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How well do venture capital databases reflect actual investments?

by

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Abstract

Researchers increasingly have used the two primary venture capital databases –

subsequently gone public. The valuations that the databases provide are relatively unbiased, but again, are fairly noisy with non-trivial average absolute errors. The sampling and milestone

We do this because we want to be absolutely sure that we have the correct data to compare to the databases. This leaves us with a sample of 143 VC investments in 98 portfolio companies by thirteen VC partnerships.

The first column of table I describes various aspects of the actual sample. Twenty-three of the 143 rounds are milestone rounds. In these rounds, the venture capitalists commit to a certain amount of funding. Some of the funding is provided at the closing of the round while additional funding is contingent on the company attaining milestones described in the contract.² Milestone rounds, therefore, are problematic because the amount invested at closing and the total amount actually invested at those terms can differ.

An additional 19 rounds are those in which we were able to determine that the companies raised additional funding at the same terms (unrelated to milestones) more than thirty days after the initial closing. These closings are typically to sell shares that were authorized but unsold at the initial closing, often to new investors.

The table also shows that the 143 rounds represent \$1,142 million in financing commitments by the VC firms. Of this, only \$859 million was actually disbursed when the rounds closed.

The remainder of the column presents the time distribution, geographic distribution, and industry distribution of the sample. The bulk of the sample financings occur between 1996 and 1998. The geographical distribution of the portfolio companies in our sample is fairly uniform across California (28%), the Midwest (20%), the Northeast (24%), and elsewhere. Relative to the VC industry as a whole, this represents a slight undersampling of California firms and an

² We consider a financing round to be a set of contracts agreed to on a particular date that determines the disbursement of funds from a VC to a company. A new financing round differs from the contingent release of funds in that the price and terms of the financing are not set in advance.

oversampling of Midwest firms. According to Venture Economics, 41% of overall VC investments were in California firms and only 14% in Midwest firms.³ Not surprisingly, the greatest percentage of companies, 41%, is in the information technology and software industries. An additional 10% are in telecommunications. Both of these industries include Internet related investments. This concentration is roughly consistent with the industry distributions reported in

2.2 *Venture Economics and VentureOne data*

For each of the 143 financing rounds, we searched the Venture Economics and VentureOne databases for the matching financing rounds. We consider the financing round a match if the round includes the VC firm in our sample, has a financing amount and occurs within four months of the date of our financing. Venture Economics claims to collect its data on VC investments primarily from VCs. In fact, it is the official database partner of the National Venture Capital Association. VentureOne claims to collect its data primarily from the companies themselves although it also surveys VCs.

Columns 3 and 4 of table I show that we are able to locate 124 financing rounds in Venture Economics and 116 in VentureOne. If we restrict the sample to the 131 actual financing rounds after 1993, Venture Economics has 113 financing rounds and VentureOne has 112 financing rounds. Venture Economics, therefore, appears to have slightly better coverage of financing rounds with the difference concentrated entirely in rounds before 1994. For the later period, both databases capture roughly 85% of the financing rounds by number.

Venture Economics and VentureOne also understate the amount of capital committed with, respectively, \$801 million and \$889 million or roughly 70% and 80% of the \$1142 million financing committed. These results suggest that aggregate statistics calculated from Venture Economics and VentureOne understate venture capital commitments in the U.S.⁴

The databases are closer to the amount of capital actually disbursed at the initial closing (\$859 million) with VentureOne above the actual amount and Venture Economics below. VentureOne's overestimates are greater in the post-1993 period (\$854 million versus \$773 million

⁴ In our data, one company completed a financing round that raised most of the round at closing and some additional money two months later for a total of \$A million. Venture Economics reports a round in excess of 30 times \$A million in the closing month and a round of \$A million two months later. The post-money value for the closing month is \$A million. We eliminated the round of 30 times \$A million in the closing month as clearly in error.

actually disbursed). The reason for the improvement is that the databases sometimes report the total amount committed in the round rather than the amount disbursed. This offsets the omission of other financing rounds. As we discuss later the, the databases sometimes report subsequent milestone achievements as additional financing rounds. This increases the overestimate of actual disbursements for VentureOne.

Both databases also report post-money values. Columns 5 and 6 indicate that there is a large difference in coverage. Venture Economics reports post-money values for only 39 financing rounds while VentureOne reports values for 82 financing rounds. The columns also suggest that both databases have a bias towards reporting post-money value for California companies.

Finally, the second panel of table I reports how well the financing rounds match the actual closing months. VentureOne is more accurate than Venture Economics with 109 of 116 rounds within one month of the closing date compared to 107 of 124 for Venture Economics.

Overall, then, the databases capture roughly 85% of the financings and commitments, but capture a larger fraction of the capital actually disbursed.

3. *Results*

3.1 Determinants of the inclusion of financing rounds

In this section, we consider the determinants of inclusion (or exclusion) of financing rounds in order to understand what biases if any are in the selection of VC investments in the different databases. Such biases potentially can affect conclusions concerning the total amount of VC investment, the distribution of that investment, and inferences concerning the returns of such investment.

We estimate a logit regression model for each database. The dependent variable equals 1 if the database reports a financing amount for the round and 0 if it does not. The regressions include the following independent variables. We use calendar year dummies (1995, 1996, 1997, and 1998 or 1999⁵) to pick up any improvements or deterioration in reporting over time – the intercept reflects financings 1994 and earlier. We include a dummy variable equal to 1 if the company financed is located in California to pick up any possible bias toward California deals. We include two dummy variables for the company’s industry – IT/Software/Telecom and Biotech/Medical/Healthcare with the intercept reflecting Retail and other. These dummy variables are motivated by Gompers and Lerner (2000) who find that VentureOne is more likely to have complete information for companies located in California and/or operating in high-technology industries. We include a dummy variable equal to 1 if the company has subsequently issued equity to the public. One might expect more information to be available for such companies. The final independent variable we use is the natural logarithm of the actual financing committed to the round.⁶

The results are presented in panel B of Table II.⁷ Venture Economics oversamples companies located in California and larger financing rounds. The estimated probability that Venture Economics reports a financing round is 98.4% if the company is located in California and 89.5% if it is not. This, in turn, implies that Venture Economics overstates the number of VC investments in California companies by 6% and understates non-California investments by

⁵ We combine 1998 and 1999 because we have only one 1999 financing round.

⁶ This includes the total financing committed amount for milestone rounds, but excludes amounts raised at closings more than 30 days after the initial closing.

⁷ The table also includes the odds ratio point estimate. For a dummy variable, the odds ratio is the multiplicative change in the odds of success – the probability of success divided by the probability of no success – when the dummy variable changes from 0 to 1, holding all other variables constant.

Table III reports our findings. Panel A includes amounts raised in subsequent closings as

measures. The VentureOne results are similar for amounts actually disbursed based upon the completion of milestones when we can calculate this). VentureOne, therefore, appears to have a tendency to report the total amount committed or the total amount ultimately disbursed, but also does not do this uniformly.

Because there are about six times as many non-milestones rounds as milestone rounds in our sample, the medians and average absolute errors for all rounds taken together are much closer to those for non-milestone rounds than those for milestone rounds. In the median company, the financing amount is correct for both databases. This implies that both databases understate and overstate financing round amounts with the same frequency leading to no overall bias in either direction in either database. For Venture Economics, the average absolute errors

original round amount and reporting them as a new round, which overstates the total amount raised.

Taken together, tables III and IV have the following implications: The databases do a better job of characterizing non-milestone rounds relative to milestone rounds. While the financing amounts are measured with a fair amount of error, the amounts tend to be unbiased on average. The presence of milestone rounds and subsequent closings leads both databases to misstate when firms receive financing. On average, the databases imply that firms receive more financing than they actually do – commitments rather than actual amounts along with double counting – and that firms receive the financing earlier than they actually do – including milestone amounts and subsequent closing amounts at the time of closing. These two effects will exert a downward bias on internal rate of return calculations using these data. To the extent that milestone deals have become more common recently, the results also imply that the databases will become less accurate over time.

3.3 Determinants of the inclusion of post-money values

In this section, we consider the determinants of whether the databases include a post-money value. This is important for those papers that attempt to calculate returns using the company valuations provided.

As reported in table I, we can calculate valuations for 119 of our 143 rounds; Venture Economics reports a post-money value for only 39; and VentureOne reports for 82. We are interested in determining whether there are factors that contribute systematically to whether the databases report post-money values for a financing round.

To do this, we estimate two logit regression models for each database. In the first model,

we use only those rounds for which a financing amount is reported in the relevant database. In the second model, we use all 143 rounds. The first model measures any potential bias relative to the relevant database. Measuring this bias does not require our data, only the data in the relevant database. The second model measures any bias relative to the entire sample of financings. The dependent variable equals 1 if the database reports a post-money value for the round, and 0 if it does not. We use the same independent variables used in the previous regressions for whether the databases include a particular financing round.

The results are presented in Table V. In both models, Venture Economics is significantly more likely to include a post-money value if the company subsequently goes public and if the company is based in California. The result for IPOs suggests that care should be taken in calculating returns using only those firms that provide valuations. Such calculations will oversample companies that subsequently go public and will overestimate returns because companies that go public tend to be more valuable and provide greater rates of return to VC investors than those that do not.

Using the average values of the independent variables provided in panel A of table V along with the regression coefficients in panel B, we can get a sense of how large this bias is. The estimated unconditional probability (i.e., using the data for all rounds) that Venture Economics reports a post-money value for the average round is 12.8% if the company does not subsequently go public and 37.3% if it does.

The oversampling of California firms will induce bias in the data if the characteristics of California firm valuations differ from those of other firms. We consider this possibility below (table VII) and find that California firms have higher valuations in Venture Economics, but not in VentureOne.

VentureOne is significantly more likely to include a post-money value for larger financing rounds, for California-based companies, and for companies in life sciences. While VentureOne is more likely to include values for firms that go public in both models, the variable is not significant when all financing rounds are included.

Because the IPO bias is smaller, return calculations using VentureOne data will be more accurate than those using Venture Economics. On the other hand, the bias in VentureOne towards valuing larger financing rounds suggests that VentureOne may oversample higher valuation rounds.

3.4 Financing Round Values

Having considered the determinants of whether the database provides a valuation, we now evaluate the accuracy of the valuations in this section.

3.4.1 Pre-money values

For the 119 rounds in our sample for which we have the necessary data, we compute the actual round pre-money value. As noted earlier, this equals the product of the price paid per share of common equivalent in the financing round and the number of common equivalents outstanding prior to the round. The value of outstanding options and warrants are calculated as if they were exercised.

In five milestone rounds, the contract either specifies that (1) the price per share paid at the initial closing will be less than the price per share paid at any later closing if the milestones are achieved or (2) amounts paid at such later closings are not in exchange for shares if milestones are not achieved.

that the milestones are achieved while the “initial” calculations assume the milestones are not achieved.

The databases do not report pre-money values directly, rather they report post-money values. We impute each round’s pre-money values as the round’s post-money value less the round amount. When this procedure results in a negative imputed pre-money value, we drop the round from our pre-money comparisons. Of the 119 rounds for which we are able to compute pre-money values, Venture Economics contains post-money values for only 35. Two of these have negative imputed pre-money values and are, therefore, dropped. VentureOne contains post-money values for 70 of the 119; none have negative imputed pre-money values.

Panel A of table VI presents the results for pre-money value. The median pre-money value in Venture Economics is roughly 90% of the actual while the median pre-money value in VentureOne is roughly 107% of the actual. The medians, however, mask a large amount of dispersion. The average absolute errors are large: Venture Economics has an average absolute error for all rounds of 85%, based on the actual amount raised; VentureOne’s is 76%. Almost 40% of the Venture Economics valuations are off by more than 25% as are almost 23% of the VentureOne valuations.

3.4.2 Post-money Values

In panels B and C of table VI, we report descriptive statistics for the ratios of the post-money values reported by Venture Economics and VentureOne to the actual post-money values. We compute the actual post-money values several different ways: including and excluding amounts raised at closings held more than 30 days after the initial closing as part of the round amount, and, for milestone rounds, based on the total committed amount, the initial amount, and

the actual amount raised (based on milestones actually attained).

Both databases do better on a percentage basis with post-money values than with pre-money values, but still with mixed results. This is in part because a post-money values are higher than pre-money values, so a given dollar error is a smaller percentage error in post-money values. VentureOne is more accurate than Venture Economics with non-milestone rounds, with an average absolute error of 11% compared to Venture Economics' 28%. Venture Economics is somewhat more accurate than VentureOne with milestone rounds, but the number of milestone round post-money observations is small (only 5). For all rounds (milestone and non-milestone) taken together, VentureOne is again more accurate than Venture Economics, with average absolute errors of 16% (based on the total committed and actual amounts) and 28% (based on the initial amount) compared to Venture Economics' 29% to 35%. Roughly 24% and 15% to 20%, respectively, of Venture Economics' and VentureOne's post-money values are in error by more than 25%. Overall, then, VentureOne is both more accurate and more complete in its coverage.

Panels B and C of Table VI also show that the Venture Economics' median post-money value errors are -6% to -7% while VentureOne's are 3% to 5%. Both databases' average post-money value errors are statistically insignificant. Thus, while the average absolute error is large, it does not appear to be biased.

3.4.3 Relative valuations of firms with Venture Economics and VentureOne values

There is one additional bias that is potentially in the data. It is possible that the firms for whom Venture Economics and VentureOne report post-money values have valuations different from those for the firms without such valuations. In table VII, we consider this bias by estimating the relationship of the actual (log) pre- and post-money values of our sample firms

with

effectively.

The latter finding along with oversampling of California companies, IPO rounds, and larger rounds also has implications for practitioners – entrepreneurs and investors – who use the VentureOne data to estimate the market valuations for similar rounds. If those estimates are upward biased, less informed investors may mistakenly shade their valuations upwards while less informed entrepreneurs may attempt to hold out for valuations that are unrealistically high.

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Table I
Sample Summary

Summary statistics for actual financing rounds and rounds reported by Venture Economics (VE) and VentureOne (V1) for 143 financing rounds in 98 companies from 1986 to 1999. The 'actual rounds' column gives the number of actual rounds by year, by company location and by industry. The 'post-money actual' column gives the number of actual rounds for which our data was sufficient to compute post-money values (based on the total committed amount, and excluding amounts raised at subsequent closings). The other columns give the number of our rounds for which VE/V1 report amounts raised and post-money values. The total committed amount is the aggregate committed financing for our 143 rounds; the total disbursed amount is the aggregate amount disbursed at the initial closings. We also report a frequency distribution for the number of months the matching round in VE/V1 differs from the actual date of the initial closing. Milestone rounds are those in which the investors invest in the company at the initial closing and commit additional funds contingent on the future achievement of milestones. Rounds with subsequent closings are those in which additional closings (unrelated to the achievement of milestones) were held more than 30 days after the initial closing.

Actual Post-money Amount raised Amount raised Post-

Table II
Determinants of a financing round appearing in Venture Economics and VentureOne

Logit regressions for the determinants of a financing round appearing in Venture Economics (VE) and VentureOne (V1) for 143 financing rounds in 98

Table IV

Treatment of milestone and subsequent closing amounts by Venture Economics and VentureOne

Treatment of milestone and subsequent closing amounts by Venture Economics (VE) and VentureOne (V1) for 143 financing rounds in 98 companies from 1986 to 1999. Milestone rounds are those in which investors invest in the company at the initial closing and commit additional funds contingent on the future achievement of milestones. We show the number of financing rounds in which amounts raised upon the achievement of milestones or at closings held more than 30 days after the initial closing are (i) included in the original round amount, (ii) reported as a new round, (iii) both (double-counted), or (iv) neither.

	VE	V1
Total number of milestone rounds	21	20
Milestone rounds in which milestones were not achieved or our data is insufficient to tell	14	12
Milestone rounds in which milestones were achieved	7	8
Milestone amount included in the original round amount	3	4
Milestone amount reported as a new round	4	3
Milestone amount double-counted	0	1
Milestone amount not reported	0	0

Total number of m 0.75 23.25 re f BT 4 Tw (0 0 9.25 553.equ-0.24678.1875 Tw (.3345) 0j EID50 on d swe 012875 sin

Table V

Determinants of whether Venture Economics and VentureOne report a post-money value for a financing round

Logit regressions of the determinants of whether Venture Economics (VE) and VentureOne (V1) report a post-money value for a financing round for 143 financing rounds in 98 companies from 1986 to 1999. For each database, the dependent variable is 1 if a post-money value is reported for the financing round, 0 if it is not. The independent variables are the natural logarithm of the amount of the financing round in millions (based on the total committed amount, excluding amounts raised at closings more than 30 days after the initial closing), calendar year dummies (1995, 1996, 1997, and 1998 or 1999), a geography indicator (equal to 1 if the company is based in California and 0 otherwise), an IT/telecom indicator (equal to 1 if the company is in the information technology or telecom industries and 0 otherwise), a life sciences indicator (equal to 1 if the company is in the biotechnology or health care industries and 0 otherwise), and an IPO indicator (equal to 1 if the company subsequently went public, 0 otherwise). The first set of regressions uses only the rounds the database has (i.e., reports a round amount for). The second set uses all rounds. Panel A presents the average values of the independent variables and Panel B presents the regression results. Reported standard errors are robust. Residuals are clustered by the VC investor in the VE regressions and by the company receiving financing in the V1 regressions, since these are the parties reporting data to the respective databases. Standard errors are in brackets.

Panel A – Independent variable average values									
	In Round amount	1995	1996	1997	1998, 1999	California	IT	LS	IPO
Only VE's rounds	1.746	0.040	0.274	0.250	0.290	0.315	0.516	0.258	0.355
Only V1's rounds	1.721	0.043	0.302	0.250	0.310	0.319	0.543	0.267	0.336
All rounds	1.584	0.056	0.273	0.252	0.273	0.280	0.510	0.245	0.336

Panel B – Regression results

	Int.	In Round Amount	1995	1996	1997	1998, 1999	Calif.	IT	LS	IPO	Pseudo R ²	Num. Obs.
1. Venture Economics:												
<u>Venture Economics' s rounds</u>												
	-5.27***	-0.19	1.46	2.78**	2.64*	2.37*	1.68***	-0.60	1.66**	4.11***	0.43	124
	[1.10]	[0.39]	[2.19]	[1.39]	[1.55]	[1.36]	[0.64]	[0.96]	[0.84]	[0.79]		
Odds ratio point estimate	0.83	4.31	16.20	14.03	10.67	5.37	0.55	5.25	61.23			
<u>All rounds</u>												
	-4.95***	0.02	0.78	2.17	2.05	1.89	1.40***	-0.22	1.26	3.38***	0.38	143
	[1.17]	[0.37]	[2.24]	[1.56]	[1.66]	[1.46]	[0.48]	[0.83]	[0.80]	[0.58]		
Odds ratio point estimate	1.02	2.18	8.77	7.77	6.65	4.05	0.80	3.54	29.32			
2. VentureOne:												
<u>VentureOne's rounds</u>												
	0.30	0.55*	-1.52*	-1.27	-2.99***	1.94***	0.48	1.48**	1.50**	0.28	116	
	[0.67]	[0.29]	[0.78]	[0.81]	[0.84]	[0.57]	[0.50]	[0.66]	[0.62]			
Odds ratio point estimate	1.74	0.22	0.28	0.05	6.93	1.62	4.39	4.50				

Panel C: Ratio of VE and V1 post-money values to actual post-money values, excluding amounts raised in subsequent closings																
VE								V1								
	Non-Milestone	Milestone			All					Non-Milestone	Milestone			All		
	Actual	Total	Initial	Actual	Total	Initial	Actual		Actual	Total	Initial	Actual	Total	Initial	Actual	
Median	0.937	0.894	1.151	0.894	0.937	0.944	0.937		1.061	0.994	1.810	0.706	1.061	1.071	1.058	
Average	1.054	0.848	1.665	0.937	1.024	1.141	1.043		1.057	0.983	2.031	0.832	1.046	1.196	1.033	
St. dev. (ave.)	0.113	0.220	0.583	0.287	0.102	0.128	0.105		0.025	0.188	0.485	0.257	0.034	0.081	0.035	
Ave. abs. error	0.277	0.408	0.792	0.366	0.295	0.350	0.285		0.118	0.480	1.254	0.530	0.170	0.280	0.161	

0.485 0.

Table VII

OLS regressions to determine whether there exist valuation biases in Venture Economics and VentureOne

The dependent variables in these OLS regressions are the natural logarithms of the actual financing round pre-