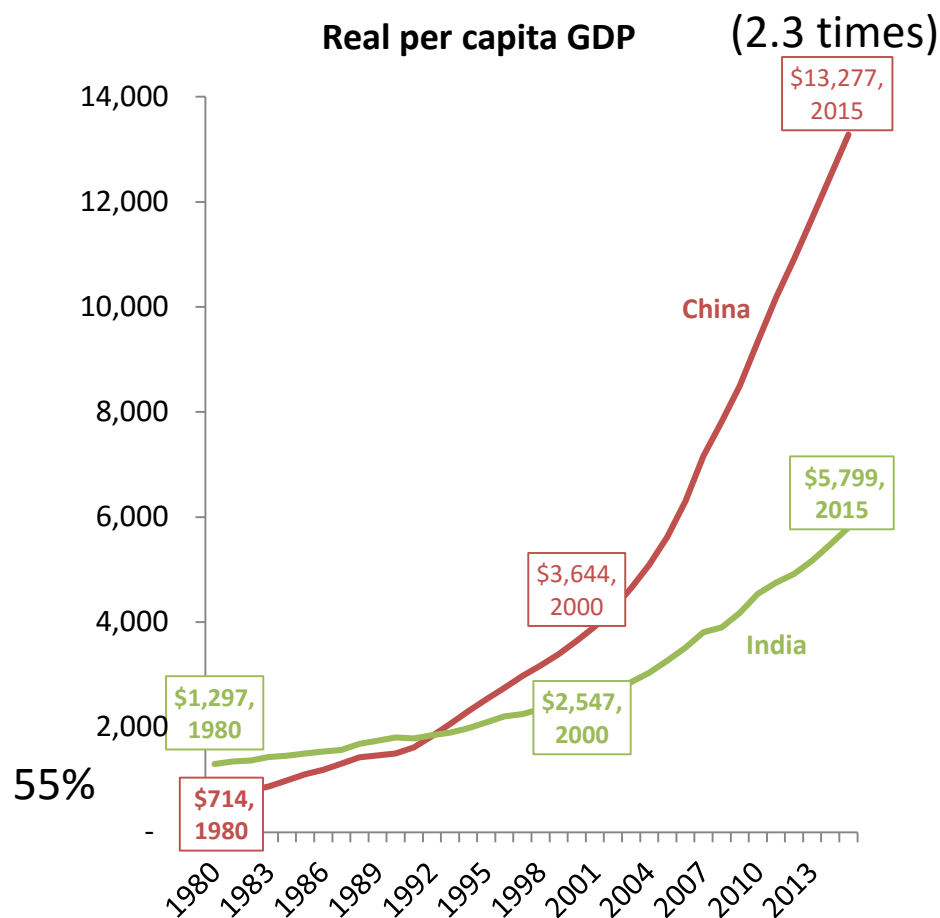


From “Made in China” to “Innovated in China”: Necessity, Prospect, and Challenges

Shang-Jin Wei, Zhuan Xie, and Xiaobo Zhang

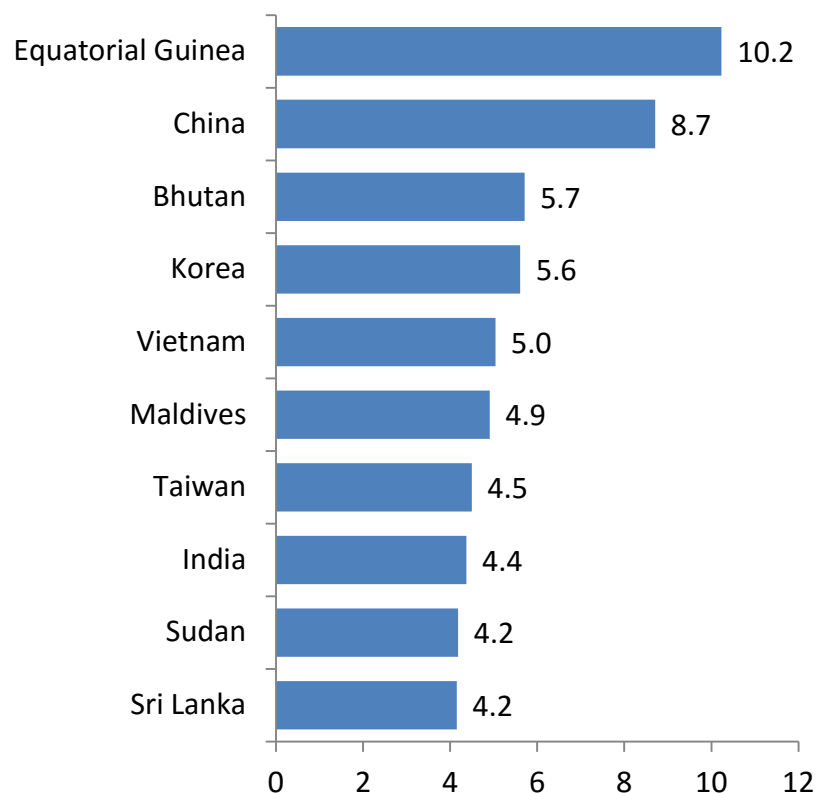
China's (past) growth has been spectacular



Note: Figures in 2011 PPP.

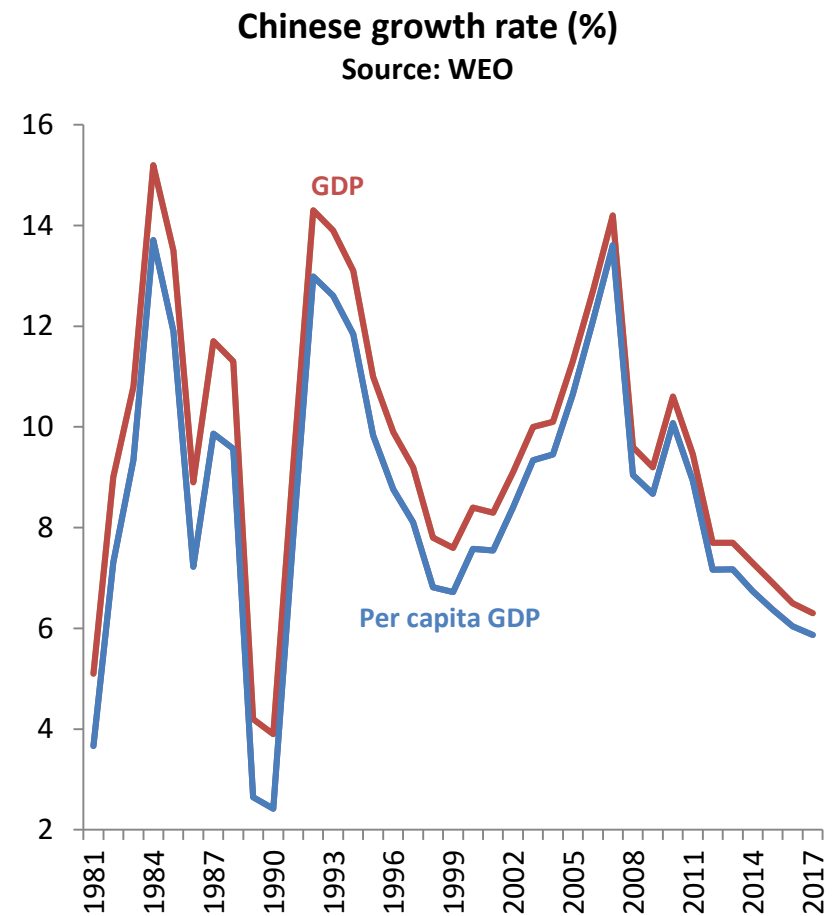
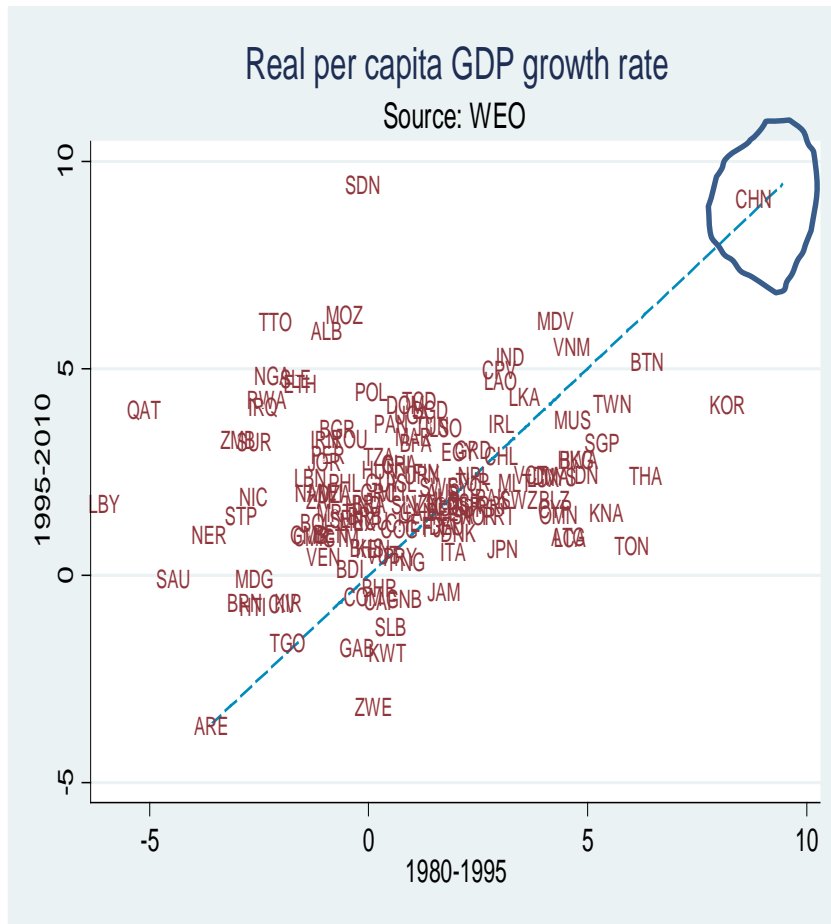
Source: ADB calculations from WEO April 2016.

Average real per capita GDP growth, 1980-2015



Note: Figures in 2011 PPP.

Source: ADB calculations from WEO April 2016.



Notes: Figures in 2011 PPP. Excluding outliers: Liberia and Equatorial Guinea

Some numbers to put things in perspective

- Average real per capita GDP growth of 8.7% during 1980–2015
- Real per capita GDP increased from \$714 in 1980 to \$13,277 in 2015
- Only Equatorial Guinea has exceeded China's performance
- Real per capita GDP growth of more than 6% for 25 consecutive years from 1990 to 2015

Note: Figures in 2011 PPP.

Reasons for the growth success (1)

- Policy actions
- Economic fundamentals

Reasons for the growth success (2)

- Policy actions

- Launching market oriented reforms

- Agriculture -“household responsibility system”
 - Industry and service
 - “grasp the large and let go of the small”
 - Lower entry barriers

- Embracing globalization

- “Democratization” of trading rights
 - Openness to FDI
 - Accession to the WTO

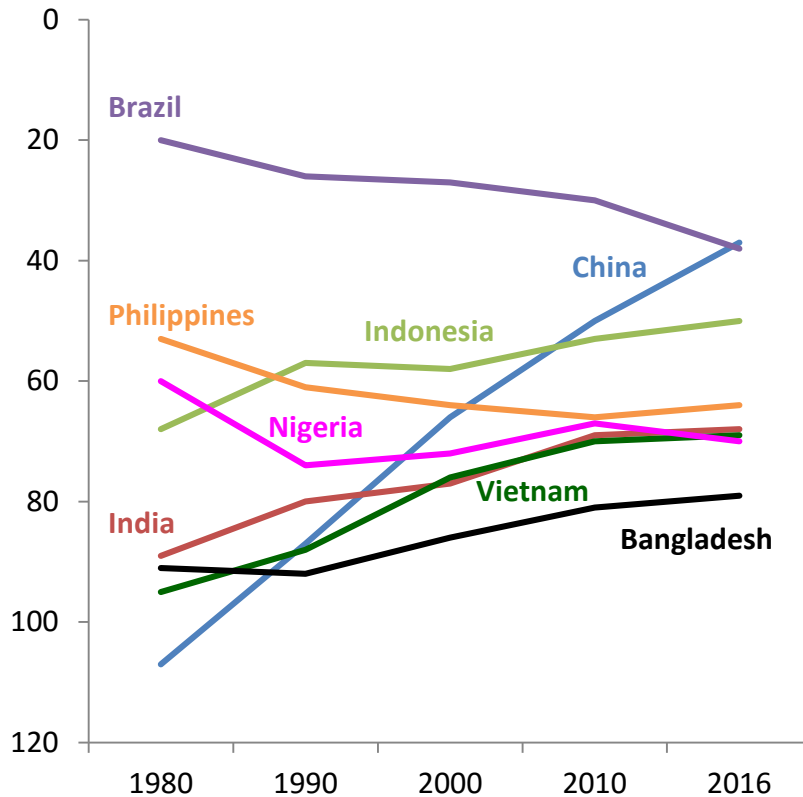
- Minimizing resistance

- Dual track system
 - Special economic zones
 - Political centralization + economic decentralization

Reasons for the growth success (3)

Economic Fundamentals: low wage + favorable demographics

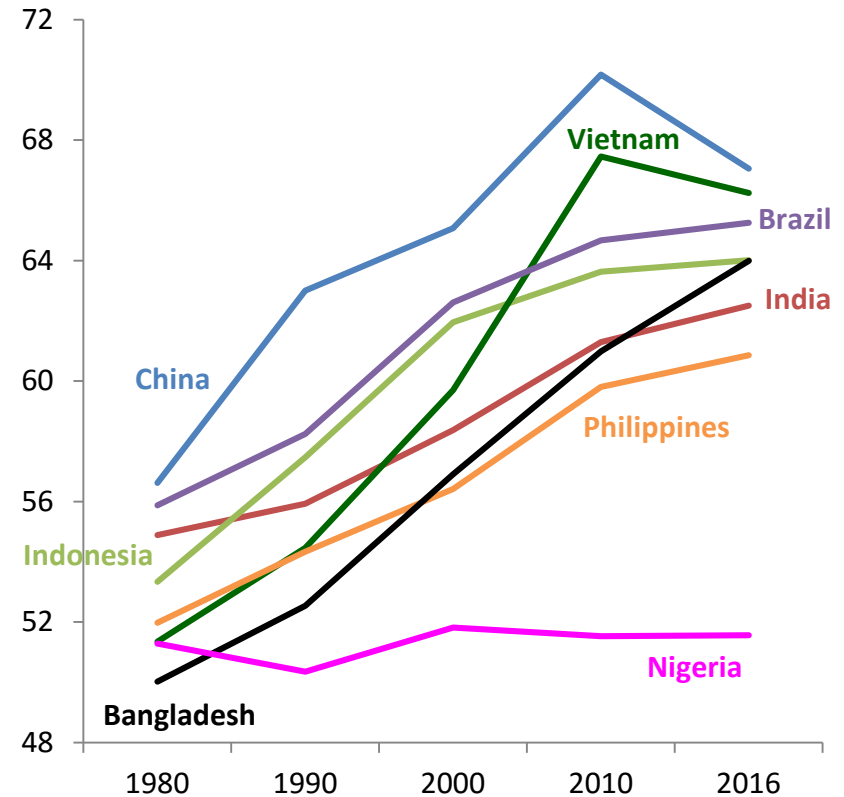
Rank of real per capita GDP
among 138 non-OECD countries



Note: Figures in 2011 PPP.

Source: ADB calculations from WEO April 2016.

Share of working age cohort (15-59)
in population (%)



Source: Haver Analytics.

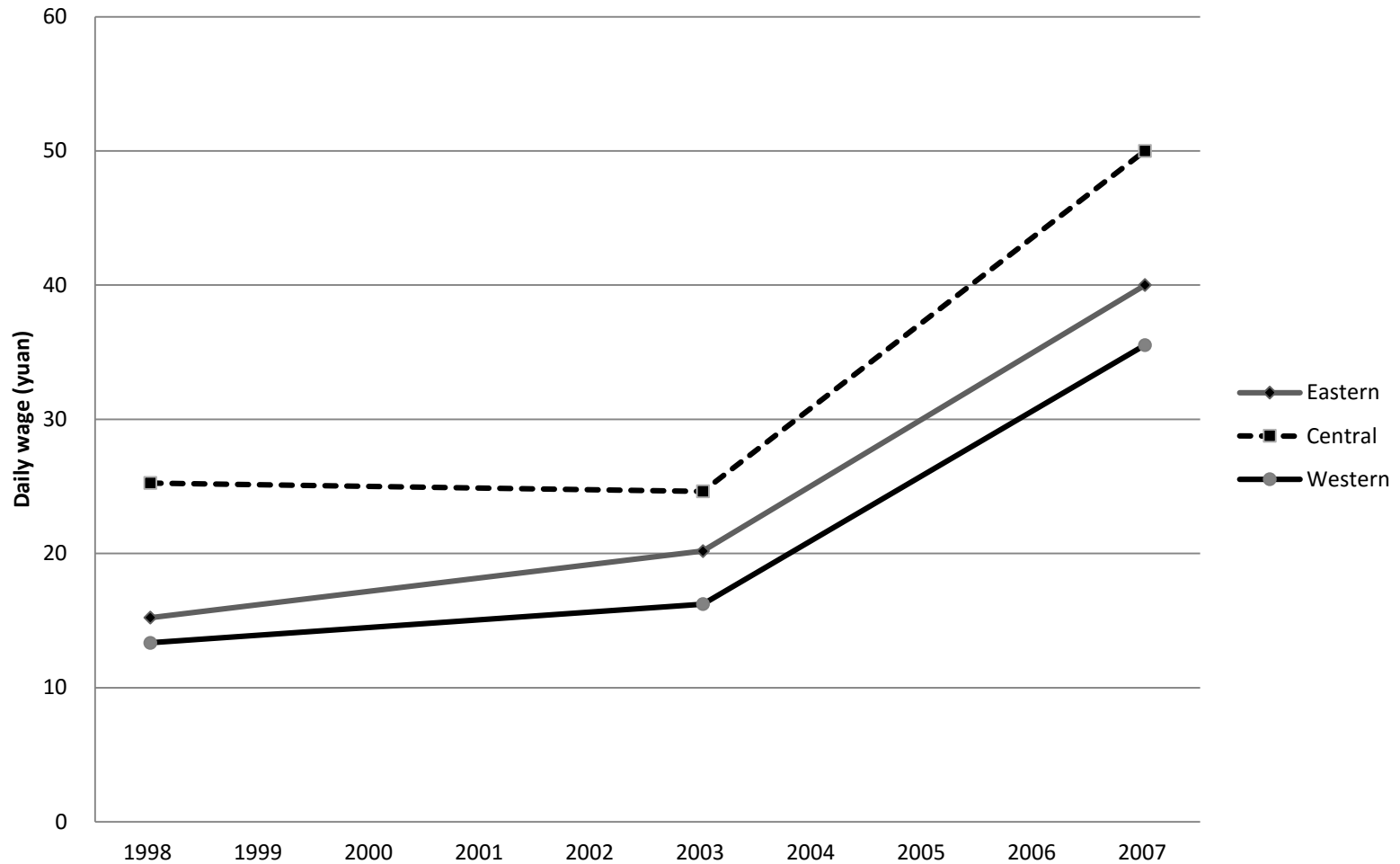
Rio Olympics opening ceremony



Beijing Olympics opening ceremony

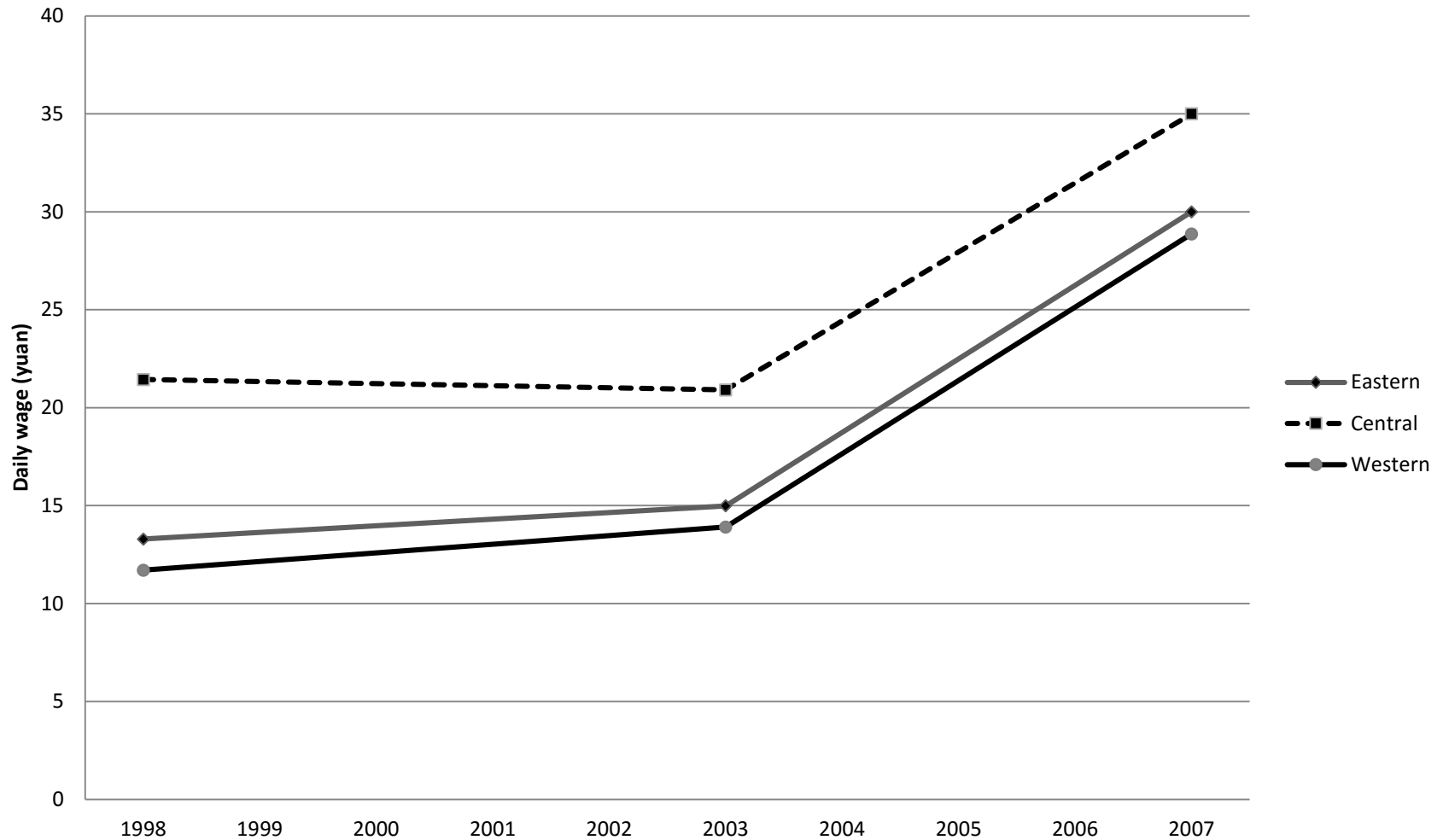


Rising Real Wages (Men)



Zhang, Yang, and Wang, CER 2011

Rising Real Wages (Women)



Chinese factories: Past and present



Growth is likely to moderate further

- Vested interest groups have formed and low-hanging fruits of institutional reforms have been picked.
- Due to cyclical (weak global economy) and structural factors (rising wages, shrinking workforce)
- Postponing retirement age, increasing female labor force participation, and relaxing family planning policy will not reverse the trend in the short-run

Options for Chinese firms

- **In:** move to inland provinces
- **Out:** outward direct investment
- **Down:** shut down
- **Up:** innovation and upgrading. Future growth must mainly come from labor productivity growth.

- Can the transition from “made in China” to “innovated in China” happen?

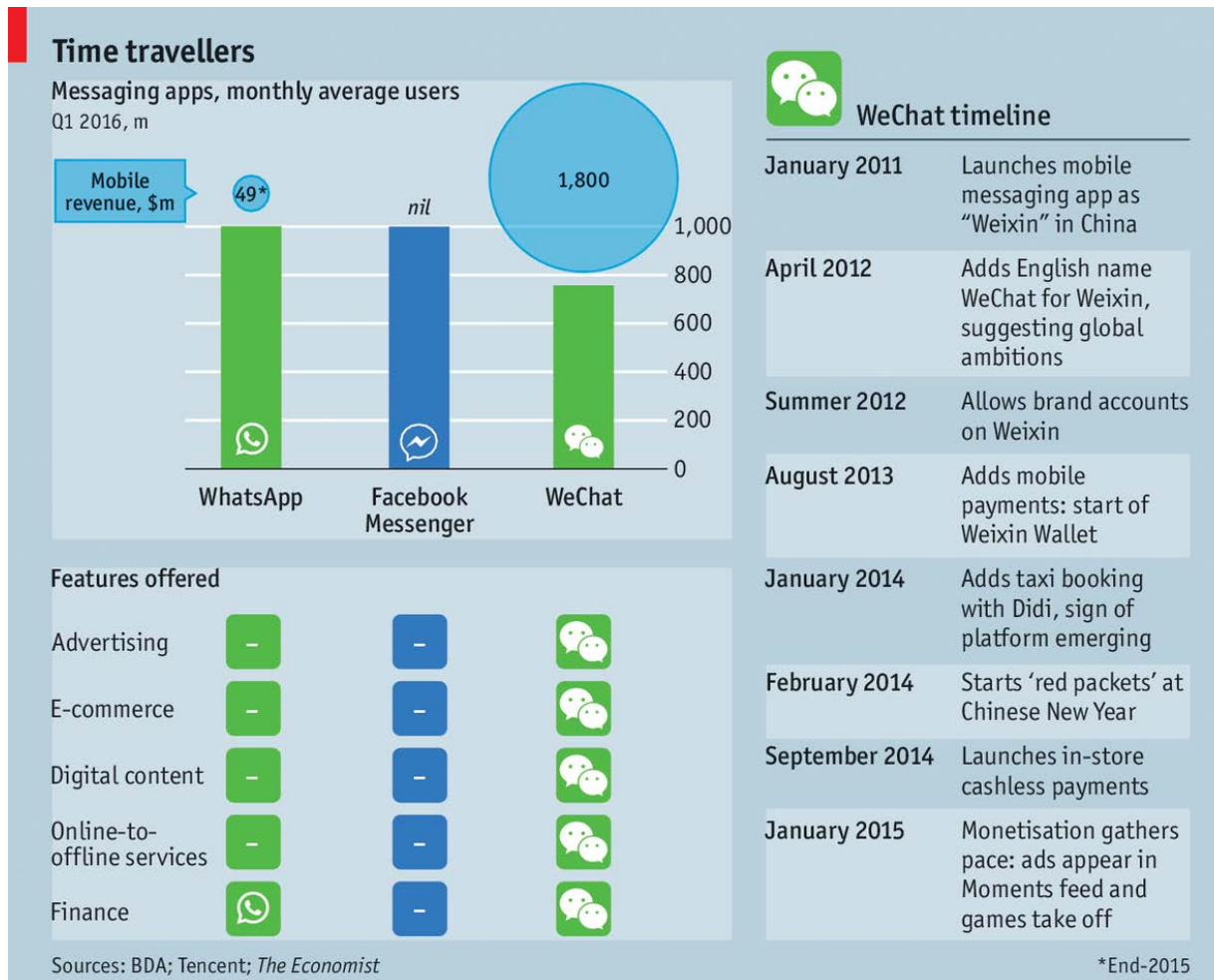
“China’s Transition to a More Innovative Economy: Progress and Challenges,” (Shang-jin Wei, Zhuan Xie, and Xiaobo Zhang), *Journal of Economic Perspective*, 31 (1): 49-70, 2017.

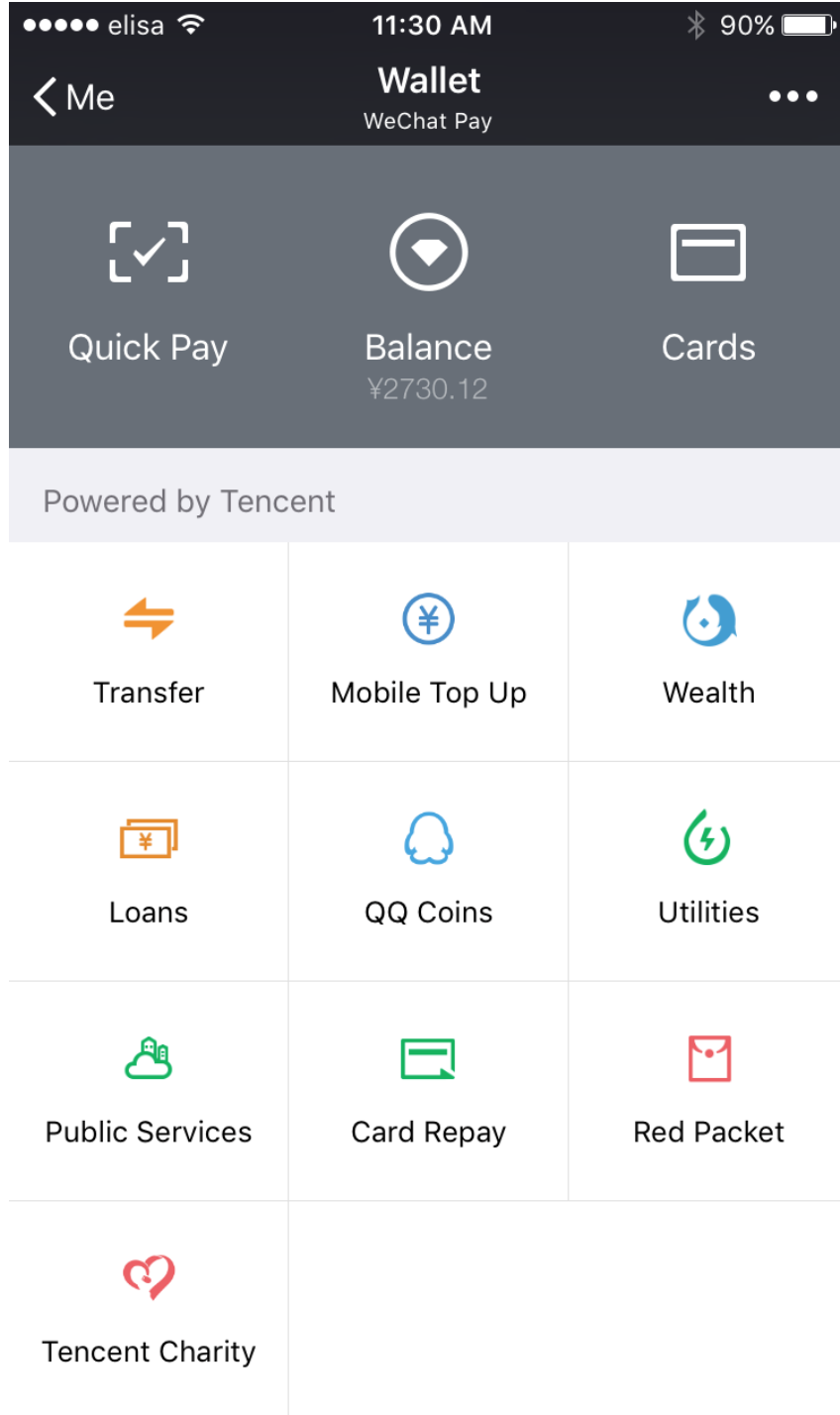
If you want to look reasons to say no, you can find them



If you wish to look for optimistic examples, you can find them too.

WeChat's world





WeChat Wallet

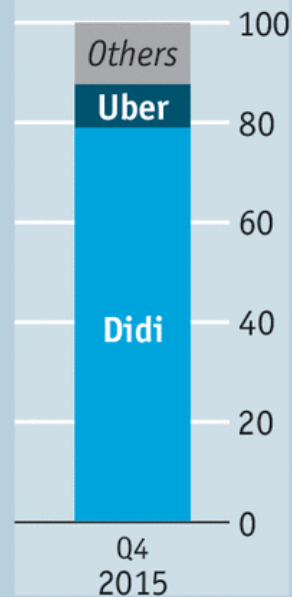
Uber gave up

The days of free-riding

China, ride-hailing*

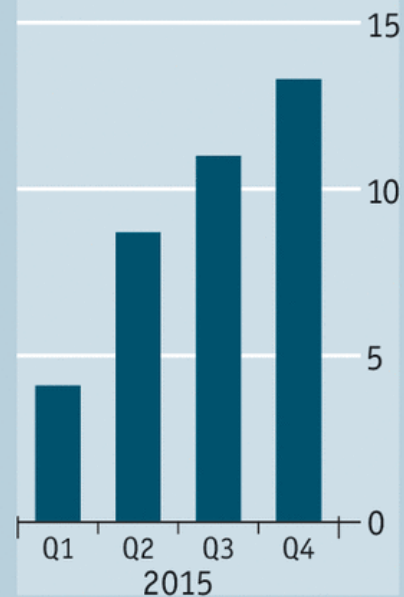
Market share

%



Fares†

Yuan bn



Source:
Analysys

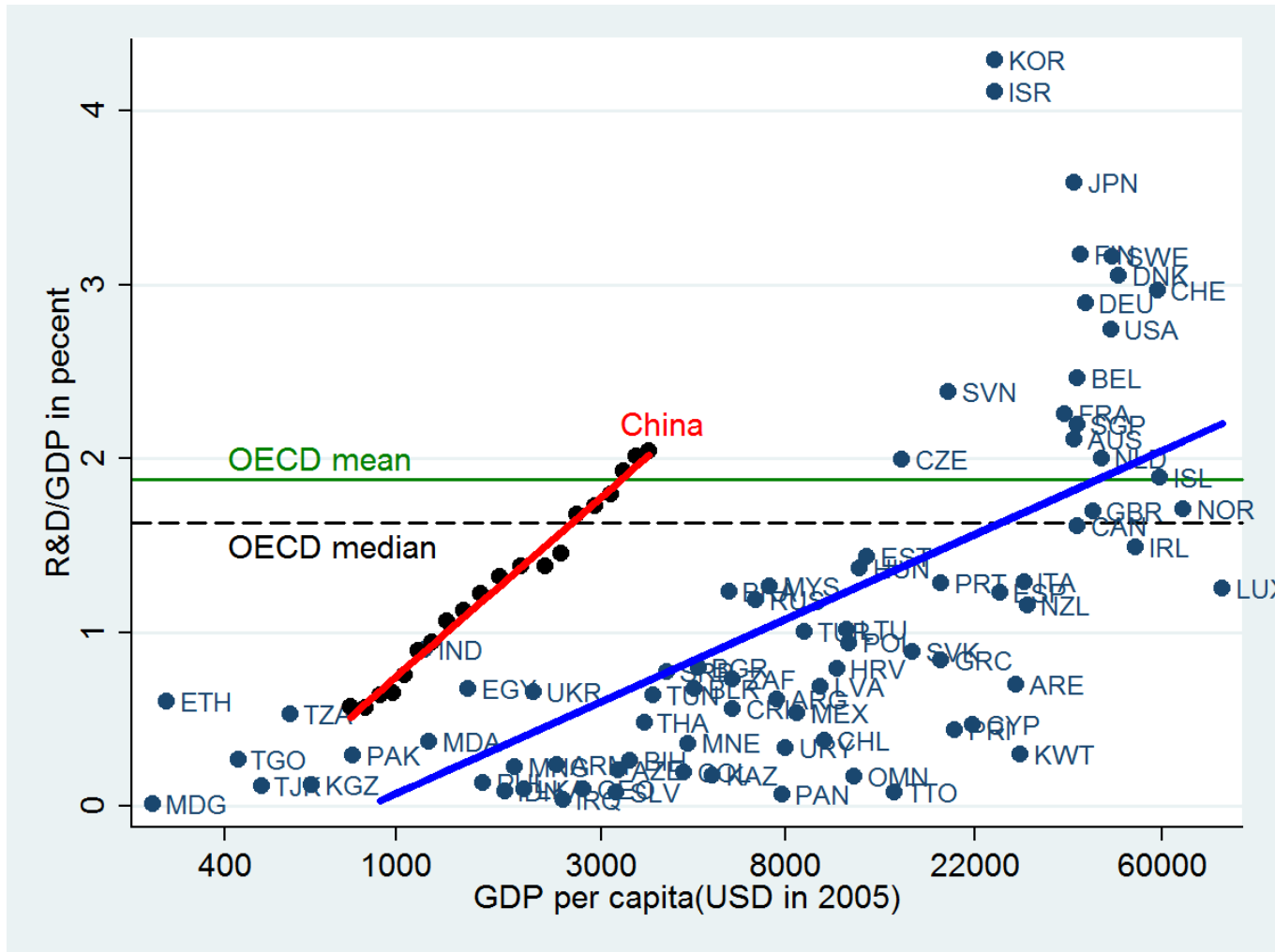
*Includes chauffeur-driven cars but not taxis
†Shared by drivers and ride-hailing firm

Economist.com

What do the systematic data say?

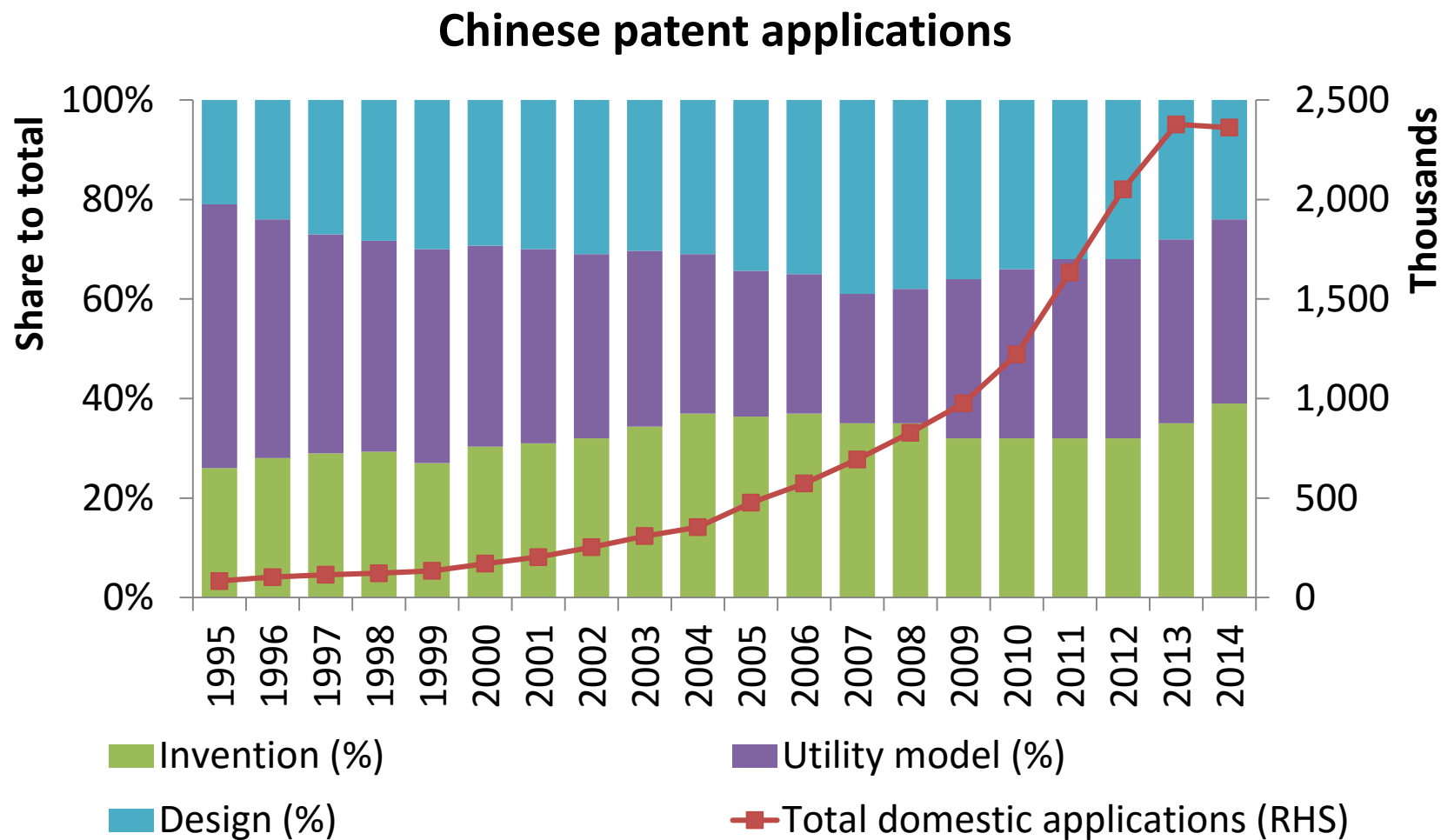
- What is the actual growth of innovation of China's firms?
- What accounts for the relatively fast pace of innovation (as measured by patent applications and approvals) by Chinese firms?
- Is there possible resource misallocation in the innovation space?

R&D/GDP vs GDP per capita



Note: data for China are from 1995 to 2014, and data for all other countries are for 2014 or the latest year available. Source: OECD database and World Bank.

Number of Chinese patents has exploded

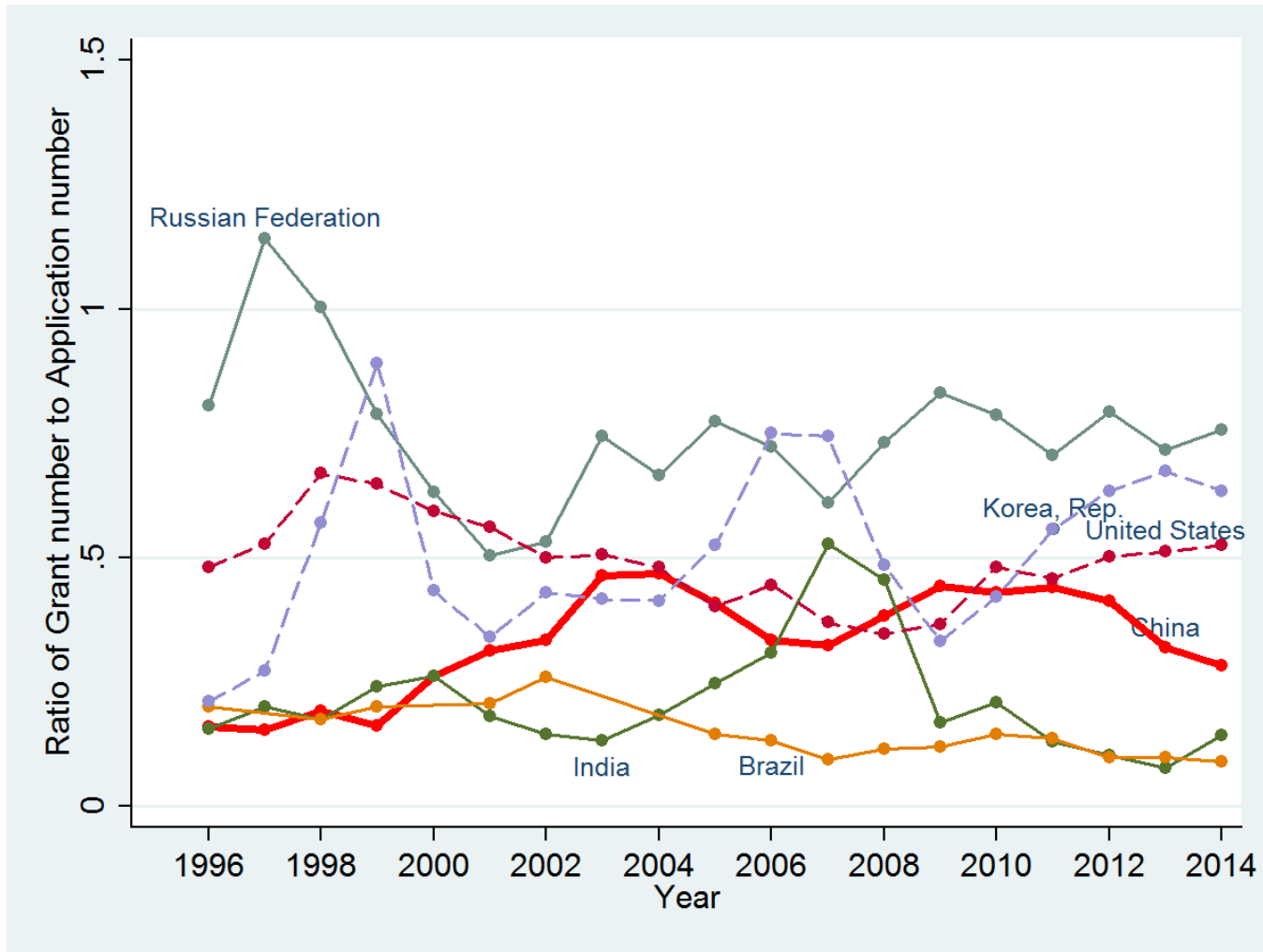


What explains China's innovation growth

- Easy approval?
- Government subsidies?
- Taking advantage of expanding market opportunities
- Spurred by rising wages?

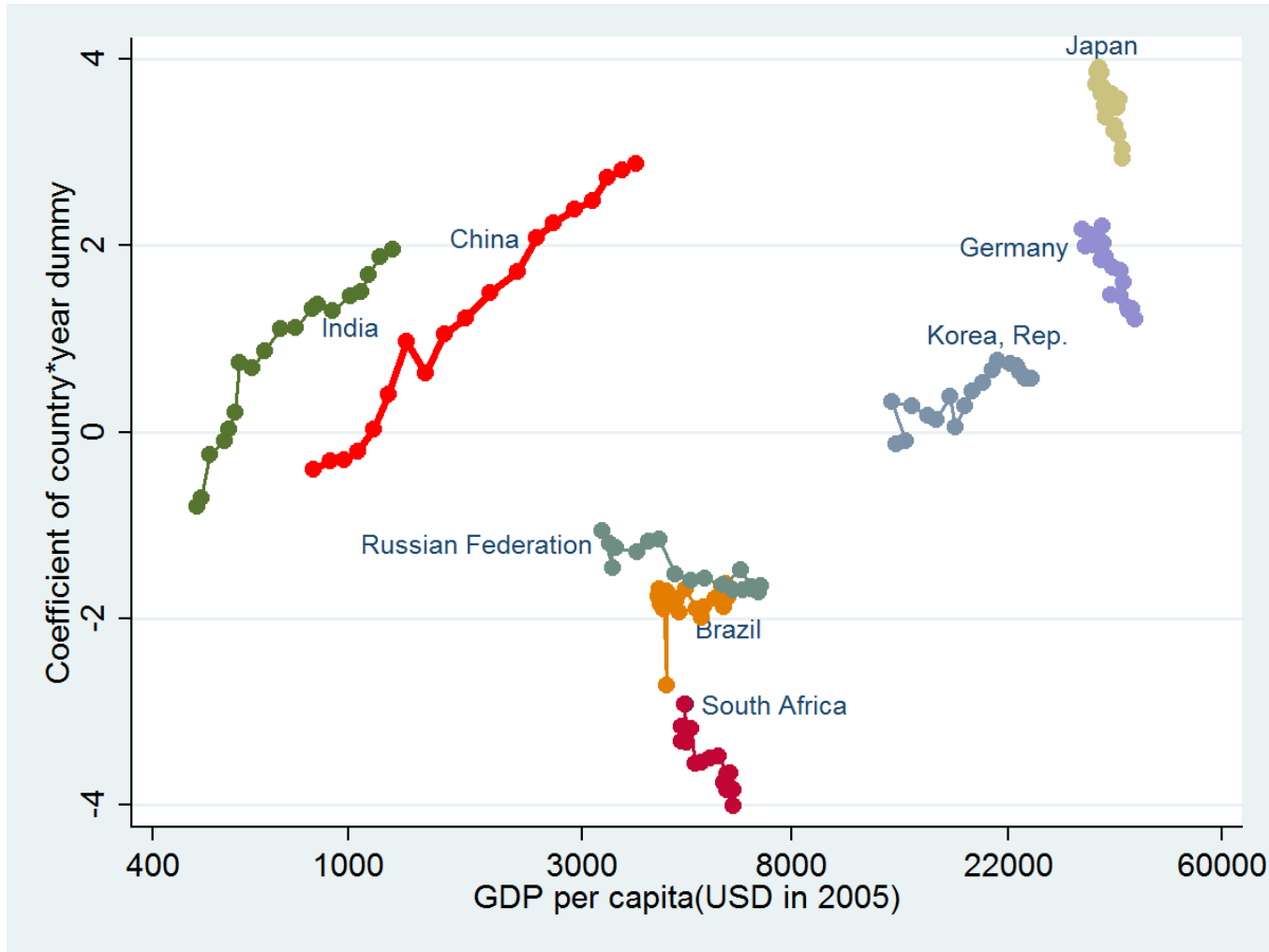
Patent approval rate is not unusually high

Patent Approval Rate in BRIC Countries, the Republic of Korea, and the U.S.



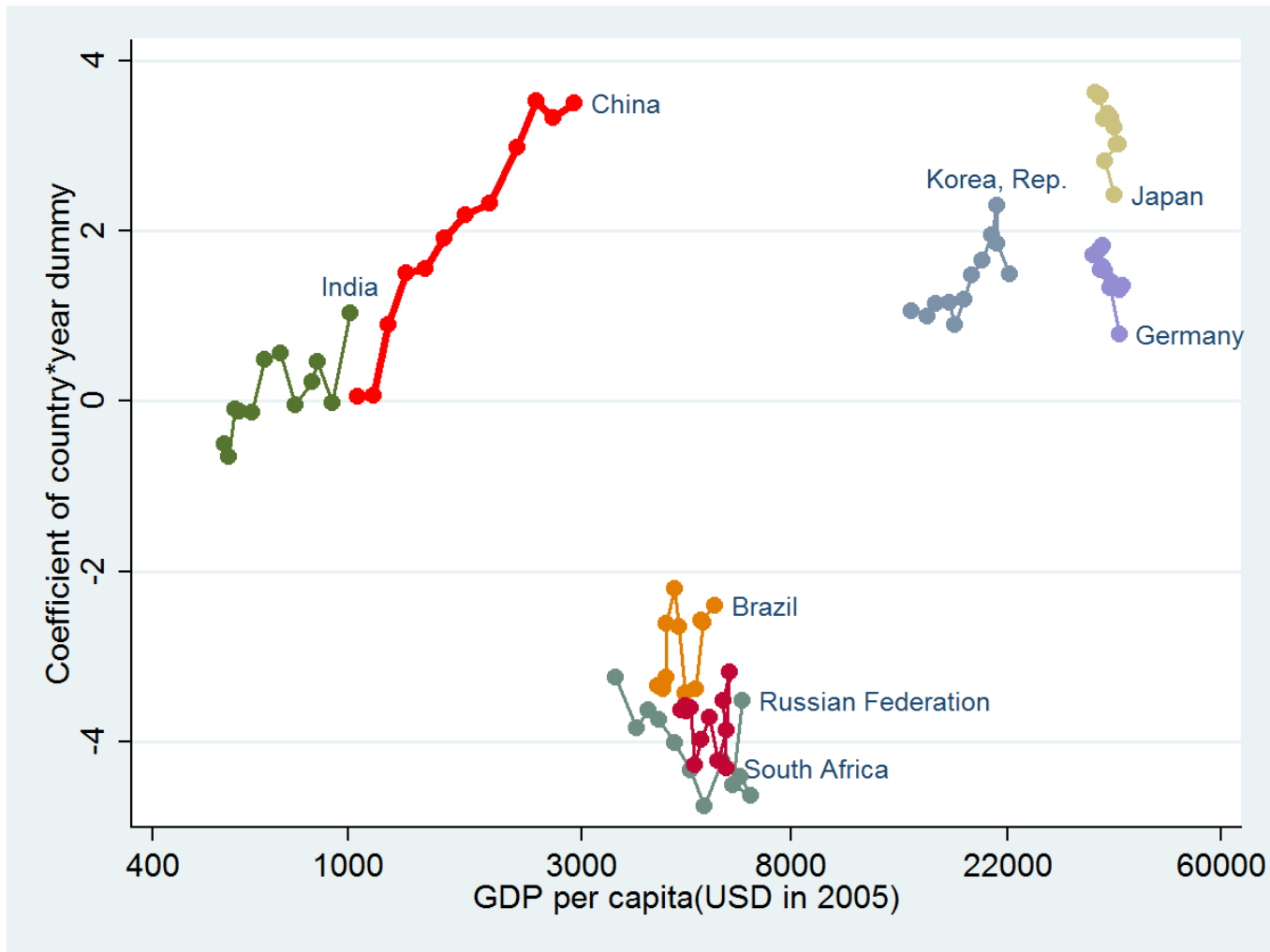
Invention patents in the US show a rising trend

Invention Patents Granted in USPTO by Different Countries



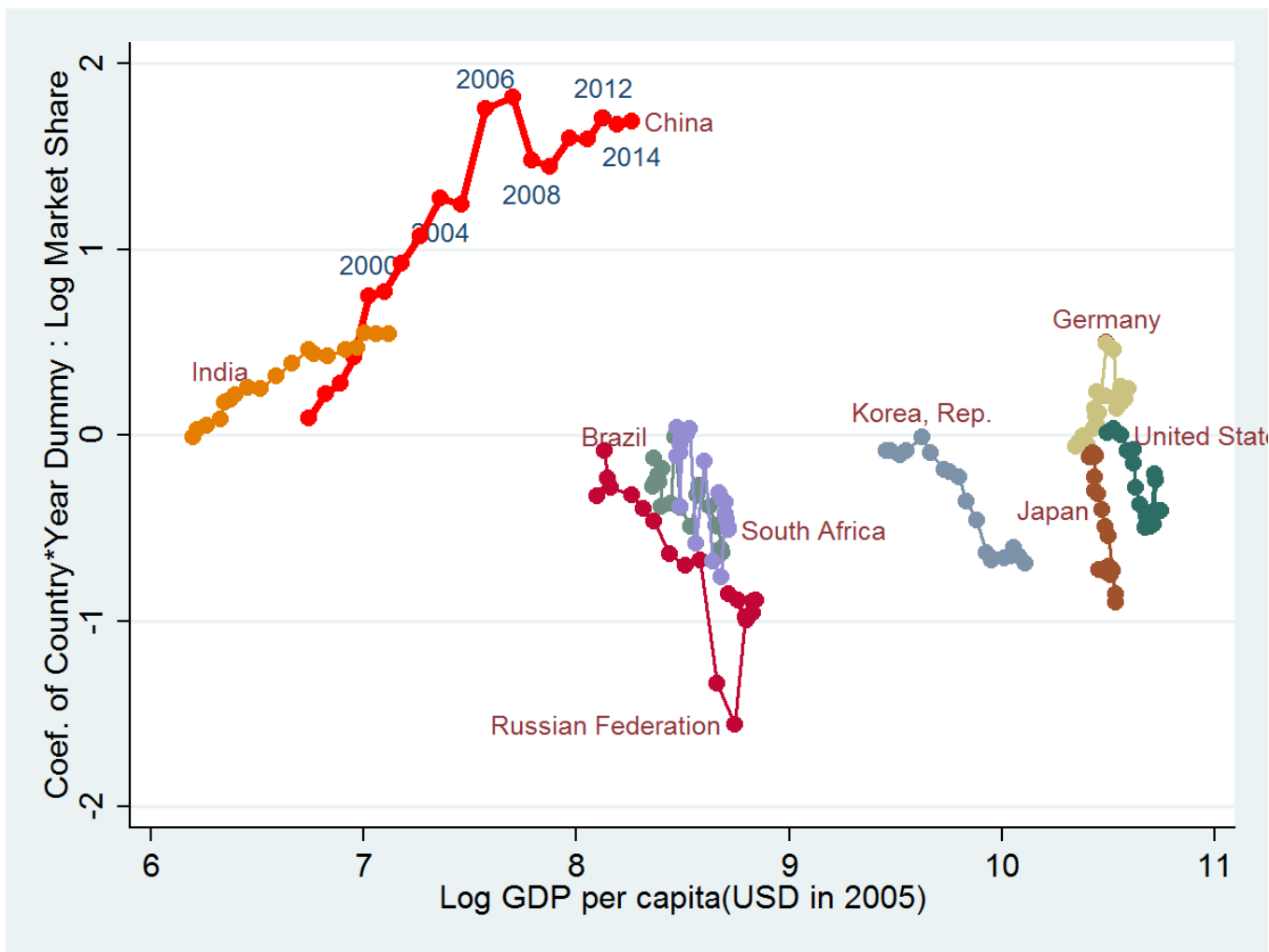
Growing patent citations indicate quality improvements

Citations on Invention Patents Granted by USPTO: Cross-country Comparison



Chinese product quality has steadily improved

Export Quality: Conditional Plot on Export Market Shares in Selected Countries

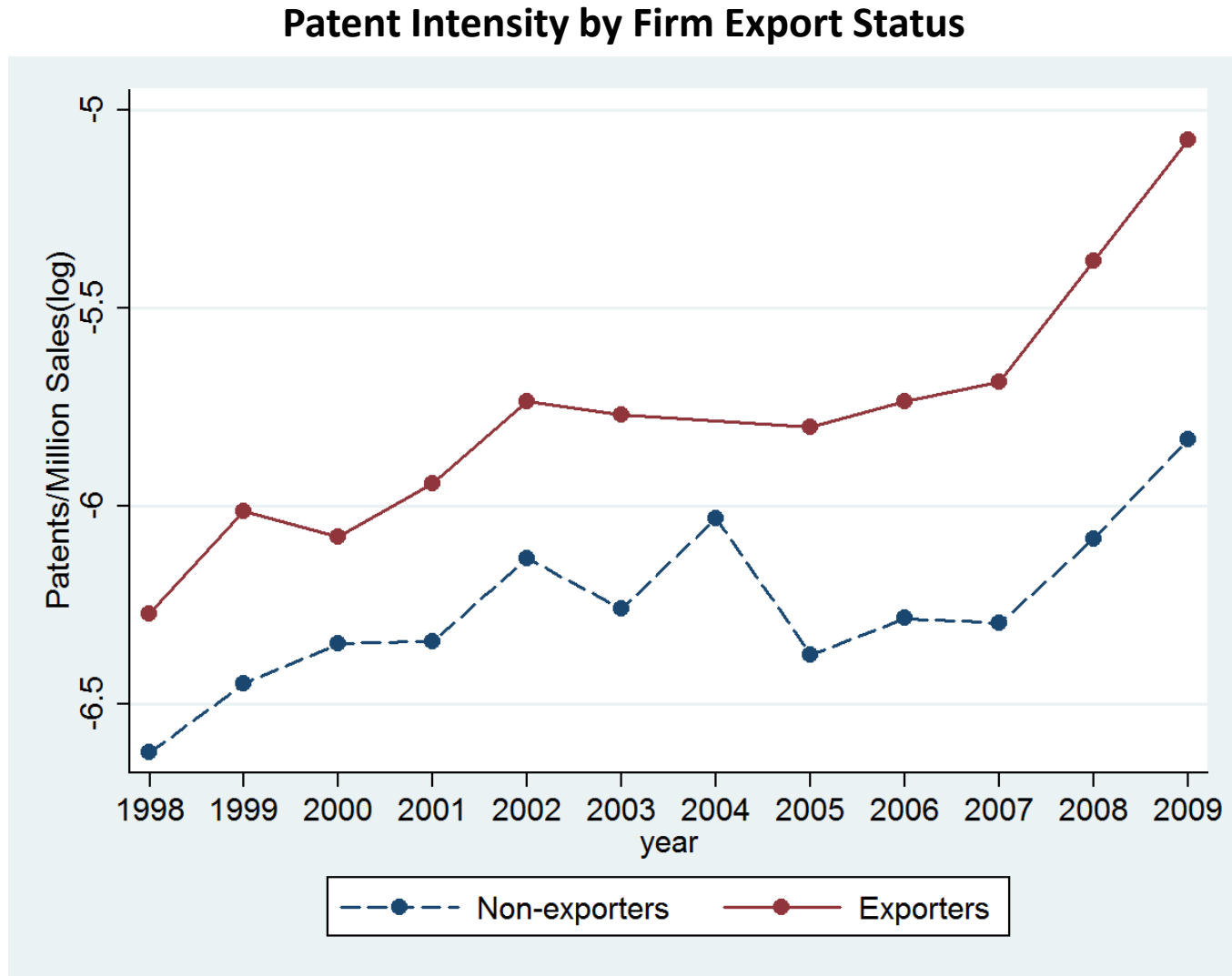


- What drives the rising pace of innovation?
- Statistical analysis

Quantifying the drivers of innovation

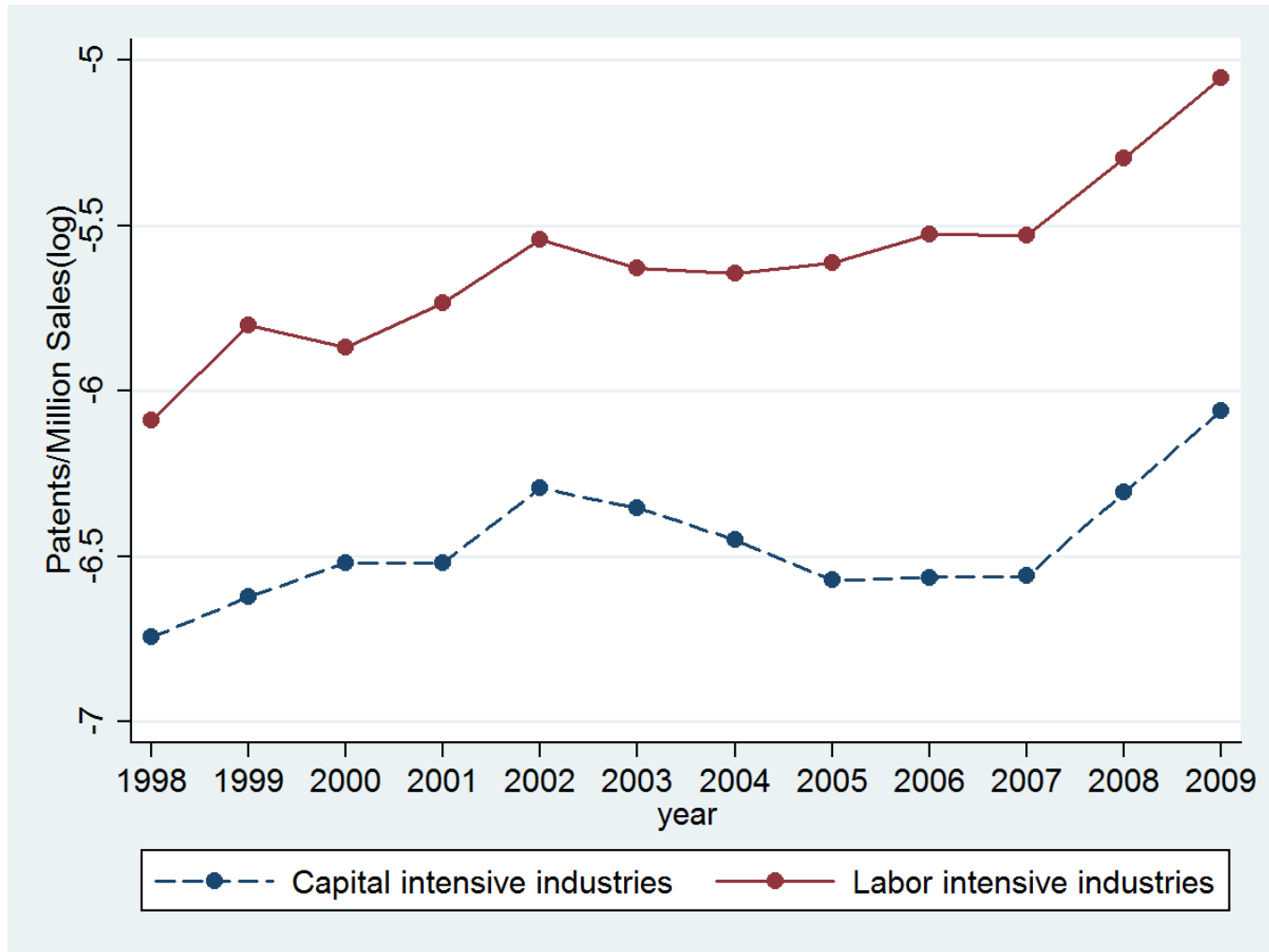
- Regress patents on:
 - Wages
 - R&D subsidy rate
 - Tariff rate of trade partners
 - Market competition
 - Other firm characteristics (e.g., sales, tax rate, interest rate on liabilities, exporter or not)

Export firms are more innovative



Labor-intensive firms innovated more

Patent Intensity by Firm Capital Intensity

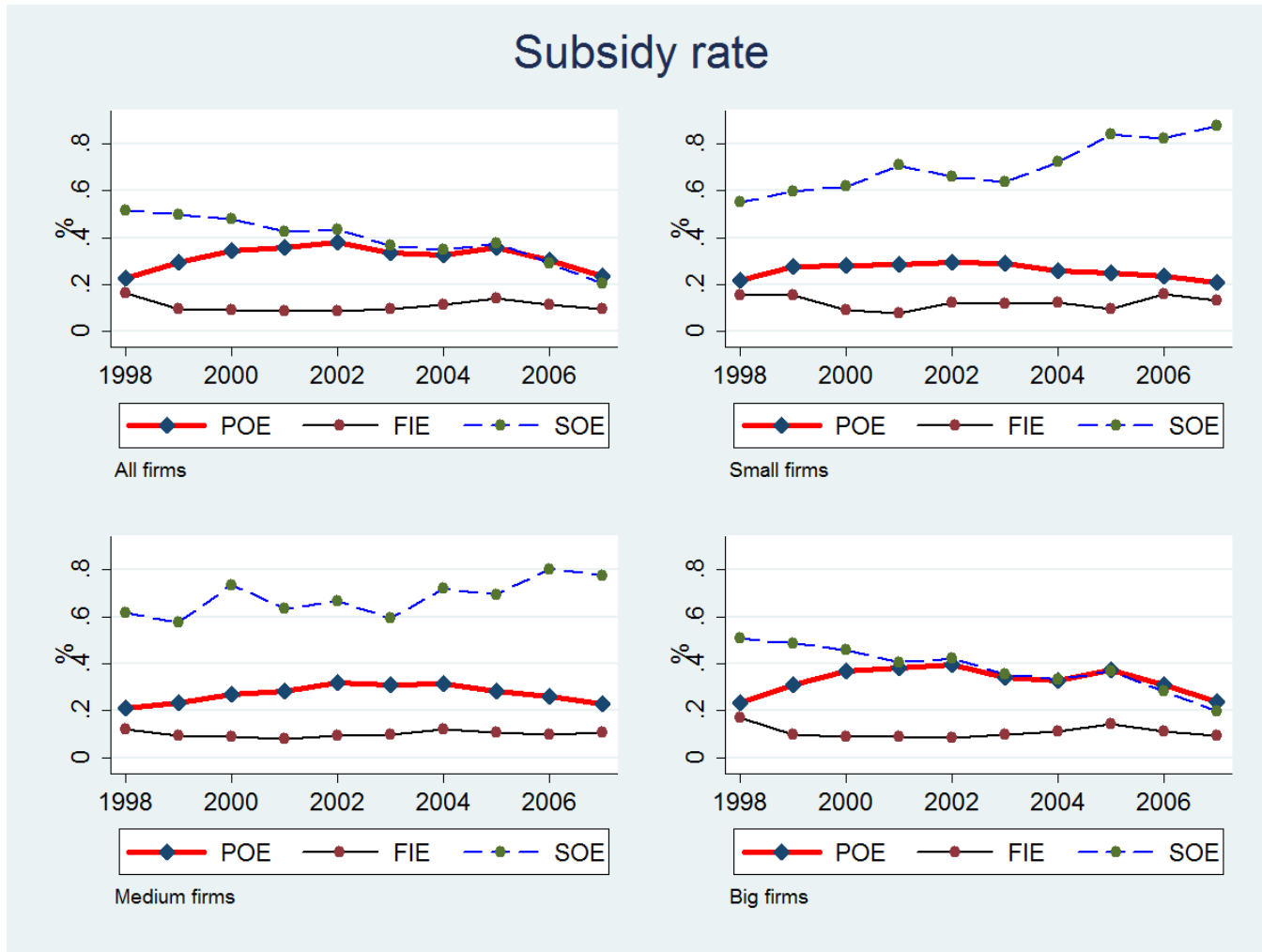


Key results

- Firm size is (+) associated with # of patents
- Export firms are more innovative
- Lower (foreign) tariffs are good for innovation
- Invention patents respond (+) to subsidies
- High tax rate discourages innovation
- Higher cost of capital discourages innovation
- Robust (+) relationship between wages and innovation

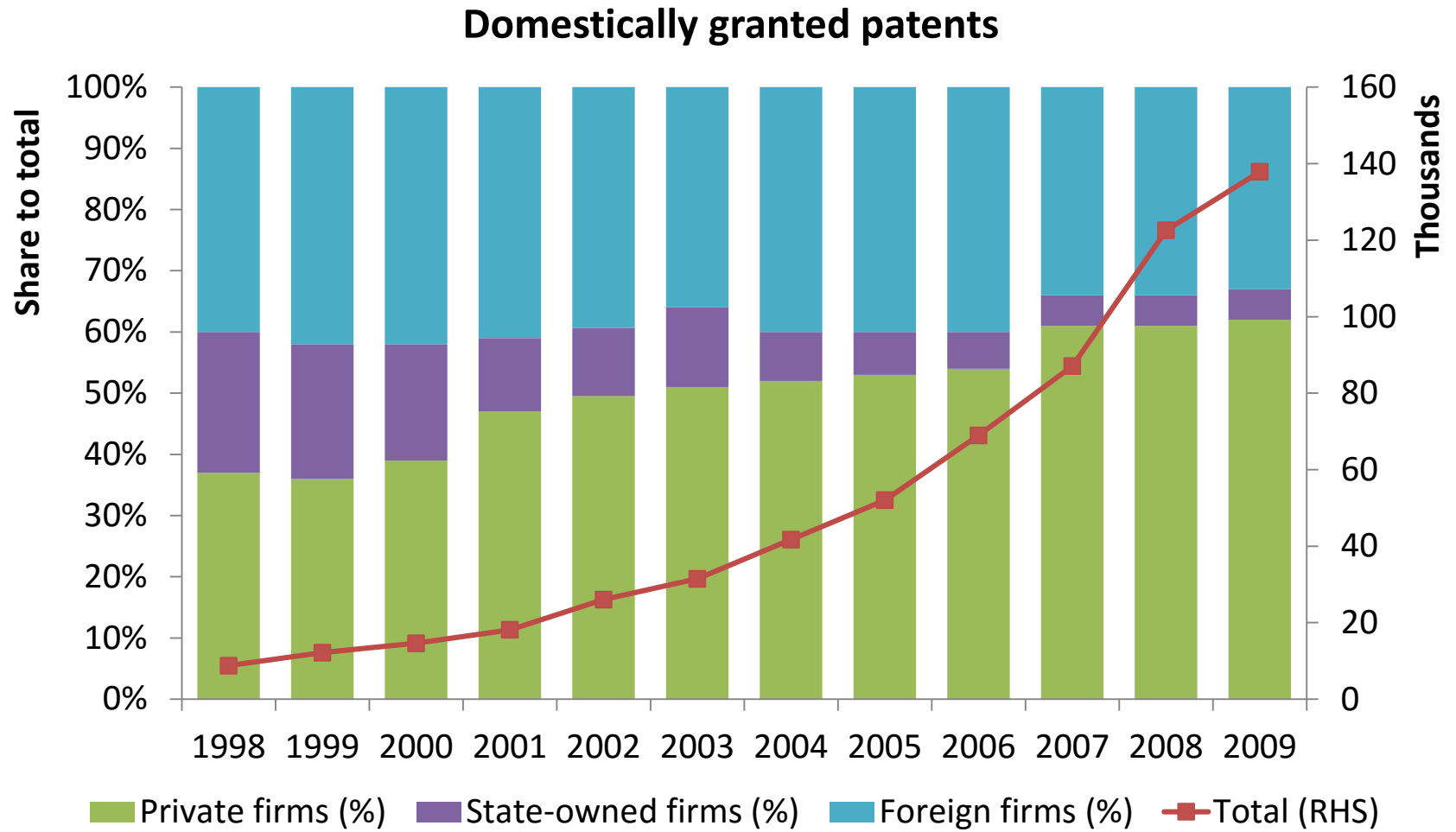
SOEs granted more subsidies...

Ratio of Subsidies to Sales by Firm Ownership and Size



Source: China annual above-scale industrial firm surveys.

...but lag behind private firms in patent generation



SOE R&D resources not efficiently spent

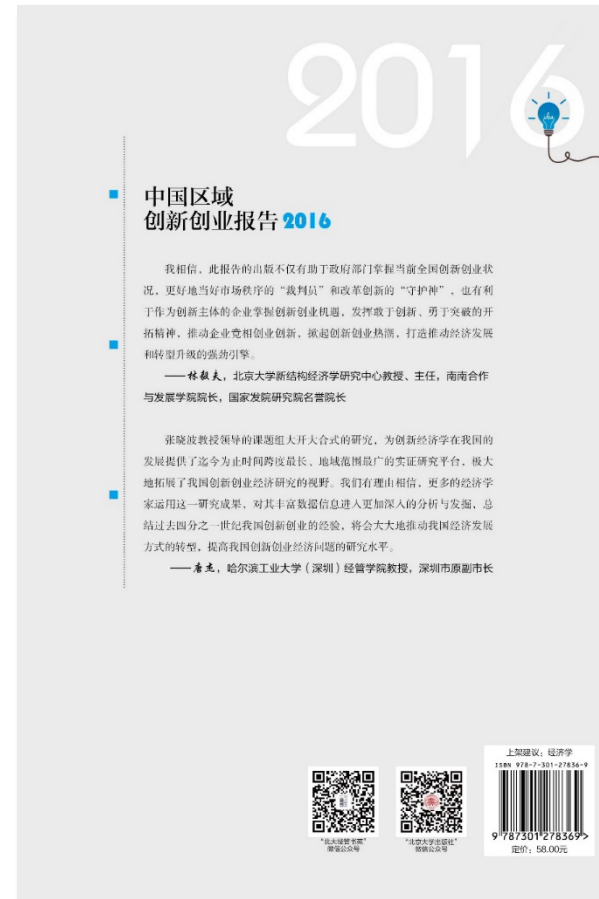
Impact of R&D on Patent Output

Variables	Total	Invention	Utility model	Design
R&D (log)*FIE	-0.006*	-0.006	0.002	-0.016**
R&D (log)*SOE	-0.011**	-0.020***	-0.004	-0.016
R&D (log)	0.015***	0.017***	0.013***	0.012***
Sales (log)	0.274***	0.328***	0.254***	0.287***
Observations	785,235	785,235	785,235	785,235
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
AIC	300800	93583	192008	136310

Note: China annual above-scale industrial firm surveys.
R&D data are available only during 2005-2007.

Summary

- The Chinese economy fortune is at crossroads
- Can Chinese firms really innovate?
 - Patent application
 - Patent citations
- Drivers of firm innovation:
 - (i) world market opportunities; (ii) rising labor costs
- Possible misallocation
 - Subsidy allocation biased in favor of SOEs, but private firms innovate more
 - Structural reforms that level the playing field can accelerate innovations



China Regional Innovation Index (1990-2015) was released in December 2016;
China Regional Innovation Report was published by Peking University Press in 2016.

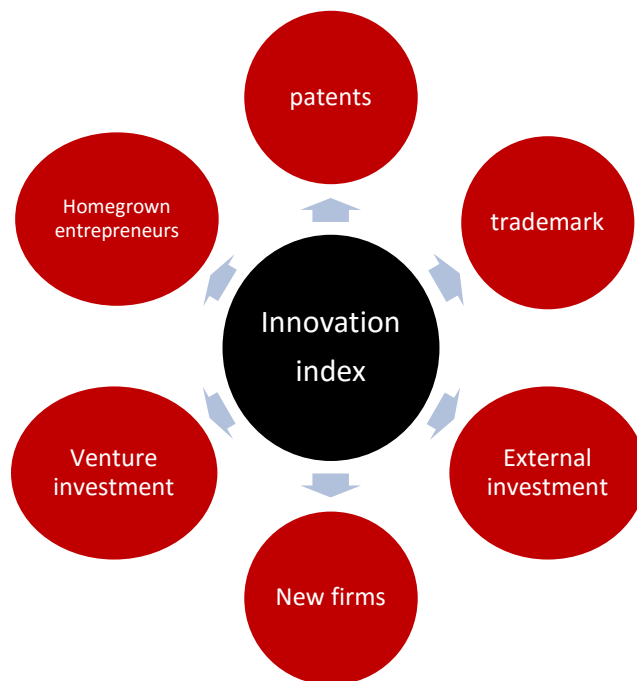
Major features

- **Market-based and output-based**
- **Universe firm database**
- **Multiple dimensions (technology, talent, and investment)**

The new innovation index combines the following data sources:

- Firm registry database, covering the number of startups and new investment
- National patent database
- National trademark database
- Venture capital investment

The major sub indicators



Methods:

- (1) Transform 10 variables into z-scores
- (2) Calculate weighted z-scores

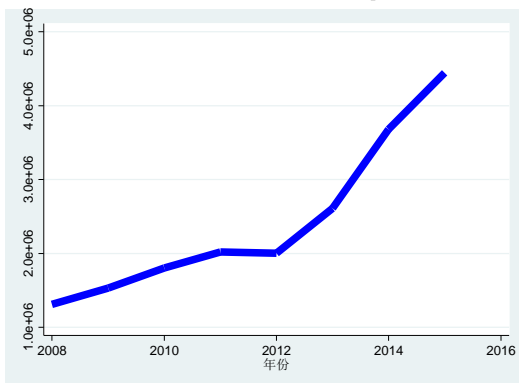
维度名称（权重）	分项指标	在子维度中所占权重	在指数中所占权重
新建企业(1/10)	新增企业注册数量	1	1/10
吸引外来投资(3/20)	新增外来法人投资的笔数	1/2	3/40
	新增外来自然人投资的笔数	1/2	3/40
吸引风险投资(1/4)	新增风险投资的企业数量	1/2	1/8
	新增风险投资的金额	1/2	1/8
诞生创业者数量(1/10)	新增本地籍创业者数量	1/1	1/10
专利授权数量（1/4）	新增发明专利授权数量	1/2	1/8
	新增实用新型专利公开数量	3/10	3/40
	新增外观设计专利公开数量	1/5	1/20
商标注册数量(3/20)	新增商标注册数量	1	3/20

Innovation index

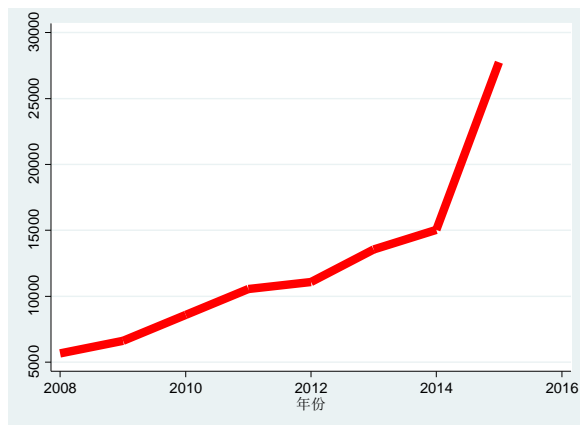
- **Time period: 1990-2005**
- **Regional coverage:**
 - (1) Ranking by province
 - (2) Ranking by city
 - (3) Ranking by county
 - (4) Ranking by urban district
- **Industry: up to SIC4 level.**

Trend of innovation

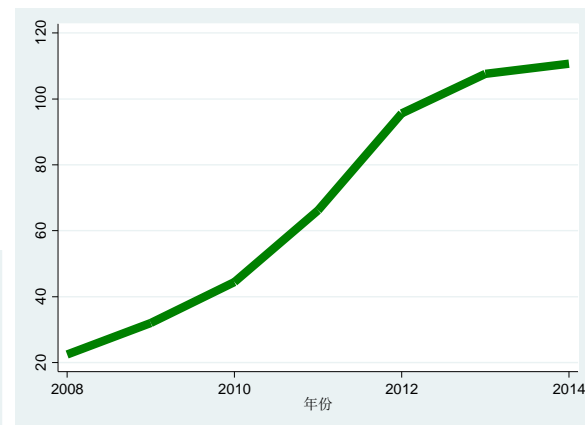
No. of startup



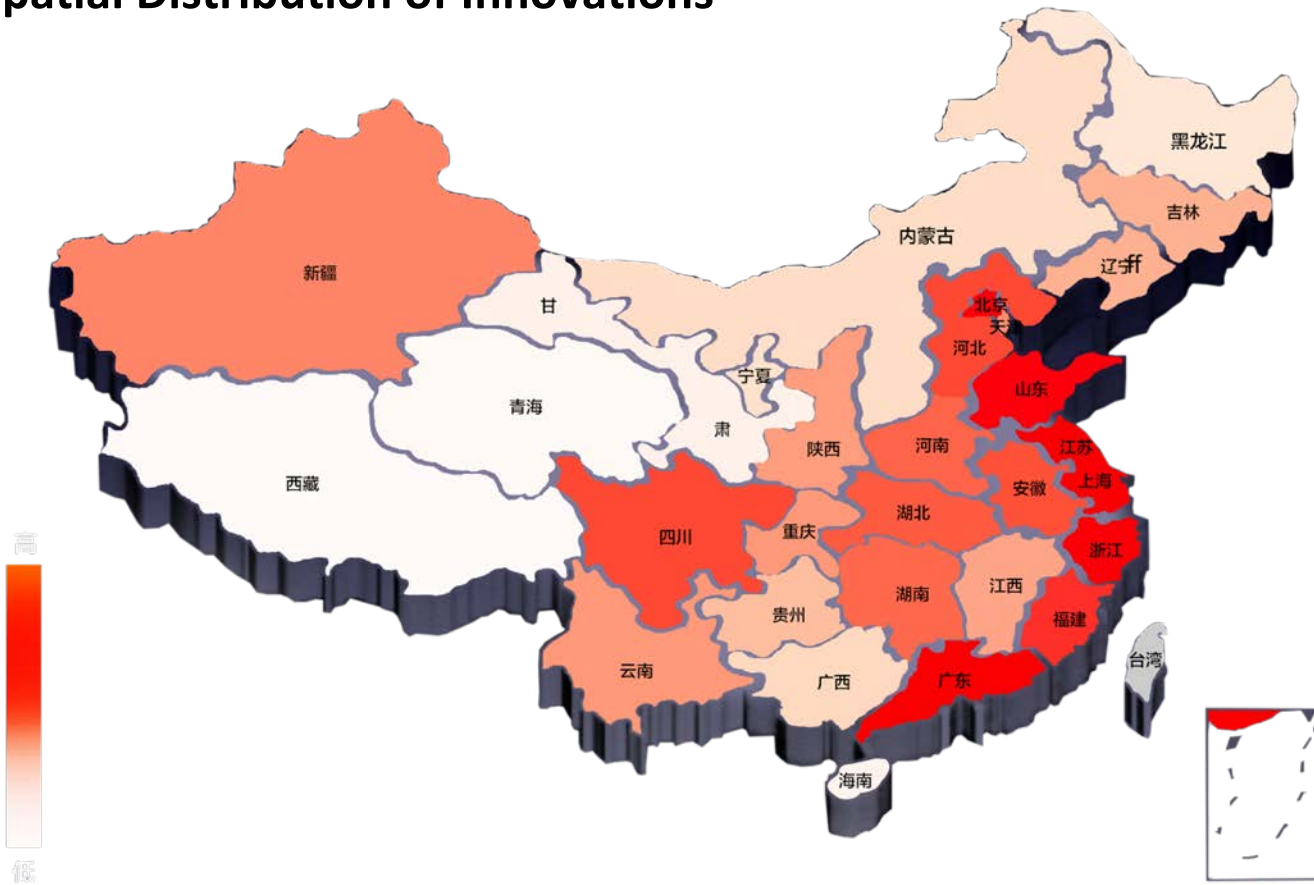
No. of VC investment



Newly granted patents



Spatial Distribution of Innovations

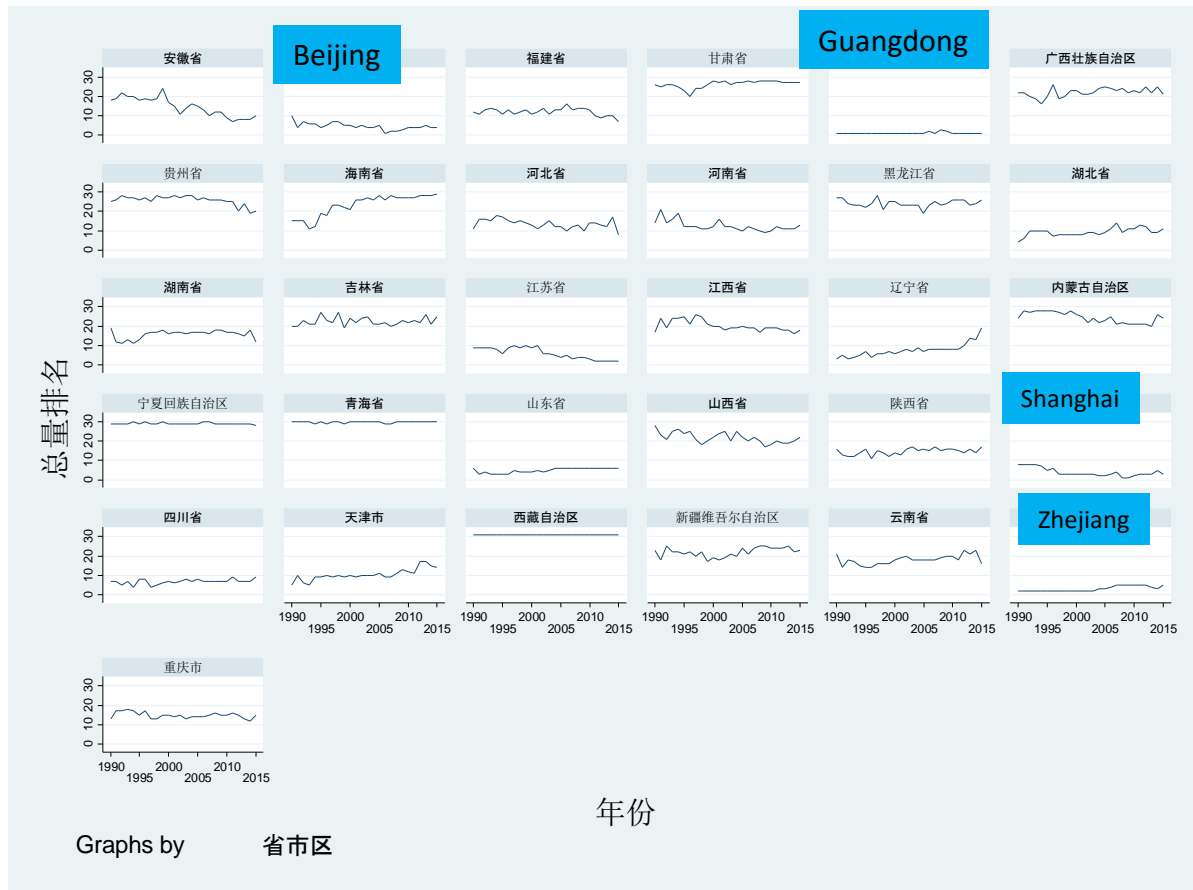


Rankings (Top 20 provinces)

Rank	Province	Total score	Ranking based on per capita
1	Guangdong 广东	95.50	5
2	Jiangsu 江苏	93.24	4
3	Zhejiang 浙江	90.36	3
4	Shanghai 上海	87.12	2
5	Beijing 北京	85.58	1
6	山东	85.22	14
7	河南	74.13	26
8	四川	73.77	25
9	湖北	72.27	8
10	安徽	70.81	15
11	福建	70.42	6
12	河北	68.12	23
13	湖南	67.30	21
14	辽宁	56.88	16
15	贵州	54.10	9
16	江西	50.24	18
17	陕西	47.58	22
18	云南	47.27	30
19	山西	39.98	20
20	重庆	37.45	27

City Ranking (top 50) in 2015

Overall ranking	城市名	总量指数得分	Per capita ranking	面积排名
1	Shanghai 上海	99.96	3	2
2	Beijing 北京	99.96	2	4
3	Shenzhen 深圳市	99.85	1	1
4	苏州市	99.35	7	6
5	杭州市	99.22	6	19
6	广州市	99.10	13	7
7	南京市	99.03	5	8
8	成都市	98.95	19	15
9	重庆市	98.83	63	70
10	天津市	98.81	28	17
11	宁波市	98.07	11	16
12	武汉市	97.61	21	18
13	长沙市	97.47	9	23
14	无锡市	97.33	12	9
15	青岛市	96.76	22	26
16	西安市	96.56	24	21
17	郑州市	96.55	25	20
18	福州市	96.55	14	30
19	合肥市	96.39	10	29
20	厦门市	96.14	4	3

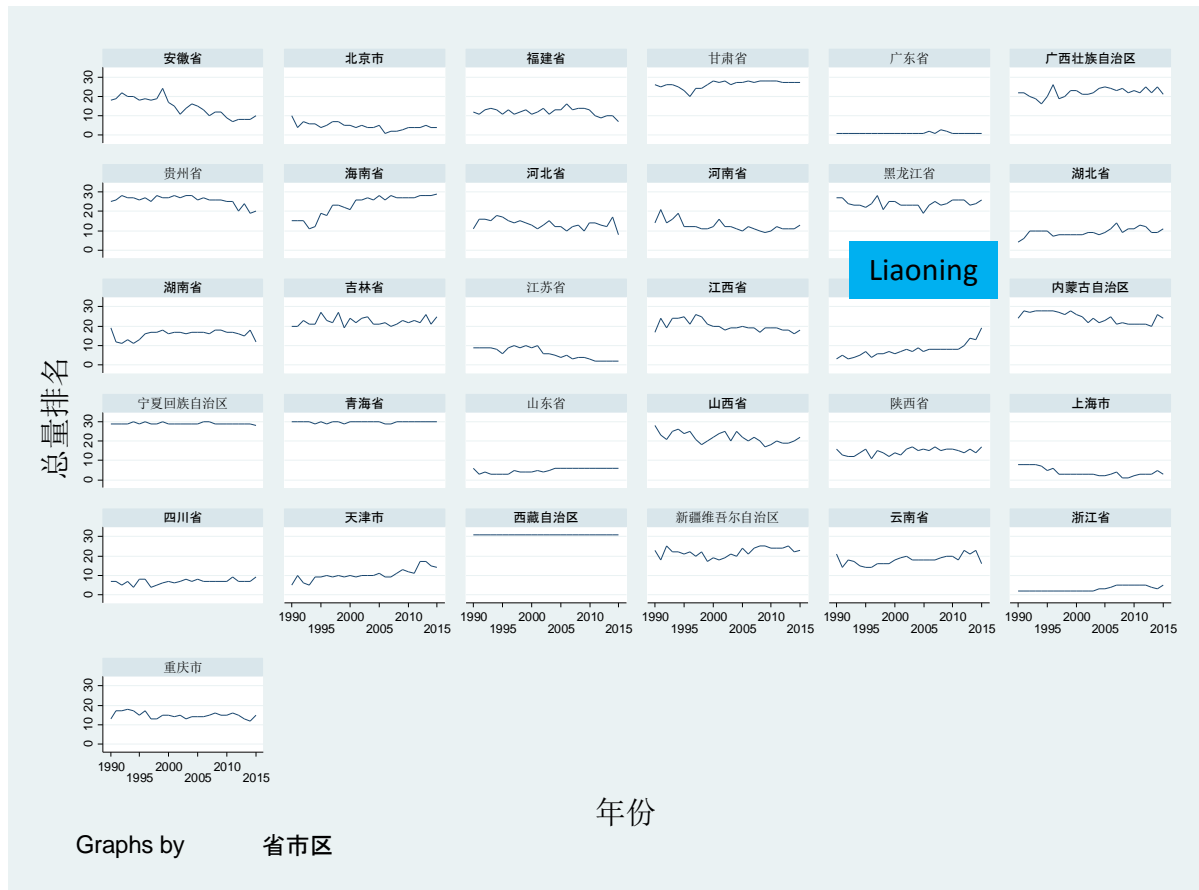


● The most innovative provinces include:

- Beijing
- Guangdong
- Shanghai
- Zhejiang

Rankings by province over time (1990-2015)

The lower the better



- Northeast region has declined.
- Liaoning's ranking drops from 5th in 1990 to 19th in 2015.

Rankings by province over time (1990-2015)

The lower the better

Ongoing work

- Peking University is going to set up a data center to focus on information at the firm level (企业大数据研究中心) .
- We will conduct Enterprise Survey for Innovation and Entrepreneurship in China (ESIEC) this summer. It will cover more than 100 counties nationwide, more than 10,000 firms.
- We will combine survey and administrative data (such as value added tax, social security, and utility bills) to keep track of both extensive and intensive firm growth. We plan to release quarterly indexes on firm performance and business environment.