

## **Political connection and corporate innovation: Evidence from China**

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### **Abstract**

This paper studied the correlation between corporate innovation and Chinese private enterprises' political connection based on a sample from 2008 to 2016 of all listed Chinese private companies. The empirical results showed that political connection contributed to corporate innovation and increased the corporate innovation output. The study further conducted a Difference-in-Difference approach which utilized China's 2013 anti-corruption campaign as a natural experiment and the results showed that the positive effects between political connection and corporate innovation were weakened among political connected firms after the anti-corruption campaign. At last, the paper explained the channel of above relationship from the prospect of financing constraints and institutional complements.

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## **1. Introduction**

Innovation is the vital long term driver of economic development (Solow,1957). With the development of China's economy, the traditional economic growth model cannot sustain. The 2015 China government work report called for "Everyone Start up business and Everyone innovate". In 2016, China state council released Outline of the national strategy for innovation-driven development and paid great attention to innovation as a national strategy. Therefore, it is of great importance to discuss how to contribute to corporate innovation and then boost the economic development. A large amount of literature has investigated corporate innovation from various aspects (He and Tian, 2017), however, few of them studied corporate innovation from the point of political connection. This paper examined the correlation between corporate innovation and Chinese private enterprises' political connection based on a sample from 2008 to 2016 of all listed Chinese private companies. The empirical results showed that the political connection contributed to corporate innovation and increased the corporate innovation output. To moderated the endogeneity problem, the study further conducted a Difference-in-Difference approach which utilized China's 2013 anti-corruption campaign as a natural experiment and the results showed that the positive effects between political connection and corporate innovation were weaken among political connected firms after the anti-corruption campaign. At last, the paper tried to explain the channel of above relationship from the prospect of financing constraints and institutional complements.

On the one hand, this paper supplement the literature of corporate innovation behavior on which corporate internal characteristics have effects. On the other hand, the paper complements the literature of political connection and conclude that political connection does benefit to private enterprises. At last, the study fills in the gap between China anti-corruption campaign and corporate innovation behavior, and adds evidence of the good effects of China anti-corruption campaign. The following parts of this paper are: literature review in part two; sample and variables in part three; empirical studies in part four; conclusion in part five.

## **2. Literature Review**

### **2.1 Political connection**

Political connection is the relationship between corporate executives and government officials and it is not strange in China if firms have relationship with the government. The state-owned-enterprises(SOEs) can be regarded as all have political connections and so does many private firms. For the facility of this research, this paper focus on private firms or Non-SOEs since the SOEs' operation target may be social benefit other than profit maximization. So, the paper does not care about SOEs for their lack of incentive in innovation. This simplification would make our results more robust and easier to explain.

Political connection is a political survival capital that are established by enterprises in economies where formal institutions are not perfect. The political connection gives firms the priority in obtaining government sources or chances and enhances

firm's competitive edge. In reality, political connection could be an informal institutional arrangement, and it also played the role of resource allocation in certain circumstance (Faccio, 2006). Allen et al. (2005) studied that some private firms might be faced with local government's "grabbing hand" during the China's economic transformation period when the legislation and judicature system were not perfect and lack of property rights protection. Bai et al. (2006) researched that political connection could be a substitution for legal protection to protect Non-SOEs welfare. Under the circumstance of China's lack of investor protection, political connection could be supplemented for weak institutional environment (Allen et al., 2005). Tian and Zhang (2013) found that political connection enhanced the performance of listed companies. Their further evidence showed that the main driver of long term positive return came from private firms and the positive return effects did not significant in SOEs. The channel they found were that political connection in SOE caused government favoritism and social burden, while political connection could contribute to property right protection and obtain government cares in Non-SOEs.

The former literature discussed political connections from various aspects such as corporate performance, property rights protection and resource allocation. However, political connections may also hurt firm value.

Claessens et al. (2008) pointed out that political connection caused bank's low efficiency loans and mismatched credit resources. Zhang et al. (2010) found that political connection firms suffering a loss of firm value after obtaining loans and over investment. Fan et al. (2007) investigated that political connection had a negative effect on the long term performance of new-issued stocks. Meanwhile, the paper showed that CEO political connected firms had a negative long term return on stocks and worse accounting performance when they are compared with other firms. Shleifer and Vishny (1998), Faccio et al. (2006) also found similar evidence that political connection hurt firm value.

## **2.2 Political connection and Corporate innovation**

There was various literature about corporate innovation and the paper referred to He and Tian (2017) when classifying these literatures. Firstly, the effects of corporate level factors on innovation behavior: VC or start-ups, corporate internal factors such as CEO, etc., corporate external factors such as analysts or institutional investors or creditors, etc. Secondly, market level factors: product market competition, bank competition and taxation, etc. Thirdly, country level or institutional level: law, social characters, financial markets development, etc.

This paper studies corporate innovation from the aspect of political connection, that is, from the aspects of corporate internal characters. Faley et al. (2014) found that more CEO connected firms gained more patents through information channel and labor market insurance. The CEO connection measured by whether different firms' CEOs had been worked in the same company or had similar education background or had similar social activity history. In fact, what we study here is also a special

personal connection, and it might be affect corporate innovation through certain channel.

Political connection can bring political burden on enterprises, and then enterprises may waste resources for the sake of maintaining political relationship or over invest in some projects which may cause negative effects on innovation activities. On the contrary, political connection can relieve financing constraints and complement imperfect institutions which contributes to private firms' innovation. Therefore, this paper examines whether the effects of political connection on corporate innovation are positive or negative, and studies the channel which may affect innovation.

### **3. Sample and Variables**

#### **3.1 Sample selection**

This paper selected listed Non-SOEs from 2008 to 2016 in China A stock. The data began in 2008 since the corporate governance variables database can be obtained first in 2008, and the sample removed financial industry companies and ST companies. There are 8882 firm-year observations in the sample and the data sources are from CSMAR database and CCER database.

#### **3.2 Variables**

##### **3.2.1 Measure of innovation**

The innovation measurement in this paper refer to Tian et al. (2015), that is to say, patent application numbers and patent quality are used to evaluate firm's innovation output. There are three kinds of patent in China: patent for an invention, patent for utility models, design patent. The former two kinds of patent defined in China are similar with US and Europe definition of patent, but the design patent mainly aims at protecting style design or color and pattern, so it does not improve technology much more than former two patents and we ignore the design patent when we selecting variables.

Patent application quantity(Patent) are the total number of finally granted patent for an invention and finally granted patent for utility models. What is more, the year variable is defined by the patent application year when the patent really yields, and the patent variable has been transformed into logarithmic form to solve skewness problem.

Patent application quality (PatentQ) only include the number of patent for an invention because patent for an invention is the most original patent output according to China legal rules. As a result, patent for an invention can be used as a proxy for patent quality. The variable also has been transformed into logarithmic form to solve skewness problem.

### **3.2.2 Political connection variables and other explanatory variables**

The proxy of political connection refers to Fan et al. (2007). CEO or chairman is holding or has hold the position of government office, such as People's Congress, Political Consultative Conference, Congress of CCP Representatives or other government positions is a measure of political connection in this paper.

The financing constraint variables are calculating just as Kaplan and Zingales (1997) or Li and Xu (2015) has done before, then we define high financing constraints when variable value is above the median.

The marketization degree used here is developed by Fan et al. (2016), that is the China market index, then we define high marketization when variable value is above the median.

### **3.2.3 Control variables**

On the basis of latest corporate innovation literature, the paper controlled corporate size, corporate age, leverage, asset tangibility, profitability, sales growth rate, corporate growth, etc. The control variables are presented in the following table.

**Table 1: Variables Definition**

	<b>Name</b>	<b>Explanation</b>
<b>Explained variable</b>	Number of patent filings (Patent)	$\ln(1 + \text{sum of patent for invention and patent for utility models})$
	Quality of patent fillings (PatentQ)	$\ln(1 + \text{number of design patent})$
<b>Explanatory variable</b>	Political connection (connect)	connect is 1 if firm is political connected, otherwise it is 0
	Anti-corruption (Anti)	Anti is 1 if the year is after anti-corruption year, otherwise it is 0
	Firm financing constraint (CONS)	The definition refer to KZ index
	regional financing constraint (FC)	FC is 1 if regional financing constraint is above median, otherwise it is 0
	Marketization degree (Above)	Above is 1 if marketization is high, otherwise it is 0
<b>Control variable</b>	Firm scale (Size)	The logarithm of sales revenue
	Firm age (Age)	The number of years since firm go public
	Leverage ratio (Leverage)	asset-liability ratio
	Tangible asset ratio (tangibility)	Tangible asset to total asset
	Profitability (ROA)	Net income to total assets
	Sales growth rate (Sales_Growth)	Year on year sales growth rate
	Patents growth rate (Patent_Growth)	The mean growth rate of patent
	Firm growth rate (MB)	Book to market ratio

### 3.3 Descriptive statistics

Table 2 presented the descriptive statistics of main variables. The results showed that the average total patent output is 23 while only 5 of them are of high quality, which reveal the problem of China low patent output quality. Among all listed political connected companies, the non-SOEs account for forty percent, which showed that political connection is a general phenomenon in China even if it is non-SOEs. So, it is very important to gain an insight into this unique question.

**Table 2: Summary statistics**

Variable	N	Mean	P50	SD	Min	Max
Patent	9984	22.83	6	128	0	6900
PatentQ	9984	5.255	0.5	43.07	0	3621
Connect	9984	0.397	0	0.489	0	1
Leverage	9984	0.409	0.345	1.338	0.00708	96.96
MB	9984	0.695	0.452	1.318	0.00791	22.03
Age	9984	9.278	7	6.006	0	26
ROA	9984	0.0408	0.0462	0.593	-48.32	22.01
Sales	9883	2809	1018	8505	0.109	247160
Sales_Growth	8882	0.0196	0.0174	0.4	-32.44	9.917
Tangibility	9984	0.928	0.955	0.0877	0.125	1

This table reports the summary statistics for a sample of Chinese listed Non-SOEs from 2008 to 2016 in this paper. Patent is the total number of finally granted patent for an invention and finally granted patent for utility models. Patent Q is the number of patent for an invention. Connect is a dummy equal one is a firm is politically connected. Leverage is the asset-liability ratio. MB is the firm's book to market ratio. Age is the number of years since firm go public. ROA is the net income to total assets. Sales is the total sales of a firm. Sales\_Growth is the year on year sales growth rate. Tangibility is ratio of tangible asset to total asset. Further information on variable definitions and data sources are provided in Section 3. Sample and Variables.

## 4. Empirical Analysis

### 4.1 Model specification

In order to investigate the impact of political connection on firm innovation, this paper first conduct the following baseline regression:

$$\begin{aligned} \ln(1 + Innovation_{i,t}) &= \beta_0 + \beta_1 * connect_{i,t} + \beta * Controls + \sum Firm + \sum Year \\ &+ \varepsilon_{i,t} \end{aligned}$$

Where subscripts  $i$  and  $t$  refer to firm and year, respectively. The dependent variable  $Innovation_{i,t}$  refers to patent quantity or patent quality just as we defined in

section 3. Sample and Variables. *Controls* refer to several control variables in table 1. The model also controls firm fixed effects to capture time invariant structural differences in innovation outputs across firms and year fixed effects to capture macroeconomic shocks and time trends.

We further expand our model by conducting difference in difference regression:

$$\begin{aligned} \ln(1 + Innovation_{i,t}) &= \beta_0 + \beta_1 * connect_{i,t} + \beta_2 * Anti_t + \beta_3 * Anti\_connect_{i,t} \\ &+ \beta * Controls + \sum Firm + \sum Year + \varepsilon_{i,t} \end{aligned}$$

Where  $Anti_t$  measures whether anti-corruption campaign has taken place.  $Anti\_connect_{i,t}$  is a cross term between anti-corruption campaign and political connection.

#### 4.2 Baseline regression

Table 3 shows the baseline regression of political connection on corporate innovation. The regression showed that non-SOEs political connection(connect) has a significant positive correlation with innovation output, that is, political connection increases both the innovation quantity and the innovation quality at the significance level of 5%.



**Table 3: Baseline regression**

	(1)	(2)
VARIABLES	Ln_patent	Ln_patentQ
<b>Connect</b>	<b>0.014**</b>	<b>0.069***</b>
	(2.51)	(4.50)
Leverage	-0.011	-0.009**
	(-1.31)	(-2.73)
MB	0.072	-0.020
	(1.21)	(-0.54)
ln_age	0.260**	0.030
	(2.53)	(0.72)
ROA	-0.002	-0.000
	(-0.10)	(-0.06)
Ln_Sales	0.247***	0.099***
	(3.46)	(7.93)
Tangibility	-0.035	-0.219
	(-0.14)	(-1.22)
Ln_Sales_Growth	0.005	0.007
	(0.95)	(1.68)
Constant	-0.675**	0.315*
	(-2.48)	(1.75)
Year FE	Controlled	Controlled
Firm FE	Controlled	Controlled
Observations	8,882	8,882
R-squared	0.076	0.266

Clustered t-statistics in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The table reports the OLS regression of innovation on political connection. The sample period is 2008-2016. The innovation is measured by patent quantity in column (1) and patent quality in column (2), respectively. All control variables are used as we defined in table 1. We include firm fixed effects and year fixed effect in each regression. The t-statistics are presented in parentheses. Standard errors are clustered at the firm level and corrected for heteroscedasticity. \*\*\*, \*\*, and \* denote significance at 1%, 5%, and 10% levels, respectively.

### **4.3 PSM-DID analysis**

Because some possible unobservable factors that may influence political connection and innovation at the same time, we have to deal with the endogenous problem. The paper conduct a difference-in-difference analysis which used Chinese president Xi Jinping's anti-corruption policy as an exogenous shock. The China anti-corruption campaign was initiated by the political bureau of the CPC central committee in December 2012. The anti-corruption campaign aimed at inspect every province and found illegal corruption officials, what is more, the inspection team was sent by the Central Commission for Discipline Inspection and inspected local government randomly. So, the anti-corruption policy can be viewed as a good natural experiment just like Ding et al. (2017) did in the paper of researching political connection and land transaction. The Anti-corruption variable(Anti) is a dummy, which we define Anti equals 1 when the year is 2013 or later, otherwise it is zero.

Before conducting DID regression, the paper will match the political connected firm with no political connected firms to make sure that they did not differ too much in other corporate characters. So we use the propensity score matching(PSM) method to make the results more robust and clean. Table 4 presents the probit regression results before and after matching. The results showed that many variables significantly influence whether firm was political connected or not, but the significant relationship nearly disappeared after matching and the P value does not significant, that is to say, whether a firm is politically connected could not be explained by these variables.

**Table 4: PSM Results**

	(1)	(2)
	Before	After
VARIABLES	Connect	Connect
ln_age	-0.211***	-0.026
	(-6.38)	(-0.83)
Leverage	-0.094	0.172*
	(-1.50)	(1.73)
MB	0.062**	0.000
	(1.97)	(0.00)
ROA	-0.088	0.025
	(-0.89)	(0.13)
Ln_Sales	0.122***	-0.013
	(7.22)	(-0.79)
Ln_Sales_Growth	-0.064	-0.053
	(-1.14)	(-1.01)
m_p	-0.014**	0.002
	(-1.97)	(0.25)
tangibility	-0.203	0.102
	(-0.87)	(0.47)
Constant	-0.489**	-0.445*
	(-1.97)	(-1.92)
Year FE	Controlled	Controlled
Firm FE	Controlled	Controlled
Observations	5,233	6,192
<b>Pseudo R-square</b>	<b>0.0143</b>	<b>0.0008</b>
<b>P-value</b>	<b>0.0000</b>	<b>0.6538</b>

Clustered t-statistics in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The table reports the probit regression of connect on firm characteristics. The sample period is 2008-2016. The column (1) shows the regression results before matching and column (2) shows the regression results after matching. All variables are used as we defined in table 1. We include firm fixed effects and year fixed effect in each regression. The t-statistics are presented in parentheses. Standard errors are clustered at the firm level and corrected for heteroscedasticity. \*\*\*, \*\*, and \* denote significance at 1%, 5%, and 10% levels, respectively.

Table 5 showed the result of balance test after matching. The pairwise comparisons demonstrated that our match was fair enough and there was no significant difference between these connected and unconnected firms after propensity score match.

**Table 5: Pairwise Comparison**

Pairwise Comparison	(1)			(2)		
		Pre-match			Post-match	
Variable	<u>control</u>	<u>treat</u>	<u>T-Diff</u>	<u>control</u>	<u>treat</u>	<u>T-Diff</u>
<b>ln_age</b>	2.1638	2.0961	-4.12***	2.1041	2.0961	-1.4
<b>leverage</b>	0.4855	0.4099	-1.53	0.4016	0.4099	1.28
<b>MB</b>	0.6652	0.73389	3.92***	0.7251	0.73389	0.42
<b>ROA</b>	0.0347	0.0447	0.46	0.0463	0.0447	-0.53
<b>Ln_Sales</b>	7.152	7.3856	6.71***	7.3982	7.3856	0.737
<b>Ln_Sales_Growth</b>	0.0146	0.0053	-0.68	0.0201	0.0053	-0.92
<b>Patent_Growth</b>	1.9641	1.8803	-1.11	1.8688	1.8803	0.871
<b>tangibility</b>	0.9298	0.9305	0.31	0.9291	0.9305	0.59

The table reports the t test between political connected firms and no connection firms. The sample period is 2008-2016. The column (1) shows the pre-match t test results and column (2) shows the post-match t test results. All variables are used as we defined in table 1. \*\*\*, \*\*, and \* denote significance at 1%, 5%, and 10% levels, respectively.

The difference-in-difference regression results after matching is presented at table 6. We focus on the cross terms *Anti\_connect*, and the regression results show that the cross term has significant negative correlation with patent quantity or patent quality, which means that the political connected firms suffer a loss of innovation after anti-corruption. The anti-corruption campaign can stop the rent seeking between government officials and firms. In other words, anti-corruption can weaken the political connection to some degree. All in all, the baseline results and the DID results both prove that political connection can increase firm innovation quantity or innovation quality.

**Table 6: PSM-DID**

	(1)	(2)
VARIABLES	Ln_patent	Ln_patentQ
connect	0.188***	0.029
	(2.99)	(0.94)
Anti	0.628***	0.445***
	(8.08)	(14.07)
<b>Anti_connect</b>	<b>-0.142*</b>	<b>-0.061**</b>
	<b>(-1.96)</b>	<b>(-2.23)</b>
leverage	-0.377***	-0.542***
	(-4.25)	(-4.18)
MB	0.069**	0.027**
	(2.58)	(2.53)
ln_age	0.246	0.180***
	(1.46)	(4.01)
ROA	0.289*	0.143
	(2.04)	(1.25)
Ln_Sales	0.285**	0.174***
	(2.67)	(5.42)
tangibility	-0.052	-0.330
	(-0.17)	(-1.56)
Ln_Sales_Growth	0.011	0.014
	(0.71)	(1.21)
Constant	-0.628	-0.026
	(-1.33)	(-0.07)
Year FE	Controlled	Controlled
Firm FE	Controlled	Controlled
Observations	6,192	6,192
R-squared	0.096	0.295

Clustered t-statistics in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The table reports the DID regression of innovation on political connection after propensity score matching. The sample period is 2008-2016. The innovation is measured by patent quantity in column (1) and patent quality in column (2), respectively. All control variables are used as we defined in table 1. We include firm fixed effects and year fixed effect in each regression. The t-statistics are presented in parentheses. Standard errors are clustered at the firm level and corrected for heteroscedasticity. \*\*\*, \*\*, and \* denote significance at 1%, 5%, and 10% levels, respectively.

#### **4.4 Robustness test**

On the one side, it takes time to turn innovation input into output. On the other side, the government might select productive firms to build connections subjectively. Both of the two situations can bias our results. So we lag the patent quantity and patent quality for one period to moderate these two issues and update our baseline results and PSM-DID regressions. The new evidence is put in table 7 and table 8 below.

Table 7 shows that the political connection and corporate innovation are still positive correlated after adjustment at the significance level of 5%, which verify that non-SOEs political connection can enhance firm innovation.

Table 8 shows that the cross term are still negative after adjustment at the significance level of 5%, which in accord with the evidence that political connected firms suffer more from innovation decrease than unconnected firms when anti-corruption campaign weaken political connections.

**Table 7: Patent lagged baseline regression**

	(1)	(2)
VARIABLES	L.Ln_patent	L.Ln_patentQ
<b>connect</b>	<b>0.073**</b>	<b>0.049**</b>
	<b>(2.26)</b>	<b>(2.13)</b>
leverage	-0.006	-0.024***
	(-0.48)	(-13.04)
MB	-0.022	-0.028
	(-0.27)	(-0.48)
ln_age	0.188**	-0.057
	(2.45)	(-0.81)
ROA	-0.000	-0.034***
	(-0.01)	(-10.69)
Ln_Sales	0.228***	0.067***
	(4.42)	(4.32)
tangibility	0.272	-0.167
	(1.14)	(-1.39)
Ln_Sales_Growth	0.008	0.003
	(1.64)	(0.71)
Constant	-0.325	0.789***
	(-1.21)	(3.65)
Year FE	Controlled	Controlled
Firm FE	Controlled	Controlled
Observations	6,872	6,872
R-squared	0.045	0.294

Clustered t-statistics in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The table reports the OLS regression of innovation on political connection. The sample period is 2008-2016. The innovation is measured by patent quantity in column (1) and patent quality in column (2), respectively. All independent variables are measured with current year value and dependent variables are measured with one-year lagged value. All variables are used as we defined in table 1. We include firm fixed effects and year fixed effect in each regression. The t-statistics are presented in parentheses. Standard errors are clustered at the firm level and corrected for heteroscedasticity. \*\*\*, \*\*, and \* denote significance at 1%, 5%, and 10% levels, respectively.

**Table 8 : Lagged PSM-DID regression**

	(1)	(2)
VARIABLES	L_patent	L_patentQ
connect	0.303***	0.013
	(4.88)	(0.23)
Anti	0.148**	0.059
	(2.70)	(1.22)
<b>Anti_connect</b>	<b>-0.141***</b>	<b>-0.074**</b>
	<b>(-3.12)</b>	<b>(-2.78)</b>
leverage	-0.595***	-0.295***
	(-4.81)	(-5.52)
ln_age	0.335***	0.323***
	(4.98)	(9.64)
MB	0.083	0.023
	(0.77)	(0.30)
ROA	0.210	0.118
	(0.85)	(1.23)
Ln_Sales	0.309***	0.091**
	(3.81)	(2.50)
tangibility	0.119	-0.375*
	(0.63)	(-1.87)
Ln_Sales_Growth	0.001	0.001
	(0.16)	(0.26)
Constant	-0.710	0.412
	(-1.27)	(1.00)
Year FE	Controlled	Controlled
Firm FE	Controlled	Controlled
Observations	5,336	5,336
R-squared	0.072	0.306

Clustered t-statistics in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The table reports the OLS regression of innovation on political connection. The sample period is 2008-2016. The innovation is measured by patent quantity in column (1) and patent quality in column (2), respectively. All independent variables are measured with current year value and dependent variables are measured with one-year lagged value. All variables are used as we defined in table 1. We include firm fixed effects and year fixed effect in each regression.



The t-statistics are presented in parentheses. Standard errors are clustered at the firm level and corrected for heteroscedasticity. \*\*\*, \*\*, and \* denote significance at 1%, 5%, and 10% levels, respectively.

#### 4.5 Channel: financing constraint

The non-SOEs in China are still faced with many restrictions in development. The most prominent problem is financing constraint, which do harm to firm's long term development (Lin and Li, 2001). Chinese financial system is mostly controlled by the state or state controlled banking system, which incent non-SOEs to build relationship with local government so as to get financing.

Boubakri et al. (2010) found that political connection can decrease corporate equity financing cost, and Fan et al. (2008) showed that political connection can help firms obtain more bank loans. Yu et al. (2012) stated that political connection moderate financing constraint through information effect and resource effect. Information effect means political connection serve as a signal when the two financing parties have asymmetric information; whereas resource effects means that political connection can be treated as a SOE and get financing in priority because of the China's bank dominated financial system. The above literature all showed evidence that political connection moderate financing constraints.

Ayyagari et al. (2011) stated that the easier firm got access to external financing, the more innovation output firm yield. If the non-SOEs have political connection, they can ease financing constraints and have more capital to make innovation invest which in turn generates more innovation output.

To verify above analysis, we have to check whether political connection ease financing constraints. The paper utilized financing constraints variable as in Kaplan and Zingales (1997) or Li and Xu (2015). After calculating the financing constraint index, we define binding financing constraints when the index is above median. That is to say, CONS equals 1 when firms facing high financing constraints, otherwise it is zero.

Table 9 reveals that the cross term *Anti\_connect* is significantly negative at the significance level of 10%, which means that political connected firms' financing constraint rise more than other firms after anti-corruption. The coefficient of *connect* is negative correlate with financing constraint, that is, political connection can help firm get external financing and ease financing constraints. Combing these two results, we can conclude that political connection is weakened after anti-corruption campaign, and the evidence in turn verify the externality of China anti-corruption policy.

**Table 9: Political Connection and Financing Constraints**

	(1)
VARIABLES	CONS
Anti	0.478***
	(24.59)
connect	-0.017*
	(-1.96)
<b>Anti_connect</b>	<b>0.016*</b>
	<b>(2.10)</b>
leverage	-0.007***
	(-3.74)
MB	0.046***
	(3.40)
ln_age	0.124***
	(7.20)
ROA	-0.016***
	(-4.24)
Ln_Sales	-0.072***
	(-6.03)
tangibility	-0.166***
	(-6.36)
Ln_Sales_Growth	0.006
	(1.19)
Constant	1.330***
	(15.99)
Year FE	Controlled
Firm FE	Controlled
Observations	8,882
Number of stkcd	1,736

Clustered t-statistics in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The table reports the OLS regression of financing constraints on political connection. The sample period is 2008-2016. The financing constraints is defined as in Li and Xu (2015) and CONS is a dummy equal 1 when firms facing high financing constraints. All control variables are used as we defined in table 1. We include firm fixed effects and year fixed effect in this regression. The t-

statistics are presented in parentheses. Standard errors are clustered at the firm level and corrected for heteroscedasticity. \*\*\*, \*\*, and \* denote significance at 1%, 5%, and 10% levels, respectively.

We classify firm into two groups, the first group(FC=1) are the firm in high financing constraint provinces which is defined by Fan et al. (2016), otherwise FC equals 0 in low financing constraints provinces.

Table 10 presents the matched sample regression results. To prove our hypothesis that political connection can increase corporate innovation through easing financing constraints, we anticipate that high financing constraint firms benefit more from political connections and suffer more after anti-corruption campaign, that is to say, the sign of triple cross term coefficient should be negative and be the same with Anti\_connect. The regression verifies this hypothesis. The triple cross term coefficient is negative and significant at the 5% level, which means that political connected firms suffer more loss of innovation after the 2013 anti-corruption policy in high financing constraint areas. In a word, political connected firms might yield more innovation output through moderating financing constraints.

**Table 10: Financing Constraints Channel**

	(1)	(2)
VARIABLES	Ln_patent	Ln_patentQ
connect	0.327***	0.055
	(3.68)	(0.67)
FC	-0.013	0.152***
	(-0.19)	(3.28)
Anti	0.147	-1.288***
	(1.31)	(-19.41)
Anti_FC	0.002	-0.096**
	(0.04)	(-2.15)
FC_connect	0.166	0.095
	(1.65)	(1.44)
Anti_connect	-0.345***	-0.149***
	(-8.31)	(-6.68)
<b>FC_Anti_connect</b>	<b>-0.275**</b>	<b>-0.107**</b>
	<b>(-2.47)</b>	<b>(-2.29)</b>
leverage	-0.380***	-0.529***
	(-4.28)	(-4.15)
ln_age	0.248	0.186***
	(1.45)	(4.15)
MB	0.069**	0.029**
	(2.54)	(2.61)
ROA	0.302**	0.136
	(2.13)	(1.22)
Ln_Sales	0.288**	0.166***
	(2.70)	(5.36)
tangibility	-0.045	-0.353
	(-0.15)	(-1.63)
Ln_Sales_Growth	0.011	0.013
	(0.69)	(1.19)

Constant	-0.656	0.184
	(-1.53)	(0.55)
Year FE	Controlled	Controlled
Firm FE	Controlled	Controlled
Observations	6,192	6,192
R-squared	0.097	0.297

Clustered t-statistics in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The table reports the OLS regression of innovation on financing constraints after propensity score matching. The sample period is 2008-2016. The high financing constraints (FC=1) are the firm in high financing constraint provinces which is defined by Fan et al. (2016). The innovation is measured by patent quantity in column (1) and patent quality in column (2), respectively. All control variables are used as we defined in table 1. We include firm fixed effects and year fixed effect in this regression. The t-statistics are presented in parentheses. Standard errors are clustered at the firm level and corrected for heteroscedasticity. \*\*\*, \*\*, and \* denote significance at 1%, 5%, and 10% levels, respectively.

#### 4.6 Channel: institutional environment

Non-SOEs would like to build relationship with local government because this connection help them avoid exploiting by governments. China did not have a perfect legal institution at present and law enforcement is not strict. Besides, there are high barriers to enter a market. All of these issues caused a lacking of investor protection market atmosphere. Under this circumstance, political connection act as a scarce resources and reduce firm's harm caused by imperfect market mechanism (Chen et al. ,2011). Fan et al. (2010) examined the effects that institutional environment have on newly issued stocks' long term performance, and they found that political connection is a substitution for weak institutional environment.

Wang (2010) utilized a sample of Word Bank 2003 China Corporate Investment Environment Survey data and showed that political connection significantly increased the probability which corporate executing contract and property right protection in commercial dispute. The evidence proved that political connection can protect corporate property rights in functional sense. Besides, it also reduces law discrimination of non-SOEs and improve firm's contract executing environment.

China is transforming economic structure nowadays. Political connection helps firms to overcome the defect of law and institution, and get rid of Ideological discrimination when compared to SOEs.

On the other side, good institution condition indeed contributes to corporate innovation (Fang et al. ,2017). Thus political connection acts as a substitution for property rights protection and helps avoid harm which may cause when non-SOEs running their business. Then non-SOEs have more incentive to make innovation, and the innovation output can be better protected and recognized too.

The paper defines the institutional index refer to Fan et al. (2016) who used market intermediary organization development and legal institution environment index to

measure institutional index. If the firm's area index is above the median, we define Above=1, otherwise it is 0. Then the paper conduct DID analysis by different groups. If political connection influence innovation through institutional environment and political connection is a substitution for institution, then we can see a more prominent effects of political connection in weak institution areas (Above=0).

The regression results are showed in table 11. When the dependent variable is patent quantity, both of the cross term coefficients are negative, and the poor institutional environment (Above=0) coefficient is -0.192, which is lower than -0.119 when Above=1, but they are not significant.

When the dependent variable is patent quality, the poor institutional environment (Above=0) coefficient is -0.299 and significant at 10% level. However, when the institutional environment is better (Above=1), the coefficient is -0.025 and not significant. The combined F-test shows a P-value of 0.0074, which means that the two groups have significantly different cross term coefficient. To conclude, the benefit political connection does for innovation reduce more in worse institutional environment areas (Above=0) than in other areas (Above=1) after anti-corruption policy, that is, political connection plays a more important role in worse institutional environment areas. All in all, political connection can improve institutional environment and protect non-SOEs, which in turn incent corporates make more innovation and overcome the defect of market imperfection.

**Table 11: Institutional Environment Channel**

	(1) (Above=0)	(2) (Above=1)	(3) (Above=0)	(4) (Above=1)
VARIABLES	Ln_patent	Ln_patent	Ln_patentQ	Ln_patentQ
connect	0.106 (0.37)	0.183** (2.01)	-0.096 (-0.38)	-0.021 (-0.27)
Anti	1.079** (2.06)	0.054 (0.26)	-0.639* (-1.79)	-1.283*** (-7.79)
<b>Anti_connect</b>	-0.192 (-0.83)	-0.119 (-1.52)	<b>-0.299*</b> <b>(-1.81)</b>	<b>-0.025</b> <b>(-0.36)</b>
leverage	-0.135 (-0.22)	-0.395* (-1.74)	-0.135 (-0.36)	-0.629*** (-3.68)
ln_age	-0.818* (-1.87)	0.381** (2.23)	-0.024 (-0.08)	0.235* (1.74)
MB	0.113* (1.88)	0.083 (1.37)	0.044 (1.07)	0.021 (0.39)
ROA	-0.490* (-1.68)	0.493*** (2.73)	-0.517** (-2.46)	0.297** (2.02)
Ln_Sales	0.598*** (3.22)	0.239*** (2.97)	0.261* (1.96)	0.161*** (2.81)
tangibility	-2.107 (-1.30)	0.046 (0.09)	0.013 (0.01)	-0.361 (-0.93)
Ln_Sales_Growth	-0.848 (-1.06)	0.023 (0.12)	-1.051* (-1.83)	0.110 (1.21)
Constant	0.399 (0.18)	-0.542 (-0.67)	-1.089 (-0.66)	0.083 (0.13)
Year FE	Controlled	Controlled	Year FE	Controlled
Firm FE	Controlled	Controlled	Firm FE	Controlled
Observations	640	5,552	640	5,552
R-squared	0.182	0.095	0.261	0.308
			$\chi^2 = 7.17$ <b>Prob &gt; <math>\chi^2 = 0.0074</math></b>	

The table reports the OLS regression of innovation on political connection after propensity score matching. The sample period is 2008-2016. The institutional index refers to Fan et al. (2016) who

used market intermediary organization development and legal institution environment index to measure institutional index. If the firm's area index is above the median, we define Above=1, otherwise it is 0. The innovation is measured by patent quantity in column (1) or (2) and patent quality in column (3) or (4), respectively. All control variables are used as we defined in table 1. We include firm fixed effects and year fixed effect in this regression. The t-statistics are presented in parentheses. The combined F-test statistics is also showed in the bottom of table. Standard errors are clustered at the firm level and corrected for heteroscedasticity. \*\*\*, \*\*, and \* denote significance at 1%, 5%, and 10% levels, respectively.

## 5. Conclusion

Political connection is a quite important method for firms to obtain resources and a great deal of literature had studied it from different aspects. This paper focus on corporate innovation and examines whether political connection does benefit for innovation or not. Through regressions on a 2008 to 2016 China listed A share non-SOEs sample, this paper proves that political connected firms have better innovation output. The study also verifies the channel why political connection contributed to firm innovation. On the one side, political connection can moderate non-SOEs financing constraints so that firm have access to more capital and make more innovation investment. On the other side, political connection serves as an informal institutional arrangement in China and protect the outcome of firm's innovation output. We also conduct PSM-DID analysis by using 2013 China anti-corruption campaign to make our regression more solid.

This paper fills in the gap between corporate innovation and political connection in China SOEs, which is a special corporate internal characters. On the other side, the study supplements the literature about political connection, and arrives at a conclusion that political connections contribute to corporate innovation. At last, this paper also enriches the emerging literature in China's anti-corruption campaign, and explores the effects of anti-corruption policy from the aspect of innovation.

Inevitably, this paper has some deficiency such as the institutional channel, which we did not show perfect evidence when the dependent variable is innovation quantity. Besides, we did not take SOE into account because it is quite different in China compared to non-SOEs. We may continue exploring SOEs innovation incentives and innovation behavior in the future. There must be some quite interesting story different from non-SOEs.

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