Community Networks and The Growth of Private Enterprise in China

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Presented by Duoxi Li and Yuheng Zhao
Agenda

- Introduction
- Model
- Empirical Analysis
- Conclusion
Introduction - Motivation

- Misallocation
  - Market Failure: credit, monopoly power
  - Governance Failure: taxes, regulations, enforcement

- What else may we miss?
  - Interactions between firms?
  - Spillover effects?
  - Role of community networks?

- Will community network alleviate the misallocation caused by market or government failure? Will it cause new issues?
Introduction - Motivation

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  - Market Failure: credit, monopoly power
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- What else may we miss?
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- **Misallocation**
  - Market Failure: credit, monopoly power
  - Governance Failure: taxes, regulations, enforcement

- **What else may we miss?**
  - Interactions between firms? Spillover effects? Role of community networks?

- **Will community network alleviate the misallocation caused by market or government failure? Will it cause new issues?**
China provides an example

Figure 1. Distribution of Firms, by Type

(a) Number of Firms
(b) Registered Capital

Source: SAIC registration database.

Firm Classification: Township-Village Enterprises (TVE’s), State Owned Enterprises (SOE’s), Foreign Owned Firms, and Private (domestically owned) Firms
Introduction - Background

- Lack of general preconditions for economic development in the early stage
  - effective legal systems
  - financial institutions

Informal force: community/social networks (guanxi)
- native-place fellows (laoxiang): entrepreneurs from the same province, city or county
- local custom and dialect: cultural identification

Effect of community networks
- alleviate misallocation between SOE and private enterprises
- cause misallocation within private enterprises
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- Effect of community networks
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Introduction - Background

Dispersion according to birth county of entrepreneurs

Figure 1: Dispersion in Firm Entry
Introduction - Main Questions

- What is the role of community networks in the growth of private enterprise in China?
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- What is the role of community networks in the growth of private enterprise in China?
- How may community network cause the dispersion in firm entry, sectoral/spatial concentration, and firm size among private enterprises
Establish that population density is a good measure of social connectedness in a county
Introduction - Steps

- Establish that population density is a good measure of social connectedness in a county
- Develop a theoretical model of network dynamics
  - networks with greater social connectedness lead to more entry, more spacial/sectoral concentration, small initial firm size, and faster growth
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Develop a theoretical model of network dynamics
  - networks with greater social connectedness lead to more entry, more spacial/sectoral concentration, small initial firm size, and faster growth

Empirically testify the predictions of the model

Quantify the impact of network by structural estimation and counter-factual experiment
  - entry over the 1995-2004 period would have been 40% lower (with a comparable decline in the stock of capital)
Model

Key Ingredients

- Dynamics of a single network originating in a given origin

- Two sources of network-based spillovers
  - Post-entry cooperation raises the productivity of the entrepreneurs in the network
  - Pre-entry referral process

- Two sources of heterogeneity:
  - Origin social connectedness
  - Individual ability
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Model

Setup

- Each origin: social connectedness: \( p \geq 0 \rightarrow \) speed of learning or productivity spillover
- Three sectors: \( T, B_1, \) and \( B_2 \)
- Initial entrepreneurs: \( n_i0 \) at \( t = 0 \) in sector \( B_i \)
- Equal-sized cohorts of new agents born at \( t = 1, 2, \ldots \) who live forever
Model

Network Dynamics

\[ N_{t-1} \equiv n_{1,t-1} + n_{2,t-1}, s_{i,t-1} \equiv \frac{n_{i,t-1}}{N_{t-1}}, A_{it} = A_0 \exp(n_{i,t-1}\theta(p)) \]

\[ t - 1: \quad \begin{array}{c}
T \\
B1 \\
B2
\end{array} \]

\[ n_{1,t-1} s_{1,t-1} A_{1,t-1} \quad n_{2,t-1} s_{2,t-1} A_{2,t-1} \]
Model

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Self-Selection Stage

- Ability: random draw $\omega$, where $\log \omega \sim U[0, 1]$
- Production:
  - sector $T$: profit $\omega^\sigma$
  - sector $B_i$: production function $y = A_{it} \omega^{1-\alpha} K^\alpha$, where the community TFP (CTFP)

\[ A_{it} = A_0 \exp(n_{i,t-1} \theta(p)) \]

$\theta(p)$ is the network quality, increasing in $p$

- capital cost $r$, fixed price, agents are selfish and myopic
Model

Self-selection Stage

- The maximized profit given $A$

$$\log \Pi^*(\omega, A) = \log \omega + \log \psi + \frac{1}{1 - \alpha} \log A - \frac{1}{1 - \alpha} \log r$$

where $\phi \equiv \alpha \frac{1}{1 - \alpha}$ and $\psi \equiv \phi^\alpha - \phi$

- Enter $B_i$ rather than $T$ iff

$$\log \Pi^*(\omega, A) > \log \omega^\sigma$$

$$\implies \text{lower bound } \log \omega \equiv \frac{1}{1 - \sigma} \left[ \log \frac{1}{\psi} - \frac{1}{1 - \alpha} \log A + \frac{\alpha}{1 - \alpha} \log r \right]$$

- $\omega \in (0, 1)$ iff

$$\log A \in \left( (1 - \alpha) \log \frac{1}{\psi} + \alpha \log r - (1 - \sigma)(1 - \alpha), (1 - \alpha) \log \frac{1}{\psi} + \alpha \log r \right)$$

- Assume $\log A_0$ satisfies this condition and consider the case where CTFP satisfies this condition
**Model**

**Dynamics of Entry and Concentration**

- Entry into $B_i$ at $t$:
  \[ e_{it} \equiv n_{i,t} - n_{i,t-1} \]

- Aggregate entry
  \[ E_t \equiv N_t - N_{t-1} = e_{1t} + e_{2t} = L + \kappa(p)N_{t-1}H_{t-1} \]

  where $H_{t-1} \equiv s_{1,t-1}^2 + s_{2,t-1}^2 = s_{1,t-1}^2 + (1 - s_{1,t-1})^2$, the Herfindahl Hirschman Index for concentration at $t - 1$.

- Greater concentration, higher aggregate entry
**PROPOSITION 1**

- Entry $E_t$, the stock of entrepreneurs $N_t$ and concentration $H_t$ are rising in $t$ (for any given $p$) and in $p$ (at any given $t$).

- $E_t - E_{t-1}$ and $H_t - H_{t-1}$ are both rising in $p$ if $\kappa(p) < 1$ for all $p$ and the share of the larger sector at $t - 1$ is not too close to 1.
PROPOSITION 2

- Initial capital size of marginal entrants (and of average entrants if $\sigma > \frac{1}{2}$) in cohort $t$ is decreasing in $p$, and decreasing across successive cohorts for any $p$, in every sector. Averaging across sectors, the initial capital size of marginal entrants (and of average entrants if $\sigma > \frac{1}{2}$) is decreasing more steeply in $p$ across successive cohorts.

- Averaging across sectors, the growth rate of capital size of incumbent entrepreneurs of any past cohort $t$ from $t' - 1 (> t)$ to $t'$ is rising in $t'$ and in $p$. 

Model

Network Dynamics

\[ N_{t-1} \equiv n_{1,t-1} + n_{2,t-1}, s_{i,t-1} \equiv \frac{n_{i,t-1}}{N_{t-1}}, A_{it} = A_0 \exp(n_{i,t-1} \theta(p)) \]

\( t - 1: \)

- **T**
- **B1**
- **B2**

New Agents

- Inflow Stage
  - 1-k
  - \( k_{s_{1,t-1}} \)
  - \( k_{s_{2,t-1}} \)

Self-seletion Stage

- **T**
- **B1**
- **B2

\( t: \)

- **T**
- **B1**
- **B2**
Comments and Critiques 1

- Implication: due to network, people with lower ability and initial capital enter certain sectors $\implies$ misallocation

- No negative spillover effects:
  - larger network, more difficult for knowledge sharing
  - no limit on firm entry and sectoral concentration
Alternative Models - No Network Spillovers

- Origin Heterogeneity
  - replace fixed $k$ as $k(p, t)$, increasing in $p$ and $t$; $A_t$ and $s_i$ invariant in $p$
  - explain firm entry, get trouble in sectoral concentration and post-entry growth
Alternative Models - No Network Spillovers

- **Origin Heterogeneity**
  - replace fixed $k$ as $k(p, t)$, increasing in $p$ and $t$; $A_t$ and $s_i$ invariant in $p$
  - explain firm entry, get trouble in sectoral concentration and post-entry growth

- **Destination Heterogeneity**
  - effect of geography, support provided by local governments, or agglomeration spillovers
  - Example: high $p$ origins have better and increasing access to the faster growing destinations $\Rightarrow$ firms from each origin locate at a unique set of destinations
  - Other possible models
Empirical Analysis - Data

Firm Data

- Firm registration database by the State Administrative of Industry and Commerce (SAIC, 1990-2009)
  - establishment date
  - 4-digit sector
  - location
  - registered capital
  - list of major shareholder and manager (with ID)

- SAIC’s inspection database
  - Annual firm-level information on assets and sales from 2004 onwards.

Network-related Data

- Population and social connectedness
  - China Family Panel Studies (CFPS, 2010)
    - Family module for frequency of social interactions;
    - Individual module for the people interact most and trust level
  - Population census (1982)
    - Population density on county level
    - Education on county level
Network (Social Connectedness)

- Measurement of social connectedness by population density in the entrepreneur’s birth county (for county-born ones)
  - Assumption: Social heterogeneity within counties does not increase with pop density.

- Argument for validity of pop density proxy
  - Condition 1: Positively associated with social connectedness;
  - Condition 2: Sufficient variation in pop density across counties.
Empirical Analysis - Social Connectedness

- Evidence from CFPS (2010)
  - More social interaction are connected with county pop density:
    - Higher frequency of visits and chatting;
    - More likelihood of chatting most with local resident;
    - More trust in local residents;
  - Things are different in city.

- Evidence from population census (1982)
  - Before the rural-urban labor migration in the early 1990’s:
    - Ranges from 20-1000 people per $km^2$
Empirical Analysis - Social Connectedness

Figure 2: Population density across counties (1982)
There could be heterogeneous community network among different counties.

The potential alternative measurement for network

- Counties characterized with more Confucian temples witnessed much less conflicts during economic shock (Kung and Ma, 2014);
- Religiosity is associated with a higher willingness to help and trust of individuals within one’s own community (Gaduh, 2012).
- Measurement: Number of ancestral shrines or temples.
Comments and Critique 2

**Figure 3:** Number of Buddhist temples from 50 CE to late Qing China.
Entry from a given origin is increasing over time and increasing in social connectedness at each point of time; Sector/spatial concentration ↑; Ability and initial firm size ↓; Post-entry growth rates of firm size ↑;
Evidence on Firm Entry

- Nonparametric estimates of relationship between firm entry and pop density
  - The firm entry is:
    - Increasing in pop density at each point in time;
    - Increasing over time;
    - Increasing more steeply in pop density over time.
  - Match with model prediction where pop density is replaced by social connectedness.

![Figure 4: Firm entry](image)
Discussion of other potential explanation

- Case 1: Pop density may be correlated with other variables (education) that determine the model’s outcome.
  - Control for 1982 literacy in an augmented specification;
- Case 2: Entrepreneurs born in high pop density counties have access to sectors or destinations that grew faster.
  - Sector fixed effect and destination fixed effect;
- 60% of county-born entrepreneurs establish their firms outside birth counties, but there are still 40% in their birth county.
- There might be estimation bias in this local group.
  - GDP per capita, infrastructure, financial institutions, labor market etc.
- What’s more, there could be substantial difference between these 2 groups (remain local and outside birth counties)
  - Who choose to run business outside of hometown?
  - Would be helpful to compare the result of 2 groups
Evidence on Firm Size

- There was a negative selection process in firm size due to network externality.
- The firm’s marginal initial capital (bottom 1%) is:
  - Decreasing in pop density at each point in time;
  - Decreasing over time;

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>marginal ability</th>
<th>marginal initial capital</th>
<th>average initial capital</th>
<th>marginal initial capital</th>
<th>average initial capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time period</td>
<td>-18.532***</td>
<td>-0.882***</td>
<td>-0.115***</td>
<td>-0.655***</td>
<td>-0.109***</td>
</tr>
<tr>
<td></td>
<td>(0.409)</td>
<td>(0.012)</td>
<td>(0.008)</td>
<td>(0.009)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Birth county population density × time period</td>
<td>-1.040***</td>
<td>-0.028**</td>
<td>0.002</td>
<td>-0.069***</td>
<td>-0.022***</td>
</tr>
<tr>
<td></td>
<td>(0.394)</td>
<td>(0.012)</td>
<td>(0.008)</td>
<td>(0.010)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>49.36</td>
<td>-1.744</td>
<td>-0.401</td>
<td>-1.223</td>
<td>-0.374</td>
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<td>Origin-sector fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Location fixed effects</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>21,028</td>
<td>43,579</td>
<td>43,579</td>
<td>46,417</td>
<td>46,417</td>
</tr>
</tbody>
</table>
Testing the Mechanism

- Whether initial entry would generates subsequent entry and how
  - One additional initial entrant generates 7 additional in 2000-2004 and 9 in 2005-2009;
  - Conditional on birth-county initial entry, the total number of entrants has no effect on subsequent entry;
  - Effect of initial entry is larger for county with higher pop density.

<table>
<thead>
<tr>
<th>Table 11a. The Effect of Initial Entry on Subsequent Entry (within birth place)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variable:</strong></td>
</tr>
<tr>
<td>Birth place:</td>
</tr>
<tr>
<td>Time period:</td>
</tr>
<tr>
<td>Initial entrants from the birth place</td>
</tr>
<tr>
<td>All initial entrants at the location</td>
</tr>
<tr>
<td>Initial entrants from the birth place × birth place population density</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td><strong>count (1) 2000-2004</strong></td>
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<tr>
<td>7.120*** (0.711)</td>
</tr>
<tr>
<td>0.054 (0.050)</td>
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<tr>
<td>–</td>
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<tr>
<td>–</td>
</tr>
<tr>
<td>3.065 (0.619)</td>
</tr>
<tr>
<td>413,452</td>
</tr>
<tr>
<td><strong>count (2) 2005-2009</strong></td>
</tr>
<tr>
<td>8.935*** (0.972)</td>
</tr>
<tr>
<td>-0.020 (0.057)</td>
</tr>
<tr>
<td>–</td>
</tr>
<tr>
<td>–</td>
</tr>
<tr>
<td>3.128 (0.991)</td>
</tr>
<tr>
<td>804,918</td>
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<tr>
<td><strong>count (3) 2000-2004</strong></td>
</tr>
<tr>
<td>5.239*** (1.065)</td>
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<td>1.361** (0.619)</td>
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<td>413,452</td>
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<td><strong>count (4) 2005-2009</strong></td>
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<td>5.796*** (1.356)</td>
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<tr>
<td>2.262** (0.991)</td>
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<td>804,918</td>
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<td><strong>count (5) 2000-2004</strong></td>
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<td>7.830*** (0.959)</td>
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<td>-0.073 (0.240)</td>
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<td>313,520</td>
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<tr>
<td><strong>count (6) 2005-2009</strong></td>
</tr>
<tr>
<td>6.994*** (0.982)</td>
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<td>–</td>
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<tr>
<td>-0.437** (0.220)</td>
</tr>
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<td>449,207</td>
</tr>
</tbody>
</table>
Structural Estimation and Quantification

\[ e_{ci,t} = G(\alpha, \sigma, r, A_0)k_cS_{ci,t-1} + \frac{\theta}{(1 - \sigma)(1 - \alpha)} k_cS_{ci,t-1} \cdot pn_{ci,t-1} + u_{ci,t} \]

\[ \log K_{ci,t}^\alpha = H_t(\alpha, \sigma, r, A_0, f_t) + \frac{\theta(1 - 2\sigma)}{2(1 - \sigma)(1 - \alpha)} pn_{ci,t-1} + v_{ci,t} \]

- Allow \( \alpha \), which measures the marginal return to capital, to vary across sectors
- 8 structural equations and 6 parameters

\[ \alpha_1, \alpha_2, \alpha_3, \alpha_4, \sigma, \theta \]
Structural Estimation and Quantification

- Seems to fit the data well both within and out of sample except for the initial capital 2000-2004
  - U shape vs decline trend;
  - Has the role of network changed?

Figure 5: Actual and predicted, firm entry and initial capital
Counter factual analysis 1

- Setting $\theta = 0$, thus shut down the network effect;
- Total entrants and stock of capital would have declined by 40% over 1995-2004;
- Sector-level spillovers has no impact on entry.

**Figure 6**: Counter-factual simulation: Effect of community networks on entry and total initial capital.
Counter-factual analysis 2

- Decrease $r$ from 0.2 to 0.15, one-time credit subsidy;
- Total profits generates are less than cost to government; But the spillover effect is substantial.
- The targeted program are strictly better in total profits.

**Figure 7:** Counter-factual simulation: Effect of interest rate subsidy on profits
Policy prescriptions

- May provide subsidized credit to marginal entrepreneurs from high pop density counties due to network externalities

Potential concerns

- Will only be effective where community network is active;
- May cause inter-community inequality.

Takeaways

- Lower ability individuals enter business sector in high pop density counties, it is another kind of misallocation, but it’s second best.
- Due to community network, smaller firms or greater dispersion in firm size may not be inefficient, but rather a effective response to missing markets and formal institutions.
This paper identifies and qualifies the role of community network in the growth of private enterprises in China.
Conclusion

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Set up a model of network based on social connectedness and validate its prediction.

Build a structural model and conduct counter-factual simulations.

Give policy prescription taking consideration of network externality.