

What's the Effect of FDI on Domestic Innovation Capability?

- Empirical Analysis of 30 Provinces Based on Spatial Panel Model

Ying Sun

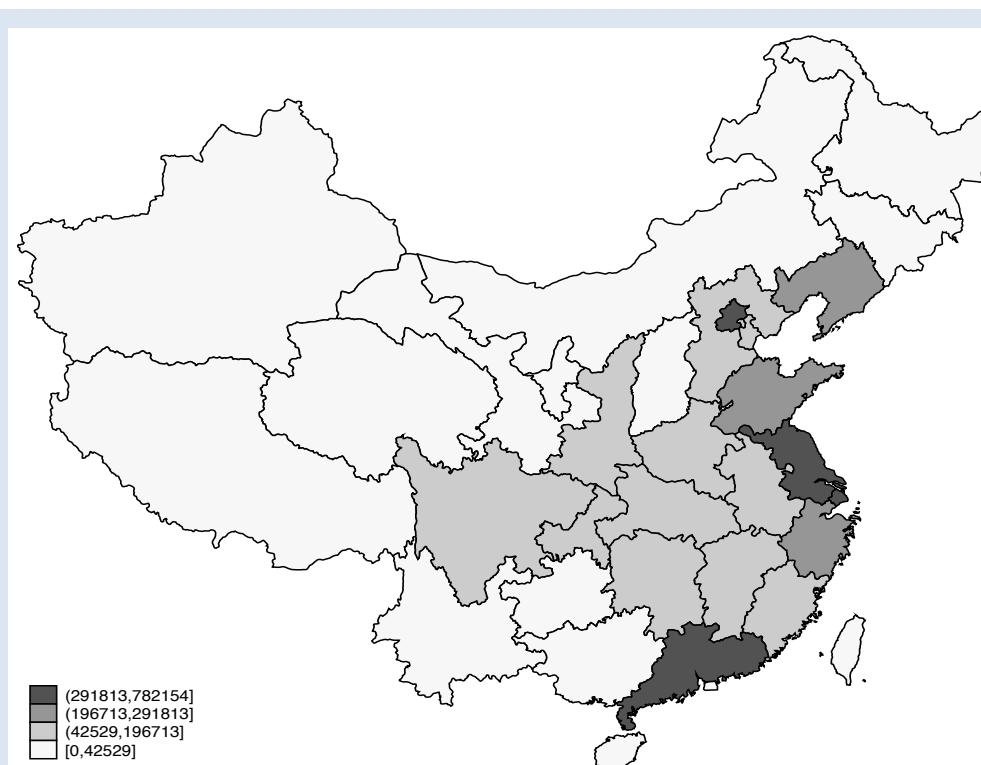
Master of Computational Social Science, Social Science Division, University of Chicago

June 03, 2019

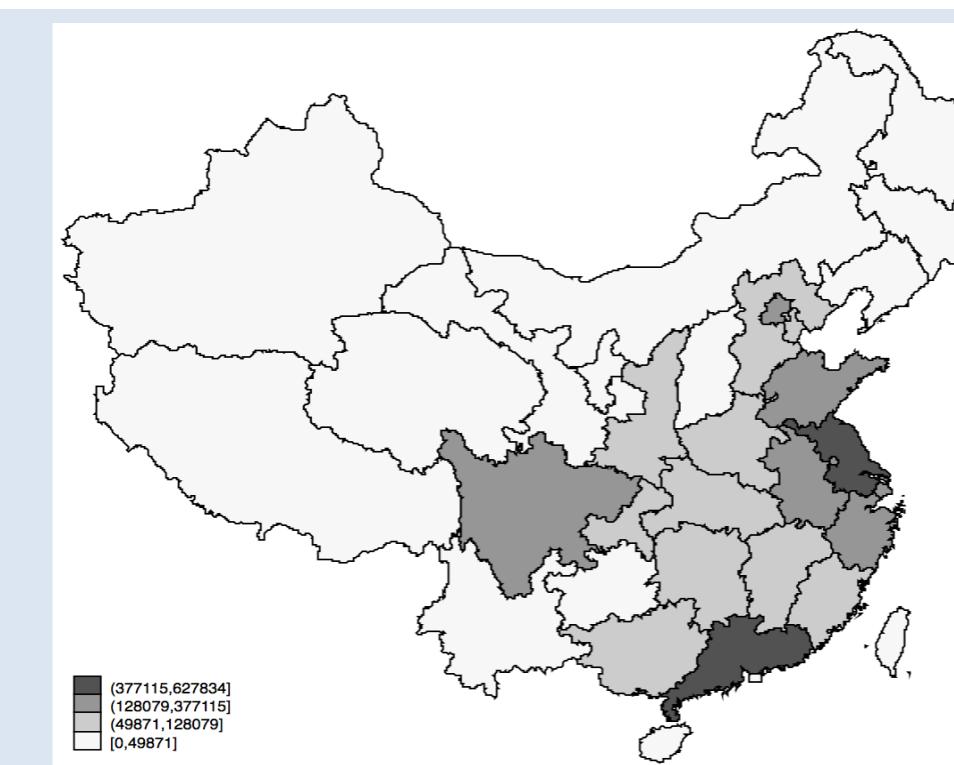
INTRODUCTION

FDI not only includes transnational flow of tangible capital, but also the international transfer of intangible capital such as technology and management methods. According to some countries' practical experience, it has many effects on host countries such as promoting technological progress, stimulating economic growth and updating the industrial structure. While it may be a different story in another country. But there is commonly accepted viewpoint that with deeper and further utilization of FDI, the technology spillover effects of FDI has increasingly become an important factor affecting regional technological innovation capabilities. However, whether FDI can enhance the level of regional technological innovation has not yet been formed consensus in the academic community.

DATA



FDI Distribution



Patent Distribution

Data source:

Wind database

China National Statistics Bureau

Variables:

regional actual utilization of foreign direct investment;

Foreign Direct Investment;

- Control Variables:

Regional innovation environment:

Degree of regional openness (international imports and exports);

Market competition level (total score of marketization process);

Economic power (GDP)

Regional absorption capability:

Regional R&D investment: Industrial Enterprises above Scale: R&D Funds)

Human capital:

Average number of students per 100,000 population: higher education

METHODS & MODEL

Spatial Durbin Model

$$y = \rho Wy + X\beta + \iota_n\alpha + WX\theta + \varepsilon$$

$$(I_n - \rho W)y = X\beta + WX\theta + \iota_n\alpha + \varepsilon$$

Denotes $S_r(W) \equiv V(W)(I_n\beta_r + W\theta_r)$ and $V(W) = (I_n - \rho W)^{-1} = I_n + \rho W + \rho^2 W^2 + \rho^3 W^3 + \dots$

Then we can rewrite the second equation:

$$\begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{pmatrix} = \sum_{r=1}^k \begin{pmatrix} S_r(W)_{11} & \dots & S_r(W)_{1n} \\ S_r(W)_{21} & \dots & S_r(W)_{2n} \\ \vdots & \ddots & \vdots \\ S_r(W)_{n1} & \dots & S_r(W)_{nn} \end{pmatrix} \begin{pmatrix} x_{1r} \\ x_{2r} \\ \vdots \\ x_{nr} \end{pmatrix} + V(W)\iota_n\alpha + V(W)\varepsilon$$

So we can get the following equation:

$$\frac{\partial y_i}{\partial x_{jr}} = S_r(W)_{ij}$$

And calculate the average direct effect and average total effect:

$$\text{Average Direct Effect} = \frac{1}{n} \text{trace}[S_r(W)]$$

$$\text{Average Total Effect} = \frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n S_r(W)_{ij}$$

CONCLUSIONS

1. FDI has no significant positive spillover effect on regional innovation capability.
2. Regional innovation environment (regional openness, market competition and economic power) has positive effect on the regional innovation capability.
3. Regional absorption capability (R&D investment intensity and human capital) has significant positive effect on regional innovation ability.

REFERENCES

- [1] Haskel, Jonathan E., Sonia C. Pereira, and Matthew J. Slaughter. "Does inward foreign direct investment boost the productivity of domestic firms?." *The review of economics and statistics* 89.3 (2007): 482-496.
- [2] Smarzynska Javorcik, Beata. "Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages." *American economic review* 94.3 (2004): 605-627.
- [3] LeSage, James P. "An introduction to spatial econometrics." *Revue d'économie industrielle* 123 (2008): 19-44.

RESULTS

1. Generate the Spatial Weights Matrix (SWM)

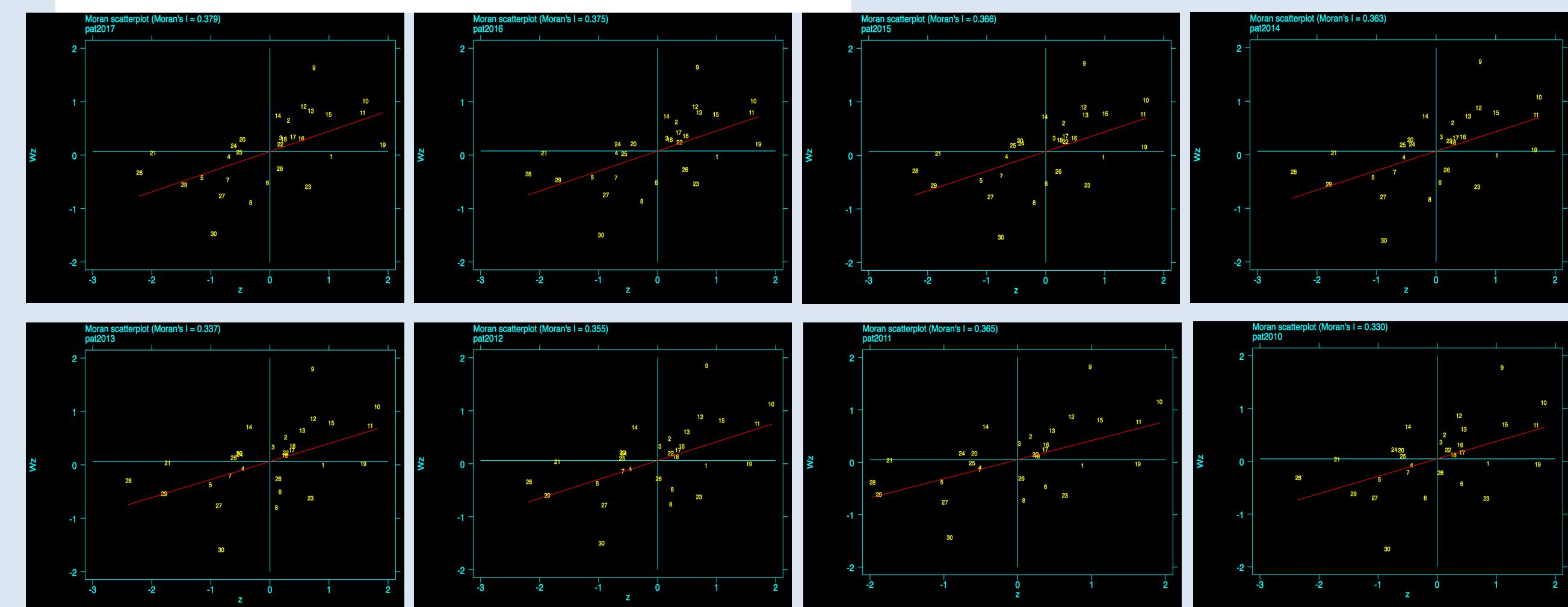
- Binary adjacency matrix in which W_{ij} represents the adjacency relationship between unit i and unit j
- By implementing the map data of China, generate the 30×30 binary adjacency matrix in GeoDa.

2. Spatial Autocorrelation Test

Table 1: Global Moran's I

Variables	I	E(I)	Sd(I)	z	p-value*
Pat2017	0.337	-0.034	0.109	3.398	0.001
Pat2016	0.335	-0.034	0.109	3.373	0.001
Pat2015	0.334	-0.034	0.109	3.374	0.001
Pat2014	0.321	-0.034	0.109	3.264	0.001
Pat2013	0.296	-0.034	0.109	3.039	0.002
Pat2012	0.311	-0.034	0.109	3.159	0.002
Pat2011	0.316	-0.034	0.109	3.193	0.001
Pat2010	0.268	-0.034	0.109	2.766	0.006
Pat2009	0.269	-0.034	0.109	2.764	0.006
Pat2018	0.226	-0.034	0.109	2.382	0.017

$$\text{Moran } I = \frac{n \sum_{i=1}^n \sum_{j=1}^n W_{ij}(X - \bar{X})}{\sum_{i=1}^n \sum_{j=1}^n W_{ij} \sum_{i=1}^n (X - \bar{X})^2}$$



3. Setting and Testing of Spatial Panel Model

Spatial Panel AutoCorrelation Tests		
Ho: Error has No Spatial AutoCorrelation		
Ha: Error has Spatial AutoCorrelation		
GLOBAL Moran MI = 0.4953	P-Value > Z(15.168)	0.0000
GLOBAL Geary GC = 0.5035	P-Value > Z(-10.878)	0.0000
GLOBAL Getis-Ord = 2.1579	P-Value > Z(-15.168)	0.0000
Moran MI Error Test = 3.7264	P-Value > Z(13.654)	0.0002
LM Error (Burridge) = 188.5863	P-Value > Chi2(1)	0.0000
LM Error (Robust) = 143.6681	P-Value > Chi2(1)	0.0000
Ho: Spatial Lagged Dependent Variable has No Spatial AutoCorrelation		
Ha: Spatial Lagged Dependent Variable has Spatial AutoCorrelation		
LM Lag (Anselin) = 82.0032	P-Value > Chi2(1)	0.0000
LM Lag (Robust) = 37.0851	P-Value > Chi2(1)	0.0000
Ho: No General Spatial AutoCorrelation		
Ha: General Spatial AutoCorrelation		
LM SAC (LMErr+LMlag_R) = 225.6714	P-Value > Chi2(2)	0.0000
LM SAC (LMlag+LMerr_R) = 225.6714	P-Value > Chi2(2)	0.0000

4. Estimated Results

SDM with random-effects		
Main	FDI	-0.031
Regional Innovation Environment	Regional Openness	0.144**
	Market Competition	0.426**
	Economic Power	1.156***
Regional Absorption Capacity	R&D	0.390***
	Human Capital	0.631***
Spatial	rho	0.424***

Note: p-value in parentheses. * p<0.1, ** p<0.05, *** p<0.01

CONTACT INFORMATION

Email: sunying2018@uchicago.edu

Full research material:
https://github.com/sunying2018/persp-research-econ_Spr19.git