The Evolution of CEO Compensation in Venture Capital Backed Startups

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Motivation

- We know relatively little about CEO compensation in private, VC backed firms
  - Prior work *assumes* minimal cash compensation to screen and motivate
  - About half of all firms that go public in US have been venture-backed
  - When does CEO compensation transition to 'professionalized' contracts widely studied in the context of public firm CEOs?
- Low cash pay and highly variable equity value is thought to deter the commercialization of ideas
  - Which CEOs and types of ideas are most impacted?
  - Both the level and *evolution* of CEO compensation relative to outside option likely important.

Research questions

1. How does the compensation contract for founder-CEOs in VC-backed startups respond to the dynamic information environment?
   - Answer reveals how compensation contracts fit into the VC toolbox to address information problems (i.e. Gompers 1995, Kaplan and Stromberg 2003).

2. Once documented, use new facts about compensation to re-evaluate the attractiveness of the VC-backed entrepreneurship career path.

What we do

1. Provide some of the first systematic data on CEO compensation in VC backed startups.

2. Identify product and financing milestones that coincide with increased liquid compensation.

3. Use this together with hand-collected founder biographical data to understand the characteristics of VC-backed founders and types of individuals whose ideas are more or less likely to be commercialized

Overview of findings

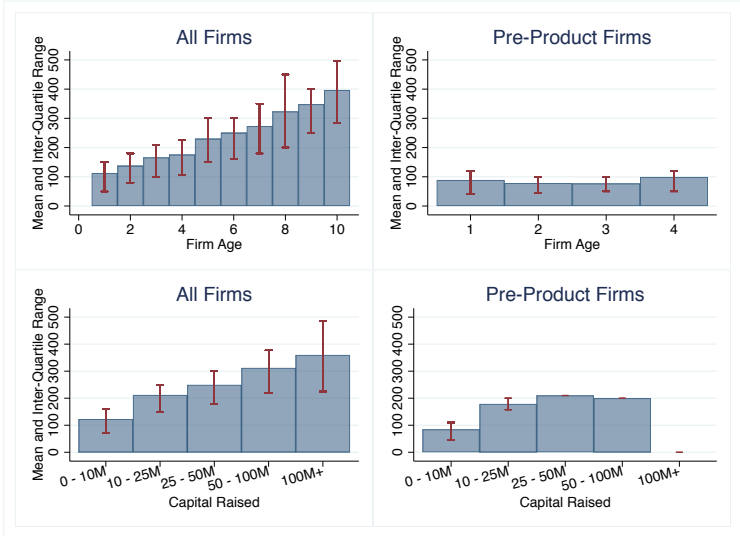
1. VC funded CEO cash compensation increases with product milestones
   - A particularly key milestone is having a product, associated with a transition from 'screening' to a 'professionalized' contract as adverse selection concerns are relaxed

2. Firms either meet milestones or fail quickly, so entrepreneurial entry is akin to experimentation: Founders don't persist with low pay!
   - Certainty-Equivalent of tech-entrepreneurship is positive for *at least* everyone up to the top 0.6% of the earnings distribution.

3. Firm founders are diverse, but largely not drawn from especially high-flying jobs
   - We may still be missing out on the ideas of the highest human capital; even more true in industries such as biotech and energy where uncertainty is not resolved as quickly as in high-tech

Paper in one-ish figure

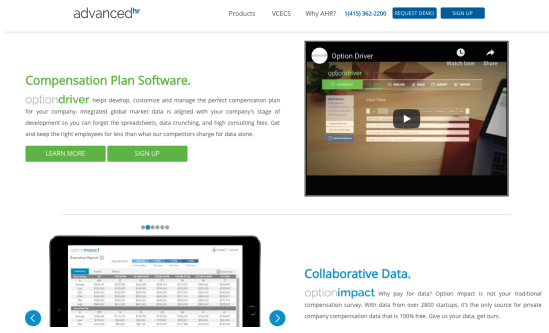
Compensation ↑ with firm age/size, but not for pre-product firms.



Agenda

1. **The Data**
2. Compensation Milestones
3. Consumption-Savings and Non-Diversifiable Risk
4. Bio Data

Compensation data: Advanced HR survey data



Firm that seeks to be a compensation consultant to small, private firms.

- selling data summaries to startups and investors
- goal to have representative data in their product

The Advanced HR sample

- 2015 and 2017 anonymous cross-sections of VC-backed technology firms
  - 2015 covers portfolio companies of 70 VC funds. 2017 is 117. Participating funds have 49% of $ investments and 42% of industry assets under management.

- Individual-level salary, total cash compensation, and fully diluted equity held by CEO and indicator for whether founder

- Information at the startup level:
  - Year founded, Industry, Geography
  - VC funding amount and Series, categorical.
  - Revenue and Product development stages, categorical.
  - Headcount, categorical.

Among surveyed VCs, AHR covers 58% of portfolio companies; representative of firm age and cumulative VC investment

Table 1A: Comparison of AHR and Eligible Startups by Age

	Venture Source (VS)		Advanced HR (AHR)		
	Startups	Share of VS	Startups	Share of AHR	AHR % of VS
Founded This Year	125	3%	78	3%	62%
1 Year Old	340	9%	269	12%	79%
2 Years Old	579	15%	348	15%	60%
3 Years Old	645	17%	336	15%	52%
4 Years Old	623	16%	329	15%	53%
5 Years Old	507	13%	248	11%	49%
6 Years Old	414	11%	208	9%	50%
7 Years Old	278	7%	138	6%	50%
8+ Years Old	388	10%	302	13%	78%
Total	3899	100%	2256	100%	58%

- Matching done on startups under 11 years old (no health/biotech).

Other data sources: VentureSource/Pitchbook, LinkedIn and Glassdoor

VentureSource/Pitchbook

- survival rates, exit valuations and exit probabilities of VC-backed startups
- startup founders and CEOs

LinkedIn

- collected full sample of 2011–2012 founders in VentureSource LinkedIn profiles
- education ($\approx$ age), experience, pre- and post-founding job titles

Glassdoor

- search for title, #s years experience, industry and location (city).
- survey data gives average salary and range for bonus

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1. The Data
2. **Compensation Milestones**
   - The evolution of cash pay, focusing on founders (see paper for non-founders)
   - Timeseries of S-1 filings beyond the AHR survey years
3. Consumption-Savings and Non-Diversifiable Risk
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Professionalizing the VC-backed firm

Rajan (2012) models the lifecycle of startups:

- VCs first seek differentiated ideas, and then, after determining demand exists for the product, proceed to *standardize* the firm
- reduces the dependence on soft assets like founder human capital

Some research documents these actions (e.g., Hellmann and Puri (2002)) but:

- little is known about the compensation contract b/t entrepreneurs and investors
- does it evolve in parallel over the lifecycle of the firm?

Dynamic contracts more generally

In many real-world scenarios, value of screening to avoid adverse selection likely falls over time

- Signals (e.g. a tangible product) that indicate entrepreneurs' value creation enable at least some insurance provision (e.g. cash salary)

Edmans et al. (2012) provides predictions consistent with this intuition.

- incentives to provide effort are not purely back-loaded
- cash compensation responds to signals of firm performance

No evidence (yet) that VC-backed compensation arrangements evolve.

First test: firm characteristics and compensation

Ask whether firm characteristics – age, revenues or milestones (X_i) – correlates with pay in the cross-section:

- $\log(\text{Comp}_i)$ is the log of total cash compensation (salary and bonus)

$$\log(\text{Comp}_i) = X_i\beta + \textit{firmAge}_i + \textit{Controls}_i + \epsilon_i$$

X is a matrix of milestones, funding events, etc.

- $\hat{\beta}$ is the partial correlation between firm observables after netting out geography, industry and time effects

Avg. compensation ↑ with startup revenue while fraction of total equity ↓

Pre-Product = report "Early / Product Definition" as their development stage.

Post-Product = report "Product Development, "Product in Beta", "Shipping Product" or "Profitable" as their product development stage.

	Share of firms	Firm age (years)	Cumulative Venture Capital Raised ($ M)	Average Headcount	Mean of CEO's Total Target Cash Compensation	Std. Dev of Total Target Cash Compensation	CEO's Equity Ownership
Pre-Product, Pre-Revenue	18%	1.8	3.8	7	85,049	62,479	39%
Post-Product, Pre-Revenue	8%	2.5	22.7	26	178,168	91,884	22%
$0-$10M	40%	4.4	27.5	48	213,486	115,812	18%
$10M-$25M	14%	7.2	64.5	118	311,715	131,300	12%
$25M-$50M	10%	8.6	104.9	195	391,208	140,105	10%
$50M-$100M	6%	8.7	141.2	235	451,279	164,594	9%
$100M+	4%	9.1	161.5	274	449,043	242,598	12%

Dramatic ↑ in compensation for "Post-Product" that have yet to realize revenue.

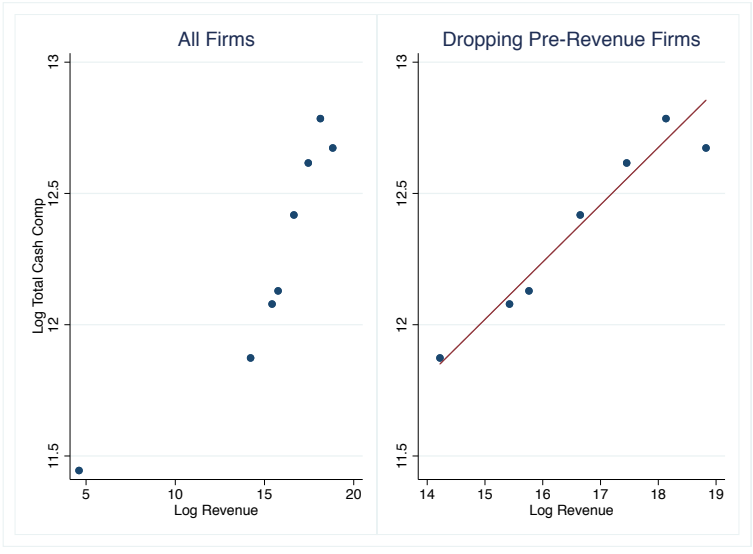
Product Development is a key milestone

$$\log(\text{Comp}_i) = X_i\beta + \textit{firmAge}_i + \textit{Controls}_i + \epsilon_i$$

	(2)	(3)	(4)	(5)
Post Product Definnition		0.596***	0.477***	0.338***
		(0.059)	(0.057)	(0.068)
Revenue (Baseline is Pre-Revenue)				
$0M-$10M	0.447***	-0.003	0.013	-0.014
	(0.045)	(0.084)	(0.083)	(0.084)
$10M-$25M	0.714***	0.263**	0.144	0.094
	(0.055)	(0.092)	(0.090)	(0.091)
$25M-$50M	0.849***	0.401***	0.242*	0.202*
	(0.064)	(0.097)	(0.097)	(0.097)
$50M-$100M	0.988***	0.540***	0.357***	0.314**
	(0.080)	(0.109)	(0.107)	(0.106)
$100M+	0.875***	0.424**	0.228	0.226
	(0.123)	(0.145)	(0.139)	(0.137)
VC Funding Round (Seed is Baseline)				
Post Series A				0.284***
				(0.062)
Post Series B				0.454***
				(0.080)
Post Series C				0.544***
				(0.092)
Firm Age Dummies	Y	Y	Y	Y
Cumulative VC Raised Dummies			Y	Y
Region and Industry Dummies			Y	Y
Unreported Venture Round Dummies Re-weighted				Y
R-Squared	0.354	0.397	0.422	0.444
Observations	1920	1920	1920	1920

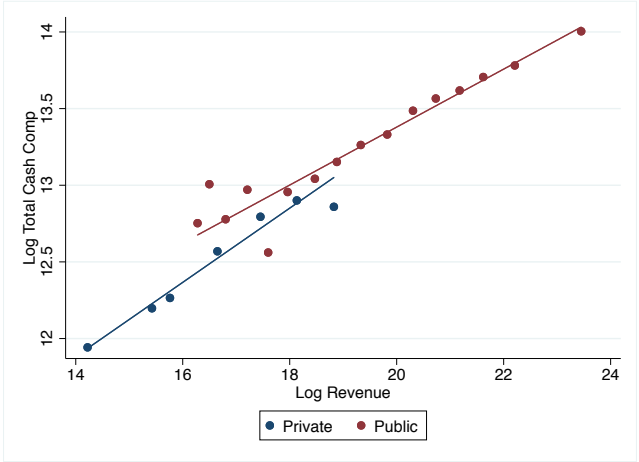
- Having revenue $\implies$ 61% $\uparrow$ in pay; post-product doing all the work.
- Under a "worst-case" analysis for unobservables, product milestones responsible for a 0.29 log point (34%) bump in pay.

Post-revenue, founder-CEO log cash increases linearly with log revenue



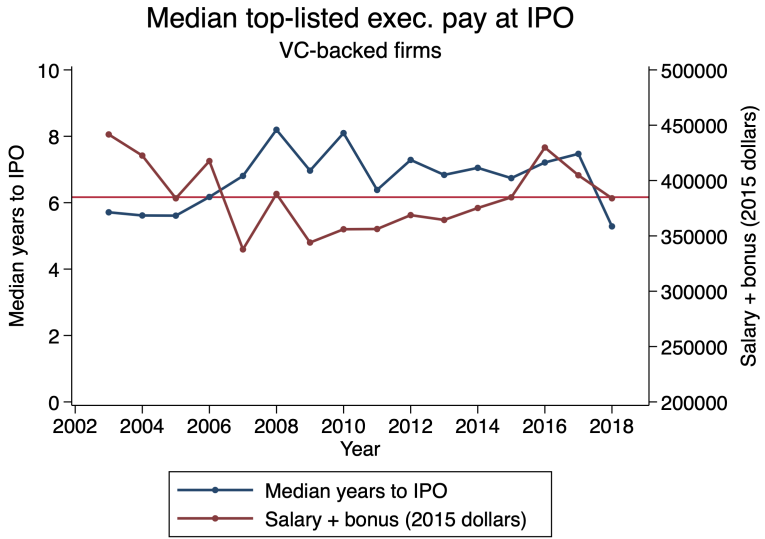
$\Longrightarrow$ shift to a "professionalized" or "standardized" contract.

Cash compensation-size elasticity similar to publicly-traded firms



Also see that levels are similar at similar sizes $\Longrightarrow$ no longer low pay

These patterns do not appear driven by a frothy VC cycle: Conditional on an IPO, median real compensation appears flat over time



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Compensation results change baseline assumptions about risk-bearing

Hall and Woodward (2010) conclude that:

> *"entrepreneurs would benefit by selling some of the value they would receive in the best outcome ... in exchange for more wealth in the most likely [event] of zero exit value ...*
>
> *But venture capitalists won't do this–they don't buy out startups at the early stages and they don't let entrepreneurs pay themselves generous salaries ...*
>
> *Moral hazard and Adverse selection bar the provision of any type of insurance to entrepreneurs - they must bear the huge risk [themselves]."*

The entrepreneur's consumption problem with assets A_t

$$
\begin{aligned}
V(A_t) &= max_{c_t < A_t} u(c_t) + \frac{1}{1+r}(1-\pi_{t+1}) \underbrace{V((A_t - c_t)(1+r) + w_t)}_{\text{Value at t+1 without exit}} \\
&\quad + \frac{1}{1+r} \underbrace{\pi_{t+1}}_{Pr(Exit)} \underbrace{\mathbb{E}_X V((A_t - c_t)(1+r) + X_{t+1})}_{\text{Expected Value at t+1 upon exit}} \\
V^{\text{Post-Exit}} &= \frac{1+r}{r} u\left(\frac{rA + w^*}{1+r}\right)
\end{aligned}
$$

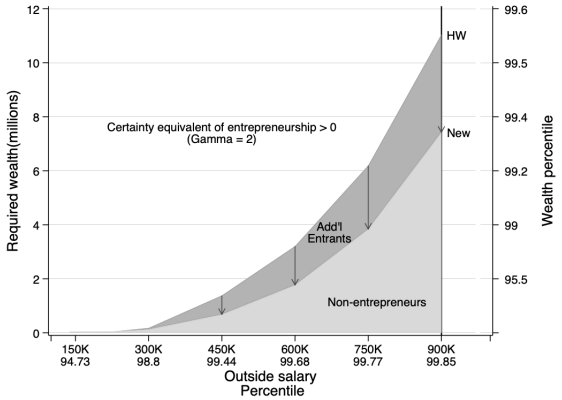
Ingredients

- Joint distribution of time-to-exit through π_t, and founder's share of value, X_t.
- Initial assets A_0, outside wage w^*, cash in startup w_t.

Revisiting the H-W Problem

- H-W set $w_t = \$150,000$ for all t.
- Motivated by our new data: integrate over all realizations of w_t for each firm age cross section.
- Compute the certainty equivalent of entrepreneurship using combinations of w^* and A_0.

Certainty equivalent of entrepreneurial opportunity ($ millions) is positive for the vast majority of the income distribution



Adding in new facts about dynamic compensation contract $\Longrightarrow \downarrow$ non-diversifiable risk

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VC-backed founders look as expected: pre-founding pay

Almost 90% of founders had estimated pre-founding salaries ($w^* < 300K$.

		Random sub-sample with detailed biographies		
	Full LinkedIn sample	Sub-sample with pre-entry cash comp estimates	Those in sub-sample with pre-entry cash comp < $300,000	Those in subsample where pre-entry cash comp is > $300,000
Number of Founder CEOs	1,415	103	91	12
Share of Founder CEOs		100%	88%	12%
Age at founding (yrs.)	35.9	36.0	35.2	42.3
# years pre-founding job exp.	11.9	11.4	10.9	15.5
# jobs pre-founding	4.4	4.5	4.4	4.9
Founder of Startup before?	0.10	0.05	0.05	0.00
Non MBA masters degree	0.40	0.51	0.51	0.50
MBA	0.22	0.31	0.32	0.25
Ph.D.	0.06	0.04	0.02	0.25
JD	0.03	0.00	0.02	0.08
Ivy league (any level)	0.02	0.01	0.01	0.00
Pre-Founding Salary (avg)		231,906	174,410	667,942
Pre-Founding Salary (25th percentile)		134,000	125,900	341,200
Pre-Founding Salary (50th percentile)		181,500	176,000	403,900
Pre-Founding Salary (75th percentile)		247,900	235,900	539,500

VC-backed founders slightly above average at pre-founding job

58% of the individuals in our sample have an estimated salary above the median salary, yet their salary is on average 43% of maximum reported salary in Glassdoor for their prior employer.

$\Longrightarrow$ modal individual starting VC-backed entrepreneurship is in a mid-level position in their firm prior to entry.

Putting it altogether

1. We provide some of the first evidence on the compensation contract between VCs and founders
   - Compensation is low early in a startup's life, pre-product
     - Consistent with a mechanism to address adverse selection
     - $\Longrightarrow$ "screening contract" to a "professionalized contract"
   - evidence that venture capital is structured to respond to a dynamic information environment

2. Cash compensation reduces the time that founders bear non-diversifiable risk of entrepreneurship
   - Risk likely to constrain only very "high-flyers" with limited wealth
   - May be a bigger issue in other sectors where uncertainty takes longer to resolve and insurance more costly for VCs

Thank you!

Comments very welcome. cstanton@hbs.edu