

Internet Appendix of “Founder Replacement and Startup Performance”

1 Appendix

1.1 Distinguishing “accommodating” vs. “separating” founder replacements in VentureSource startups

Founders who have been replaced may stay with the company they started or leave entirely; Hellmann and Puri (2002) refer to this distinction as “accommodating” vs. “separating” replacements. Prior studies have asked founders directly regarding the nature of their replacement, which is impractical among the population of startups tracked by VentureSource. In some cases we can determine whether a founder had an “accommodating” replacement, where they remain at the firm with a different title, as opposed to a “separating” replacement where they are no longer with the firm. The VentureSource data on startup executives includes a short biographical string such as “Founder, Widgets Inc.; Engineer, Google”. In some instances, this biographical information will contain two titles for the same company, so we can compare the titles and identify whether a replaced founder stayed with the firm. Similarly, there are instances where VentureSource will include two observations for an executive of the firm, one for each of their titles. In total, 243 of 1,999 replaced founders in the main sample are “accommodating replacements” using these definitions and VentureSource data. This is likely a lower bound, so we supplement this information on these title changes using LinkedIn.

1.2 LinkedIn profile collection

We collected LinkedIn profile information for 1,322 of the 1,999 replaced founders as well as the executives who replaced them. For each individual, we searched for their public LinkedIn profile – using their name, startup firm and dates of entry (exit) – and if found, captured all the relevant information about their background. The profile link was found using Google and a com-

bination of their full name and startup name. Data collected included work experience, education, age as proxied by year of graduation and location. The educational data allows us to create variables such as “PhD”, “MBA” and “MD” from a text analysis of degrees earned. The founders that lack a LinkedIn profile either had their resume restricted to registered users of LinkedIn or simply did not have a LinkedIn profile we could find.

Our objective is to measure the human capital of the founder executives at the time of firm founding. To do this, we first identify the startup they founded or joined in their work experience and past employment. All experience measures presented in the paper are measured before the start date of this entry in their work history. If the startup is not listed, we consider only the job positions with a start date before the reported founding year of the startup in VentureSource.¹

1.2.1 Additional replacement types

The LinkedIn data allows us to more reliably distinguish between “accommodating” and “separating” replacements than relying on VentureSource alone. The LinkedIn data on work experience typically includes a start and end date for each position. We use this data for the startup entry to determine whether the individual founder stayed at the firm for at least one year after the date they were replaced. If the founder either has an end date a year after the replacement or starts a new job as reported in LinkedIn more than a year later, then we label the replacement as “accommodating.” This exercise labeled an additional “accommodating” 314 replacements. When combined with our original search for such replacements using VentureSource title histories and biographical information, 507 of the 1,322 (38%) replaced founders for which we have a LinkedIn profile are accommodating. This number is quite close to the 40% reported by Hellmann and Puri (2002).

¹Some profiles had a list of employers without start or end dates. These profiles are not included in the same because we cannot accurately track human capital at the time of firm founding.

1.3 Data collection for “home bias” analysis

Our full dataset includes 1,999 replacements of executives. Our aim is to establish the prior geographic location of each replacement hire in order to understand whether the replacement was from the same state as the focal startup. Such an analysis helps reinforce our assumption that changes in non-compete laws in a state primarily impact companies in that same state. VentureSource provides the name and most recent employer for each executive at each startup but does not contain the location of that prior employer.

The replacement’s prior location is not always the same as the previous employer’s state of incorporation or its current location (as the firm may have moved). Moreover, since the non-compete contracts that form the basis of our instrumental variable are governed by the state where the worker performs the job and not the corporate headquarters – especially in the case of large companies with multiple offices – we need to know where the replacement hire was working. Finally, many companies have similar names, have changed names, or have undergone mergers or acquisitions. Given these complications, we proceed in two stages.

First, we look for direct evidence of where the replacement hire worked. Often this was available by means of self-report on profile websites such as LinkedIn. Many executive hirings were announced in articles in business news publications which provided information about work history. Executive biographies often indicated that a particular person “managed the Atlanta office”, etc. In some cases, more specialized research was involved, such as instances where the assignee address on a patent provided the location of where the replacement hire performed the work.

Second, when references to a specific individual’s work history was unavailable, we relied on inferring their location through identification of the prior employer’s address at the time of their affiliation. Frequently we were able to glean locations from company data on sites such as Capital IQ, Zoom-

info, or CrunchBase. In many cases this was straightforward because the firm had a single location, or because its various locations were contained within a single state. In cases of large, multi-state firms, we assumed that an executive-level hire likely came from the corporate headquarters unless that person's jobs both before and after were in a different state. For example, if the prior employer was Microsoft but both the (subsequent) startup and the job prior to Microsoft were located in Silicon Valley, we assumed that the person worked for Microsoft in California.

Using this method, we were able to compile (state-level) locations for 1,474 of the 1,999 (73%) replacement hires. (Note that this number is higher than those for whom we found career histories using LinkedIn profiles. This is both because we were sometimes able to determine the replacement's location from the VenutraceSource biography string or other sources, even if LinkedIn was not available.)

1.4 NETS data description

The analysis of the firms' annual employment uses a merge of VentureSource and the National Establishment Time-Series (NETS). NETS covers more than 40 million firms founded between 1990 and 2010 and with employment data available through 2013. NETS is constructed from annual Dun & Bradstreet reports, so data reliability is believed to be high. We merged NETS with the firms in our sample using company name, address, founding date and industry. Not all firms in VentureSource are found in NETS: of the 11,929 in our sample, we matched 7,146 to NETS. The two variables often used from NETS are establishment-level annual sales and employment. Given the average age of firms in our sample is less than four years old, most are single establishment firms.

1.5 Search for additional founders

We conducted several data collection exercises to improve coverage of founders among the company executives reported by VentureSource. The statistics reported below consider the set of entrepreneurial firms that are backed by venture capital investors and were founded in our sample period.²

VentureSource has imperfect coverage of startup founders, so we conducted several data collection exercises to improve the identification of founders.

³ We omitted any startup where VentureSource reports no founders; however, before doing so we took several steps to identify founders not reported by VentureSource.

First, we searched for founders using online resources.⁴ These resources included the company's website, CapitalIQ, LinkedIn and Zoominfo. For each of these firms that lacked a founder, a research assistant was given all the executives listed in VentureSource and asked to flag which ones were founders according to at least two unique sources outside of VentureSource.⁵ This search resulted in an additional 2,776 founders at 2,159 firms. Second, for each executive listed as starting at the firm before the firm's first VC financing and who was not listed as a founder, we searched for whether the individual was a founder. An additional 740 founders we identified this way.

Third, after collecting founders for firms that lacked any, we searched for additional founders to further improve coverage. Additional founders were first identified by merging VentureSource entrepreneurial firms to Crunchbase using website URL. Crunchbase provides a list of founders, which were then

²We also drop firms where a founder left before they raised venture capital, which happened in fewer than 100 firms.

³Much of these these were in fact completed before the first submission, although we did not exhaustively describe our methods, which may have suggested that we uncritically accepted VentureSource as original data.

⁴We in fact searched for over 4500 such firms, but many were not in our final sample because of founding year or investor characteristics.

⁵This rule ensures minimizes the problem of individuals assigning themselves as firm founders years after the firm is established.

compared to the executives in VentureSource, resulting in 508 additional founders. (a reassuringly low 5% of firms that merged).

Fourth, we focused on the set of firms that had solo founding teams after this data collection and were not already analyzed by an RA. For each of the firms, an RA searched for whether any non-executive was listed as a founder of the firm using the sources described above. This resulted in 1,226 additional founders. In the raw VentureSource data, there were 6,219 firms with just one founder. Following the above data collection exercises, there were 8,471, an increase of 36%. Each of these data cleaning exercises relied on VentureSource listing the founder as a manager or executive of the firm. The final data exercise attempted to determine the quality of this coverage.

A large fraction of startups in VentureSource with at least two founders were not directly addressed in the data cleaning or collection discussed thus far. To confirm that these set of firms have their founders flagged, we repeated a similar exercise as just described for 200 random firms.⁶ A research assistant was given two hundred company names, urls, background and location and tasked with finding all the founders of the firm. The set of identified founders and founding team size was then compared to our coverage of the same firms. In less than 12% of the instances did a firm have a founder not in our data while in less than 5% of the cases did VentureSource have a founder that was not identified as one through this search. Fortunately for our analysis, many of the founders not labeled as such in VentureSource for non-single founder firms did not have executive titles above VP. This paper's focus is on founder executives with such titles, so we conclude that VentureSource's coverage of top executives of firms accurately captures the vast majority of possible founders with executive roles.

Following these four steps of data collection, we identify 5,250 new founders in 4,631 firms. The impact of team size from this data collection is mean-

⁶It was prohibitively expensive to confirm all the founders in VentureSource. Our focus was primarily on finding founders of firms with no reported founders and solo teams.

ingful. The search for both founders of firms that lacked a founder in VentureSource or additional founders in the executive team resulted in a team size increase from 1.6 in the raw VentureSource data to 2.15 in the cleaned version.

Our average of 2.15 founders per startup compares favorably with prior survey-based studies. In their sample of 50 venture-backed companies that completed an IPO, Kaplan, Sensoy and Strömberg (2009) find 1.9 founders on average. Beckman (2006) augments the dataset used by Hellmann and Puri (2002) to include data on all founders of the 170 Silicon-Valley-based companies collected by Burton (1995), finding 2.2 founders on average. Wasserman (2003) finds an average of 2.5 founders among a combination of 202 venture-backed and non-venture backed startups. Note moreover that some studies of founder-CEO replacement, such as Hellmann and Puri (2002) and Chen and Thompson (2015), examine the CEO and did not report the number of founders.

References

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2 Figures and Tables

Figure 1: Exit valuation trends for firms financed in strengthened CNC law states

Notes: Figure reports the log of the average exit valuation for startups financed before the law changes in the states where the CNC law changes were strengthened.

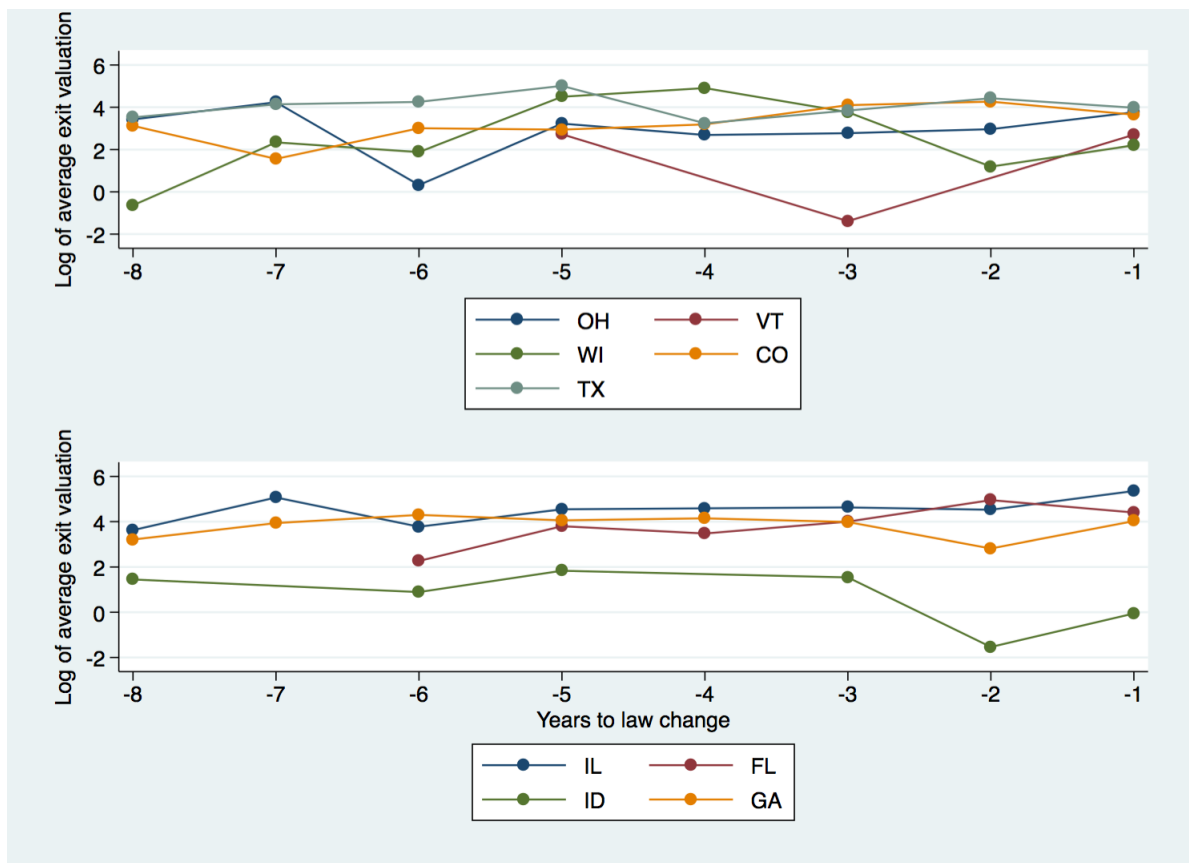


Figure 2: Exit valuation trends for firms financed in weakened CNC law states

Notes: Figure reports the log of the average exit valuation for startups financed before the law changes in the states where the CNC law changes were weakened.

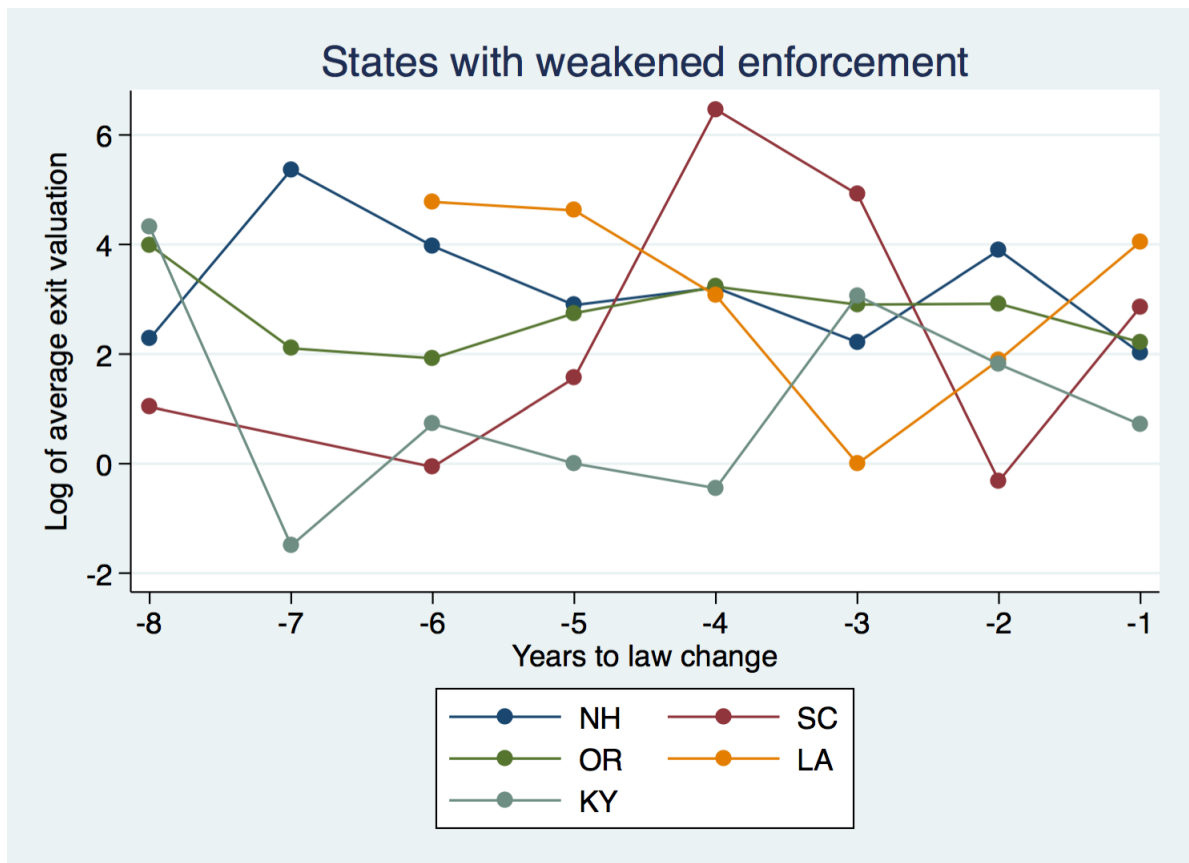


Table A1: Top 40 employers of replacing executives joining entrepreneurial firms

Notes: Table tabulates the count of employers for the executives that join the entrepreneurial firms in our sample where we identify a replacement. Employers are from the short biographical string of the executive available in VentureSource. The table only reports the top 40 firms where we can (i) identify the past employer in VentureSource and (ii) identify that firm in VC-backed acquisition activity and SDC. “Total acquisitions” counts the number of firms acquiring US-based targets from 1992 to 2008.

	Count	Percent	Cumulative %	Total acquisitions
IBM	59	6.81	6.81	80
Oracle	57	6.57	13.38	44
HP	43	4.96	18.34	60
Cisco	42	4.84	23.18	86
Lucent	39	4.50	27.68	26
AT&T	38	4.38	32.06	31
Microsoft	36	4.15	36.22	87
GE	30	3.46	39.68	197
Intel	29	3.34	43.02	42
Nortel	28	3.23	46.25	8
Motorola	26	3.00	49.25	47
Sun Microsystems	24	2.77	52.02	39
EMC	23	2.65	54.67	32
PeopleSoft	21	2.42	57.09	15
Symantec	21	2.42	59.52	34
Ernst & Young	20	2.31	61.82	34
Price Waterhouse	19	2.19	64.01	1
SAP	19	2.19	66.21	1
Deloitte & Touche	18	2.08	68.28	33
Siebel	18	2.08	70.36	15
Lucent	17	1.96	72.32	26
Dell	17	1.96	74.28	9
3Com	16	1.85	76.12	18
Siemens	16	1.85	77.97	23
McKesson	15	1.73	79.70	25
Novell	14	1.61	81.31	17
Cadence Design Systems	13	1.50	82.81	29
EDS	13	1.50	84.31	29
Yahoo	13	1.50	85.81	26
Ariba	12	1.38	87.20	26
Medtronic	12	1.38	88.58	32
i2	12	1.38	89.97	9
AOL	11	1.27	91.23	15
Accenture	11	1.27	92.50	0
Apple	11	1.27	93.77	13
Computer Associates	11	1.27	95.04	2
FOX	11	1.27	96.31	5
Pfizer	11	1.27	97.58	19
Sony	11	1.27	98.85	4
Merck & Co	10	1.15	100.00	7
Total	867	100.00		

Table A2: Comparison of replaced founders who stayed vs. left

Note: We retrieved career histories for 1,352 replaced founders from LinkedIn. The table reports means, differences and two-sided t-statistic p-values for two sub-samples. All variables are measured at the date (year) of the startup founding. “Years experience pre-startup” reports the number of years from either undergraduate graduation or first reported job to the founding year. “Number of jobs on LinkedIn” is the count of the number of unique jobs prior to joining the startup. “Held CEO position” is one if the founder held the CEO title in any of these past positions. “Past founder” is one if any of the past positions has a founder title. “Ph.D”, “MBA,” “Master’s degree,” “M.D.” and “Bachelor’s degree” are dummy variables for whether the individual had one of these degrees listed on their profile. “# LinkedIn connections (truncated)” are the number of connections reported on their profile, truncated at 500 (set to 501 if this is the case). Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Founder left	Founder stayed	Diff/s.e.
Years experience pre-startup	16.25	14.52	1.730*** 0.492
Number jobs on LinkedIn	4.567	4.246	0.321** 0.160
Held CEO position	0.604	0.602	0.00226 0.0293
Past founder	0.586	0.622	-0.0356 0.0294
Held CXO position	0.889	0.881	0.00726 0.0191
Ph.D	0.116	0.185	-0.0690*** 0.0209
M.D.	0.0279	0.0286	-0.000716 0.00992
MBA	0.274	0.213	0.0612** 0.0259
Master’s degree (including MBA)	0.453	0.380	0.0724** 0.0296
Bachelor’s degree	0.795	0.769	0.0260 0.0246
# LinkedIn connections (truncated)	303.0	293.0	9.968 13.04
Number founders	800	501	1301

Table A3: Changes in Non-compete enforceability and startup liquidity events

Notes: Table assesses the correlation between adjustments in non-compete enforcement policy and liquidity events of startup companies in the same state. Observations are state-years. “Increased Enforceability” is defined as -1, 0, 1 for states where non-compete enforceability was loosened, unchanged, or tightened (respectively). “Log # active startups in state, previous year” reports the number of startups active in that state during the previous calendar year, as a measure of the stock of companies that could potentially exit. Robust standard errors reported in parentheses, clustered at the state. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Number of state-level IPOs and acquisitions	
	All states (1)	Treated states (2)
Increased Enforceability	-0.0684 (0.157)	-0.173 (0.150)
Log # active startups	1.046*** (0.270)	1.012* (0.581)
Observations	1010	290
Pseudo- R^2	0.819	0.488
Model	Neg. Bin.	Neg. Bin.
Year FE?	Y	Y
State # FE?	Y	Y

Table A4: Employment growth and firm outcomes: Instrumental variables

Notes: Table reports OLS and 2SLS estimates for founder replacement and entrepreneurial firm outcomes. The unit of observation is a entrepreneurial firm where there still remain active founders on the executive team. The sample of entrepreneurial firms is described in Section 4. Column (1) regresses a dummy variable for whether a startup has an IPO or attractive acquisition on a set of controls. The control “Increase employment?” is one if the firm had positive employment growth in its last pre-law change financing. Employment growth is measured from the NETS database. “Increased Enforceability” is a dummy variable representing whether the state in which a focal startup is located changed its non-compete laws; values of 1, 0, and -1 correspond to an increase in enforceability, no change, and a decrease in enforceability, respectively. Other controls are as defined in Table 1. Column (2) reports the first stage probit estimates where the replacement dummy is instrumented by the interaction term “Increased Enforceability” given the policy change (if any) in that startup’s state. “1st. stage F” is the first-stage F-statistic for weak instruments. Column (3) reports the two-stage least squares second stage estimates. Columns (4) - (5) consider the dependent variable that is the log of the exit valuation (set to 25% of capital raised if the firm failed, had an unknown exit valuation or was still private by the end of the sample). “Financing year FE” are fixed effects for the financing year and “Round # FE” are fixed effects for the financing round number. “Industry FE” are fixed effects for the seven major industries in VentureSource. “State FE” are fixed effects for the startup’s headquarter state. “F-stat” is the Cragg-Donald Wald F weak instruments statistic. Robust standard errors reported in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	IPO/Acq.? OLS (1)	Emp. Growth First stage (2)	IPO/Acq.? 2SLS (3)	Log exit value OLS (4)	Log exit value 2SLS (5)
Increase employment?	0.0644* (0.0348)		-0.421 (0.877)	0.260 (0.151)	-5.196 (7.249)
Increased Enforceability		0.140 (0.144)			
Log capital stock	0.0316*** (0.00916)	0.0393 (0.0461)	0.0361** (0.0154)	1.137*** (0.0582)	1.171*** (0.109)
Syndicate size	-0.0180 (0.0166)	0.0852 (0.101)	-0.00443 (0.0365)	0.0664 (0.0769)	0.199 (0.270)
Profitable at financing	-0.0236 (0.0323)	0.109 (0.134)	-0.00485 (0.0503)	-0.0442 (0.129)	0.150 (0.382)
Constant	-0.191 (0.199)	-0.628 (0.807)	-0.120 (0.410)	-3.353*** (0.424)	-1.454 (3.354)
Observations	625	625	625	618	618
R^2	0.0187	0.137	.	0.479	.
1st stage F-stat		1.280			
Financing year FE?	Y	Y	Y	Y	Y
Founding year FE?	Y	Y	Y	Y	Y
Round # FE?	Y	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y	Y
State FE?	Y	Y	Y	Y	Y

Table A5: Founder replacement and firm outcomes: Instrumental variables without state fixed effects

Notes: Table reports OLS and 2SLS estimates for founder replacement and entrepreneurial firm outcomes. The unit of observation is a entrepreneurial firm first financed before a focal non-compete change. Startups are either headquartered in one of the states with a non-compete law change or in another state but have received capital from an investor in a treated startup. The sample of entrepreneurial firms is described in Section 4 of the main paper. All columns are as described in Table 9 of the main draft. “Financing year FE” are fixed effects for the financing year prior to the reference law change year and “Round # FE” are fixed effects for the financing round number. “Industry FE” are fixed effects for the seven major industries in VentureSource. “Founding year FE” are fixed effects for the startup’s founding year. “State FE” are fixed effects for the startup’s headquarter state. Robust standard errors clustered at the entrepreneurial firm reported in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	IPO/Acq.?	Replaced?	IPO/Acq.?	Log exit value	
	OLS (1)	First stage (2)	2SLS (3)	OLS (4)	2SLS (5)
Founder replaced	-0.0633*** (0.0166)		0.420*** (0.159)	-0.283*** (0.0544)	1.679** (0.812)
Increased Enforceability		-0.328*** (0.0875)			
Log capital stock	0.0354*** (0.00616)	0.242*** (0.0135)	0.0127* (0.00727)	1.145*** (0.0145)	1.053*** (0.0409)
Syndicate size	0.0168* (0.00947)	-0.0159 (0.0299)	0.0188** (0.00813)	0.0627* (0.0335)	0.0747** (0.0362)
Profitable at financing	0.0146 (0.00996)	0.0689* (0.0385)	0.00943 (0.0101)	0.0785* (0.0431)	0.0565 (0.0470)
Constant	-0.124*** (0.0348)	-2.794*** (0.377)	-0.0709** (0.0320)	-3.018*** (0.234)	-2.692*** (0.271)
Observations	8879	8879	8879	8708	8708
R^2	0.0492	0.0798	.	0.463	.
1st stage F-stat		14.08			
Financing year FE?	Y	Y	Y	Y	Y
Founding year FE?	Y	Y	Y	Y	Y
Round # FE?	Y	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y	Y
Industry*Found. year FE?	Y	Y	Y	Y	Y
State FE?	N	N	N	N	N

Table A6: Founder replacement and firm outcomes: Instrumental variables and VC firm fixed effects

Notes: Table reports OLS and 2SLS estimates for founder replacement and entrepreneurial firm outcomes. The unit of observation is a entrepreneurial firm - VC investor in the VC's portfolio and financed before the focal non-compete change. We include VC investors who have at least one investment in a treated startup and have at least five total investments over the sample period. The sample of entrepreneurial firms is described in Section 4 of the main paper. All columns are as described in Table 9 of the main draft. "Financing year FE" are fixed effects for the financing year prior to the reference law change year and "Round # FE" are fixed effects for the financing round number. "Industry FE" are fixed effects for the seven major industries in VentureSource. "Founding year FE" are fixed effects for the startup's founding year. "State FE" are fixed effects for the startup's headquarter state. Robust standard errors clustered at the entrepreneurial firm reported in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	IPO/Acq.?	Replaced?	IPO/Acq.?	Log exit value	
	OLS (1)	First stage (2)	2SLS (3)	OLS (4)	2SLS (5)
Founder replaced	-0.0808*** (0.0148)		0.896** (0.405)	-0.292*** (0.0599)	5.624*** (2.162)
Increased Enforceability		-0.0438*** (0.0154)			
Log capital stock	0.0282*** (0.00485)	0.0523*** (0.00429)	-0.0231 (0.0214)	1.071*** (0.0200)	0.761*** (0.114)
Syndicate size	0.0115 (0.00978)	-0.00733 (0.00939)	0.0183*** (0.00562)	0.0470 (0.0394)	0.102*** (0.0325)
Profitable at financing	0.0220* (0.0126)	0.0152 (0.0120)	0.00781 (0.00912)	0.131** (0.0532)	0.0342 (0.0507)
Constant	-0.554*** (0.103)	-0.352*** (0.0998)	-0.207 (0.303)	-4.224*** (0.422)	-2.078 (1.584)
Observations	41874	41874	41874	41010	41010
Num. VCs	3559	3559	3559	3553	3553
R^2	0.0742	0.0554	.	0.428	.
1st stage F-stat		8.130			
Financing year FE?	Y	Y	Y	Y	Y
Founding year FE?	Y	Y	Y	Y	Y
Round # FE?	Y	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y	Y
Industry*Found. year FE?	Y	Y	Y	Y	Y
VC firm FE?	Y	Y	Y	Y	Y
State FE?	N	N	N	N	N