Is it all about who you know?
Prior work connections and entrepreneurial success

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Motivation

- What makes a start-up firm successful?
- Employees and founders (human capital) are crucial - these individuals comprise the firm.
- How does the mix of the founding team enter? Do employee networks matter?
- Why might networks matter?
  - Close links - trust, mutual verification, resource sharing
  - Weak links - access to greater information and resource set
  - Factors that pass through networks - access to financial capital, risk taking, selection on unobservables
- We are going to show in a reduced form way that the role of past employment networks matter for current entrepreneurial outcomes.

Empirics show that there is variation in prior employment networks

We consider firms that started with 2 to 100 employees.
In this sample, 30% of firms include at least *some* prior work connections through the last place of employment, at startup.

For example, among firms with 3 initial employees:

87.6%	Firms whose members do not have shared prior work experience.
9.5%	Two of the members worked together at their previous job.
2.9%	All three members worked together at their previous job.

Primary framework

Granovetter, 1973

"The Strength of Weak Ties"

- Strong ties: overlapping information, greater assistance.
- Weak ties: access to an expanded set of information.

Rauch and Watson, 2007

"Clusters and Bridges in Networks of Entrepreneurs"

- Reaching across networks signals higher quality and opens the possibility for a better match.

It is not clear whether firms started by previously related individuals will perform better or worse, hence this becomes an empirical question.

Related Literature

Large related literature on the role of networks on:

- Spinoffs - *Klepper and Sleeper 2005, Franco and Filson 2006, Anton and Yao 1995, Cabral and Wang 2008, Muendler, Rauch and Tocoian 2012*
- Entrepreneurial entry and outcomes - *Beckman 2006, Lerner and Malmendier 2011, Gianetti and Simonov 2009, Nanda and Sorenson 2009, Elfring and Hulsink 2003*
- Employee performance - *Fehr and Falk 2002, Bandiera, Barankay and Rasul (2005, 2007, 2009, 2010)*

This paper:

- Move away from spinoff definition - study all startups.
- Document broad economy-wide patterns relating networks to new firm success.
    - On the flip side, we cannot isolate mechanisms as is possible in experiments that alter incentives within individual establishments.
- Use simple 2 dimensional network measures to separate the roles of large core teams versus network variety.
- Look at impact on survival and performance.

Simply put:

- Firms are different at the onset in terms of how founding members are related.

- We show empirically that networks (employment links) predict new firm success.

Methodology

Network measures

Concentration measure - HHI

$$HHI = \sum_{j=1}^{J} s_j^2$$

- Standardized HHI to take on values between 0 and 1 and is equivalent to the share, out of all possible employee pairs, of the number of pairs linked by previous employment.
- We use this continuous *HHI* measure and an indicator for $HHI > 0$.

Share Decomposition

Two combined vars: *share unconnected* and *share top network*.

- share unconnected: share of employees with no common work experience
- share top network: share of employees that make up the largest existing network.

Estimation

$$y_{it} = \beta_0 + \beta_1 Network_{i0} + \beta_2 X_{i0} + \epsilon_{it}$$

y_{it} measures performance:

- survival (cox hazard,logit LPM)
- initial average wages
- growth in employment
- growth in wages

$Network_{i0}$ measures network links:

- HHI indicator
- HHI continuous
- Share Decomposition

X_{i0} controls include:

- share of initial employees with formal sector experience
- share of initial employees who were previously unemployed
- share of initial employees with formal experience in the same sector
- human capital controls (previous wage, education)
- demographic characteristics (sex, age, share close to retirement)
- parent firm size
- cohort and sector fixed effects
- initial firm size controls

Data

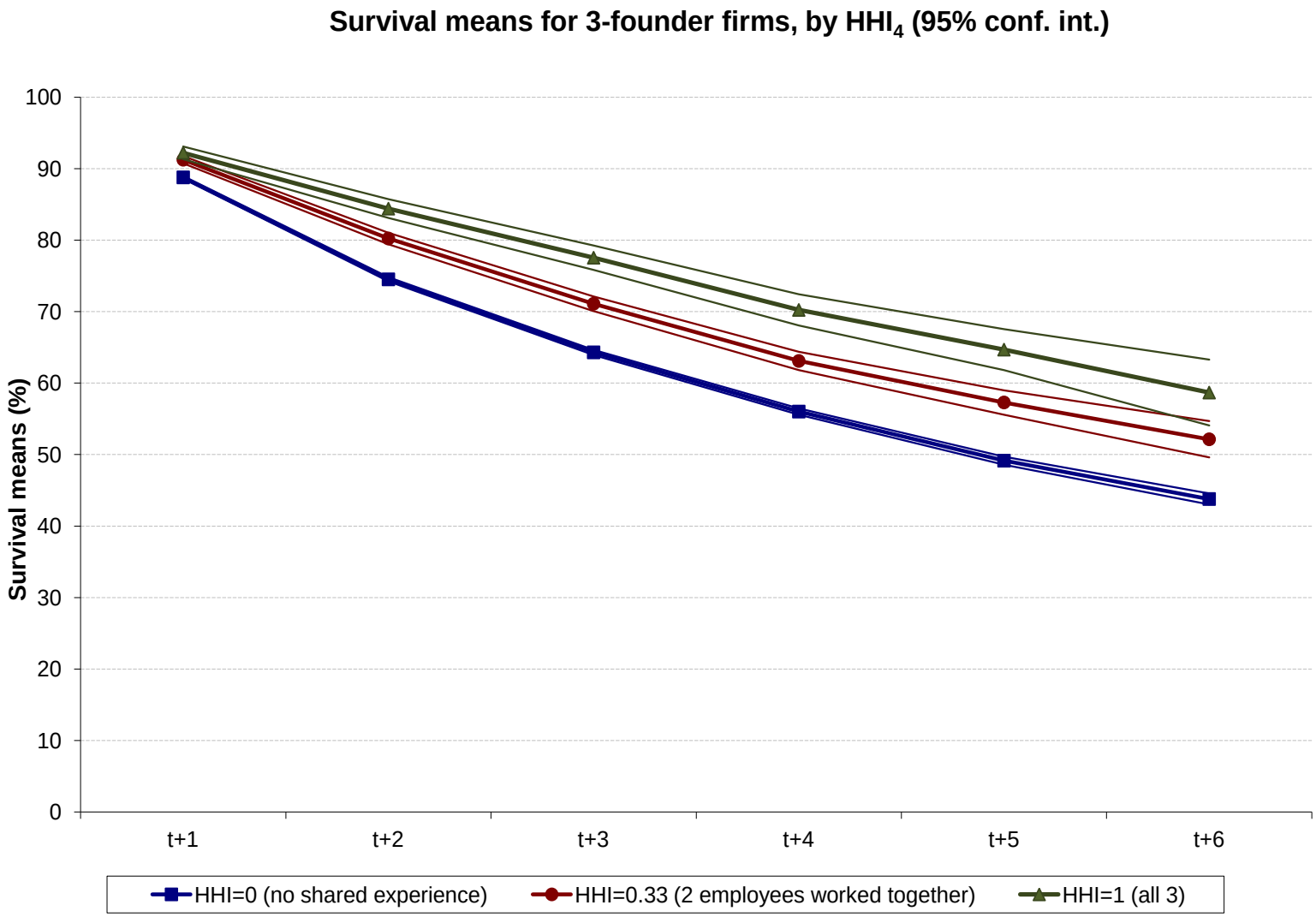
[label=earlystats]

- Brazilian RAIS data (dataset runs from 1986 - 2001)
- Annual census of salaried employees
- 71.1 million employees, 556.3 million job spells, 3.75 million firms
- We limit analysis to firms started between 1995 and 2000
  - We exclude firms we identify as divestitures from existing firms.
  - We exclude certain legal form categories, such as branches of government, firms with state ownership, cooperatives, any type of holding company, and branches of foreign firms
  - Final dataset of 550K new firms
- Firms are tracked for a minimum of 1 year and a maximum of 6

Size distribution and network concentration

Initial size	Num firms	Percent	HHI			Share unconnected	Share top network
			Mean	SD	> 0		
2	146,075	26.4%	0.078	0.268	7.8%	70.0%	53.9%
3-4	159,143	28.8%	0.075	0.201	18.1%	59.0%	37.0%
5-10	154,911	28.0%	0.076	0.169	37.2%	52.4%	26.6%
11-20	56,316	10.2%	0.080	0.160	64.2%	48.3%	22.1%
21-50	28,826	5.2%	0.088	0.162	86.8%	44.6%	21.3%
51-100	7,288	1.3%	0.101	0.171	98.1%	39.8%	22.2%
Total	552,559	100%	0.078	0.208	30.1%	58.0%	36.0%
100+	4,168		0.142	0.223	99.7%	33.0%	25.8%

3-employee firm survival



Firm survival and early growth

	Cox survival model		initial	growth t to t+3	
	t to t+3	t+3 to t+6	ln(wage)	empl	wage
	(1)	(2)	(3)	(4)	(5)
HHI > 0	-0.14***	-0.09***	0.01**	-0.06***	-0.01**
	(0.01)	(0.02)	(0.00)	(0.01)	(0.00)
Share w/ formal experience	-0.18***	-0.09***	0.34***	0.23***	-0.07***
	(0.02)	(0.03)	(0.01)	(0.02)	(0.01)
Share from unemployment	0.30***	0.13***	-0.11***	-0.14***	0.01**
	(0.02)	(0.03)	(0.01)	(0.02)	(0.01)
Share from same sector	-0.19***	-0.17***	0.05***	0.02**	-0.01***
	(0.03)	(0.04)	(0.01)	(0.01)	(0.00)
Mean employee age (/10)	0.01	0.01	0.06***	-0.02***	-0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Share close to retirement	-0.09	-0.01	-0.06**	-0.12***	0.13***
	(0.06)	(0.13)	(0.03)	(0.04)	(0.02)
Mean years of schooling	-0.01***	-0.00	0.02***	0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log mean previous wages	-0.04***	-0.02*	0.32***	0.05***	-0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Share female workers	0.02	0.08**	-0.06***	-0.02	0.03***
	(0.02)	(0.03)	(0.01)	(0.02)	(0.01)
Initial size bins	Yes	Yes	Yes	Yes	Yes
Parent size bins	Yes	Yes	Yes	Yes	Yes
Industry + cohort FE	Yes	Yes	Yes	Yes	Yes
Observations	552,559	163,575	520,602	195,986	195,986
R^2			0.340	0.0707	0.0287

Alternate network measures

		Cox survival reg		initial	growth from t to t+3	
		t to t+3	t+3 to t+6	ln(ave wage)	ln(empl)	ln(ave wage)
		(1)	(2)	(3)	(4)	(5)
(B)	HHI	-.21 (.02)***	-.22 (.04)***	.04 (.01)***	-.12 (.01)***	-.02 (.006)***
(B')	Share unconnected workers	.11 (.05)*	-.07 (.06)	.01 (.01)	.25 (.03)***	.02 (.01)**
	Share of top network	-.24 (.08)***	-.46 (.10)***	.08 (.02)***	.23 (.06)***	.006 (.01)

Results

- Basic measure of network ties: links from previous employment.
- Stronger links are associated with:
  - better odds of survival
  - slower early growth
- Share decomposition suggests:
  - In the early stages, it is important to survival that all workers be vetted by at least one other member.
  - Past the early years, a large core network (strong ties) dominates for survival.
  - As regards employment growth, a large central network is helpful, but variety in network representation dominates
- Aside from average new employee age, standard human capital measures are not predictive of high growth, truly entrepreneurial ventures.

Interpreting the findings

Our interpretation of the findings:

- Networks matter:

  Working with former co-workers-with whom informational asymmetries are presumably resolved, increases compatibility and resource sharing - qualities which are vital to new firm survival. Firm growth, on the other hand, appears to benefit from a more diverse resource set, facilitated by drawing on individuals from a variety of backgrounds.

Other mechanisms that pass through networks:

- Access to financing: empirical tests suggest this is not the main mechanism

- Unobserved heterogeneity and selection into entrepreneurial networks: arguably not the main driver of our findings

Appendix

Sector distribution and network concentration

Sector	Num firms	Percent	HHI			Share unconnected	Share top parent
			Mean	SD	> 0		
Manufacturing	81,017	14.7%	0.083	0.202	37.7%	54.1%	34.2%
Car sales, repair	22,154	4.0%	0.081	0.216	26.4%	60.3%	39.4%
Wholesale	30,012	5.4%	0.079	0.207	29.9%	60.7%	37.0%
Retail	175,132	31.7%	0.065	0.197	21.6%	59.0%	37.8%
Hotels, restaurants	48,047	8.7%	0.047	0.155	25.5%	57.7%	30.6%
Medical activities	11,025	2.0%	0.097	0.246	28.0%	58.0%	40.7%
Prof. activities	42,573	7.7%	0.085	0.213	35.6%	58.6%	35.1%
Other	142,599	25.8%	0.096	0.229	36.7%	57.9%	35.8%
Total	552,559	100%	0.078	0.208	30.1%	58.0%	36.0%

Expanded performance analysis (incl. growth from t+3 to t+6)	initial	growth t to t+3		growth t+3 to t+6	
	ln(wage)	empl	wage	empl	wage
	(1)	(2)	(3)	(4)	(5)
HHI $>$ 0	0.01**	-0.06***	-0.01**	-0.00	0.00
	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)
Share w/ formal experience	0.34***	0.23***	-0.07***	0.00	-0.04***
	(0.01)	(0.02)	(0.01)	(0.03)	(0.01)
Share from unemployment	-0.11***	-0.14***	0.01**	0.04	0.00
	(0.01)	(0.02)	(0.01)	(0.03)	(0.01)
Share from same sector	0.05***	0.02**	-0.01***	-0.00	0.00
	(0.01)	(0.01)	(0.00)	(0.02)	(0.01)
Mean employee age (/10)	0.06***	-0.02***	-0.05***	-0.03***	-0.01**
	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)
Share close to retirement	-0.06**	-0.12***	0.13***	0.01	0.07*
	(0.03)	(0.04)	(0.02)	(0.08)	(0.04)
Mean years of schooling	0.02***	0.01***	-0.01***	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log mean previous wages	0.32***	0.05***	-0.05***	0.00	-0.03***
	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)
Share female workers	-0.06***	-0.02	0.03***	-0.01	-0.01
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
Observations	520,602	195,986	195,986	25,854	25,854
R^2	0.34	0.07	0.03	0.05	0.03
Initial size bins	Yes	Yes	Yes	Yes	Yes
Parent size bins	Yes	Yes	Yes	Yes	Yes
Industry + cohort FE	Yes	Yes	Yes	Yes	Yes

	s1	s2	s3	s4	s5
	(1)	(2)	(3)	(4)	(5)
HHI	9.46	8.51	8.20	6.66	4.40
	(.35)***	(.36)***	(.37)***	(.40)***	(.42)***
Share w/ formal experience		.90	1.44	1.88	4.83
		(.24)***	(.34)***	(.40)***	(.43)***
Share from unemployment					-6.92
					(.37)***
Share from same sector				4.83	4.41
				(.26)***	(.26)***
Log mean previous wages				1.13	.88
				(.14)***	(.14)***
Mean employee age			-.05	-.07	-.03
			(.01)***	(.02)***	(.02)**
Share close to retirement			2.78	3.60	2.97
			(1.24)**	(1.43)**	(1.43)**
Mean years of schooling			.27	.26	.24
			(.03)***	(.03)***	(.03)***
Share female workers			-1.86	-1.13	-1.26
			(.25)***	(.29)***	(.29)***
Unobserved parent size			-.67	-2.17	-.47
			(.32)**	(.59)***	(.60)
Medium parents (10 to 100)			-.64	-.41	-.28
			(.23)***	(.25)	(.25)
Large parents (100 to 1,000)			-2.56	-2.33	-1.99
			(.25)***	(.27)***	(.27)***
Very large parents (1,001+)			-2.59	-2.25	-1.75
			(.32)***	(.35)***	(.36)***
Initial size categories		Yes	Yes	Yes	Yes
Cohort, sector FE	Yes	Yes	Yes	Yes	Yes
Obs.	443,111	443,111	437,149	340,893	343,444
R^2	.03	.04	.04	.04	.04

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Survival at:	t+1	t+2	t+3	t+4	t+5	t+6
	(1)	(2)	(3)	(4)	(5)	(6)
HHI	.08	2.86	4.40	4.97	3.87	5.39
	(.21)	(.32)***	(.42)***	(.52)***	(.71)***	(1.10)***
Human capital controls						
Share w/ formal experience	3.32	4.31	4.83	4.70	5.60	5.42
	(.22)***	(.34)***	(.43)***	(.53)***	(.72)***	(1.08)***
Share from unemployment	-5.27	-6.47	-6.92	-6.41	-7.49	-7.22
	(.19)***	(.29)***	(.37)***	(.46)***	(.67)***	(1.11)***
Share from same sector	1.86	3.86	4.41	5.02	6.08	5.29
	(.13)***	(.20)***	(.26)***	(.32)***	(.42)***	(.60)***
Log mean previous wages	.45	.90	.88	1.01	.59	.36
	(.07)***	(.11)***	(.14)***	(.17)***	(.23)***	(.33)
Mean employee age	-.04	-.04	-.03	-.05	-.03	-.08
	(.008)***	(.01)***	(.02)**	(.02)***	(.03)	(.04)**
Share close to retirement	1.45	1.76	2.97	3.30	-.09	5.07
	(.77)*	(1.14)	(1.43)**	(1.77)*	(2.34)	(3.49)
Mean years of schooling	.27	.28	.24	.18	.12	.18
	(.02)***	(.03)***	(.03)***	(.04)***	(.05)**	(.08)**
Share female workers	.39	-.56	-1.26	-1.58	-2.11	-3.18
	(.15)***	(.23)**	(.29)***	(.36)***	(.48)***	(.71)***
Average size of parent firm						
Unobserved parent size	-.24	-.59	-.47	-.75	-2.00	-3.55
	(.28)	(.45)	(.60)	(.79)	(1.21)*	(1.94)*
Medium parents (10 to 100)	-.19	-.17	-.28	-.31	-.40	-1.00
	(.12)	(.19)	(.25)	(.31)	(.43)	(.63)
Large parents (100 to 1,000)	-1.23	-1.82	-1.99	-1.88	-1.79	-2.79
	(.14)***	(.21)***	(.27)***	(.34)***	(.46)***	(.68)***
Very large parents (1,001+)	-1.27	-1.65	-1.75	-1.46	-1.44	-2.58
	(.19)***	(.28)***	(.36)***	(.44)***	(.58)**	(.87)***
Initial size, cohort, sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	552,559	444,449	340,893	243,668	138,606	64,067
R^2	.02	.03	.04	.05	.07	.08

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log of:	at entry (t) ave wage	growth from t to t+3 empl	growth from t to t+3 ave wage	growth t+3 to t+6 empl	growth t+3 to t+6 ave wage
	(1)	(2)	(3)	(4)	(5)
HHI	.04 (.003)***	-.12 (.009)***	-.02 (.005)***	.04 (.02)*	.006 (.01)
Human capital controls					
Share w/ formal experience	.34 (.003)***	.24 (.01)***	-.07 (.005)***	-.01 (.03)	-.04 (.01)***
Share from unemployment	-.10 (.003)***	-.15 (.009)***	.01 (.004)**	.06 (.03)**	.005 (.01)
Share from same sector	.04 (.002)***	.03 (.006)***	-.01 (.003)***	-.007 (.01)	.0005 (.007)
Mean employee age	.006 (.0001)***	-.002 (.0004)***	-.005 (.0002)***	-.003 (.0009)***	-.001 (.0004)**
Share close to retirement	-.06 (.01)***	-.11 (.03)***	.13 (.02)***	.009 (.07)	.07 (.04)*
Mean years of schooling	.02 (.0003)***	.008 (.0008)***	-.006 (.0004)***	.002 (.002)	.00004 (.0009)
Log mean previous wages	.32 (.001)***	.05 (.003)***	-.05 (.002)***	.006 (.008)	-.03 (.004)***
Share female workers	-.06 (.002)***	-.02 (.007)**	.03 (.004)***	-.01 (.02)	-.01 (.009)
Parent size controls					
Unobserved parent size	.06 (.004)***	.05 (.01)***	-.01 (.007)	.03 (.05)	-.04 (.02)*
Medium parents (10 to 100)	-.02 (.002)***	.07 (.006)***	.009 (.003)***	-.02 (.01)	.004 (.007)
Large parents (100 to 1,000)	-.03 (.002)***	.09 (.006)***	.01 (.003)***	.002 (.02)	.002 (.008)
Very large parents (1,001+)	-.04 (.003)***	.07 (.008)***	.01 (.004)**	-.02 (.02)	-.006 (.01)
Initial size, cohort, sector FE	Yes	Yes	Yes	Yes	Yes
Obs.	520,602	195,986	195,986	25,854	25,854
R^2	.34	.07	.03	.05	.03

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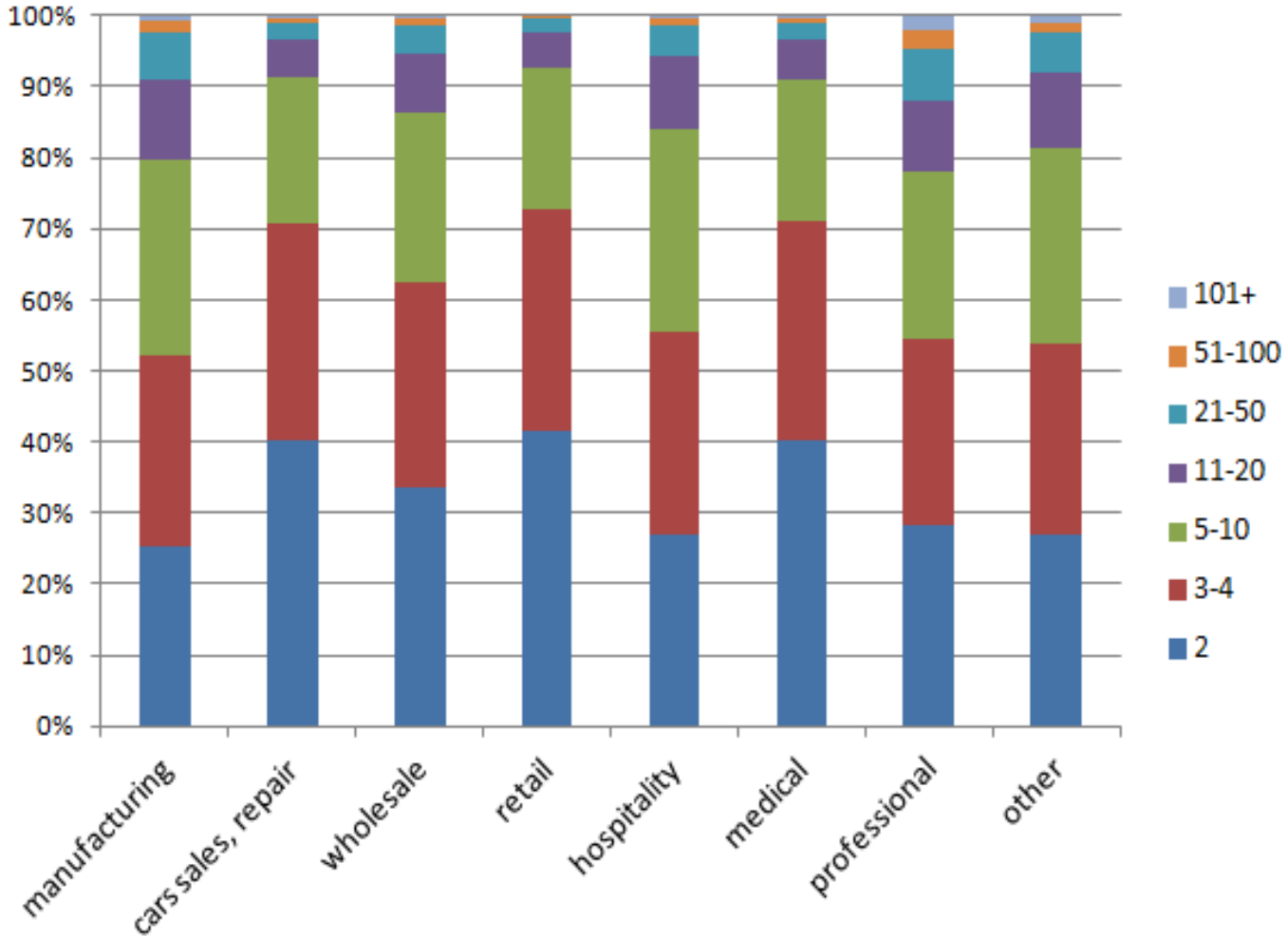
Initial size by sector



Survival, sector interactions

Survival at:	t+1	t+2	t+3	t+4	t+5	t+6
	(1)	(2)	(3)	(4)	(5)	(6)
HHI4 (retail)	.97	4.32	5.47	5.71	4.41	8.64
	(.35)***	(.56)***	(.75)***	(.96)***	(1.30)***	(1.99)***
HHI4*manufacturing	1.72	1.37	2.43	2.36	1.73	.73
	(.58)***	(.92)	(1.22)**	(1.56)	(2.15)	(3.32)
HHI4*car sales + repairs	2.62	2.81	2.20	1.51	5.97	16.32
	(.81)***	(1.37)**	(1.90)	(2.49)	(3.39)*	(4.82)***
HHI4*wholesale	1.96	2.08	.83	-.60	-1.74	-8.11
	(.87)**	(1.39)	(1.82)	(2.27)	(2.98)	(4.41)*
HHI4*hotels, restaurants	.80	2.66	1.63	-1.85	-1.07	-4.93
	(1.02)	(1.53)*	(1.97)	(2.46)	(3.28)	(5.07)
HHI4*medical activities	-.07	-.18	.28	-.77	1.87	-1.82
	(.89)	(1.39)	(1.93)	(2.58)	(3.43)	(5.57)
HHI4*services	2.91	3.41	4.82	5.15	4.33	-.98
	(.76)***	(1.15)***	(1.48)***	(1.90)***	(2.59)*	(4.06)
HHI4*other	4.22	6.53	9.60	12.04	13.80	7.37
	(.46)***	(.71)***	(.94)***	(1.19)***	(1.62)***	(2.55)***

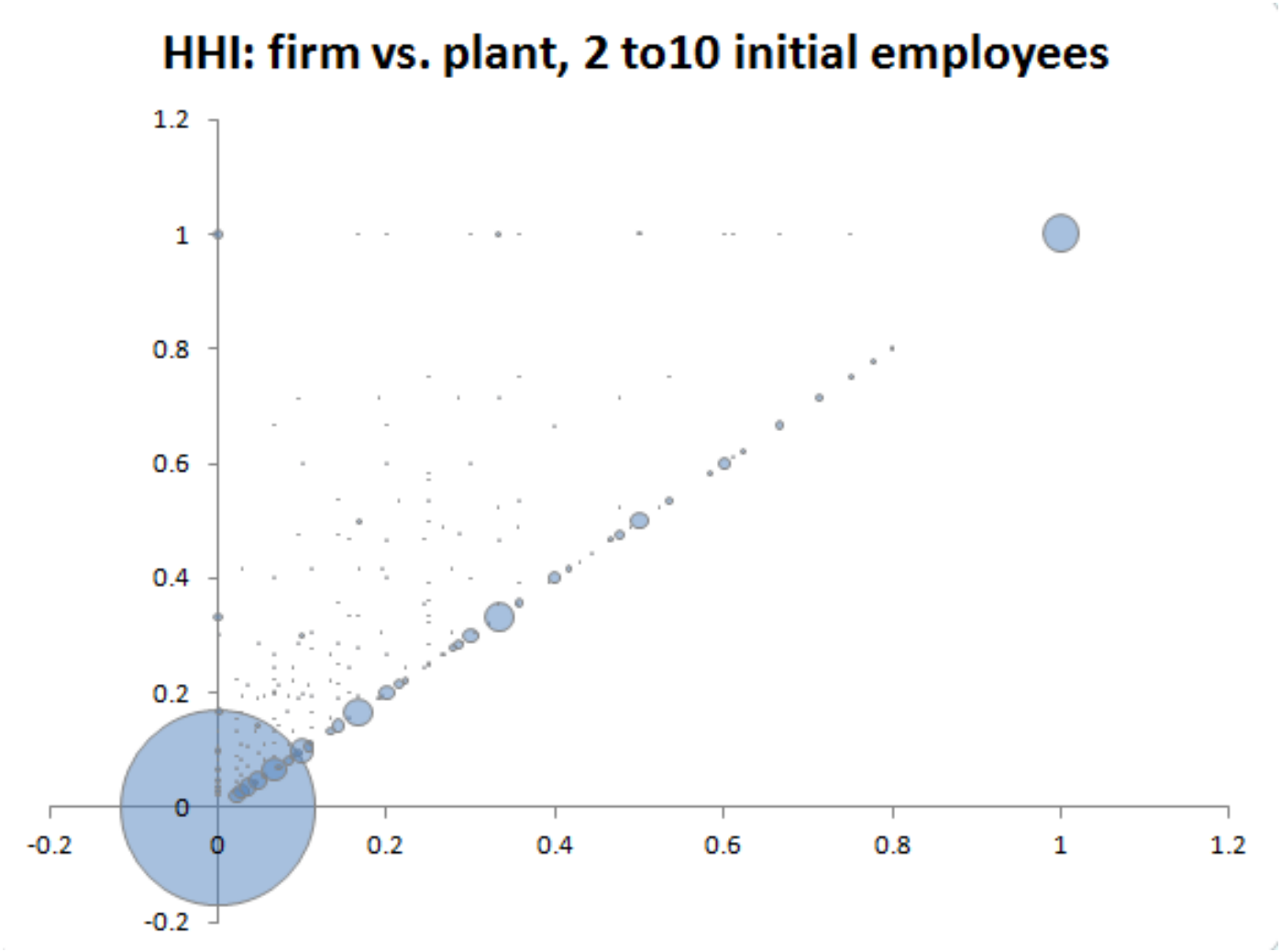
Notes: The regressions include all standard controls. The excluded category is retail. Dependent variable is the survival indicator multiplied by 100. Robust standard errors are shown in parentheses. Significance is at 10%(*), 5%(**), and 1%(***).

Performance regressions, sector interactions

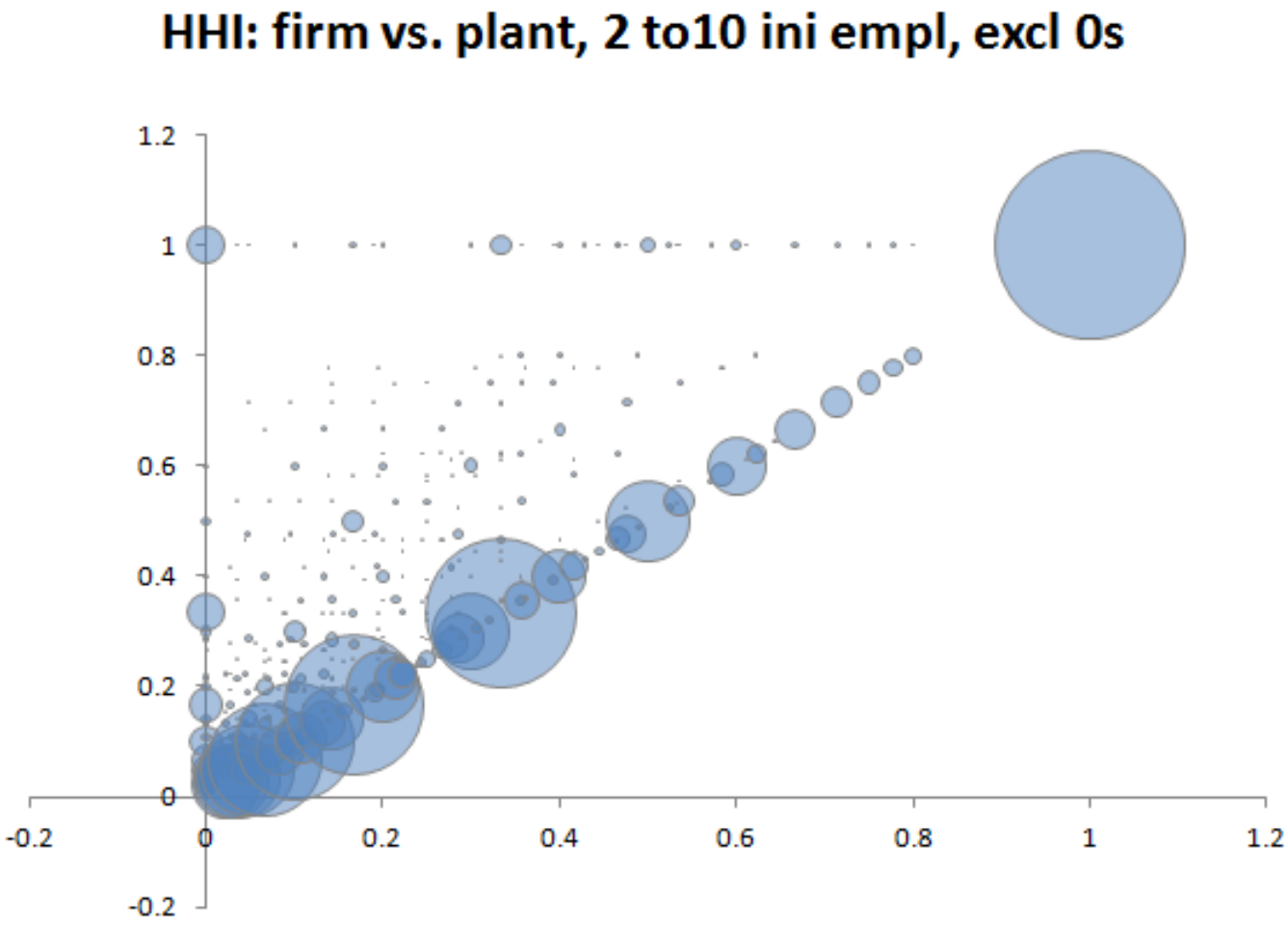
	at entry (t)	growth from t to t+3		growth t+3 to t+6	
	ln(ave wage)	ln(empl)	ln(ave wage)	ln(empl)	ln(ave wage)
	(1)	(2)	(3)	(4)	(5)
HHI4 (retail)	-.002	-.09	-.004	-.005	.005
	(.005)	(.01)***	(.007)	(.03)	(.02)
HHI4*manufacturing	.08	.07	-.01	.002	-.06
	(.009)***	(.03)***	(.01)	(.06)	(.03)**
HHI4*car sales, repairs	.07	.05	-.01	.13	-.002
	(.01)***	(.03)	(.02)	(.09)	(.04)
HHI4*wholesale	.09	-.02	-.009	-.01	.008
	(.01)***	(.04)	(.02)	(.10)	(.06)
HHI4*hotels, restaurants	-.04	.002	.04	.12	.002
	(.01)***	(.04)	(.02)**	(.08)	(.04)
HHI4*medical activities	.06	-.06	.003	-.13	-.05
	(.01)***	(.03)**	(.02)	(.09)	(.05)
HHI4*prof. services	.19	-.13	-.06	.04	.03
	(.01)***	(.03)***	(.02)***	(.09)	(.05)
HHI4*other	.17	-.06	-.02	.06	.01
	(.007)***	(.02)***	(.009)*	(.04)	(.02)
Obs.	546,871	206,936	206,936	27,432	27,432
R^2	.31	.05	.02	.02	.01

Notes: The regressions include all standard controls. The excluded category is retail. Robust standard errors are shown in parentheses. Significance is at 10%(*), 5%(**), and 1%(***).

Do employees come from the same establishment?



Do employees come from the same establishment?, cont'd



Concentration measure examples

3-employee firms

case	HHI	share unconnected	share top network
no shared experience	0	1	0
2 employees connected	1/3	1/3	2/3
all 3 employees connected	1	0	1

4-employee firms

case	HHI	share unconnected	share top network
no shared experience	0	1	0
2 employees connected	1/6	1/2	1/2
2 parents, 2 empl each	1/3	0	1/2
3 employees connected	1/2	1/4	3/4
all 4 employees connected	1	0	1