

Does Licensing Induce Technological Spillovers to Domestic Firms?*

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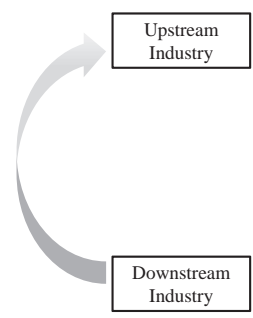
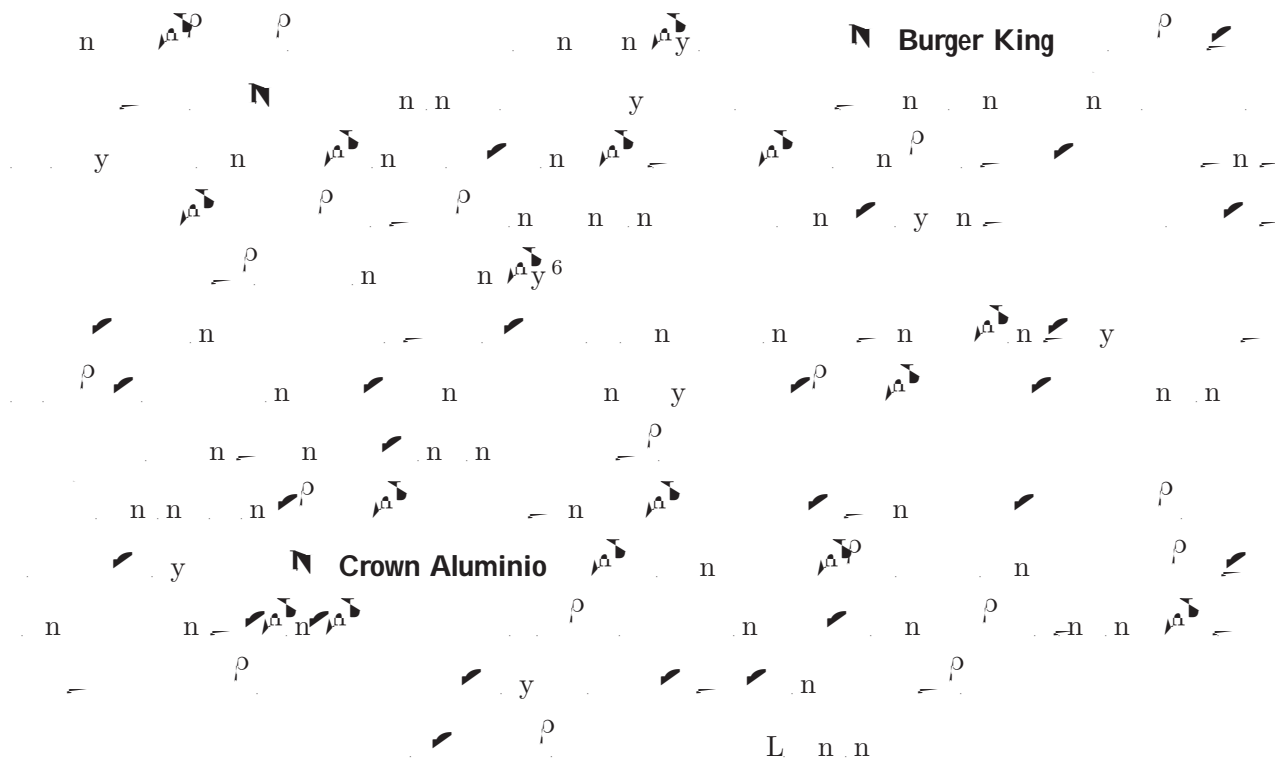
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Abstract

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y

$\frac{d^{\sigma} - \tau}{d}$ $\frac{d}{d}$ $\frac{d^{\rho}}{d}$ $\frac{d^{\rho}}{d}$ $\frac{d^{\rho}}{d}$ $\frac{d^{\rho}}{d}$ $\frac{d^{\rho}}{d}$ $\frac{d^{\rho}}{d}$ $\frac{d^{\rho}}{d}$ $\frac{d^{\rho}}{d}$

$$\frac{d^{\sigma} - \tau}{d} \quad \frac{d}{d} \quad \frac{d^{\rho}}{d}$$

$\frac{dc}{d} < \left| \frac{dc}{d} \right| \Rightarrow \frac{d^{\rho}}{d} \frac{dc}{d} - \frac{dc}{d} >$

$$\left| \frac{dc}{d} \right| < \left| \frac{dc}{d} \right| \Rightarrow \frac{d^{\rho}}{d} \frac{dc}{d} - \frac{dc}{d} >$$

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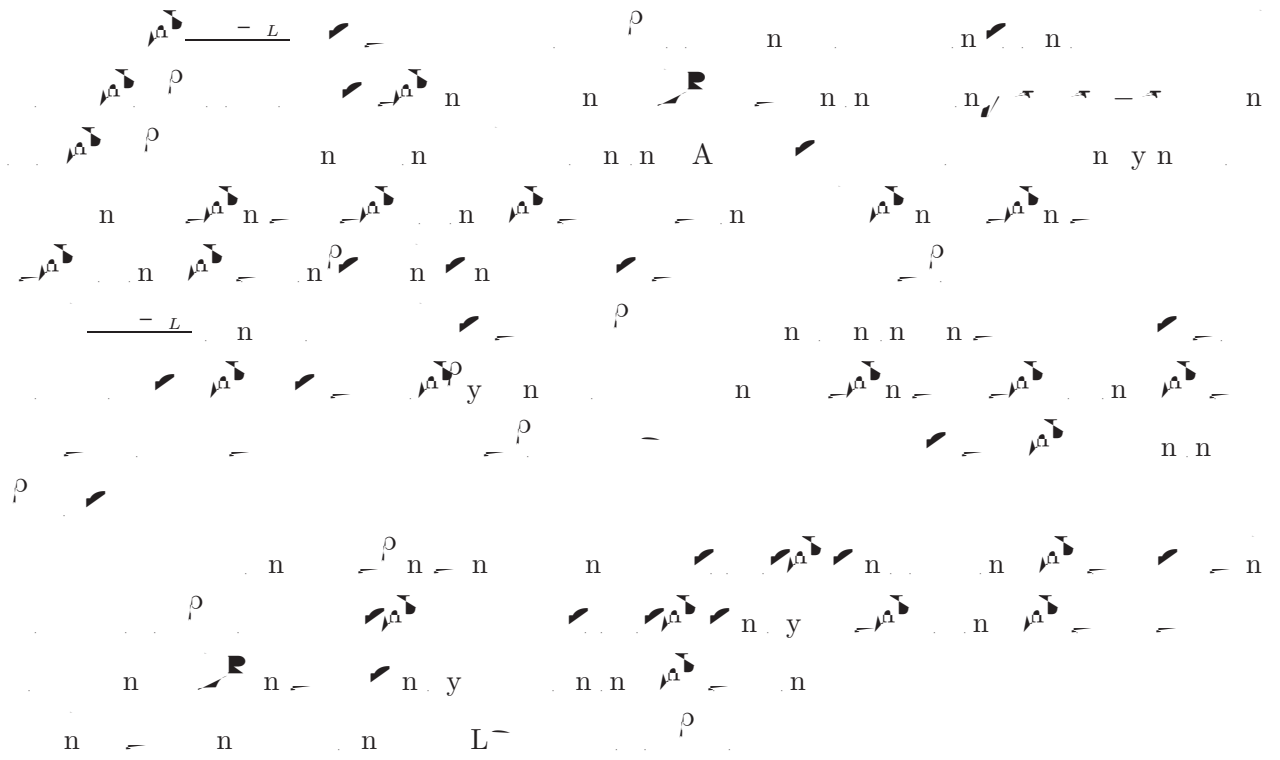
$$\frac{d^{\sigma} - \tau}{d} \quad \frac{d^{\sigma}}{d} \quad \frac{d^{\sigma}}{d}$$

$\frac{d^{\sigma}}{d} \rho^{1-} - [\rho^{\sigma} - \rho^{\sigma}] - \frac{d^{\rho}}{d} - \frac{d^{\rho}}{d}$

$$\frac{d^{\sigma}}{d} \rho^{1-} - [\rho^{\sigma} - \rho^{\sigma}] - \frac{d^{\rho}}{d} - \frac{d^{\rho}}{d}$$

$$\rho^{1-} - [\rho^{\sigma} - \rho^{\sigma}] - >$$

$$\frac{d^{\sigma}}{d} \frac{d^{\rho}}{d} (\rho^{\sigma} - \rho^{\sigma}) \geq \quad \frac{d^{\sigma}}{d} \frac{d^{\rho}}{d} (\rho^{\sigma} - \rho^{\sigma}) \geq$$



$$s_i n \left(\frac{d^{\sigma} - \tau}{d} \right) s_i n (d)$$

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International Standard Industrial Classification of All Economic Activities

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3.1.1 Data cleaning

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Tarapacá **Arica y Parinacota** **Tarapacá** **Los Rios** **Los Rios**
Los Lagos n n n n y n n n n
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¹³ This could present a problem if the majority of firms are multi-plant; however, as noted by Pavcnik (2002), using a previous version of this dataset, around 90% of the firms have a single plant. For the 2001–2007 period, this figure is around 89%.

¹⁴ See: <http://unstats.un.org/unsd/cr/registry/regcst.asp?cl=2> for more detail.

¹⁵ The covered industries are, in terms of ISIC (Rev.3) codes, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31,

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Variable	Mean	Std. Dev.	Min	Max
Capital Stock	1,946	15,532.6	0	953,000
% Domestic Capital	96	19.3	0	100
% Foreign Capital	4	19.3	0	100
Value Added	2,342	19,274.8	0	1,720,000
Sales of Production	3,815	29,328.1	0	1,770,000
Total Wages	375	2,148.9	0	275,000
Gross Production Value	5,449	46,237.2	2	3,480,000
Payments for Licenses and Foreign Assistance	8	151.3	0	11,864
Income due to Exports	1,090	8,654.9	0	401,000
Number of Skilled Workers	13	46.4	0	1,554
Skilled/Unskilled Workers Ratio	1	3.5	0	159
Skilled/Total Workers Ratio	0	0.3	0	1

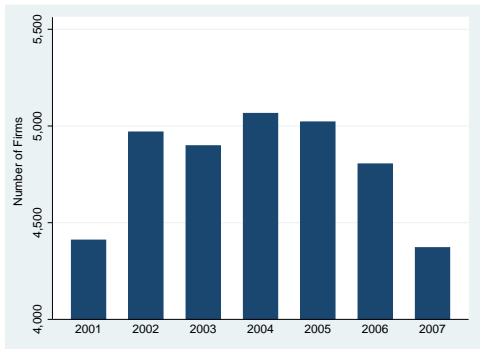
Note: All monetary values are in 2003 Million Pesos.

Owner	Freq.	Percent	Cum.
Domestic	31,733	94.62	94.62
Foreign	1,805	5.38	100
Total	33,538	100	

(a) Ownership

Licensing	Freq.	Percent	Cum.
Does Not Pay Licenses	31,897	95.11	95.11
Pays Licenses	1,641	4.89	100
Total	33,538	100	

(b) Licensing







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2001-2007

		Period t+1			Total
		No Licensing	Licensing	Exit	
Period t	No Licensing	75.2%	1.5%	9.4%	86.0%
	Licensing	1.4%	2.6%	0.4%	4.4%
	Enter	9.2%	0.4%	0.0%	9.6%
Total		85.8%	4.5%	9.7%	100.0%

2001-2004 (BEFORE)					
		Period t+1			
		Domestic	Foreign	Exit	Total
Period t	Domestic	72.4%	0.4%	8.8%	81.5%
	Foreign	0.5%	3.8%	0.4%	4.7%
	Enter	13.1%	0.7%	0.0%	13.8%
	Total	85.9%	4.9%	9.2%	100.0%
2005-2007 (AFTER)					
		Period t+1			
		Domestic	Foreign	Exit	Total
Period t	Domestic	80.5%	0.4%	9.9%	90.8%
	Foreign	0.5%	4.1%	0.6%	5.2%
	Enter	3.9%	0.2%	0.0%	4.1%
	Total	84.8%	4.7%	10.4%	100.0%

(a) Ownership

2001-2004 (BEFORE)					
		Period t+1			
		No Licensing	Licensing	Exit	Total
Period t	No Licensing	71.8%	1.5%	8.9%	82.1%
	Licensing	1.3%	2.4%	0.3%	4.1%
	Enter	13.3%	0.5%	0.0%	13.8%
	Total	86.4%	4.4%	9.2%	100.0%
2005-2007 (AFTER)					
		Period t+1			
		No Licensing	Licensing	Exit	Total
Period t	No Licensing	79.5%	1.5%	10.0%	91.1%
	Licensing	1.6%	2.8%	0.4%	4.8%
	Enter	3.9%	0.2%	0.0%	4.1%
	Total	85.1%	4.5%	10.4%	100.0%

(b) Licensing

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99

$\int_{-\infty}^{\infty} f(x) \delta(x-y) dx = f(y)$
 $\int_{-\infty}^{\infty} f(x) \delta(x) dx = f(0)$
 $\int_{-\infty}^{\infty} f(x) \delta(x-a) dx = f(a)$
 $\int_{-\infty}^{\infty} f(x) \delta(x-b) dx = f(b)$
 $\int_{-\infty}^{\infty} f(x) \delta(x-c) dx = f(c)$
 $\int_{-\infty}^{\infty} f(x) \delta(x-d) dx = f(d)$



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4.1.1 Total Factor Productivity (TFP) estimation

$$y_t = A_t \left(\sum_{i=1}^n \rho_i x_{it}^{\rho_i} \right)^{\frac{1}{\rho}} \quad (1)$$
$$y_t = A_t \left(\sum_{i=1}^n \rho_i x_{it}^{\rho_i} \right)^{\frac{1}{\rho}} \quad (2)$$
$$\ln y_t = \ln A_t + \frac{1}{\rho} \ln \left(\sum_{i=1}^n \rho_i x_{it}^{\rho_i} \right) \quad (3)$$
$$A_t = y_t \left(\sum_{i=1}^n \rho_i x_{it}^{\rho_i} \right)^{-\frac{1}{\rho}} \quad (4)$$
$$\ln A_t = \ln y_t - \frac{1}{\rho} \ln \left(\sum_{i=1}^n \rho_i x_{it}^{\rho_i} \right) \quad (5)$$
$$\ln A_t = \ln y_t - \frac{1}{\rho} \sum_{i=1}^n \rho_i \ln x_{it} \quad (6)$$
$$\ln A_t = \ln y_t - \frac{1}{\rho} \sum_{i=1}^n \rho_i \ln x_{it} \quad (7)$$
$$\ln A_t = \ln y_t - \frac{1}{\rho} \sum_{i=1}^n \rho_i \ln x_{it} \quad (8)$$

²⁶ Since there would be an excessive amount of results to p4109(l)3.9itun

$$y_{it} = \alpha + \beta_1 x_{it} + \beta_2 x_{it}^2 + \beta_3 x_{it}^3 + \beta_4 x_{it}^4 + \beta_5 x_{it}^5 + \beta_6 x_{it}^6 + \beta_7 x_{it}^7 + \beta_8 x_{it}^8 + \beta_9 x_{it}^9 + \beta_{10} x_{it}^{10} + \beta_{11} x_{it}^{11} + \beta_{12} x_{it}^{12} + \beta_{13} x_{it}^{13} + \beta_{14} x_{it}^{14} + \beta_{15} x_{it}^{15} + \beta_{16} x_{it}^{16} + \beta_{17} x_{it}^{17} + \beta_{18} x_{it}^{18} + \beta_{19} x_{it}^{19} + \beta_{20} x_{it}^{20} + \beta_{21} x_{it}^{21} + \beta_{22} x_{it}^{22} + \beta_{23} x_{it}^{23} + \beta_{24} x_{it}^{24} + \beta_{25} x_{it}^{25} + \beta_{26} x_{it}^{26} + \beta_{27} x_{it}^{27} + \beta_{28} x_{it}^{28} + \beta_{29} x_{it}^{29} + \beta_{30} x_{it}^{30} + \beta_{31} x_{it}^{31} + \beta_{32} x_{it}^{32} + \beta_{33} x_{it}^{33} + \beta_{34} x_{it}^{34} + \beta_{35} x_{it}^{35} + \beta_{36} x_{it}^{36} + \beta_{37} x_{it}^{37} + \beta_{38} x_{it}^{38} + \beta_{39} x_{it}^{39} + \beta_{40} x_{it}^{40} + \beta_{41} x_{it}^{41} + \beta_{42} x_{it}^{42} + \beta_{43} x_{it}^{43} + \beta_{44} x_{it}^{44} + \beta_{45} x_{it}^{45} + \beta_{46} x_{it}^{46} + \beta_{47} x_{it}^{47} + \beta_{48} x_{it}^{48} + \beta_{49} x_{it}^{49} + \beta_{50} x_{it}^{50} + \beta_{51} x_{it}^{51} + \beta_{52} x_{it}^{52} + \beta_{53} x_{it}^{53} + \beta_{54} x_{it}^{54} + \beta_{55} x_{it}^{55} + \beta_{56} x_{it}^{56} + \beta_{57} x_{it}^{57} + \beta_{58} x_{it}^{58} + \beta_{59} x_{it}^{59} + \beta_{60} x_{it}^{60} + \beta_{61} x_{it}^{61} + \beta_{62} x_{it}^{62} + \beta_{63} x_{it}^{63} + \beta_{64} x_{it}^{64} + \beta_{65} x_{it}^{65} + \beta_{66} x_{it}^{66} + \beta_{67} x_{it}^{67} + \beta_{68} x_{it}^{68} + \beta_{69} x_{it}^{69} + \beta_{70} x_{it}^{70} + \beta_{71} x_{it}^{71} + \beta_{72} x_{it}^{72} + \beta_{73} x_{it}^{73} + \beta_{74} x_{it}^{74} + \beta_{75} x_{it}^{75} + \beta_{76} x_{it}^{76} + \beta_{77} x_{it}^{77} + \beta_{78} x_{it}^{78} + \beta_{79} x_{it}^{79} + \beta_{80} x_{it}^{80} + \beta_{81} x_{it}^{81} + \beta_{82} x_{it}^{82} + \beta_{83} x_{it}^{83} + \beta_{84} x_{it}^{84} + \beta_{85} x_{it}^{85} + \beta_{86} x_{it}^{86} + \beta_{87} x_{it}^{87} + \beta_{88} x_{it}^{88} + \beta_{89} x_{it}^{89} + \beta_{90} x_{it}^{90} + \beta_{91} x_{it}^{91} + \beta_{92} x_{it}^{92} + \beta_{93} x_{it}^{93} + \beta_{94} x_{it}^{94} + \beta_{95} x_{it}^{95} + \beta_{96} x_{it}^{96} + \beta_{97} x_{it}^{97} + \beta_{98} x_{it}^{98} + \beta_{99} x_{it}^{99} + \beta_{100} x_{it}^{100} + \epsilon_{it}$$

4.2 Econometric issues

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$$y_{it} = \alpha + \beta_1 x_{it} + \beta_2 x_{it}^2 + \beta_3 x_{it}^3 + \beta_4 x_{it}^4 + \beta_5 x_{it}^5 + \beta_6 x_{it}^6 + \beta_7 x_{it}^7 + \beta_8 x_{it}^8 + \beta_9 x_{it}^9 + \beta_{10} x_{it}^{10} + \beta_{11} x_{it}^{11} + \beta_{12} x_{it}^{12} + \beta_{13} x_{it}^{13} + \beta_{14} x_{it}^{14} + \beta_{15} x_{it}^{15} + \beta_{16} x_{it}^{16} + \beta_{17} x_{it}^{17} + \beta_{18} x_{it}^{18} + \beta_{19} x_{it}^{19} + \beta_{20} x_{it}^{20} + \beta_{21} x_{it}^{21} + \beta_{22} x_{it}^{22} + \beta_{23} x_{it}^{23} + \beta_{24} x_{it}^{24} + \beta_{25} x_{it}^{25} + \beta_{26} x_{it}^{26} + \beta_{27} x_{it}^{27} + \beta_{28} x_{it}^{28} + \beta_{29} x_{it}^{29} + \beta_{30} x_{it}^{30} + \beta_{31} x_{it}^{31} + \beta_{32} x_{it}^{32} + \beta_{33} x_{it}^{33} + \beta_{34} x_{it}^{34} + \beta_{35} x_{it}^{35} + \beta_{36} x_{it}^{36} + \beta_{37} x_{it}^{37} + \beta_{38} x_{it}^{38} + \beta_{39} x_{it}^{39} + \beta_{40} x_{it}^{40} + \beta_{41} x_{it}^{41} + \beta_{42} x_{it}^{42} + \beta_{43} x_{it}^{43} + \beta_{44} x_{it}^{44} + \beta_{45} x_{it}^{45} + \beta_{46} x_{it}^{46} + \beta_{47} x_{it}^{47} + \beta_{48} x_{it}^{48} + \beta_{49} x_{it}^{49} + \beta_{50} x_{it}^{50} + \beta_{51} x_{it}^{51} + \beta_{52} x_{it}^{52} + \beta_{53} x_{it}^{53} + \beta_{54} x_{it}^{54} + \beta_{55} x_{it}^{55} + \beta_{56} x_{it}^{56} + \beta_{57} x_{it}^{57} + \beta_{58} x_{it}^{58} + \beta_{59} x_{it}^{59} + \beta_{60} x_{it}^{60} + \beta_{61} x_{it}^{61} + \beta_{62} x_{it}^{62} + \beta_{63} x_{it}^{63} + \beta_{64} x_{it}^{64} + \beta_{65} x_{it}^{65} + \beta_{66} x_{it}^{66} + \beta_{67} x_{it}^{67} + \beta_{68} x_{it}^{68} + \beta_{69} x_{it}^{69} + \beta_{70} x_{it}^{70} + \beta_{71} x_{it}^{71} + \beta_{72} x_{it}^{72} + \beta_{73} x_{it}^{73} + \beta_{74} x_{it}^{74} + \beta_{75} x_{it}^{75} + \beta_{76} x_{it}^{76} + \beta_{77} x_{it}^{77} + \beta_{78} x_{it}^{78} + \beta_{79} x_{it}^{79} + \beta_{80} x_{it}^{80} + \beta_{81} x_{it}^{81} + \beta_{82} x_{it}^{82} + \beta_{83} x_{it}^{83} + \beta_{84} x_{it}^{84} + \beta_{85} x_{it}^{85} + \beta_{86} x_{it}^{86} + \beta_{87} x_{it}^{87} + \beta_{88} x_{it}^{88} + \beta_{89} x_{it}^{89} + \beta_{90} x_{it}^{90} + \beta_{91} x_{it}^{91} + \beta_{92} x_{it}^{92} + \beta_{93} x_{it}^{93} + \beta_{94} x_{it}^{94} + \beta_{95} x_{it}^{95} + \beta_{96} x_{it}^{96} + \beta_{97} x_{it}^{97} + \beta_{98} x_{it}^{98} + \beta_{99} x_{it}^{99} + \beta_{100} x_{it}^{100} + \epsilon_{it}$$

²⁷ An important thing to note here is that due to econometric constraints, it is not possible to include so many dummies and at the same time calculate the standard errors using clustering at the industry-year level, thus one way to overcome this is to drop all the firms that changed ei

$$\begin{aligned} & \int_{\mathbb{R}^n} \psi(x) \delta(x-y) dx = \psi(y) \\ & \int_{\mathbb{R}^n} \psi(x) \delta(x) dx = \psi(0) \end{aligned}$$

Dependent variable: log (TFP)	No IPR	Fraser IPR	Dummy IPR
Horizontal Spillovers	-1.57 (1.37)	0.05 (0.57)	-0.07 (0.28)
Backward Spillovers	4.85*** (1.13)	2.66*** (0.72)	1.20*** (0.46)
Forward Spillovers	-0.70 (2.24)	-1.33 (0.81)	-0.19 (0.48)
IPR Fraser		-0.54** (0.23)	
IPR Fraser x Horizontal Spillovers		-0.02 (0.07)	
IPR Fraser x Backward Spillovers		-0.31*** (0.10)	
IPR Fraser x Forward Spillovers		0.23** (0.09)	
Dummy IPR			0.11*** (0.04)
Dummy IPR x Horizontal Spillovers			-0.09 (0.21)
Dummy IPR x Backward Spillovers			-0.87*** (0.29)
Dummy IPR x Forward Spillovers			0.71** (0.28)
Kleibergen-Paap LM Statistic (under-identification test)	0.00	0.00	0.00
Hansen J Statistic (over-identification test)	0.26	0.38	0.40
Observations	2,884	8,932	8,932
R-squared	0.01	0.00	0.00
Time, Industry and Region Dummies	YES	YES	YES

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

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Dependent variable: log (TFP)	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Horizontal Spillovers	3.71* (2.10)	1.20 (1.20)	1.02 (0.79)	-1.93*** (0.52)
Backward Spillovers	11.20*** (3.81)	6.46*** (2.08)	0.74 (1.36)	5.91*** (1.17)
Forward Spillovers	-10.85*** (2.55)	-4.68*** (1.75)	-1.96* (1.12)	-0.54 (1.15)
IPR Fraser	-1.20 (0.92)	-0.48 (0.42)	-0.19 (0.42)	-1.26* (0.66)
IPR Fraser x Horizontal Spillovers	-0.24 (0.23)	0.07 (0.12)	-0.13 (0.08)	0.21*** (0.05)
IPR Fraser x Backward Spillovers	-1.41** (0.56)	-0.79** (0.31)	-0.13 (0.17)	-0.63*** (0.14)
IPR Fraser x Forward Spillovers	1.15*** (0.22)	0.19 (0.16)	0.26** (0.12)	0.35*** (0.13)
Foreign Ownership	-0.04 (0.19)	0.07 (0.10)	0.12 (0.18)	0.04 (0.06)
Market presence	-0.43** (0.17)	-0.14** (0.07)	0.07 (0.05)	-0.03 (0.05)
Kleibergen-Paap LM Statistic (under-identification test)	0.00	0.00	0.00	0.00
Hansen J Statistic (over-identification test)	0.12	0.41	0.81	0.76
Observations	1,818	2,240	2,355	2,519
R-squared	0.03	0.02	0.01	-0.01
Time, Industry and Region Dummies	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent variable: log (TFP)	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Horizontal Spillovers	2.62* (1.37)	1.54* (0.82)	0.48 (0.50)	-0.95*** (0.36)
Backward Spillovers	4.52** (1.94)	2.79*** (0.94)	-0.02 (0.98)	3.10** (1.23)
Forward Spillovers	-5.35*** (1.90)	-3.73*** (1.20)	-0.81 (0.76)	0.98 (1.30)
Dummy IPR	0.19 (0.16)	0.20*** (0.08)	0.11 (0.08)	0.12 (0.09)
Dummy IPR x Horizontal Spillovers	-0.76 (0.63)	0.17 (0.33)	-0.42* (0.24)	0.62*** (0.15)
Dummy IPR x Backward Spillovers	-4.07*** (1.57)	-2.23** (0.89)	-0.37 (0.49)	-1.88*** (0.40)
Dummy IPR x Forward Spillovers	3.35***	0.59	0.83**	cs 08 -9.26367
0.00	0.00	0.00		
0.12	0.41	0.81	0.76	
R-squared	2,240	2,519	0.03	0.02
			0.01	-0.01

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Dependent variable: log (TFP)	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Horizontal Spillovers	-1.48 (1.06)	3.47*** (0.58)	0.67 (1.17)	-1.11 (0.97)
Backward Spillovers	6.14*** (1.59)	2.03* (1.19)	-0.54 (1.05)	2.52* (1.32)
Forward Spillovers	0.30 (1.56)	-7.48*** (1.52)	-1.09 (1.57)	0.82 (1.37)
IPR Fraser	-1.01* (0.53)	-0.06 (0.33)	-0.13 (0.27)	-0.94** (0.39)
IPR Fraser x Horizontal Spillovers	0.06 (0.10)	-0.19** (0.07)	-0.02 (0.13)	0.06 (0.12)
IPR Fraser x Backward Spillovers	-0.61*** (0.22)	-0.16 (0.17)	-0.02 (0.15)	-0.34* (0.17)
IPR Fraser x Forward Spillovers	0.17 (0.15)	0.32 (0.20)	0.19 (0.17)	0.13 (0.15)
Foreign Ownership	0.20*** (0.04)	0.09 (0.15)	-0.01 (0.13)	0.05 (0.09)
Market presence	-0.26 (0.17)	-0.13 (0.10)	-0.03 (0.04)	-0.01 (0.05)
Kleibergen-Paap LM Statistic (under-identification test)	0.00	0.00	0.00	0.00
Hansen J Statistic (over-identification test)	0.25	0.41	0.45	0.03
Observations	2,039	2,006	2,273	2,614
R-squared	0.01	0.00	0.00	0.01
Time, Industry and Region Dummies	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.6 Robustness tests

4.6.1 Issues with firms exiting the market

A

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Dependent variable: log (TFP)				
Horizontal Spillovers	-1.17 (0.73)	2.59*** (0.33)	0.64 (0.68)	-0.84 (0.53)
Backward Spillovers	3.27*** (0.96)	1.21* (0.69)	-0.69 (0.61)	1.10 (0.86)
Forward Spillovers				

4.6.2 Specification Issues

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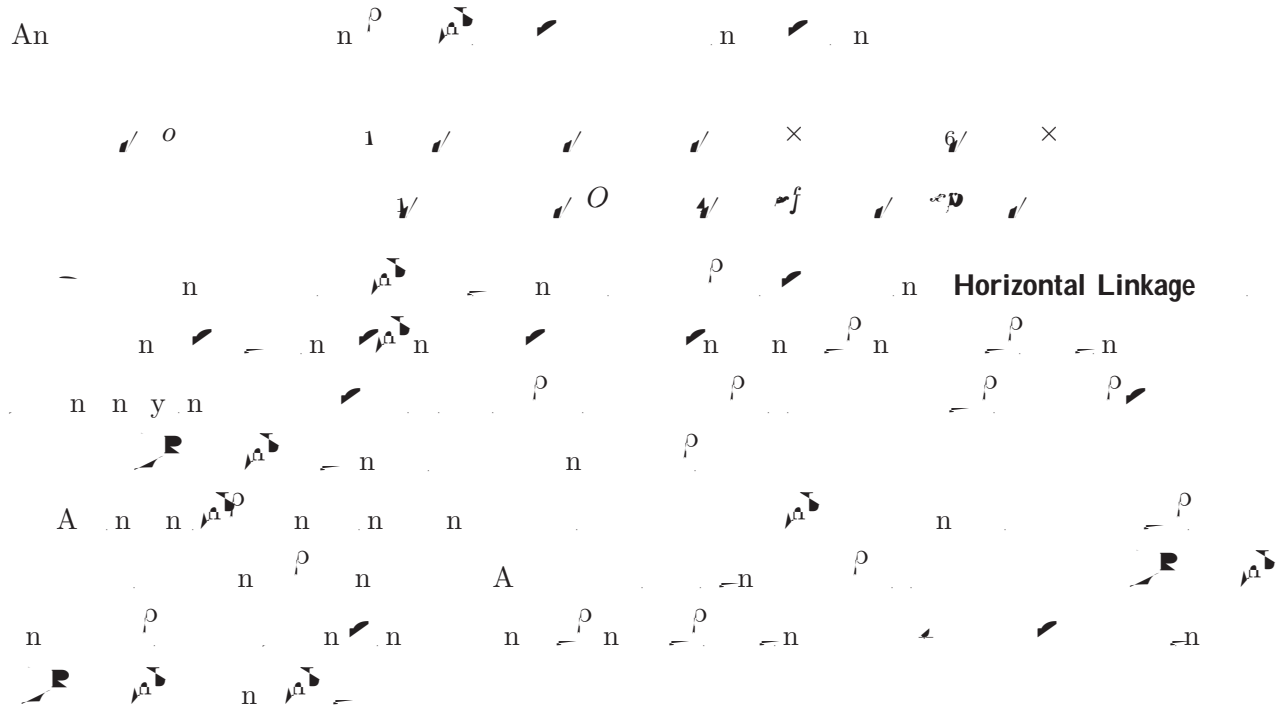
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4.6.2.1 No foreign presence

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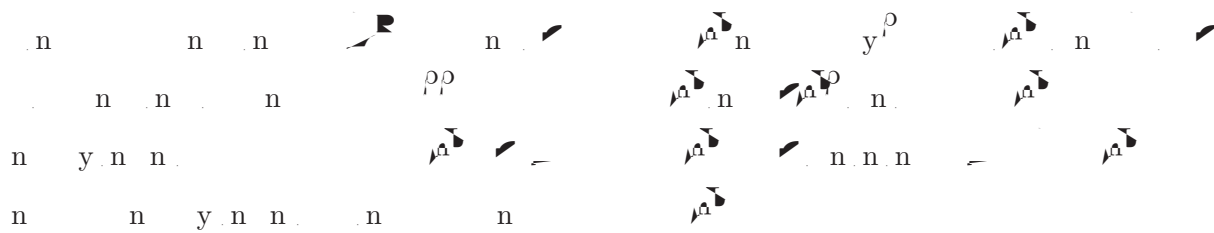
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4.6.2.4 Different use of IV

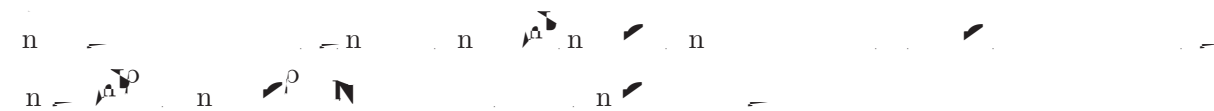


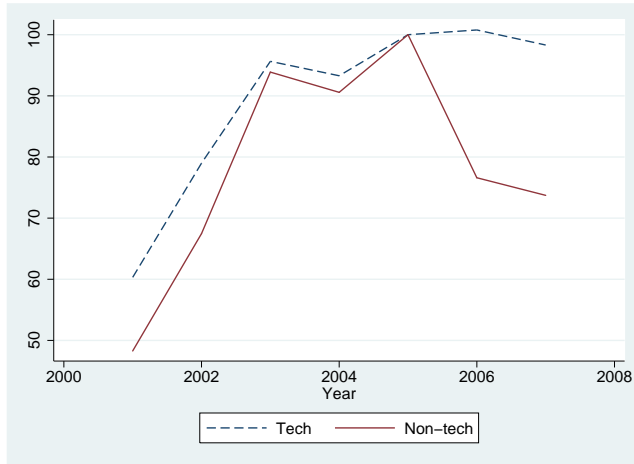
5 FDI vs. Licensing

5.1 Empirical approach



5.1.1 Generating test and comparison groups





5.3 Results

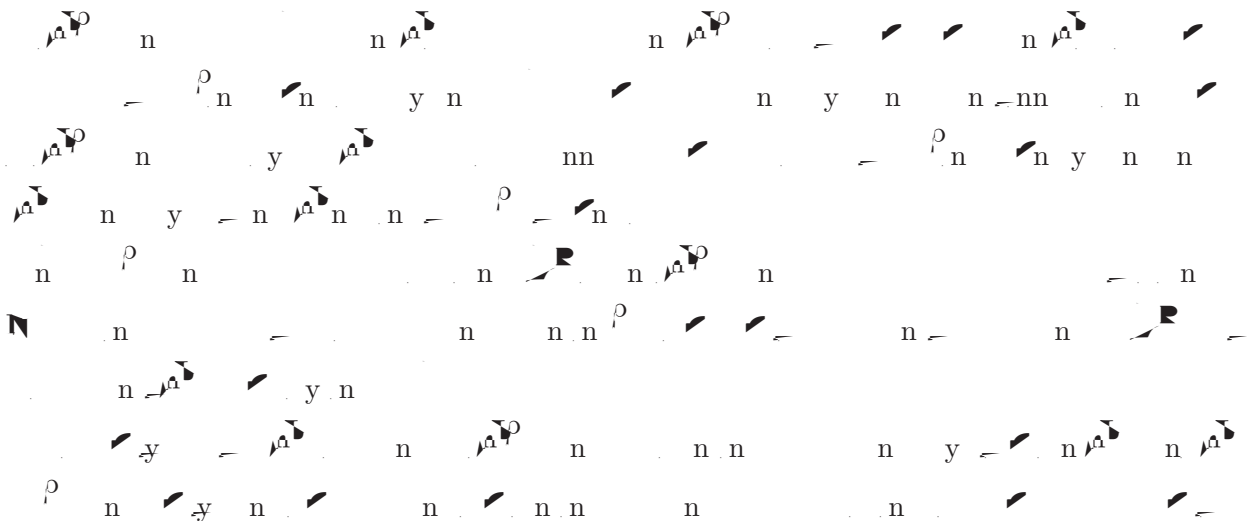
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VARIABLES	(1) fdikstock	(2) fdikstock	(3) license	(4) license
Fraser IPR x Tech		-0.03*** (0.01)		122.30** (62.16)
Dummy IPR x Tech	-0.09*** (0.02)		346.16** (163.63)	
Exchange Rate	-0.00 (0.00)	-0.00 (0.00)	17.09** (7.49)	17.54** (7.61)
Inflation	0.00 (0.01)	0.00 (0.01)	-41.82* (22.18)	-44.10* (23.51)
Size	0.06*** (0.02)	0.06*** (0.02)	-87.19* (49.49)	-84.53* (49.36)
Market	0.12** (0.06)	0.13** (0.06)	-29.32 (115.01)	-34.52 (116.35)
Dummy IPR	0.01 (0.03)		143.12 (97.60)	
Fraser IPR		0.00 (0.01)		49.50 (34.33)
Observations	714	714	714	714
R-squared	0.80	0.80	0.90	0.90
Time Trend	YES	YES	YES	YES
Industry Dummies	YES	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

6 Conclusions



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Journal of Development Economics

National Bureau of Economic Research Working Paper Series

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European economic review

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Econometrica, Journal of the Econometric Society

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Appendices

A Descriptive statistics

ISIC rev.3 at 2-digit level	Observations	Description
15	10,764	Manufacture of food products and beverages
17	1,656	Manufacture of textiles
18	1,773	Manufacture of wearing apparel; dressing and dyeing of fur
19	883	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20	2,320	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21	1,026	Manufacture of paper and paper products
22	1,716	Publishing, printing and reproduction of recorded media
24	2,033	Manufacture of chemicals and chemical products
25	2,144	Manufacture of rubber and plastics products
26	1,816	Manufacture of other non-metallic mineral products
28	2,473	Manufacture of fabricated metal products, except machinery and equipment
29	1,844	Manufacture of machinery and equipment n.e.c.
31	499	Manufacture of electrical machinery and apparatus n.e.c.
33	205	Manufacture of medical, precision and optical instruments, watches and clocks
34	482	Manufacture of motor vehicles, trailers and semi-trailers
35	296	Manufacture of other transport equipment
36	1,608	Manufacture of furniture; manufacturing n.e.c.

B Spillovers

	L n a an				L n a an			
	L n a an				L n a an			
	L	n	a	an	L	n	a	an
L n a	-	4	4	4	-	4	4	4
L n a n a	-	4	4	4	-	4	4	4
L n a	-	4	4	4	-	4	4	4
n a n a	-	4	4	4	-	4	4	4

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C.3.1 Index numbers

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Method	Indy556(0.91)-2																
	15	17	18	19	20	21	22	24	25	26	28	29	31	33	34	35	36
OLS																	
No of Obs.	10764	1656	1773	883	2320	1026	1716	2033	2144	1816	2473	1844	499	205	482	296	1608
Inskilled	0.49	0.43	0.40	0.45	0.28	0.63	0.45	0.51	0.36	0.51	0.37	0.48	0.38	0.40	0.64	0.47	0.54
lnunskilled	0.41	0.40	0.41	0.41	0.09	0.29	0.33	0.19	0.30	0.23	0.33	0.37	0.34	0.27	0.48	0.33	0.51
lnkstock	0.30	0.27	0.33	0.39	0.46	0.32	0.38	0.38	0.40	0.24	0.35	0.28	0.30	0.40	0.37	0.33	0.21
RTS	1.20	1.10	1.15	1.25	0.83	1.24	1.16	1.07	1.06	0.97	1.06	1.13	1.02	1.08	1.49	1.13	1.26
TORNQVIST INDEX																	
No. of Obs.	8,400	1,295	1,365	681	1,793	818	1,338	1,598	1,672	1,406	1,903	1,414	388	163	366	222	1,211
Inskilled	0.16	0.13	0.15	0.14	0.08	0.07	0.17	0.08	0.08	0.11	0.14	0.38	0.09	0.14	0.13	0.13	0.13
lnunskilled	0.22	0.21	0.19	0.26	0.40	0.11	0.12	0.13	0.34	0.17	0.18	0.14	0.16	0.15	0.22	1.18	0.20
lnkstock	0.62	0.66	0.66	0.60	0.52	0.82	0.71	0.80	0.58	0.72	0.68	0.47	0.75	0.71	0.65	-0.31	0.67
RTS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
OP Manually																	
No. of Obs.	4477	696	578	302	1088	500	755	1170	1064	748	1044	765	219	95	173	134	543
Inskilled	0.27	0.33	0.21	0.25	0.11	0.17	0.26	0.39	0.23	0.33	0.26	0.36	0.28	0.40	0.44	0.28	0.37
lnunskilled	0.18	0.28	0.24	0.30	0.05	0.05	0.20	0.17	0.19	0.17	0.23	0.30	0.28	0.26	0.36	0.24	0.38
lnkstock	0.12	0.15	0.24	0.07	0.13	0.03	0.28	0.13	0.22	0.09	0.17	0.06	0.06	0.32	0.29	0.11	0.08
RTS	0.56	0.76	0.69	0.62	0.29	0.25	0.74	0.68	0.63	0.59	0.65	0.72	0.62	0.99	1.09	0.62	0.84
Olley and Pakes																	
No of Obs.	5604	851	729	388	1354	618	956	1468	1342	961	1312	969	283	121	218	177	709
Inskilled	0.16	0.20	0.16	0.12	0.10	0.31	0.36	0.15	0.21	0.04	0.23	0.03	0.28	0.29	0.21	0.22	0.26
lnunskilled	0.27	0.33	0.21	0.25	0.10	0.18	0.26	0.38	0.23	0.33	0.26	0.36	0.28	0.40	0.45	0.29	0.38
lnkstock	0.18	0.28	0.24	0.30	0.06	0.06	0.19	0.16	0.19	0.17	0.23	0.29	0.29	0.27	0.35	0.22	0.38
RTS	0.61	0.81	0.61	0.67	0.26	0.55	0.81	0.69	0.63	0.55	0.72	0.68	0.84	0.97	1.01	0.73	1.02
Levinsohn and Petrin																	
No of Obs.	10733	1654	1771	875	2317	1025	1709	1953	2143	1777	2469	1834	499	205	482	296	1607
Inskilled	0.22	0.34	0.24	0.32	0.14	0.20	0.26	0.46	0.25	0.23	0.27	0.40	0.29	0.38	0.54	0.41	0.38
lnunskilled	0.17	0.31	0.23	0.29	0.07	0.11	0.20	0.17	0.21	0.09	0.24	0.29	0.25	0.18	0.36	0.28	0.37
lnkstock	0.14	0.16	0.17	0.14	0.14	0.07	0.19	0.17	0.23	0.09	0.18	0.11	0.26	0.38	0.26	0.16	0.14
RTS	0.53	0.81	0.64	0.75	0.35	0.38	0.65	0.80	0.69	0.41	0.69	0.80	0.80	0.94	1.16	0.84	0.88
Akerberg, Caves, and Fraser																	
No of Obs.	8400	1295	1365	681	1793	818	1338	1598	1672	1406	1903	1414	388	163	366	222	1212
Inskilled	0.35	0.48	0.42	0.28	0.40	0.56	0.42	0.54	0.36	0.42	0.36	0.54	0.19	0.47	0.47	0.62	0.46
lnunskilled	0.34	0.64	0.35	0.39	0.29	0.56	0.29	0.21	0.32	0.30	0.34	0.49	0.05	0.42	0.52	0.34	0.56
lnkstock	0.13	0.16	0.22	0.15	0.13	0.06	0.20	0.15	0.21	0.16	0.21	0.10	0.18	0.18	0.16	0.14	0.12
RTS	0.81	1.28	1.00	0.82	0.81	1.18	0.91	0.90	0.90	0.88	0.91	1.14	0.42	1.06	1.14	1.11	1.13

C.4 Robustness tests

	No IPR	Fraser IPR	Dummy IPR
Dependent variable: log (TFP)			
Horizontal Spillovers	0.02 (0.96)	-0.25 (0.46)	-0.21 (0.24)
Backward Spillovers	4.15** (1.80)	3.37*** (0.58)	1.41*** (0.44)
Forward Spillovers	-2.52** (1.20)	-1.22* (0.73)	-0.06 (0.39)
IPR Fraser		-0.58*** (0.22)	
IPR Fraser x Horizontal Spillovers		0.01 (0.06)	
IPR Fraser x Backward Spillovers		-0.40*** (0.05)	
IPR Fraser x Forward Spillovers		0.23** (0.09)	
Dummy IPR			0.11*** (0.04)
Dummy IPR x Horizontal Spillovers			-0.00 (0.17)
Dummy IPR x Backward Spillovers			-1.10*** (0.15)
Dummy IPR x Forward Spillovers			0.70** (0.28)
Kleibergen-Paap LM Statistic (under-identification test)	0.00	0.00	0.00
Hansen J Statistic (over-identification test)	0.21	0.65	0.65
Observations	2,884	8,932	8,932
R-squared	0.00	0.00	0.00

N - n p

Dependent variable: log (TFP)	No IPR	Fraser IPR	Dummy IPR
Backward Spillovers	4.26*** (1.30)	2.66*** (0.55)	1.13*** (0.41)
Forward Spillovers	-2.84*** (0.79)	-1.33*** (0.48)	-0.30 (0.29)
IPR Fraser		-0.53** (0.22)	
IPR Fraser x Backward Spillovers		-0.31*** (0.07)	
IPR Fraser x Forward Spillovers		0.21*** (0.07)	
Dummy IPR			0.10*** (0.03)
Dummy IPR x Backward Spillovers			-0.90*** (0.21)
Dummy IPR x Forward Spillovers			0.61*** (0.20)
Kleibergen-Paap LM Statistic (under-identification test)	0.00	0.00	0.00
Hansen J Statistic (over-identification test)	0.63	0.62	0.63
Observations	2,884	8,932	8,932
R-squared	0.01	0.00	0.00
Time, Industry and Region Dummies	YES	YES	YES

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

N - n p
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Dependent variable: log (TFP)	No IPR	Fraser IPR	Dummy IPR
Backward Spillovers	2.43 (1.90)	2.12*** (0.67)	0.93** (0.42)
Forward Spillovers	-2.26* (1.16)	-1.56*** (0.50)	-0.51* (0.26)
IPR Fraser		-0.56*** (0.21)	
IPR Fraser x Backward Spillovers		-0.25*** (0.09)	
IPR Fraser x Forward Spillovers		0.22*** (0.07)	
Dummy IPR			0.13*** (0.03)
Dummy IPR x Backward Spillovers			-0.71*** (0.25)
Dummy IPR x Forward Spillovers			0.63*** (0.20)
Kleibergen-Paap LM Statistic (under-identification test)	0.00	0.00	0.00
Hansen J Statistic (over-identification test)	0.12	0.63	0.62
Observations	2,409	7,227	7,227
R-squared	0.00	0.01	0.01
Time, Industry and Region Dummies	YES	YES	YES

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

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Dependent variable: log (TFP)	No IPR	Fraser IPR	Dummy IPR
Backward Spillovers	4.26*** (1.23)	3.13*** (0.44)	1.13*** (0.41)
Forward Spillovers	-2.57*** (0.73)	-1.56*** (0.47)	-0.30 (0.29)
IPR Fraser			

D FDI Vs. Licensing

Table D.1: Descriptive Statistics (Low-Tech vs. High-Tech Firms)

Variable	Low-Tech Firms (31,300 firms)				High-Tech Firms (2,308 firms)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Capital Stock	1509.42	9322.24	0	680,000	8057.26	48590.63	0	950,000
% Domestic Capital	96.73	16.63	0	100	79.89	38.39	0	100
% Foreign Capital	3.26	16.59	0	100	20.11	38.39	0	100
Value Added	1758.89	8594.42	0	470,000	10496.43	66820.67	0.51	1,720,000
Sale of Production	2934.43	11245.13	0	367,000	16126	105000.00	0	1,770,000
Total Wages	331.84	1793.99	0	275,000	978.91	4879.48	1.87	200,000
Gross Production Value	4078.29	15670.79	2.28	504,000	24622.16	168000.00	6.17	340,000
Licenses and Foreign Assistance	4.12	72.84	0	5,578	63	515.47	0	1,000
Income Due to Exports	945.39	6913.39	0	311,000	3118.39	21210.31	0	400,000
Number of Skilled Workers	12.36	43.71	0	1,554	23.08	74.04	0	1,000
Skilled/Unskilled Workers Ratio	0.64	3.39	0	159	0.98	5.03	0	100
Skilled/Total Workers Ratio	0.24	0.3	0	1	0.24	0.29	0	1