





LM Business | FF.2

Business, Markets, and Competition

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Diffusion and embeddedness of innovative activities in China

Reference materials

- 1. Prodi G, Frattini F, Nicolli F, 2018, The Diffusion and Embeddedness of Innovative Activities in China, Economia Politica 35(1): 71–106
- 2. Naughton B, 2018, *The Chinese Economy* (second edition). MIT Press: 95–126
- 3. Abramovitz M, 1986, <u>Catching Up</u>, Forging Ahead, and Falling Behind. *The Journal of Economic History* 46(2): 385–406
- 4. Lall S, 1992, <u>Technological capabilities</u> and industrialization, <u>World Development</u> 20(2):165–186

Economic development in China after 1978

a summary

First, prepare to the market

1979–1992

Second, empower the market

1992-2001

Third, a market socialist economy

2001-onward

Technological upgrade, innovative activities and economic growth

Seeding economic growth

- SEZs have been originally established in four cities during the 80s (Shenzhen, Zhuhai, Shantou, Xiamen). Later, also in Shanghai, Tianjin and Hainan.
- They are all coastal regions.
- In 1981, the four original SEZs were attracting more than 60% of all FDI in China.
- SEZs can represent exogenous seeds of innovative activities.

Seeding innovative activities

- The growth of innovative activities in the SEZs have been often complemented by supporting governmental initiatives, such as technological and development parks.
- The most relevant of these initiatives here are:
 - Spark Program (1985)
 - Torch Program (1988)
 - Technology Spreading Program (1990)
- These initiatives represent endogenous seeds of innovative activities (that can be complementary or not with exogenous activities).



Patent applications to EPO from inventors resident in China, 1981–2009. Arrangement on the OECD REGPAT database, January 2014. Prodi et al., 2018.

Might a strategy reliant on importing foreign technologies having constrained or delayed innovative activities to take roots?

A matter of "embeddedness"

How to understand the relevance of "embeddedness"?

Assumptions

- Patents can be used as a proxy for innovative activities.
- Inventors' location can be used to locate "material" innovative activities.
- Applicants' location can be used to locate initiative, financing and control of innovative activities.
- A relative prevalence of inventors and applicants in a city can be used to "measure" the embeddedness of innovative activities.

– Patents from Taiwan, Hong Kong and Macau excluded.

Strategy (very in brief) 1/3

- tot_{it} is the number of patent fractions located in a city i in a year t (without a separation between inventors and applicants)
- app_{it} is the number of patent fractions located in a city i in a year t based on applicants
- $\texttt{inv}_{\texttt{it}}$ is the number of patent fractions located in a city i in a year t based on inventors
- both_{it} is the number of patent fractions located in a city i in a year t based on applicants AND inventors

Strategy (very in brief) 2/3 $APP_{it} = (app_{it} - both_{it}) / tot_{it}$ BOTH_{it}=both_{it}/tot_{it} INV_{it}=(inv_{it}-both_{it})/tot_{it} O≤APP_{i+}, BOTH_{it}, INV_{it}≤1 $APP_{it} + BOTH_{it} + INV_{it} = 1 \quad \forall i, t:tot_{it} > 0$

Strategy (very in brief) 3/3

- A period average is computed for the three indexes.
- Indexes are taken to group cities based on an unconstrained procedure.
- Groups' centroids are taken to regroup cities based on a constrained procedure (efficiency).
- The groups obtained are arranged and ranked according to assumptions about embeddedness.



Distribution of the INV index across Chinese prefectural cities, 1981–2009. Arrangement on the OECD REGPAT database, January 2014. Prodi et al., 2018.



Distribution of the BOTH index across Chinese prefectural cities, 1981–2009. Arrangement on the OECD REGPAT database, January 2014. Prodi et al., 2018.



Distribution of the APP index across Chinese prefectural cities, 1981–2009. Arrangement on the OECD REGPAT database, January 2014. Prodi et al., 2018.

	Ranked groups	F	Resulting cluster	sulting clusters			# of cases	
Code	Description	S1	S2	S3	S1	S2	S3	
0	No activity (not included)				305	258	158	
1	INV	2, 5, 6	4, 5, 6	3, 4	29	68	130	
2	INV and BOTH	3, 4	1	5	3	7	38	
3	ВОТН	1, 7	2, 3	1	8	12	14	
4	both and app			2	0	0	5	
5	APP				0	0	0	

Arrangement of resulting clusters into ranked groups. Prodi et al., 2018.

What evidence?

Four main trends

- 1. A rapid diffusion of innovative activities across Chinese cities
- 2. A growing volume of innovative activities overall
- 3. A stronger growth of innovative activities where they have taken roots first
- 4. Innovative activities also gaining embeddedness



Groups of innovative cities in China, 1981–1992. Prodi et al., 2018.



Groups of innovative cities in China, 1993–2001. Prodi et al., 2018.



Groups of innovative cities in China, 2002–2009. Prodi et al., 2018.

Selected cities/regions	Ranked group		S1	S2	S3
SEZ	0	No activity (not included)	28.6	14.3	14.3
	1	INV	42.9	28.6	28.6
	2	INV and BOTH	14.3	28.6	28.6
	3	ВОТН	14.3	28.6	28.6
	4	BOTH and APP	0.0	0.0	0.0
Zhejiang	0	No activity (not included)	72.7	54.5	0.0
	1	INV	18.2	27.3	45.5
	2	INV and BOTH	0.0	9.1	18.2
	3	ВОТН	9.1	9.1	27.3
	4	BOTH and APP	0.0	0.0	9.1

Distribution of ranked groups among selected cities/regions (%). Prodi et al., 2018.

What conclusions?

A growing diffusion and embeddedness of innovative activities in Chinese cities

This process is aligned with overall economic development

There is evidence since 2001 especially

SEZs were crucial to seed innovative activities in a number of Chinese cities

Exogenously seeded innovative activities keep being strongly related to imported capitals

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