
of which: non-underwriting expenses per old share, ¢	12.85 *9.37*	17.07 *22.53*	*3.091***	11.06	12.48	*3.010***
of which: total underwriter compensation per old share, ¢	32.74 *21.52*	33.52 *29.20*	*0.383*	28.69	28.00	*–0.911*

Table II*b*.
Descriptive sample statistics, 1990s.

The data set consists 513 venture-capital backed and 908 non-venture backed IPOs floated between January 1996 to December 1998. For variable definitions refer to Table II*a*. Company age is missing for eight non-venture backed IPOs. Note that in contrast to the 1980s sample, the origin (primary versus secondary) of over-allotment shares sold is known in the 1990s sample. We update Megginson and Weiss' underwriter market share proxy for underwriter reputation into the 1990s and use the Carter-Dark-Singh (1998) update of the Carter-Manaster (1990) tombstone variable. One, two and three asterisks indicate significance at the 5%, 1% and 0.1% level or better, respectively.

	Means			**Medians**		
	Venture-backed	**Non-VC Backed**	***difference in means***	**Venture-backed**	**Non-VC Backed**	***difference in medians***
Panel A: Issuer characteristics						
Book value of assets, in $m	115.033 *1,099.411*	493.270 *3,738.195*	*2.237**	18.000	35.000	*5.276****
Age of company at IPO	8.9 *11.4*	13.3 *19.9*	*4.561****	6.0	7.0	*0.947*
Pre-flotation number of shares (in '000s)	11,295 *18,512*	14,414 *39,396*	*1.713*	7,953	6,000	*–5.541****
Panel B: Offering characteristics						
Offer price, in $	12.17 *4.22*	12.06 *5.20*	*0.424*	12.00	12.00	*0.000*
Nominal gross proceeds, in $m	51.868 *59.277*	86.467 *220.087*	*3.459****	38.233	35.595	*–1.786*
Number of secondary shares sold (in '000s)	404 *831*	911 *4,270*	*2.658***	0	0	*0.000*
Number of primary shares sold (in '000s)	3,490 *2,539*	4,420 *8,889*	*2.317**	2,900	2,552	*–3.811****
Participation ratio, in %	4.73 *8.80*	6.05 *13.32*	*2.020**	0.00	0.00	*0.000*
Dilution factor, in %	42.55 *25.51*	57.13 *67.19*	*4.726****	36.40	44.00	*4.375****
Fraction of post-flotation capital sold, in %	31.52 *11.60*	36.14 *15.32*	*5.933****	30.04	34.25	*5.533****
Underwriter market share, in %	2.35 *1.73*	1.95 *2.16*	*–3.648***	2.02	0.92	*–6.795****
Underwriter tombstone variable	8.31 *1.25*	7.76 *1.70*	*–5.856****	8.75	8.75	*0.000*
Panel C: Costs and wealth losses						
Underpricing return (offer to close), in %	17.77 *26.68*	16.61 *31.45*	*–0.702*	10.40	9.50	*–0.304*
Partial wealth loss per old share, in ¢	100.11 *148.75*	103.95 *196.88*	*0.384*	46.97	48.49	*0.207*
Total wealth loss per old share, in ¢	153.36 *163.70*	176.34 *235.09*	*1.962**	94.65	111.68	*2.453**
of which: non-underwriting expenses per old share, ¢	13.76 *12.19*	20.67 *22.56*	*6.453****	10.60	13.80	*6.148****
of which: total underwriter compensation per old share, ¢	39.49 *25.37*	51.69 *69.26*	*3.848****	32.40	38.21	*4.193****

Table III.
Tests of the incentives hypothesis.

The three dependent variables are defined as follows. *exp* is total non-underwriting expenses per share sold, consisting of all due diligence and marketing costs but not the underwriting fee. *UP* is the percentage underpricing return from offer to close. *twl* is total wealth losses per old share as defined in Section I, consisting of losses due to underpricing, dilution, and all cash expenses (non-underwriting plus spread). Amongst the regressors, $n_{o,s}$ is the participation ratio, defined as the number of secondary shares offered, $N_{o,s}$, normalized by the pre-flotation number of shares, N_o. n_n is the dilution factor, defined as the number of primary shares offered, N_n, normalized by the pre-flotation number of shares, N_o. *age* (the number of years between incorporation and the IPO) and *uwfee* (the dollar fee for underwriting cover, per share sold) are our proxies for ex ante uncertainty. Note that *uwfee* is defined differently from the "7%" number in Chen and Ritter (1998). *GRPROC* is total gross proceeds including the overallotment option as exercised. A negative coefficient for *exp* and a positive coefficient for its square in the total wealth loss regression indicate a non-monotonic U-shaped relationship. An insignificant coefficient for *exp* indicates that the first-order condition for the minimization of total wealth losses holds cross-sectionally. Ordinary least-squares standard errors are given in italics under the coefficient estimates, adjusted for the presence of heteroskedasticity using White's (1980) covariance matrix. One, two and three asterisks indicate significance at the 5%, 1% and 0.1% level or better, respectively. The test of triangularity is based on the covariance of the residuals from the *exp* regression with those from the *UP* and *twl* regression, respectively. The *p*-value refers to the hypothesis that the covariance is zero, as required if equation-by-equation least-squares estimation is to give consistent estimates.

	1980s			1990s		
Dependent variable	*exp*	*UP*	*twl*	*exp*	*UP*	*Twl*
	(1)	(2)	(3)	(4)	(5)	(6)
constant	–0.095* *0.039*	0.003 *0.027*	–0.603*** *0.133*	0.067 *0.036*	0.111*** *0.026*	–0.363 *0.189*
$n_{o,s}$	0.296*** *0.047*	0.108 *0.078*	2.510*** *0.679*	0.027 *0.029*	–0.087* *0.038*	2.673*** *0.459*
n_n	0.382*** *0.075*	0.218* *0.095*	1.315*** *0.265*	0.243*** *0.056*	–0.021* *0.010*	2.184*** *0.412*
age	0.001 *0.0006*	–0.0009* *0.0005*	–0.003 *0.003*	–0.0003* *0.0002*	–0.001*** *0.0003*	–0.005** *0.002*
uwfee	0.473*** *0.056*	0.333** *0.110*	4.471*** *0.582*	0.012 *0.057*	0.513*** *0.111*	4.603*** *0.724*
exp		–0.393* *0.172*	–0.703 *0.847*		–0.047 *0.032*	–1.051 *0.953*
exp^2			$1.29\cdot10^{-6}$ $1.12\cdot10^{-6}$			$4.56\cdot10^{-7*}$ $1.88\cdot10^{-7}$
GRPROC	$-1.72\cdot10^{-9***}$ $3.03\cdot10^{-10}$			$-1.53\cdot10^{-10**}$ $5.34\cdot10^{-11}$		
Adj. R^2	70.1 %	6.3 %	32.8 %	49.8 %	2.8 %	33.8 %
F-statistic	26.46***	5.34***	21.99***	7.12***	11.37***	24.92***
Test of triangularity		–0.0003 p = 71.03%	0.0006 p = 85.51%		–0.0001 p = 91.31%	0.0007 p = 90.8%
No.	636	636	636	1412	1412	1412

Table IV.
Tests of the certification hypothesis: underpricing.

The dependent variable is underpricing. $n_{o,s}$, n_n, *age*, *uwfee* and *exp* are defined as in Table III. We use two different proxies of underwriter reputation. *uwmkt* is Megginson and Weiss' (1991) proxy, based on each underwriter's market share. *uwrank* is Carter and Manaster's (1990) 'tombstone' ranking. *VC* is a dummy which equals one for venture-backed offerings. White's (1980) heteroskedasticity-consistent least-squares standard errors are given in italics under the coefficient estimates. One, two and three asterisks indicate significance at the 5%, 1% and 0.1% level or better, respectively, whilst † indicates significance at the 10% level. In the presence of interaction terms, in columns (5)-(7), the total effect of venture backing is equal to $\hat{\beta}_{VC\,\text{dummy}} + \hat{\beta}_{VC*uwmkt} * uwmkt$, whose significance is tested in an *F*-test.

Table IV (cont'd).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: 1980s							
constant	0.101***	0.030	0.044	0.113	0.030	0.049	0.137**
	0.036	*0.030*	*0.030*	*0.045*	*0.031*	*0.032*	*0.059*
$n_{o,s}$		0.088	0.089	0.113	0.089	0.090	0.127†
		0.077	*0.076*	*0.067*	*0.077*	*0.077*	*0.066*
n_n		0.206	0.190	0.092	0.206*	0.186*	0.084
		0.094	*0.093*	*0.054*	*0.094*	*0.093*	*0.055*
age	–0.002***	–0.001*	–0.001*	–0.001*	–0.001*	–0.001†	–0.001**
	0.0005	*0.0004*	*0.0004*	*0.0004*	*0.000*	*0.000*	*0.000*
uwfee	0.189	0.341**	0.389***	0.401***	0.342**	0.396***	0.405***
	0.141	*0.108*	*0.108*	*0.111*	*0.109*	*0.107*	*0.110*
exp		–0.388*	–0.386*	–0.247*	–0.387*	–0.381*	–0.218†
		0.170	*0.167*	*0.114*	*0.171*	*0.170*	*0.117*
uwmkt			–0.006***			–0.008***	
			0.001			*0.002*	
uwrank				–0.015***			–0.020***
				0.004			*0.006*
VC	–0.051***	–0.043**	–0.036**	–0.013	–0.042*	–0.052*	–0.066
	0.015	*0.014*	*0.013*	*0.014*	*0.020*	*0.025*	*0.062*
Interaction terms:							
*VC*exp*					–0.007	–0.015	–0.076
					0.097	*0.095*	*0.120*
*VC*uwmkt*						0.005*	
						0.002	
*VC*uwrank*							0.010
							0.007
Adj. R^2	2.8 %	7.4 %	8.7 %	8.3 %	7.2 %	8.7 %	8.6 %
F-statistic	9.78***	6.89***	9.68***	7.42***	5.94***	8.16***	5.75***
F-test: total *VC* effect = 0					9.91**	6.35*	0.18
No.	636	636	636	549	636	636	549
Panel B: 1990s							
constant	0.080**	0.110***	0.099***	–0.031	0.104***	0.112***	0.012
	0.027	*0.030*	*0.029*	*0.034*	*0.031*	*0.030*	*0.039*
$n_{o,s}$		–0.086*	–0.096*	–0.089†	–0.084*	–0.080*	–0.080
		0.039	*0.041*	*0.049*	*0.040*	*0.041*	*0.050*
n_n		–0.021*	–0.021*	–0.022	–0.023*	–0.022*	–0.025
		0.010	*0.010*	*0.018*	*0.010*	*0.009*	*0.018*
age	–0.001***	–0.001***	–0.002***	–0.001***	–0.001***	–0.001***	–0.001***
	0.0003	*0.0003*	*0.0003*	*0.0003*	*0.0003*	*0.0003*	*0.0003*
uwfee	0.526***	0.514***	0.475***	0.832***	0.514***	0.466***	0.826***
	0.113	*0.112*	*0.111*	*0.221*	*0.112*	*0.111*	*0.223*
exp		–0.046	–0.023	–0.061	–0.015	–0.017	–0.030
		0.032	*0.031*	*0.043*	*0.035*	*0.033*	*0.046*
uwmkt			0.008*			0.001	
			0.004			*0.004*	
uwrank				0.010			0.004
				0.006			*0.008*
VC	0.010	0.003	–0.0002	0.004	0.030	–0.049†	–0.147*
	0.016	*0.017*	*0.017*	*0.021*	*0.024*	*0.026*	*0.062*
Interaction terms							
*VC*exp*					–0.183†	–0.065	–0.209†
					0.098	*0.083*	*0.126*
*VC*uwmkt*						0.026***	
						0.008	
*VC*uwrank*							0.022**
							0.008
Adj. R^2	2.5 %	2.8 %	3.0 %	4.3 %	2.9 %	3.5 %	4.6 %
F-statistic	16.93***	9.49***	8.67***	9.27***	8.21***	7.53***	9.03***
F-test: total *VC* effect = 0					0.08	0.05	0.09
No.	1412	1412	1412	1091	1412	1412	1091

Table V.
Tests for differences in certification quality: underpricing.

This table repeats the underpricing regressions of Table IV, but splits the *VC* dummy into two: companies whose lead VC is in either of the two Top-20 league tables listed in Table I, and companies whose lead VC is outside the Top 20. All other variables are as previously defined. The total effect of venture backing is the sum of the direct effect (the dummy) and the product of the interaction term and the underwriter reputation level. Wald tests for the significance of these total effects are provided at the bottom. We also test whether underpricing is significantly depending on whether the VC backer is in the Top 20 or not ("coeff(Top 20) = coeff(non-Top 20)"). White's (1980) heteroskedasticity-consistent least-squares standard errors are given in italics under the coefficient estimates. One, two and three asterisks indicate significance at the 5%, 1% and 0.1% level or better, respectively, whilst † indicates significance at the 10% level.

Table V (cont'd).
Tests for differences in certification quality: underpricing.

	No control for underwriter choice		Control: Underwriter market shares		Control: 'Tombstone' rankings	
	(1)	(2)	(3)	(4)	(5)	(6)
constant	0.109***	0.110***	0.114***	0.115***	0.022	0.022
	0.030	*0.030*	*0.029*	*0.029*	*0.039*	*0.039*
$n_{o,s}$	–0.086*	–0.082*	–0.080†	–0.076†	–0.084†	–0.082†
	0.040	*0.040*	*0.041*	*0.041*	*0.050*	*0.050*
n_{n}	–0.021*	–0.021*	–0.021*	–0.021*	–0.022	–0.022
	0.010	*0.010*	*0.009*	*0.010*	*0.019*	*0.018*
age	–0.001***	–0.001***	–0.001***	–0.001***	–0.001***	–0.001***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
uwfee	0.514***	0.509***	0.465***	0.461***	0.820***	0.817***
	0.112	*0.111*	*0.111*	*0.110*	*0.222*	*0.222*
exp	–0.046	–0.045	–0.028	–0.028	–0.064	–0.064
	0.032	*0.032*	*0.031*	*0.031*	*0.043*	*0.043*
uwmkt			0.001	0.000		
			0.004	*0.004*		
uwrank					0.003	0.003
					0.008	*0.008*
Dummies: venture-backed and …						
...lead VC in Top 20 (number)	0.015		–0.038		–0.126	
	0.027		*0.044*		*0.117*	
*...lead VC **not** in Top 20 (number)*	–0.002		–0.069***		–0.217**	
	0.017		*0.021*		*0.067*	
...lead VC in Top 20 (market cap)		0.060		0.049		–0.232
		0.038		*0.065*		*0.162*
*...lead VC **not** in Top 20 (market cap)*		–0.009		–0.080***		–0.195**
		0.017		*0.020*		*0.063*
Interaction terms: *uwmkt* times …						
...lead VC in Top 20 (number)			0.021			
			0.015			
*...lead VC **not** in Top 20 (number)*			0.029**			
			0.009			
...lead VC in Top 20 (market cap)				0.005		
				0.019		
*...lead VC **not** in Top 20 (market cap)*				0.031***		
				0.009		
Interaction terms: *uwrank* times …						
...lead VC in Top 20 (number)					0.015	
					0.015	
*...lead VC **not** in Top 20 (number)*					0.027**	
					0.009	
...lead VC in Top 20 (market cap)						0.030
						0.020
*...lead VC **not** in Top 20 (market cap)*						0.024**
						0.009
Adj. R^2	2.7 %	3.0 %	3.4 %	3.8 %	4.4 %	4.4 %
Wald tests (F-statistics)						
total Top 20 effect = 0	0.33	2.53	0.22	2.42	0.00	0.40
total non-Top 20 effect = 0	0.02	0.32	0.00	0.21	0.25	0.05
coeff(Top 20) = coeff(non-Top 20)	0.43	3.43†	0.48	3.90*	0.54	0.05
all coefficients jointly = 0	8.17***	8.48***	6.86***	7.35***	7.84***	8.11***
Observations	1412	1412	1412	1412	1091	1091

Table VI.
Tests of the certification hypothesis: total wealth losses.

The dependent variable is total wealth losses as defined previously. All regressors are defined as in Table IV. A negative coefficient for *exp* and a positive coefficient for its square in the total wealth loss regression indicate a non-monotonic U-shaped relationship. An insignificant coefficient for *exp* indicates that the first-order condition for the minimization of total wealth losses holds cross-sectionally. The total effect of venture backing is the sum of the direct effect (the dummy) and the product of the interaction term and the underwriter reputation level. Wald tests for the significance of these total effects are provided at the bottom. White's (1980) heteroskedasticity-consistent least-squares standard errors are given in italics under the coefficient estimates. One, two and three asterisks indicate significance at the 5%, 1% and 0.1% level or better, respectively.

	1980s				1990s					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
constant	0.174	–0.611***	–0.565***	–0.558**	1.057***	–0.444*	–0.601**	–2.084***	–0.548**	–1.771***
	0.104	*0.138*	*0.138*	*0.181*	*0.177*	*0.206*	*0.201*	*0.383*	*0.199*	*0.423*
$n_{o,s}$		2.516***	2.521***	2.643***		2.707***	2.568***	2.676***	2.620***	2.717***
		0.676	*0.674*	*0.708*		*0.458*	*0.478*	*0.505*	*0.481*	*0.508*
n_n		1.318***	1.272***	1.218***		2.187***	2.137***	2.800***	2.143***	2.820***
		0.264	*0.258*	*0.324*		*0.412*	*0.392*	*0.500*	*0.395*	*0.501*
age	–0.002	–0.003	–0.002	–0.004	–0.008***	–0.005*	–0.006**	–0.006**	–0.006**	–0.006**
	0.003	*0.003*	*0.003*	*0.003*	*0.002*	*0.002*	*0.002*	*0.002*	*0.002*	*0.002*
uwfee	4.336***	4.468***	4.647***	4.240***	4.059***	4.651***	4.132***	8.524***	4.101***	8.452***
	0.587	*0.582*	*0.593*	*0.654*	*0.790*	*0.728*	*0.705*	*1.578*	*0.705*	*1.584*
exp		–0.704	–0.813	0.513		–0.993	–0.234	–0.282	–0.297	–0.452
		0.849	*0.772*	*0.974*		*0.958*	*0.995*	*1.406*	*1.004*	*1.419*
exp^2		$1.28\cdot10^{-6}$	$1.50\cdot10^{-6}$	$9.11\cdot10^{-8}$		$4.57\cdot10^{-7*}$	$2.65\cdot10^{-7}$	$1.35\cdot10^{-7}$	$2.84\cdot10^{-7}$	$1.82\cdot10^{-7}$
		$1.13\cdot10^{-6}$	*$1.03\cdot10^{-6}$*	*$1.19\cdot10^{-6}$*		*$1.89\cdot10^{-7}$*	*$2.04\cdot10^{-7}$*	*$3.13\cdot10^{-7}$*	*$2.05\cdot10^{-7}$*	*$3.16\cdot10^{-7}$*
uwmkt			–0.022***				0.111***		0.085**	
			0.006				*0.026*		*0.030*	
uwrank				–0.015				0.086†		0.048
				0.019				*0.046*		*0.056*
VC	–0.151*	0.012	0.039	0.067	–0.226*	0.142	0.102	0.077	–0.097	–1.023**
	0.076	*0.064*	*0.065*	*0.076*	*0.109*	*0.092*	*0.092*	*0.110*	*0.122*	*0.383*
Interaction terms										
*VC*uwmkt*									0.090*	
									0.042	
*VC*uwrank*										0.135**
										0.051
Adj. R^2	12.1%	32.7 %	33.3 %	31.8 %	2.8 %	33.8 %	34.6 %	36.5 %	34.7 %	36.6 %
F-statistic	18.75***	18.88***	19.78***	18.10***	12.80***	21.44***	22.60***	21.95***	20.37***	21.13***
F-test: total *VC* effect = 0									1.52	0.77
No.	636	636	636	549	1412	1412	1412	1091	1412	1091

Table VII.
Tests of conflicts of interest:
The impact of VC selling behavior on underwriter choice, 1990s.

This table reports logit regressions of the likelihood of choosing a 'high-reputation' underwriter in the 1990s. We use four classification for 'high-reputation'. Using the Carter-Manaster 'tombstone' variable, we define an lead underwriter as high-reputation if its 'tombstone' rank is at least 7, 7½, 8 or 8½, respectively. The regressors are company *age* at flotation as defined previously; *ln_assets*, the natural log of 1 + the book value of assets pre-IPO; the number of months the lead VC has been on the board; the age of the lead VC, measured in years since inception as reported in *Pratt's Guide to Venture Capital Sources* and the *VCJ*; and three dummies: *VC* for venture-backed companies, *noVCsale* identifying the 144 cases where someone other than the lead VC sells old shares in the IPO, and another dummy for the 80 cases where the lead VC also sells old shares. Standard errors are corrected for heteroskedasticity. One, two and three asterisks indicate significance at the 5%, 1% and 0.1% level or better, respectively, whilst † indicates significance at the 10% level.

	Rank ≥ 7	Rank ≥ 7½	Rank ≥ 8	Rank ≥ 8½
	(1)	(2)	(3)	(4)
constant	–1.152***	–1.286***	–1.401***	–1.430***
	0.234	*0.225*	*0.212*	*0.208*
age	–0.010*	–0.008†	–0.004	–0.005
	0.005	*0.004*	*0.004*	*0.004*
ln_asset	0.691***	0.626***	0.504***	0.479***
	0.070	*0.064*	*0.054*	*0.052*
age of lead VC	0.050**	0.033	0.045*	0.045*
	0.018	*0.024*	*0.019*	*0.019*
months on board	–0.012*	–0.010*	–0.010**	–0.008*
	0.005	*0.005*	*0.004*	*0.004*
Dummies				
VC	1.102**	1.415***	0.793*	0.853**
	0.359	*0.390*	*0.322*	*0.318*
noVCsale	0.190	0.113	0.745*	0.667*
	0.416	*0.387*	*0.328*	*0.319*
lead VC selling	–0.392	–0.417	–0.076	–0.240
	0.386	*0.371*	*0.318*	*0.313*
Pseudo-R^2	18.6 %	17.1 %	14.0 %	13.7 %
Observations	1091	1091	1091	1091

Table VIII.
Tests of conflicts of interest:
The impact of VC selling behavior on underpricing, 1990s.

The dependent variable is underpricing. Most of the regressors are defined as in Table IV. *noVCsale* is a dummy identifying the 144 cases where someone other than the lead VC sells old shares in the IPO. The total effect of *noVCsale* is the sum of the direct effect (the dummy) and the product of the interaction term and the underwriter reputation level. Wald tests for the significance of these total effects are provided where appropriate. White's (1980) heteroskedasticity-consistent least-squares standard errors are given in italics under the coefficient estimates. One, two and three asterisks indicate significance at the 5%, 1% and 0.1% level or better, respectively, whilst † indicates significance at the 10% level.

	Dependent variable: underpricing						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
constant	0.102***	0.091***	0.095***	0.097***	–0.027	–0.016	–0.024
	0.026	*0.025*	*0.025*	*0.025*	*0.032*	*0.033*	*0.032*
$n_{o,s}$	–0.094*	–0.102*	–0.098*	–0.096*	–0.092*	–0.091*	–0.092*
	0.038	*0.040*	*0.040*	*0.040*	*0.046*	*0.046*	*0.046*
n_n	–0.021*	–0.021*	–0.021*	–0.021*	–0.022	–0.020	–0.021
	0.010	*0.009*	*0.009*	*0.009*	*0.018*	*0.018*	*0.018*
age	–0.001***	–0.002***	–0.002***	–0.002***	–0.001***	–0.001***	–0.001***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
uwfee	0.510***	0.475***	0.472***	0.470***	0.825***	0.822***	0.824***
	0.109	*0.108*	*0.108*	*0.108*	*0.212*	*0.212*	*0.212*
exp	–0.036	–0.015	–0.017	–0.020	–0.056	–0.060	–0.057
	0.032	*0.031*	*0.031*	*0.030*	*0.044*	*0.044*	*0.044*
uwmkt		0.007*	0.006	0.006			
		0.004	*0.004*	*0.004*			
uwrank					0.009	0.007	0.008
					0.006	*0.006*	*0.006*
noVCsale	0.072**	0.069**	0.027		0.053*	–0.173	
	0.028	*0.028*	*0.046*		*0.025*	*0.128*	
Interaction terms:							
noVCsale * *uwmkt*			0.016	0.023*			
			0.015	*0.010*			
noVCsale * *uwrank*						0.027	0.007*
						0.016	*0.003*
Adj. R^2	3.3 %	3.4 %	3.4 %	3.5 %	4.7 %	4.7 %	4.7 %
F-statistic	10.24***	9.22***	8.13***	9.26***	9.79***	8.62***	9.84***
noVCsale effect = 0 (*F*)			5.37*			4.18*	
Observations	1412	1412	1412	1412	1091	1091	1091

Table IX.
Tests of conflicts of interest: The impact of VC selling behavior on total wealth losses, 1990s.

The dependent variable in columns (1)-(7) is total wealth losses as defined previously. In columns (8)-(9) and (10)-(11) the dependent variable is the total wealth losses as suffered by the lead VC and other pre-IPO owners, respectively. We have assumed that the costs of issuing new shares are pro-rated to ownership, whilst the costs of selling old shares are borne by the selling shareholders. Alternative specifications yield similar results. For computations, see text. The regressors are defined as in Table VIII. *noVCsale* is a dummy identifying the 144 cases where someone other than the lead VC sells old shares in the IPO. These are the cases where total wealth losses per old share are different for the lead VC and other shareholders. The total effect of *noVCsale* is the sum of the direct effect (the dummy) and the product of the interaction term and the underwriter reputation level. Wald tests for the significance of these total effects are provided where appropriate. White's (1980) heteroskedasticity-consistent least-squares standard errors are given in italics under the coefficients. One, two and three asterisks indicate significance at the 5%, 1% and .1% level or better, respectively.

Dependent variable:	Total wealth losses							total wealth losses to lead VC		total wealth losses to other shareholders	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
constant	–0.423* *0.190*	–0.593*** *0.186*	–0.578** *0.185*	–0.554** *0.183*	–2.042*** *0.379*	–1.950*** *0.379*	–2.022*** *0.378*	–0.572** *0.184*	–1.995*** *0.378*	–0.589** *0.184*	–2.020*** *0.379*
$n_{o,s}$	2.626*** *0.457*	2.504*** *0.475*	2.521*** *0.477*	2.545*** *0.475*	2.642*** *0.497*	2.655*** *0.498*	2.644*** *0.497*	2.450*** *0.473*	2.578*** *0.495*	2.487*** *0.477*	2.6329*** *0.498*
n_{n}	2.185*** *0.411*	2.137*** *0.392*	2.139*** *0.393*	2.142*** *0.394*	2.805*** *0.500*	2.821*** *0.501*	2.809*** *0.500*	2.137*** *0.392*	2.804*** *0.500*	2.134*** *0.390*	2.802*** *0.501*
age	–0.005* *0.002*	–0.006*** *0.002*	–0.006*** *0.002*	–0.006*** *0.002*	–0.006*** *0.002*	–0.006*** *0.002*	–0.006*** *0.002*	–0.006*** *0.002*	–0.006*** *0.002*	–0.006*** *0.002*	–0.007*** *0.002*
uwfee	4.579*** *0.714*	4.089*** *0.691*	4.077*** *0.690*	4.063*** *0.690*	8.437*** *1.533*	8.415*** *1.536*	8.431*** *1.533*	4.017*** *0.682*	8.289*** *1.513*	4.024*** *0.684*	8.315*** *1.519*
exp	–0.978 *0.954*	–0.230 *0.994*	–0.258 *0.999*	–0.293 *0.995*	–0.321 *1.405*	–0.408 *1.413*	–0.343 *1.405*	–0.242 *0.992*	–0.359 *1.404*	–0.226 *0.989*	–0.400 *1.410*
exp^2	$4.56\cdot10^{-7*}$ $1.89\cdot10^{-7}$	$2.69\cdot10^{-7}$ $2.04\cdot10^{-7}$	$2.76\cdot10^{-7}$ $2.05\cdot10^{-7}$	$2.82\cdot10^{-7}$ $2.04\cdot10^{-7}$	$1.49\cdot10^{-7}$ $3.11\cdot10^{-7}$	$1.68\cdot10^{-7}$ $3.13\cdot10^{-7}$	$1.55\cdot10^{-7}$ $3.12\cdot10^{-7}$	$2.71\cdot10^{-7}$ $2.04\cdot10^{-7}$	$1.58\cdot10^{-7}$ $3.11\cdot10^{-7}$	$2.77\cdot10^{-7}$ $2.05\cdot10^{-7}$	$1.82\cdot10^{-7}$ $3.13\cdot10^{-7}$
uwmkt		0.108*** *0.026*	0.103*** *0.027*	0.098*** *0.026*				0.108*** *0.026*		0.114*** *0.026*	
uwrank					0.083 *0.044*	0.071 *0.045*	0.080 *0.044*		0.081 *0.044*		0.084 *0.044*
noVCsale	0.483** *0.175*	0.437* *0.174*	0.267 *0.287*		0.309* *0.150*	–1.303 *0.799*		0.142 *0.158*	0.012 *0.140*	0.495** *0.177*	0.383* *0.168*
Interaction terms:											
*noVCsale * uwmkt*			0.065 *0.087*	0.136* *0.054*							
*noVCsale * uwrank*						0.189* *0.095*	0.038* *0.018*				
Adj. R^2	34.2 %	35.0 %	34.9 %	35.0 %	36.6 %	36.7 %	36.7 %	35.3 %	36.8 %	34.8 %	35.8 %
F-statistic	22.09***	22.96***	20.37***	22.81***	22.07***	19.66***	22.10***	22.37***	21.34***	23.22***	22.31***
F-test: noVCsale effect = 0			7.46**			3.35					
Observations	1412	1412	1412	1412	1091	1091	1091	1412	1091	1412	1091