

Angels and Venture Capitalists: Complements or Substitutes?

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Who are them Angels?



Angel market as big as VC market

Table 2.2. Estimates of the angel market and comparisons with venture capital

USD millions

	“Visible” angel market size (share of total market) in 2009	Estimated size of angel market in 2009	Total VC^a market in 2009
United States	469 (3%)	17 700	18 275
Europe	383 (7%)	5 557	5 309
United Kingdom	74 (12%)	624	1 087
Canada	34 (9%)	388	393

*Note: VC market size includes VC investments in all stages: *i)* seed, *ii)* start-up, *iii)* early, *iv)* expansion, and *v)* later stage.

Definitions: Angels and VCs

- Many informal characterizations untenable
 - Small vs. large, active vs. passive, nice vs. nasty, ...
- Key distinction: intermediated or not?
 - VC invest other's money: GP-LP structure
 - Angels invest own money
- Grey zone: angel funds
 - Individuals, but some intermediation
- Angels vs. “family & friends”
 - Family: objective definition, partially observable
 - Friends: subjective definition, unobservable

Project with unique data

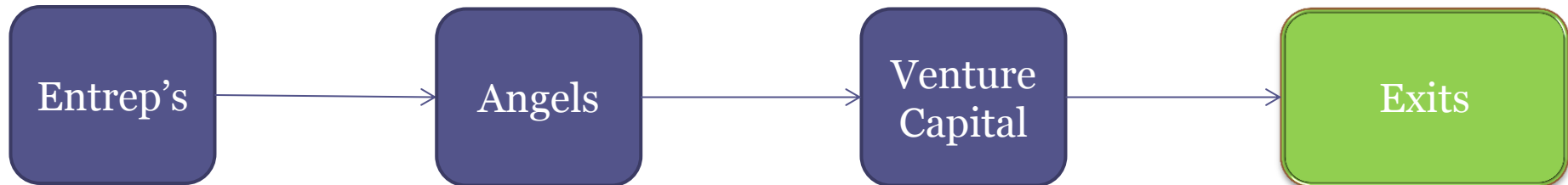
Broad objectives:

- Examine interaction between angels and VCs
- Examine angel heterogeneity
- Explore implications for start-up performance

Central research question

- Are Angels and VCs complements or substitutes?
 - Choice of investors over time
 - How do prior investor type choices affect subsequent investor type choices?
 - Performance implications of investor choices

Conventional View: Stepping Stone Logic

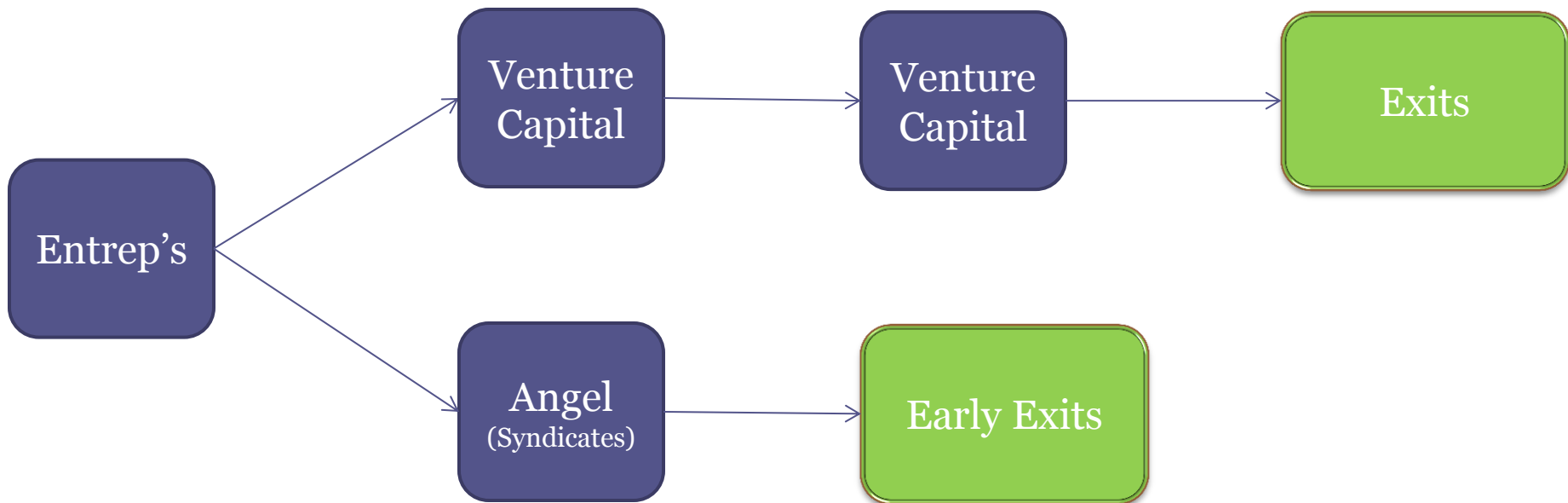


Marc Andreessen (Venture Capitalist)

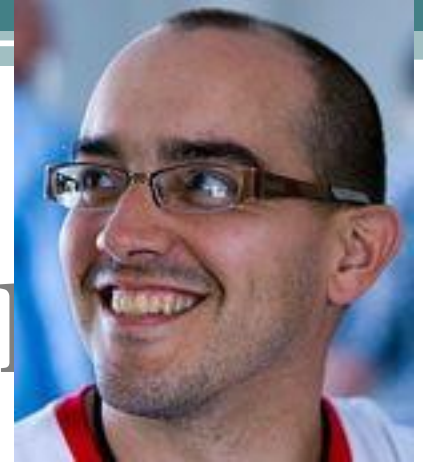


“[...] to get the best introductions to the A stage venture firms is to work through the seed investors [...]”

Alternative View: Parallel Universes



Dave McClure
(Self-declared Super-angel)



“[...] it is all about VCs failing and failing to return capital and being [...] idiots. VCs are stupid. They are absolutely stupid.”

Michael Arrington
(Founder of Tech Crunch)



VCs and Super Angels:
The War For The Entrepreneur

“Pick the wrong investor and you’ve closed the door on others. You’ll never even know why it happened, but it will”

Theoretical Considerations (1): Dynamic financing pattern

- **Complements:**
 - Examples: Google and Facebook
 - “Integrated financial eco-system”
 - Stepping stone logic
- **Substitutes:**
 - Examples: Smartcells, Club Pinguin
 - “Separate financial eco-systems”
 - Lock-in effect

Theoretical Considerations (2): Reasons for substitute / complements

- Investor-led
 - Investors create integration/separation
 - Treatment effect logic
- Company-led
 - Companies self-select into investor types
 - Selection effect logic
- Both important and interesting
 - Slightly different implications

Findings

- **Substitutes in dynamic financing patterns**
 - Not only an average company effect
 - Both selection and treatment at work
 - IV results : treatment effect plays role for AN to VC substitutes effect
 - Angels diversity relevant for subst./complements
- **Also**
 - VC backed companies have better exit performance
 - But mixing Angels and VCs: worse performance

Literature

- Goldfarb, Hoberg, Kirsch, and Triantis (2012)
 - “Brobeck” data of VC & angel syndicates
 - VCs have more aggressive control rights
 - Mixing angels & VCs bad for performance
 - Driven by split decision rights
- Kerr, Lerner and Schoar (2014)
 - Data on 2 angel groups
 - Regression discontinuity approach
 - Getting angel financing good for companies
- Hellmann and Thiele (2014)
- Nascent angel literature
 - Theory: Chemmanur and Chen (2006), Schwienbacher (2009)
 - Emp: Mason and Harrison (2002), Shane (2008), Bernstein, Korteweg and Law (2014)
- VC literature on investor types
 - Da Rin, Hellmann and Puri (2012)
 - Ozmel, Robinson and Stuart (2013), Chemmanur, Loutskina and Tian (2014), Hellmann, Lindsay and Puri (2008))

The Data

Special thanks to the Investment Capital Branch of the
Government of the Province of British Columbia

BC Investment Capital Program

30% 'check in the mail'

BC taxpayers: residents and companies

Various caps and restrictions

Sub-programs for VC funds, Angel Funds & Small Angels

Data sources

- BC Venture Capital Program
 - Regulator's database
 - Tax credits, hence **Investment activity**
 - Company regulatory filings data
 - Financial statements
 - **Share registries**
- Augment with other sources:
 - Thomson One: (VX, SDC GNI, SDC M&A)
 - CapitalIQ
 - Bureau van Dijk (Dunn Bradstreet)
 - SEDAR
 - BC company registry
 - Internet searches

Investor data sources

- Share registries
 - Detailed and accurate
 - Available for 49% of companies
- Tax credit database
 - Accurate for all tax credit investments
 - Misses all non-tax-credit investments
- Venture Expert
 - Decent coverage, but not perfect
 - Mostly contains venture capital investments

Data quality

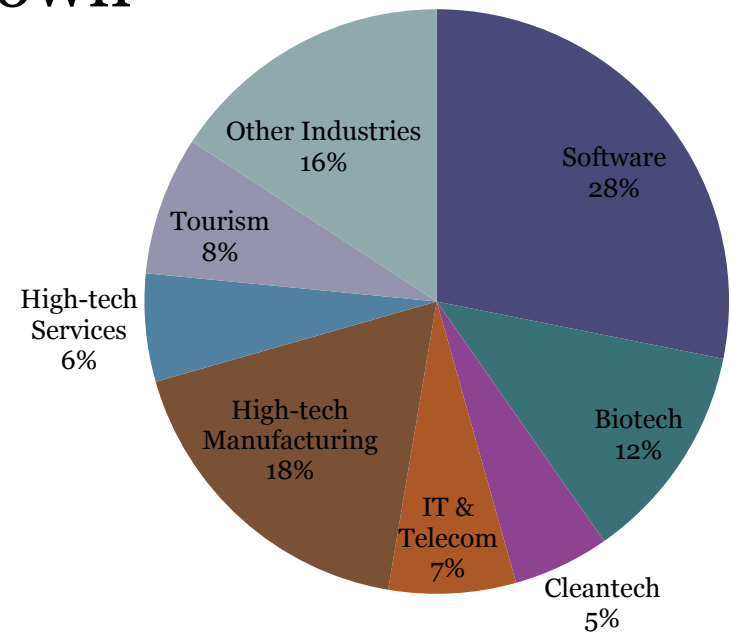
- Strengths:
 - Rare data
 - Rich & precise data
- Weaknesses:
 - Huge data processing
 - External validity?

Sample

- Companies have received funding under VCP
- Sample period:
 - Funding: 1995 Q1 – 2009 Q1
 - Exits up to May 2014
- Number of observations
 - 469 companies
 - 18,925 investments by 9424 unique investors
 - 2168 financing rounds
 - 1715 rounds with a prior round
- Average company age:
 - ...at first financing round: 2.4 years
 - ...at last round: 6.2 years

Some descriptive statistics

- 73% of companies in Greater Vancouver Area
- 17% exited & 35% failed (by May 2014)
- 10% obtained US VC investment
- Standard industry breakdown



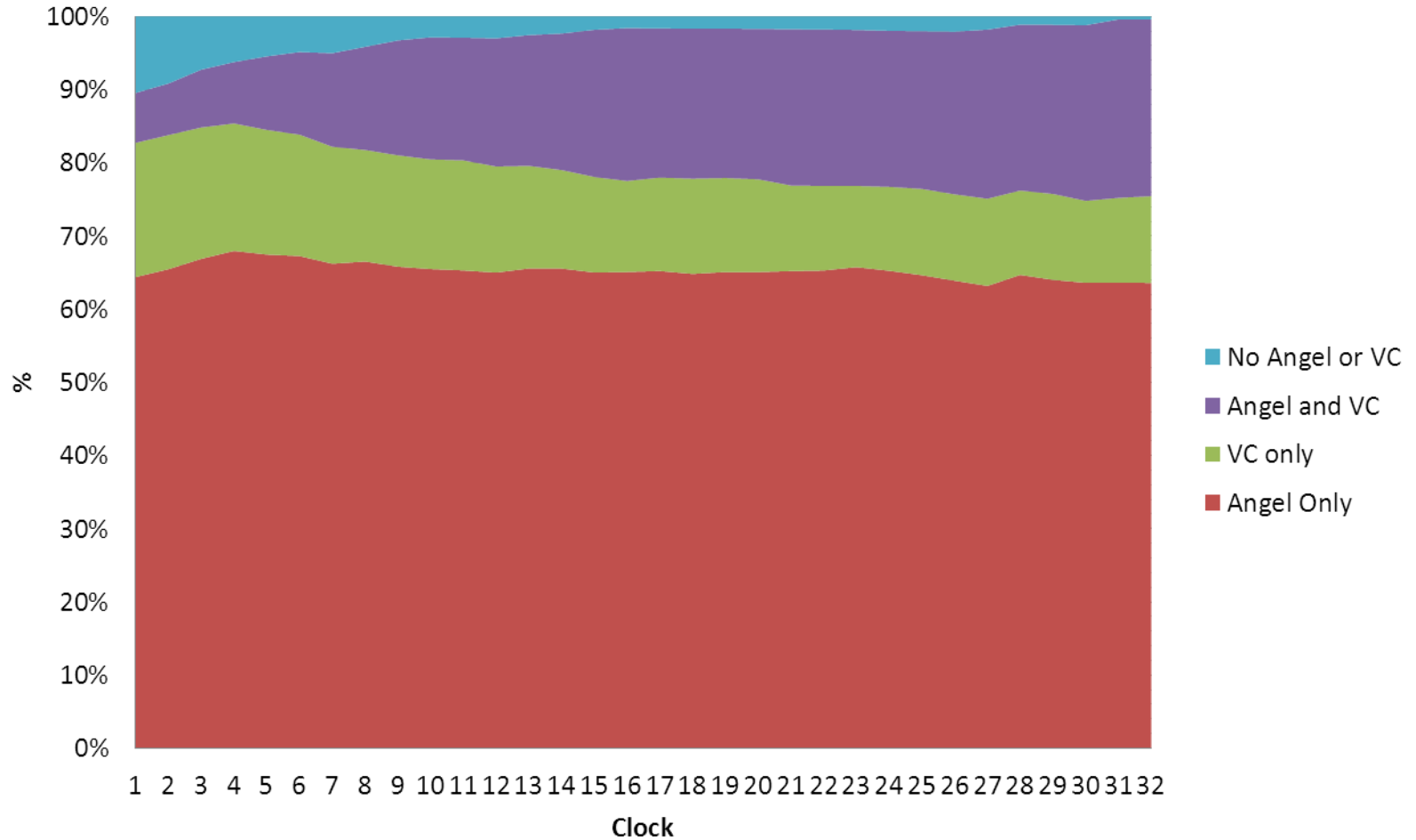
Some descriptive statistics

Investor type(s)	Number of distinct investors	Percentage of rounds involved
All	9424	100
AN	7215	68
VC	454	32
OI	1755	37
AN - CASU	6801	16
AN - SERI	214	47
AN - FUND	200	28
VC - PRIV	443	15
VC - GOVT	11	26
OI - CORP	710	23
OI - FOFA	1045	26

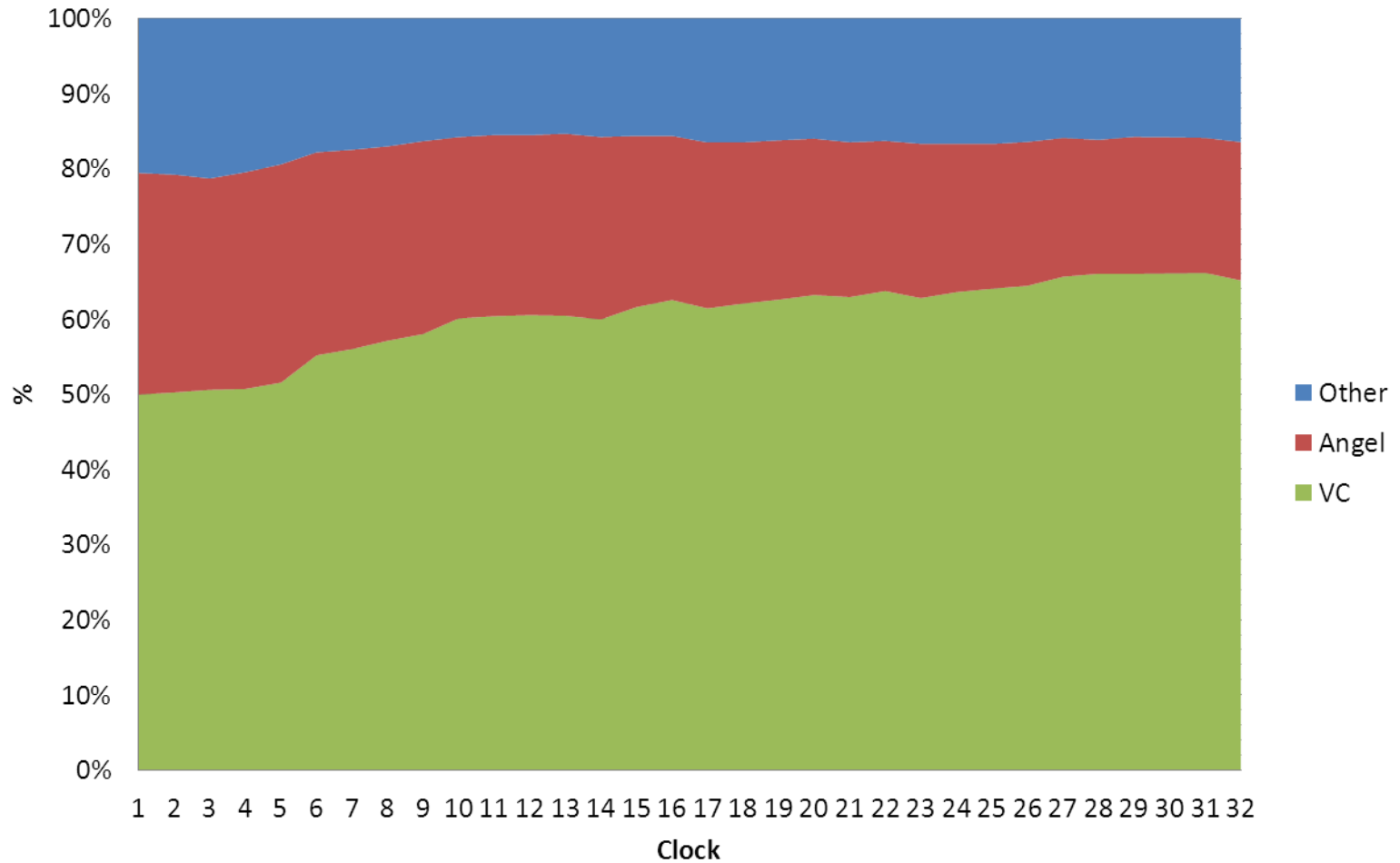
Some descriptive statistics

First Round Investments		All Rounds Investments	
1	2	3	4
# Companies Funded (%)	Avg. Funding Amt if Amt>0 (in \$Th.)	# Companies Funded (%)	Avg. Funding Amt if Amt>0 (in \$Th.)
469 (100%)	1,160	469 (100%)	7,130
328 (70%)	440	394 (84%)	1,320
117 (25%)	2,300	178 (38%)	13,430
215 (46%)	590	262 (56%)	1,730
79 (17%)	480	164 (35%)	1,050
230 (49%)	30	305 (65%)	170
140 (30%)	390	220 (47%)	950
56 (12%)	1,880	126 (27%)	10,410
89 (19%)	1,850	150 (32%)	7,080
122 (26%)	540	206 (44%)	1,520
164 (35%)	380	192 (41%)	620

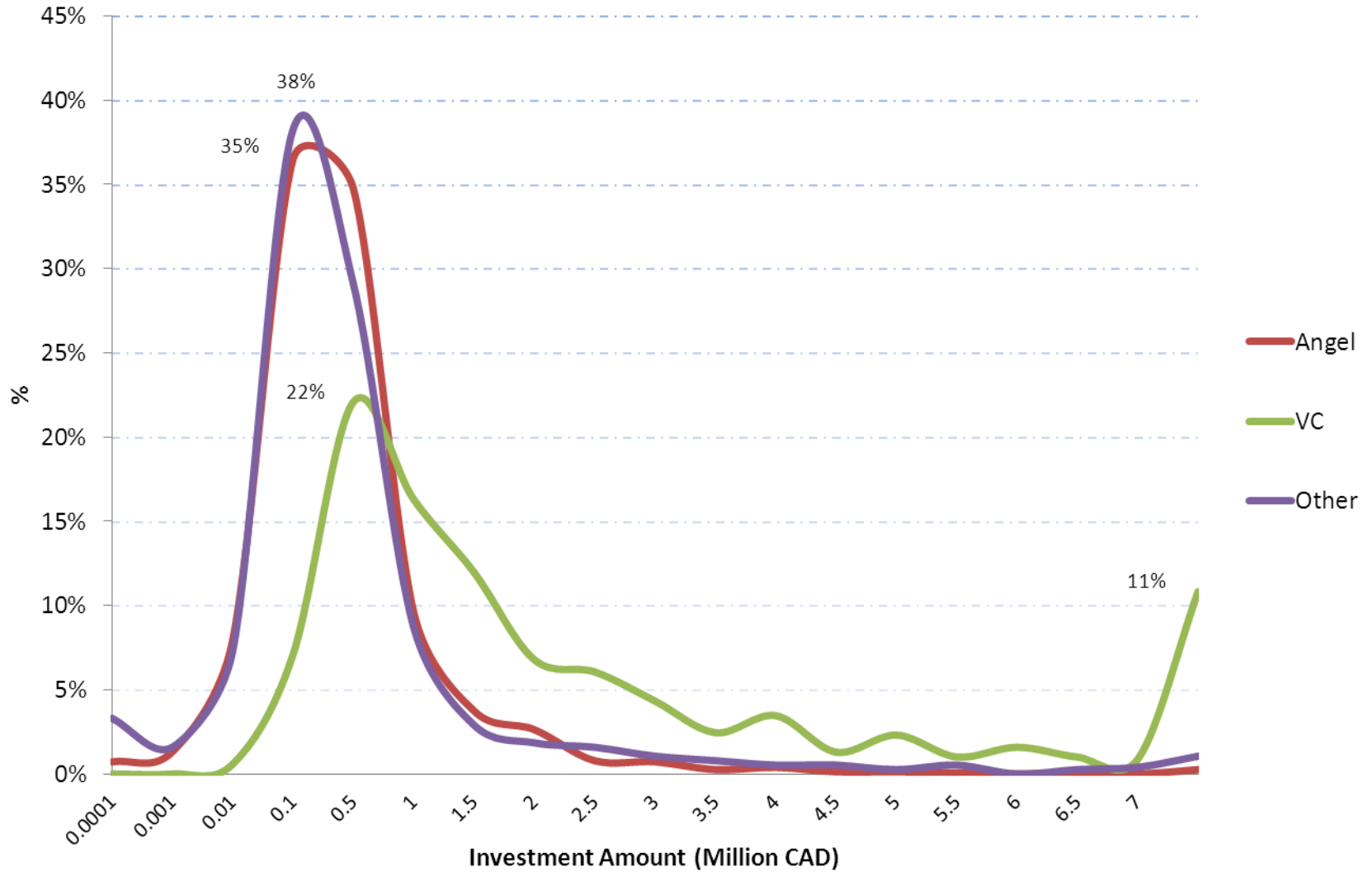
Angel vs. VC - Number of Companies (Cumulative Investments)



Cumulative Investment Amount by Investor Types



Distribution of Investment Amount by Investor Types.



The Dynamics of Financing Arrangements

Basic Regression Framework

- Linear panel regressions (each investor type)
 - Time measured in financing rounds
 - Cross section of companies
- Dependent variable
 - Log amount of current-round investment by new investors of the investor type
- Key independent variables:
 - Log amounts of cum. prior investments of investor types
- Controls

Controls

- Age at first round (log)
- Amount last round (log)
- Geography fixed effects
- Industry fixed effects
- Calendar time fixed effects
- Non-parametric clocks
 - Time since first investment
 - Time since last round

Main results

Table 3: The Relationship between Prior Funding and Current Funding: Round-to-Round Analysis

Variables	Investment Amounts in Current Round by New Investors			
	1 New AN \$	2 New VC \$	3 New OI \$	4 All New \$
Prior AN \$	0.259*** (0.0358)	-0.351*** (0.0362)	-0.0847*** (0.0321)	-0.154*** (0.0329)
Prior VC \$	-0.237*** (0.0390)	0.334*** (0.0372)	0.00854 (0.0276)	0.0585* (0.0315)
Prior OI \$	-0.0391 (0.0359)	-0.0835*** (0.0237)	0.166*** (0.0289)	-0.0939*** (0.0355)
Age at First Round	-0.00840 (0.0520)	0.0619 (0.0378)	-0.0338 (0.0500)	0.0713 (0.0483)
Previous Round Amount	-0.236*** (0.0881)	0.377*** (0.0768)	-0.0423 (0.0834)	0.116 (0.0799)
Other Controls	YES	YES	YES	YES
Observations	1,715	1,715	1,715	1,715
Number of companies	469	469	469	469
R-squared	0.378	0.661	0.275	0.214

Variations of main model

- Is the result robust?
 - Dummies (not \$)
 - Quarters (not rounds)
 - Controlling for outcome: Successful or average company effect?
- Selection or treatment?
- Diversity among financiers
 - Are all Angels and VCs responsible?

Table 4, Panel B: Analysis Based on Investor Dummies

	Investor dummies			
	1	2	3	4
	New AN Dummy	New VC Dummy	New OI Dummy	Any Dummy
Prior AN Dummy	1.361*** (0.184)	-1.782*** (0.194)	-0.419*** (0.150)	-1.082*** (0.281)
Prior VC Dummy	-1.179*** (0.178)	1.525*** (0.163)	0.0355 (0.151)	0.180 (0.211)
Prior OI Dummy	-0.186 (0.173)	-0.556*** (0.181)	0.784*** (0.139)	-1.062*** (0.238)
Controls	YES	YES	YES	YES
Observations	1,715	1,715	1,715	1,715
Number of companies	469	469	469	469

Table 7: The Relationship between Prior Funding and Current Funding by New Investors - Controlling for Outcome.

Investment Amounts by New Investors in Current Round								
Prior Cumulative Investment Amounts	1 New AN \$	2 New VC \$	3 New OI \$	4 All New \$	5 New AN \$	6 New VC \$	7 New OI \$	8 All New \$
Prior AN \$	0.259*** (0.0359)	-0.344*** (0.0357)	-0.0778** (0.0314)	-0.148*** (0.0325)	0.220*** (0.0606)	-0.373*** (0.0546)	-0.078 (0.0536)	-0.199*** (0.063)
Prior VC \$	-0.241*** (0.0392)	0.318*** (0.0374)	-0.0102 (0.0273)	0.0405 (0.0308)	-0.232*** (0.0574)	0.363*** (0.0627)	0.0209 (0.0505)	0.0629 (0.0579)
Prior OI \$	-0.042 (0.0355)	-0.0885*** (0.0239)	0.167*** (0.028)	-0.0992*** (0.0345)	-0.0392 (0.0618)	-0.0588* (0.0314)	0.158*** (0.0461)	-0.109* (0.0608)
Exit	0.772 (0.58)	1.943*** (0.455)	2.313*** (0.468)	2.356*** (0.469)	1.86 (1.349)	0.777 (1.444)	2.171* (1.16)	2.616* (1.402)
Survives	1.087** (0.509)	0.368 (0.298)	0.731* (0.38)	1.302*** (0.469)	0.997 (1.286)	-0.519 (1.213)	0.346 (0.909)	1.221 (1.231)
Prior AN \$ x Exit					0.146* (0.0815)	0.022 (0.0945)	-0.0502 (0.0798)	0.0599 (0.0825)
Prior VC \$ x Exit					-0.0512 (0.0743)	-0.0107 (0.0901)	-0.0804 (0.0691)	-0.038 (0.0718)
Prior OI \$ x Exit					0.0541 (0.0697)	-0.0947* (0.0526)	0.0977 (0.0643)	0.0376 (0.0618)
Prior AN \$ x Survives					0.0034 (0.0769)	0.0588 (0.0685)	0.0322 (0.0646)	0.0759 (0.0762)
Prior VC \$ x Survives					-0.00132 (0.0661)	-0.0713 (0.0699)	-0.0232 (0.0544)	-0.0298 (0.0638)
Prior OI \$ x Survives					-0.0181 (0.0664)	-0.0226 (0.0425)	-0.0279 (0.0489)	-0.00311 (0.0609)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,715	1,715	1,715	1,715	1,715	1,715	1,715	1,715
Number of companies	469	469	469	469	469	469	469	469
R-square	0.382	0.666	0.288	0.231	0.39	0.668	0.292	0.234

Endogeneity

- Treatment:
 - Prior investor actions cause current investor choices
- Selection / unobserved heterogeneity
 - Unobserved company characteristics (“company needs”) are driving correlation current and prior investor choices
- Both effects are interesting!

Approach: IV using tax credits shocks

- Exploit variation in availability of funding due to government tax credit budget changes
- Differentiate by program
 - Three programs: RVC, ANF, ANI
- Rank condition:
 - Variation by program over time
- Exclusion Restriction
 - Shocks unrelated to future funding and performance
- Limitation
 - Strictly speaking *uptake* rather than *availability*

IV construction

- Total tax credits for program “p” & year “t”
 - $TC(p,t)$
- Weighted average for {p,t} for company “j”
 - $Z(p,t,j) = \sum_{\tau=t_0j}^{\tau=t} w(j, \tau) TC(p,t)$
- Weights
 - $w(j, \tau) = \frac{I(\tau)}{\sum_{\tau'=t_0j}^{\tau'=t} I(\tau')}$
- Many refinements possible

IV construction - numerical example

Year	Current Invnt in ABC	Cumulative Invnt in ABC	ANI Tax Credits	IV ANI Tax Credits	RVC Tax Credits	IV RVC Tax Credits
2002	\$1	\$1	\$20	\$20	\$100	\$100
2003	\$0	\$1	\$30	\$20	\$90	\$100
2004	\$4	\$5	\$40	\$36	\$80	\$84
2005	\$0	\$5	\$50	\$36	\$70	\$84
2006	\$5	\$10	\$60	\$48	\$60	\$72

First-stage regressions

Table 5. The Relationship between Prior Funding and Current Funding by New Investors – Instrumental Variable Estimation – First-stage regressions

	1 Prior AN \$	2 Prior VC \$	3 Prior OI \$
Tax credits – RVC	-0.049** (0.0196)	0.06*** (0.021)	-0.032* (0.019)
Tax credits – ANF	0.143*** (0.031)	-0.031 (0.033)	0.023 (0.030)
Tax credits – ANI	0.052*** (0.018)	-0.044** (0.019)	-0.003 (0.0175)
Controls	YES	YES	YES
Observations	1,715	1,715	1,715
Number of companies	469	469	469

Second-stage regressions

Panel B: The Relationship between Prior Funding and Current Funding by New Investors -- Second-stage IV.

Prior Cumulative Investment Amounts	Investment Amounts by New Investors in Current Round			
	1 New AN \$	2 New VC \$	3 New OI \$	4 All New \$
Prior AN \$ - IV	0.197 (0.331)	-0.497* (0.297)	-0.319 (0.268)	-0.333 (0.261)
Prior VC \$ - IV	-0.434 (0.555)	-0.100 (0.498)	-0.315 (0.450)	-0.499 (0.439)
Prior OI \$ - IV	0.864 (1.026)	-0.875 (0.920)	0.610 (0.832)	0.0111 (0.810)
Controls	YES	YES	YES	YES
Observations	1,715	1,715	1,715	1,715
Number of companies	469	469	469	469
R-square	0.185	0.374	0.183	0.073

Finer investor decomposition

Angels:

- Casual angel
 - Invests in only one company
 - May invest in several rounds
 - No indication of commitment to angel investing
- Serial angel
 - Angel invests in more than one company
 - Some indication of commitment to angel investing
- Angel fund
 - Investment vehicle owned by multiple angels

Finer investor decomposition

- VCs
 - Government VCs
 - Retail VCCs
 - Government-owned banks
 - Private VCs
- Other investors
 - Corporate Investors
 - Founders and Families

Finer investor decomposition

Table 9: The Relationship between Prior Funding and Current Funding by New Investors – Decomposition into investor subcategories.

Prior Cumulative Investment Amounts	Investment Amounts in Current Round by New Investors						
	1 New AN - CASU	2 New AN - SERI	3 New AN - FUND	4 New VC - PRIV	5 New VC - GOVT	6 New OI - CORP	7 New OI - FOFA
Prior AN – CASU	0.308*** (0.0386)	0.0698*** (0.0260)	-0.0792** (0.0333)	-0.0983*** (0.0237)	-0.180*** (0.0307)	-0.0170 (0.0253)	-0.0194 (0.0224)
Prior AN – SERI	-0.0261 (0.0381)	0.0496 (0.0326)	-0.0195 (0.0335)	0.0130 (0.0201)	0.0131 (0.0296)	0.0211 (0.0264)	0.00934 (0.0252)
Prior AN – FUND	-0.178*** (0.0268)	-0.0112 (0.0188)	0.128*** (0.0303)	-0.0860*** (0.0195)	-0.160*** (0.0261)	-0.0513*** (0.0199)	-0.0472*** (0.0163)
Prior VC – PRIV	-0.0649** (0.0285)	-0.0468** (0.0238)	-0.0858*** (0.0326)	0.228*** (0.0370)	0.0672* (0.0373)	0.0330 (0.0285)	-0.0116 (0.0172)
Prior VC – GOVT	-0.124*** (0.0280)	0.0190 (0.0235)	-0.114*** (0.0306)	0.0118 (0.0322)	0.340*** (0.0380)	0.0230 (0.0255)	0.00610 (0.0200)
Prior OI – CORP	0.00542 (0.0280)	-0.0138 (0.0193)	-0.00333 (0.0252)	0.0596*** (0.0215)	-0.0489** (0.0223)	0.147*** (0.0242)	0.0105 (0.0209)
Prior OI – FOFA	-0.0316 (0.0431)	-0.0235 (0.0276)	-0.0300 (0.0292)	-0.0287 (0.0184)	-0.0774*** (0.0299)	0.00923 (0.0274)	0.0937*** (0.0238)
Controls	YES	YES	YES	YES	YES	YES	YES
Observations	1,715	1,715	1,715	1,715	1,715	1,715	1,715
Number of companies	469	469	469	469	469	469	469
R-square	0.438	0.153	0.292	0.403	0.584	0.176	0.316

Conclusion

- Agenda: Examine interaction angels and VCs
- Question: Substitutes or complements?
- British Columbia dataset:
 - Rare company data
 - Share registries with time dimension
 - BC Government that has tweaked the program

Conclusion

- Main findings
 - Substitutes in dynamic financing patterns
 - IV results: Both selection and treatment at work
 - AN to VC path is partially treatment effect
 - Angel diversity really matters
 - Substitutes pattern is robust
 - Not only an average company effect

Conclusion

- Policy
 - External validity: US... EU...
 - Substitutes result
 - Two separate tracks in the start-up eco-system
 - Tracks reflect diversity in company needs?
 - Is promoting just one track good?
 - How to promoting Angel investments?
 - Learn more: angel diversity paper
 - Learning and experience important:
 - Promoting accelerators, angel groups/networks

The Relationship between Financing Arrangements and Performance

Performance

Performance and stepping stone logic

- VCs → better performance
- Mixing Angels and VCs → Better performance
- Complements for best performers

Measures imperfect (as usual)

- Exit (IPO or Acquisition)
- Failure
- Incomplete outcome measures in data:
 - Revenues, Employees

Performance

Table 6: Investor Choices and Company Performance – Panel A: Base Specification

Prior Cumulative Investment Amounts	Outcome dummies X 1,000			
	1 Exit	2 Failure	3 Exit	4 Failure
Prior AN	-0.459 (0.996)	0.715 (0.956)	-1.314 (1.196)	0.555 (1.076)
Prior VC	2.344*** (0.827)	-2.730*** (0.980)	1.930** (0.886)	-2.811*** (1.007)
Prior OI	1.085 (0.796)	0.758 (0.963)	1.377* (0.825)	0.822 (0.999)
Prior AN & Prior VC Interaction			-0.240*** (0.0913)	-0.0556 (0.102)
Controls	YES	YES	YES	YES
This panel reports the t-test on the regression coefficients. Chi-square values at one degree of freedom are reported in the parentheses for all hypothesis testing. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.				
Prior AN vs. Prior VC	-2.803*** (10.69)	3.445*** (11.31)	-3.244*** (12.15)	3.366*** (10.13)
Observations	2,168	2,168	2,168	2,168
Number of companies	469	469	469	469
R-square	0.219	0.286	0.222	0.286

Performance

Table 6: Investor Choices and Company Performance – Panel B: Investor Dummies Specification

Dummy variables indicating whether a company receives financing from current financing round	Outcome dummies X 1,000			
	1 Exit	2 Failure	3 Exit	4 Failure
Prior AN – Dummy	-12.16 (14.29)	13.26 (14.50)	5.595 (13.06)	36.72** (14.40)
Prior VC – Dummy	34.39*** (13.32)	-41.83*** (16.06)	56.79*** (13.52)	-13.47 (16.41)
Prior OI – Dummy	13.28 (11.61)	11.61 (15.13)	15.09 (11.54)	13.28 (15.15)
Prior AN Dummy * Prior VC Dummy			-34.09*** (10.67)	-37.71*** (12.07)
Controls	YES	YES	YES	YES

This panel reports the t-test on the regression coefficients. Chi-square values at one degree of freedom are reported in the parentheses for all hypothesis testing. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Prior AN vs. Prior VC	-46.55*** (12.14)	-55.09*** (10.98)	-51.195*** (13.80)	-50.19*** (9.05)
Observations	2,168	2,168	2,168	2,168
Number of companies	469	469	469	469
R-square	0.219	0.285	0.222	0.287