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Introduction

Policymakers in many developing countries have placed enormous attention on attracting foreign direct investment (FDI) due to the belief that FDI can generate technology spillovers (Buckley et al. 2007; Dunning 1993). Recent studies on spillovers have put special emphasis on the influence of institutions. The spillover effects have been linked with, for example, host country intellectual property rights (IPR) protection (Allred and Park 2007; Yi et al. 2015), tax and tariff incentives (Du et al. 2014), economic freedom (Hong et al. 2016), as well as corruption and transparency (Meyer and Sinani 2009).

However, the existing literature provides little insight into the following research question: do institutions have different effects on spillovers to different firms in the same location? Answers to this question will not only enrich our understanding of the determinants of spillovers, but also provide implications on how to enlarge the gains from FDI in practice.

This study aims to investigate the nonlinear effects of region-specific institutions on FDI spillovers in China. China is justified as a suitable context to study the impact of institutions on FDI spillovers, as it has attracted large amounts of FDI and there is large heterogeneity in the quality of local institutions.

This paper contributes to the existing literature in two ways. First, we examine the nonlinear effects of institutions on FDI spillovers conditional on firm characteristics. Second, we try to disentangle the spillover effects through different mechanisms within a unifying framework.

Table 1. Summary statistics for FDI variables over years

Year	Horizontal			Backward			Forward		
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
1998	111511	0.086	0.123	111487	0.066	0.028	111487	0.037	0.016
1999	120739	0.093	0.129	120715	0.070	0.029	120715	0.039	0.018
2000	123759	0.097	0.136	123714	0.077	0.035	123714	0.044	0.022
2001	136814	0.104	0.140	136744	0.083	0.038	136744	0.046	0.023
2002	150317	0.108	0.143	150228	0.085	0.039	150228	0.047	0.022
2003	172071	0.113	0.147	172142	0.090	0.044	172142	0.051	0.025
2004	257317	0.111	0.140	257452	0.085	0.040	257452	0.049	0.023
2005	254196	0.130	0.156	254228	0.099	0.045	254228	0.055	0.026
2006	286632	0.130	0.155	286662	0.103	0.050	286662	0.057	0.029
2007	325358	0.130	0.156	325374	0.102	0.050	325374	0.057	0.028

Data and Methods

Our data come from the annual surveys of manufacturing enterprises conducted by the National Bureau of Statistics (NBS) of China from 1998 to 2007.

The econometric model is specified as:

$$TFP_{it} = \beta_0 + \beta_1 FDI_{jct} + \beta_2 FDI_{jct} * INST_{pt} + \beta_3 FDI_{jct} * INST_{pt} * FIRM_{it} + \beta_4 CONTROL_{it} + \varphi_j + \mu_p + \delta_t + \varepsilon_{it}$$

where i, j, c, p, t denote firm, sector, city, province, and year, respectively. In this model, the dependent variable TFP is the total factor productivity of domestic firms, FDI is a vector of FDI variables (*Horizontal*, *Backward*, and *Forward*), $INST$ is a vector of institutional variables (*IPR*, *GOVIN*, and *ROL*), $FIRM$ is a vector of firm/sector characteristics (*TECH*, *ASSET*, and *RS*), and $CONTROL$ is a vector of the control variables. We lag the main independent variables by one year. We employ the FE method for estimation.

Table 2. Main variables

Variable	Definition
<i>TFP</i>	Total factor productivity estimated based on the OP method
<i>Horizontal</i>	Intra-sector FDI, foreign presence within the same sector
<i>Backward</i>	Backward FDI, foreign presence in the downstream sectors
<i>Forward</i>	Forward FDI, foreign presence in the upstream sectors
<i>IPR</i>	Intellectual property rights protection index
<i>GOVIN</i>	Government interference index
<i>ROL</i>	Rule of law index
<i>TECH</i>	Firm technological competence, the share of sales of new products in total sales of a firm
<i>ASSET</i>	Firm size, the values of firm assets
<i>RS^{backward}</i>	Relationship-specificity in the backward sector of MNEs
<i>RS^{forward}</i>	Relationship-specificity in the forward sector of MNEs
<i>AGE</i>	Firm age
<i>STATE</i>	An ownership dummy (=1 if state-owned; =0 if private-owned)

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Results

We show the nonlinear effects of region-specific institutions on FDI spillovers.

Intellectual property rights protection on average lowers the **demonstration** effect of FDI on local productivity, while it can increase the spillover benefits for local firms with high technological competence.

The marginal productivity gains due to the increased **competition** are higher in regions with higher levels of government interference. Nevertheless, government interference reduces the competition effect of FDI on the productivity of local firms with large size.

The better rule of law raises the **linkage** effects of FDI for upstream suppliers providing a high share of output to relationship-specific sectors (backward) and downstream firms in sectors with high relationship-specificity (forward).

Table 3. Main estimation results

Variable	Basic (1)	Demonstration (2)	Competition (3)	Competition (4)	Competition (5)	Backward (6)	Forward (7)
<i>Horizontal</i>	-0.0003 (0.0003)	0.0053*** (0.0004)	0.0022*** (0.0007)	0.0665*** (0.0029)	0.1620*** (0.0142)	-0.0003 (0.0003)	-0.0003 (0.0003)
<i>Backward</i>	0.0231*** (0.0052)	0.0235*** (0.0052)	0.0235*** (0.0052)	0.0227*** (0.0052)	0.0229*** (0.0052)	0.0662*** (0.0232)	0.0241*** (0.0052)
<i>Forward</i>	-0.0093 (0.0065)	-0.0084 (0.0065)	-0.0086 (0.0065)	-0.0076 (0.0065)	-0.0076 (0.0065)	-0.0078 (0.0070)	0.0803*** (0.0140)
<i>IPR(ln)</i>	-0.0289*** (0.0029)	-0.0510*** (0.0031)	-0.0513*** (0.0031)	-0.0193*** (0.0029)	-0.0193*** (0.0029)	-0.0285*** (0.0029)	-0.0279*** (0.0029)
<i>IPR(ln)*Horizontal</i>		-0.0062*** (0.0003)	-0.0055*** (0.0005)				
<i>IPR(ln)*Horizontal*TECH</i>			0.0001* (0.0000)				
<i>GOVIN(ln)</i>	-0.1670*** (0.0185)	-0.1320*** (0.0184)	-0.1300*** (0.0184)	-0.1010*** (0.0210)	-0.0967*** (0.0210)	-0.1650*** (0.0185)	-0.1640*** (0.0185)
<i>GOVIN(ln)*Horizontal</i>				0.0334*** (0.0014)	0.0780*** (0.0071)		
<i>GOVIN(ln)*Horizontal*ASSET(ln)</i>					-0.0045*** (0.0007)		
<i>ROL(ln)</i>	0.0950*** (0.0031)	0.0858*** (0.0031)	0.0871*** (0.0031)	0.0863*** (0.0031)	0.0860*** (0.0031)	0.0957*** (0.0064)	0.0908*** (0.0105)
<i>ROL(ln)*Backward</i>						-0.0186*** (0.0032)	
<i>ROL(ln)*Backward*RS^{backward}</i>						0.0407*** (0.0044)	
<i>ROL(ln)*Forward</i>							-0.0066** (0.0026)
<i>ROL(ln)*Forward*RS^{forward}</i>							0.0132*** (0.0030)
<i>TECH</i>	0.0020*** (0.0003)	0.0019*** (0.0003)	0.0009** (0.0004)	0.0018*** (0.0003)	0.0018*** (0.0003)	0.0020*** (0.0003)	0.0020*** (0.0003)
<i>ASSET(ln)</i>	-0.2320*** (0.0140)	-0.2360*** (0.0140)	-0.2350*** (0.0140)	-0.2410*** (0.0140)	-0.2640*** (0.0144)	-0.2370*** (0.0140)	-0.2340*** (0.0140)
<i>ASSETSQ(ln)</i>	0.0145*** (0.0007)	0.0147*** (0.0007)	0.0146*** (0.0007)	0.0149*** (0.0007)	0.0160*** (0.0007)	0.0148*** (0.0007)	0.0146*** (0.0007)
<i>RS^{backward}</i>	0.0046 (0.0321)	0.0094 (0.0320)	0.0092 (0.0320)	0.0096 (0.0320)	0.0101 (0.0320)	-0.1090 (0.1310)	-0.1380*** (0.0388)
<i>RS^{forward}</i>	0.0585** (0.0232)	0.0623*** (0.0232)	0.0621*** (0.0232)	0.0576** (0.0232)	0.0576** (0.0232)	0.0593** (0.0237)	-0.5090*** (0.0892)

Discussion and Conclusion

Using a panel dataset on Chinese manufacturing firms and province-level institutions from 1998 to 2007, we find that the effects of institutions on FDI spillovers depend on firm heterogeneity.

This study provides implications for theory development. First, it is a step forward to incorporate firm heterogeneity into the framework of research on institutions and FDI spillovers. Second, we distinguish the effects from different channels of spillovers. Third, we develop both conceptual and empirical links between various institutional dimensions and FDI spillovers. Fourth, unlike most prior studies, which focus on country-level institutions, this paper explores the effects of heterogeneous institutions across regions within one country.

This paper also has some important policy implications. First, institutions may play different roles in attracting FDI to a region and influencing the effects of FDI on local productivity. Second, policy makers should be aware of the interactive effects of institutions and firm characteristics on FDI spillovers, so that they can design and implement policies which help most local firms to reap the spillover benefits.

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