International Joint Ventures and Internal vs. External Technology Transfer: Evidence from China

Kun Jiang
University of Nottingham

Wolfgang Keller
University of Colorado and NBER

Larry D. Qiu
University of Hong Kong

William Ridley
University of Colorado

香 港 大 學
THE UNIVERSITY OF HONG KONG

January 4, 2019

I'm a reporter for the Wall Street Journal who has long covered economic issues. I focus a lot of my time on U.S.-China economic and trade relations. I read with interest your paper on the impact of JVs on Chinese firms and the economy.

Does your research shed any light on the political controversy surrounding joint ventures? **As you know, the US charges that US partners in the ventures are forced to transfer their technology**. I note that your research says US-partner JVs are the most productive.

Given your research, what's your view on a) **whether the tech transfer is forced**, b) **whether the JV helps the US partners** and c) **should the JVs be liberalized in some fashion?**

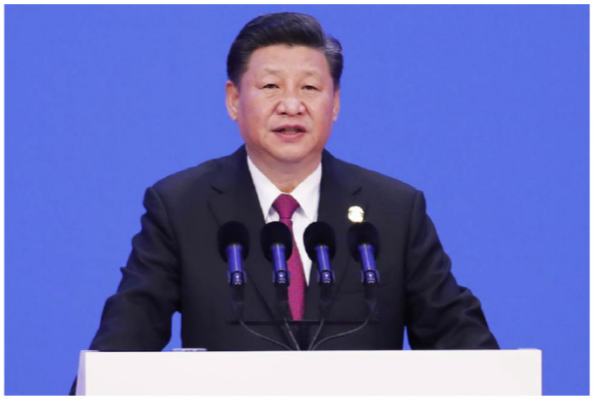
Thanks,
Bob Davis
Senior Editor, **Wall Street Journal**

Tue, Apr 10, 2018

THE WALL STREET JOURNAL.

REAL TIME ECONOMICS | TRADE

Study Shows Big Benefits to Chinese Companies From Joint Ventures with U.S. Firms



China's President Xi Jinping in April. **PHOTO:** AGENCE FRANCE-PRESSE/GETTY IMAGES

By Bob Davis

Apr 12, 2018 7:49 am ET

THE WALL STREET JOURNAL.

Outline

- Introduction
- Contributions and Related Literature
- Data
- Empirical Analysis and Results
- Conclusion

- International joint ventures (**IJVs**): major vehicle for FDI

- **Local firms**: Why might IJVs be favored to wholly foreign-owned FDI?
  - Access to intellectual property and foreign capital

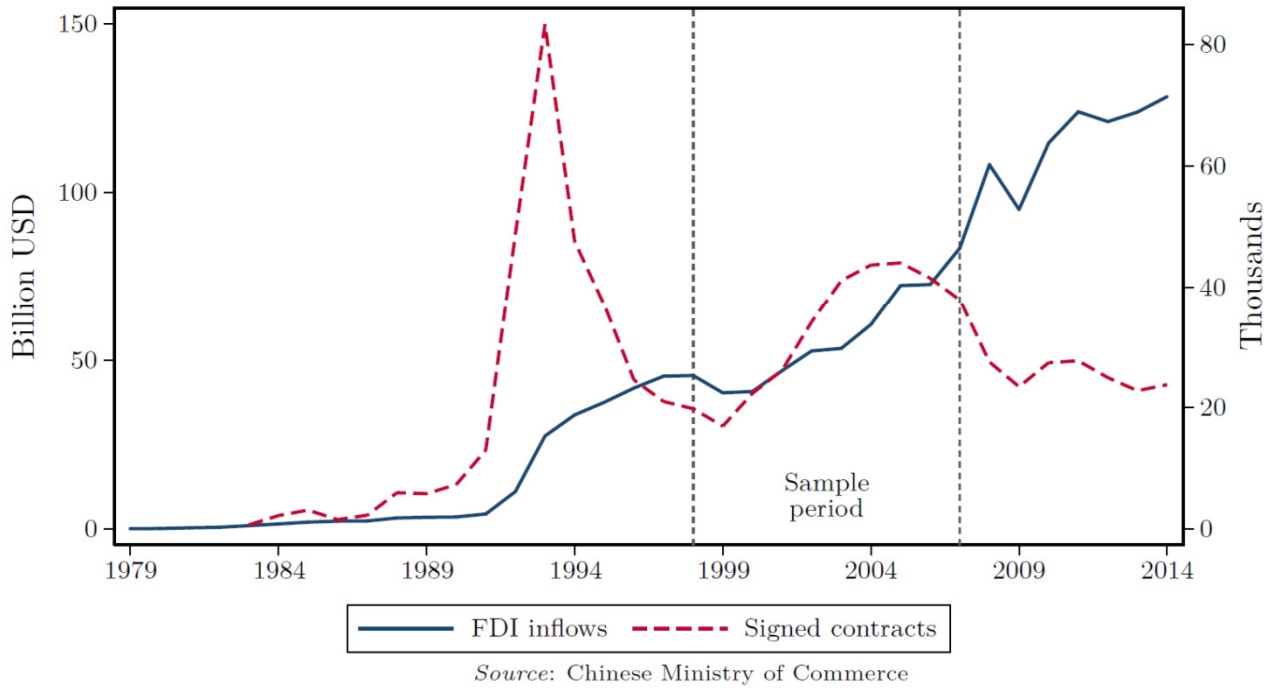
- **Foreign firms**: Benefit from IJVs because that avoids some of the complexities inherent in entering the local market
  - Regulatory as well as cultural barriers

- **Host country**: IJVs as part of development strategy
  - More political support for government if the country catches up and grows fast

FDI in China

- China is a top FDI recipient country

Figure 1: Chinese FDI inflows, 1979–2014



Source: Chinese Ministry of Commerce

FDI and IJVs in China

- China's *Catalogue of Industries for Foreign Direct Investment*
  - Four types of industries "encouraged", "permitted", "restricted", "prohibited"
  - In "restricted" areas, foreign firms are legally required to partner with a domestic firm in a Sino-foreign JV.

- However, FDI environment has been liberalized over time
  - Partly through entry into WTO
  - Reducing the number of "restricted" economic activities, now **38**, but still a point of contention
  - Moving to "negative list"

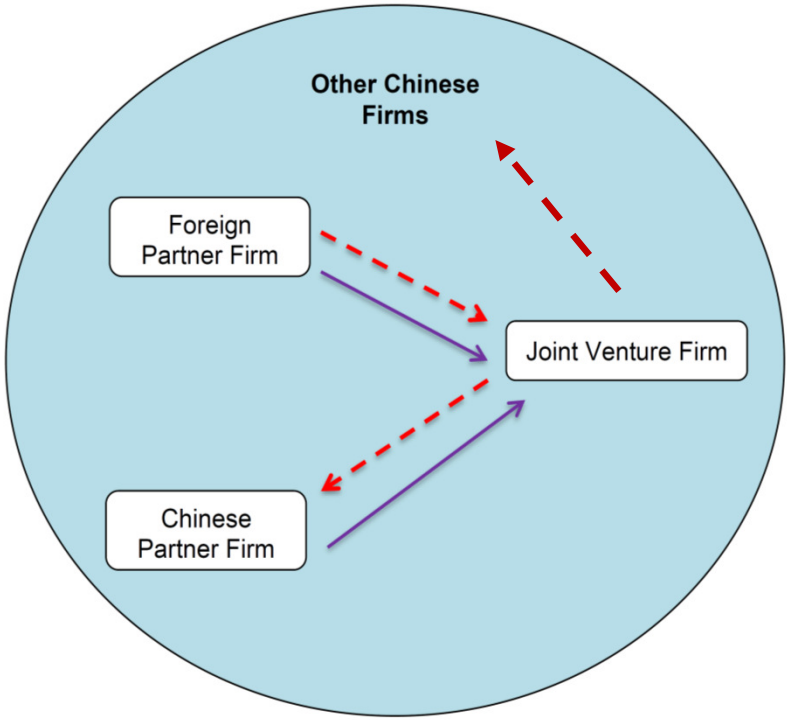
- Modes/Types of FDI in China: Sino-foreign JVs and Wholly Foreign-owned Enterprises

	1997	2002	2007	2012
Equity joint venture	19,495	14,992	15,596	21,706
% of total FDI flows	43.1	28.4	20.9	19.4
Contractual joint venture	8,929	5,058	1,416	2,308
% of total FDI flows	19.7	9.6	1.9	2.1
Wholly foreign-owned enterprise	16,187	31,725	57,264	86,132
% of total FDI flows	35.8	60.2	76.6	77.1
Share company with foreign investment	288	492	697	1,570
% of total FDI flows	0.6	0.9	0.9	1.4
Total FDI	19,495	14,992	15,596	21,706

Source: China Statistical Yearbook

Basic questions we ask

- How do foreign firms choose JV partners?
  - Whom are more likely to be chosen?
  - Selection issue
- Will Chinese JV partners benefit from JVs?
  - **Internal** technology transfer (Intra-firm spillovers)
- Will other Chinese firms benefit from JVs?
  - **External** technology transfer (Inter-firm spillovers)



Basic findings

About selection

- We find that the Chinese firms more likely to be chosen as partners in IJVs
  - are large (in terms of employment),
  - exhibit high productivity (in terms of total factor productivity),
  - have large sales and profits,
  - undertake a high level of innovation (in several dimensions),
  - export-oriented,
  - government-connected.

About intra-firm spillovers

- Firms which have entered into a JV tend to exhibit higher levels of
  - Innovation
  - Productivity
  - Sales, etc.

About inter-firm spillovers

- We find both spillover channels are present with IJVs in China
  - Positive innovation spillover in industries ……
  - Negative innovation spillover in industries ……

- **Heterogeneous** spillover effects
  - JV vs WFOE
  - JV vs other domestic firms
  - R&D-intensive industries
  - US vs other countries

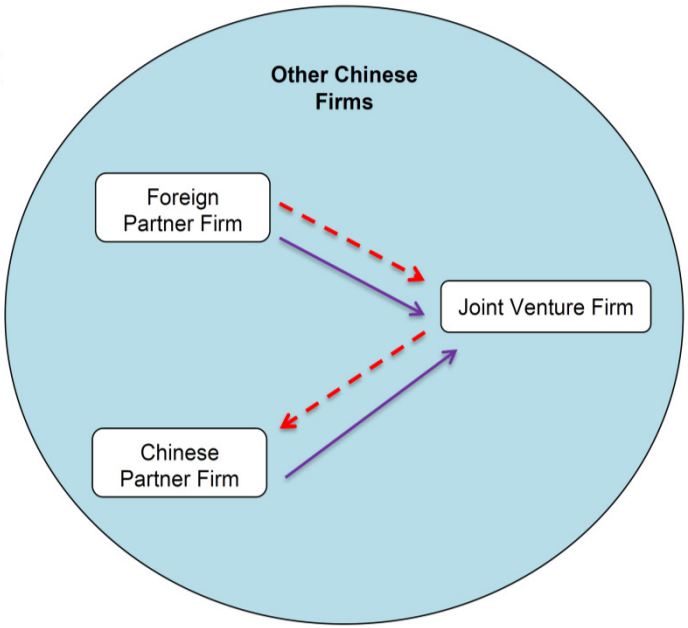
Outline

- Introduction
- Contributions and Related Literature
- Data
- Empirical Analysis and Results
- Conclusion

Contributions and Literature Review

The feature of this study:

- We use **Chinese** data, deal with **IJV** partner selection, and identify and quantify **intra-firm** spillovers (to JV partners) and **inter-firm** spillovers, on a spectrum of **performance**.



- First, one challenge in quantifying spillovers is that they are typically **inferred** from the extent of FDI or foreign presence in an industry rather than directly measured through a **firm-to-firm link** (Van Reenen and Yueh 2012)

  - **We** have the **ownership link** between two specific firms
  - Javorcik and Spatareanu (2009) on **supply link** between local firms (upstream) and foreign multinationals (downstream)

- Second, while there are hundreds of papers on the spillovers of FDI, **quantitatively** we still know quite little on the effects of **IJVs**.
  - A large literature on FDI (not IJV) spillovers
    - Empirical results are mixed: positive technology spillover and negative competition effect
  - IJV effects mainly qualitative analysis and discussion in the international business and management fields
  - **Our paper** uses large data set (rather than survey data) and conducts econometric analysis of IJV

- Third, we produce a number of important new results for the case of China

  - FDI spillover with Chinese data
    - Cheung and Lin (2004): spillover effects of FDI on innovation
    - Lin et al (2009): FDI horizontal and vertical spillover effects on domestic firms
    - Lu et al (2010): Distance matters
    - Xu and Sheng (2011): Domestic firm's ownership matters
    - Liu and Qiu (2013): Effects of foreign acquisitions on target firms
    - Lu, Tao and Zhu (2017): Identify negative effects using exogenous policy change
  - **Our paper**: IJV and intra-firm spillovers on innovation and other performances, firm level data, etc

Outline

- Introduction
- Contributions and Related Literature
- Data
- Empirical Analysis and Results
- Conclusion

Data: Three sources

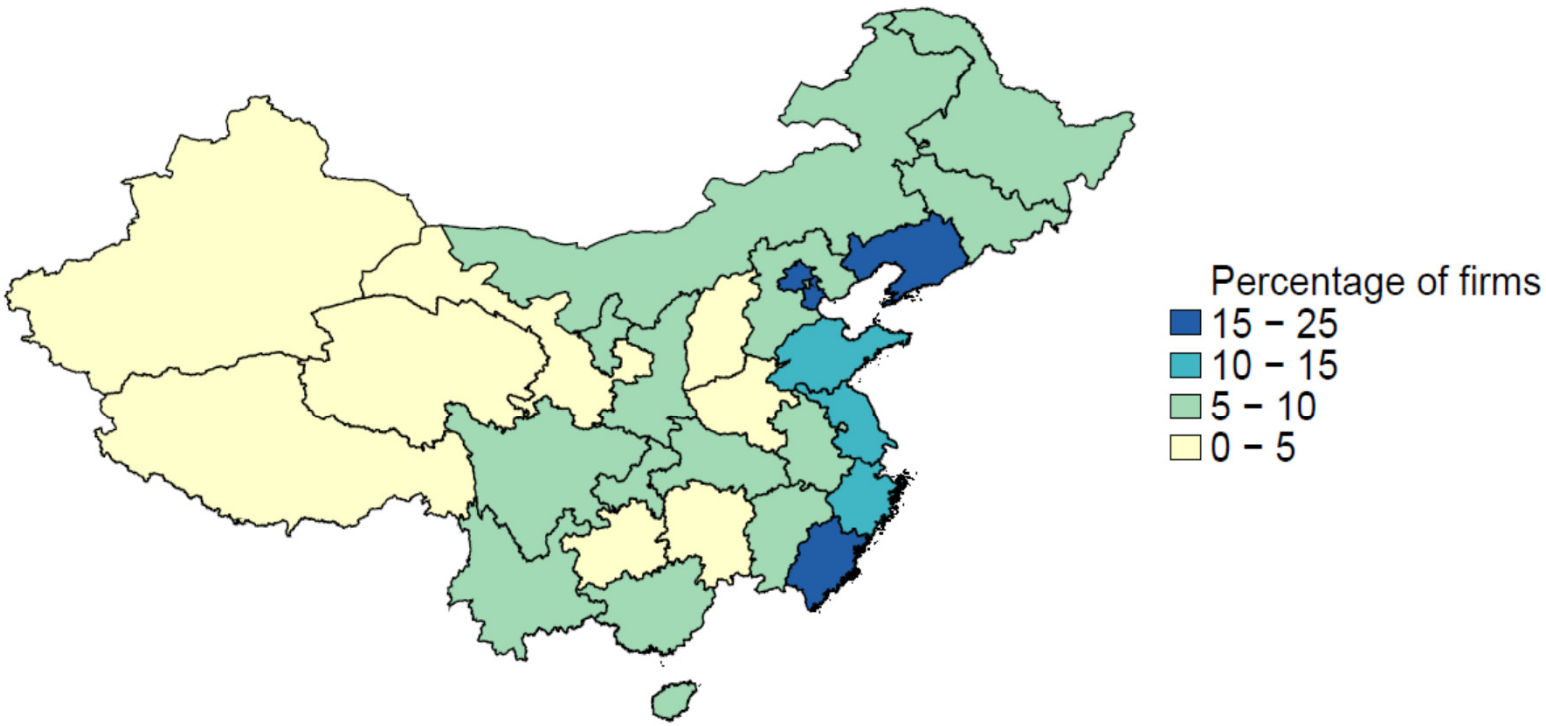
- *Above-scale Industrial Firms Panel* 1998-2007 (ASIFP)

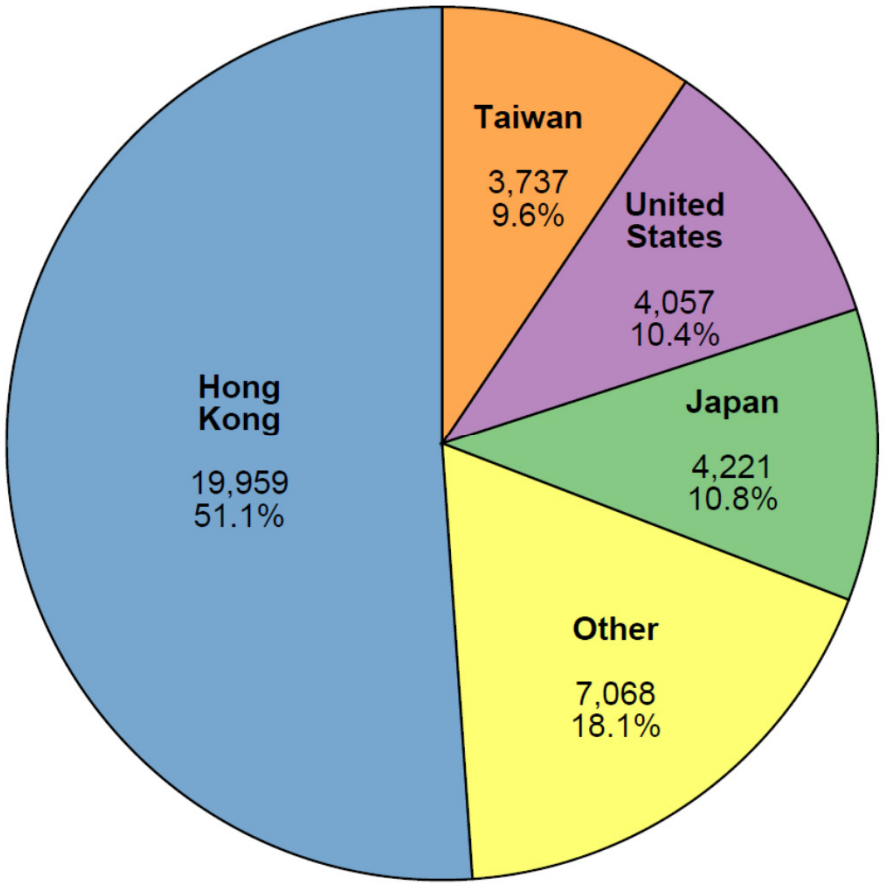
  - It is representative
  - All SOEs and others with 5 (10) million RMB sales and above
  - The enterprises covered by the ASIFP account for more than 91% of the total sales of all industrial firms in China in 2004 (from census data)
  - Firm data

- *Name List of Foreign and Domestic Joint Ventures in China*
  - Identifying information on all Chinese IJVs in China
  - Key for intra-firm effect

- *China's State Intellectual Property Office* (SIPO) Patent Database
  - Patent applications of firms

Figure 4: Share of Domestic Firms that are Joint Venture Partners by Province, 2002




Taiwan
3,737
9.6%
United States
4,057
10.4%
Japan
4,221
10.8%
Other
7,068
18.1%
Hong Kong
19,959
51.1%

1998-2007

Table 2: Sample Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Variable	Obs.	Mean	Std. Dev.
Panel A: Full Sample				**Panel B: Joint Venture Firms**			
Age	1,979,502	9.25	7.67	Age	25,857	8.37	4.2
Employment	1,979,746	280.3	1,371.54	Employment	25,857	321.18	603.47
Foreign Share	1,979,746	0.02	0.1	Foreign Share	25,857	0.24	0.28
Govt. Share	1,978,942	0.14	0.33	Govt. Share	25,856	0.12	0.24
Export Ratio	1,723,524	0.12	0.3	Export Ratio	22,754	0.26	0.63
Net Profits	1,979,746	4,368.23	193,694.92	Net Profits	25,857	12,746.16	100,582.17
TFP (OLS)	1,863,425	0.01	1.2	TFP (OLS)	24,432	0.39	1.18
TFP (OP)	1,863,301	2.69	1.38	TFP (OP)	24,432	2.91	1.32
Patents	1,979,746	0.11	5.88	Patents	25,857	0.41	7.42
Invention Patents	1,979,746	0.03	5.01	Invention Patents	25,857	0.15	5.77
Sales	1,979,746	73,834.92	769,441.53	Sales	25,857	206,236.67	1,209,433.02
Total Assets	1,979,746	84,269.81	1,145,572.97	Total Assets	25,857	192,087.02	806,783.77
Panel C: Joint Venture Partner Firms				**Panel D: Other Chinese Firms**			
Age	170,229	10.68	6.58	Age	1,783,416	9.13	7.79
Employment	170,240	594.95	2,859.34	Employment	1,783,649	249.67	1,136.62
Foreign Share	170,240	0.12	0.22	Foreign Share	1,783,649	0.01	0.07
Govt. Share	170,215	0.12	0.28	Govt. Share	1,782,871	0.14	0.34
Export Ratio	151,350	0.32	0.42	Export Ratio	1,549,420	0.1	0.27
Net Profits	170,240	9,913.43	136,299.36	Net Profits	1,783,649	3,717.51	199,294.58
TFP (OLS)	160,915	0.09	1.16	TFP (OLS)	1,678,078	0	1.2
TFP (OP)	160,907	2.77	1.36	TFP (OP)	1,677,962	2.68	1.38
Patents	170,240	0.37	15.64	Patents	1,783,649	0.08	3.76
Invention Patents	170,240	0.14	13.92	Invention Patents	1,783,649	0.02	2.98
Sales	170,240	183,208.70	1,409,458.67	Sales	1,783,649	61,476.38	666,911.12
Total Assets	170,240	239,380.61	1,832,475.15	Total Assets	1,783,649	67,902.30	1,060,165.53

Notes: Panel A gives summary statistics for the entire sample. Panel B limits the sample to joint venture firms. Panel C limits the sample to domestic IJV partners that are partners in an IJV during the observation year. Panel D limits the sample to non-joint venture, non-partner firms.

Outline

- Introduction
- Contributions and Related Literature
- Data
- Empirical Analysis and Results
- Conclusion

Empirical analysis and results

IJV partner selection

$$PT\_Select_{it} = f\left(\boldsymbol{X}'_{it}\gamma, \lambda_j, \lambda_r, \lambda_t, \varepsilon_{it}\right)$$

- PT_Select_{it}: 1 if Chinese firm *i* is selected as an IJV partner in year *t*, 0 otherwise. **Omitted** from the rest of the years once IJV is formed.
- $\boldsymbol{X}_{it}$: Firm-level productivity, innovativeness, size, financial characteristics
- Control for industry (*j*), province (*r*) and year (*t*) fixed effects
- **Control group**: for each "treatment" firm, we randomly select five firms from the same region and industry, which never enter into an JIV.

Table 3: Logit Regression of IJV Partner Selection on Firm Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Employment	0.691***	0.719***	0.837***	0.838***	0.823***	0.805***	0.790***	0.672***	0.692***
	(0.038)	(0.037)	(0.042)	(0.042)	(0.040)	(0.040)	(0.039)	(0.036)	(0.036)
Age		–0.159***	–0.144***	–0.139***	–0.112***	–0.115***	–0.114***	–0.077	–0.076
		(0.039)	(0.040)	(0.040)	(0.042)	(0.042)	(0.044)	(0.050)	(0.051)
Foreign Share					2.886***	2.878***	2.703***	2.398***	2.328***
					(0.615)	(0.618)	(0.627)	(0.604)	(0.600)
Govt. Share					–0.123	–0.144	–0.114	0.073	0.111
					(0.115)	(0.117)	(0.119)	(0.120)	(0.119)
Subsidy						0.381***	0.399***	0.337***	0.348***
						(0.071)	(0.071)	(0.073)	(0.076)
Export Ratio							0.635***	0.715***	0.722***
							(0.130)	(0.127)	(0.126)
Net Profit								0.143***	0.103***
								(0.016)	(0.020)
TFP (OLS)									0.192***
									(0.048)
Observations	11,692	11,692	11,692	11,692	11,692	11,692	11,692	11,692	11,692
Pseudo R^2	0.106	0.108	0.132	0.137	0.147	0.149	0.154	0.165	0.167
Industry FE	N	N	Y	Y	Y	Y	Y	Y	Y
Province FE	N	N	Y	Y	Y	Y	Y	Y	Y
Year FE	N	N	Y	Y	Y	Y	Y	Y	Y
JV Age FE	N	N	N	Y	Y	Y	Y	Y	Y

Notes: Employment, Age, and Net Profit are expressed in natural logarithms. Robust standard errors clustered by 2-digit industry in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 4: Logit Regression of IJV Partner Selection on Firm Characteristics, Including Innovation and Financial Measures

Return

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Employment	0.659***	0.683***	0.681***	0.651***	0.675***	0.573***	0.651***	0.054
	(0.036)	(0.037)	(0.036)	(0.035)	(0.036)	(0.041)	(0.035)	(0.055)
Age	−0.085	−0.078	−0.077	−0.085	−0.078	−0.091*	−0.085	−0.089
	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)	(0.053)	(0.052)	(0.054)
Foreign Share	2.306***	2.349***	2.345***	2.289***	2.330***	2.156***	2.289***	1.703***
	(0.564)	(0.577)	(0.573)	(0.556)	(0.569)	(0.504)	(0.555)	(0.435)
Govt. Share	0.089	0.098	0.064	0.058	0.066	0.005	0.058	−0.202*
	(0.124)	(0.121)	(0.121)	(0.125)	(0.121)	(0.126)	(0.126)	(0.111)
Subsidy	0.343***	0.352***	0.342***	0.334***	0.343***	0.269***	0.334***	0.194**
	(0.073)	(0.075)	(0.073)	(0.073)	(0.075)	(0.078)	(0.073)	(0.081)
Export Ratio	0.755***	0.745***	0.747***	0.761***	0.750***	0.783***	0.761***	1.022***
	(0.120)	(0.121)	(0.121)	(0.120)	(0.121)	(0.114)	(0.120)	(0.119)
Net Profit	0.099***	0.104***	0.104***	0.098***	0.103***	0.150***	0.098***	0.034*
	(0.020)	(0.020)	(0.021)	(0.020)	(0.021)	(0.023)	(0.020)	(0.018)
TFP (OLS)	0.177***	0.183***	0.183***	0.173***	0.179***	0.216***	0.173***	0.056
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.049)	(0.048)	(0.046)
Patents	0.640***			0.631***		0.625***	0.631***	0.540***
	(0.135)			(0.135)		(0.134)	(0.135)	(0.124)
Invention		1.390***			1.347***			
		(0.383)			(0.359)			
New Prod. Ratio			0.878***	0.855***	0.868***	0.813***	0.855***	0.628***
			(0.239)	(0.239)	(0.238)	(0.239)	(0.239)	(0.229)
ROA						−2.895***		
						(0.637)		
Leverage							0.004	
							(0.069)	
Total Assets								0.683***
								(0.057)
Observations	11,692	11,692	11,692	11,692	11,692	11,691	11,691	11,692
Pseudo R^2	0.172	0.168	0.169	0.174	0.171	0.181	0.174	0.213
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
JV Age FE	Y	Y	Y	Y	Y	Y	Y	Y

Notes: Employment, Age, Patents, Invention, and Total Assets are expressed in natural logarithms. Robust standard errors clustered by 2-digit industry in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

IJV Partner Selection - Summary

- Foreign investors seek out domestic partners that are
  - Larger
  - More established
  - More innovative, higher productivity
  - Have government connections

- Such partners are most able to contribute to the success of the IJV

- Results are plausible but rarely taken into account when assessing IJV performance and spillovers.

Joint Ventures and Firm Performance

Are joint ventures different from other Chinese firms?

- Firm outcomes as a function of joint venture status:

$$y_{it} = \alpha + \beta_1 JV_i + \boldsymbol{X}'_{it}\gamma + \lambda_j + \lambda_r + \lambda_t + \varepsilon_{it}$$

- JV_i: Firm i formed as joint venture between Chinese and foreign partner
- $\boldsymbol{X}_{it}$: Firm employment, age, government connections, foreign ownership
- β_1 gives difference b/n joint ventures and non-JV in the same industry-province-year

Table: Joint Ventures and Firm Performance

	(1) TFP (OLS)	(2) TFP (OP)	(3) Patents	(4) New Pr. Ratio	(5) Sales	(6) Export Ratio
JV	**0.327[a]**	**0.256[a]**	**0.022[a]**	**0.011[a]**	**0.491[a]**	**0.025[a]**
	(0.025)	**(0.021)**	**(0.007)**	**(0.002)**	**(0.029)**	**(0.009)**
Employment	0.074[a]	−0.059[a]	0.037[a]	0.010[a]	0.866[a]	0.030[a]
	(0.010)	(0.019)	(0.006)	(0.002)	(0.026)	(0.004)
Age	−0.112[a]	−0.042[b]	−0.004[b]	−0.002[a]	−0.142[a]	−0.008[a]
	(0.011)	(0.019)	(0.002)	(0.001)	(0.012)	(0.003)
Foreign Share	0.500[a]	0.344[a]	0.009	0.010[a]	0.792[a]	0.293[a]
	(0.064)	(0.053)	(0.008)	(0.003)	(0.107)	(0.029)
Govt. Share	−0.823[a]	−0.900[a]	−0.015[a]	0.005[a]	−0.811[a]	−0.036[a]
	(0.046)	(0.037)	(0.004)	(0.002)	(0.039)	(0.007)
Subsidy	0.091[a]	0.048[b]	0.036[a]	0.015[a]	0.193[a]	0.011[a]
	(0.017)	(0.018)	(0.006)	(0.002)	(0.018)	(0.004)
Observations	970,913	970,861	851,995	899,072	1,015,192	899,072
Industry FE	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

a: $p < 0.01$, b: $p < 0.05$, c: $p < 0.10$

IJVs and Performance - Summary

- IJVs have a 30% productivity premium over comparable non-IJV firms
  - Consistent with technology transfer from the foreign partner to the IJV

- IJVs also have higher
  - Sales
  - Patenting
  - Export ratio
  - New-product ratio

Chinese Partner Status and Firm Performance

How does IJV affect performance of Chinese partner firm?

- Firm outcomes as a function of being an IJV partner:

$$y_{it} = \alpha + \beta_1 PT_{it} + \boldsymbol{X}'_{it}\gamma + \lambda_j + \lambda_r + \lambda_t + \varepsilon_{it}$$

- PT_{it}: Firm is the Chinese partner of a foreign firm establishing a joint venture
  - Partner firm is observed before and after joint venture formation
- $\boldsymbol{X}_{it}$: Employment, age, government connections, foreign ownership

Methodology

- Have shown that foreign firms tend to pick more productive, larger, more established firms

- Two strategies

  - Inverse probability weighting with regression adjustment (IPWRA)

  - Firm fixed effects

Inverse Probability Weighting with Regression Adjustment

IPWRA

1. Propensity ($\hat{p}_i$) of each firm **to be selected** as partner in IJV as a function of average firm characteristics ($\bar{\boldsymbol{X}}_i$):

$$\Pr\left(PT_i = 1|\bar{\boldsymbol{X}}_i\right) = f\left(\bar{\boldsymbol{X}}_i, \lambda_j, \lambda_r\right),$$

Pooled logit estimation based on our selection findings Table

$\Longrightarrow$ Yielding inverse probability regression weights for each firm:

$$IPW_i = \frac{PT_i}{\hat{p}_i} + \frac{1 - PT_i}{1 - \hat{p}_i}$$

$$IPW_i = \frac{PT_i}{\hat{p}_i} + \frac{1 - PT_i}{1 - \hat{p}_i}$$

2. Use the constructed IPW_i's **as weights** in the linear regression to relate outcomes to IJV status

- Treatment firms ($PT_{it} = 1$) given a high weight when they most resemble control firms ($\hat{p}_i$ is low)
- Control firms ($PT_{it} = 0$) given a high weight when they most resemble treatment firms ($1 - \hat{p}_i$ is low)

Table: Chinese Partner Firm Performance and JVs w/ IPWRA

	(1) TFP (OLS)	(2) TFP (OP)	(3) Patents	(4) New Pr. Ratio	(5) Sales	(6) Export Ratio
PT	**0.052[a]**	**0.021**	**0.008[b]**	**0.007[a]**	**0.234[a]**	**0.013[b]**
	(0.015)	**(0.020)**	**(0.003)**	**(0.001)**	**(0.030)**	**(0.006)**
Employment	0.077[a]	–0.053[a]	0.041[a]	0.008[a]	0.854[a]	0.029[a]
	(0.009)	(0.018)	(0.006)	(0.002)	(0.025)	(0.004)
Observations	944,177	944,125	810,902	854,986	966,072	854,986
Industry FE	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

a: $p < 0.01$, b: $p < 0.05$, c: $p < 0.10$; includes Age, Foreign & Govt. Share, Subsidy.

Table: Spillover Effects to Chinese IJV Partners

	(1) TFP (OLS)	(2) TFP (OP)	(3) Patents	(4) New Pr. Ratio	(5) Sales	(6) Export Ratio
Industry-Province Fixed Effects						
PT	0.052[a]	0.021	0.008[b]	0.007[a]	0.234[a]	0.013[b]
Firm Fixed Effects						
PT	0.078	0.078	0.065[c]	0.006	0.136[a]	0.011[c]
Observations	944,177	944,125	810,902	854,986	966,072	854,986

a: $p < 0.01$, b: $p < 0.05$, c: $p < 0.10$; includes Age, Foreign & Govt. Share, Subsidy. Clustered s.e. at industry level; includes year fixed effects

Intra-firm spillovers - Summary

- Both analyses show that IJV formation **causes** the following to the Chinese JV partners
  - Higher productivity
  - Larger sales
  - More patenting
  - Higher new product ratio
  - Higher export ratio

- Performance gains to the Chinese JV partner firms: **intra-firm technology transfer**

Joint Ventures and Spillovers to Other Firms

- Do JVs generate **externalities** to firms in the **same** industry?

$$SPILL_{jt}^{JV} = \frac{\sum_{i=1}^{N_{jt}} JV_i \times Sales_{it}}{\sum_{i=1}^{N_{jt}} Sales_{it}} \qquad SPILL_{jt}^{PT} = \frac{\sum_{i=1}^{N_{jt}} PT_{it} \times Sales_{it}}{\sum_{i=1}^{N_{jt}} Sales_{it}}$$

- *SPILL*: Share of industry j's sales in year t conducted by joint ventures **or** domestic IJV partners
  - Sales-weighted importance of joint ventures and Chinese partner firms in industry
    - Chance for externalities ⇑ when joint ventures are relatively common
  - **Negative** externalities: Market share rivalry
  - **Positive** externalities: Technological learning

- Estimate spillovers from (1) joint ventures and from (2) partner firms:

$$y_{it} = \alpha + \beta_2 \, SPILL_{jt}^{JV} + \boldsymbol{X}'_{it}\boldsymbol{\gamma} + \lambda_i + \lambda_t + \varepsilon_{it}$$

$$y_{it} = \alpha + \beta_1 \, PT_{it} + \beta_2 \, SPILL_{jt}^{PT} + \boldsymbol{X}'_{it}\boldsymbol{\gamma} + \lambda_i + \lambda_t + \varepsilon_{it}$$

- β_2: extent to which joint venture formation impacts performance of other firms

Table: Industry Spillovers from Joint Ventures

	(1) TFP (OLS)	(2) TFP (OP)	(3) Patents	(4) New Pr. Ratio	(5) Sales	(6) Export Ratio
$SPILL^{JV}$	1.003[b]	1.035[b]	−0.049	0.014	1.316[a]	0.007
	(0.419)	(0.454)	(0.104)	(0.015)	(0.188)	(0.028)
N	970,800	970,748	851,950	898,995	1,015,117	898,995
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

a: $p < 0.01$, b: $p < 0.05$, c: $p < 0.10$; includes Employment, Age, Foreign Share, Govt. Share, Subsidy; robust s.e. clustered by industry.

IJVs create **productivity spillovers**

Table: Industry Spillovers from JV Partner Firms

	(1) TFP (OLS)	(2) TFP (OP)	(3) Patents	(4) New Pr. Ratio	(5) Sales	(6) Export Ratio
$SPILL^{PT}$	0.431[b]	0.472[b]	–0.066[b]	-0.016[b]	0.543[a]	0.001
	(0.196)	(0.454)	(0.104)	(0.015)	(0.188)	(0.028)
PT	0.047	0.050	0.058[b]	0.005	0.069[b]	0.008
	(0.041)	(0.041)	(0.028)	(0.005)	(0.031)	(0.005)
Observations	970,800	970,748	851,950	898,995	1,015,117	898,995
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

a: $p < 0.01$, b: $p < 0.05$, c: $p < 0.10$; includes Employment, Age, Foreign Share, Govt. Share, Subsidy; robust s.e. clustered by industry.

Chinese JV partner firms also create **productivity spillovers**

Heterogeneity in JV Effects

- Foreign country of investor
- Industry heterogeneity
- Before and after WTO entry
- Chinese FDI policy: the four categories

Heterogeneity by "Foreign Country" Investors

1. Hong Kong, Macau, and Taiwan (HMT)

2. Japan

3. United States of America

Heterogeneous results

Table: External Effects of Joint Ventures on Productivity:

	(1) Baseline	(2) HMT	(3) Japan	(4) USA
$SPILL^{JV}$	1.035[b]	0.984[a]	1.605[a]	0.433
	(0.454)	(0.293)	(0.541)	(0.518)
$SPILL^{JV}_{HMT}$		0.194		
		(1.532)		
$SPILL^{JV}_{Japan}$			−3.744[c]	
			(2.167)	
$SPILL^{JV}_{USA}$				3.213[b]
				(1.537)
Observations	970,748	970,748	970,748	970,748
Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y

a: $p < 0.01$, b: $p < 0.05$, c: $p < 0.10$; Dep. var. TFP (O-P)

- Strongest JV spillovers are coming from joint ventures formed with **US companies**

- Does this mean that US firms **relinquish know-how to a greater extent** than other firms?

- **Composition effects** are another possibility
  - US companies are relatively close to the world tech frontier: more know-how to transfer
    - US JVs productivity higher than Japan's JVs by 17%
    - Nature of US and Japanese FDI is different

Table: External Effects of Joint Ventures on Export Orientation

	(1) Baseline	(2) HMT	(3) Japan	(4) USA
$SPILL^{JV}$	0.007	0.026	-0.048	0.033
	(0.028)	(0.042)	(0.037)	(0.041)
$SPILL^{JV}_{HMT}$		-0.071		
		(0.123)		
$SPILL^{JV}_{Japan}$			0.364[c]	
			(0.195)	
$SPILL^{JV}_{USA}$				-0.142
				(1.537)
Observations	898,995	898,995	898,995	898,995
Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y

a: $p < 0.01$, b: $p < 0.05$, c: $p < 0.10$; Dep. var. TFP (O-P)

Outline

- Introduction
- Contributions and Related Literature
- Data
- Empirical Analysis and Results
- Conclusion

Concluding remarks

- We find
  - IJV partner selection
  - Conditional on selection, intra-firm IJV effects (on Chinese parent firms)
  - Inter-firm (intra-industry) spillovers

Open Questions

- Did China “force” US companies into JVs?
- Was there “theft” of American intellectual property?
- Did China benefit from its FDI policy requiring JVs?