What Explains Regional Innovation Disparities at Firm Level: Geographical Location or Firm Behaviour?

Xiaolan Fu

Oxford University

Introduction

- Innovation as a main driver of long term economic growth
- Inequalities in industrial capacity and economic income as a result of unbalanced innovation capacity across regions (Fu, 2008)
- A self-perpetuating cycle that may lead to persistent disparities (Fu, et al, 2011)

- Most research focus on macro and meso level evidence and policy under the framework of regional innovation system, research at micro firm level is limited.

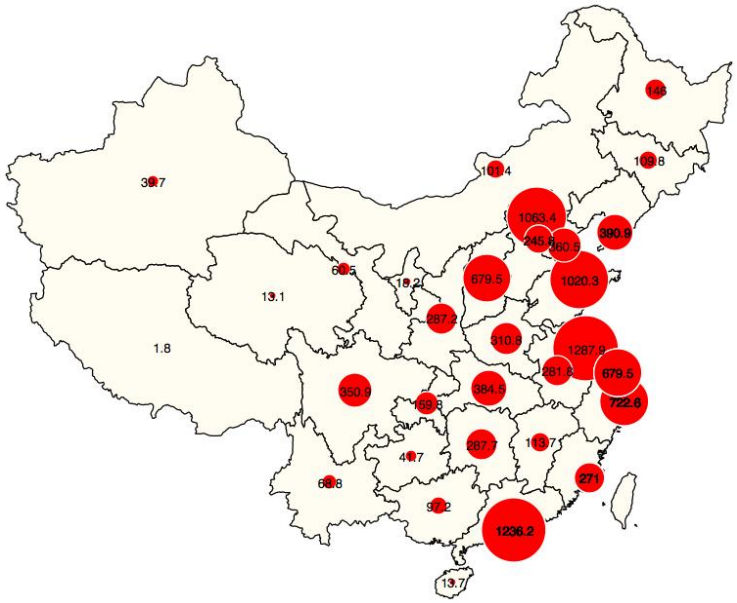
This study

- What explains the difference in innovation performance between firms in the coastal and inland regions?
  - where you locate? or
  - what you do?

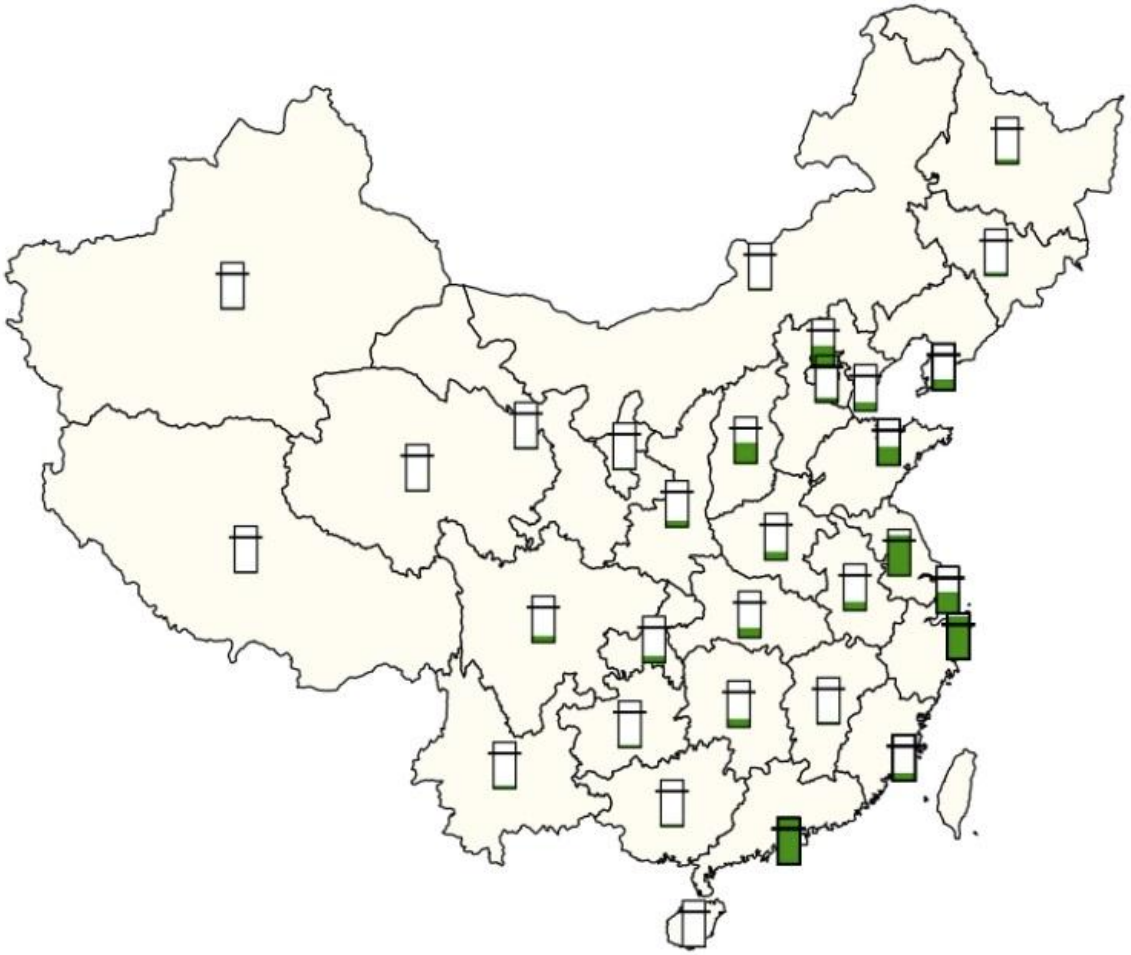
The Geography of innovation in China: 2012

2012, R&D staff

2012 R&D investment



Patent applications, 2012



The increasing regional gap in innovation

2000, R&D spending

2012, R&D spending

Received wisdom

- Sources of regional disparities in innovation performance

- ✓ Foreign direct investment
- ✓ Absorptive capacity
- ✓ Human capital
- ✓ Universities
- ✓ Clusters

Understand cross regional differences at firm level

- Firms innovate less in one region than those in another

  - Locate in a wrong location (unfavourable environment) or they do things differently? May be both.

- Drivers of firm innovation:

  - Leadership and incentives
  - R&D investment (resources, behaviour)
  - Skills, knowledge base (resources)
  - Innovation strategy and management (behaviour)

  Open innovation as a response to constraints and risks (Fu, Chesbrough, et al., 2014)

Data

- Chinese CIS in 2008: 1408 manufacturing firms
- Carried out by National Stat Bureau & Tsinghua Uni
- In 42 cities (both coastal & inland), 83.6% response rate
- 9% SOEs and COEs; 7% POEs, 53% Ltd com, 30% FIEs
- Oversampled large and innovative firms
- 33% small; 50% medium; 17% large-sized firms
- Accounted for 18% of total R&D invest. in manufacturing sector
- Cleaned sample: 802 firms; 95% innovators

Methodology

- Measurement of innovation: % of new sales
  - Novel innovation: new to the world
  - Imitative innovation: new to country/firm & sig. improved.

- Focus on:

  Investment in R&D, ownership, open innovation

  Control for firm size, age, sector

- Generalised Tobit (Hurdle) model: correction of selection bias
- Test for endogeneity.

Innovation in inland and coastal China: Does geographic location matter:

	Novel	Imitative	Novel	Imitative
Coastal	2.170**	-3.007	1.407	-1.287
	(0.944)	(2.05)	(0.963)	(2.091)
Foreign-invested firm			3.458***	-7.798***
			(0.952)	(2.065)

Data: use China National Innovation Survey carried out by National Statistical Bureau
1408 valid firm level responses in more than 40 cities.

Coastal & Inland China: Does geographical location matter

	Novel new sales	Imitative new sales
Coastal region	**2.644**	**-6.406***
	4.892	**3.533**
Foreign-invested firms	15.24***	-5.787
	5.158	3.934
Coop-international	16.13***	1.819
	5.178	3.61
Coop-domestic	-1.277	7.565*
	5.728	3.921
Ln (intra mural R&D)	1.326	2.776***
	0.903	0.59
Ln (extra mural R&D)	1.515**	-0.074
	0.642	0.462
age	-0.132	-0.066
	0.157	0.0622
size	1.019	-5.425
	5.57	3.868
Constraints in Human capital	-2.361	-4.431
	5.13	3.913
Industry dummies	yes	yes
Constant	yes	Yes
Observations	819	804
LogLikelihood	-1291	-3320

Differences in the breadth of open innovation (OI)

	1	*2*	*3*	*4*
Firm Size	0.531***	0.489***	0.528***	0.559***
Firm age	0.004	0.005	0.005	0.005
SOE	0.136	0.203	0.197	0.162
POE	0.278	0.341	0.296	0.258
Coastal reg	0.347*	0.272	0.230	0.290
IntramuralR&D	0.551***	0.523***	0.492***	0.520***
ExtramuralR&D	0.399***	0.419***	0.409***	0.397***
Collaboration	0.173**	0.193**	0.167*	0.153*
Finance/risk constraints	0.459***			0.298**
Knowledge/skills constraints		0.286**		-0.238
Institute/market constraints			0.639***	0.652***
Industry	Yes	Yes	Yes	Yes

Differences in the depth of OI

	1	*2*	*3*	*4*
Firm Size	0.082***	0.057***	0.077***	0.080***
Firm age	0.009***	0.009***	0.010***	0.009***
SOE	0.018	0.063	0.065	0.052
POE	0.238***	0.244***	0.218***	0.220***
Coastal reg	0.390***	0.363***	0.338***	0.347***
IntramuralR&D	0.529***	0.545***	0.518***	0.522***
ExtramuralR&D	0.166***	0.149***	0.154***	0.136***
Collaboration	0.129***	0.121***	0.115***	0.111***
Finance/risk constraints	0.236***			0.084***
Knowledge/skills constraints		0.328***		0.130***
Institute/market constraints			0.418***	0.265***
Industry	Yes	Yes	Yes	Yes

Drivers of innovation: differences between regions

	Coastal		Inland	
	Novel	Imitative	Novel	Imitative
co_i	**19.30*** **	1.914	10.78	0.016
co_d	-5.754	**10.79** **	10.26	-2.975
lrdin	0.34	**2.916*** **	**5.833*** **	**2.311** **
lrdex	**1.848** **	-0.305	0.136	0.683
foreign	**15.85*** **	-7.190*	11.33	5.407
age	-0.376	-0.05	-0.135	-0.048
size4	13.55**	-3.945	-27.35***	-5.814
lack_hc1	-4.056	-2.092	2.331	-9.691

	International collaboration and novel innovation					
	1	2	3	4	5	6
Company group_i	6.114					
Supplier_i		11.74*				
Customer_i			33.34***			
Competitor_i				15.47**		
Private Res Inst._i					19.32**	
Universities & PRI_i						23.54**
Int'l collaboration	16.02***	11.89*	-2.714	12.19**	15.60***	15.60***
Domestic collab.	-4.806	-5.451	-5.332	-4.723	-4.75	-4.525
Ln(intramural R&D)	1.129	1.17	1.118	1.06	1.132	1.11
Ln(extramural R&D)	1.569**	1.541**	1.640**	1.470**	1.508**	1.504**
age	-0.178	-0.176	-0.167	-0.188	-0.176	-0.169
size4	2.762	2.726	2.178	2.81	2.558	2.307
lack_hc1	-2.056	-2.1	-2.924	-1.769	-2.253	-1.011
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	819	819	819	819	819	819

	Domestic collaboration and diffusionary innovation					
	1	2	3	4	5	6
Company group_d	5.904					
Supplier_d		2.745				
Customer_d			7.617**			
Competitor_d				1.724		
Private Res Inst.-d					2.437	
Universities & PRI_d						-0.872
Int'l collaboration	-0.109	0.041	-0.714	0.000	-0.069	0.219
Domestic collab.	6.541	7.805*	5.527	8.657**	8.547**	9.917*
Ln(intramural R&D)	2.725***	2.767***	2.803***	2.754***	2.760***	2.760***
Ln(extramural R&D)	-0.107	-0.098	-0.111	-0.096	-0.124	-0.086
age	-0.035	-0.038	-0.039	-0.037	-0.037	-0.036
size4	-6.546*	-6.206	-6.137	-6.121	-6.252	-6.152
lack_hc1	-4.070	-4.330	-4.589	-4.258	-4.302	-4.158
Observations	802	802	802	802	802	802
loglikelihood	-3313	-3314	-3312	-3314	-3314	-3314

	Inland region: Collaboration and innovation					
	1	2	3	4	5	6
Company group	Domestic** +Diffusionary					
Supplier		insig				
Customer			Domestic* +Diffusionary			
Competitor				insig		
Private Res Inst.					insig	
Universities & PRI						International** +Novel

To what extent can ICT facilitate territorial inclusiveness?

Importance of information sources for innovation activities: Top 6 sources

1. Clients or customers
2. Internet (Conditional on being connected)
3. Sources within your enterprise (colleagues)
4. Member of cluster
5. Member of associations
6. Competitors or other enterprises in your sector

Source: DILIC survey in Ghana 2014

TECHNOLOGY and MANAGEMENT for DEVELOPMENT CENTRE

UNIVERSITY OF OXFORD

Top 10 important foreign knowledge sources
(1-5, Insignificant=1 , Crucial = 5)

		MEAN
A.	Imported machinery and equipment	2.18
B.	Imported goods in the same industry	1.73
C.	Imported goods that input as intermediary goods into your production	1.72
D.	Foreign customers	1.64
E.	Observing and imitating competitors in export market	1.54
F.	New product or quality requirement raised by customers in export market	1.50
G.	Foreign firms in the same industry	1.52
H.	Foreign firms In downstream industry	1.51
I.	**Information found via internet**	1.55
J.	Attending international trade fairs	1.52

Source: DILIC survey in Ghana 2014

TECHNOLOGY and MANAGEMENT for DEVELOPMENT CENTRE

UNIVERSITY OF OXFORD

Conclusions and Policy implications

- Variations in firm innovation performance are significantly associated with “what they do” instead of “where they are”.

- How much do they invest in R&D?
- How do they spend in R&D: in-house vs extramural.
- Openness in innovation and Collaboration
- Collaborate along the value chain
- Linkages with universities

- A role of ICT in facilitating territorial inclusiveness, esp. SMEs

Thank you!

Future research: Attributes of different firm behaviour:
Marketisation and incentive structure

Sources of R&D investment, 2012