

The 62nd European Regional Science Association Congress



How Regions Cope with Shocks?

Studies of Regional Economic Resilience in China

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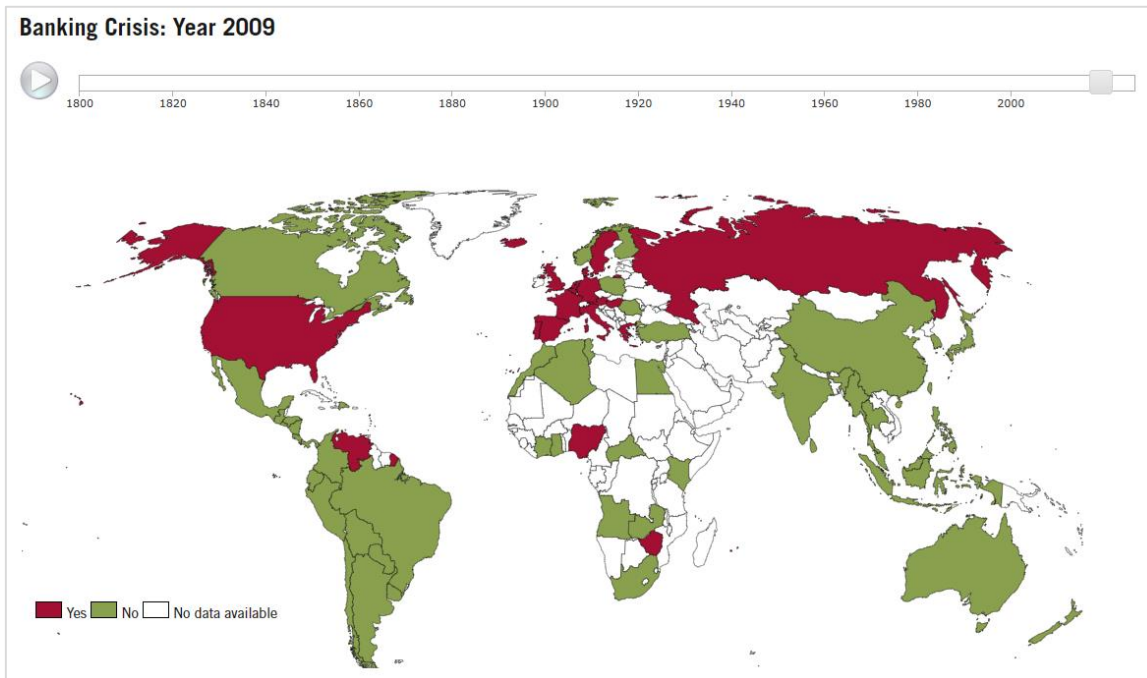
August 28th - Sept. 01st, 2023

Alicante, Spain

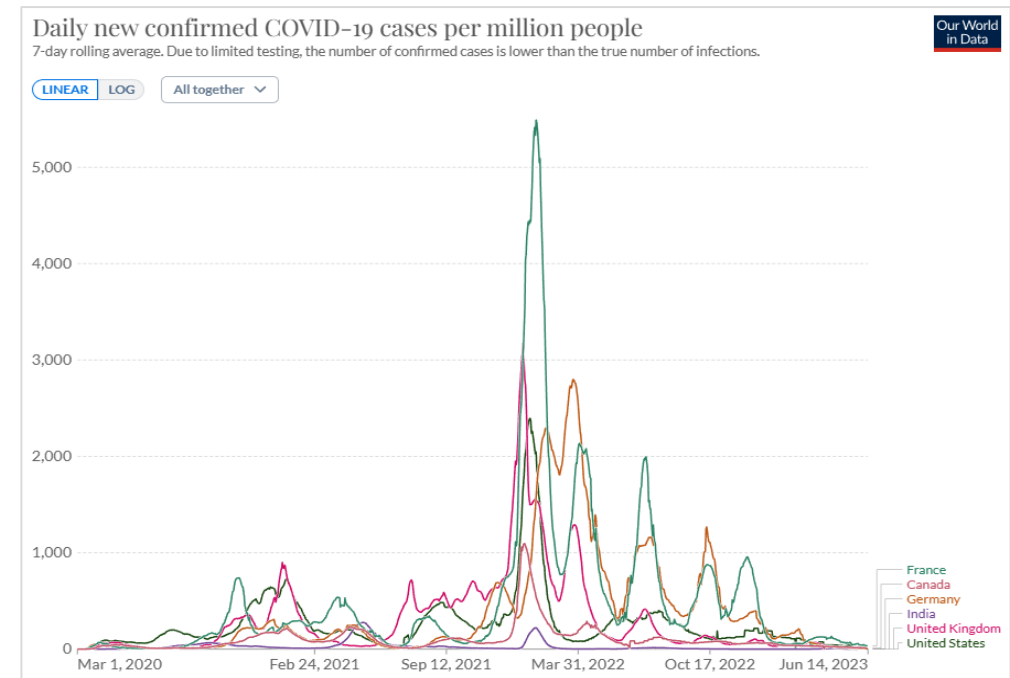
Why this topic

- In recent years, globalization has changed dramatically;
- Shocks, wars and trade frictions lead to decoupling, recoupling, reshoring, derisking...
- “Grey rhinos” and “black swans” are popping up all over the place;
- The research on **regional economic resilience** provides new insights !

how to heal the world ?

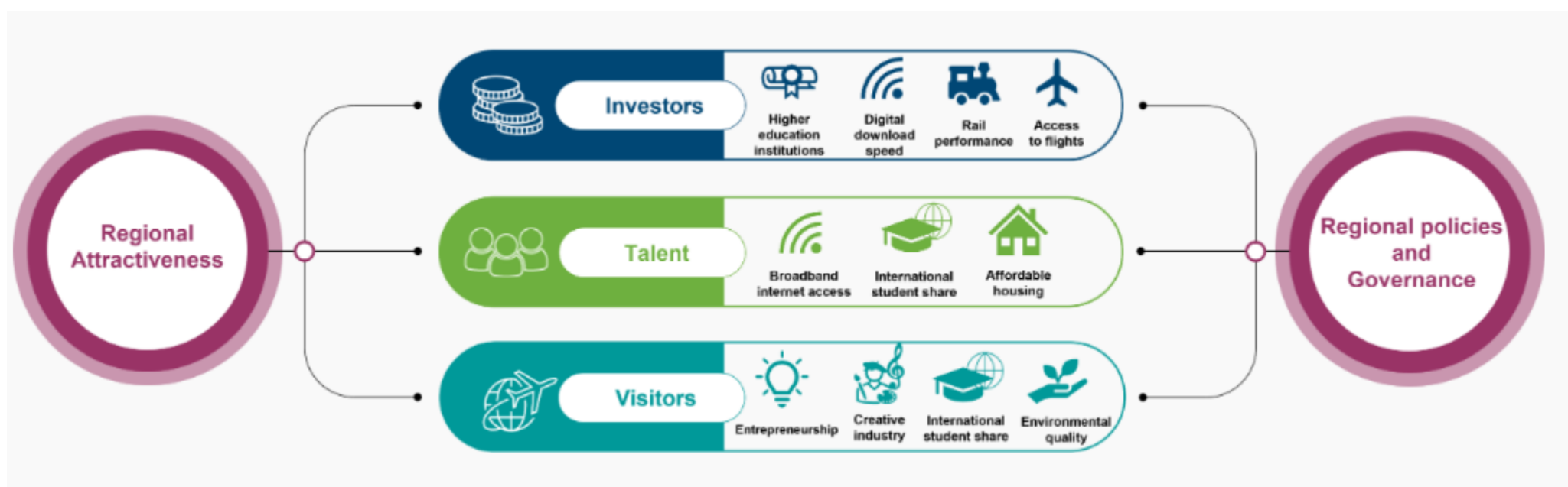


Harvard Business School



The role of regions

- Region is the main vehicle for large countries to participate in economic globalization;
- Global-local interactions contribute to tighter linkages among world regions;
- Region, as a complex giant system, may win **benefits** or suffer **losses** from such linkages;
- How to cope with external shocks is vital for regional development and policy implementation.



Part 1: Theories

1.1 / **Concept & Context**

1.2 / **Theoretical development**

1.3 / **Theoretical outlook**

Part 2: Empirics

2.1 / **Financial crisis and RER**

2.2 / **US-China trade conflicts and RER**

2.3 / **COVID-19 pandemic and RER**

Outline

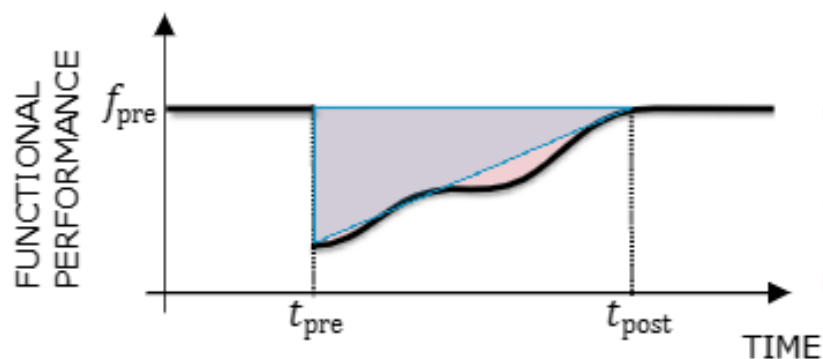
Part 1 Theories

Some definitions and reviews...

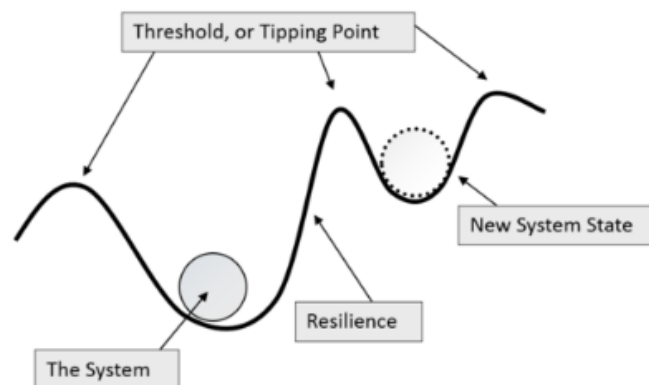
- 1.1 **Concept & Context**
- 1.2 **Theoretical development**
- 1.3 **Theoretical outlook**

1.1 Concept & Context

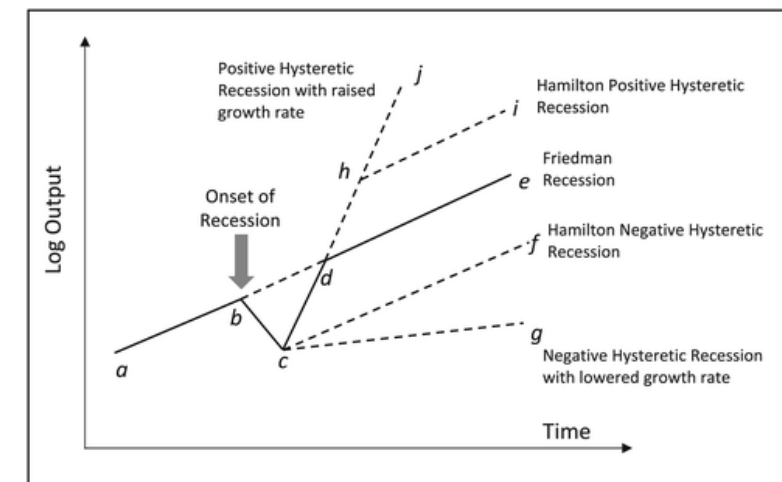
- A large literature has explored the resilience of regional economic systems after the 2008 financial crisis;
- Resilience has been viewed from engineering, ecological and adaptative perspectives;
- Overall, resilience is the ability of a system to bounce back from shocks;
- But not necessarily reach another equilibrium... e.g. evolutionary resilience



Engineering perspective
 Altherr et al., (2018)



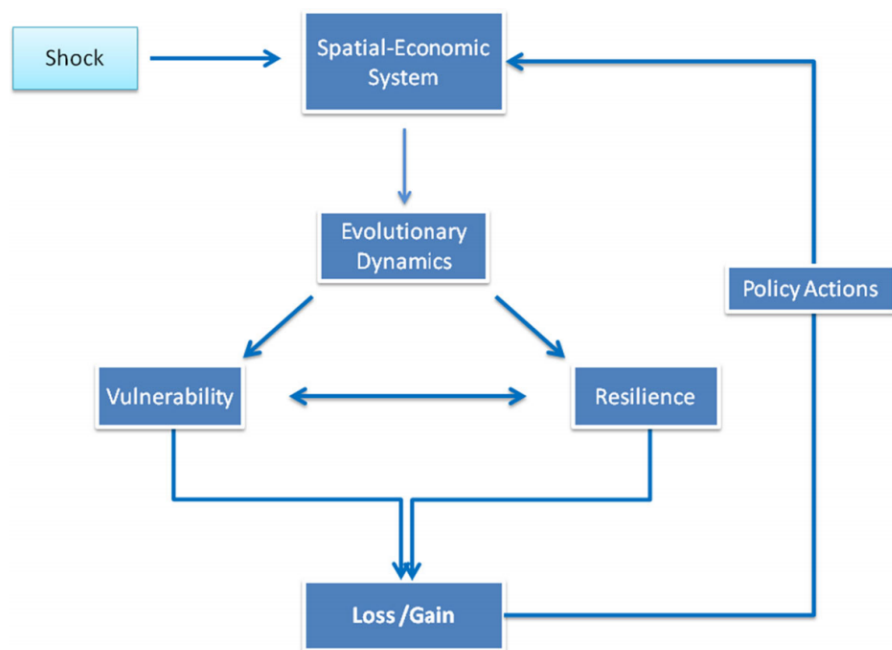
Ecological perspective



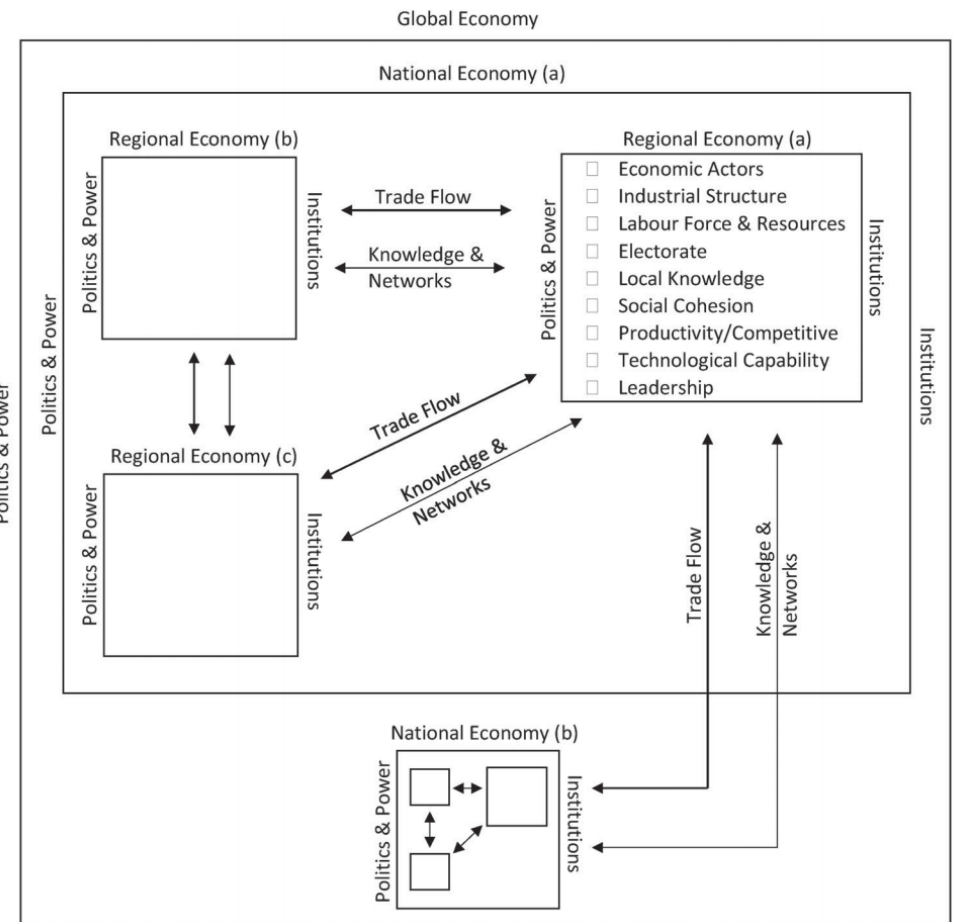
Evolutionary perspective
 Martin and Sunley (2015)

1.1 Concept & Context

- Regional economic resilience refers to the ability of a region to withstand and recover from shocks and disruptions. It involves the capacity of a region to adapt, adjust, and bounce back from shocks that may negatively impact the local economy.
- Viewing economic resilience from a spatial perspective so that we can study the spatial distribution of economic resilience.



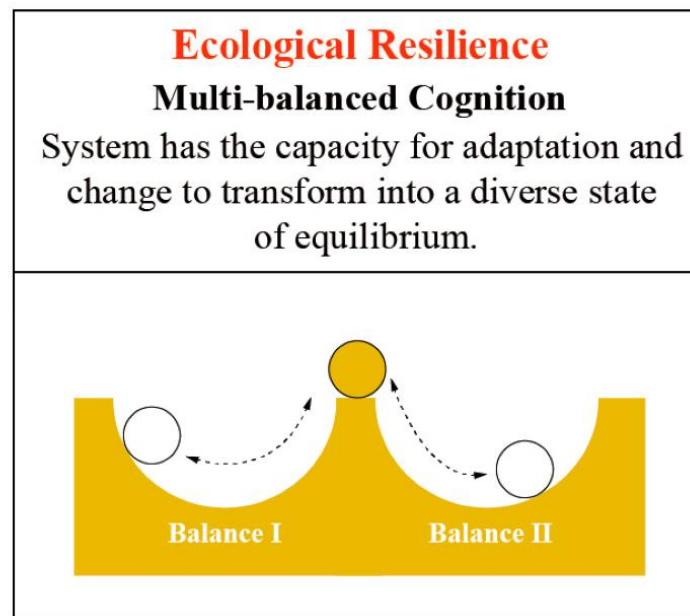
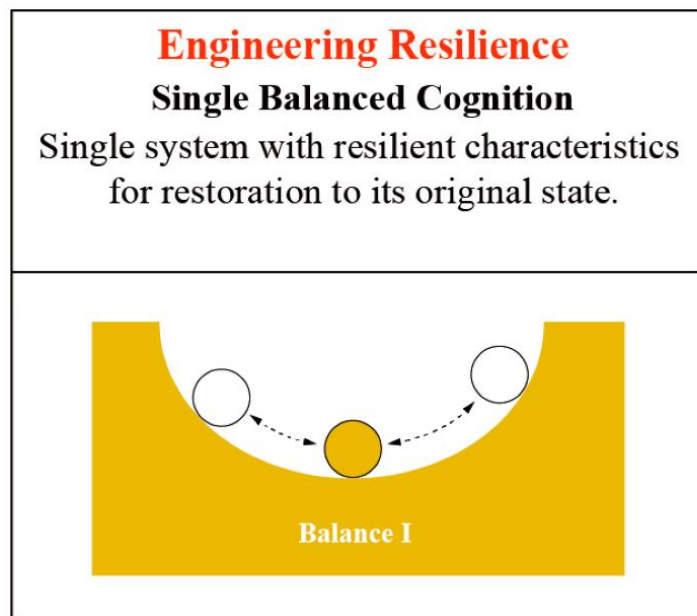
Spatial economic resilience
 Modica and Reggiani (2014)



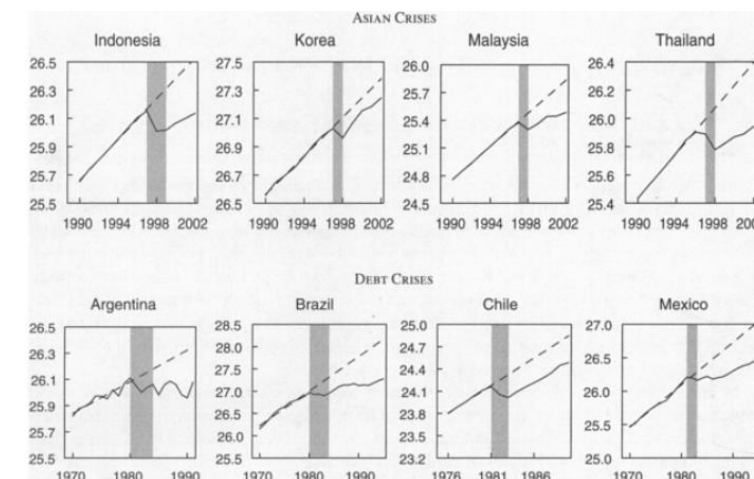
Multi-scale determinants of regional economic resilience
 Sutton and Arku (2022)

1.2 Theoretical development

- The **equilibrium perspective** believes that the bouncing back could reach the original level;
- Or, achieve a new equilibrium... maybe lower or maybe higher;
- Common in physics, engineering and ecology. But is that true in an economic system ?



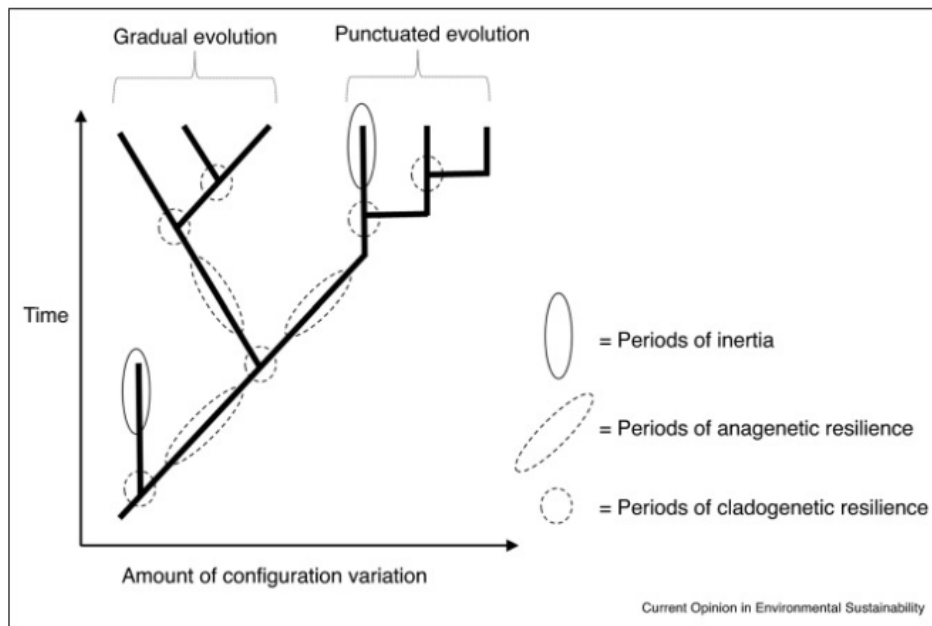
Wu et al. (2022)



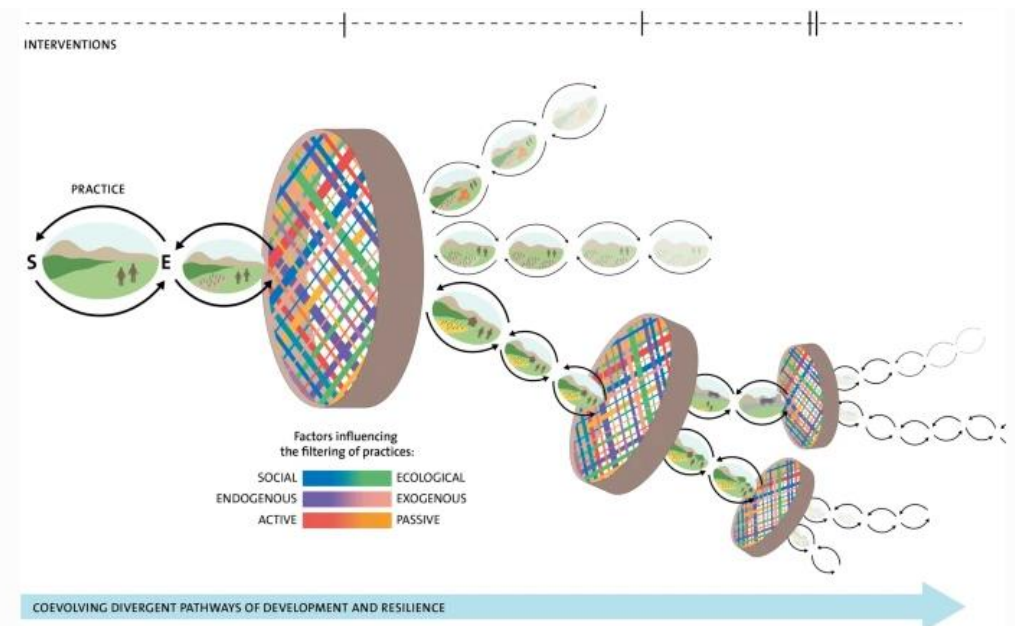
Cerra and Saxena (2008)

1.2 Theoretical development

- However, regional development is a complex system;
- No straightforward equilibrium, but evolutionary and adaptive;
- Hence, the **adaptive resilience** fits better;
- Path dependence, varieties and complexity have been integrated with economic resilience.



McCarthy et al. (2017)

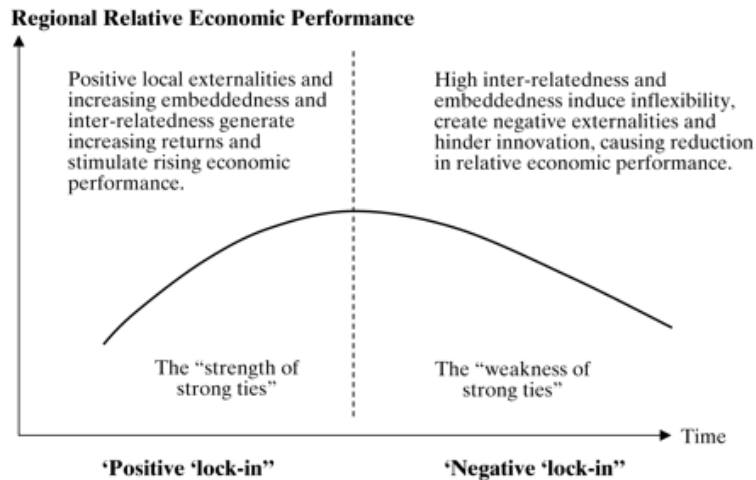


Haider et al. (2021)

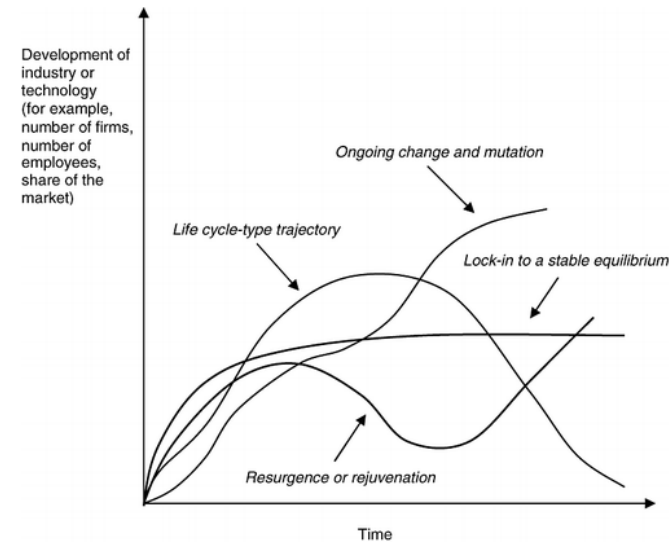
1.2 Theoretical development

Path dependence

- Path dependence, path lock-in, path creation... are important components of the theory;
- Regional development is highly related to industrial base, historical conditions, endowments...;
- Path lock-in may weaken regional innovation, thus leading to poor economic resilience;
- For instance, old industrial bases in USA & China...



Martin and Sunley (2006)

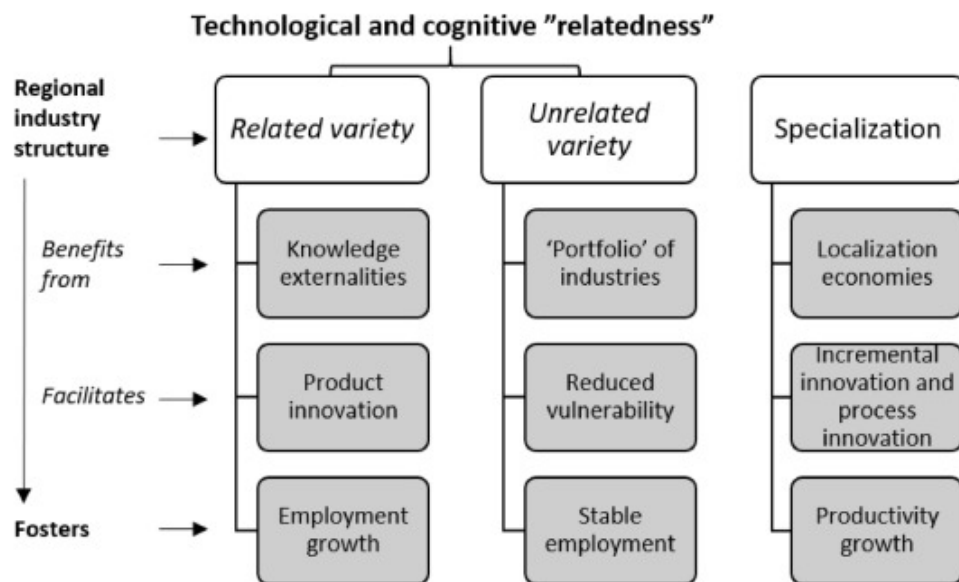


Martin (2015)

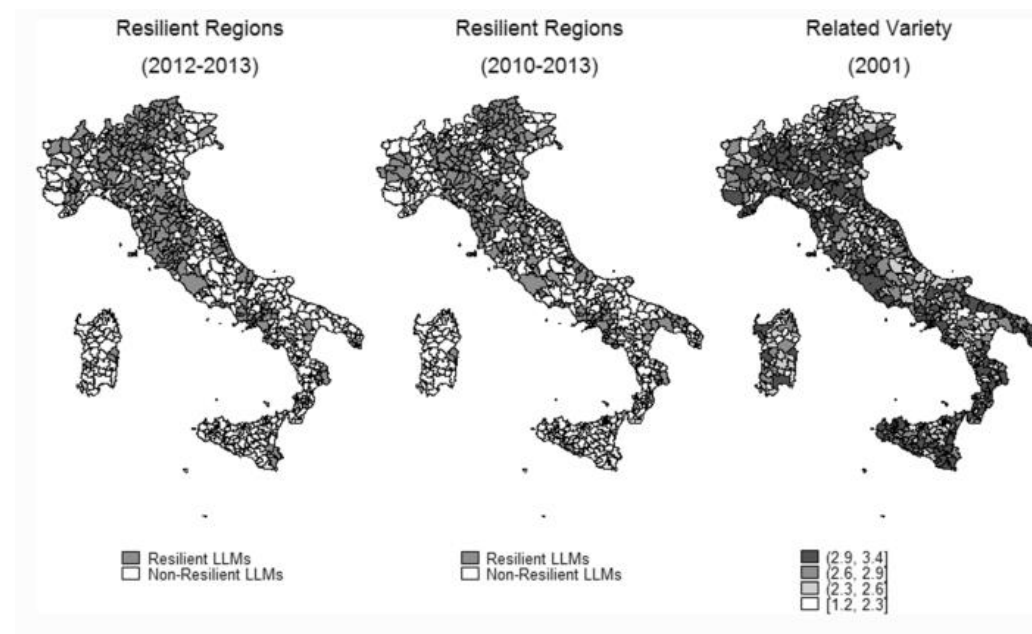
1.2 Theoretical development

Varieties

- Regional industrial variety as a source of generating economic externalities;
- Related variety vs unrelated variety;
- Who promotes or harms regional economic resilience ? Not sure...



Ejdemo and Örtqvist (2020)

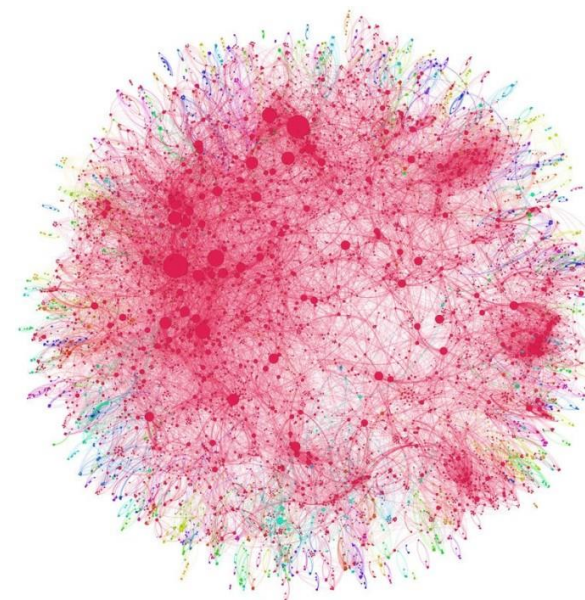
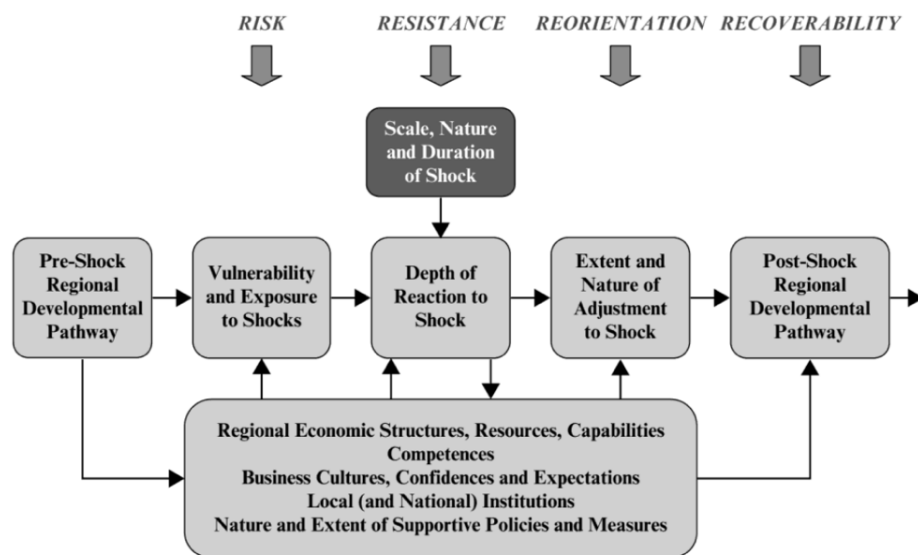


Cainelli et al. (2019)

1.2 Theoretical development

Complexity

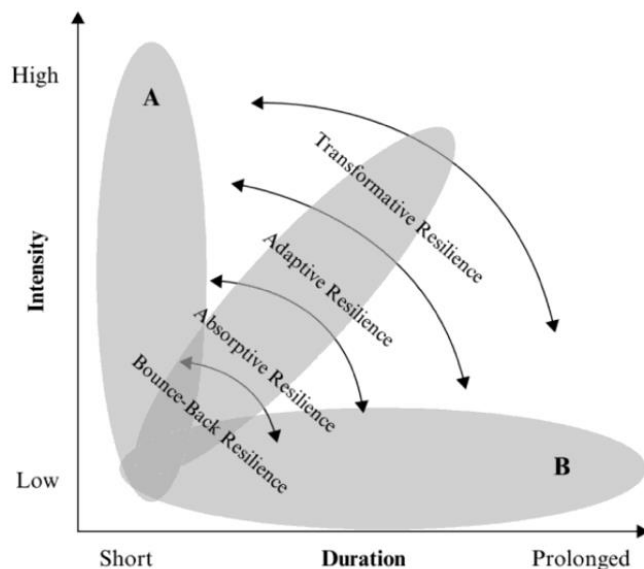
- Regional economic resilience does not occur at a particular point in time;
- The ability of self-organization and self-adaptation;
- Shocks have hysteresis as well -- we need a “complex” model -- e.g. complex networks.



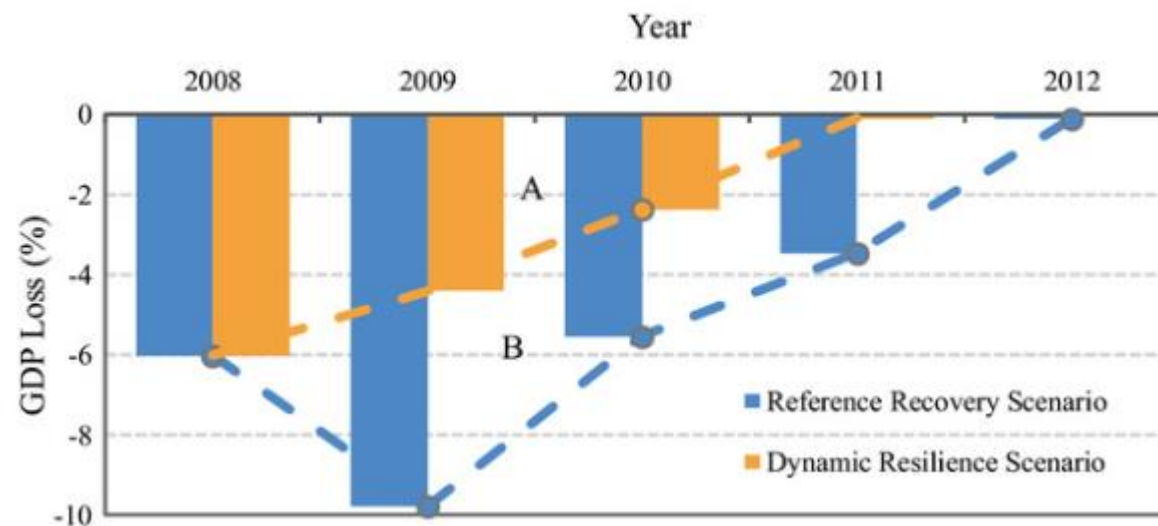
1.3 Theoretical outlook

What we further need -- Dynamic perspective

- The resilience of regional economic systems to risk evolves dynamically;
- Region's response to various shocks is different;
- There is an endogenous dynamic process of change in the regional economic system.



Martin and Sunley (2020)

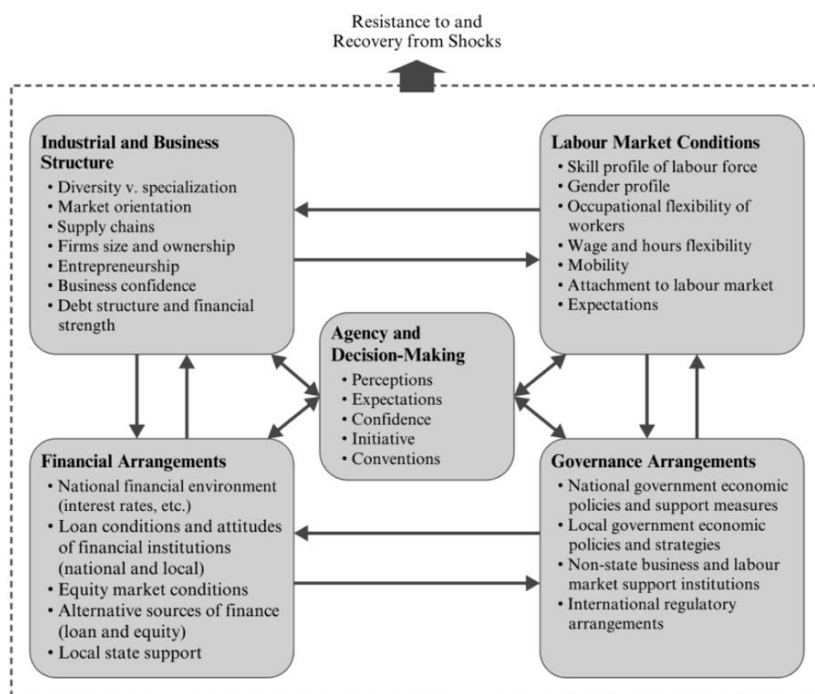


Xie et al. (2018)

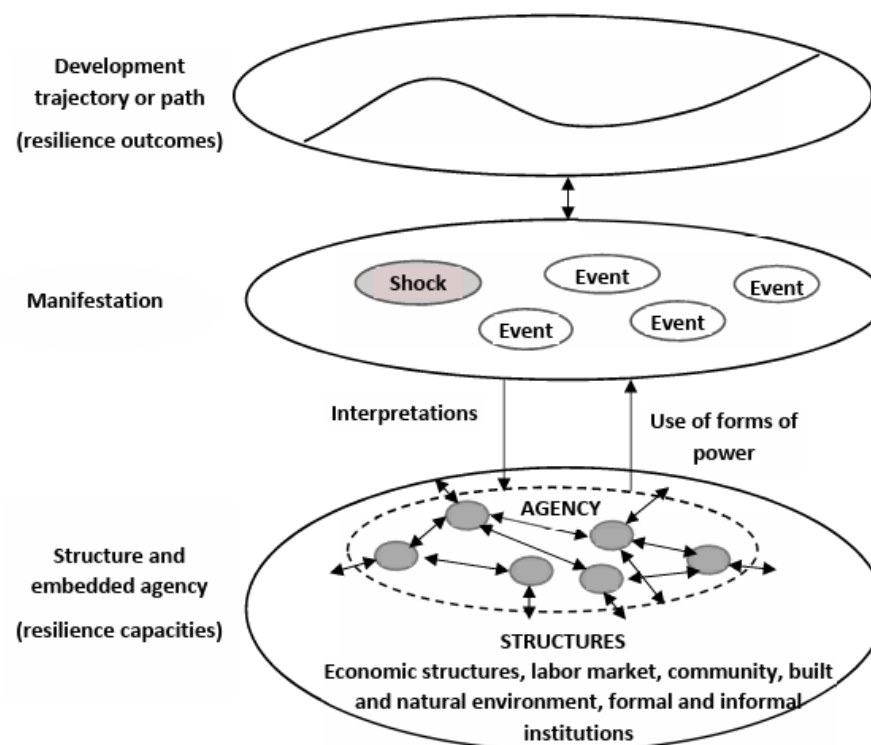
1.3 Theoretical outlook

What we further need -- Agency perspective

- Multi-agency interactions can have a significant impact on regional economic resilience;
- E.g. firms, governments, NGOs, labor force... and even a single person.



Martin and Sunley (2020)

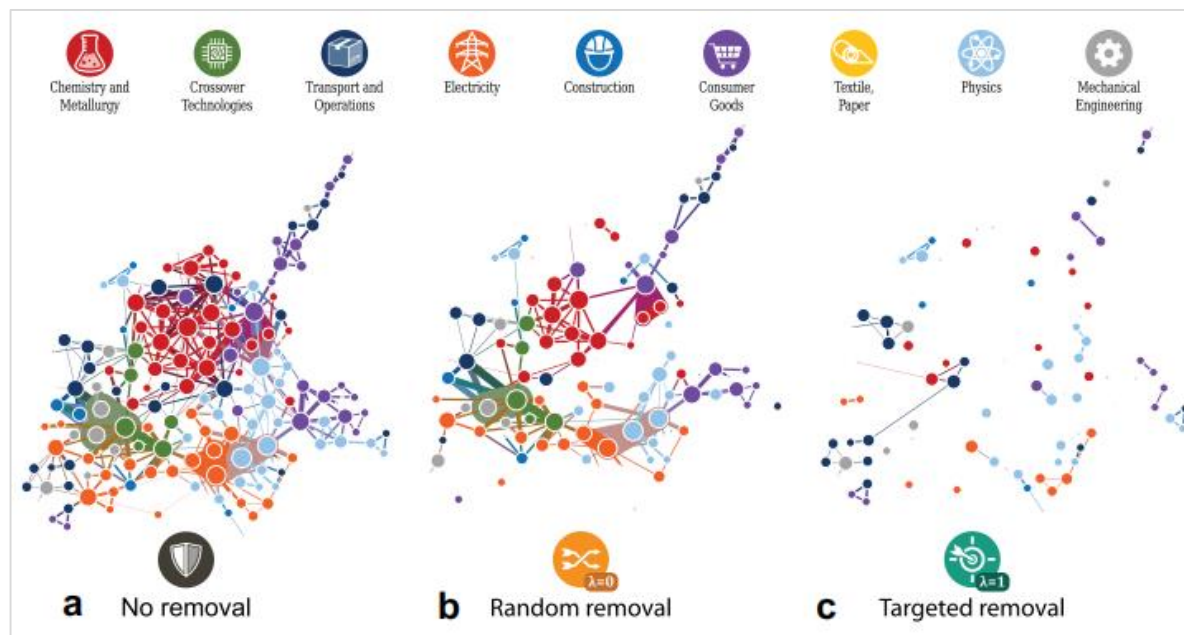


Kurikka and Grillitsch (2020)

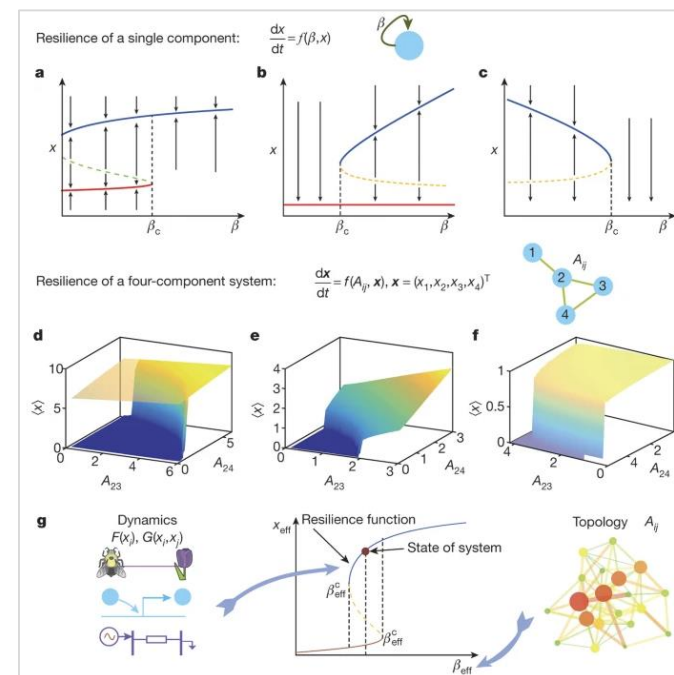
1.3 Theoretical outlook

What we further need -- Network perspective

- Network resilience reveals the micro-foundations of regional economic resilience;
- E.g. network robustness, vulnerable nodes (edges)...
- Geography may **cross-fertilize** with physics, informational biology and system engineering.



Tóth et al. (2022)



Gao et al. (2016)

Part 2 Empirics

How Chinese regions cope with external shocks?

- 2.1 **Global financial crisis and RER**
- 2.2 **US-China trade wars and RER**
- 2.3 **COVID-19 pandemic and RER**

2.1 Financial crisis and RER

Research Background

Industrial and Corporate Change, 2021, 30, 1655–1676
 DOI: <https://doi.org/10.1093/icc/dtab044>
 Advance access publication date: 27 July 2021

Original Article



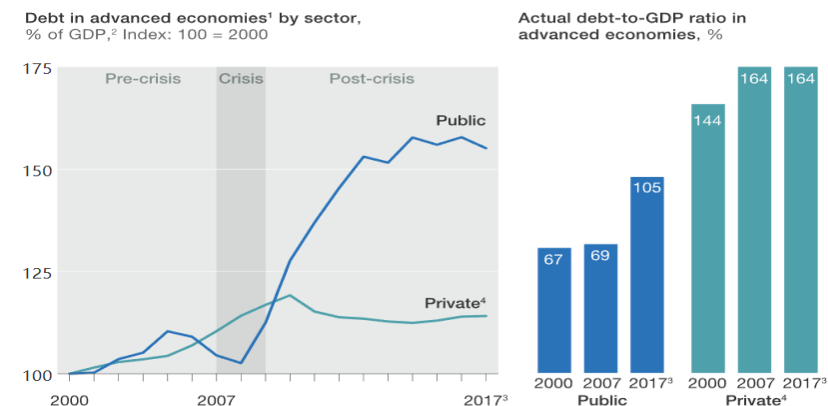
Do not put eggs in one basket: related variety and export resilience in the post-crisis era

Canfei He^{1,2}, Tao Chen³ and Shengjun Zhu^{4,5,*}



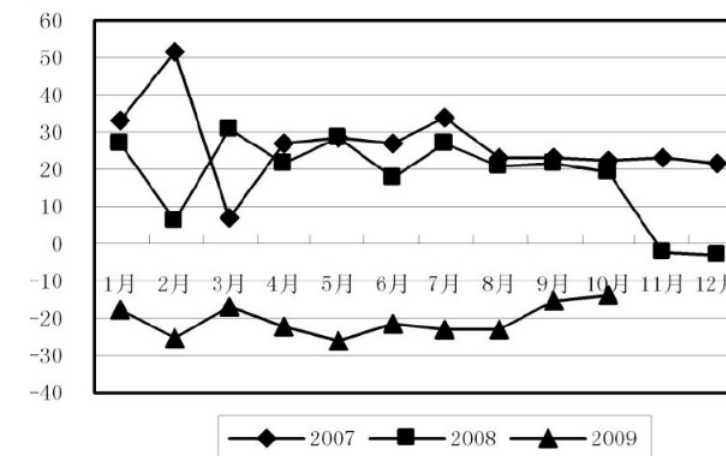
- Export resilience reflects a country's globalization participation;
- Of course, the financial crisis has swept through global markets;
- We ask the following questions:
 - Who was most affected by the shock ?
 - What conditioned the spread of financial risks ?

Public debt increased rapidly after the crisis in advanced economies.



¹Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Singapore, South Korea, Spain, Sweden, Switzerland, United Kingdom, and United States.
²Debt as percent of GDP is indexed to 100 in 2000; numbers are not actual figures.
³First half of 2017.
⁴Includes household and nonfinancial corporate-sector debt.
 Source: Bank for International Settlements; McKinsey Global Institute analysis

McKinsey&Company

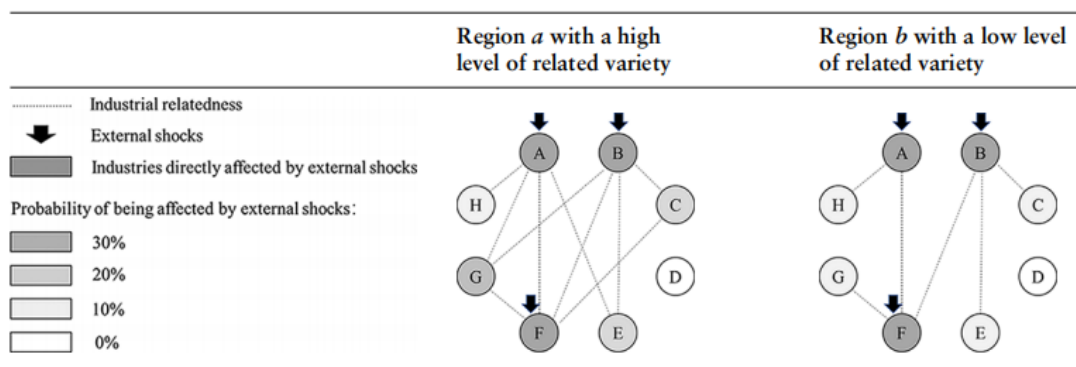


The fluctuations of China's trade

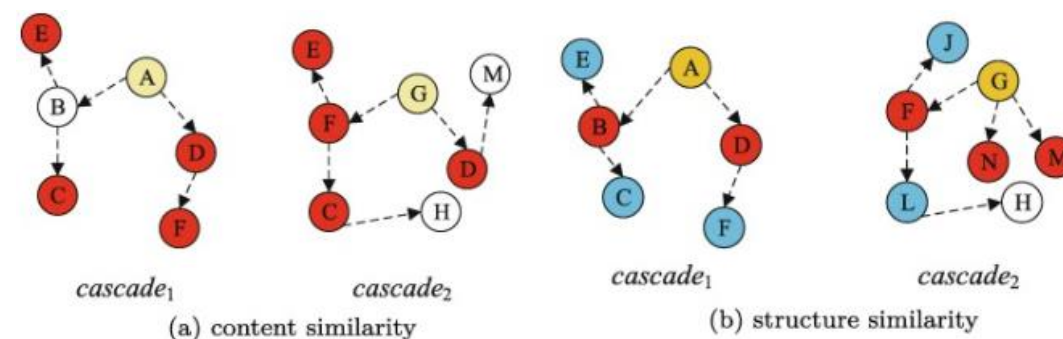
2.1 Financial crisis and RER

Theoretical analysis

- We focus on the effects of industrial structure (varieties) on Regional Economic Resilience;
- Related variety is an important way to promote knowledge spillovers; However, it may **amplify** the transmission of risks -- the Domino effect (cascade);
- Unrelated variety, and the corresponding network structure, may **diverse** external risks.



From the author

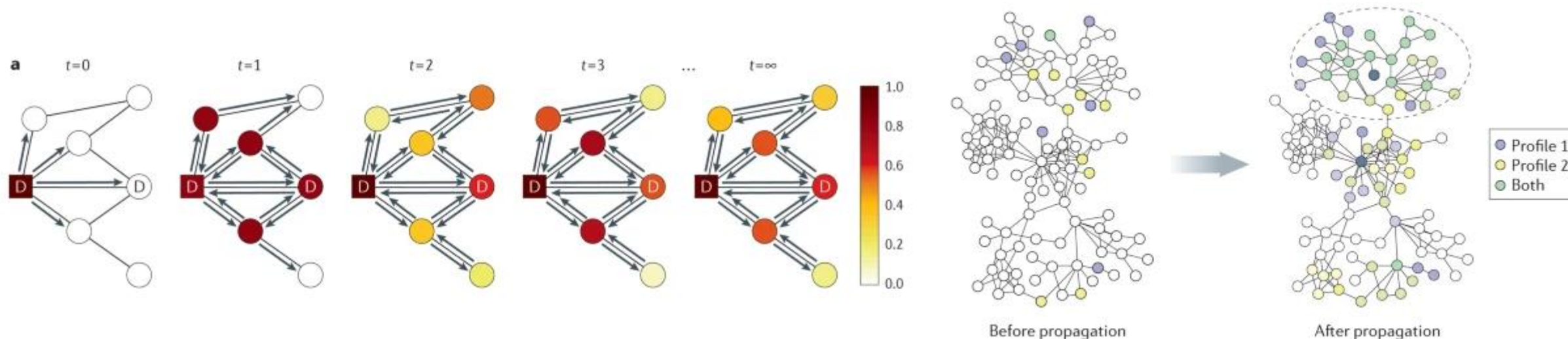


Feng et al.(2021)

2.1 Financial crisis and RER

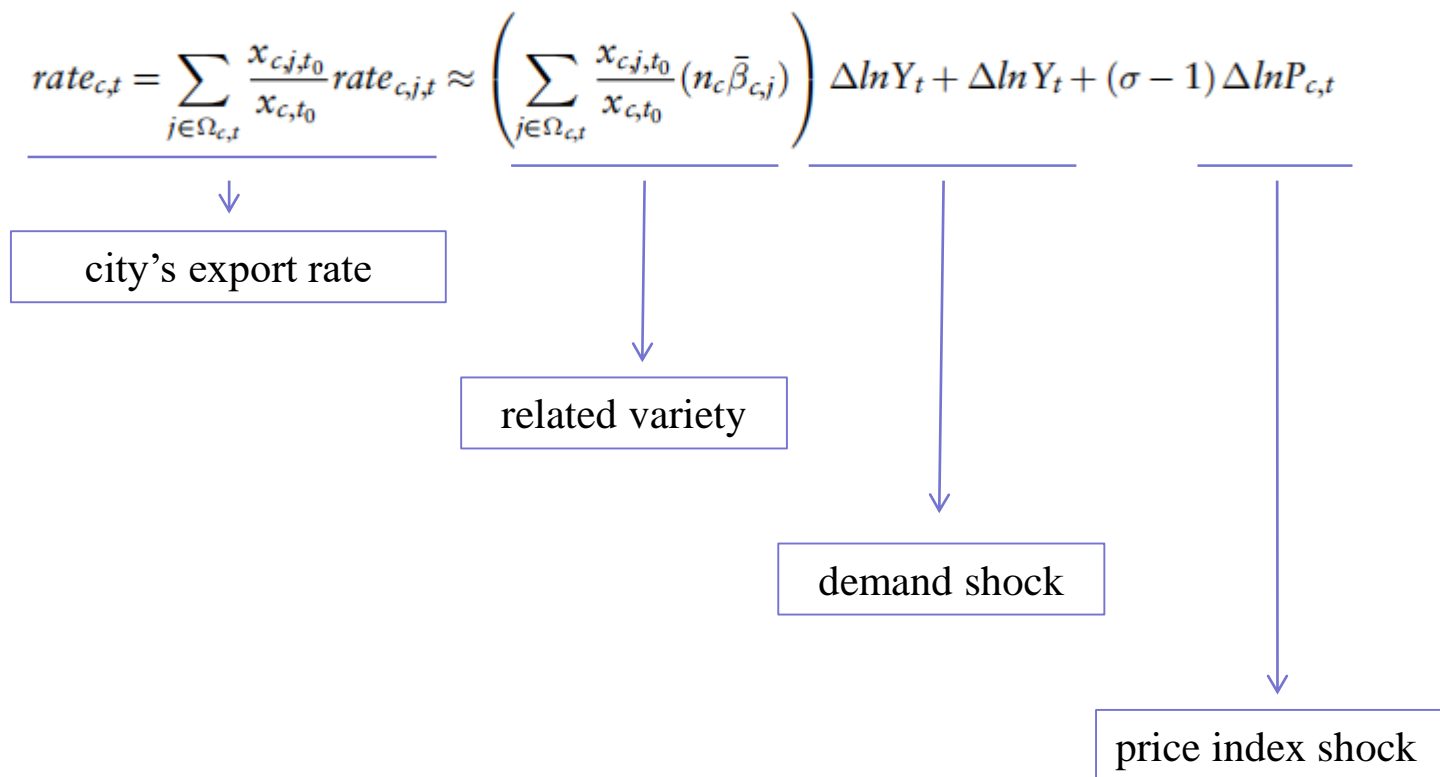
Hypothesis

- Discussions on unrelated variety is far from enough (when we conducted this work); Inspired by network science, we propose that:
- H1: Regions with many related industries are more vulnerable to external demand shocks;
- H2: The negative effects on certain industries may be easily transferred to other related industries.



2.1 Financial crisis and RER

Methodology & Model



Intuition: Given the price index and the level of demand shock, higher RV leads to greater export losses.

$$rv_{c,2007} = - \sum_j (S_{c,J,2007} H_{c,J,2007})$$

$$H_{c,J,2007} = \sum_{j \in R_j} \left(\frac{S_{c,j,2007}}{S_{c,J,2007}} \log_2 \left(\frac{S_{c,j,2007}}{S_{c,J,2007}} \right) \right)$$

The calculation of related-variety index

$$resilience_{c,t} = \frac{(\Delta x_{c,t} - \Delta \hat{x}_{c,t})}{|\Delta \hat{x}_{c,t}|}$$

$$\Delta \hat{x}_{c,t} = \left(\frac{x_t - x_{2008}}{x_{2008}} \right) x_{c,2008}$$

The calculation of RES index

$$resilience_{c,j,t} = C_0 + \beta_1 rv_{c,j,2007} + X_{c,j,2007} + \eta_{j,t} + \eta_{c,t} + \varepsilon_{c,j,t}$$

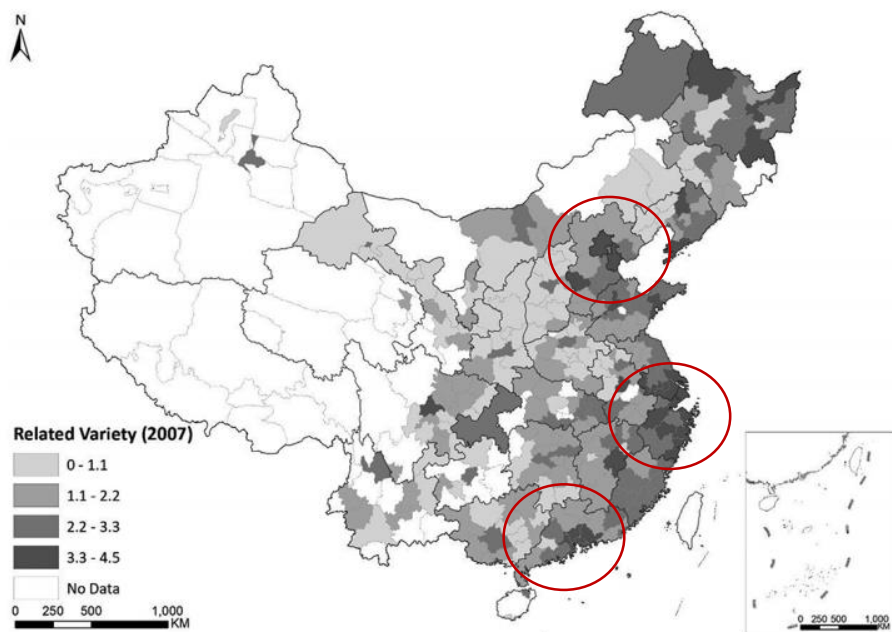
- ✓ Dependent: resilience of city-level export;
- ✓ Independent: varieties of local industry;
- ✓ Controls: population, innovation, infrastructure, etc.

The setting of a baseline regression model

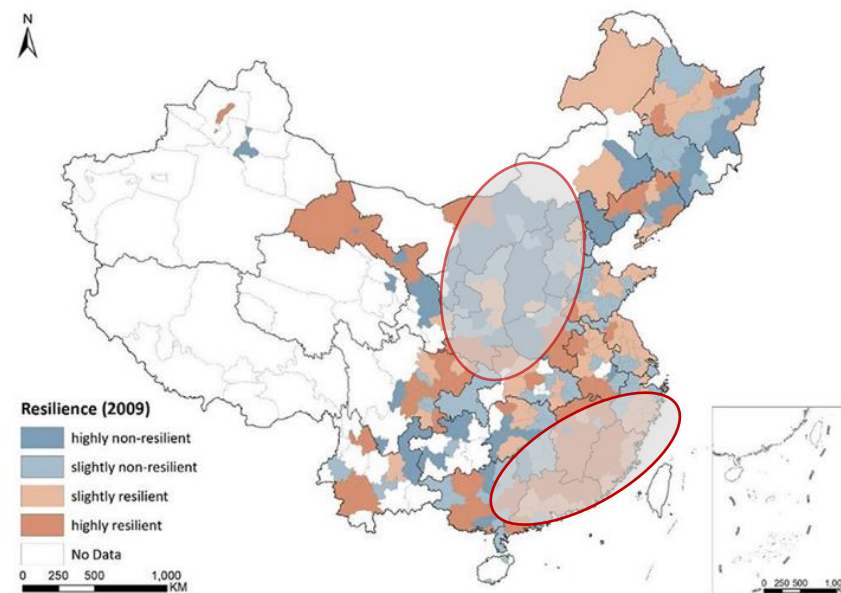
2.1 Financial crisis and RER

Descriptions

RV index is higher in the Yangtze River Delta, the Pearl River Delta and the Beijing-Tianjin-Hebei Region.



Non-resilient areas are mainly distributed in the central provinces, while those along the southeast coast have a higher RER level.



2.1 Financial crisis and RER

City-level Results

- Related variety **harms** city-level export resilience ;
- Meanwhile, unrelated variety **counterbalances** !

Dependent variable: resilience	(1)	(2)	(3)
rv	-0.588 [*] (0.299)	-1.030 ^{***} (0.288)	-0.957 ^{***} (0.329)
uv		1.287 ^{***} (0.297)	1.337 ^{***} (0.301)
popdensity			-0.934 (8.030)
patent			0.032 [*] (0.019)
infrastructure			-0.037 (0.037)
distance			2.816 [*] (1.675)
intervention			0.256 (0.329)
Fixed effects		Province-year	
Observations	559	559	559
R-squared	0.252	0.292	0.301

Robust standard errors clustered at the city level in parentheses.

*** $P < 0.01$.

** $P < 0.05$.

* $P < 0.1$.

2.1 Financial crisis and RER

Robustness checks

	IV 2SLS	IV 2SLS
Dependent variable: resilience	(1)	(2)
rv	-2.528** (1.077)	-2.412** (0.986)
uv	1.821*** (0.451)	1.775*** (0.426)
popdensity	8.715 (11.263)	8.118 (10.722)
patent	0.062* (0.032)	0.059** (0.029)
infrastructure	0.016 (0.053)	0.013 (0.052)
intervention	0.155 (0.327)	0.167 (0.326)
distance	3.212* (1.819)	3.159* (1.769)
Observations	553	555
R-squared	0.247	0.256
rv_emp1998	0.489*** (0.108)	
rv_emp1999		0.438*** (0.098)
First stage F	19.98	20.55

Method 1 : Introduce an instrument variable (IV)

- Calculate the RV and UV on the basis of city employment structure in 1998 and 1999;
- It may determine the variety level of 2007;
- But historical data may not directly impact the export of 2007;
- An effective control for endogeneity (reverse causality...)

2.1 Financial crisis and RER

Robustness checks

New rv measure (four-digit)	New rv measure (median)	New rv measure (mean)
(3)	(4)	(5)
-1.248*** (0.403)	-0.898*** (0.329)	-0.839** (0.328)
1.369*** (0.298)	2.203*** (0.516)	2.118*** (0.515)
-2.738 (7.788)	-0.388 (8.112)	-0.544 (8.123)
0.029 (0.019)	0.029 (0.019)	0.028 (0.019)
-0.041 (0.036)	-0.040 (0.037)	-0.042 (0.037)
0.264 (0.340)	0.265 (0.334)	0.271 (0.335)
2.645 (1.716)	2.845* (1.690)	2.839* (1.696)
559 0.299	559 0.300	559 0.298

$$\phi_{i,j,2007} = \min \left(P(RCA_{c,i,2007} > 1 | RCA_{c,j,2007} > 1), P(RCA_{c,j,2007} > 1 | RCA_{c,i,2007} > 1) \right), \quad (14)$$

where

$$RCA_{c,i,2007} = \frac{x_{c,i,2007} / \sum_i x_{c,i,2007}}{\sum_c x_{c,i,2007} / \sum_{c,i} x_{c,i,2007}} \quad (15)$$

$$H_{c,j,2007} = - \sum_{i \in R_{j,2007}} (s_{c,i,2007} \log_2(s_{c,i,2007})) \quad (16)$$

$$s_{c,i,2007} = \frac{x_{c,i,2007}}{\sum_{i \in R_{j,2007}} x_{c,i,2007}} \quad (17)$$

$$rv_{c,2007} = \sum_j H_{c,j,2007} \times \frac{x_{c,j,2007}}{\sum_j x_{c,j,2007}} \quad (18)$$

Method 2 : New measurements of RV and UV

- We use 4-digit industries (instead of 6-digit) to re-calculate the indices;
- Follow Boschma et al., (2012) as above. The results are good !

2.1 Financial crisis and RER

Robustness checks

Winsorized dependent variable	Growth rate	w/o direct- controlled municipalities	2009–2013
(6)	(7)	(8)	(9)
-0.874 ^{***} (0.299)	-0.109 ^{***} (0.037)	-0.962 ^{***} (0.330)	-0.678 ^{***} (0.226)
1.244 ^{***} (0.283)	0.154 ^{***} (0.035)	1.357 ^{***} (0.302)	1.019 ^{***} (0.203)
0.267 (7.762)	-0.075 (0.908)	-3.564 (8.377)	-0.138 (5.848)
0.029 [*] (0.017)	0.004 (0.002)	0.035 [*] (0.019)	0.019 (0.016)
-0.039 (0.034)	-0.004 (0.004)	-0.036 (0.037)	-0.024 (0.026)
0.252 (0.321)	0.027 (0.036)	0.248 (0.327)	0.315 (0.293)
2.897 [*] (1.534)	0.352 [*] (0.190)	3.436 [*] (1.881)	2.078 [*] (1.117)
559	559	551	1,399
0.312	0.373	0.303	0.315

Method 3 : Replacement of the dependent variable

- Winsorized dependent variable at 0.25% and 99.75%;
- Regard export growth rate as a proxy for resilience;
- Exclude direct-controlled municipalities;
- Widen the time frame (2009-2013).

2.1 Financial crisis and RER

Industry-level Results

- Related variety **harms** industry-level export resilience;
- Such a result is supported by different measurements of RV.

Dependent variable: resilience	rv based on industrial classification		rv based on export relatedness	
	(1)	(2)	(3)	(4)
rv ^{ic}	-0.046** (0.019)	-0.046** (0.019)		
rv ^{ir}			-0.188*** (0.034)	-0.184*** (0.033)
sea		0.043 (0.032)		0.044 (0.032)
foe		-0.184*** (0.040)		-0.183*** (0.039)
processing		-0.106 (0.073)		-0.100 (0.072)
Fixed effects			City-year, industry-year	
Observations	354,923	354,923	354,923	354,923
R-squared	0.052	0.052	0.052	0.052

2.1 Financial crisis and RER

Industry-level Results

	(1)	(2)	(3)	(4)
rv^{ic}	0.060 ^{***} (0.023)		0.068 [*] (0.037)	
rv^{ir}		-0.100 ^{***} (0.037)		-0.077 (0.049)
$rv^{ic} \times dif$	-0.131 ^{***} (0.025)			
$rv^{ir} \times dif$		-0.083 ^{***} (0.022)		
$rv^{ic} \times manu$			-0.118 ^{***} (0.035)	
$rv^{ir} \times manu$				-0.110 ^{***} (0.033)
sea	0.065 [*] (0.034)	0.066 [*] (0.034)	0.043 (0.032)	0.044 (0.032)
foe	-0.179 ^{***} (0.041)	-0.178 ^{***} (0.040)	-0.184 ^{***} (0.040)	-0.181 ^{***} (0.039)
Processing	-0.106 (0.076)	-0.103 (0.075)	-0.105 (0.073)	-0.101 (0.072)
Observations	318,099	318,099	354,923	354,923
R-squared	0.052	0.053	0.052	0.052

- Firms exporting diversified products may be hit harder;
- Manufacturing firms may be hit harder
- A possible reason is that both types of firms often need richer market information, and the financial crisis has impeded their information flow

2.1 Financial crisis and RER

Mechanisms

	(1)	(2)	(3)	(4)	(5)	(6)
	resilience	density ^{ic}	resilience	resilience	density ^{ir}	resilience
rv ^{ic}	-0.046** (0.019)	0.009*** (0.002)	-0.035** (0.018)			
density ^{ic}			-1.145*** (0.162)			
rv ^{ir}				-0.184*** (0.033)	0.005*** (0.001)	-0.079*** (0.028)
density ^{ir}						-21.786*** (2.976)
sea	0.043 (0.032)	-0.000 (0.001)	0.043 (0.032)	0.044 (0.032)	-0.000 (0.000)	0.041 (0.032)
foe	-0.184*** (0.040)	-0.003 (0.002)	-0.187*** (0.039)	-0.183*** (0.039)	0.001** (0.000)	-0.164*** (0.037)
processing	-0.106 (0.073)	-0.002 (0.003)	-0.108 (0.073)	-0.100 (0.072)	0.003*** (0.001)	-0.032 (0.075)
t value of rv	-2.38		-2.02	-5.54		-2.79
$\beta_2 \times \beta_4$			-0.010			-0.105
$P(\beta_2 \times \beta_4) = 0$			0.000			0.000
Observations	354,923	354,923	354,923	354,923	354,923	354,923
R-squared	0.052	0.331	0.054	0.052	0.971	0.059

Robust standard errors clustered at the city level in parentheses.

***P < 0.01.

**P < 0.05.

*P < 0.1.

All dependent variables are winsorized at 0.25% and 99.75%.

$$density_{c,j,t} = \frac{\sum_{i \neq j} \phi_{i,j,2007} I_{i,t}}{\sum_{i \neq j} \phi_{i,j,2007}}$$

The calculation of density index

$$resilience_{c,j,t} = C_0 + \beta_1 rv_{c,j,2007} + X_{c,j,2007} + \eta_{c,t} + \eta_{j,t} + \varepsilon_{c,j,t} \quad (24)$$

$$density_{c,j,t} = C_1 + \beta_2 rv_{c,j,2007} + X_{c,j,2007} + \eta_{c,t} + \eta_{j,t} + \varepsilon_{c,j,t} \quad (25)$$

$$resilience_{c,j,t} = C_2 + \beta_3 rv_{c,j,2007} + \beta_4 density_{c,j,t} + X_{c,j,2007} + \eta_{c,t} + \eta_{j,t} + \varepsilon_{c,j,t} \quad (26)$$

Mediation effects model

- We introduce the density index to measure the relatedness between industries.
- Shocks may propagate to more related sectors !
- E.g. From metal to car manufacturing...
- RV-style industrial layout has been challenged !

2.1 Financial crisis and RER

Conclusions



James Tobin



- Related variety may harm city's export resilience;
- Shocks tend to propagate via industrial networks;
- RV is good... but... not forever;
- However, we only consider the background of financial crisis here;
- Possibly, industrial RV may enhance economic recovery;
- E.g. after an earthquake or other natural hazards...

But remember, putting eggs in too many baskets may lead to loss as well...

2.2 US-China trade wars and RER

Research Background

Economic sanctions and regional resilience: Evidence from the US-China trade war

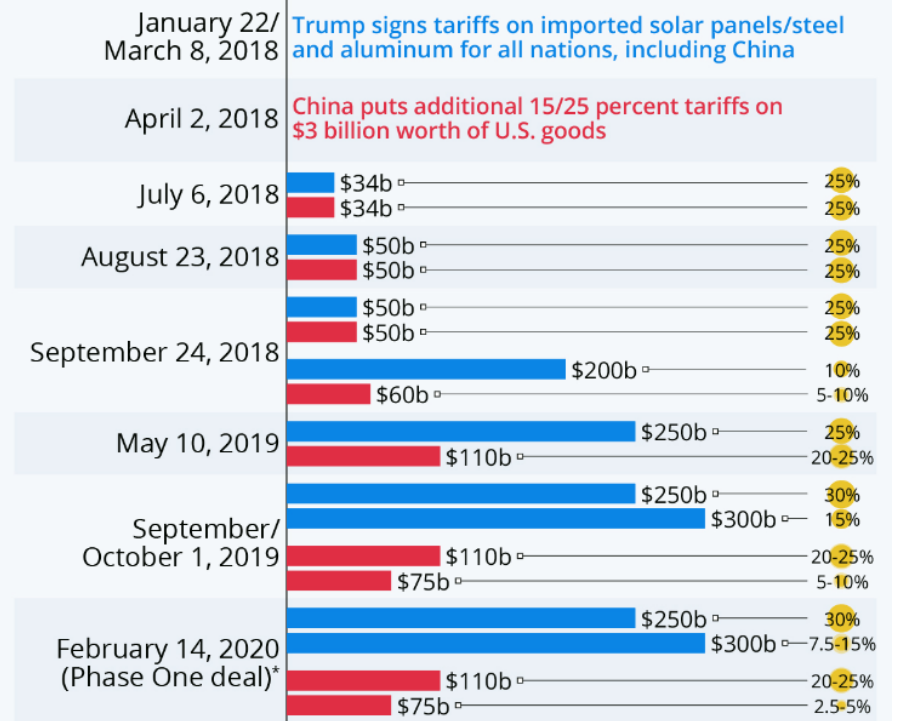
Peng Zhang^a, Canfei He^b, Jing Li^a, Wenyu Wang^b

- Economic sanctions may harm economic globalization;
- US-China trade war is eye-catching !
- What types of cities suffered the most ?
- How to mitigate the negative effects ?

U.S.-China Trade War: A Timeline

Cumulative tariffs between the U.S. in China in 2018-2020

■ US tariff action ■ Chinese tariff action ● Tariff rate



* China/the U.S. have also been accepting tariff exemption applications for a range of products

Source: Media reports





2.2 US-China trade wars and RER

Theoretical analysis

- Why the U.S.-China trade friction is affecting the city's exports ?
- The **tariff hike** could reduce demand for Chinese products in the U.S. market and lower the revenues of exporters in some Chinese cities;
- Some exporters may **opt out of** the Chinese market due to falling expectations of the economy.
- Moreover, export patterns dominated by foreign-owned firms may be less resilient to trade wars; cities with predominantly low value-added trade are less resilient to trade wars.
- Government matters ! Businesses in areas with high-tech parks are likely to have higher expectations of economic prospects and more confidence in the support provided by policymakers.

H1: The U.S.-China trade war has had a negative impact on economic activity in Chinese cities that rely heavily on U.S. imports.

H2: Domestic firms' higher exports to the U.S. help mitigate the negative impact of the U.S.-China trade account on the city's economy.

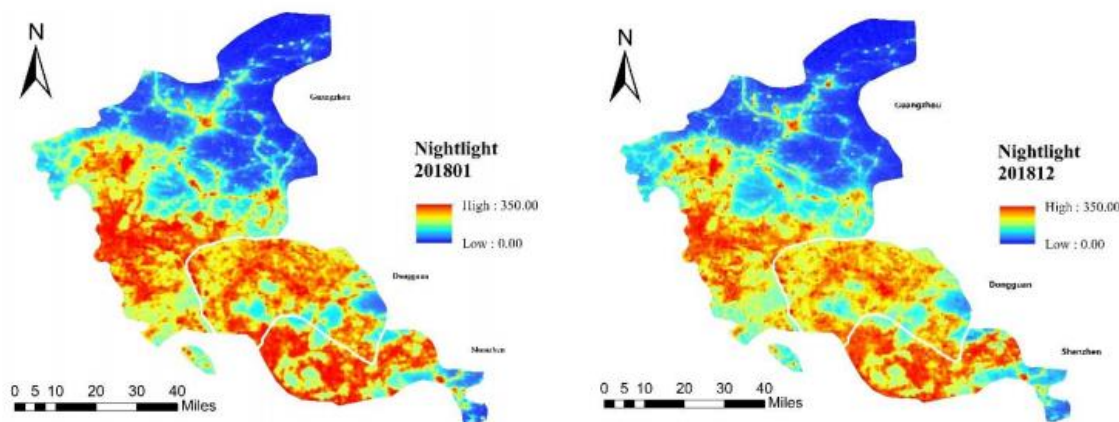
H3: Upgrading to higher-value-added trade can help mitigate the negative impact of the U.S.-China trade account on the city's economy.

H4: The layout of high-tech parks helps to increase the resilience of the city's exports.

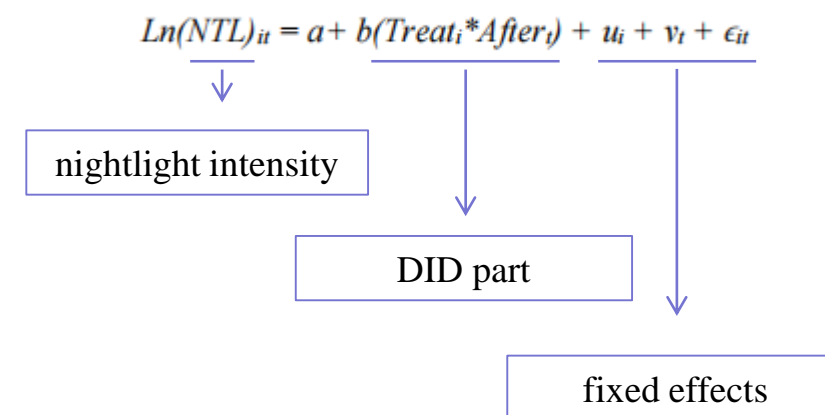
2.2 US-China trade wars and RER

Methodology & Model

- The concern is high-frequency economic data (GDP) are not accessible;
- We use remote sensing data (VIIRS/DNB monthly level night light series) as proxies;
- Set a PSM(Propensity Score Match)-DID(Difference in Difference), regarding Aug-Dec 2018 as the experimental period;
- Divide the treated and control groups by city exports to the United States.



Samples of remote sensing images



The baseline DID model

2.2 US-China trade wars and RER

Empirical Results

- U.S.-China trade war has more significant negative impact on cities with higher U.S. exports;
- The losses are estimated to be around **2.4%-3%** GDP (or 1.45% GDP per capita) in these cities;

VARIABLES	(1)	(2)	(3)
	H1: baseline DID	Value of exports on the tariff list/GDP Large Ratio=1	Large Ratio=0
Treat * after	-0.031** (0.013)	-0.038** (0.017)	-0.029 (0.019)
Constant	11.162*** (0.011)	11.419*** (0.011)	10.878*** (0.019)
City FE	YES	YES	YES
Time FE	YES	YES	YES
N	2826	1484	1342
R ²	0.14	0.177	0.153

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. If the information on NTL luminosity is unavailable occasionally for a city due to weather conditions (no more than 4 times in our monthly panel of Chinese cities) or the process of removing outliers, we still include the observations in other months for this city to get a representative sample of Chinese cities. We include city fixed effects which control for the number of missing NTL values for each city in all regressions.

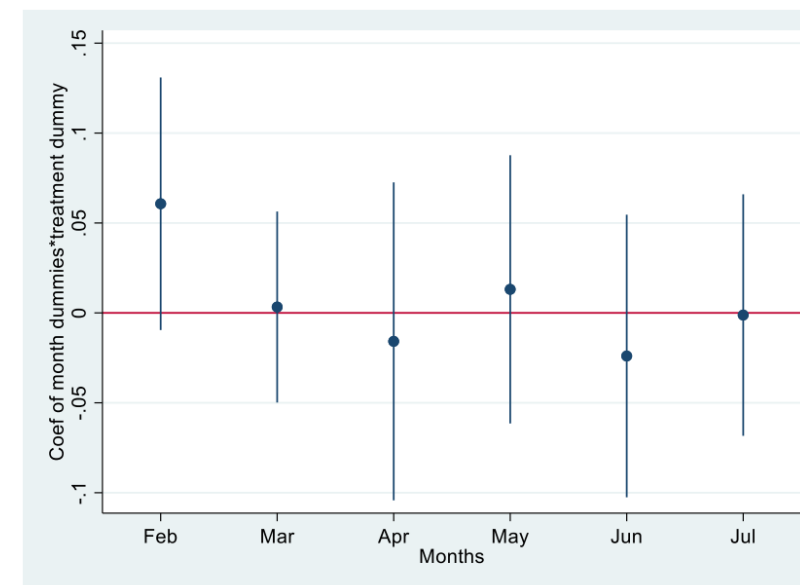
2.2 US-China trade wars and RER

Robustness checks

- We use the nightlight intensity of 2016 and 2017 and run placebo tests (for H1);
- There is no significant seasonal trends in nighttime lighting data;
- The coefficients for July 2018 and before are not significantly different from zero, so it is assumed that there is a parallel trend between the experimental group and the control group.

VARIABLES	(1)	(2)		(3)	(4)	(5)		(6)
	H1: baseline DID	2017		H1: baseline DID	2016		H1: baseline DID	H1: baseline DID
		Value of exports on the tariff list/GDP			Value of exports on the tariff list/GDP			
		Large Ratio=1	Large Ratio=0		Large Ratio=1	Large Ratio=0		
Treat * after	0.015 (0.016)	0.009 (0.014)	0.039 (0.026)	0.002 (0.013)	0.008 (0.016)	0.007 (0.020)		
Constant	11.121*** (0.016)	11.335*** (0.018)	10.883*** (0.026)	10.724*** (0.014)	11.064*** (0.017)	10.350*** (0.022)		
City FE	YES	YES	YES	YES	YES	YES		
Time FE	YES	YES	YES	YES	YES	YES		
N	2,881	1,514	1,367	2,813	1,492	1,321		
R ²	0.091	0.075	0.140	0.26	0.272	0.315		

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.



2.2 US-China trade wars and RER

Mechanisms

- Domestic exports help boost economic resilience, thus mitigating the negative effects of the trade-frictions;
- Higher value-added trade also enhances regional economic resilience towards the frictions;
- The role of government matters ! High-tech parks and preferential policies seem to work well.

VARIABLES	DOMEST=1	DOMEST=0	OTRD =1	OTRD=0	ZONE=1	ZONE=0
Treat * after	-0.025 (0.021)	-0.036** (0.015)	-0.010 (0.014)	-0.052*** (0.020)	-0.031 (0.021)	-0.029* (0.016)
Constant	10.996*** (0.014)	11.316*** (0.017)	11.023*** (0.015)	11.310*** (0.016)	11.728*** (0.018)	10.856*** (0.013)
City FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
N	1360	1466	1456	1370	991	1835
R ²	0.149	0.139	0.196	0.110	0.096	0.202

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

2.2 US-China trade wars and RER

Mechanisms

- Again, the placebo tests underpin our hypotheses H2-H4;
- All the coefficients are not significantly different from zero.

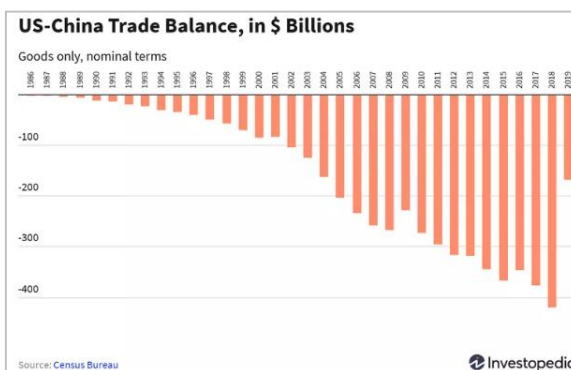
	(1)	(2)	(3)	(4)	(5)	(6)
	H2a		H2b		H3	
VARIABLES	DOMEST=1	DOMEST=0	OTRD=1	OTRD=0	ZONE=1	ZONE=0
Treat*after	0.031 (0.019)	0.002 (0.025)	0.027 (0.023)	0.002 (0.021)	-0.010 (0.029)	0.028 (0.019)
Constant	10.957*** (0.019)	11.273*** (0.024)	10.982*** (0.021)	11.268*** (0.024)	11.667*** (0.029)	10.820*** (0.018)
City FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
N	1387	1494	1486	1395	1023	1858
R2	0.137	0.072	0.127	0.072	0.054	0.133

Note: Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.

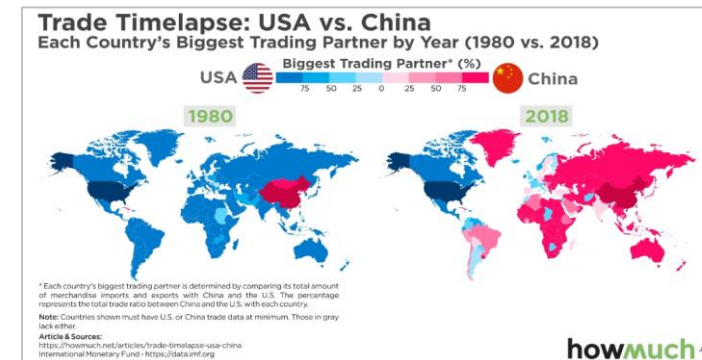
2.2 US-China trade wars and RER

Conclusions

- Night-time lights intensity can be a proxy for economic resilience indicator;
- Inter-regional linkages, value chain upgrading, and government power are important !
- Policy implications: MNEs management, **industrial parks**, national strategies...
- The loss of firm welfare and firm's evolutionary adaptation should be further considered.



Trump signs a trade agreement with Chinese Vice Premier Liu He, in the East Room of the White House, Jan. 15, in Washington. (AP Photo/Evan Vucci)



2.3 COVID-19 pandemic and RER

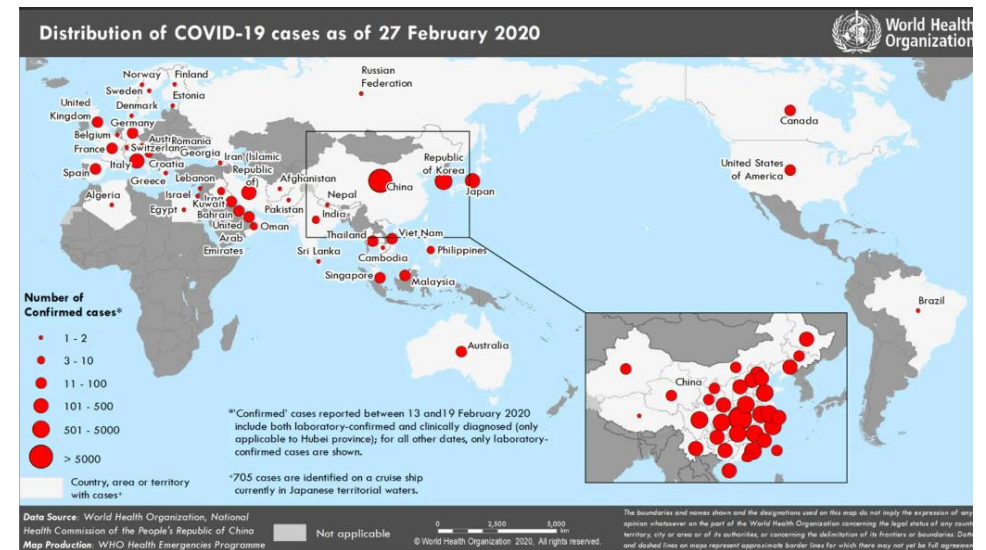
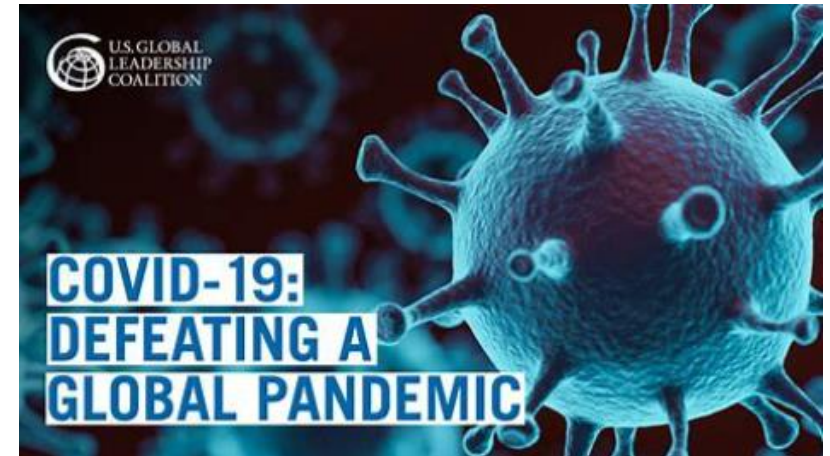
Research Background

Pandemic, Path Dependence and Regional Economic Resilience: Evidence from China

He, Canfei, Xing, Zuge., Sheng, Hantian, Dai, Xiaomian

- COVID-19 pandemic... unforgettable memory, right ?
- We focus on the challenges brought by the pandemic;
- Actually, two decades ago, many Chinese cities suffered from SARS (spring, 2003);
- Bad experience → stronger resilience ?
- As a Chinese saying goes:

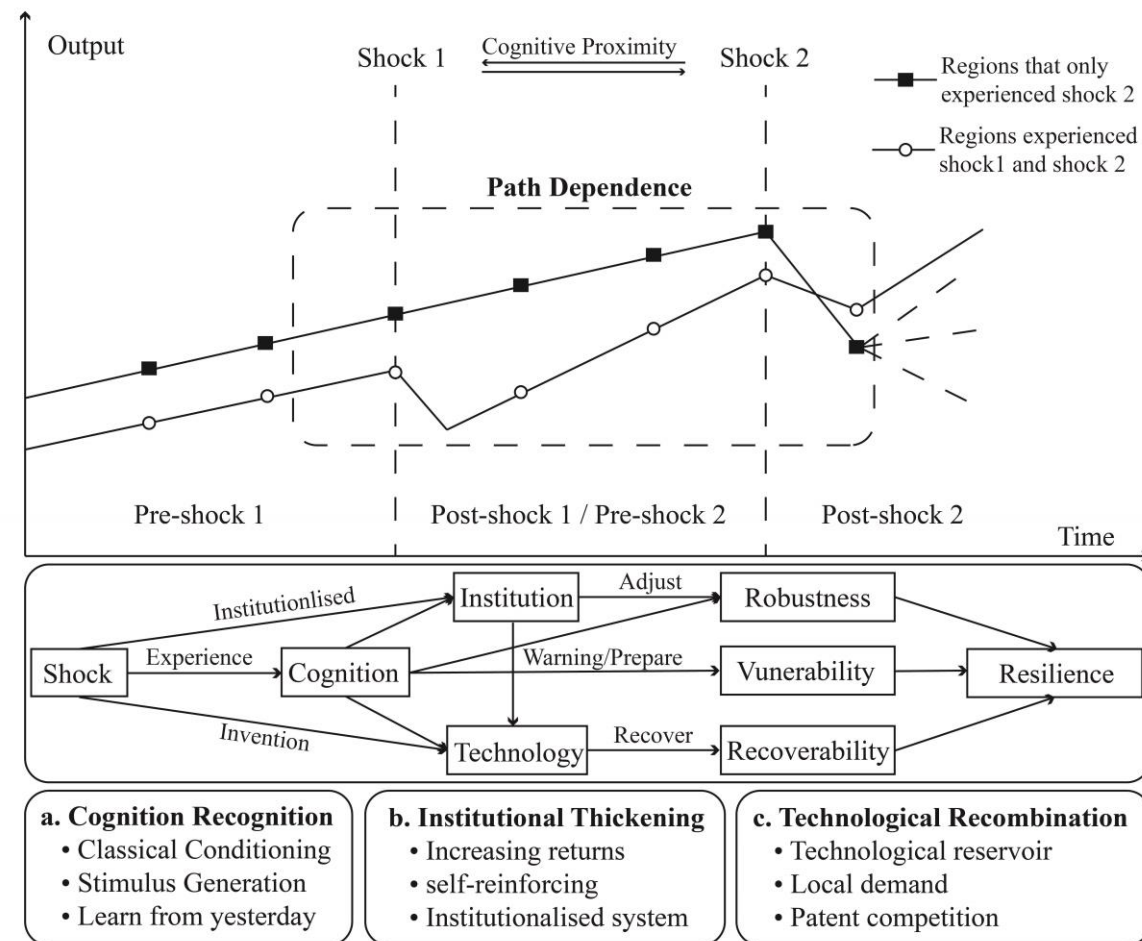
A fall into a pit, a gain in your wit



2.3 COVID-19 pandemic and RER

Theoretical analysis

- The theory of path dependence argues that regions learn from historical experience;
- However, “region” is a broad concept... who learns the experience ?
- **Residents → Cognition**
 - learn something... that has been widely discussed by psychologists and culture geographers;
- **Government → Institution**
 - learns something...e.g. better preparation, faster response, knowing what/how to do;
- **Firms → Technology**
 - learn something...consider technology reserves, drugs/vaccine development.



2.3 COVID-19 pandemic and RER

Hypothesis

- **H1: Cognition recognition**

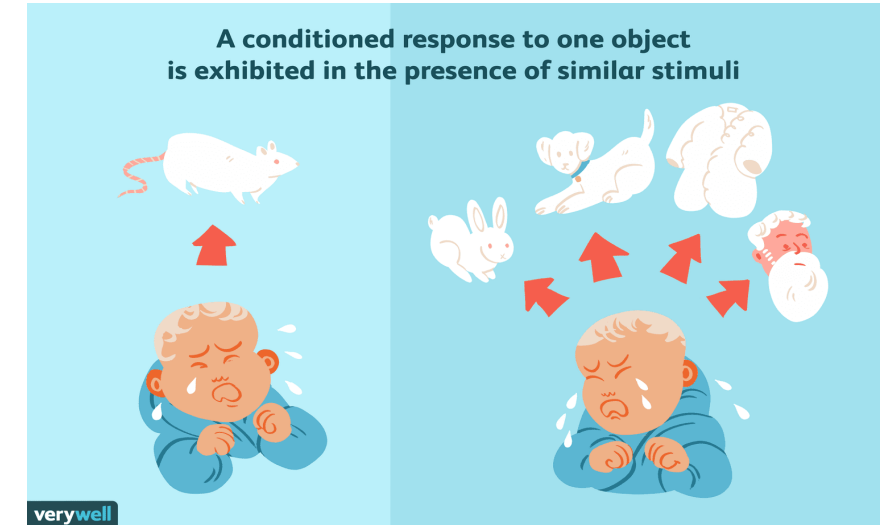
- Cities experienced SARS improve early warning of crises capacity;

- **H2: Institutional thickening**

- Cities experienced SARS may have permanent prevention and control measures;

- **H3: Technology recombination**

- Cities experienced SARS have a knowledge base for coping with the pandemic.



All of these factors contribute to regional economic resilience !

2.3 COVID-19 pandemic and RER

Methodology & Model

- We regard 2019 as the base period, and calculate city-level resilience index of 2020 (dependent);
- GDP is used as the key indicator for counterfactual analysis;
- Cognition recognition: the website browsing index of “SARS” from 2019.12 to 2020.2;
- Institutional thickening: laws and regulations related to SARS in each prefecture from 2003 to 2020;
- Technology recombination: the citation of SARS-related patents in 2020.

Baseline model

$$RES_i^{t+k} = \beta_0 + \beta_1 \cdot SARS_i + \beta_i X_i^{t+k} + u_i + \varepsilon$$



whether experienced SARS in 2003

Robustness checks -- spatial autocorrelation

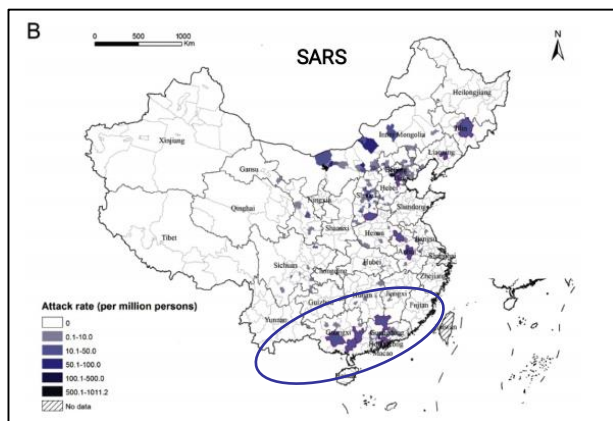
$$RES_i^{t+k} = \beta_0 + \beta_1 W \cdot RES_i^{t+k} + \beta_2 \cdot SARS_i + \beta_3 W \cdot SARS_i + \beta_i X_i^{t+k} + u_i + \varepsilon$$



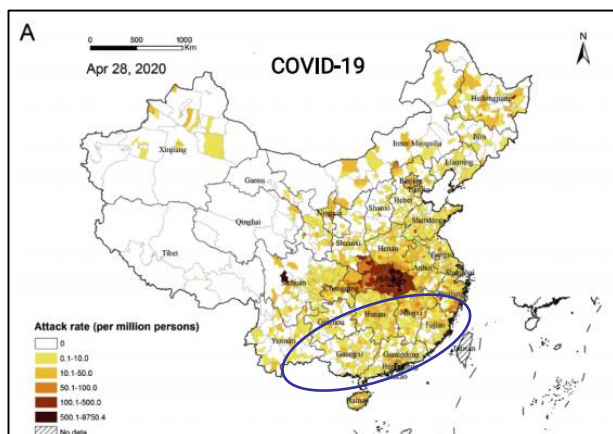
capture spatial spillovers

2.3 COVID-19 pandemic and RER

Descriptions



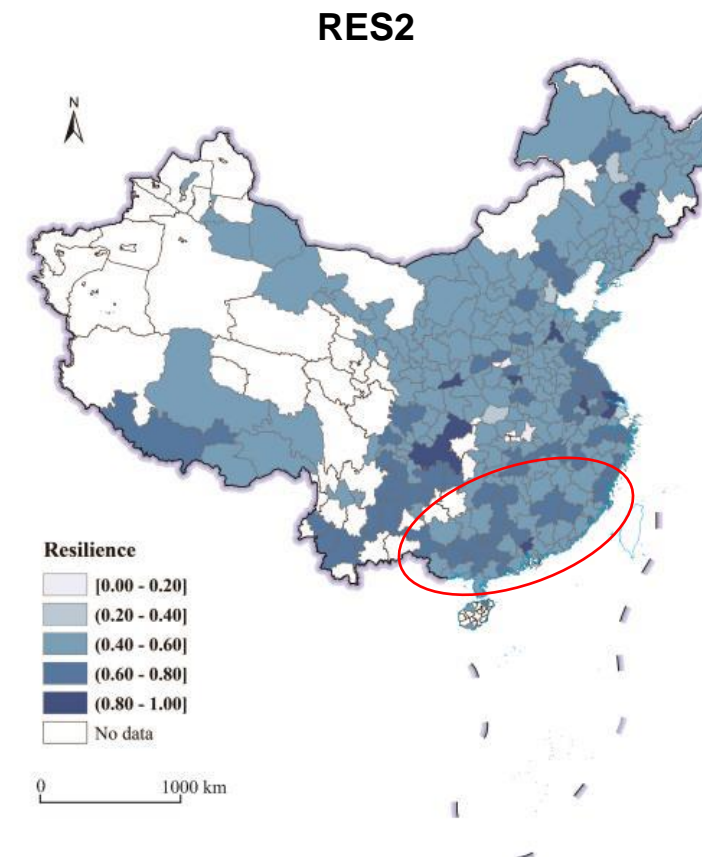
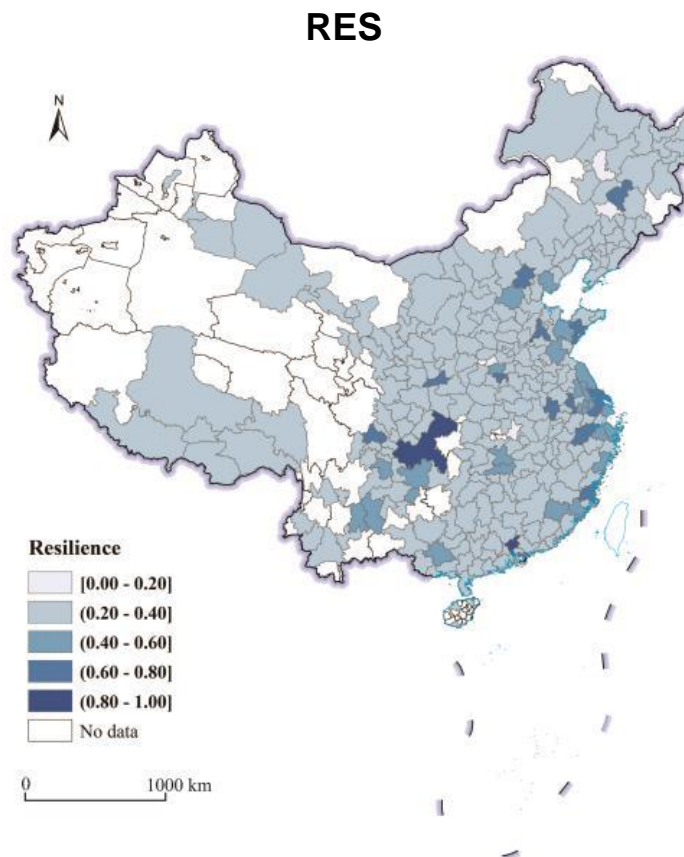
Distribution of cases



$$RES_i^{t+k} = E_i^{t+k} - E_i^t$$

$$(\Delta E_i^{t+k})^{exp} = \sum E_i^t g_N^{t+k}$$

$$RES2_i^{t+k} = \frac{[\Delta E_i^{t+k} - (\Delta E_i^{t+k})^{exp}] * E_i^t}{|(\Delta E_i^{t+k})^{exp}|}$$



- The spatial distribution of regional economic resilience is obviously uneven;
- Some cities that experienced SARS (2003) are more resilient in 2020;
- E.g. South China region.

2.3 COVID-19 pandemic and RER

Empirical Results

- The experience of SARS significantly **improves** city economic resilience (in COVID-19 pandemic);
- We also control varieties, population density, number of infected cases, etc.;
- The findings still hold even if the spatial autocorrelation is taken into account.

	Full Sample		Restricted Sample			
	(1)	(2)	SARS		COVID-19	
	RES	RES2	RES	RES2	RES	RES2
SARS	0.0375*** (0.0119)	0.0235** (0.0106)	0.0411*** (0.0142)	0.0299** (0.0120)	0.0408*** (0.0121)	0.0276** (0.0104)
V	0.0429 (0.0663)	0.0450 (0.0537)	-0.0196 (0.0649)	-0.0050 (0.0520)	0.0378 (0.0650)	0.0375 (0.0531)
UV	0.0815 (0.0574)	0.0361 (0.0562)	0.1066* (0.0571)	0.0572 (0.0565)	0.0858 (0.0573)	0.0537 (0.0533)
STRUC	-0.1070 (0.0956)	-0.1139 (0.0831)	-0.0453 (0.0962)	-0.0869 (0.0918)	-0.1444 (0.1051)	-0.1310 (0.0894)
LEVEL	0.1119*** (0.0301)	0.0582*** (0.0173)	0.0800*** (0.0215)	0.0467** (0.0186)	0.1201*** (0.0285)	0.0635*** (0.0167)
OPEN	0.0413 (0.0295)	0.0125 (0.0182)	0.0491 (0.0368)	0.0287 (0.0215)	0.0325 (0.0284)	0.0079 (0.0193)
POPD	0.0378*** (0.0086)	0.0201*** (0.0056)	0.0310*** (0.0076)	0.0191*** (0.0066)	0.0369*** (0.0082)	0.0189*** (0.0057)
CASE	-0.0075*** (0.0005)	-0.0105*** (0.0004)	-0.0071*** (0.0005)	-0.0105*** (0.0005)	0.0258 (0.0235)	0.0036 (0.0161)
GOV	0.1946** (0.0872)	0.1208* (0.0590)	0.1080 (0.0698)	0.0757 (0.0622)	0.2075** (0.0822)	0.1339** (0.0553)
_CONS	-1.2488*** (0.4149)	-0.2424 (0.2342)	-0.7844** (0.2933)	-0.0380 (0.2517)	-1.2988*** (0.3714)	-0.2852 (0.2147)
Province FE	YES	YES	YES	YES	YES	YES
N	292	292	271	271	280	280
R ²	0.4728	0.4248	0.4886	0.4627	0.4360	0.2358

	Adjacency		Economic	
	(1)	(2)	(3)	(4)
	RES	RES2	RES	RES2
SARS	0.0343*** (0.0122)	0.0228** (0.0105)	0.0349*** (0.0117)	0.0256** (0.0100)
W*SARS	0.0004 (0.0070)	-0.0034 (0.0057)	0.0514** (0.0233)	0.0446 (0.0291)
W*RES	0.0135** (0.0064)		0.2280** (0.1075)	
W*RES2		0.0045 (0.0041)		0.1165 (0.1104)
Controls	YES	YES	YES	YES
Province FE	YES	YES	YES	YES
N	291	291	291	291
R ²	0.5836	0.1855	0.5910	0.2512

2.3 COVID-19 pandemic and RER

Identification issue

First Stage	(5)	(6)
	sars	sars
sun	-0.0015*** (0.0624)	-0.0015*** (0.0624)
Controls	YES	YES
Province FE	YES	YES
Second Stage	(7)	(8)
	Res	Res_E
sars	0.1730** (0.0624)	0.0956* (0.0486)
Controls	YES	YES
Province FE	YES	YES
LM statistic	9.1770***	9.1770***
Wald F statistic	19.095 [16.38]	19.095 [16.38]

- We use average sunshine hours (summer 2003) as an instrument variable;
- Longer sunshine hours may slow the spread of the virus (SARS), that is why we have negative first-stage coefficients;
- But sunshine time may not directly impact the virus spread in 2020 (COVID-19);
- The significant results of 2SLS show that it is a good way to address the endogeneity issue.

2.3 COVID-19 pandemic and RER

Mechanisms

Cognition recognition: the website browsing index of “SARS” from 2019.12 to 2020.2;

Institutional thickening: laws and regulations related to SARS in each prefecture from 2003 to 2020;

Technology recombination: the citation of SARS-related patents in 2020.

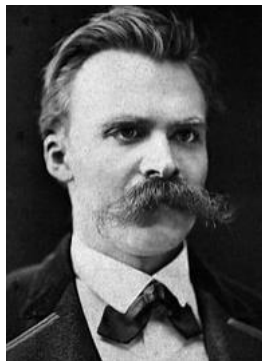
- The three mechanisms mentioned earlier hold !
- Cognition recognition, institutional thickening and technological recombination **benefit** RER (at least in our case).

	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
	attention	law	patent	Res	Res	Res	Res_E	Res_E	Res_E
sars	0.3655*** (0.0852)	0.2108* (0.1039)	0.3178*** (0.0942)						
attention				0.0723*** (0.0107)			0.0307*** (0.0084)		
law					0.0418*** (0.0108)			0.0233*** (0.0080)	
patent						0.0789*** (0.0095)			0.0425*** (0.0085)
_cons	4.5841*** (1.5776)	-10.4945*** (2.2646)	-14.3083*** (3.4067)	-1.5806*** (0.4062)	-0.8104** (0.3431)	-0.1200 (0.2270)	-0.3835 (0.2421)	0.0018 (0.2010)	0.3649* (0.2083)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	292	292	292	292	292	292	292	292	292
R ²	0.6503	0.4072	0.5607	0.5976	0.5275	0.6377	0.4513	0.4469	0.4905

2.3 COVID-19 pandemic and RER

Conclusions

- We have addressed the concern about RER in the context of global pandemic;
- It is a novel trial to integrate the literature of EG, psychology and innovation theory;
- Cognition, institution and technology are important !
- In this way, we broaden the scope of “**knowledge**” in EG studies;
- However, the memorial of other shocks should be discussed further.



Friedrich Wilhelm Nietzsche



**What Doesn't Kill You
Makes You Stronger !**



Main takeaways

- Regional economic resilience is a promising topic in EG, international management, governance...
- Human society is disaster-prone → it is hard to predict what will happen tomorrow;
- But we can prepare for disasters that we had experienced !
- Resilient to what, resilient of what... It is a good way to conclude economic resistance and recovery;
- But it is also a good start point to better understand the operation of regions.

Our relevant works

[1]He Canfei,Chen Tao,Zhu Shengjun. Do not put eggs in one basket: related variety and export resilience in the post-crisis era[J]. Industrial and Corporate Change,2022,30(6).

[2]Zhang Peng, He Canfei, Li Jing, Wang Wenyu. Economic sanctions and regional economic resilience: Evidence from the US-China trade war. Journal of World Business, R&R.

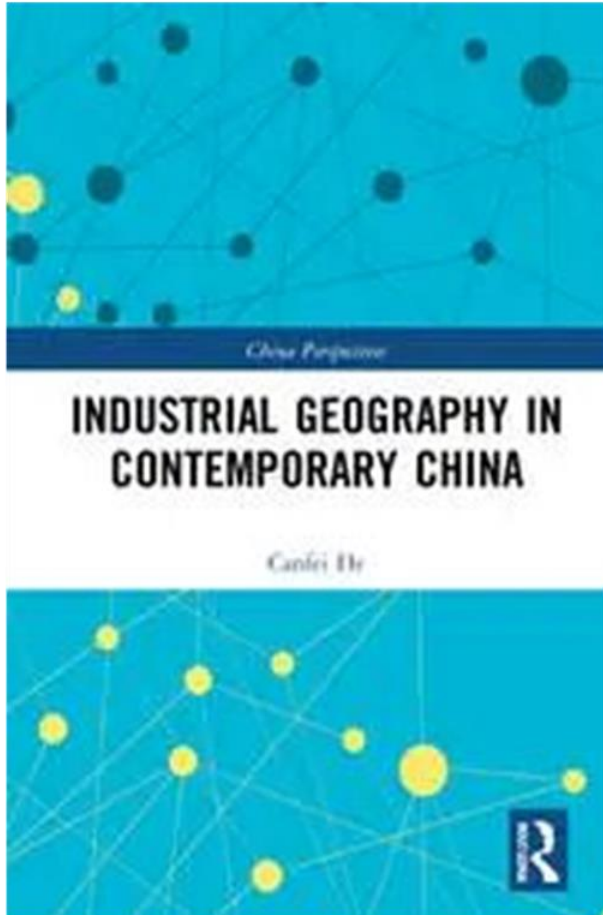
[3]He Canfei, Xing Zuge, Sheng Hantian, Dai Xiaomian. Pandemic, path dependence and regional economic resilience: Evidence from China. Working Paper.

[4]He Canfei, Sheng Hantian. Institutional quality, related variety and regional economic resilience in China. The Annals of Regional Science, under review.

[5]He Canfei, Sheng Hantian, Dai Xiaomian, Zhang Yifan. Hustle and bustle in China's Capital: The effects of COVID-19 pandemic on urban industrial dynamics. Working Paper.

[6]Sheng Hantian, Dai Xiaomian, He Canfei. Gone with the pandemic? The spatial effects of the Covid-19 on global investment network[J]. Applied Geography, 2023, 102978.

英文专著：Industrial Geography in Contemporary China (2022)



- 从当代中国视角梳理了改革开放以来中国工业地理的发展历程、中国工业地理的研究范式以及中国工业地理研究所取得的理论与实践成果。
- ◆ 通过系统的参考文献，丰富的实证结果，生动的案例分析，帮助读者全面准确了解中国工业地理研究的脉络，把握相关领域的前沿信息。本书前两章重点介绍了中国工业化与工业政策演变的历史背景；接下来从产业集聚、城市发展与规划、演化经济地理、对外贸易与投资、土地资源利用、创新、环境治理等多维度审视了中国工业地理的格局、影响及相关机制。
- ◆ 本书是经济地理研究生、相关领域研究者的重要参考读物，也有助于将中国工业发展的经验、成果推向世界舞台。

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ERSA 2023, Alicante, Spain

Thanks for your attention!

Gracias!

谢谢!

Canfei He, Professor

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