Common Institutional Ownership and Cooperation in Innovation

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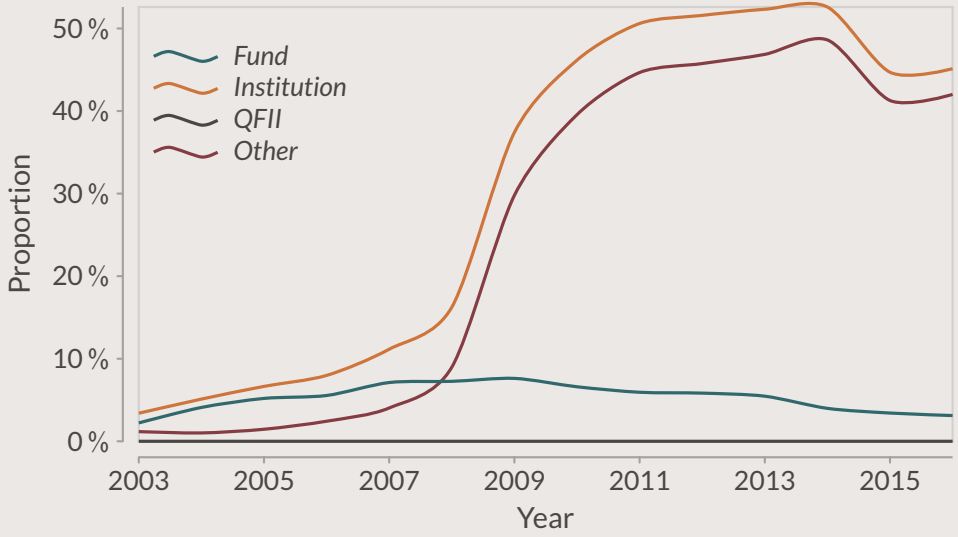
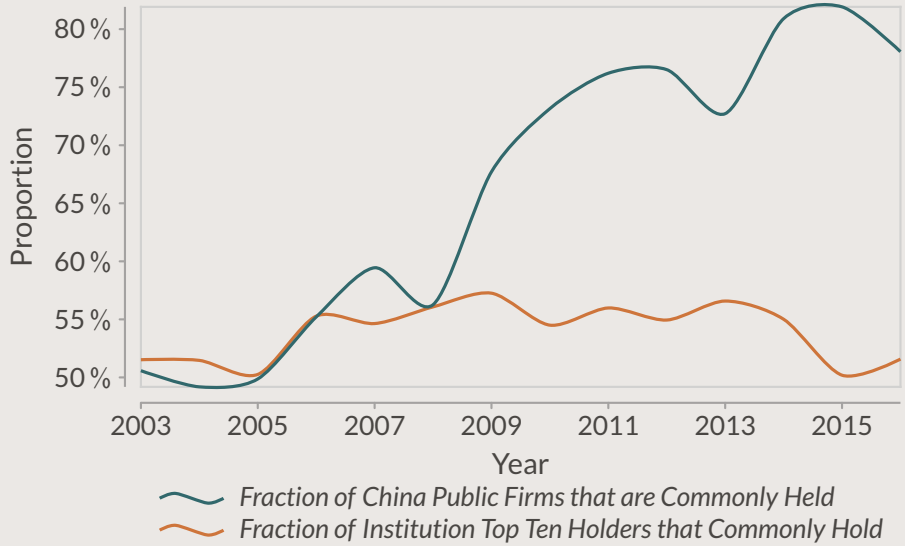
November 18, 2018

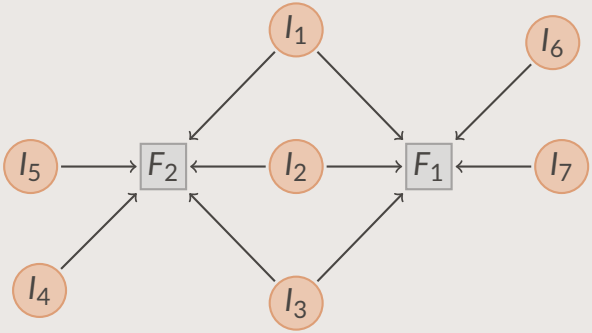
Time Trend of Institutional Ownership



Patterns of Institutional Cross-Ownership



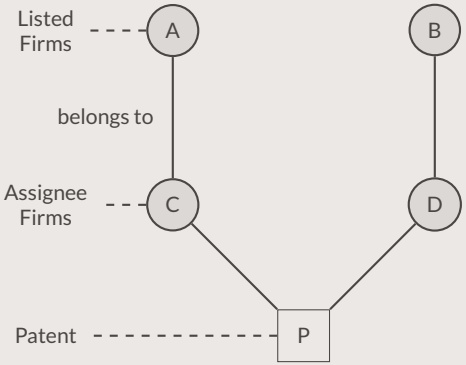
Definition of Common Ownership



- Common ownership reflects scenarios where two firms are at least partially owned by the same investor.

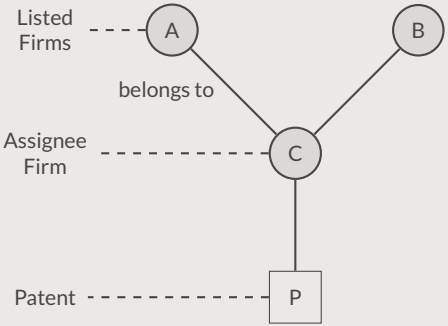
- Measurement: Common ownership$_{ijt}$ = min{%i − ownership of j's investors, %j − ownership of i's investors}

Collaboration Types Behind Patent Coassignments 1



- The assignees are subsidiaries of their respective parent public firms.
- There is high possibility that some outside forces facilitate these two entities to collaborate, through providing more precise information and acting as a monitor.
- Institutional cross-holders can form this bridge for the firms.

Collaboration Types Behind Patent Coassignments 2



- The public firms are both investors of the assignee.
- Their collaboration may have been proposed before the assignee company being established.

Research Questions

- Do the institution facilitate cooperations between/among the firms he commonly holds? by which ways?

Main Findings

- We show a positive causal effect of institutional common ownership on innovation cooperation, using a DID approach.
- Possible mechanisms:
  - Firms tend to collaborate in innovation more frequently when locating in the same district and similar in technology position.
  - Institutional common ownership enlarges these semi-elasticities.

Related Literature 1

- Institutions and Innovation
  - Institutions plays a crucial information disclosure role facilitating innovation production. (*Aghion, et al.*, 2013)
  - Quasi-indexed investors increasingly play an active role in corporate governance in the United States. (*Appel et al.*, 2016; *Bena et al.*, 2017)
  - Public listing is beneficial to the inno- vation of firms in industries that are more dependent on external finance. (*Acharya et al.*, 2017)

Related Literature 2

- Cross-ownership and Firm's Decisions
  - Cross-owners holding two firms in same industry prefer a less competitive product market achieved by redesigning contracts of top managers (anti-competitive behavior). (*Anton, et al.*, 2017)
  - Cross-holding leads to contagion and the propagation of financial shocks. (*Manconi, et al.*, 2012)
  - Institutional cross-ownership between two firms increases the probability of them merging, and affects the outcomes of mergers and acquisitions. (*Matvos, et al.*, 2008; *Harford. et al.*, 2010; *Zeng*, 2018)
  - Cross-held firms experience significantly higher market share growth than non-cross-held firms. (*He, et al.*, 2017)
  - Higher common institutional ownership is associated with higher intensity of patent citations. (*Kostovetsky, et al*, 2018)

Related Literature 3

- Innovation Network and Cooperation
  - Geographic location is important for productivity, perhaps dominating other spillover mechanisms. (*Lychagin, et al.*, 2014)
  - Cooperation of innovation production will take place in strategic alliances which are formed spontaneously by corporates with similiar patent fields. (*Li, et al.*, 2018)

Specification

- H: Firms sharing higher common ownership are more likely to cooperate in innovation at higher intensity.
- Regression Model:

$$y_{i,j,t} = \alpha + \beta \text{CO}_{i,j,t-1} + X_{i,t-1}\gamma_i + \epsilon_{i,j,t} + FE_{i,j} + FE_t$$

  - $y = ln(1 + \#\text{PatentCoApplications})$
  - $\text{CO}_{ijt} = \min\{\%i - \text{ownership of } j\text{'s investors}, \%j - \text{ownership of } i\text{'s investors}\}$
  - Control variables contains firm size, B/M, profitability, debt/assets, past return, and cash holding.

Sample Selections

- A-share stock market
- Non-missing marketvalue data from 2003-2016, to make sure the firms without troubles
- We end up with 2321 firm-partner-year observations between 2004 and 2016.

Variable Definitions

Name	Formula/Description	Source
Cooperation intensity	$ln(1 + \#\text{PatentCoApplications})$	PATSTAT
Institutional common ownership	$\text{CO}_{ijt} = \min\{\%i - \text{ownership of } j\text{'s investors}, \%j - \text{ownership of } i\text{'s investors}\}$	Wind
	$\text{CO}_{max,ijt} = max_{k \in j}(\text{CO}_{jkt})$	Wind
	$\text{CO}_{mean,ijt} = mean_{k \in j}(\text{CO}_{jkt})$	Wind
Size	$ln(\textit{total market value})$	CSMAR
B/M	book-to-market ratio	CSMAR
Profitability	operating profits-to-total assets ratio	CSMAR
Debt/Assets	$(\text{total} - \text{other liabilities})/\text{total assets}$	CSMAR
Past return	return on a-fiscal-year investment	CSMAR
Cash holding	cash-to-total assets ratio	CSMAR
SpillGeo_{Corr}	$SpillGeo_{corr}(d_{kl}) = \begin{cases} 1 & if\ k = l \\ 0 & if\ k \neq l \end{cases}$	CSMAR, BaiduMap
SpillGeo_{exp}	$SpillGeo_{exp}(d_{kl}) = exp(-\alpha d_{kl})$	CSMAR, BaiduMap
$F_{i,t}$	$F_{i,t} = (F_{i,1,t}, F_{i,1,t}, ..., F_{i,k,t})$	PATSTAT
TechProx	$TechProx_{i,j,t} = < \frac{F_{i,t}}{\|\|F_{i,t}\|\|}, \frac{F_{j,t}}{\|\|F_{j,t}\|\|} >$	PATSTAT

Basic result: Common Ownership and Cooperation

Dependent variable is $ln(1 + \#\text{PatentCoApplications})$			
	(1)	(2)	(3)
Partner type	Single partner	Group partners	
CO	0.054**		
	(0.026)		
CO_max		0.033**	
		(0.014)	
CO_mean			0.048**
			(0.019)
Size	0.046	0.035	0.034
	(0.031)	(0.027)	(0.027)
B/M	0.056	0.05	0.05
	(0.051)	(0.047)	(0.047)
Profitability	0.078	0.073	0.071
	(0.061)	(0.055)	(0.055)
Debt/Assets	0.019	0.017	0.016
	(0.013)	(0.012)	(0.012)
Past return	−0.033**	−0.024**	−0.024**
	(0.013)	(0.012)	(0.012)
Cash holding	-0.133	-0.17	-0.174
	(0.146)	(0.124)	(0.124)
Pair f.e.	Y	Y	Y
Year f.e.	Y	Y	Y
N	2321	2949	2949

Heterogeneity 1: Different Cooperation Types

Dependent variable is $ln(1 + \#\text{PatentCoApplications})$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cooperation type		Type 1			Type 2			Both	
Partner type	Single partner	Group partners		Single partner	Group partners		Single partner	Group partners	
CO	0.054**			0.019			0.034**		
	(0.026)			(0.014)			(0.017)		
CO_max		0.033**			0.007			0.021*	
		(0.014)			(0.013)			(0.011)	
CO_mean			0.048**			0.015			0.032**
			(0.019)			(0.014)			(0.014)
Size	0.046	0.035	0.034	0.017	0.009	0.008	0.020	0.013	0.013
	(0.031)	(0.027)	(0.027)	(0.057)	(0.051)	(0.051)	(0.029)	(0.026)	(0.025)
B/M	0.056	0.050	0.050	0.302***	0.277***	0.278***	0.101**	0.093**	0.094**
	(0.051)	(0.047)	(0.047)	(0.115)	(0.105)	(0.104)	(0.050)	(0.044)	(0.044)
Profitability	0.078	0.073	0.071	0.621**	0.509*	0.508*	0.164**	0.141**	0.139**
	(0.061)	(0.055)	(0.055)	(0.305)	(0.258)	(0.258)	(0.073)	(0.064)	(0.064)
Debt/Assets	0.019	0.017	0.016	0.310	0.272	0.273	0.038***	0.035***	0.035***
	(0.013)	(0.012)	(0.012)	(0.199)	(0.184)	(0.184)	(0.014)	(0.013)	(0.013)
Past Return	−0.033**	−0.024**	−0.024**	0.008	0.031	0.031	-0.024*	-0.007	-0.007
	(0.013)	(0.012)	(0.012)	(0.025)	(0.026)	(0.026)	(0.012)	(0.012)	(0.012)
Cash holding	-0.133	-0.170	-0.174	-0.101	0.021	0.023	-0.091	-0.088	-0.090
	(0.146)	(0.124)	(0.124)	(0.273)	(0.243)	(0.243)	(0.151)	(0.130)	(0.130)
Pair f.e.	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	2321	2949	2949	1682	1851	1851	3515	4260	4260

Heterogeneity 2: Different Patent Types

Dependent variable is $ln(1 + \#\text{PatentCoApplications})$						
	(1)	(2)	(3)	(4)	(5)	(6)
Patent type	Utility			Invention		
Partner type	Single partner	Group partners		Single partner	Group partners	
CO	0.005			0.061**		
	(0.009)			(0.028)		
CO_max		0.004			0.04**	
		(0.005)			(0.017)	
CO_mean			0.006			0.053**
			(0.007)			(0.021)
Size	0.030	0.023	0.023	0.041	0.035	0.034
	(0.031)	(0.026)	(0.026)	(0.031)	(0.028)	(0.028)
B/M	0.079	0.078	0.077	0.046	0.031	0.032
	(0.062)	(0.055)	(0.055)	(0.050)	(0.046)	(0.046)
Profitability	0.025	0.027	0.027	0.092	0.081	0.079
	(0.061)	(0.050)	(0.050)	(0.061)	(0.059)	(0.059)
Debt/Assets	0.021	0.020	0.020	0.019	0.015	0.015
	(0.013)	(0.012)	(0.012)	(0.013)	(0.012)	(0.012)
Past return	-0.014	-0.009	-0.009	−0.036**	−0.028*	−0.028*
	(0.009)	(0.008)	(0.008)	(0.016)	(0.014)	(0.015)
Cash holding	-0.007	-0.030	-0.031	-0.100	-0.145	-0.146
	(0.155)	(0.129)	(0.130)	(0.126)	(0.115)	(0.114)
Pair f.e.	Y	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y	Y
N	1416	1852	1852	1805	2188	2188

Mechanism 1: Geographical Proximity

Dependent variable is $ln(1 + \#\text{PatentCoApplications})$								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Patent type	All				Utility		Invention	
Method	Sample division		Interaction		Interaction		Interaction	
Spillover in Geograph	$Corr = 1$	$Corr = 0$	$CO \times Exp$	$CO \times Corr$	$CO \times Exp$	$CO \times Corr$	$CO \times Exp$	$CO \times Corr$
CO	0.118*	0.039	0.028	0.036	0.006	0.004	0.034	0.043
	(0.063)	(0.026)	(0.028)	(0.026)	(0.013)	(0.012)	(0.032)	(0.029)
$CO \times SpillGeo$			0.097	0.094	-0.006	0.002	0.094	0.091
			(0.076)	(0.072)	(0.016)	(0.014)	(0.08)	(0.075)
Size	0.044	0.045	0.046	0.047	0.030	0.030	0.042	0.042
	(0.060)	(0.038)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
B/M	-0.077	0.080	0.055	0.056	0.079	0.079	0.045	0.046
	(0.105)	(0.058)	(0.051)	(0.051)	(0.062)	(0.062)	(0.050)	(0.050)
Profitability	-0.046	0.091	0.077	0.077	0.025	0.025	0.091	0.091
	(0.088)	(0.080)	(0.061)	(0.061)	(0.061)	(0.061)	(0.060)	(0.060)
Debt/Assets	-0.011	0.021	0.018	0.019	0.021	0.021	0.019	0.019
	(0.025)	(0.016)	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)
Past Return	−0.063**	-0.017	−0.035**	−0.035**	-0.014	-0.014	−0.038**	−0.038**
	(0.028)	(0.017)	(0.014)	(0.014)	(0.009)	(0.009)	(0.017)	(0.017)
Cash holding	0.244	−0.293*	-0.128	-0.127	-0.007	-0.007	-0.093	-0.093
	(0.290)	(0.170)	(0.145)	(0.145)	(0.155)	(0.155)	(0.127)	(0.127)
Pair f.e.	Y	Y	Y	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y	Y	Y	Y
N	619	1702	2321	2321	1416	1416	1805	1805

Mechanism 2: Technological Proximity

Dependent variable is $ln(1 + \#\text{PatentCoApplications})$				
	(1)	(2)	(3)	(4)
Patent type	All		Utility	Invention
CO		-0.008	-0.004	-0.028
		(0.036)	(0.023)	(0.043)
CO × *TechProx*		0.194*	0.007	0.260**
		(0.102)	(0.032)	(0.120)
TechProx	0.159**	0.123*	0.146	0.071
	(0.075)	(0.065)	(0.097)	(0.066)
Size	0.057	0.047	0.035	0.044
	(0.039)	(0.037)	(0.037)	(0.040)
B/M	0.031	0.032	0.104	0.003
	(0.070)	(0.070)	(0.086)	(0.062)
Profitability	0.036	0.028	-0.007	0.048
	(0.071)	(0.071)	(0.059)	(0.067)
Debt/Assets	0.005	0.003	0.020	0.005
	(0.017)	(0.017)	(0.017)	(0.015)
Past Return	−0.048***	−0.052***	−0.020*	−0.054**
	(0.018)	(0.019)	(0.012)	(0.022)
Cash holding	0.011	0.020	0.175	0.001
	(0.199)	(0.195)	(0.230)	(0.163)
Pair f.e.	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y
N	1482	1482	858	1118