

Does political corruption impede firm innovation? Evidence from the United States

Presenter: Tao Yuan
CityU HK

Coauthored with Qianqian Huang
CityU HK

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Motivation (1/6)

What is political corruption?



Motivation (2/6)

Corruption and the economy

Theory:

- Sanding wheel hypothesis (Shleifer and Vishny, 1993; Murphy et al., 1993)
- Greasing wheel hypothesis (Leff, 1964; Leys, 1965)

Empirics:

- Sanding wheel hypothesis is well supported:

GDP and total investment (Mauro, 1995; Glaeser and Saks, 2006), FDI (Wei, 1999), school enrollment and human capital accumulation (Reinikka and Svensson, 2005), Inefficient Public spending (Tanzi and Davoodi (1997), Parking violation (Fisman and Miguel, 2006), Municipal bond yield (Butler et al., 2009)

Motivation (3/6)

Why corporate innovation?

- Driving force of economic growth (Kogan et al., 2017; Chang et al., 2015; Schumpeter (1934), Solow (1957), Romer (1990))

- A large literature explores the determinants of corporate innovation
 - Firm characteristics (financial constraint (Brown et al., 2012); market competition (Aghion et al., 2005); institutional holding (Aghion et al., 2013); analyst coverage (He et al., 2015); stock liquidity (Fang et al., 2014); failure tolerance (Tian et al., 2013); executive or non-executive compensation (Francis et al., 2011; Chang et al., 2015); hedge fund (Brav et al., 2016).....
 - Relative few studies focus on **institutional features**: tax (Mukherjee et al., 2016); religion (Banabow et al., 2015)); financial development (Hsu et al., 2014); political uncertainty (Cumming et al., 2016; Bhattacharya et al., 2017); bankruptcy and labor laws (Acharya and Subramanian, 2009; Acharya et al. 2014)

Motivation (4/6)

Corruption and innovation

- **Disincentive effect:** Innovators are more likely to be targeted for the following reasons and therefore have less incentive to innovate *ex ante*. (Murphy, Shleifer and Vishny, 1993)
 - High and inelastic demand for government goods: permits, license, etc.
 - The interests of politically connected incumbent firms.
 - Long-term nature and more expropriation opportunities.
 - High tail risk and vulnerable to ex post rent seeking.

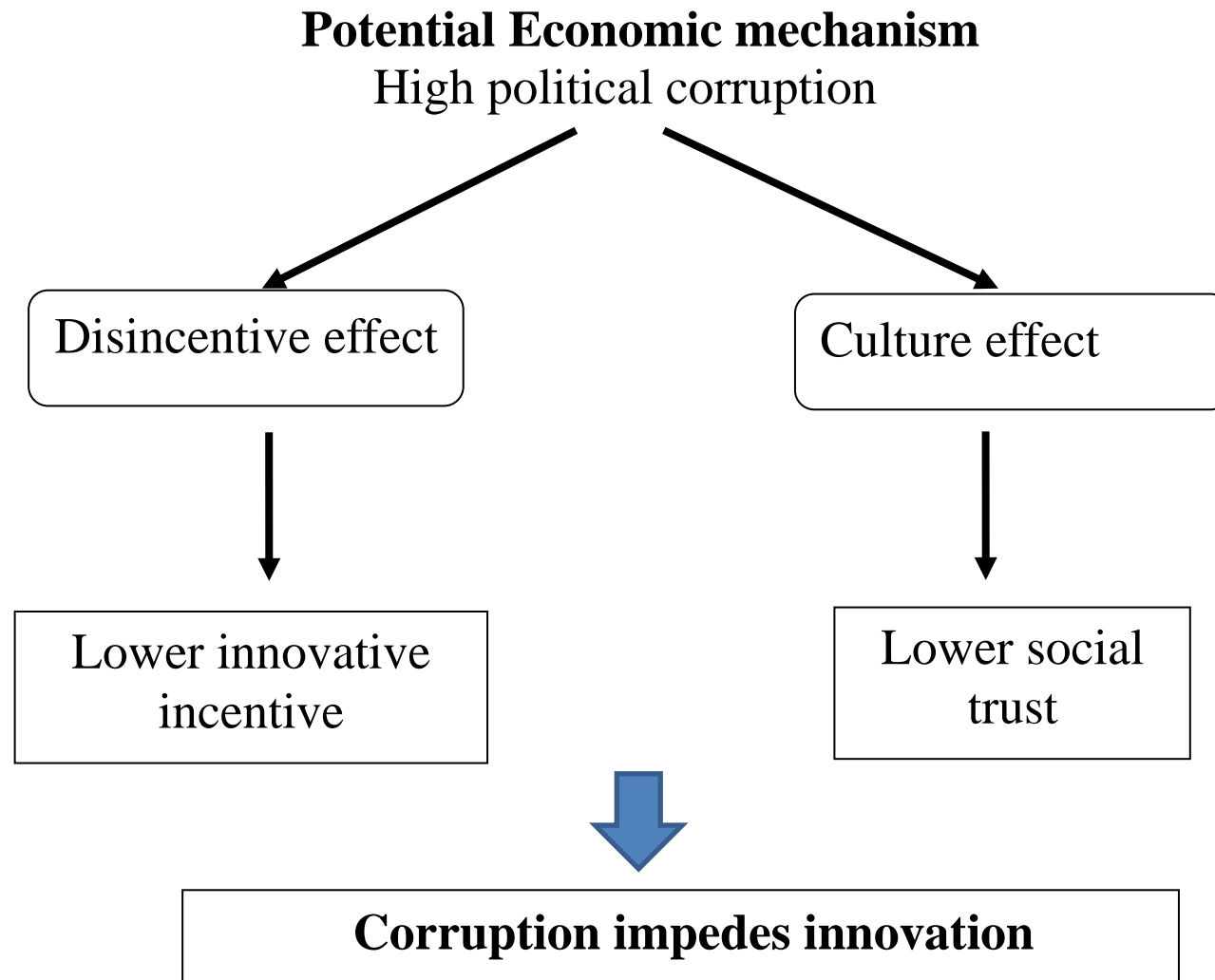
- **Culture effect:**
 - Sociology and political science literature: The quality of government affects people's perceptions of the trustworthiness of others and that public corruption decreases social trust
 - Corruption can form as a culture (Parsons et al.(2016), Liu (2016)) that hurts social trust (Anokhin and Schulze, 2009), while innovation demands collaboration and trust (Xie et al., 2016)

Motivation (5/6)

Why the U.S.?

- Cross-country studies (Anokhin and Schulze, 2009; Paunov, 2016), China (Xu and Yano, 2017). As an innovation-leading country, can the existing findings be generalized to the U.S.?
- Single-country vs cross-country studies.
- Corruption conviction in the U.S. is not rare: In our data, more than 14,000 corrupt government officials between 1990 and 2005
- U.S. corruption has impact on firm outcomes: Cash holding and leverage (Smith, 2016); Firm value (Brown et al., 2015); Financial misconduct (Liu, 2016; Parsons et al., 2016)

Motivation (6/6)



Key Findings

- Firms located in more corrupt districts in the U.S. are much less innovative

- The negative effect survives the inclusion of fixed effects, a large set of firm-level and regional-level controls, the instrument variable analysis, and alternative corruption measures

- Disincentive effect:
 - Political corruption reduce R&D investment
 - and risky innovation
 - The negative impact of corruption is stronger for firms operating more concentrated around their headquarters

- Culture effect:
 - The negative impact of corruption on innovation is less pronounced for firms located in areas with higher religiosity

Data and Sample (1/3)

Measure of corruption

- Corruption conviction rate of public officials across 90 Federal Judicial Districts
- Data source: Annual Public Integrity Report (PIN) to the Congress by Department of Justice from 1990 to 2013
- Broadly used in finance literature (Glaeser and Saks, 2006; Bultler et al. 2009; Smith, 2016; Brown et al., 2015)

Data and sample (2/3)

Measure of innovation

- Patent number, Citation per patent at firm-year level (NBER patent database)
- Adjust the truncation bias using the lag distribution according to Hall, Jaffe, and Trajtenberg (2001)
- More nuanced measures: innovation efficiency, innovation productivity, originality, generality, dollar value of patents, number of new products

Data and sample (3/3)

- Merge local corruption data with Compustat using firms' headquarter locations (FIPS to ZIP)
- Other data sources: COMPUSTAT, CRSP, Thompson Reuters, Census Bureau, Bureau of Economic Analysis, Bureau of Labor Statistics, Department of Housing and Urban Development.
- Excluding firms with non-positive book asset, financial firms, utility firms, public sectors and firms with headquarters outside the U.S.
- Final sample period: 1990 to 2006

The Geography of innovation and political corruption

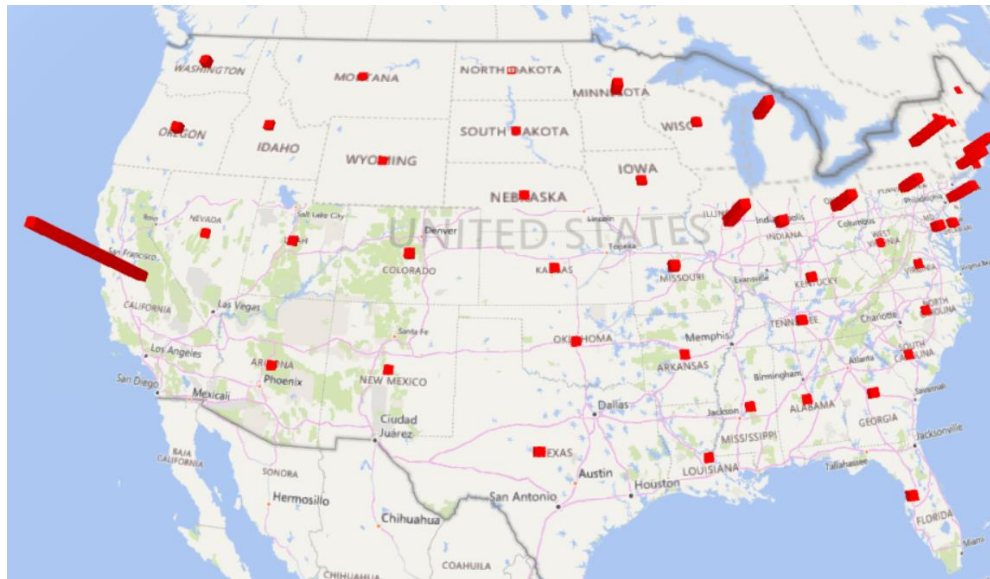
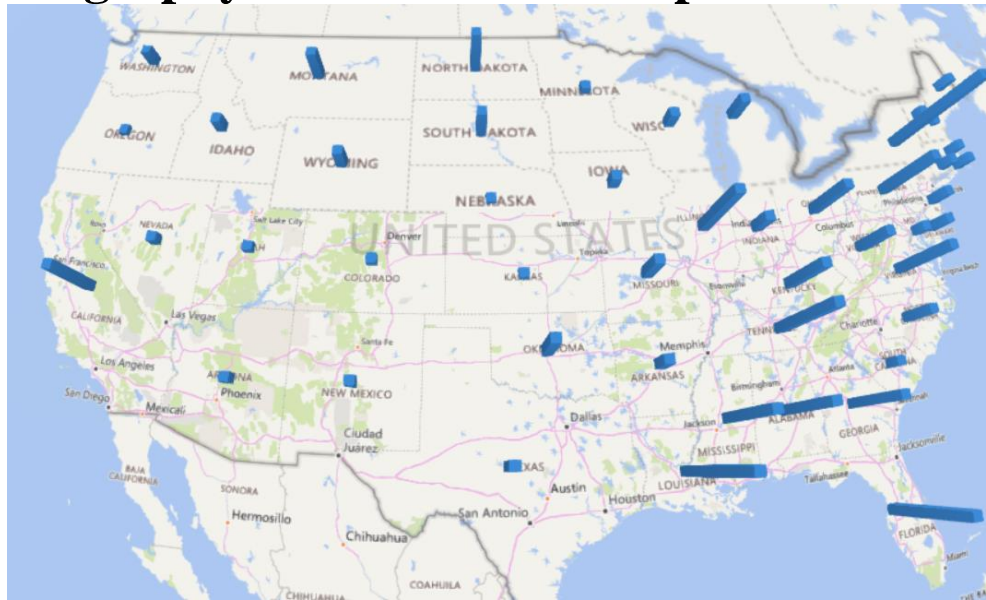
Top 10 corrupt districts

US Federal Judicial District	Corruption conviction (aggregated)
District of Columbia	126.3
Louisiana, Eastern	19.8
Mississippi, Northern	15.4
Tennessee, Western	15.0
Florida, Southern	14.7
New York, Southern	14.0
North Dakota	13.3
Louisiana, Middle	13.0
Virginia, Eastern	12.5
Kentucky, Eastern	12.0

Top 10 innovative districts

US federal judicial district	Patents (aggregated)
California, Northern	4,843.2
Massachusetts	1,975.4
Illinois, Northern	1,418.7
California, Central	1,412.5
New Jersey	1,282.0
Connecticut	1,093.8
Minnesota	957.6
New York, Southern	876.5
Ohio, Northern	837.0
California, Southern	835.6

The Geography of innovation and political corruption



Results (1/12)

Baseline regression: U.S. political corruption and firm innovation

	Log(1+Patents)		Log(1+Citations)	
	(1)	(2)	(3)	(4)
Corruption	-0.122*** (-3.086)		-0.116*** (-3.292)	
Highcorruption		-0.071*** (-2.711)		-0.084*** (-3.162)
Firm size	0.236*** (11.845)	0.236*** (11.815)	0.156*** (13.795)	0.156*** (13.759)
R&D	1.479*** (10.357)	1.485*** (10.392)	1.650*** (14.129)	1.649*** (14.297)
ROA	0.036 (0.518)	0.038 (0.553)	0.224*** (3.157)	0.223*** (3.211)
PPE	-0.198*** (-3.033)	-0.197*** (-3.007)	-0.159*** (-2.811)	-0.160*** (-2.810)
Leverage	-0.300*** (-7.463)	-0.301*** (-7.474)	-0.358*** (-8.807)	-0.357*** (-8.860)
Capex	0.639*** (2.775)	0.644*** (2.802)	0.598*** (3.091)	0.602*** (3.131)
Tobin's Q	0.056*** (16.133)	0.056*** (16.091)	0.051*** (12.673)	0.051*** (12.615)
KZ index	0.001*** (7.170)	0.001*** (7.246)	0.001*** (3.364)	0.001*** (3.388)
Firm age	0.101*** (8.323)	0.101*** (8.356)	0.073*** (4.813)	0.073*** (4.898)
HHI	0.308* (1.730)	0.307* (1.726)	0.129 (0.722)	0.130 (0.731)
HHI2	-0.035 (-0.180)	-0.034 (-0.173)	0.008 (0.046)	0.007 (0.042)
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Observations	56,565	56,565	56,565	56,565
R-squared	0.315	0.315	0.240	0.240

Results (2/12)

The impact of corruption on innovation input

	Lead R&D		
	Full	Exclude missing R&D	Exclude missing or zero R&D
	(1)	(2)	(3)
Corruption	-0.017*** (-3.118)	-0.016** (-2.527)	-0.016** (-2.037)
Baseline controls	yes	yes	yes
Industry FE	yes	yes	yes
Year FE	yes	yes	yes
Observations	51,494	31,790	25,908
R-squared	0.483	0.491	0.464

Alternative innovation output measures

	Log (1+IE_Patents)	Log (1+IE_Citations)	Log (1+Patents/Employees)	Log (1+Originality)	Log (1+Generality)	Log (1+Dollar value)	Log (1+New product)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Corruption	-0.031*** (-3.858)	-0.035*** (-4.430)	-0.151*** (-3.809)	-0.088*** (-3.028)	-0.052** (-2.427)	-0.207*** (-2.803)	-0.016* (-1.784)
Baseline controls	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes	yes
Observations	22,339	22,339	55,725	56,565	56,565	56,565	56,565
R-squared	0.066	0.076	0.209	0.302	0.271	0.334	0.084

Results (3/12)

Endogeneity issue

- Reverse causality: Firms lack innovation capabilities may actively engage in some rent-seeking activities to secure their economic rents, leads to more public corruption
- Omitted variable bias: Local economic conditions may affect both corruption and innovation.
- Self-selection bias: A firm may consider local corruption when choosing its headquarter location
- Measurement error: The corruption measure is not perfect

Empirical strategies

- More controls
- Fixed effect analysis
- Instrumental variable approach
- Alternative corruption measures
- Subsample tests

Results (4/12)

Fixed effect analysis

	Log (1+Patents)		Log (1+Citations)	
	(1)	(2)	(3)	(4)
Corruption	-0.110** (-2.410)	-0.133** (-2.602)	-0.120** (-2.249)	-0.116** (-2.056)
Baseline controls	yes	yes	yes	yes
Industry FE	yes	no	yes	no
State-year FE	yes	no	yes	no
Industry-state-year FE	no	yes	no	yes
Observations	56,565	56,565	56,565	56,565
R-squared	0.332	0.399	0.261	0.334

Results (5/12)

Add more controls

	Log (1+Patents)		Log (1+Citations)	
	(1)	(2)	(3)	(4)
Corruption	-0.133** (-2.308)	-0.163** (-2.050)	-0.080** (-2.079)	-0.104* (-1.693)
Income level	-0.028*** (-2.838)	-0.033** (-2.443)	-0.033*** (-4.109)	-0.037*** (-3.916)
Unemployment rate	0.004 (0.428)	0.010 (0.923)	-0.023** (-2.232)	-0.018 (-1.498)
Education attainment	1.380*** (3.863)	1.520*** (3.498)	1.099*** (3.418)	1.094*** (2.644)
Government size	-0.229* (-1.956)	-0.269* (-1.863)	-0.130 (-1.300)	-0.113 (-0.839)
Capital isolation	0.026 (0.968)	0.016 (0.446)	0.036 (1.247)	0.020 (0.544)
Institutional ownership		-0.290*** (-3.917)		0.006 (0.117)
Amihud illiquidity		0.027*** (5.276)		-0.021*** (-3.345)
Marginal tax rate		-0.320*** (-3.063)		-0.144 (-1.518)
Baseline controls	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Observations	49,707	21,853	49,707	21,853
R-squared	0.316	0.393	0.242	0.304

Results (6/12)

Instrumental variable analysis

- FOIA7YR: equals to 1 if a firm is headquartered in a state that has transitioned from weak to strong FOIA laws at least 7 years ago.
- Relevance: Cordis and Warren (2014) show US states transition from weak to strong FOIA law experience decrease in corruption.

Exclusion: It is unclear that FOIA law can affect innovation through other ways

	First stage		Second stage	
	Corruption	Log (1+Patents)	Log (1+Citations)	Log (1+Dollar value)
	(1)	(2)	(3)	(4)
FOIA7YR	-0.195*** (-25.05)			
Corruption		-0.371** (-2.013)	-0.383 (-1.617)	-0.791*** (-2.787)
Baseline				
controls	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
F-statistics	12.185			
Prob > F	0.003			
Observations	12,399	12,399	12,399	12,399
R-squared	0.181	0.300	0.226	0.328

Results (7/12)

Alternative corruption measures

- Raw conviction numbers scaled by state government size
- Weighted average corruption by the fraction of business in each state, instead of corruption at headquarter location
- Survey data: Integrity score at state level from State Public Integrity Survey in 2012
- Corruption conviction data from TRACfed

Results (8/12)

Alternative corruption measures

Panel A: Dependent variable: $\text{Log}(1 + \text{Patents})$

	(1)	(2)	(3)	(4)
Corruption_employee	-0.011*** (-4.577)			
Corruption_operation		-0.271*** (-3.067)		
Corruption_survey			-0.006** (-2.629)	
Corruption_TRAC				-0.115** (-2.432)
Observations	50,498	32,558	56,440	56,565
R-squared	0.312	0.335	0.316	0.314

Panel B: Dependent variable: $\text{Log}(1 + \text{Citations})$

	(1)	(2)	(3)	(4)
Corruption_employee	-0.007*** (-3.668)			
Corruption_operation		-0.246*** (-4.086)		
Corruption_survey			-0.004* (-1.829)	
Corruption_TRAC				-0.120*** (-2.857)
Observations	50,498	32,558	56,440	56,565
R-squared	0.237	0.258	0.240	0.239

Results (9/12)

Robustness tests

Panel A: Dependent variable: $\text{Log}(1+\text{Patents})$

	Excluding DC	Excluding DC, CA & MA	Excluding bubble period	Innovator subsample
	(1)	(2)	(3)	(4)
Corruption	-0.116*** (-2.935)	-0.070** (-2.209)	-0.131*** (-3.112)	-0.162*** (-3.214)
Baseline controls	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Observations	56,431	46,388	44,908	15,598
R-squared	0.315	0.312	0.315	0.210

Panel B: Dependent variable: $\text{Log}(1+\text{Citations})$

	Excluding DC	Excluding DC, CA & MA	Excluding bubble period	Innovator subsample
	(1)	(2)	(3)	(4)
Corruption	-0.114*** (-2.806)	-0.083** (-2.355)	-0.122*** (-3.683)	-0.102** (-2.294)
Baseline controls	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Observations	56,431	46,388	44,908	15,598
R-squared	0.240	0.232	0.249	0.200

Results (10/12)

Disincentive effect: The asymmetric impact on operation concentrated firms

	R&D		Log (1+Patents)		Log (1+Citations)	
	(1)	(2)	(3)	(4)	(5)	(6)
Corruption × Concentration	-0.043** (-2.615)		-0.098 (-1.003)		-0.235** (-2.155)	
Corruption × Highconcentration		-0.020** (-2.430)		-0.078 (-1.490)		-0.086* (-1.880)
Corruption	-0.005 (-1.464)	* (-2.816)	-0.117* (-1.896)	-0.127** (-2.231)	-0.043 (-0.873)	-0.070 (-1.401)
Concentration	0.034*** (3.530)		0.344*** (3.944)		0.309*** (3.943)	
Highconcentration		0.015*** (3.305)		0.184*** (3.611)		0.127*** (3.538)
Baseline controls	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Observations	18,338	18,338	20,348	20,348	20,348	20,348
R-squared	0.518	0.517	0.330	0.330	0.257	0.256

Results (11/12)

Disincentive effect: Riskiness of innovation

	$\sigma(\text{Citations})$ (1)	Log (1+Highly cited patents)	Log (1+Zero-cite patents) (2)
Corruption	-1.384** (-2.181)	-0.057** (-2.333)	-0.041** (-2.523)
Baseline			
controls	yes	yes	yes
Industry FE	yes	yes	yes
Year FE	yes	yes	yes
Observations	7,350	56,565	56,565
R-squared	0.225	0.252	0.209

Results (12/12)

Religiosity and culture effect

	Log (1+Patents)		Log (1+Citations)	
	(1)	(2)	(3)	(4)
Corruption × Religion	0.194** (2.173)		0.193** (1.990)	
Corruption × Highreligion		0.169** (2.505)		0.148** (2.211)
Corruption	-0.279*** (-3.203)	-0.165*** (-3.453)	-0.276*** (-3.322)	-0.154*** (-3.904)
Religion	-0.142* (-1.985)		-0.147** (-2.059)	
Highreligion		-0.094* (-1.969)		-0.082* (-1.853)
Baseline controls	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Observations	56,394	56,394	56,394	56,394
R-squared	0.305	0.316	0.229	0.240

Conclusion

- Political corruption impedes firm innovation in the U.S.
- The results are unlikely to be driven by omitted variables or reverse causality.
- Disincentive effect and culture effect may serve as two possible channels.