New Research Directions in Trade, Investment and IP Protection

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Introduction

The literature on “trade and IP” seems mainly to address three interrelated areas:

1. How “trade-related” (including investment, licensing, and other forms of measured cross-border flows) are IPRs, specifically protected patent rights?

2. How have TRIPS and TRIPs-Plus FTAs, bilateral investment treaties, and other policies affected provision of public goods? Such as:

- Access to medicines (pricing and availability);
- Access to green technologies;
- Access to knowledge.

3. The role of extensive IP chapters in regional trade agreements: issues of unintended increases in protection, potential inconsistencies, etc.

Elements 2 and 3 are likely to be covered by the panel. I would like to focus on recent and ongoing research by trade economists, mainly item 1.

IP, trade and innovation has become a prominent and highly topical area of research, both empirical and theoretical.

What are some recent important findings? What would be interesting directions in which to take this research?

Is there an empirical consensus about IP and trade?

- Based on the most carefully specified studies (circa 2012), one could conclude with some confidence:
  - High-technology exports from advanced industrial economies to emerging economies (and to each other) are significantly stimulated by patent-law reforms.
  - Inward FDI flows and licensing (both with affiliates and arm's-length) in higher-technology sectors also go up in those countries.
  - The sales, employment, and technological activities of local producing affiliates of MNEs in high-tech sectors are also stimulated in reforming countries, including exports in new products and markets.
  - Each of these flows is associated with higher inward patent applications, but not generally the reverse.
  - Exports of high-tech products (as classified) from emerging economies increase after a lag (see below).
  - There is little evidence of trade or FDI responses in poor developing countries.
  - I think most of us in the small (but growing) group of trade/IP specialists would agree with this characterization.

A few preliminary observations

- Trade and FDI are important but not necessarily indications of overall welfare gains.
- Economists still argue about the technical details of such studies: causality, measurement, etc.
- The biggest problem is we know little about *why* these flows may be enhanced.
- What might all of this say about the volume and channels of technology diffusion?
- Following is a selective review.

New questions and new results (all need additional research)

- What is the nature of export growth from developed countries to emerging economies after patent reforms?
  - Olena Ivus (JIBS 2015):
    - Detailed product-line US export data, 1990-2000;
    - Strengthening patent rights in developing countries expanded US exports of new products in patent-sensitive industries. (IV estimation)
    - This extensive-margin effect into new varieties accounted for virtually all of US export growth to such countries.
    - Suggests both that patent reforms increase access to new technologies and products and that multinational firms pay attention to patent laws in choosing export locations.
  - Jenny Lin and William Lincoln (JIE 2017):
    - First comprehensive firm-level database matching US patent ownership and export transactions by destination.
    - Just 9% of US firms own patents but account for 89% of exports.
    - Firms holding patents are considerably more likely to export high-tech varieties to countries with stronger patent rights (both cross-section (gravity) and studying 6 major reforms (DID)).
    - Again, this “extensive margin” effect dominates export responses.
  - Both studies suggest there are consumer variety gains and higher productivity in local firms after patent rights are strengthened.

New questions and new results

- **Do the particulars of legal patenting structures matter for trade?**
- Paul Jensen, Alfons Palangkaraya, and Beth Webster (JIE 2017):
  - Conventional prior wisdom: “weak” patent systems deter inward trade due to a fear of local imitation. A correlation at best, little corroboration.
  - Implicitly this view assumed would-be exporters could always get a patent but it might be infringed. An impossible counterfactual.
  - But one can compare the likelihood of getting a patent in different national systems. JPW construct measures in destination countries of (1) foreign applicant refusals and (2) potential blocking patents.
  - 189 exporting countries to Japan and 13 European countries in 1990s; equivalent patent applications at EPO and Japan. Industry-level trade.
  - Results: (1) Potential exporters are significantly deterred from exporting to countries where patent refusals are more likely. (2) Holding refusal rates constant, the existence of local patents that might be infringed also reduces imports.
  - Seems to be the first rigorous study of how patent examination systems affect detailed trade flows.

New questions and new results

- **Does IP protection in developed countries limit high-technology exports from developing countries?**
- Wonkyu Shin, Keun Lee, and Walter Park (The World Economy 2016):
  - Bilateral trade flows of more than 70 countries, 2000-2007.
  - Construct a measure of technological capacity by country using patents granted abroad (anywhere) and US patent grants.
  - Estimate gravity (aggregate) bilateral trade flows with interactions between exporter technology levels and importer patent protection.
  - Find that in “South to North” exports there is a significantly negative interaction: exports to North become more limited as patent profiles of the South countries expand.
  - Interpretation: rules to block potentially infringing imports are effective deterrents to South-North technology trade. A barrier to export growth in emerging countries.
  - No such deterrent exists in North to South technology exports.
  - This analysis should be considered preliminary but it opens up interesting questions.

New questions and results

- **Can IP reforms in developing countries spur export growth?**
- Mercedes Delgado, Margaret Kyle and Anita McGahan (J Industrial Economics 2013):
  - All WTO members, imports and exports by sector, 1993-2009.
  - Diff-in-diff approach: (1) High-IP versus low-IP goods; (2) Specific IP-intensive sectors versus low-IP goods.
  - Focus on effects after TRIPS implementation (compliance dates).
  - Find evidence of higher exports of high-IP products in both developed and developing countries, mostly in biopharma and ICT.
  - Primary increase in imports of developing countries post-TRIPS was in ICT.

New questions and results

- **If patent reforms raise exports of emerging and developing countries, what are the channels of learning they go through?**
- Keith Maskus and Lei Yang (CJE, 2018):
  - Estimate effects of national characteristics (endowments, incomes, patent rights) interacted with industry characteristics (including patent intensity) on exports by SIC sector, 102 countries, 2000-2010.
  - Extended analysis interacts the patent variable with 3 measures of potential learning channels:
    - Non-resident patent application stocks by sector, over prior 5 years (NP);
    - Share of country's intra-party imports in US total imports by sector (IPT);
    - Share of affiliate employment (US MNEs) in total employment by sector (FEMP).
  - Estimates of patent impacts are large and enhanced by each form of learning (table).

TABLE 8
Patent rights and export specialization: Potential learning channels

Dependent variable: Log exports of countries by sector								
Variable	Panel	Panel	Panel	Panel	Panel	Panel	Panel	Panel
$PR_{ct} * r_{jt}$	0.33***	0.25***	0.14***	0.32***	0.22***	0.16***	0.11*	0.22***
	(0.037)	(0.033)	(0.041)	(0.052)	(0.049)	(0.044)	(0.057)	(0.079)
$PR_{ct} * r_{jt} * NP_{cjt}$	0.07***			0.09***	0.07***			0.11***
	(0.012)			(0.015)	(0.012)			(0.017)
$PR_{ct} * r_{jt} * IPT_{cjt}$		0.06***		0.04***		0.05***		0.04***
		(0.008)		(0.010)		(0.008)		(0.011)
$PR_{ct} * r_{jt} * FEMP_{cjt}$			0.07***	0.07***			0.07***	0.07***
			(0.006)	(0.007)			(0.006)	(0.008)
$PR_{ct} * r_{jt} * UMI$					−0.04***	−0.05***	−0.04***	−0.05***
					(0.009)	(0.008)	(0.009)	(0.012)
$PR_{ct} * r_{jt} * LI$					−0.02**	−0.01	0.01	−0.01
					(0.010)	(0.009)	(0.010)	(0.013)
R^2	0.79	0.80	0.80	0.79	0.80	0.80	0.80	0.79
No. of obs.	8,953	8,901	8,620	5,675	8,953	8,901	8,620	5,675

NOTES: Results are standardized beta coefficients. Explanatory variables are lagged five years. Robust standard errors are in parentheses. Coefficients are significant at 1% (***), 5% (**) or 10% (*). Panel regressions include country–year and industry–year fixed effects, along with all other controls.

New questions and new results

- **Do firms in developing countries change their export and technology-importing behavior in the presence of stronger IP protection?**
- Huiwen Lai, Keith Maskus, and Lei Yang (working paper, under review):
- Firm-level data in China, matched carefully to exports and imports, 2000-2006.
- Two measures of tech transfer: capital imports and new products.
- Two measures of provincial IP enforcement: judicial “win rates” for IP holder and settled patent cases relative to total provincial patents.
- Model of firms with heterogeneous productivity. Key assumption is that stronger IP lowers fixed costs of exporting. Predictions:
  - Stronger IP will increase exit rate of low-productivity firms.
  - Stronger IP will increase margin of exporting (both extensive and intensive margins).
  - Stronger IP will increase margin of firms that both export and bring in new technology.
- Results (OLS and IV; controlled for sector tariffs) strongly support these predictions (table excerpts). Firms in provinces with relatively higher increases in “enforcement” are more likely to enter exports, start importing capital goods, and introduce new products. In cross-sections firms in provinces with higher enforcement levels have higher export volumes and greater volumes of capital-goods imports.

Table 3B: Change of IPRs on Export Decision

Variables	dependent=start exporting dummy							
	(1) OLS	(2) OLS	(3) Fixed Effects	(4) Fixed Effects	(5) OLS	(6) OLS	(7) Fixed Effects	(8) Fixed Effects
Change of IP cases win rates	0.0382***	0.0545***	0.0293***	0.0367***				
	(0.0134)	(0.0137)	(0.00859)	(0.00873)				
Change of settled patent ratio					11.31***	12.83***	8.923***	11.17***
					(3.315)	(3.428)	(2.168)	(2.277)

Table 3D: Change of IPR on New Products Decision

Variables	dependent=start new products dummy							
	(1) OLS	(2) OLS	(3) Fixed Effects	(4) Fixed Effects	(5) OLS	(6) OLS	(7) Fixed Effects	(8) Fixed Effects
Change of IP cases win rates	0.266***	0.222***	0.261***	0.220***				
	(0.0289)	(0.0279)	(0.0243)	(0.0244)				
Change of settled patent ratio					25.69***	23.76***	27.13***	24.42***
					(6.157)	(5.625)	(5.054)	(4.777)

Table 4A: IPRs Impact on Export Volume

Variables	Dependent=log(export)							
	(1) OLS	(2) OLS	(3) Fixed Effects	(4) 2nd-stage IV	(5) OLS	(6) OLS	(7) Fixed Effects	(8) 2nd-stage IV
IP cases win rates	0.458***	0.223***	0.159***	0.751***				
	(0.0215)	(0.0273)	(0.0236)	(0.0542)				
Settled patent ratio					-0.541***	-0.254***	29.41***	67.98***
					(0.0202)	(0.0394)	(5.447)	(13.22)

Table 4B: IPRs Impact on Capital Goods Import Volume

Variables	Dependent=log(capital goods import)							
	(1) OLS	(2) OLS	(3) Fixed Effects	(4) 2nd-stage IV	(5) OLS	(6) OLS	(7) Fixed Effects	(8) 2nd-stage IV
IP cases win rates	0.00784	-0.360***	0.519***	0.827***				
	(0.0528)	(0.0785)	(0.107)	(0.181)				
Settled patent ratio					0.105**	0.820***	17.96	257.2***
					(0.0492)	(0.0987)	(14.52)	(45.03)

New questions and new results

- **To what extent are supply chains a source of learning and technical change?**
- Roberta Piermantini and Stela Rubinova (working paper 2018).
  - Does participation in global value chains raise innovation?
  - Industry-level patent data (PCT applications) for 25 countries, 2000-2008.
  - Country/industries are linked to foreign stock of R&D available through GVC weights (computed from value-added trade). (Like the old Coe-Helpman-Hoffmaister study of import-weighted knowledge (R&D) spillovers).
  - Findings: knowledge spillovers into domestic patenting are significant: expansion of GVCs links raised average country's patenting by 5% per year, both developed and emerging.
  - Spillovers are larger where absorptive capacity is better.
  - The GVC-based knowledge spillovers are larger than those through gross trade or intermediate-input imports.

New questions and new results

- **What are the roles of MNCs in developing and sharing knowledge in R&D networks?**
- Lee Branstetter, Brad Jensen, and Britta Glennon (NBER working paper 2018) and related studies.
- Several features jump out:
  - Science (R&D) and innovation (patents) have become increasingly globalized through the development of international research teams. True in basic (university) research and MNCs.
  - R&D success requires the existence of deep and complementary sets of human capital skills; largely absent in developing countries.
  - There was almost no internationally shared innovation involving developing or emerging countries before the ITC revolution and proliferation of teams is quite recent.
  - MNCs play a prominent (or dominant) role in sharing R&D work.
  - Within high-tech industries (IT, pharma, agriculture, etc.) the share of foreign inventors listed on patents grows over time.
- This seems to be evidence that international collaboration in R&D becomes an increasingly important mechanism for sharing specific knowledge with R&D facilities in developing countries over time. The role of MNCs is crucial in this regard.

New questions and new results

- **What is the interplay between financial development (FD) and patent protection in encouraging R&D?**
- Sahar Milani, Keith Maskus and Rebecca Neumann (Research Policy, forthcoming).
- Motivation: begin trying to unpack findings of positive trade (innovation?) effects post-reforms.
- Long-discussed idea: the form of financing matters for R&D. Briefly:
  - R&D outcomes are uncertain and decisions are subject to information asymmetries and moral hazard.
  - Roughly, financing forms that facilitate monitoring and shared input decisions in R&D programs should address such problems. (Bank lending, concentrated equity ownership and FDI are strong candidates.)
  - But patents also help resolve information problems so they should be most effective where monitoring-oriented finance is less developed.
- There is evidence that these claims hold up in the OECD industrial R&D data (table). R&D rises more in patent-intensive sectors with patent rights where FD is limited (below median) for private credit, stock-market capitalization, and all international financing sources.
- Interestingly, the most prominent boost in this patent/R&D relationship comes from FDI financing, at all levels of FD.
- Economic significance: at the average patent intensity by industry a one-standard deviation increase in measured patent rights increases R&D intensity by 0.35 percentage points when we use FDI as the measure of FD and by 0.26 percentage points when using private credit. (Average R&D intensity is 1.7%.)

Table 2: Regression of R&D intensity on patent protection interacted with patent intensity across different domestic financial development variables interacted with external dependence and tangibility

	Private credit			Stock-market capitalization			Private bond		
	(1) Full	(2) Above	(3) Below	(4) Full	(5) Above	(6) Below	(7) Full	(8) Above	(9) Below
Industry share in GDP	-0.123*	-0.160*	-0.090	-0.119*	-0.154*	-0.074	-0.113*	-0.118*	-0.115*
	(0.061)	(0.090)	(0.053)	(0.058)	(0.083)	(0.058)	(0.055)	(0.060)	(0.055)
PR*patent intensity	0.049*	0.074	0.047***	0.052**	0.024	0.050***	0.052**	0.086*	0.027
	(0.025)	(0.054)	(0.009)	(0.024)	(0.069)	(0.006)	(0.024)	(0.042)	(0.017)
PR	-0.001	-0.000	-0.001*	-0.001	0.001	-0.001**	-0.001	-0.001	-0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.001)	(0.001)

Table 3: Regression of R&D intensity on patent protection interacted with patent intensity across different international financial development variables interacted with external dependence and tangibility

	FDI liabilities			Debt liabilities			Portfolio equity liabilities		
	(1) Full	(2) Above	(3) Below	(4) Full	(5) Above	(6) Below	(7) Full	(8) Above	(9) Below
Industry share in GDP	-0.121*	-0.234**	-0.001	-0.143*	-0.257*	-0.042	-0.100**	-0.113	-0.075
	(0.060)	(0.099)	(0.049)	(0.071)	(0.123)	(0.048)	(0.047)	(0.080)	(0.052)
PR*patent intensity	0.058**	0.087**	0.044**	0.053*	0.024	0.077***	0.061**	0.052	0.065***
	(0.024)	(0.034)	(0.017)	(0.025)	(0.085)	(0.013)	(0.024)	(0.062)	(0.008)
PR	-0.001	-0.001***	-0.000	-0.000	0.001	-0.001***	-0.001	-0.001	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.001)	(0.000)

New questions and new results

- **Does the presence of an extensive IP chapter in PTAs have impacts on high-technology trade?**
- Mercedes Campi and Marco Duenas (working paper, 2018):
- Nice documentation of the growth of IP-related PTAs.
- Primary result: PTAs with enforceable IP chapters raise high-IP imports with a lag.

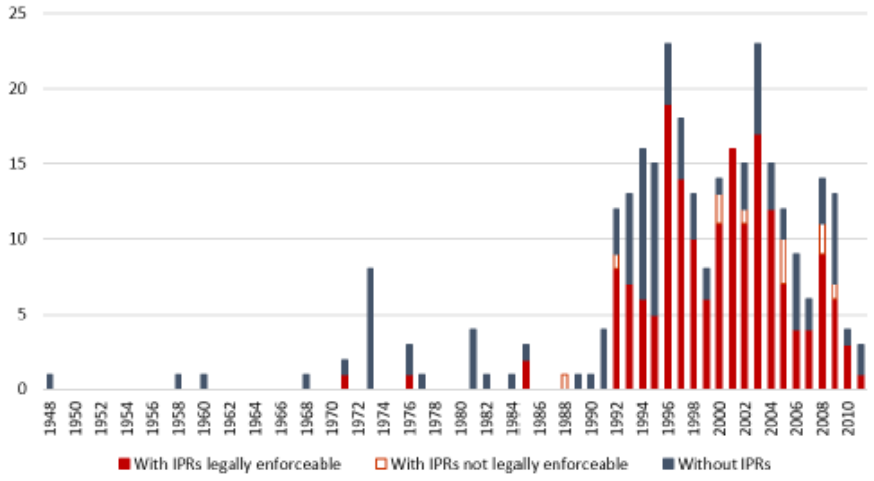

Figure 1: Evolution of the number of signed trade agreements. 1948-2011

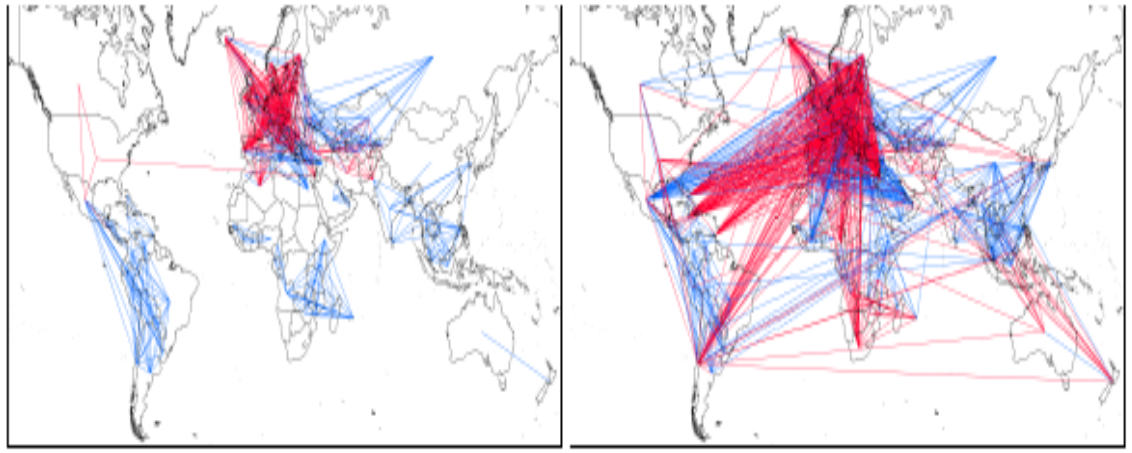

Figure 2: Network of countries with trade agreements. In blue, trade agreements with no IP chapters. In red, trade agreements with IP chapters. 1995 (left) and 2010 (right)

New questions and new results

- Keith Maskus and William Ridley, working paper (2018):
- Gravity model with bilateral exports and imports in both high-IP versus low-IP and specific high-IP sectors versus aggregation of low-Ip sectors. PPML with and without zero trade flows generate very similar results.
- An IP-related PTA is defined as one signed with US or EU/EFTA that have extensive and enforceable IP chapters ("TRIPS plus").
- Lots of regressions but the primary takeaway is that, controlling for TRIPS compliance and a full battery of fixed effects, IP-related PTAs expand exports *to third markets (non-PTA partners)* of specific sectors (biopharmaceuticals, analytical instruments, medical devices, production technologies, and other high-IP goods). True for LMI, UMI and HI countries.
- Low-IP exports seem to be reduced.
- Imports expand significantly in biopharma, ICT, and medical devices.

Some thoughts on where to take this literature

- Better attempts to link patents (innovation) and exports from emerging countries. Are there important extensive margin effects in export growth?
- Also link patents from inside and outside PTA partners to trade flows. Is there “IP creation” and “IP diversion”?
- What are the theoretical and empirical tradeoffs between IP “concessions” and tariff cuts in PTAs?
- Additional work to determine economic conditions and policy frameworks to maximize domestic learning from inward technology flows post-reforms.