Political Pluralism and Innovation

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What is known about innovations…

- Innovation is fundamental for economic growth (Schumpeter 1934, 1942)

- Country-level differences in innovation / innovative activities are associated with:
  - Property rights (Arrow 1962)
  - Legal institutions (La Porta et al. 1998; Khan 2004)
  - Financial market development (Rajan and Zingales 1998; Johnson et al., 2002; Hsu, Po-Hsuan, Tian, and Xu, 2014)
  - Cultural settings (Alford 1995; Huang and Xu, 1999)
  - Demographical, religious, geographical, and socio-economic factors (e.g. Webber 1951, Nef 1953, Needham 1969, Elvin 1984 ……)
  - Political preferences and political uncertainty (Acemoglu and Robinson 2000; Bhattacharya et al. 2014)

What is less known …

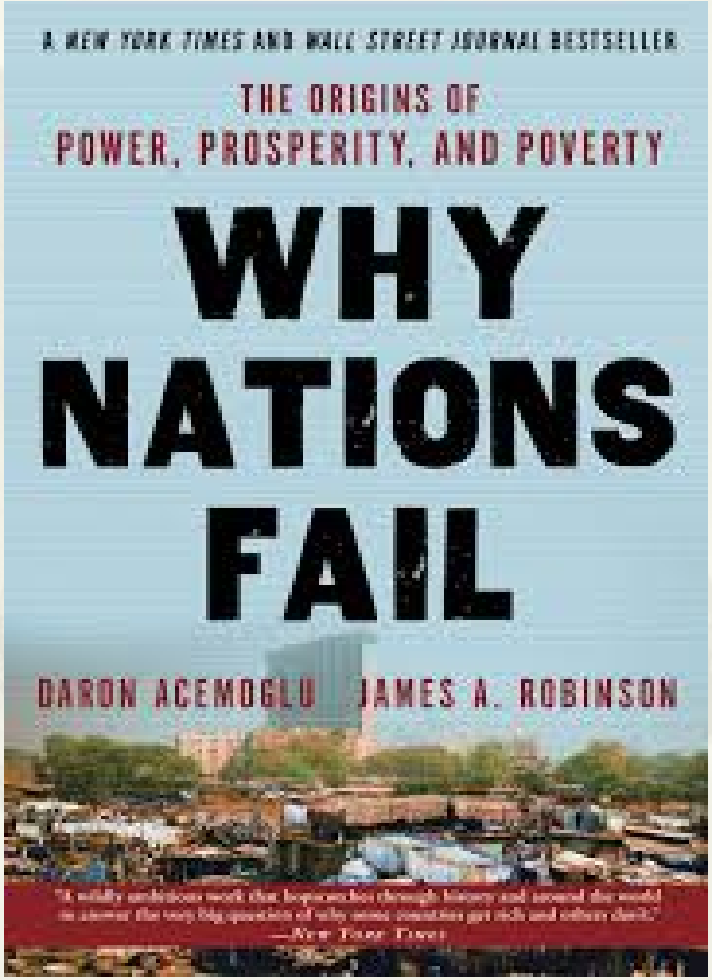
In an authoritarian political regime, does more democracy promote innovation?

Acemoglu and Robinson's Hypotheses on 'Inclusive' and 'Extractive' Political Institutions

* Inclusive Political Institutions
  * Political institutions that are "sufficiently *centralized* and *pluralistic*"

* Extractive Political Institutions
  * powers are concentrated in the hands of narrow elite who will structure the economic institutions to extract resources from the rest of the society;

  * Exclusive institution will ultimately fail when innovations and "creative destruction" are needed to push the frontier



Inclusive Political Institution and Innovation

- The dazzling civilization of the Roman Republic (509 to 27 BC) and its form of government with modern democratic ideologies (Greene 2000, Glower 2009)
- The Industrial Revolution and British political advances (Evans 2001, Harvie and Matthew 2005, Williams 2004, Atterbury 2009). Enhancement in the voting rights of the males, increasingly represented political system, debate in newspapers and both houses of parliament.
- Meiji Reform (1868-1873) and Japan's massive technology advancements in the late 19th and early 20th century (Norman 2000). Initiated series of anti-monarchy constitutions and advocated democracy revolutions; emergence of Japan as a modern state.

Extractive Political Institution and Innovation

- Russian and Austrian / Hungarian Empire tried to hold back the Industrial Revolution (Acemoglu and Robinson 2000)

- In Islamic lands, since the demise of the Spanish Islamic Civilization (11^{th}-14^{th}), religious leaders forbade the printing press as a source of blasphemy and heresy; according to Landes (1998) this is the main reason why the Islamic world started to lag behind the West in economic development.

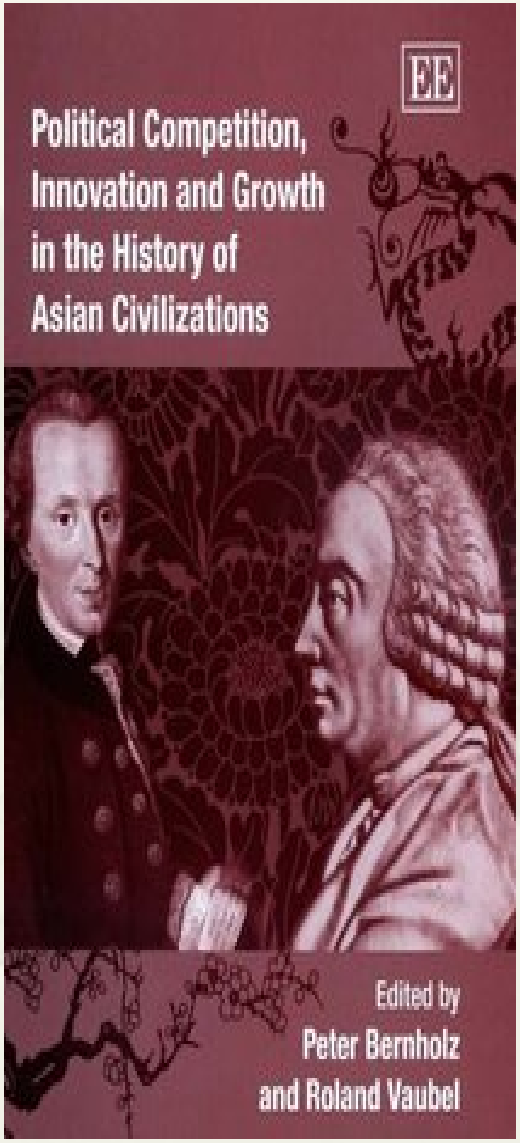
Empirical Challenges

- Reasons for the lack of rigorous statistics-based evidence:
  - **Endogeneity:** Countries can be different for a number of reasons that generate differences in both political institutions (autocracy versus democracy) and innovation;
  - **Non-linear relationship:** Rapid expansions in political opportunities can create political instability and violence, which are hardly conducive for innovation (Friedman et al. 2011);
  - **Reverse causality:** It is possible that the effect is running from innovation to political environment (Rajan and Zingales 2003).

What about China?

* Mote and Twitchett (1988) estimate China's total technological inventions from Qin to Ming Dynasty (B.C. 221 to A.D. 1644) accounted for about 2/3 that of the world in the same period.

* Compass, Gun Powder, Paper Making and Printing (Golden Age: Hans 221 BC to Tang (618-907).

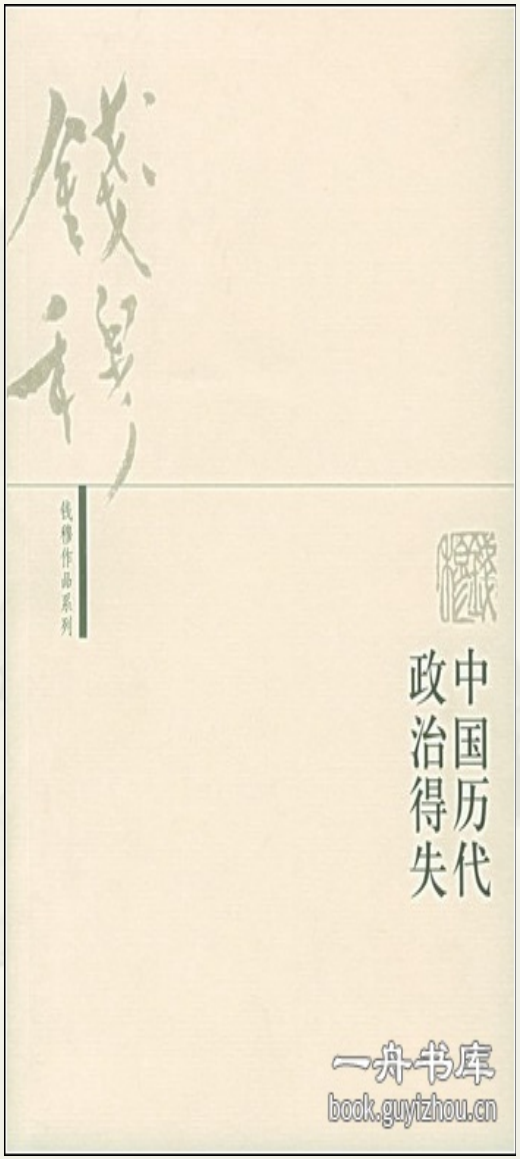


What about China?

- However, since Qing Dynasty (1644-1911) and subsequent republics, China's share of the word's inventive output declined dramatically.

- The famous "Needham Puzzle" of "Why was China overshot by the West in science and technology"? (Webber 1951, Graham 1973, Needham 1982, Alford 1995, Elvin 2004)

- Bad political institutions are widely seen as a major reason for China's failure to keep innovating (Diamond 1997)



In this paper, we ask a simple question:

"When a country starts from a single-party authoritarian, whether a little bit more political pluralism will do more good than harm for innovative activity?"

- We focus on the Communist China, a clear example of extractive political institution' in Acemoglu and Robinson (2012).

In 2014 China ranked:

- 144 (out of 167) in the world's Democracy Index
- 175 (out of 180) in the Press Freedom Index,
- 100 (out of 175) in the Corruption Perception Index.

What do we do?

- Our examination is based on a unique provincial level panel dataset on political pluralism in China from 1991 to 2012.
  - We construct novel measures of political pluralism based on compositions in provincial congresses
  - A **panel-based fixed effects identification approach** to associate provincial politics with innovation
  - An **instrumental variable** approach based on the pre-culture revolution provincial political institutions
  - We test **two embedding channels** through which political pluralism affects innovation: the policy to attract Highly Skilled Emigrates (HSE) and the policy for Patent Promotion and Protection Act (PPP),
  - To establish causality, we exploit the staggered adoption of two rare political experiments : (1) The change from 'show of hands' to 'secret ballot' voting method in provincial congresses; and (2) county-level democracy experiment *within* the CPC to reform the tenure system of party congress, in a **difference-in-differences** setup

The Political Institution in China

* The highest power lies in the National People's Congress (NPC), whose over 3,000 members are elected from the Provincial People's Congresses.
* Members of the provincial congresses are elected by lower level congresses, with layers that ends with popularly elected basic level congresses.
* China's Constitution provides the NPC system must be operated under the leadership of the Communist Party of China (CPC).
* Every five years the CPC holds its Party Congress to make key personnel decisions shortly before the People's Congress. The People's Congress then officially endorse these key decisions in the name of all voters in China.
* During the interval of the five year period, the power of the Party or People Congresses is exercised by a much smaller Standing Committee whose members meet every a few months.

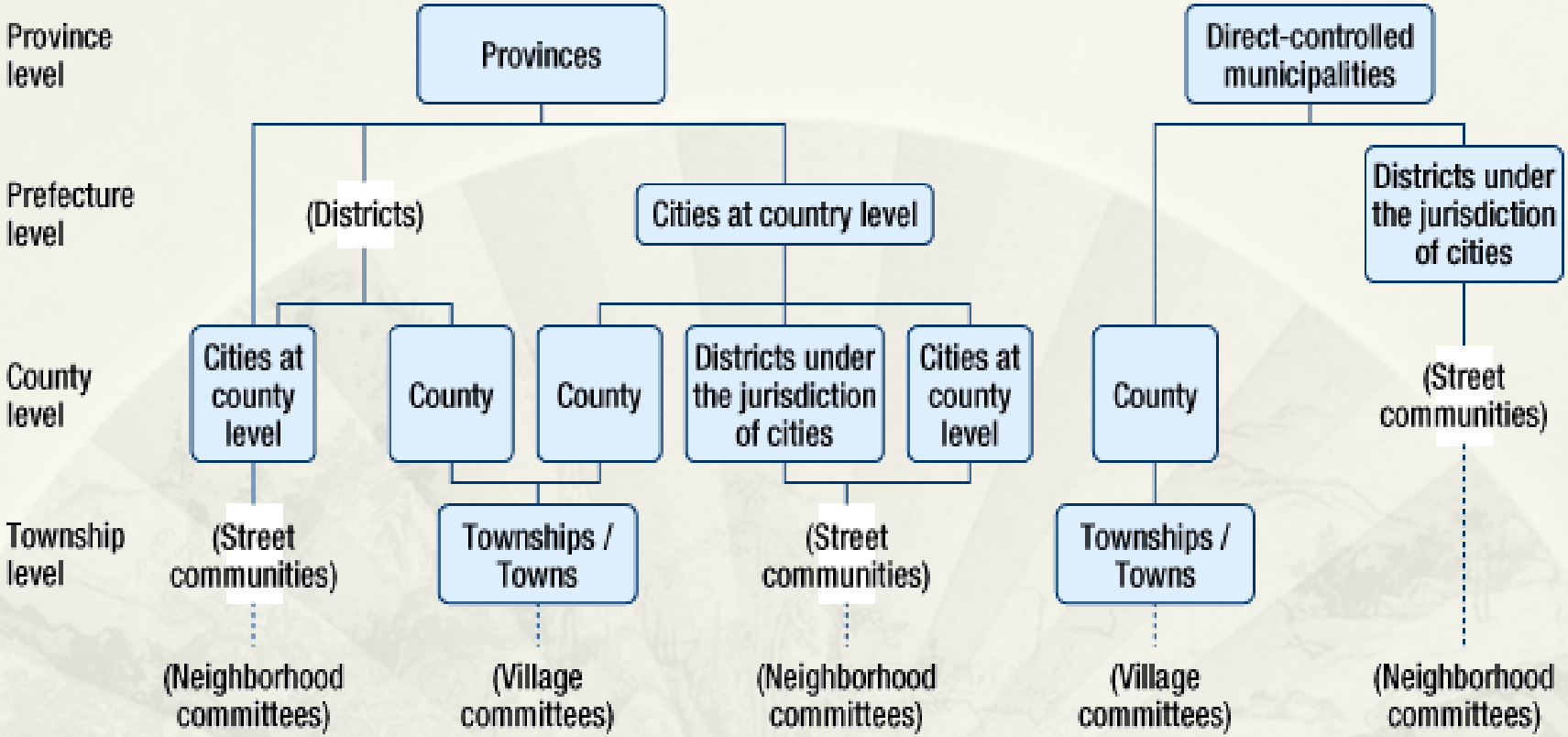
The Party Leadership

The political institution in china (Cont.)

* CCP – 85 Million Member.
* One of the most meritocratic group of politicians in the modern world (Eric Li, 2013)

* 8 Non-communist Parties:
  * Revolutionary Committee of the Kuomintang (founded in 1948, 80,000+ members)
  * China Democratic League (founded in 1941, 180,000+ members)
  * China Democratic National Construction Association (founded in 1945, 100,000+ members)
  * China Association for the Promotion of Democracy (founded in 1945, nearly 100,000 members)
  * Chinese Peasants and Workers' Democratic Party (founded in 1930, 90,000+ members)
  * China Zhi Gong Dang (founded in 1925, nearly 20,000 members)
  * Jiusan Society (founded in 1944, nearly 100,000 members)
  * Taiwan Democratic Self-government League (founded in 1947, 2100+ members).

Sub-national Administrative Hierarchy



Why political pluralism matters innovation?
1. resource allocation channel

- Innovation has demand for resources. The distribution of resources in society is an inherently conflictual, and therefore political, decision (Acemoglu 2005).
- Politicians often do not catch up with science community, but have power on policy making and resource allocations.
- Unlike the monopolistic incumbents the innovators have no established lobbies and are not part of the government 'elite', and they are often credit-constrained and cannot as easily find the cash to pay bribes (Murphy, Shleifer, and Vishny, 1993 AER).
- An inclusive political environment helps innovators by vesting the power broadly and protects against regulatory capture (Laffont 2005).
- A non-extractive political environment also encourages true innovators, for entrepreneurs face less expropriation risk thus can channel their efforts more on productive activities such as innovation than unproductive activities such as rent seeking (Baumol 1990).

Why political pluralism matters innovation?
2. Economics of pluralism

- Political pluralism means diversified people (people with different demographic and psychological attributes, intellectual backgrounds, occupational and international experiences) are allowed to participate in politics.

- The issue of diversity has been at the forefront of many fields, including economics, management, and social psychology. Team diversity is associated with knowledge diffusion and accumulation of universally applicable human capital (Hargadon and Sutton, 1997; Galunic and Rodan, 1998; Lazear, 1999a, 1999b) and higher levels of creativity (Amabile, 1988; Barron and Harrington, 1981; Martindale, 1989).

- In elite politics, a more diverse group of politicians could obtain a wider range of options, reduce groupthink, and enable one to make better policy choice and decisions.

Sample

- 31 Chinese provinces (including 4 municipalities) 1991-2012;
- All variables measured at the province-year level except for the test of causality by county-level experiment of PSPC;
- All data are collected from public sources, and many involve hand-collection.

Empirical Design- Baseline Model

Count model of:

$$\text{Innovation} = \alpha 0 + \beta 1 * \text{political pluralism} + \beta 2 * \text{controls} + \varepsilon$$

Where, **innovation is measured** in four dimensions:

* **Patent domestic:** the count of total patents filed in China (invention patent + utility model + Exterior design)
* **Invention patent domestic:** the count of invention patents filed domestically
* **Patent US&EP:** the count of Chinese patents filed in the U.S. and European Patent Office aggregated at province-year level;
* **CW Patent US&EP:** the citation-weighted count of patents filed in US and EPO.

Empirical Design
Baseline Model (CONT.)

Political Pluralism is measured by:

- (a) the diversification of provincial congress based on (1-HHI index) of five components of congress members: farmers and workers, military officers, cadres, intellectuals, and others ('**Congress Diversity**');
- (b) the proportion of non-Communist Party members in the provincial congress ('**% Non-CP**')
- (c) the proportion of the class of "intellectuals" in the provincial congress ('**% Intellectuals**')

Empirical Design
Baseline Model (CONT.)

Control variables:

* GDP per capita, at 1980 price level
* ln(population)
* College degree holder % in population
* Unemployment rate
* Wage differential between state and non-state sector
* Long-term bank loans/GDP
* IPO proceeds/GDP

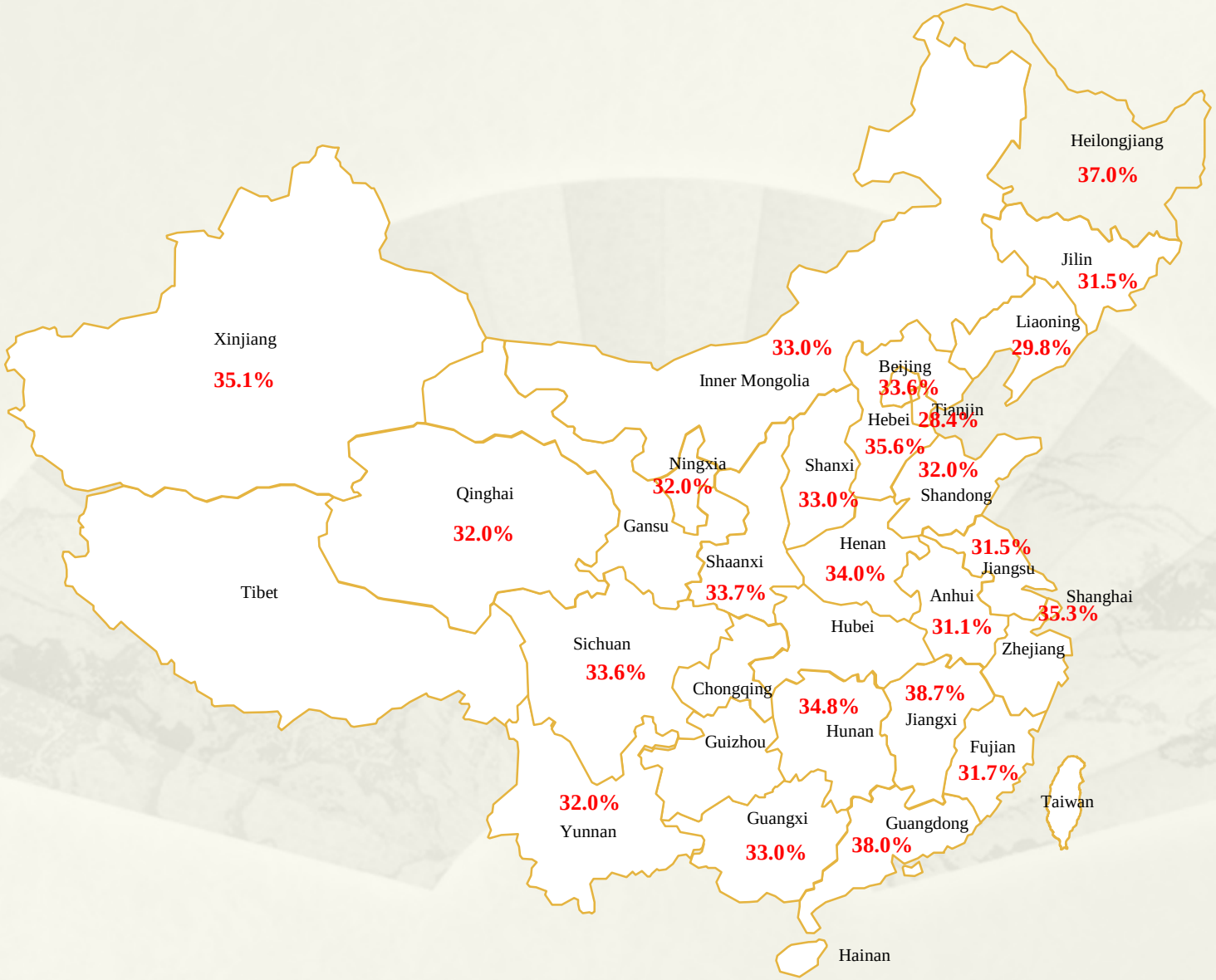
Descriptive statistics

Variables		Obs.	Mean	Median	Std.	Min	Max
Measures of innovation	Patent domestic	1017	9.0720	1.5100	29.2795	0	472.656
	Invention patent domestic	1011	2.2701	0.2850	7.3214	0	110.091
	Patent US&EP	837	0.0768	0.0040	0.3610	0	3.7960
	CW Patent US&EP	837	0.0502	0.0017	0.2052	0	2.2036
Measures of political pluralism	Provincial congress diversification	1015	0.8920	0.9025	0.0627	0.6615	0.9656
	Non-Communist Party % in provincial congress	1015	0.3195	0.3280	0.0641	0.1380	0.5100
	Intellectuals % in provincial congress	1015	0.1923	0.2000	0.0629	0.0720	0.3510
Control variables	GDP per capita, at 1980 price level	1011	0.2344	0.1309	0.2519	0.0270	1.6823
	ln(population)	1011	17.1631	17.3907	0.9168	14.4532	18.5543
	College degree holder % in population	1012	0.0425	0.0301	0.0462	0.0009	0.3735
	Unemployment rate	985	0.0313	0.0324	0.0126	0.0020	0.0770
	Wage differential between state and non-state sector	1008	0.0017	-0.0217	0.2386	-0.6094	1.1047
	Long-term bank loans/GDP	850	0.3423	0.2597	0.2721	0.0129	1.855
	IPO proceeds/GDP	1022	0.0054	0.0004	0.0169	0	0.2733

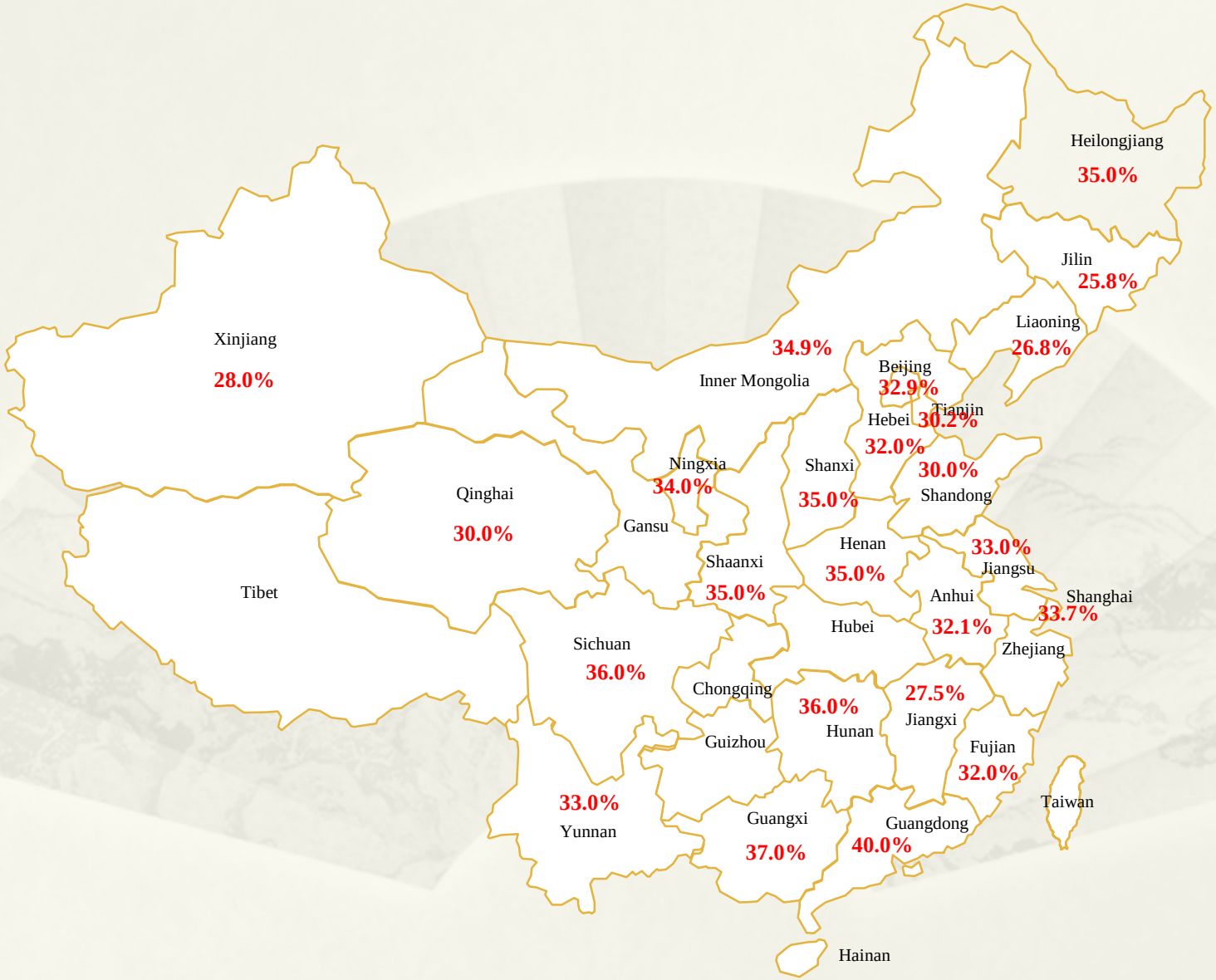
Trends in China's political environment since 1990s

- More political participation by non-CCP member in the People's Congress (Shi 1997; Li 2006)
- CCP member composition shows pluralist trend (Dickson 2003).
- Voting methods transformed from 'applaud in consensus' and 'show of hands' into anonymous ballot vote (Hasan et al. 2009).
- Publicity of high-profile corruption cases and political connections (Fan et al. 2008; Li et al. 2008)
- 'Democracy within Party': the experiments of the '**Permanent System of Party Congress (PSPC)** '.

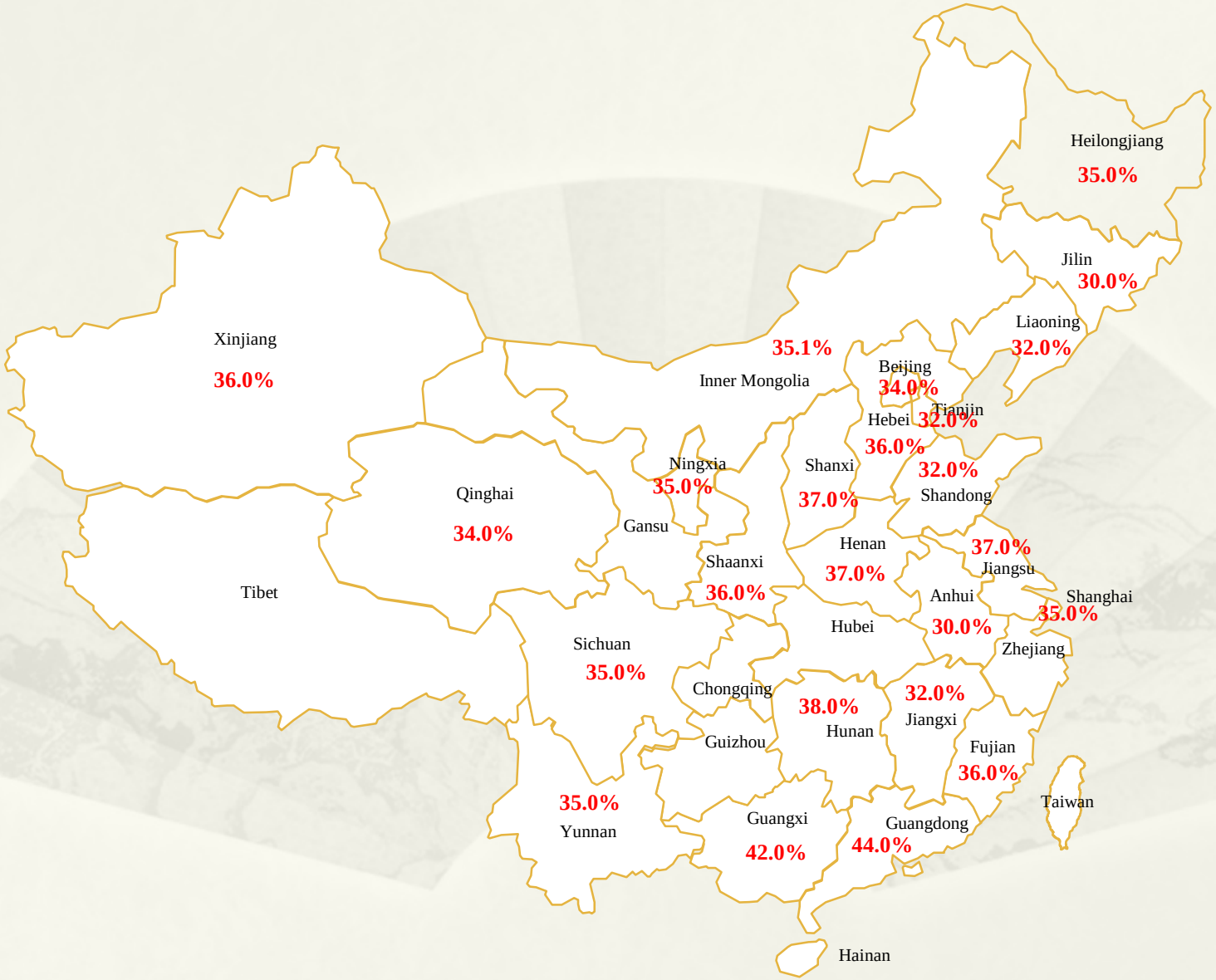
Non-CCP member in Provincial People's Congress (1988-1992)



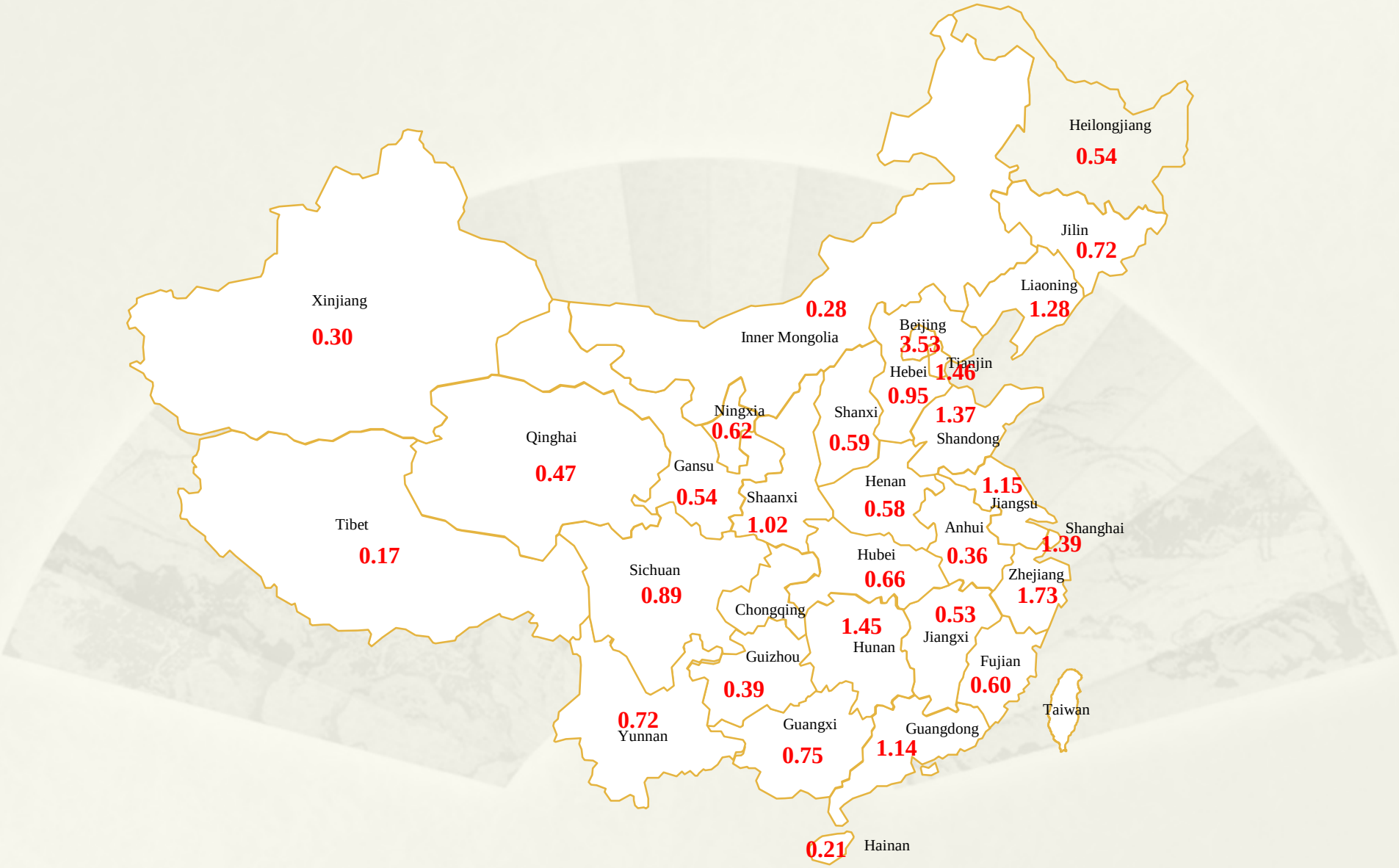
Non-CCP member in Provincial People's Congress (1998-2002)



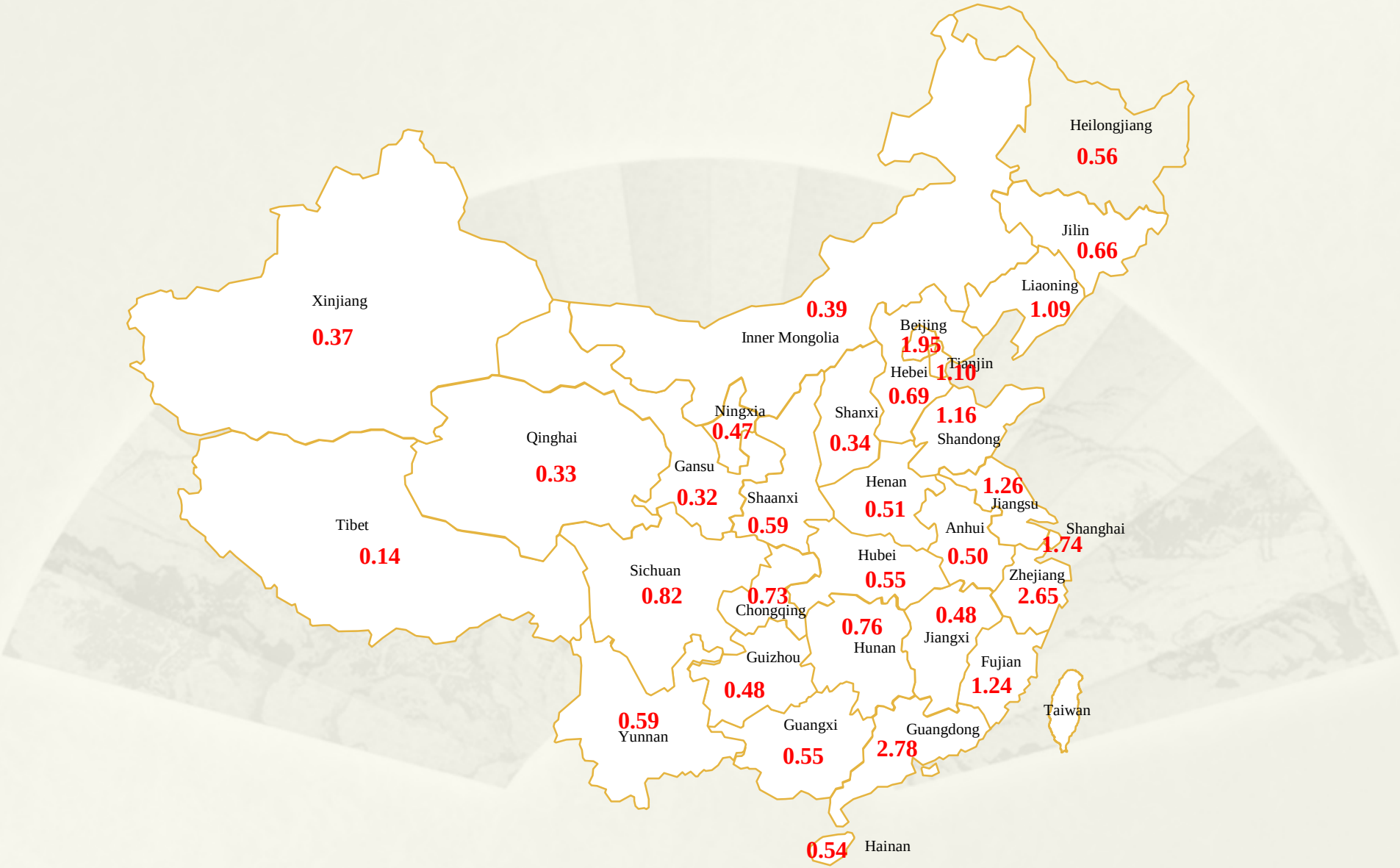
Non-CCP member in Provincial People's Congress (2008-2012)



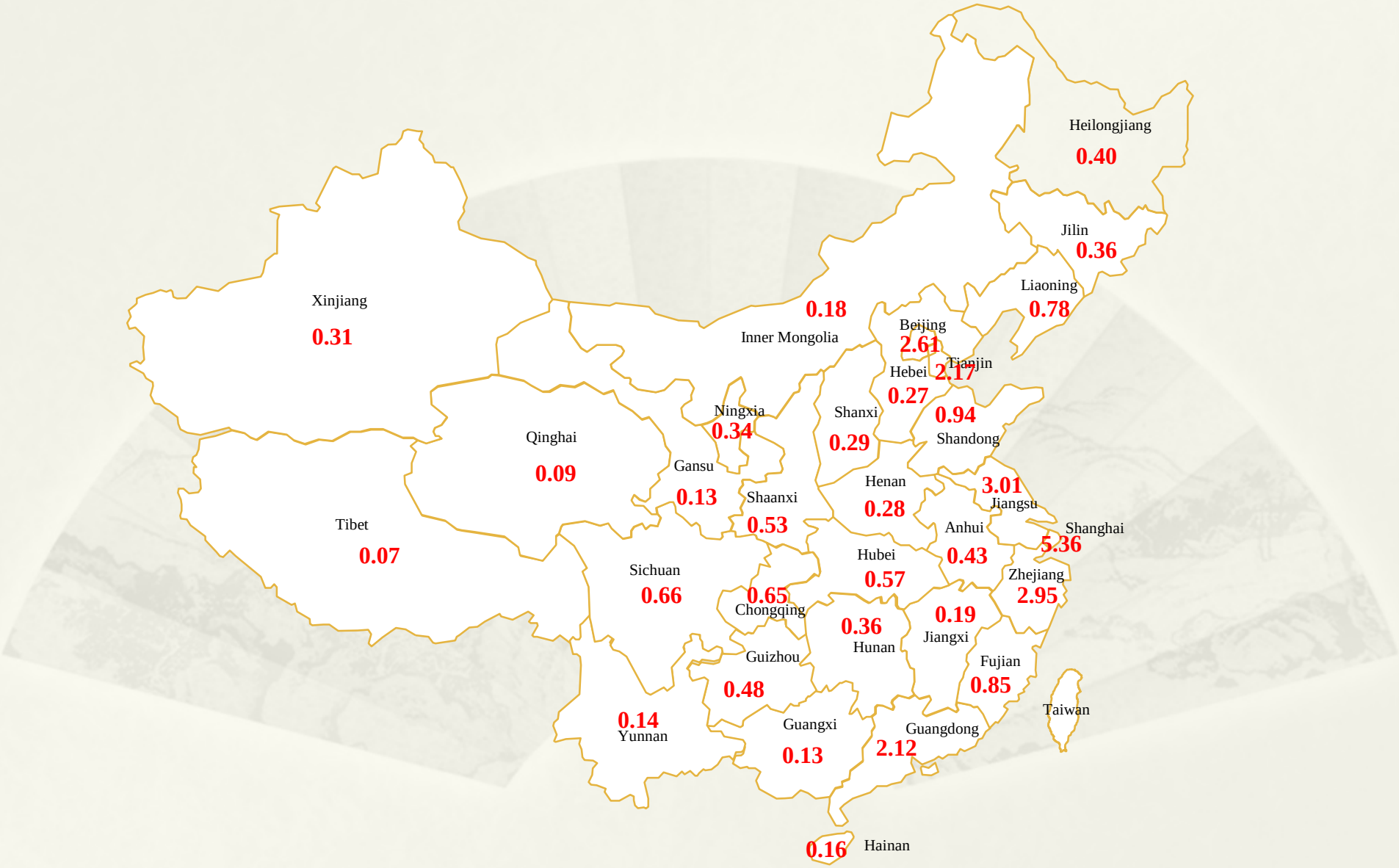
Innovation Output: Provincial Level to National Average in 1991



Innovation Output: Provincial Level to National Average in 2000



Innovation Output: Provincial Level to National Average in 2010



Baseline Model Results

	Congress Diversity		% Non-CP		% Intellectuals		N	ll
Panel Data Fixed Effects Negative Binomial Model Estimations								
(i) Dep.Var.: Patent domestic	6.309***	[7.68]					829	-1401.5
			1.700**	[1.99]			829	-1427
					6.014***	[4.69]	829	-1417.2
	6.169***	[7.37]	0.669	[1.47]			829	-1401.2
			1.173**	[2.34]	5.801	[1.50]	829	-1416.3
	5.923***	[5.64]	0.652*	[1.75]	0.602	[0.39]	829	-1401.1
(ii) Dep.Var.: Invention patent domestic	5.673***	[3.92]					829	-701.17
			0.847**	[2.51]			829	-709.12
					5.449**	[2.31]	829	-706.52
	5.681***	[3.90]	0.073**	[2.04]			829	-701.17
			0.458	[0.28]	5.384	[1.27]	829	-706.27
	6.139***	[3.21]	0.063**	[2.04]	1.164	[0.37]	829	-701.1
(iii) Dep.Var.: Patent US&EP	9.245***	[5.67]					787	-620.27
			1.477***	[5.13]			787	-612.29
					2.374**	[2.15]	787	-602.23
	9.456**	[4.76]	1.563**	[2.34]			787	-630.74
			1.489**	[2.20]	2.055	[0.46]	787	-635.58
	10.386**	[2.23]	0.987*	[1.87]	2.071	[0.11]	787	-639.07
(iv) Dep.Var.: CW Patent US&EP	2.669**	[2.14]					760	-466.76
			2.240***	[5.74]			760	-487.55
					10.252	[0.31]	760	-57.41
	3.275**	[2.17]	2.646**	[2.18]			760	-557.58
			2.772*	[1.78]	10.460	[0.49]	760	-457.47
	2.347**	[2.38]	3.915**	[2.25]	13.669	[0.58]	760	-557.36

t-statistics are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.

The Instrumental Variable Approach

The instrument variable, ideally, shall satisfy our exclusion restriction that, it has no effect on the region's innovations other than through our endogenous political pluralism variables.

In this sense, we choose the following IV:

* the pre-Revolution political pluralism
  * (a) the diversification of provincial congress at 1965;
  * (b) the proportion of non-Communist Party members in the provincial congress at 1965;
  * (c) the proportion of the class of "intellectuals" in the provincial congress at 1965.

China's Cultural Revolution (1966-1976)

- Launched by Mao in May 1966, who advocated violent class struggle to defend against capitalism throughout the society.
- China's youth formed Red Guard groups with revolution being the only objective of the country.
- Millions of people were persecuted in the violent class struggles that ensued across the country, and suffered a wide range of abuses including public humiliation, arbitrary imprisonment, torture, sustained harassment, and seizure of property.
- The decade long Culture Revolution completely paralyzed the country's economic institutions and education system, Economic activity was halted, schools and universities were closed.
- A large segment of the population was forcibly displaced, most notably the transfer of urban youth to rural regions during the "Down to the Countryside" Movement.

The Exclusion Restriction

* This instrument satisfies the exclusion restriction in that, given the local human capital and economic resources were largely reshuffled in a mass scale during the Culture Revolution, it is unlikely the 1965 political pluralism level in the provincial congress has any impact on the post-1990 innovation activities of that province, except through the political channel.

IV Test Results (2nd stage)

Dependent Variable	Congress Diversity		% Non-CP		% Intellectuals		N	R2	Wald F
Dep.Var.: Patent domestic	4.066**	[2.03]					942	0.137	735.504
			2.744*	[1.82]			942	0.134	216.296
					3.018	[1.46]	942	0.036	821.377
	3.669*	[1.92]	3.430	[0.92]	5.536*	[1.65]	942	0.126	55.201
Dep.Var.: Invention patent domestic	2.363**	[2.16]					932	0.133	722.896
			2.550*	[1.79]			932	0.130	215.287
					2.806	[1.38]	932	0.033	803.173
	4.158	[1.07]	3.021*	[1.84]	5.584*	[1.70]	932	0.121	55.718
Dep.Var.: Patent US&EP	1.460**	[1.99]					595	0.154	271.866
			1.151**	[2.09]			595	0.152	125.522
					0.591	[0.52]	595	0.054	372.920
	1.609	[0.77]	1.659*	[1.74]	0.352	[0.23]	595	0.152	22.534
Dep.Var.: CW patent US&EP	5.136	[0.56]					493	0.082	112.617
			10.259*	[1.94]			493	0.114	196.970
					1.068	[0.19]	493	0.085	255.806
	5.873	[0.56]	16.453*	[1.66]	3.768	[0.56]	493	0.132	160.280

t-statistics are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Possible Channels:

The 'brain gain' and 'patent protection & promotion'

Prior work on innovation shows the patenting activities are promoted by a country's human capital stock (Saxenian 2002; Moser, Voena and Waldinger 2014) and intellectual property environment (Dass, Nanda and Xiao 2014) .

Giannetti, Liao and Yu (2014 JF) find China's staggered provincial policy to attract Highly Skilled Emigrant (HSE) has caused an increase in the supply of higher skilled Chinese individual with foreign experience in corporate boards, leading to better corporate performance.

Follow China's accession to the WTO in 2001, the country level Patent Law was promulgated in the same year. Subsequently different provincial congresses (and their standing committees) in China were promulgating their own Patent Protection and Promotion (PPP) Policies at different time.

Empirical Design
Test of Mechanism (CONT.)

We use a two-stage IV variable approach in the following to test whether pluralism is associated with adoption (a dummy variable) of the policy and whether adoption of the policy promotes innovation as expected:

Equation 1: $adoption_{i,t} = f(political\ pluralism_{i,t}, controls_{i,t})$

Equation 2: $innovation_{i,t} = g(instrumented\ adoption_{i,t}, controls_{i,t})$

First-stage regressions: Political Pluralism and HSE/PPP Policy

	Regressions using pre-Revolution political pluralism		Regressions using post-Revolution political pluralism	
	HSE Policy	PPP Policy	HSE Policy	PPP Policy
Congress diversification	0.444**	0.414**	0.550***	0.566***
	[2.54]	[2.38]	[2.91]	[2.61]
% Non-CP	0.033	0.447***	0.198	0.581***
	[1.26]	[3.35]	[1.23]	[3.36]
% Intellectuals	0.185	0.027	0.435**	0.502***
	[1.52]	[0.22]	[2.37]	[2.63]
N	813	788	844	794
Adj R2	0.731	0.647	0.74	0.651
F	65.74	43.442	71.48	44.526

t-statistics are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Second-stage regressions: HSE/PPP Policy and Innovations

Dependent Variable	Regressions using pre-Revolution political pluralism				N	ll	Wald F
	HSE Policy		PPP Policy				
Dep.Var.: Patent domestic	3.696*	[1.81]			916	-2246.72	22.17
			2.709*	[1.89]	884	-2128.72	24.49
Dep.Var.: Invention patent Domestic	4.308	[0.95]			910	-2224.47	21.16
			1.955*	[1.67]	878	-2072.1	24.49
Dep.Var.: Patents US&EP	1.007**	[2.20]			595	-827.2	22.48
			0.134	[0.14]	575	-741.14	23.28
Dep.Var.: CW patents US&EP	3.001*	[1.69]			493	-1340.73	22.66
			5.804	[1.13]	477	-1330.19	20.53
Dep.Var.: R&D/GDP	0.097**	[2.41]			813	-1791.94	22.24
			0.048***	[2.89]	788	-2136.41	24.74

t-statistics are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Second-stage regressions: HSE/PPP Policy and Innovations (Cont.)

Dependent Variable	Regressions using post-Revolution political pluralism				N	ll	Wald F
	HSE Policy		PPP Policy				
Dep.Var.: Patent domestic	0.545**	[2.20]			946	-2228.09	24.95
			0.496**	[2.18]	890	-2115.68	25.45
Dep.Var.: Invention patent Domestic	0.31	[1.12]			940	-2176.39	14.95
			0.803**	[2.31]	884	-2070.64	25.48
Dep.Var.: Patents US&EP	0.581*	[1.67]			613	-841.27	25.21
			0.518	[0.65]	578	-752.96	15.02
Dep.Var.: CW patents US&EP	1.086**	[2.34]			500	-1349.25	24.86
			0.054	[0.02]	480	-1290.97	16.40
Dep.Var.: R&D/GDP	0.051***	[3.02]			844	-2290.36	24.82
			0.065***	[3.60]	794	-1997.22	26.10

t-statistics are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Identifications of causality from democracy to innovation

We use three tests to identify the causality from democracy to innovation:

- **Difference-in-difference (DiD)** approach based on a voting method reform: From 'show of hands' to 'secret ballot'
- **Twin-city DiD** tests based on a county-level within-CPC democracy experiment of the Permanent System of Party Congress (**PSPC**)
- **Propensity score matching**-based test on top-down crack-down on **corruptive** provincial high ranked officials

Ballot Voting: The background

- Until 1990s almost all the decisions or nominations were passed by ‘applauded in consensus’ or ‘show of hands’;

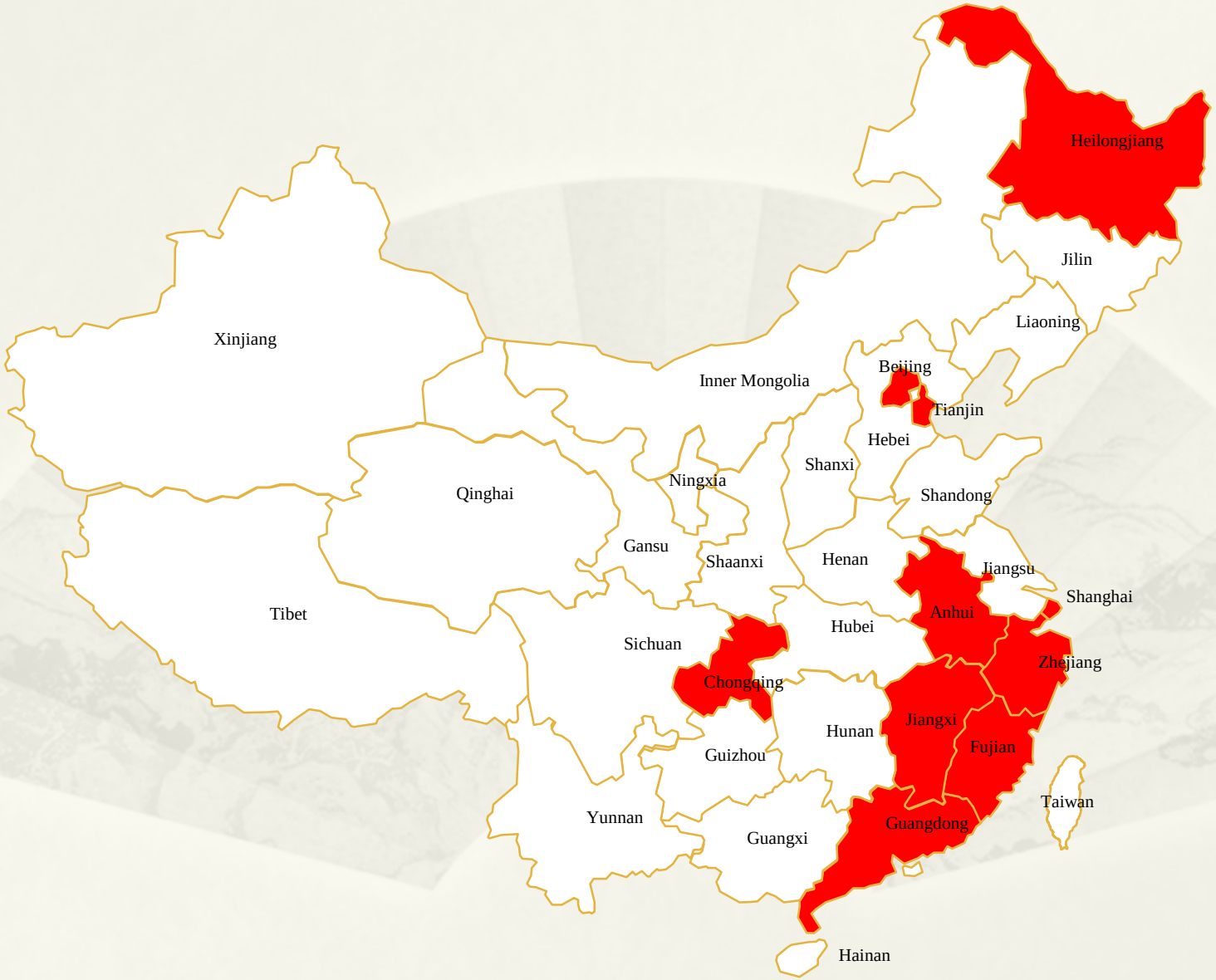
- In contrast, secret ballot does not need voters to reveal their underlying preferences, thus protecting their political privacy without the fear of retaliation;

- Starting from the late 1990s, many local People’s Congresses have abandoned the old ‘applause’ voting method and implemented ‘secret ballot’ voting method on important issues including government work reports, appointment and removal of government officials, etc.

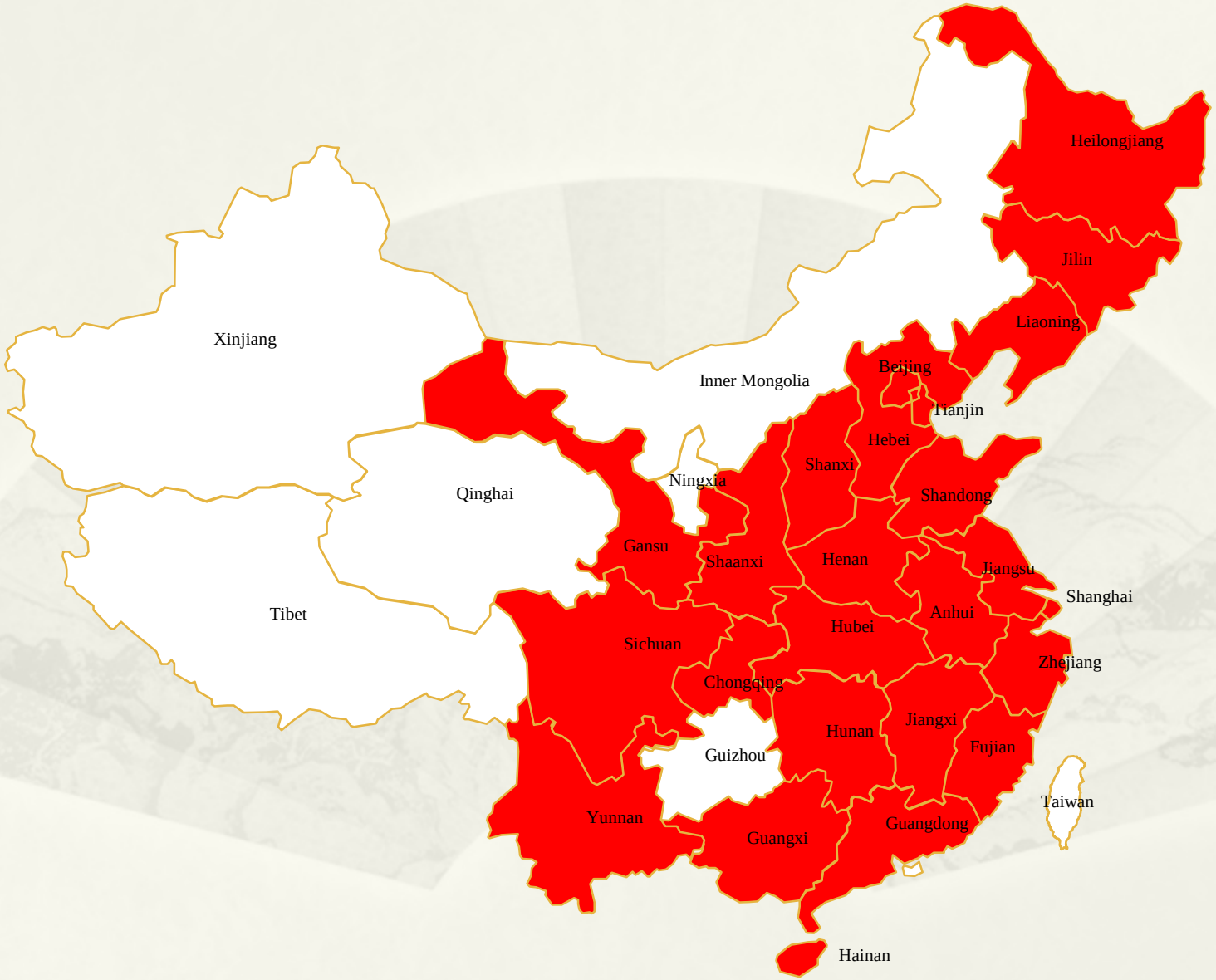
- Data are hand-collected by reading the statements associated with meetings of each individual provincial congress in newspapers and government documents.

Ballot Vote: Provinces that adopt ballot vote in 2000

Ballot Vote: Provinces that adopt ballot vote in 2003



Ballot Vote: Provinces that adopt ballot vote in 2005



DiD Test of Ballot Voting Experiment Result

Dependent Variable	Post Ballot Voting		Treatment		Post Ballot*Treatment		N	ll
Difference-in-Difference Estimations based on Panel Data FE Negative Binomial Model								
Dep.Var.: Patent domestic	0.019**	[2.14]					801	-1365.730
			0.006**	[2.10]			832	-1428.940
	0.008**	[2.21]	0.004	[0.12]	0.026***	[3.16]	801	-1365.710
Dep.Var.: Invention patent domestic	0.135**	[2.48]					801	-675.220
			-0.102	[-0.98]			832	-708.820
	0.057	[1.35]	-0.073	[0.62]	0.158***	[4.14]	801	-673.910
Dep.Var.: Patent US&EP	0.175*	[1.91]					759	-380.790
			-0.060	[-0.09]			789	-62.290
	-0.264	[0.27]	0.026	[0.67]	0.366***	[3.67]	759	-457.160
Dep.Var.: CW Patent US&EP	0.055	[0.02]					733	-52.890
			0.042	[0.06]			762	-57.600
	0.028	[0.25]	0.014	[0.28]	0.067**	[5.32]	733	-520.480

t-statistics are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.

The Permanent System of Party Congress (PSPC)

The background

- Theoretically, the highest power should stem from party congresses (at all levels) , generally held once every five years.
- However in the past, delegates to party congresses are honorary nominations, with no power derived from their positions. Their function as party delegates ends as soon as the party congress ends.
- This caused concentrated power in the hands of the party secretary and standing committee, leading to corruption.
- Members of the party feel excluded from information and participation, much as the general public is.
- Both problems threaten the legitimacy of the party.

Objective of the PSPC:
To create the 'parliament within the Party'.

Key Features of the PSPC experiment:

1) To improve the quality of party delegates by having them face competitive election by members of the party (He 2006).
2) To have party delegates serve the entire five-year terms, and meet on an annual basis.

* At such annual meetings, party representatives are given right:
  * to supervise party organizations and leading cadres
  * to recommend, elect and assess party cadres
  * to ask the presidium of party congresses or relative party organizations to explain hot issues of concern to party members
  * and to put forward proposals for dismissing the party officials who have violated party disciplines and laws.

The PSPR Experiment

- The initial list of a dozen counties and prefectures for this experiment was determined by the Central Organizational Department of CCP in late 1988 (**top-down selection**)
- Among these 12 counties and prefectures from five provinces, there was a good mixture of developed and coastal regions like Zhejiang, developing regions like Heilongjiang and Hebei, and less-developed, interior regions like Shaanxi.
- The scope and intensity of this experiment **vary over time and across provinces**. By 2011, over 132 counties and prefectures in China are implementing this experiment.

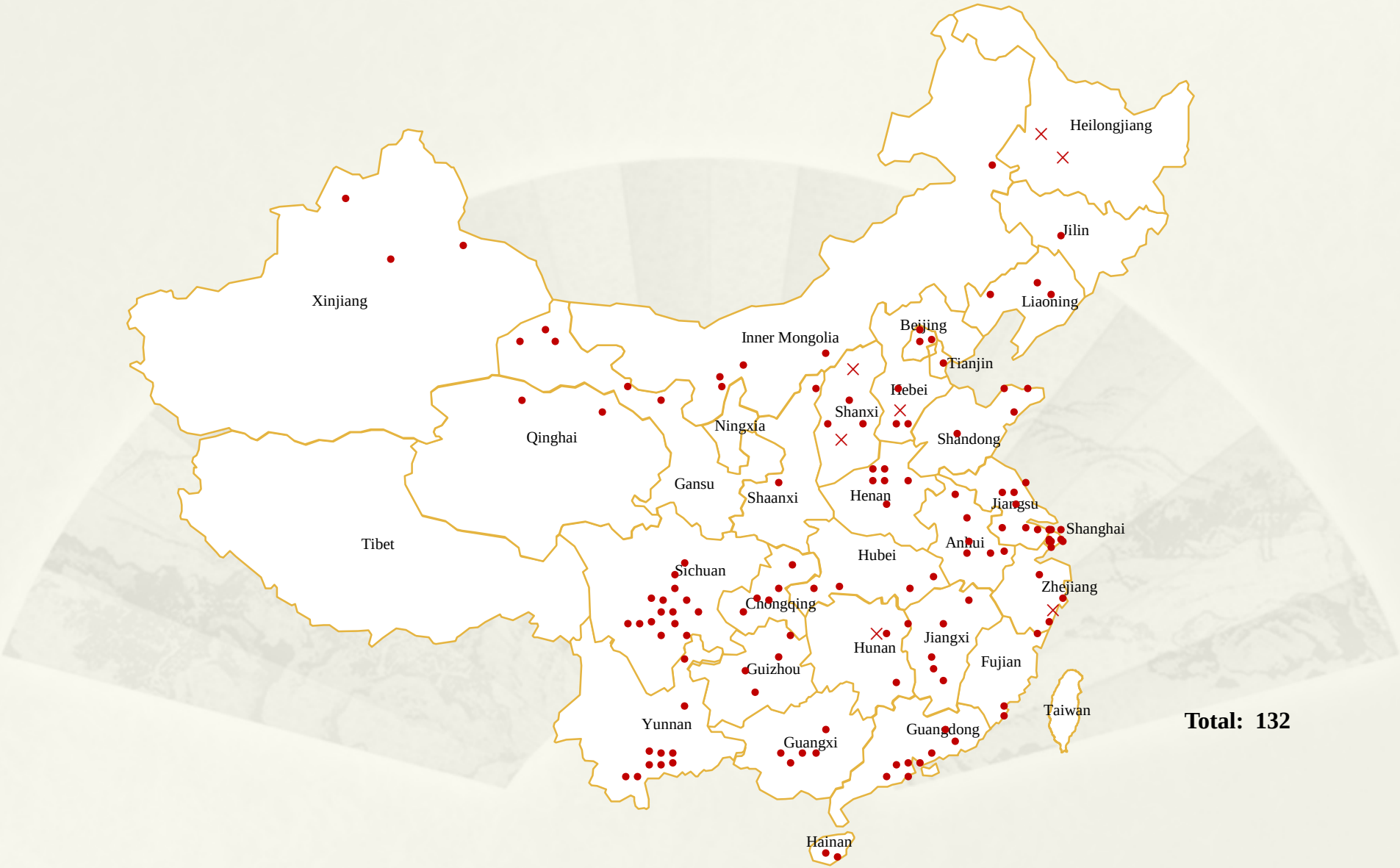
PSPR Experiment Sites- 1989

Total: 12

PSPR Experiment Sites- 2002

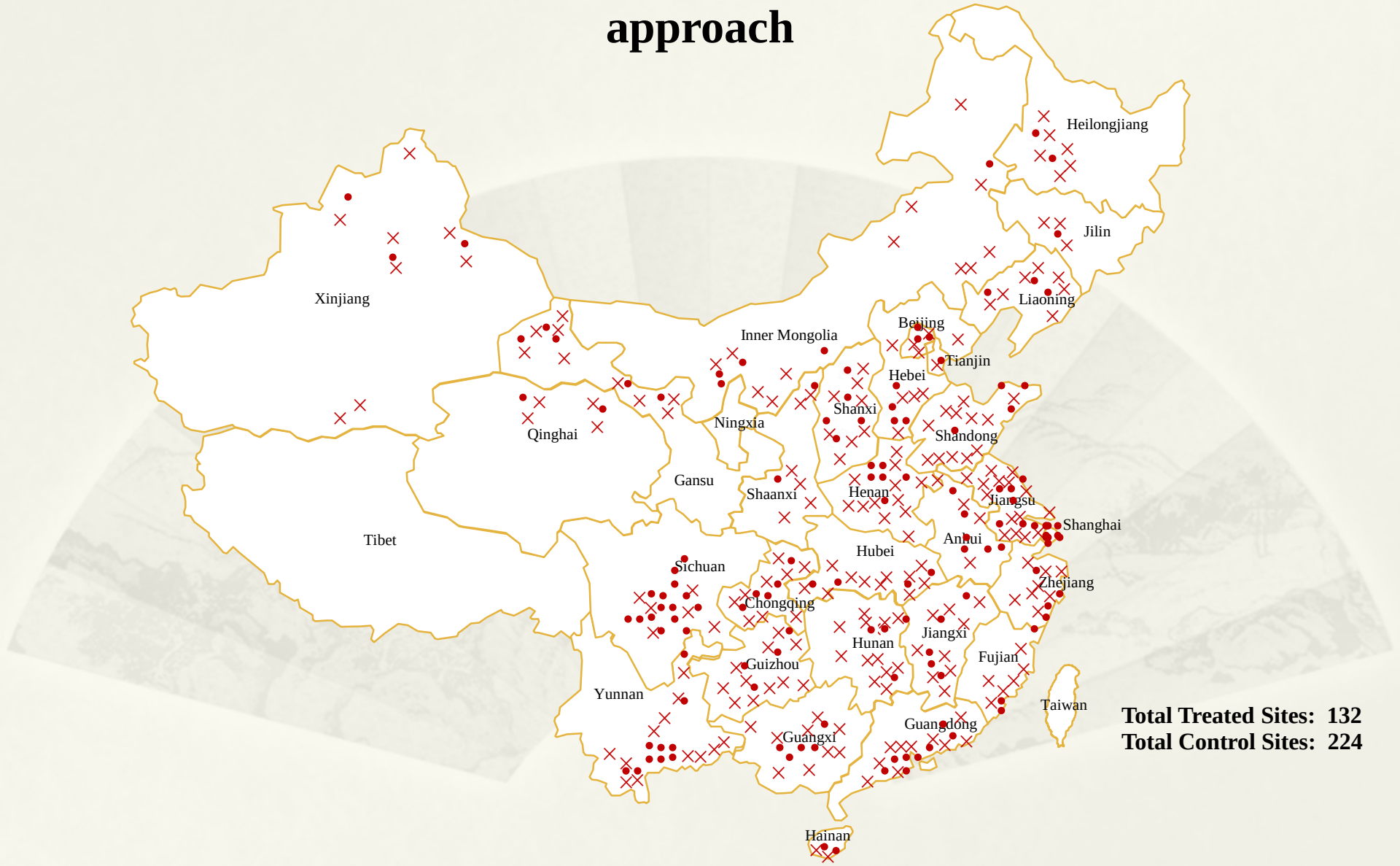
Total: 30

PSPR Experiment Sites- 2011



Total: 132

Our Approach: a “twin-city” difference-in-differences approach



Total Treated Sites: 132
Total Control Sites: 224

“Twin-city” DiD Test of County Level Inner Party Experiment (PSPC) Result

Dependent Variable	Treat	Post1	Treat∗Post1	Post2	Treat∗Post2	Post3	Treat∗Post3	N	pseudo R2	ll
Number of Application (Invention, in thousands)	0.572	-0.021	0.109					213	0.336	-27.71
	[0.48]	[-0.02]	[0.08]							
	0.690			0.230	0.006**			414	0.348	-56.17
	[0.77]			[0.26]	[2.01]					
	0.713					0.426	0.095***	601	0.371	-91.74
	[0.90]					[0.56]	[3.11]			
Number of Publications (Invention, in thousands)	0.706	-0.209	0.050					213	0.333	-25.01
	[0.58]	[-0.16]	[0.03]							
	0.876			0.052	0.102			414	0.349	-52.03
	[0.95]			[0.05]	[0.09]					
	0.862					0.290	0.082*	601	0.368	-81.85
	[1.04]					[0.35]	[1.89]			
Number of Applications (Utility Model, in thousands)	0.608	0.158	0.080*					240	0.289	-81.14
	[1.09]	[0.29]	[1.72]							
	0.632			0.267	0.043**			467	0.301	-163.95
	[1.50]			[0.65]	[2.09]					
	0.616*					0.448	0.046*	683	0.326	-248.62
	[1.65]					[1.27]	[1.91]			
Number of Publications (Utility Model, in thousands)	0.748	0.119	0.194					240	0.275	-71.36
	[1.24]	[0.19]	[0.26]							
	0.735			0.251	0.145**			467	0.284	-148.45
	[1.64]			[0.56]	[2.27]					
	0.681*					0.399	0.122**	683	0.308	-223.86
	[1.73]					[1.05]	[2.18]			

t-statistics are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1

Propensity Score Matching-based Pairwise DID Approach for Corruption Crack-down Tests

Dependent Variable	Treat	Post1	Treat∗Post1	Post2	Treat∗post2	Post3	Treat∗post3	N	pseudo R2	ll
PSM-Pairwise Difference-in-Difference Estimations based on Negative Binomial Model										
Dep.Var.: Patent domestic	0.112	0.011	0.087					62	0.381	-129.429
	[0.62]	[0.05]	[0.40]							
	0.329			-0.077	0.043**			63	0.334	-149.162
	[1.49]			[-0.32]	[2.16]					
	0.342					-0.002	0.187*	63	0.337	-155.114
	[1.50]					[-0.01]	[1.68]			
Dep.Var.: Invention patent domestic	-0.020	0.091	0.073					62	0.437	-70.915
	[-0.05]	[0.21]	[0.16]							
	0.274			-0.030	0.003			63	0.415	-81.582
	[0.75]			[-0.08]	[0.01]					
	0.340					0.162	0.271*	63	0.412	-88.200
	[0.95]					[0.43]	[1.67]			

t-statistics are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Based on a hand-collected dataset of 92 crackdowns on corruption among Party cadres of deputy ministry and above level during 2002-2011. These crackdowns form a staggered set of exogenous shocks to the risk of being held accountable for self-serving behavior among politicians. Data from Tu (2011)

PROPENSITY SCORE MATCHING-BASED PAIRWISE DID APPROACH FOR CORRUPTION CRACK-DOWN TESTS (CONT.)

Dependent Variable	Treat	Post1	Treat∗Post1	Post2	Treat∗post2	Post3	Treat∗post3	N	pseudo R2	ll
PSM-Pairwise Difference-in-Difference Estimations based on Negative Binomial Model										
Dep.Var.: Patent US&EP	0.327	0.154	0.005					62	0.502	-7.220
	[0.10]	[0.04]	[0.00]							
	0.715			-0.634	0.131**			63	0.489	-7.624
	[0.23]			[-0.18]	[2.03]					
	0.709					-0.640	0.081	63	0.422	-7.837
	[0.23]					[-0.18]	[0.02]			
Dep.Var.: CW Patent US&EP	1.921	1.079	0.849					62	0.572	-4.931
	[0.31]	[0.15]	[0.11]							
	2.068			-0.189	0.901**			63	0.537	-4.820
	[0.34]			[-0.03]	[2.12]					
	1.817					-0.173	0.288**	63	0.534	-4.361
	[0.30]					[-0.02]	[2.04]			

t-statistics are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Summary of Findings

- Higher political pluralism at provincial congresses, represented by (1) more diversified interest groups, (2) higher proportion of non-communist members, and (3) higher proportion of intellectuals, positively affects the quantity and quality of innovations in that province.
- Baseline results are robust to our instrumental variable approach.
- Provinces with higher political pluralism have earlier policy to attract highly skilled emigrants and earlier policy for patent promotion, leading to higher levels of innovation.
- Our DiD approach shows the change from show of hands to secret ballot voting methods at provincial congress improves levels of innovation;
- Our "twin-city" DiD approach by finding the control group of the cities that are immediate neighbors of the experimenting cities in the same province finds enhanced inner-Party democracy improves levels of innovation.
- Anti-corruption crackdowns in a province positively affect subsequent innovations.

Conclusions

- Our evidence supports Acemoglu and Robinson's (2012) proposition that an 'inclusive' (as opposed to extractive) political institution promotes innovation.

- One should be careful that the democracy in China is at a rudimentary state. Hence our results do not suggest that more democracy would always be a boon for innovation, but rather that if a country starts from an authoritarian political regime, a little bit more political pluralism will do more good than harm for innovative activity.

- Our evidence has implications on other authoritarian political regimes that wish to develop through innovation.

Thank you!

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