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Determinants of Quadic Patenting: Market Access, Imitative Threat, Competition and Strength of Intellectual Property Rights

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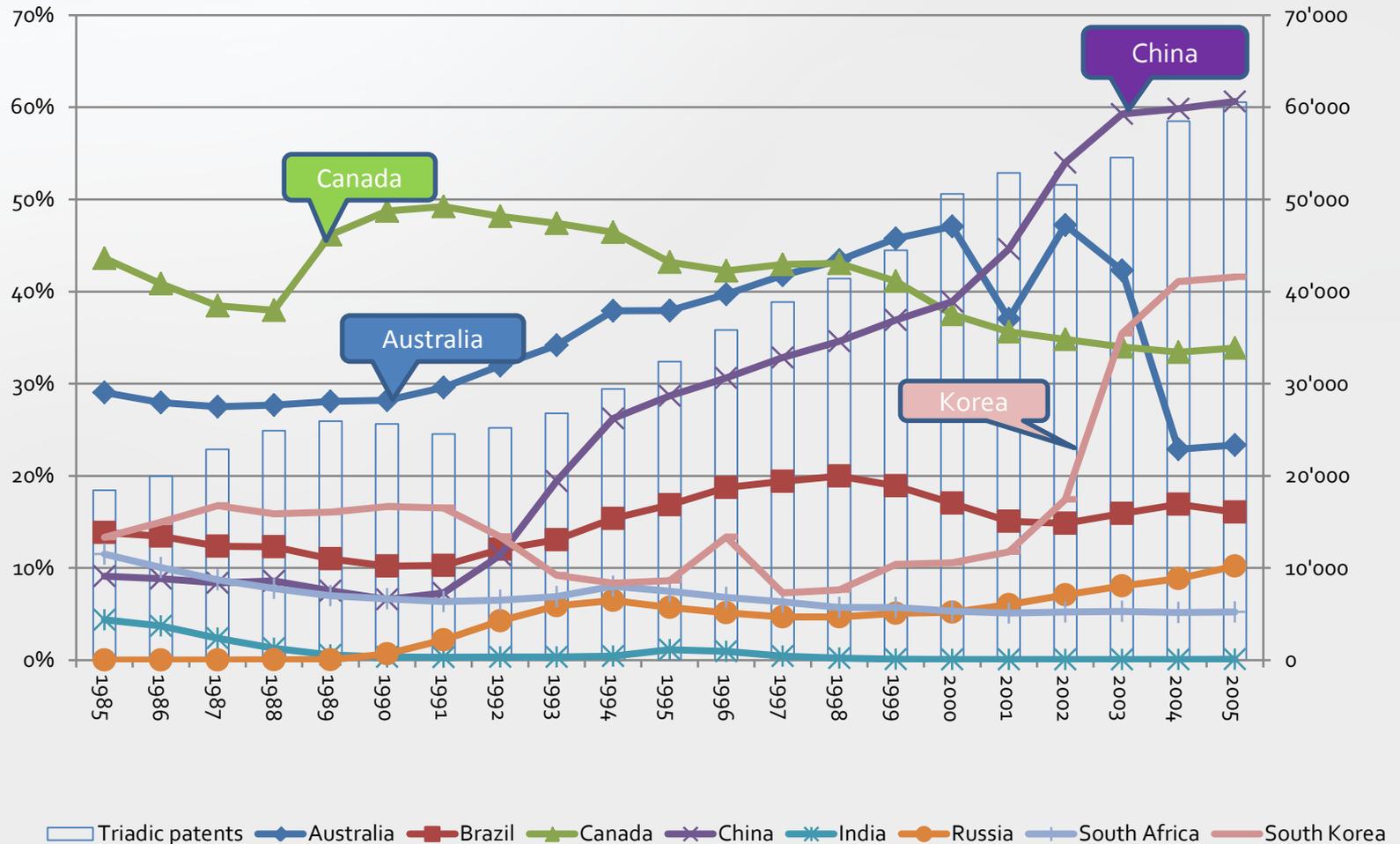
Outline

- Introduction and background
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- Conclusion and discussion

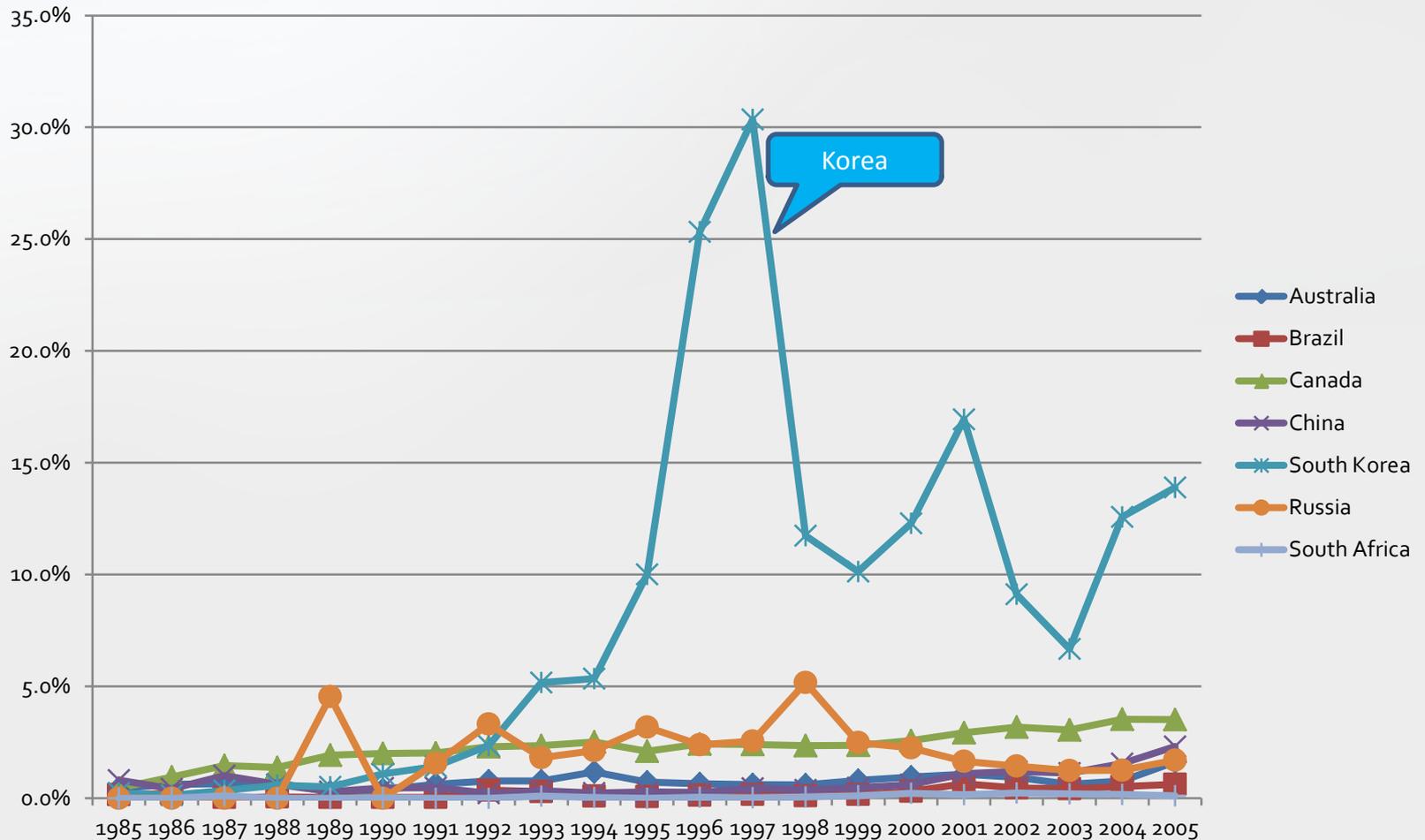
Introduction and Background

- Growing internationalization of innovation activities
- Internationalization of patenting activities (Bosworth, 1984; Eaton and Kortum, 1996; Grupp and Schmoch 1999)
- Increasing focus on Intellectual Property Rights (IPR) protection in emerging economies - China (Yang and Kuo, 2008; Hu 2010; Ma et al., 2011)
- Use of triadic patent family as indicator for innovativeness
- Use of national patents
 - differences in quality – heterogeneous customs and enforcement
- This paper
 1. Quadric patents
 2. Patent-based absorptive capacity measure
 3. Domestic competition
 4. Separate analysis on the within-country (China) and cross-country patenting activities (20 year period, 38 countries and regions)

Trends in Triadic Patents and the Proportion of Quadric Patents to Triadic Patents: 1985-2005



Proportion of Inventors Residing in the Relevant Country in Total Inventors in Quadic Patents



Hypothesis 1: market access

- Size of host-country market, Trade, Multinational Corporations (MNC) operations (Bosworth, 1984; Eaton and Kortum, 1996; Yang and Kuo, 2008; Hu 2010; Ma et al., 2011)
- Large domestic market represents large potentials for exploiting technological know how
- Imports and foreign investment(foreign penetration) represent extent of realized potentials

Hypothesis 1 (market access): The size of the market and the degree of foreign penetration in the local market have a positive influence on quadric patent applications.

Hypotheses 2 & 3: imitative threat & competitive pressure

- Greater technological capability of local firms raises the imitative threat they pose
- Greater competition triggers the need for
 1. introducing state of the art technologies and protecting them
 2. patent portfolios for preempting defensive patenting by competitors
- Little research on the role of domestic market competition

Hypothesis 2 (imitative threat): Imitative threat in the local market has a positive influence on quadic patent applications.

Hypothesis 3 (competitive pressure): Product market competition has a positive impact on quadic patents applications.

Hypotheses 4: IPR strength

- Patent decision depends on the extent of protection guaranteed from infringement
- Weak enforcement would reduce incentive for patenting (Maskus, 2000)
- Beyond a level, IP protection may not matter much (Ginarte and Park 1997, Allred and Park 2007)
- **Hypothesis 4 (IPR strength):** Strength of IPR has an inverted-U shaped effect on quadic patent applications.

Data sources

- Two sets of analyses
 1. China regression: 18 Chinese manufacturing industries, 1985-2004
 2. International regression: 38 countries and regions, 1985-2004 (non-triadic countries and regions)
- Dependent variable: number of quadric patent applications
 - Triadic plus the focal country (US, Japan, EPO plus the focal country)
 - Removes bias of national patents resulting from heterogeneous national customs and laws
 - China regression: Fractional counts in 4-digit International Patent Classification classes mapped to 2-digit industries
- Source: EPO's PATSTAT Database

Data sources

- Data to measure market size
 - China statistical year book (industry level data)
 - Annual survey of industrial enterprises (firm level data)
 - World Bank's World Trade, Production & Protection – imports
 - World Development Indicators – value added data

Key explanatory variables

- Market access:
 1. Total sales
 2. Imports
 3. sales of foreign firms (prior studies use FDI)
- Imitative threat
 - Triadic patents with inventors from China/focal countries and regions
- Product market competition – Herfindahl index
- Strength of IPR protection – Ginarte and Park index (1997)

Control variables

- WTO dummy
 - Members obliged to provide minimum protection under TRIPS
- Share of inventors
 - inventors from China/focal countries and regions in total inventors in quadic patents
- Triadic patents (China regression) – global trend in patenting activities in the two-digit manufacturing industries
- Year dummies

Descriptive statistics

China regression		Mean	Standard deviation	1	2	3	4	5	6	7	8
1	Quadic patents	654.0	1471.0	1							
2	Total sales revenue	6.9	1.1	.35	1						
3	Imports	14.7	1.7	.57	.65	1					
4	Sales revenue of foreign-owned firms	5.6	1.5	.35	.65	.83	1				
5	Triadic patents originating in China	1.4	1.5	.85	.41	.64	.52	1			
6	Herfindahl index	-6.1	1.2	-.20	-.08	-.19	-.46	-.26	1		
7	Share of inventors who reside in China	-6.3	1.3	.41	.25	.22	.27	.47	-.13	1	
8	Triadic patents	6.0	1.9	.78	.38	.68	.56	.94	-.24	.25	1
Cross-country regression		Mean	Standard deviation	1	2	3	4	5	6	7	8
1	Quadic patents	1999.7	4881.3	1							
2	Manufacturing value added	22.9	1.8	.56	1						
3	Manufacturing imports	16.1	1.6	.57	.88	1					
4	Triadic patents originating in the country	2.4	2.0	.70	.78	.83	1				
5	Strength of patent regime	2.7	1.1	.42	.35	.54	.60	1			
6	(Strength of patent regime) ²	8.3	5.4	.47	.39	.56	.64	.98	1		
7	WTO membership	0.8	0.4	.08	.18	.19	.20	.29	.28	1	
8	Share of inventors who reside in the country	-10.5	4.6	.57	.61	.61	.76	.49	.53	.13	1

Determinants of Quadric Patenting: China Regression

Independent variables	Dependent variable: Quadric patents					
	1987–2004	1987–2004	1993–2004	1999–2004	1999–2004	1999–2004
	Fixed-effects	Fixed-effects	Fixed-effects	Fixed-effects	Fixed-effects	Fixed-effects
	(1)	(2a)	(3)	(4)	(5)	(6)
KEY EXPLANATORY VARIABLES						
H ₁ Total sales revenue	.28***	-	-	.44***	-	-
H ₁ Imports	-	.064**	-	-	.044	-
H ₁ Sales revenue of foreign-owned firms	-	-	.10**	-	-	.33***
H ₂ Triadic patents originating in China	.097***	.11***	.093***	.10**	.072	.10**
H ₃ Herfindahl index	-	-	-	-.14***	-.11*	-.13***
CONTROL VARIABLES						
Share of inventors who reside in China	-.047***	-.034**	-.019	-.050	-.065*	-.037
Triadic patents	.17**	.089	.052	.13	-.13	.29**
Constant	-.17	1.13*	2.73***	-.65	4.17***	-.29
Year dummy	Included	Included	Included	Included	Included	Included
Number of observations	342	342	228	114	114	114
Number of group	19	19	19	19	19	19
Log Likelihood	-1301.1	-1310.6	-913.8	-419.6	-420.7	-421.0

*** denotes significance at the 1% level, ** denotes significance at the 5% level, * denotes significance at the 10% level.

Determinants of Quadric Patenting: International Regression

Independent variables		Dependent variable: Quadric patents	
		1985–2004	
		Fixed-effects (1)	Fixed-effects (2)
KEY EXPLANATORY VARIABLES			
H ₁	Manufacturing value added	.10*	-
H ₁	Manufacturing imports	-	.084
H ₂	Triadic patents originating in the country	.29***	.32***
H ₄	Strength of patent regime	.54***	.51***
H ₄	(Strength of patent regime) ²	-.0029	.0019
CONTROL VARIABLES			
	WTO membership	.16	.10
	Share of inventors who reside in the country	.013	.015
	Constant	-4.39***	-3.23***
	Year dummy	Included	Included
	Number of observations	675	706
	Number of groups	36 ²	38
	Log Likelihood	-3153.1	-3515.3

Conclusions

- Quadic patenting in emerging economies (China)
- Determinants in China
 - Exploitation of potentials of the Chinese market
 - Imitative threat
 - Intense domestic competition
- Determinants in cross-country sample
 - Similar as above
 - Strength of IPR

Contributions & Future research

- Quadric patent family as an alternative indicator compared with triadic patent family and national patents
- A new measure of absorptive capacity: Triadic patents originating in a country
- Firm-level analysis needed to link MNCs' market access strategies with their innovation & location strategies

Thank you !

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List of 38 countries and regions

Argentina, Australia, Brazil, Canada, Chile, China, Colombia, Costa Rica, Algeria, Ecuador, Egypt, Guatemala, Hong Kong SAR of China, Honduras, Indonesia, Israel, India, Kenya, South Korea, Sri Lanka, Morocco, Malawi, Mexico, Malaysia, New Zealand, Panama, Peru, Philippines, Russia, Singapore, El Salvador, Taiwan Province of China, Tunisia, Trinidad and Tobago, Ukraine, Uruguay, Vietnam, South Arica