Intellectual Property Rights and South-North R&D Linkages

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Research questions

1. To what extent is **IPR protection** relevant for fostering **international R&D linkages for firms in/from emerging economies?**

2. How persistent **differences in IPR regimes** impact international innovation activities? Do stronger IPR protection home and abroad foster **international R&D for the South?**

Methodology

- *Firm level analysis:* INGINEUS survey results from China and India ICT sector

- *Cross country analysis*

the context:
patent applications in and from NIC

The TRIPS agreement as condition for WTO membership:

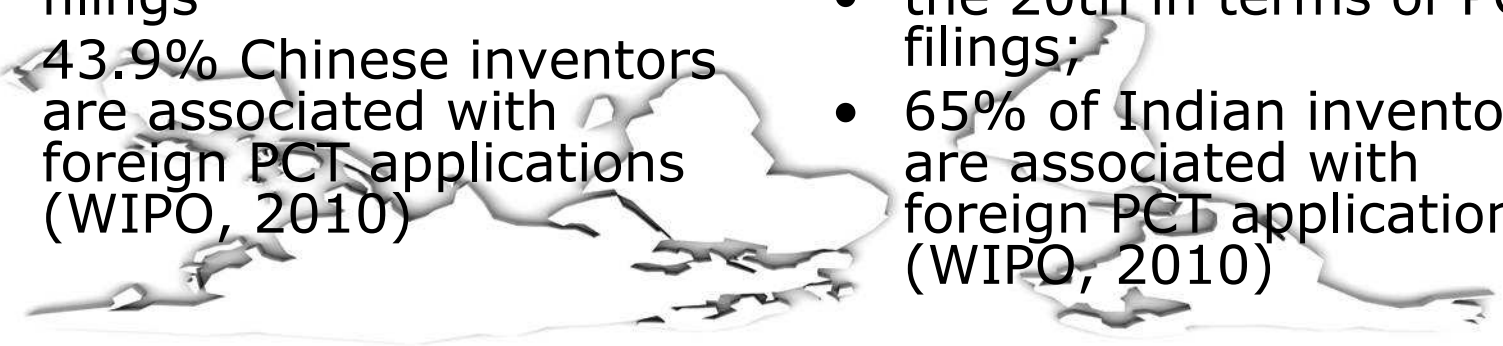
- **Patent Law of PRC**, 1985 was amended in 1993 and 2001.
- In **India, the Patent Act**, 1970 was amended in 1999, 2002 and 2005.

China

- the 3rd largest patent office,
- the 4th world largest country in terms of PCT filings
- 43.9% Chinese inventors are associated with foreign PCT applications (WIPO, 2010)

India

- the 8th largest patent office, since 2000 with a sustained growth up to 43%,
- the 20th in terms of PCT filings;
- 65% of Indian inventors are associated with foreign PCT applications (WIPO, 2010)



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the context:
the ICT sector in China and India

INDIA: the IT sector 88.1 USD revenues in 2011 (86.4% for the software and service sector)

CHINA: 14.6% of the global electronics hardware production, ICT-related patent applications are largely associated with ICT hardware production.

Survey results: INGINEUS data

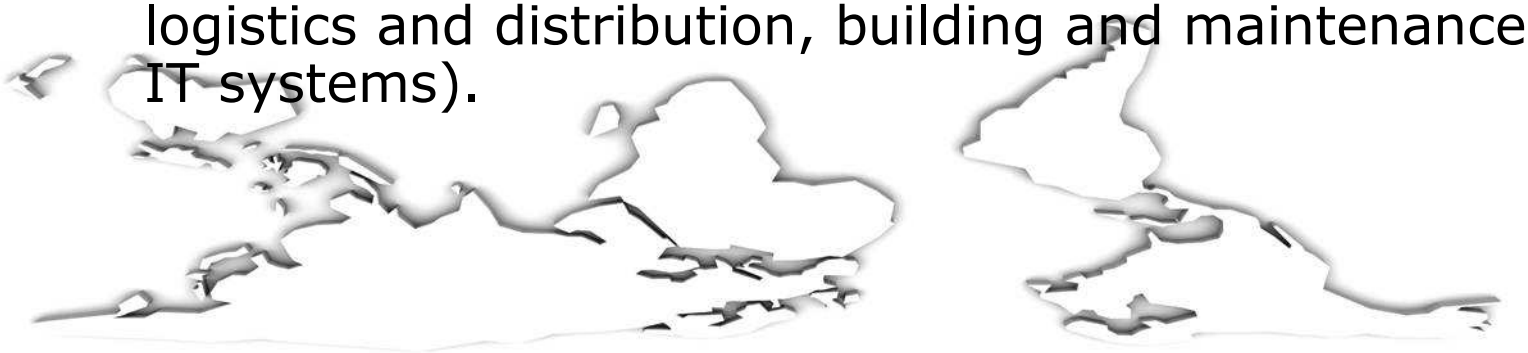
Sample:

China (243) and India (324), both ICT sector, both NICs.

R&D linkages (*Dependent Variables*):

GIN: firms established collaborations with foreign actors for the development of their most important innovation (clients, suppliers, competitors, consultancy companies, governmental institutions, Universities, research institutions, open source communities)

OUT: firms perform some specific innovation activities through *offshoring or outsourcing* abroad (product and process development, operations, procurement, logistics and distribution, building and maintenance of IT systems).



Survey results: empirical analysis

Focus on factors for the internationalization of firms' innovative activities, firms' experience with regard to:

(i) human resource (**HR** =1): positive experience with relevant labour force training and skills

(ii) national system for intellectual property protection (**IPR** = 1): positive experience with regulations, practices and jurisprudence around IPRs.

$$LINK_i = \beta_0 + \beta_1 HR_i + \beta_2 IPR_i + \boldsymbol{\beta_3 X_i} + \delta_c + \delta_s + \upsilon_i$$

Table 2: IPRs as determinants of global R&D linkages for Chinese and Indian ICT sector

Dep. Variable	*GIN*	*OUT*	*GIN*	*OUT*
	[1]	*[2]*	*[3]*	*[4]*
IPR	0.204	0.131	0.197***	0.105
	(0.058)***	(0.057)**	(0.070)	(0.067)
IPR_China	-0.059	-0.113	-0.062	-0.130
	(0.084)	(0.070)	(0.084)	(0.071)*
China	-0.150	-0.240	-0.087	-0.211
	(0.065)**	(0.055)***	(0.068)	(0.059)***
HR			0.092	0.146
			(0.051)*	(0.067)*
Foreign			0.327	0.170
			(0.076)***	(0.072)**
IPR_foreign			-0.183	-0.075
			(0.095)*	(0.091)
Hardware	0.001	0.106	-0.093	0.014
	(0.041)	(0.036)***	(0.061)	(0.047)
Constant	0.425	0.289	0.306	0.267
	(0.052)	(0.050)	(0.051)	(0.049)
Obs	567	567	544	544
R-sq.	0.0706	0.1460	0.1193	0.1460

Robust standard errors in parenthesis; (*) p-value<0.1; (**)p-value<0.05; (***)p-value<0.01

Table 3: IPRs as determinants of global R&D linkages for ICT sub-sectors

Dep. variable	*GIN*	*OUT*	*GIN*	*OUT*
	[1]	[2]	[3]	[4]
IPR	0.171 (0.060)***	-0.008 (0.043)		
fIPR			0.198 (0.060)***	-0.065 (0.053)
IPR_hardware	-0.015 (0.083)	0.157 (0.074)**		
fIPR_hardware			-0.070 (0.083)	0.153 (0.049)**
hardware	-0.020 (0.064)	0.003 (0.057)	0.010 (0.059)	0.017 (0.057)
China	-0.172 (0.042)***	-0.293 (0.035)***	-0.225 (0.042)***	-0.297 (0.036)***
foreign	0.205 (0.045)***	0.102 (0.042)**	0.217 (0.045)***	0.108 (0.042)***
constant	0.398 (0.053)	0.347 (0.049)	0.415 (0.048)	0.388 (0.035)
Obs	544	544	544	544
R-sq.	0.1031	0.1525	0.1043	0.1471

Robust standard errors in parenthesis; (*) p-value<0.1; (**)p-value<0.05; (***)p-value<0.01

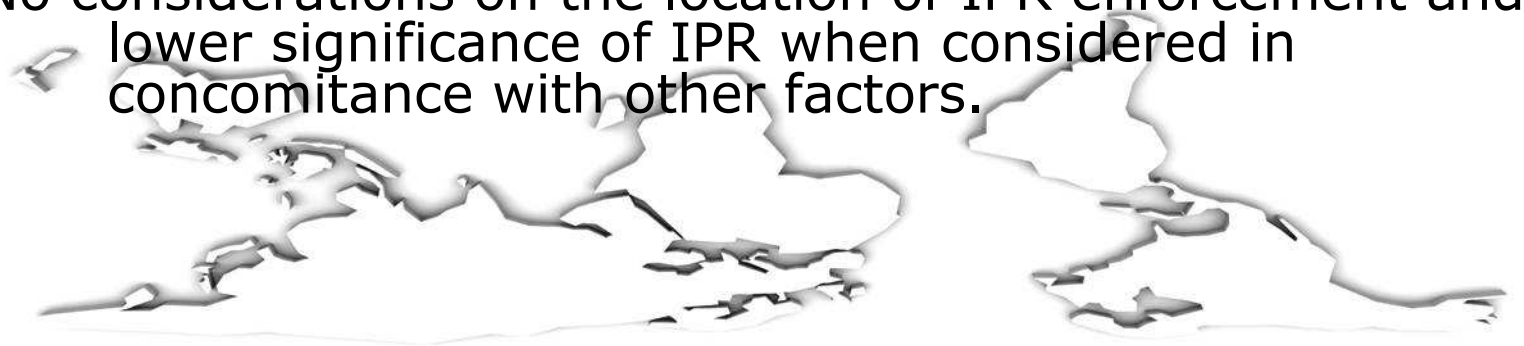
From firm-level to global level

Firm level-analysis:

1) IPRs are amongst the determinants of the participation of firms in the South to GINs but not in the internationalization of their R&D value chain.
2) IPRs are more relevant for domestic (hence Southern, i.e. Chinese and Indian) than foreign firms, even if foreign firms are in general more involved in R&D linkages.
3) securing intellectual assets is a determinant of international R&D collaborations for the ICT industry, but it proves more relevant for the hardware segment when engaging in international R&D linkages through outsourcing and offshoring activities

Limits:

No considerations on the location of IPR enforcement and lower significance of IPR when considered in concomitance with other factors.



cross country analysis

- **Level of analysis:** empirical gravity model.
- **Measure of *Foreign Patenting*** (of country *i* in country *j*):

$$PAT_{ijt}$$

(log) average number of patents filed in country *j* by residents of country *i* (in the time period *t).*

- **Countries involved:** 14 NICs (*i*) and 31 OECD countries (*j*)
- **Time variation:** Three 5-year intervals (1995/1999-2000/2004-2005/2008).

cross country analysis

- **Regression equation:**

$$PAT_{ijt}=G_t+D_i+D_j+\boldsymbol{X}_{it}+\boldsymbol{Y}_{jt}+\boldsymbol{D}_{ij}+\boldsymbol{D}_{ijt}+u_{ijt}$$

- Fixed *time* and *country*-specific fixed effects
- Country-specific controls: IPR protection index (0-4), from Park(2008), POP, GDPpc; educational level (Barro-Lee, 2010); share of ICT exported goods.
- Time-invariant country-pair variables: distance, common border, common language
- Time-variant variables: distance in IPR protection
- Obs.: $I*J*T=1293$ $(I\neq J)$

Table 5: Determinants of strengthening South-North formation of GINs.

Dependent variable: log of number of patents filed in country j by residents in country i (all specifications include monadic country dummies and time dummies).

	(1)	(2)	(3)	(4)	(5)	(6)
DIST_ij	-0.59	-0.59	-0.58	-0.49	-0.59	-0.59
	(0.08)***	(0.08)***	(0.08)***	(0.09)***	(0.08)***	(0.08)***
COM_LAN_ij	1.11	1.12	1.13	1.25	1.13	1.12
	(0.15)***	(0.15)***	(0.15)***	(0.17)***	(0.15)***	(0.15)***
COM_BOR_ij	0.00	0.01	0.03	0.19	0.03	-0.00
	(0.31)	(0.31)	(0.31)	(0.32)	(0.31)	(0.31)
POP_it	6.99	6.44	5.14	4.88	5.14	6.37
	(1.73)***	(1.84)***	(1.85)***	(2.06)**	(1.93)***	(1.79)***
POP_jt	8.49	7.74	6.69	5.09	7.47	8.59
	(2.25)***	(2.25)***	(2.25)***	(2.64)*	(2.25)***	(2.25)***
GDP_pc_it	1.04	1.07	1.02	0.74	0.90	1.05
	(0.23)***	(0.22)***	(0.23)***	(0.29)**	(0.24)***	(0.22)***
GDP_pc_jt	-1.08	-0.49	-0.49	-0.69	-0.47	-1.00
	(0.40)***	(0.43)	(0.43)	(0.50)	(0.43)	(0.41)**
IPR_it		0.05	-0.01	-0.23	0.05	
		(0.11)	(0.11)	(0.18)	(0.11)	
IPR_jt		-0.77	-0.72	-0.65	-0.78	
		(0.21)***	(0.21)***	(0.25)***	(0.21)***	
ICT_IPR_it			1.54	1.83		
			(0.49)***	(0.59)***		
EDU_it					0.12	
					(0.06)**	
EDU_jt					-0.02	
					(0.02)	
dist_IPR_ijt						-0.04
						(0.03)
Obs.	649	649	632	476	649	649
R^2	0.79	0.80	0.81	0.78	0.82	0.80

Standard errors in parentheses. (***) p-value < 0.01, (**) p-value <0.05, (*) p-value <0.1

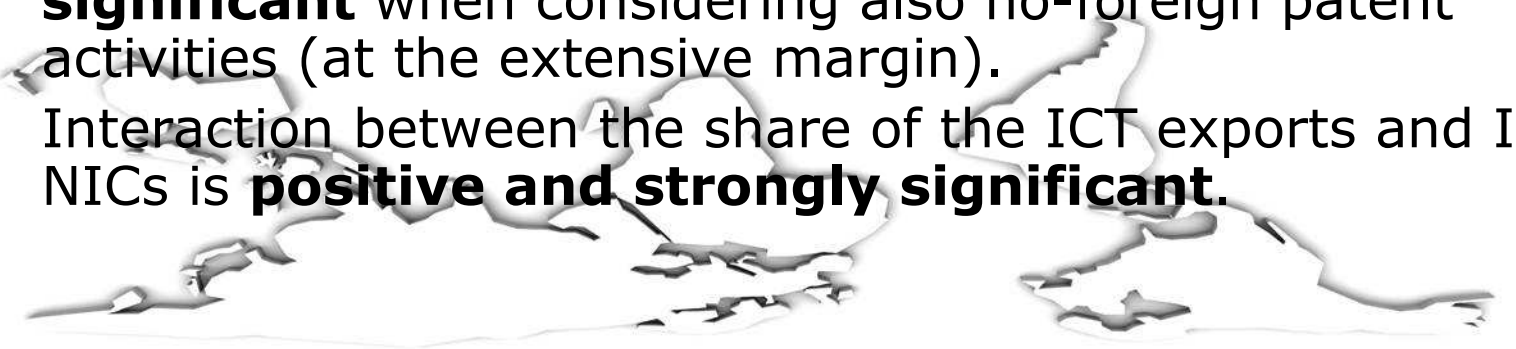
Table 6: Determinants of South-North formation of GINs.

Dependent variable: number of patents filed in country *j* by residents in country *i* (all specifications include monadic country dummies and time dummies).PAT

	(1)	(2)	(3)	(4)	(5)
Method	Poisson	Poisson	Poisson	Poisson	Negative Binomial
DIST_ij	-0.27 (0.02)***	-0.27 (0.02)***	-0.28 (0.02)***	-0.27 (0.02)***	-0.63 (0.07)***
COM_LAN_ij	0.53 (0.04)***	0.53 (0.04)***	0.54 (0.04)***	0.55 (0.04)***	1.06 (0.13)***
COM_BOR_ij	0.19 (0.10)*	0.16 (0.10)	0.17 (0.10)*	0.17 (0.10)*	-0.05 (0.28)
POP_it	2.98 (0.56)***	1.29 (0.58)**	3.52 (0.56)***	3.50 (0.57)***	7.41 (1.74)***
POP_jt	1.86 (1.07)*	6.18 (1.33)***	2.92 (1.07)***	-0.02 (0.98)	5.65** (2.30)
GDP_pc_it	1.33 (0.08)***	1.10 (0.08)***	1.08 (0.08)***	1.30 (0.08)***	1.27 (0.22)***
GDP_pc_jt	-0.99 (0.16)***	-1.56 (0.20)***	-0.97 (0.16)***	-0.65 (0.15)***	-1.08 (0.39)***
IPR_it	0.61 (0.02)***	0.59 (0.03)***	0.43 (0.03)***		
IPR_jt	-0.41 (0.13)***	-0.37 (0.13)***	-0.49 (0.13)***		
EDU_it		0.20 (0.02)***			
EDU_jt		0.02 (0.00)***			
ICT_IPR_it			3.29 (0.15)***		
dist_IPR_ijt				-0.12 (0.01)***	-0.07 (0.03)***
Obs.	1293	1293	1293	1293	1293
Pseudo-R^2	0.95	0.95	0.95	0.95	0.43

GLOBAL data: main findings

- Language as important determinant
- Common borders not and geographical distance lower than expected.
- Country SIZE: positive impact (i and j)
- Country DEVELOPMENT: origin country positive effect; destination country negative.
- **HR** in the origin country results positive and significant.
- **IPR index of the destination country** negative and strongly significant: defensive patenting and/or market power effect, Allred and Park (2007).
- **IPR index of the origin country positive and strongly significant** when considering also no-foreign patent activities (at the extensive margin).
- Interaction between the share of the ICT exports and IPR in NICs is **positive and strongly significant**.



conclusion

- The role of IPR in the formation of global innovation linkages varies:

  Survey data - IPRs do not necessarily foster outsourcing and offshoring activities of Southern firms.

  IPRs are more important for domestic than foreign firms operating in the South.

  Country level – stronger IPR could have a negative impact in foreign patenting by NICs (i.e. defensive patenting, market power effect).

  Stronger IPRs work at the extensive margin.

- To study IPRs it is important to look at sectors and sub-sectors:

  the ICT industry, particularly the hardware segment, relies on IPRs when engaging in the international outsourcing and offshoring of innovation or in patenting activities abroad.

Thanks for your attention

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