Cai and Szeidl (2018) QJE

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Lecture 8: Business Networks
Econ 14.772: Development Economics

Overview

Motivation: Barriers to firm growth?

- Within firms: credit constraints, skills, management

- Between firms: **business network**, contracting, misallocation

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Question: What is the effect of an exogenous expansion of business networks on firm performances?

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Findings:

Overview

Motivation: Barriers to firm growth?
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Question: What is the effect of an exogenous expansion of business networks on firm performances?

How: A large-scale field experiment to randomly match managers of SMEs in China

Findings:
- Persistent effects on sales, profits, number of clients, management scores, etc

- Mechanisms: Learning from peers and better partnering
    - Competition may decrease diffusion of rival information

Contribution

1. Firm to firm interactions
   - Theory: Acemoglu et al. (2012), Antràs and Chor (2013)
   - Observational data evidence: McMillan and Woodruff (1999), Khawaja et al (2011) etc

   $\rightarrow$ New here: Experimental evidence on the impacts of networks on firm outcomes

2. Experiments to study private sector development
   - Business training: McKenzie and Woodruff (2014, review)
   - Management consulting: Bloom et al. (2013)

   $\rightarrow$ New here: Organizing business associations

3. Network effects in economics (broadly)
   - Peer effects, information diffusion, referrals, trust

   $\rightarrow$ New here: Competition can limit the transmission of rival information

Today's plan

1. Context, Experiment, Data

2. Result 1: Firm Performances

3. Result 2: Mechanisms

4. Conclusion

5. Research Idea (3 slides, if time permits)

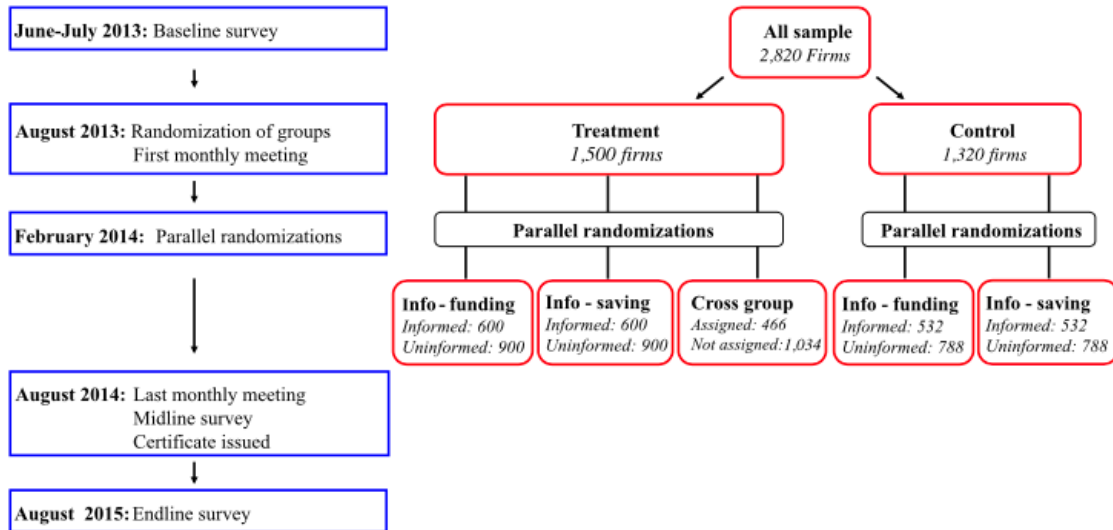# 1. Context, Experiment, Data

Context

Experimental site: Nanchang in southeastern China
- 5 million people (2014)
- 30,000 SMEs during 2010-2013

Background of experiment:
- Collaboration with Commission of Industry and Information Technology (CIIT): private sector development
- Summer 2013- Summer 2014 (timeline next page)

Timeline and Interventions

June-July 2013: Baseline survey

↓

August 2013: Randomization of groups
First monthly meeting

↓

February 2014: Parallel randomizations

↓

August 2014: Last monthly meeting
Midline survey
Certificate issued

↓

August 2015: Endline survey

All sample
2,820 Firms

Treatment
1,500 firms

Control
1,320 firms

Parallel randomizations

Parallel randomizations

Info - funding
Informed: 600
Uninformed: 900

Info - saving
Informed: 600
Uninformed: 900

Cross group
Assigned: 466
Not assigned: 1,034

Info - funding
Informed: 532
Uninformed: 788

Info - saving
Informed: 532
Uninformed: 788

▸ 1. Randomization of groups   ▸ 2. Additional randomization

Basic Intervention

Randomization of groups: 2820 firms
- Treatment: 1,500
- Control 1,320

Also variation in the composition of groups by size and sector

Treatment: Meeting
- Randomized into mtg groups with 10 firms each
- Expected to meet once a month, every month, for a year
- Typical mtg (half a day): tour the firm of hosts and discuss biz-relevant issues
- 87% attendance rate

Additional Interventions

1. Randomly give information (0%, 50%, or 80% of the managers in each mtg group)

   1.1 Funding opportunity for firms (RMB 200,000=USD 32,000)

   1.2 Saving opportunity for managers (annual return 7% > mkt return 4-5%)

2. One-time cross-group meetings

   - 466 managers into 43 cross-groups

   - No two managers from the same mtg groups

	All sample	Treatment	Control	Difference
Number of Observations	2,820	1,500	1,320	
Panel A: Firm characteristics (2013 baseline)				
Firm age	2.34	2.39	2.29	0.10
	(1.75)	(1.72)	(1.77)	(0.07)
Ownership: domestic private firms	0.98	0.98	0.98	0.00
	(0.15)	(0.15)	(0.15)	(0.01)
Sector: manufacturing	0.50	0.51	0.48	0.03
	(0.50)	(0.50)	(0.50)	(0.02)
Sector: service	0.48	0.47	0.49	−0.02
	(0.50)	(0.50)	(0.50)	(0.02)
Number of employees	36.19	36.33	36.01	0.32
	(86.49)	(90.63)	(81.55)	(3.37)
Panel B: Managerial characteristics (2013 baseline)				
Gender (1=male, 0=female)	0.84	0.85	0.84	0.01
	(0.37)	(0.36)	(0.37)	(0.01)
Age	40.84	41.05	40.59	0.46
	(8.85)	(8.46)	(9.27)	(0.34)
Education: college	0.29	0.29	0.30	−0.01
	(0.45)	(0.45)	(0.46)	(0.02)
Government working experience	0.23	0.24	0.22	0.02
	(0.42)	(0.42)	(0.41)	(0.02)
Communist Party member (1=yes, 0=no)	0.21	0.21	0.20	0.01
	(0.4)	(0.4)	(0.4)	(0.02)

	All sample	Treatment	Control	Difference
Number of Observations	2,820	1,500	1,320	
Panel A: Partnership (2013 baseline)				
Number of clients	45.89	45.58	46.23	−0.65
	(57.37)	(56.16)	(58.74)	(2.24)
Number of suppliers	16.38	16.70	16.02	0.68
	(19.23)	(20.30)	(17.94)	(0.75)
Panel B: Borrowing (2013 baseline)				
Bank loan (1=yes, 0=no)	0.25	0.25	0.25	0.00
	(0.43)	(0.44)	(0.43)	(0.02)
Informal loan (1=yes, 0=no)	0.12	0.11	0.13	−0.02
	(0.33)	(0.32)	(0.34)	(0.013)
Panel C: Accounting (2013 baseline)				
Sales (10,000 RMB)	1,592.70	1,510.62	1,686.19	−175.57
	(6,475.18)	(5,291.86)	(7,603.11)	(252.32)
Log sales	5.59	5.61	5.58	0.03
	(2.01)	(1.99)	(2.02)	(0.08)
Net profit (10,000 RMB)	79.23	77.26	81.52	−4.25
	(205.35)	(199.92)	(211.55)	(8.09)
Panel D: Attrition and shutdown (relative to baseline sample)				
Attrition (2014 midline, %)	6.21	6.33	6.06	0.27
	(24.13)	(24.36)	(23.87)	(0.91)
Attrition (2015 endline, %)	9.08	9.27	8.86	0.41
	(28.73)	(29.01)	(28.43)	(1.08)
Shutdown (2015 endline, %)	10.25	10.20	10.30	−0.10
	(30.33)	(30.27)	(30.41)	(1.14)
Panel E: Valuation of the CIIT certificate				
2014 midline (10,000 RMB)	0.56	0.56	0.56	−0.00
	(0.25)	(0.25)	(0.26)	(0.01)
2015 endline (10,000 RMB)	0.56	0.56	0.56	−0.00
	(0.26)	(0.26)	(0.26)	(0.01)

2. Result 1: Firm Performances

Basic Firm Performances

Firm FE model a là De Mel, McKenzie, and Woodruff (2008)

$$y_{it} = const. + \beta_1 \cdot \underbrace{Midline_{it}}_{time\ dummy} + \beta_2 \cdot \underbrace{Endline_{it}}_{time\ dummy}$$

$$+ \beta_3 \cdot \underbrace{Meetings_{it}}_{treatment\ dummy} \times Midline_{it} + \beta_4 \cdot \underbrace{Meetings_{it}}_{treatment\ dummy} \times Endline_{it} + Firm\ f.e. + \epsilon_{it}$$

- Replace *Firm f.e.* with *Firm controls* if the outcome variables are only available only at the follow-up surveys

- *Firm controls*: firm sizes, sectors, regions, etc

More Meetings, More Sales, Profit, Size, Asset, Inputs, Productivity

TABLE III

EFFECT OF MEETINGS ON FIRM PERFORMANCE

Dependent var.:	log Sales	Profit (10,000 RMB)	log Number of employees	log Total assets	log Material cost	log Utility cost	log Productivity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Midline	0.004	11.886**	0.018	0.013	0.0003	−0.022	−0.010
	(0.019)	(5.402)	(0.017)	(0.017)	(0.023)	(0.021)	(0.010)
Endline	0.013	12.213	0.029	0.019	0.023	0.024	0.007
	(0.029)	(8.278)	(0.024)	(0.031)	(0.029)	(0.027)	(0.016)
Meetings*midline	0.078**	25.746**	0.052**	0.061**	0.055	0.099***	0.037**
	(0.036)	(12.587)	(0.026)	(0.031)	(0.041)	(0.036)	(0.017)
Meetings*endline	0.098**	32.596*	0.077*	0.104**	0.091*	0.116**	0.025
	(0.049)	(18.525)	(0.044)	(0.047)	(0.054)	(0.046)	(0.025)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,857	7,664	7,857	7,857	7,857	7,676	7,857
Mean dep. var. for control firms	5.587	104.259	2.706	3.959	4.882	1.831	1.590

More Meetings, More Clients, Suppliers, Bank Loan, Innovation

TABLE IV

INTERMEDIATE OUTCOMES AND ALTERNATIVE EXPLANATIONS

Dependent var.:	log Number of clients	log Number of suppliers	Bank loan	Innovation	log Reported - log book sales	Tax/sales
	(1)	(2)	(3)	(4)	(5)	(6)
Midline	0.015	0.027	−0.040***		−0.001	0.001
	(0.020)	(0.021)	(0.011)		(0.007)	(0.001)
Endline	0.044	0.049*	0.008		−0.007	0.0017
	(0.029)	(0.029)	(0.014)		(0.006)	(0.0012)
Meetings*midline	0.090***	0.085***	0.091***		−0.001	0.001
	(0.030)	(0.031)	(0.016)		(0.011)	(0.001)
Meetings*endline	0.118**	0.090**	0.079***	0.082***	−0.002	−0.002
	(0.046)	(0.041)	(0.019)	(0.028)	(0.009)	(0.002)
Firm fixed effects	Yes	Yes	Yes	No	Yes	Yes
Firm demographics	No	No	No	Yes	No	No
Observations	7,841	7,826	7,857	2,646	7,796	7,849
Mean dep. var. for control firms	3.211	2.13	0.239	0.123	0.028	0.024

Notes. Standard errors clustered at the meeting group level for treated firms and at the firm level for control firms. Firm demographics are indicators for firm size (above median employment in subregion at baseline), sector, subregion, and their interactions. ***$p < .01$, **$p < .05$, *$p < .1$.

More Meetings, Better Management

TABLE V

EFFECT OF MEETINGS ON FIRM MANAGEMENT

Dependent var.:	Management score (standardized)					
	Overall (1)	Evaluation (2)	Target (3)	Incentive (4)	Operation (5)	Delegation (6)
Meetings*midline	0.211***	0.094**	0.034	0.237***	0.159***	0.071*
	(0.051)	(0.046)	(0.043)	(0.047)	(0.05)	(0.041)
Meetings*endline	0.215***	0.096**	0.021	0.223***	0.179***	0.070
	(0.048)	(0.045)	(0.046)	(0.047)	(0.044)	(0.043)
Observations	5,211	5,211	5,211	5,211	5,211	5,211
Mid/endline*firm demographics	Yes	Yes	Yes	Yes	Yes	Yes

Notes. Standard errors are clustered at the meeting group level for treated firms and at the firm level for control firms. Column (1) reports the impact of the treatment on the overall management z-score. Columns (2)–(6) report the impact on five components of management: evaluation and communication of employee performance; targets and responsibilities; attracting and incentivizing talent; process documentation and development; and delegation. ***$p < .01$, **$p < .05$, *$p < .1$.

Group Composition and Peer Effects

Use only samples in treatment group

$$y_{it} = const. + \delta_1 \cdot Post_{it} + \delta_2 \cdot Post_{it} \times \log Peer\ size_{it} + Controls + Firm\ f.e. + \epsilon_{it}$$

- $Post_{it}$: $= 1$ if midline or endline. Use only treatment groups, so this is "D"
- $\log Peer\ size_{it}$: avg of log emp. of other firms in the same mtg group
- $Controls$: interaction of $Post_{it}$ with all vars on which random assignment was conditioned

Larger Peers, More Sales, Profit, Inputs, Clients, Management

TABLE VII

Effect of Peer Composition on Firm Performance

Panel A: Main performance measures

Dependent var.:	log Sales	Profit (10,000 RMB)	log Number of employees	log Total assets	log Material cost	log Utility cost	log Productivity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post*log peer size	0.105***	27.825**	0.043	−0.016	0.100*	0.141***	0.029
	(0.040)	(13.432)	(0.032)	(0.034)	(0.052)	(0.042)	(0.020)
Post*firm demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,183	4,076	4,183	4,183	4,148	4,086	4,183

Panel B: Intermediate outcomes and alternative explanations

Dependent var.:	log Number of clients	log Number of suppliers	Bank loan	Management	Innovation	log Reported - log book sales	Tax/sales
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Post*log peer size	0.068**	−0.001	0.017	0.162***	0.027	0.022	−0.001
	(0.032)	(0.030)	(0.016)	(0.027)	(0.017)	(0.014)	(0.001)
Post*firm demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	No	No	Yes	Yes
Observations	4,173	4,170	4,183	2,774	1,409	4,152	4,178

Notes. Table only uses data for treated firms. Specification (11) is based only on the midline and endline surveys; specification (12) is based only on the endline survey; in those two specifications we also included uninteracted firm demographics. Log peer size is the average of log employment of other group members. Firm demographics are size category, sector, subregion, and their interactions. Standard errors clustered at the meeting group level in parentheses. ***$p < .01$, **$p < .05$, *$p < .1$.

Summary so far

Meetings increase final and intermediate (network, management) outcomes

Better to have larger peers

Some issues with interpretation
1. Experimenter demand effects
    - but no difference between reported and actual book sales ▸ Table IV column (5)
    - unlikely to explain peer effects

2. Side effects (e.g., tax avoidance, collusion)
    - tax: but tax/sales unchanged ▸ Table IV column (6)
    - collusion: quantity (factors) **decreases** in a standard model of collusion

Then, why are meetings good?—next section "Mechanism"

3. Result 2: Mechanisms

Mechanisms

So far, meetings increase business performances

But why?

1. Learning from others?
   - Meetings facilitate the diffusion of information

2. Partnering?
   - Meetings makes matching better

Spoiler: **Both matter**

Learning: Empirical Strategy (1)

re: randomly give information (0%, 50%, or 80% of the managers in each mtg group)
- Funding opportunity for firms (RMB 200,000=USD 32,000): **to firm, more rival**

- Saving opportunity for managers (annual 7% > mkt 4-5%): **personal, not rival**

- Samples: Uninformed managers in the mtg

$$Applied_i = const. + \underbrace{\gamma_4 \cdot Groupmember\ informed_i}_{\text{Learning from peers?}} + \gamma_5 \cdot Competition_i$$

$$+ \underbrace{\gamma_6 \cdot Groupmember\ informed_i \times Competition_i}_{\text{Rivalry change information cascade?}} + controls + \epsilon_i$$

- $Groupmember\ informed_i = 1$ if at least one member in the same group informed
- $Competition_i = 1$ if higher-than-median in-group competition
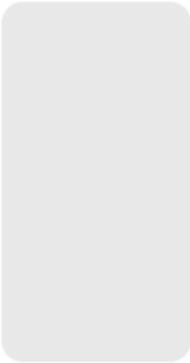
TABLE IX
DIFFUSION OF INFORMATION ABOUT FUNDING OPPORTUNITY FOR THE FIRM

Dependent var.:	Applied for the firm funding product				
	(1)	(2)	(3)	(4)	(5)
Sample:	All firms		Uninformed firms in meetings		
Info					
No info * meetings					
Info * meetings					
Having informed group members			0.291***		0.411***
			(0.035)		(0.054)
Competition				−0.150***	−0.060
				(0.052)	(0.040)
Having informed group members *competition					−0.212***
					(0.068)
Firm demographics			Yes	Yes	Yes
Observations			846	846	846

Notes. Table uses data from the midline survey. Competition is 1 for groups in which the average number of competitors (reported by firms) is higher than the median across groups, and 0 otherwise. Firm demographics are firm size category, sector, subregion, and their interactions. Standard errors clustered at the meeting group level in parentheses. ***p <.01, **p <.05, *p <.1.

TABLE X

DIFFUSION OF INFORMATION ABOUT SAVING OPPORTUNITY FOR THE MANAGER

Dependent var.:	Applied for the private saving product				
	(1)	(2)	(3)	(4)	(5)
Sample:	All firms		Uninformed firms in meetings		
Info					
No info * meetings					
Info * meetings					
Having informed group members			0.346***		0.341***
			(0.033)		(0.048)
Competition				0.005	0.018
				(0.046)	(0.046)
Having informed group members *Competition					0.016
					(0.065)
Firm demographics			Yes	Yes	Yes
Observations			835	835	835

Notes. Table uses data from the midline survey. Competition is 1 for groups in which the average number of competitors (reported by firms) is higher than the median across groups, and 0 otherwise. Firm demographics are firm size category, sector, subregion, and their interactions. Standard errors clustered at the meeting group level in parentheses. ***p < .01, **p < .05, *p < .1.

Partnering: Empirical Strategy

re: cross-group intervention
- Compare # of new connections in regular groups and in the cross-group

Expect no differences if treatment effects are
- just treatment-induced firm growth (not via partnering)
- just information friction (search)

Regression: sample=firms participated in both regular and cross-group mtg

$$Relation_{igt} = const. + \underbrace{\theta_1 \cdot Midline_{igt} \times Regular_{igt} + \theta_2 \cdot Endline_{igt} \times Regular_{igt}}_{\text{Regular mtg create better relations than one-time mtg?}}$$

$$+ Controls + Firm \ f.e. + \epsilon_i$$

- Unit: (i, g, t) triplet
- g: group category (regular or cross-group)
- $Relation_{igt}$: relationships between firm i with peers in group g

TABLE XI
Repeated Interactions and New Partnerships

Variables	Number of referrers (1)	Number of direct partners (2)	Choice in trust game (3)
Regular meetings*midline	2.178***	1.161***	2.742***
	(0.119)	(0.106)	(0.172)
Regular meetings*endline	2.400***	1.275***	3.009***
	(0.122)	(0.107)	(0.175)
Peer demographics	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Observations	1,744	1,744	1,744
Mean dep. var. for cross-group	0.084	0.302	0.960

Notes. Each observation is a (firm, group category, year) triple. The sample consists of treated firms that participated in both regular and cross-group meetings. Referrer is a group member who referred a partner or employee to the firm in the given year. Direct partner is a group member doing business with the firm in the given year. Peer demographics are the share of peers in the given group which are larger than the subregion median (measured with employment at baseline) and the share of peers in the given group that are in the same sector as the firm. Standard errors in parentheses. ***$p < .01$, **$p < .05$, *$p < .1$.

4. Conclusion

Conclusion

Examine the effect of an exogenous expansion business networks on firm performances

A large scale field experiment to randomly set meeting groups for Chinese SMEs

Find persistent effects on various outcomes
- Final outcomes: sales, profit, inputs

- Intermediate outcomes: # of suppliers, management scores

Both leanings and partnering seem in action as mechanisms
- Competition may decrease information diffusion

Comments/discussion?

Comments/discussion?

Bothering economists' question: *"Meetings are beneficial. Why did not the managers organize meetings by themselves?"*

- Paper's takes: search cost, trust, public goods, underestimating gains

Long-run (> 2 years) effects?

Knowledge spillovers and implications for agglomeration?

5. Research Idea (3 page)

Why do firms agglomerate?

Overview: Knowledge Spillovers and Agglomeration

Why do firms agglomerate?

Marshall (1890)'s three hypotheses:
- Knowledge spillovers:
- Labor market pooling:
- Industry linkages:

Overview: Knowledge Spillovers and Agglomeration

Why do firms agglomerate?

Marshall (1890)'s three hypotheses:
- Knowledge spillovers: **untested**
- Labor market pooling:tested by Overman and Puga (2008)
- Industry linkages: tested by Miyauchi (2021)

Empirical challenge for precise mechanisms = data

Overview: Knowledge Spillovers and Agglomeration

Why do firms agglomerate?

Marshall (1890)'s three hypotheses:
- Knowledge spillovers: **untested**
- Labor market pooling:tested by Overman and Puga (2008)
- Industry linkages: tested by Miyauchi (2021)

Empirical challenge for precise mechanisms = data

This project: Differentiate **roles of knowledge spillovers in agglomeration**
- Use unique business-card transaction data in Japan
- combine with patent cross-citation data (and firm-to-firm trade data)

Data: Business-card transaction data

Personal information such as name, company/organization, job title, contact information
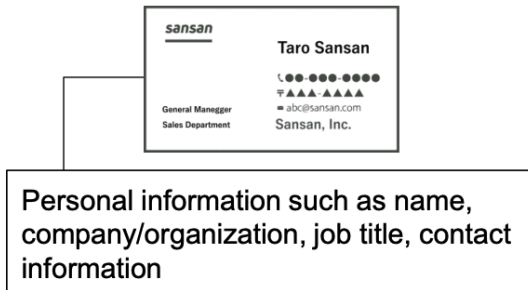
- Business card app ("Eight' by Sansan, Inc.)

- Users scan $\rightarrow$ OCR

- Covering 3 million people (2018-2021, daily)

- Can identify almost all the first meetings between individuals

My Plan

Ideal: RCT or quasi-experimental designs to estimate agglomeration elasticity
  - Miyauchi (2021): Unanticipated bankrupts to estimate supply chain disruptions

Real: No relevant shocks for travel cost: new railroad, airports during 2018-2021

What I plan to do
1. Document and compare moments against distances (travel cost)
     - Knowledge spillovers: meeting, patent cross-citation
     - Industry linkage: firm-to-firm trade

2. Match parameters of a structural model to the data moments

3. Run counterfactual to examine how knowledge spillovers are important for agglomeration