Intellectual Property-Related Preferential Trade Agreements and the Composition of Trade

KEITH E. MASKUS AND WILLIAM RIDLEY

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Introduction

Empirical international economists focus their analysis on commercial policies (tariffs, investment and service barriers) and changes in technology and transport costs.

Far less studied but at least as important are trade-related regulatory systems:

- Rules of origin;
- Investment regulations;
- Competition policy;
- Financial markets regulation;
- Technical product standards;
- Labor protection rules, etc.

Introduction

A highly significant regulatory area is protection of intellectual property rights (IPRs).

Patents, plant variety rights, copyrights, trade secrets, trademarks, geographical indications and other policies giving exclusive rights to use (produce, sell, import, and license) an intellectual invention or creation for some time.

In return, inventors and creators are expected to disclose their knowledge and bring new ideas and products to the market.

Introduction

Why are IPRs important for international trade and investment? (More comments later.)

- IPRs are attached to virtually all international transactions.
- IPRs should have impacts on technology transfer through trade and FDI.
- They affect fundamental strategic tradeoffs (basic example: standard-essential patents in electronics).
- Technological change demands updates in IPRs, with impacts on trade and investment.

IPRs are themselves subject to significant globalization.

IPRs remain understudied by international economists, except for reduced-form regressions of trade and FDI.

The globalized IPRs system

Last 20+ years have seen unprecedented expansion and harmonization of IPRs protection.

- TRIPS at the WTO, subject to dispute settlement;
- Additional WIPO treaties and rules;
- “TRIPS-Plus” requirements in various PTAS, which have become more common over time.
- Extension of investment protection guarantees to IPRs in BITs, IIAs, and PTAs.

Expanding attention paid to IPR over time in PTAs and Partnership Agreements

US-Israel FTA 1985: one paragraph mentioning NT and MFN.

NAFTA 1994: essentially anticipated TRIPS.

US-Jordan FTA 2001 ("gold standard" IPR): 5 pages, added some TRIPS-Plus features in patent standards, pharma, test data, digital CRs and anti-circumvention.

US-Chile 2004: regularized test data periods, PV patents.

US-Australia 2005: further pharma protection, linkage, limits on CR exceptions.

US-Korea 2012: further limits on CR exceptions, patents for new uses, no pre-grant opposition, detailed rules on ISPs, extensive enforcement.

Original TPP: biologics test data protection, trade secrets obligations, criminal enforcement. Some of this scaled back by CPTPP.

EU Partnership Agreements and FTAs (e.g., with Canada) increasingly focus on IP issues, especially GIs.

IP-related PTAs

Well over 400 PTAs exist currently (more if we include sector-specific agreements).

PTAs are a recent phenomenon, especially those with IPRs. (first chart)

And the implied international linkages are complex (second chart).

Source: Campi and Duenas (2017)

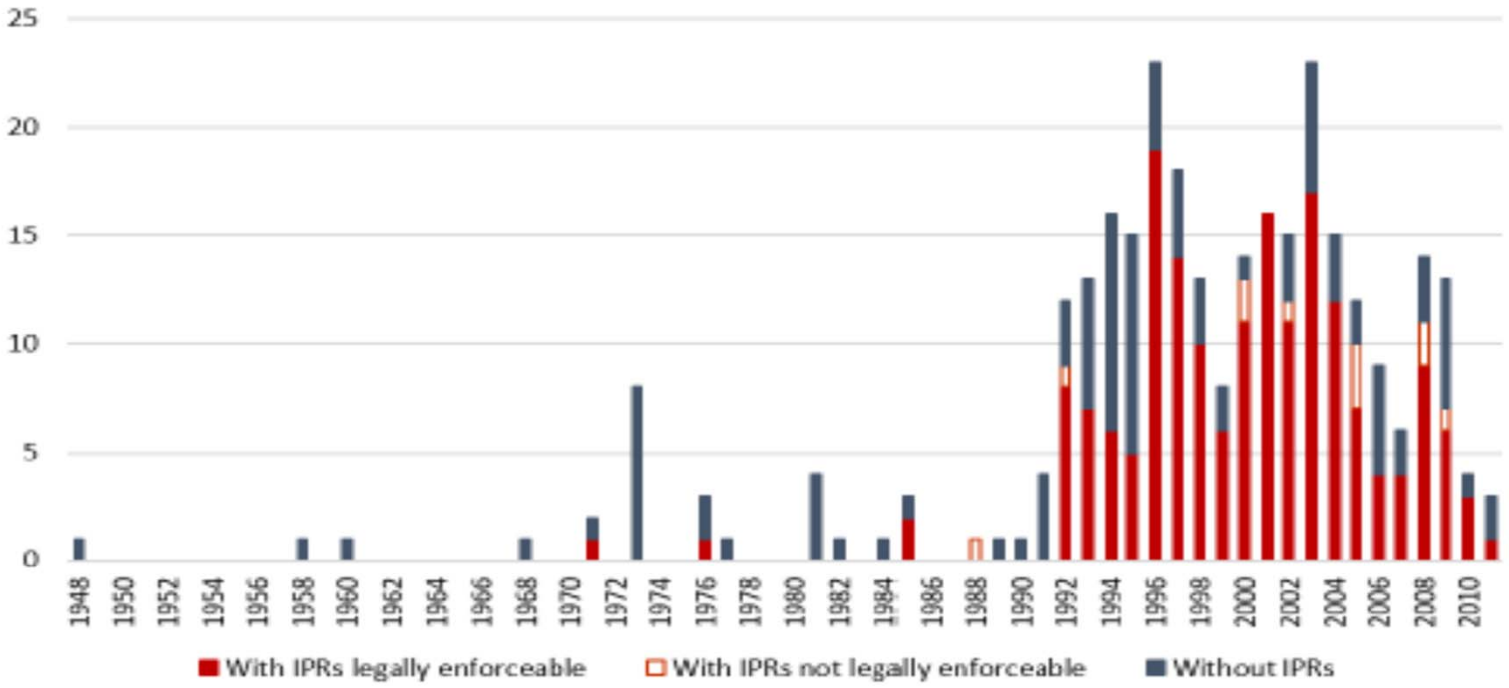


Figure 1: Evolution of the number of signed trade agreements. 1948-2011

Source: Campi and Duenas (2017)

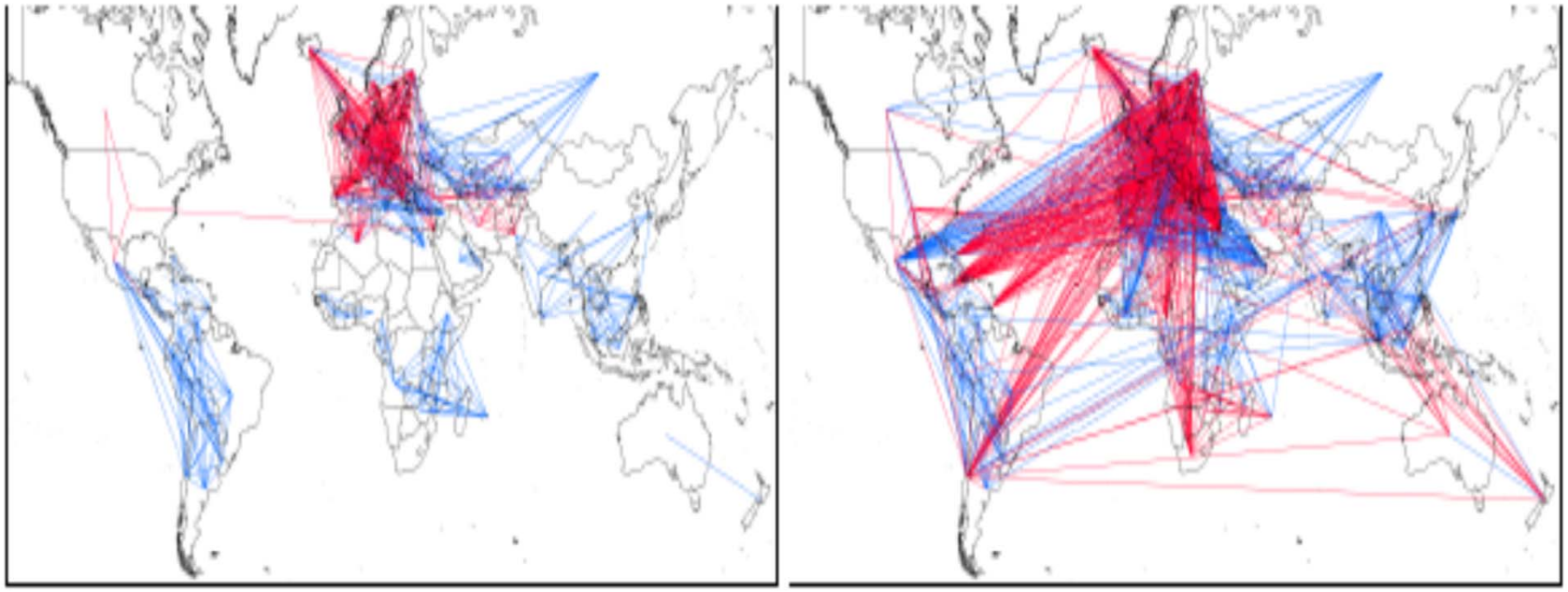


Figure 2: Network of countries with trade agreements. In blue, trade agreements with no IP chapters. In red, trade agreements with IP chapters. 1995 (left) and 2010 (right)

IP-related PTAs

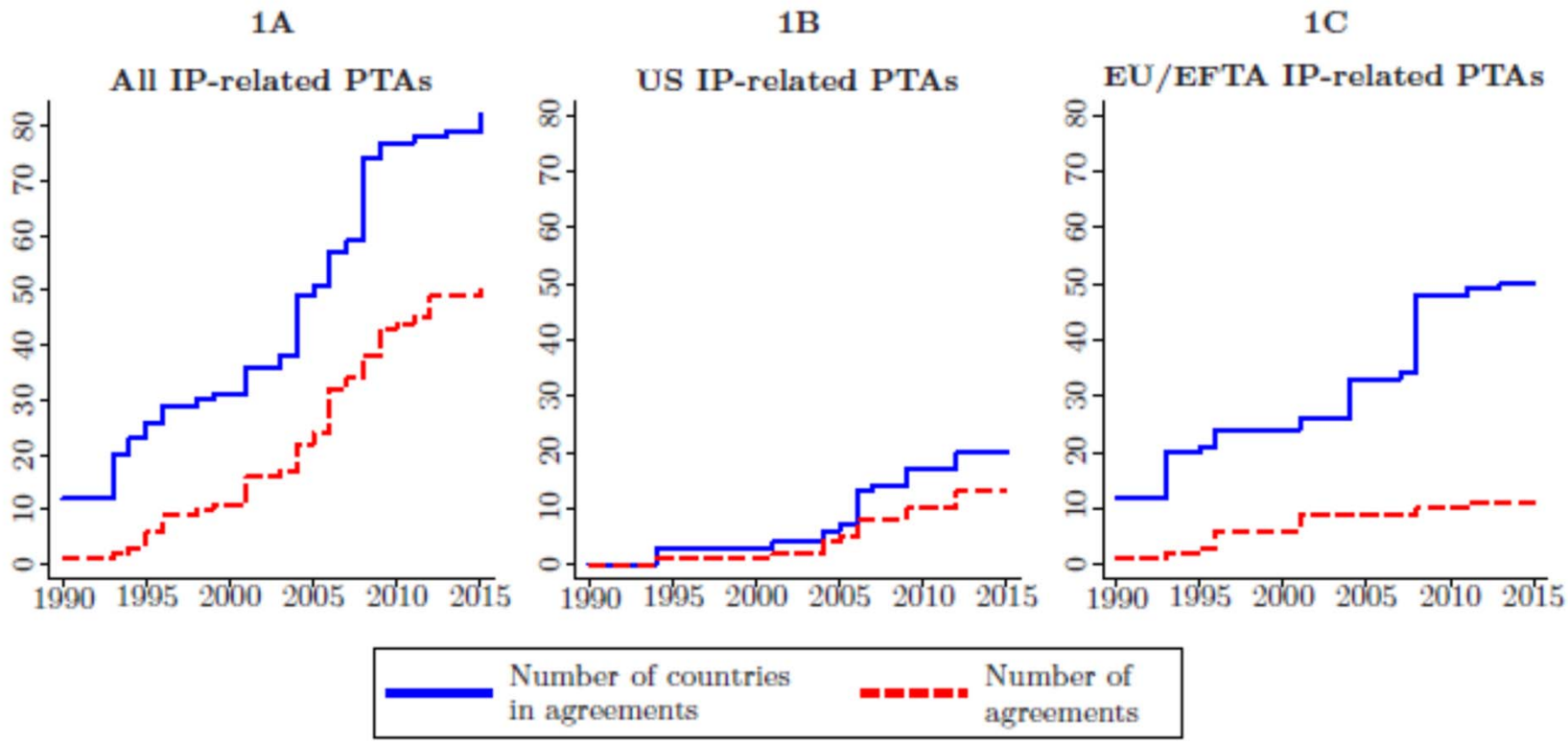
50 PTAs (as of 2015) have IP chapters of varying complexity. Most of these involve a developed country partner but newer developing-country PTAs increasingly feature them.

82 countries are now members of at least one such PTA (Figure 1A).

We will define our “treatment” PTAs as those involving the US or EU/EFTA as a partner (Figure 1B and 1C).

These PTAs vary in their legal coverage. Often the US and EU have different negotiating objectives regarding specific IPRs standards.

Figure 1: Number of IP-related trade agreements and number of countries with membership in one or more IP-related trade agreements by year, 1990 to 2015



Source: Based on data from Dür et al. (2014)

Motivation

All of this suggests a potentially rich area for trade research on the economic effects of IPRs (and regulatory chapters) of PTAs.

Some questions to be asked:

- Do IP-related PTAs matter beyond the effects of TRIPS?
- Are there impacts on trade, FDI, licensing, and innovation?
- Are there interactions between IPRs and tariff cutting in PTAs?
- Are there interactions between IPRs and other regulatory elements of PTAs?

The current paper is a first attempt at the most basic question: do IP-related PTAs have exceptional effects on member countries' aggregate and bilateral trade flows?

What about on trade in specific IP-sensitive sectors?

Potential trade effects

The relationships between IPRs (e.g., patent laws and enforcement) and the volume and composition of trade are inherently empirical.

Theory offers little definitive guidance.

Regarding IPRs in trade agreements they differ fundamentally from tariff cuts because any policy changes in IPRs must be enacted on an MFN basis (no discrimination).

Recent empirical trade literature

Branstetter et al (JIE 2011): Emerging countries undertaking IP reforms see expanded technology activities by both affiliates and local firms. Growth in extensive-margin exports.

Ivus (JIE 2010): TRIPS patent reforms have expanded high-tech exports to "treatment" emerging economies.

Delgado, et al (J Ind Econ 2013): TRIPS-inspired IP reforms have increased high-IP imports in developing countries.

Maskus and Yang (CJE 2018): countries with stronger patent rights specialize more in R&D-intensive exports. Effect is enhanced by inflows of patent applications and intra-firm trade.

Campi and Duenas (working paper 2018): lagged IPAs seem to expand exports of both high-IP and low-IP goods.

Identification approach

Our analysis uses a DID approach to study imports and exports. We apply the method to both TRIPS effects and IP-related PTA (IPA) effects.

Data sample: all countries in Comtrade, 1993-2013, exports and imports broken down into high-IP and low-IP goods.

Sectors further broken down into specific IP-intensive sectors, such as biopharmaceuticals and information-communication technologies.

Identification approach

The identification is based on:

- Difference 1: subset of countries joined an IPA with US or EU/EFTA (treatment), others did not (control). Dummy variable for year of joining and after. Also broken down into 4 income groups (development level).
- Corresponding difference in dates at which countries came into compliance with TRIPS.
- Difference 2: effects should differ between high-IP industries and low-IP industries, using various definitions.
- Important: our specifications focus on effects in countries joining IPAs *after* becoming compliant with TRIPS; an attempt to sort out impacts of the 2 policy variables.

Data summary

National indicators for 186 countries:

- 40 HI, 26 UMI, 63 LMI, 57 LI

Trade data (COMTRADE, 6 digits HS):

- Aggregate sectoral trade and bilateral sectoral trade by country.
- Bilateral trade estimated with a gravity equation using PPML estimation.
- Trade data classified into high-IP sectors and low-IP sectors; not exhaustive across industries (SITC, rev 3).
- Trade data further classified into specific IP sectoral clusters (defined below).

Identified 24 “treatment” IP-related PTAs (IPAs) (Table A2, next page).

Countries are in the treatment group if they joined any of these IPAs during the sample.

Control group: countries that did not join any of these 24. Note many of these countries are in FTAs that do not have strong IPR chapters.

Table A2: US, EU, and EFTA IP-related preferential trade agreements and entry-into-force years

Agreement	Entry-into-force year
Australia-USA	2005
Bahrain-USA	2006
Bulgaria-EFTA	1993
CARIFORUM-EU	2008
Central American Free Trade Agreement	2006
Chile-USA	2004
Colombia-EFTA	2011
Colombia-USA	2012
EU-Macedonia	2001
EU-Turkey	1996
EFTA-Estonia	1996
EFTA-Latvia	2006
EFTA-Mexico	2001
EFTA-Slovenia	1995
European Free Trade Association (Services)	2001
European Union	Varies by member
Jordan-USA	2001
Morocco-USA	2006
North American Free Trade Agreement	1994
Oman-USA	2009
Panama-USA	2012
Peru-USA	2009
Singapore-USA	2004
South Korea-USA	2012

Identification and endogeneity

As with any empirical study, there is an evident endogeneity problem: non-random selection into IPAs.

One response is that IPRs rules in PTAs were exogenously implemented in most PTA partners.

- IPRs (TRIPS-Plus): Inclusion of such rules again is demanded by one partner with far greater bargaining power.
- Developing and emerging countries would not likely adopt such rules endogenously.
- For most PTA members the IPRs chapters are seen as secondary to gaining market access.

To manage additional concerns we estimate the effects of IPAs on trade with external countries that are not members of the particular agreement.

Baseline case: aggregate trade with income groups

Is there a differential effect of IPAs on aggregate trade (exports and imports estimated separately) in high-IP goods versus low-IP goods in treatment countries?

Is there a differential effect of TRIPS?

Regressions conditioned by interactions with income groups LI, LMI, UMI, and HI (fixed at 1995).

Coefficients should be interpreted as effects on trade in comparison with trade trends in countries that are not in an IPA within industry-income group categories.

Specification is on the next page.

$$
\begin{aligned}
\log(TR_{ist}) = {} & \beta_1 \log(GDP_{it}) + \beta_2 \, High\text{-}IP_s \times \log(GDP_{it}) \\
& + \sum_g \beta_{3g} Group_i \times Low\text{-}IP_s \times IPA_{it} \\
& + \sum_g \beta_{4g} Group_i \times High\text{-}IP_s \times IPA_{it} \\
& + \sum_g \beta_{5g} Group_i \times Low\text{-}IP_s \times TRIPS_{it} \\
& + \sum_g \beta_{6g} Group_i \times High\text{-}IP_s \times TRIPS_{it} \\
& + \alpha_{gst} + \alpha_i t + \varepsilon_{ist}.
\end{aligned}
$$

Baseline case

TR_{ist} = imports or exports of country i in s (high-IP or low-IP), year t.

IPA_{it} = indicator variable for whether i is a member of at least one IPA (in force) at t.

- Focus on countries that entered an IPA after coming into compliance with TRIPS. This actually removes NAFTA and 1 other pre-1995 IPA from the analysis.

$TRIPS_{it}$ = indicator variable for whether i is compliant with TRIPS at t.

High-IP_s = indicator variable for high-IP industry group; Low-IP for low-IP industry group.

FE's for income group-sector-year and country-specific time trends.

β_{3g} = direct trade effect in low-IP of IPA by income group (β_{5g} for TRIPS).

B_{4g} = direct trade effect in high-IP of IPA by income group (β_{6g} for TRIPS).

By including the exhaustive list of income groups and sectors (including low-IP) this approach permits recovery of all group X sector interaction variables.

Table 2 presents the baseline results for total trade and for trade excluding IPA partners.

Table 2: Aggregate Trade in High-IP vs. Low-IP Sectors

	Exports		Imports	
	(1)	(2)	(3)	(4)
	Total	Total net of partner trade	Total	Total net of partner trade
log(GDP)	0.753***	0.722***	0.545***	0.526***
	(0.102)	(0.106)	(0.045)	(0.043)
High-IP × log(GDP)	0.140**	0.129**	0.084***	0.080***
	(0.061)	(0.064)	(0.015)	(0.017)
Low-IP × LI × IPA	–0.322	–0.327	–0.444**	–0.458**
	(0.291)	(0.246)	(0.172)	(0.184)
Low-IP × LMI × IPA	–0.549***	–0.503***	–0.083	0.037
	(0.170)	(0.174)	(0.091)	(0.109)
Low-IP × UMI × IPA	–0.621**	–0.424	0.165	0.366**
	(0.312)	(0.322)	(0.139)	(0.175)
Low-IP × HI × IPA	–0.528	–0.626*	0.175**	0.259***
	(0.335)	(0.346)	(0.088)	(0.099)
High-IP × LI × IPA	–0.072	0.049	–0.212**	–0.104
	(0.573)	(0.552)	(0.105)	(0.107)
High-IP × LMI × IPA	0.355*	0.559***	–0.136*	–0.228**
	(0.199)	(0.202)	(0.071)	(0.088)
High-IP × UMI × IPA	0.618**	0.875***	–0.000	0.021
	(0.278)	(0.329)	(0.095)	(0.160)
High-IP × HI × IPA	0.793***	0.897***	0.111	–0.039
	(0.299)	(0.308)	(0.101)	(0.127)
Low-IP × LI × TRIPS	–0.105	–0.136	0.066	0.075
	(0.207)	(0.211)	(0.089)	(0.088)
Low-IP × LMI × TRIPS	–0.548**	–0.594***	–0.116	0.004
	(0.216)	(0.218)	(0.072)	(0.079)
Low-IP × UMI × TRIPS	–0.728***	–0.725***	–0.039	0.001
	(0.255)	(0.271)	(0.080)	(0.082)
Low-IP × HI × TRIPS	0.169	0.149	–0.048	–0.079
	(0.480)	(0.484)	(0.154)	(0.158)
High-IP × LI × TRIPS	0.030	0.053	0.007	0.019
	(0.235)	(0.235)	(0.080)	(0.080)
High-IP × LMI × TRIPS	0.225	0.268	–0.058	–0.082
	(0.213)	(0.216)	(0.057)	(0.061)
High-IP × UMI × TRIPS	0.641**	0.776***	0.137	0.059
	(0.254)	(0.268)	(0.089)	(0.116)
High-IP × HI × TRIPS	0.094	0.092	0.118	0.086
	(0.419)	(0.421)	(0.122)	(0.125)
Observations	7,132	7,132	7,132	7,132
Number of countries	187	187	187	187
R^2	0.926	0.912	0.978	0.971
Country trends	Y	Y	Y	Y
Group-sector-year FE	Y	Y	Y	Y

Notes: The dependent variable is log (exports) in columns (1) and (2) and log (imports) in columns (3) and (4). Estimation method is OLS. Robust standard errors clustered by country are reported in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Baseline aggregate results

High-IP goods have a higher elasticity with respect to GDP in both exports and imports.

There is a negative effect of IPA on low-IP exports in all groups; significant for LMI and HI countries.

In contrast, there are sharply positive impacts on exports of high-IP sectors in LMI, UMI, and HI. This is a novel result in the literature on FTAs. These results suggest that IPAs exert a sorting influence at the margin, away from exports of low-IP to high-IP industries.

We also see a reduction of low-IP imports in LI countries in IPAs.

There is no evidence of positive import effects in high-IP goods from joining IPAs (and it is negative for LMI). This contrasts with the literature on IP reforms without considering IPAs.

TRIPS seems to have a similar sorting impact on exports, at least for UMI countries.

The primary result to this point: controlling for TRIPS, membership in IP-related PTAs seems to reduce low-IP imports and exports in developing countries but stimulates high-IP exports in emerging (LMI, UMI) and developed countries.

Extension to bilateral trade

We repeat this analysis using bilateral trade, again distinguishing between imports and exports.

The variable IPA is split into whether the exporter or importer is in a treatment agreement (IPA).

The estimation is essentially a “gravity model” explaining exports from any country i to any country j. The specification (next slide) adds country-pair fixed effects.

The coefficients refer to trade with non-member countries.

$$
\begin{aligned}
T_{ijst} = \exp\Big\{ & \beta_1 \log(GDP_{it}) + \beta_2 \, High\text{-}IP_s \times \log(GDP_{it}) \\
& + \beta_3 \log(GDP_{jt}) + \beta_4 \, High\text{-}IP_s \times \log(GDP_{jt}) \\
& + \sum_g \beta_{5g} \, Group_i^g \times Low\text{-}IP_s \times IPA_{it} + \sum_g \beta_{6g} \, Group_i^g \times High\text{-}IP_s \times IPA_{it} \\
& + \sum_g \beta_{7g} \, Group_i^g \times Low\text{-}IP_s \times TRIPS_{it} + \sum_g \beta_{8g} \, Group_i^g \times High\text{-}IP_s \times TRIPS_{it} \\
& + \sum_g \beta_{9g} \, Group_j^g \times Low\text{-}IP_s \times IPA_{jt} + \sum_g \beta_{10g} \, Group_j^g \times High\text{-}IP_s \times IPA_{jt} \\
& + \sum_g \beta_{11g} \, Group_j^g \times Low\text{-}IP_s \times TRIPS_{jt} + \sum_g \beta_{12g} \, Group_j^g \times High\text{-}IP_s \times TRIPS_{jt} \\
& + \alpha_i t + \alpha_j t + \alpha_{g_i st} + \alpha_{g_j st} + \alpha_{ij} \Big\} + \nu_{ijst}.
\end{aligned}
$$

Bilateral trade results

Results for bilateral trade are in Table 3 (this is one big gravity regression).

We find a consistent sorting effect: IPA membership is associated with reductions in low-IP exports and increases in high-IP exports across nearly all income groups.

TRIPS has similar effects on exports. Both IPAs and TRIPS cut trade in low-IP goods in favor of high-IP goods.

There is now evidence of higher imports of high-IP goods in developing and emerging countries with both IPAs and TRIPS. This result is more consistent with recent literature.

Table 3: Bilateral High-IP vs. Low-IP Trade

	(1) Exporter Effects	(2) Importer Effects
log(GDP)	0.129***	0.533***
	(0.036)	(0.032)
High-IP × log(GDP)	0.373***	0.023
	(0.033)	(0.034)
Low-IP × LI× IPA	−0.131	−0.264*
	(0.107)	(0.154)
Low-IP × LMI × IPA	−0.265***	−0.003
	(0.097)	(0.066)
Low-IP × UMI × IPA	−0.748***	−0.062
	(0.143)	(0.099)
Low-IP × HI × IPA	−0.222**	0.029
	(0.100)	(0.079)
High-IP × LI × IPA	−0.064	0.298**
	(0.215)	(0.134)
High-IP × LMI × IPA	0.388***	0.019
	(0.111)	(0.078)
High-IP × UMI × IPA	0.471***	0.258***
	(0.155)	(0.082)
High-IP × HI × IPA	0.173***	−0.031
	(0.067)	(0.068)
Low-IP × LI × TRIPS	−0.298***	0.230**
	(0.077)	(0.107)
Low-IP × LMI × TRIPS	−0.561***	0.146**
	(0.084)	(0.058)
Low-IP × UMI × TRIPS	−0.488***	−0.173**
	(0.077)	(0.078)
Low-IP × HI × TRIPS	0.451***	0.068
	(0.102)	(0.096)
High-IP × LI × TRIPS	0.595***	0.354***
	(0.115)	(0.097)
High-IP × LMI × TRIPS	1.428***	−0.079
	(0.154)	(0.049)
High-IP × UMI × TRIPS	1.130***	0.137**
	(0.163)	(0.055)
High-IP × HI × TRIPS	0.150**	0.012
	(0.074)	(0.059)
Observations		1,055,276
Number of Country Pairs		27,892
Country trends		Y
Group-sector-year FEs		Y
Pair FEs		Y

Disaggregating high-IP goods by industrial cluster

Previous regressions considered trade effects in an expansive group of high-IP sectors.

But there are likely to be heterogeneous effects across high-tech industries with greater or lesser reliance on IPRs.

Obvious examples:

- pharmaceuticals, chemicals, medical devices (patents);
- Information and communication technologies (copyrights, patents);

TRIPS-Plus standards in IPAs tend to elevate requirements in just these sectors (e.g., patent extensions, test-data confidentiality, linkage rules, anti-circumvention)

Define specific clusters as $Sector_s$ = indicator for analytical instruments (AI), biopharmaceuticals (BIO), chemicals (CHEM), information and communication technologies (ICT), medical devices (MED), production technologies (PT), and other high-IP goods.

Regression specification next slide: exhaustive list of income groups and sectors, including control sector (low-IP).

$$\log(TR_{ist}) = \beta_1 \log(GDP_{it}) + \sum_s \beta_{2s}\, Sector_s \times \log(GDP_{it}) \qquad (5)$$

$$+ \sum_g \sum_s \beta_{gs}\, Group_i \times Sector_s \times IPA_{it}$$

$$+ \sum_g \sum_s \beta_{gs}\, Group_i \times Sector_s \times TRIPS_{it}$$

$$+ \alpha_{gst} + \alpha_i t + \varepsilon_{ist}$$

Results for industry clusters: aggregate exports

Regression for aggregate exports by cluster are in Table 4. Again, these are trade effects with non-member countries.

The results are from a single regression; coefficients read down cluster columns.

The direct IPA and TRIPS policy variables both seem to restrict exports in low-IP goods.

Overall the effects of IPAs and TRIPS at cluster level seem to be insignificant, with exceptions:

- Some evidence of reduced exports by LI countries.
- ICT exports from UMI countries register a positive and significant coefficient (assembly in microelectronics?)
- Exports of biopharmaceuticals from LI and HI countries are stimulated by IPAs.
- TRIPS has this effect in analytical instruments (HI) and chemicals (UMI).

A visual demonstration of IPA results is in Figure 3.

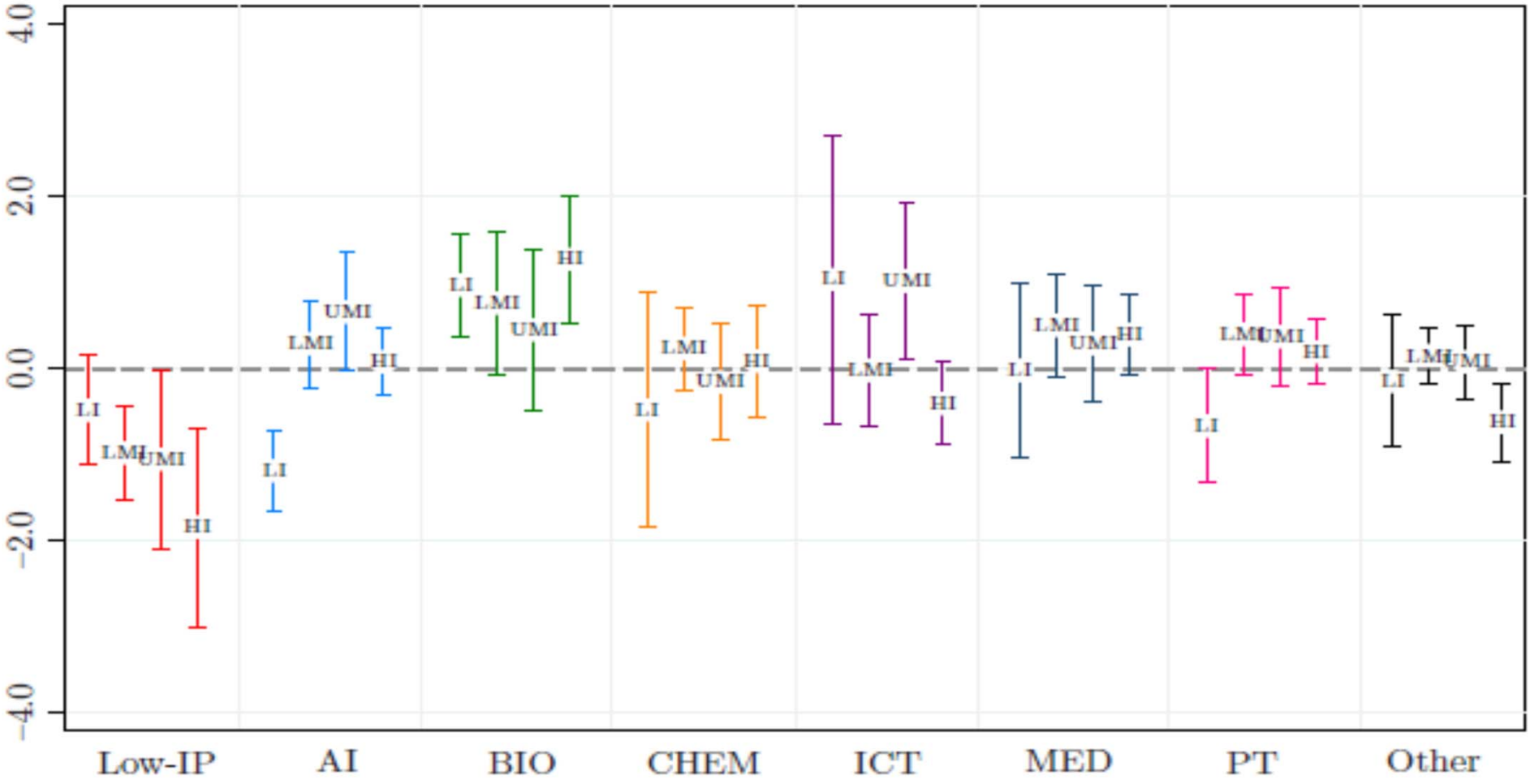
Table 4: Aggregate Exports of High-IP Clusters

	(1) Low-IP	(2) AI	(3) BIO	(4) CHEM	(5) ICT	(6) MED	(7) PT	(8) Other
log(GDP)	0.428***							
	(0.093)							
Sector × log(GDP)		0.138**	0.218***	0.273***	0.154*	0.223***	0.200***	0.168***
		(0.067)	(0.070)	(0.076)	(0.086)	(0.077)	(0.059)	(0.059)
Sector × LI × IPA	–0.481	–1.187***	0.974***	–0.478	1.034	–0.021	–0.663*	–0.147
	(0.324)	(0.234)	(0.302)	(0.690)	(0.852)	(0.513)	(0.339)	(0.389)
Sector × LMI × IPA	–0.979***	0.286	0.762*	0.234	–0.023	0.503*	0.401*	0.150
	(0.274)	(0.256)	(0.422)	(0.243)	(0.328)	(0.300)	(0.239)	(0.160)
Sector × UMI × IPA	–1.052**	0.659*	0.449	–0.156	1.018**	0.291	0.371	0.074
	(0.527)	(0.348)	(0.478)	(0.340)	(0.458)	(0.336)	(0.293)	(0.217)
Sector × HI × IPA	–1.843***	0.077	1.267***	0.088	–0.403	0.394*	0.197	–0.627***
	(0.585)	(0.199)	(0.376)	(0.328)	(0.246)	(0.233)	(0.190)	(0.232)
Sector × LI × TRIPS	–0.104	0.239	0.541	–0.144	0.226	0.161	0.228	0.096
	(0.361)	(0.238)	(0.336)	(0.292)	(0.234)	(0.260)	(0.209)	(0.227)
Sector × LMI × TRIPS	–0.932**	–0.166	0.432	0.267	0.062	0.120	–0.225	–0.215
	(0.375)	(0.171)	(0.363)	(0.260)	(0.276)	(0.275)	(0.184)	(0.178)
Sector × UMI × TRIPS	–1.910**	0.079	0.865**	1.167***	0.301	–0.649	0.208	–0.416
	(0.787)	(0.176)	(0.431)	(0.388)	(0.446)	(0.843)	(0.192)	(0.589)
Sector × HI × TRIPS	0.203	0.662***	–0.392	0.598	0.367	0.347	0.371	0.256
	(0.711)	(0.232)	(0.597)	(0.371)	(0.279)	(0.303)	(0.287)	(0.242)
Observations								27,950
Country trends								Y
Group-sector-year FEs								Y

Notes: The dependent variable is log(Exports), and the estimation method is OLS. Columns (1)–(8) are from a single regression corresponding to equation (4). Robust standard errors clustered by country are reported in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Figure 3: Aggregate Exports of High-IP Clusters

3a: IPA Exporter Effects



Results for industry clusters: aggregate imports

Results are in Table 5.

Again, imports in relatively few clusters/income groups seem to be affected by either IPAs or TRIPS.

AI and PT see reductions in imports in LI and LMI countries within IPAs.

Imports of biopharmaceuticals are sensitive to IPAs in HI countries. This is some evidence of growth in two-way trade due to IPAs.

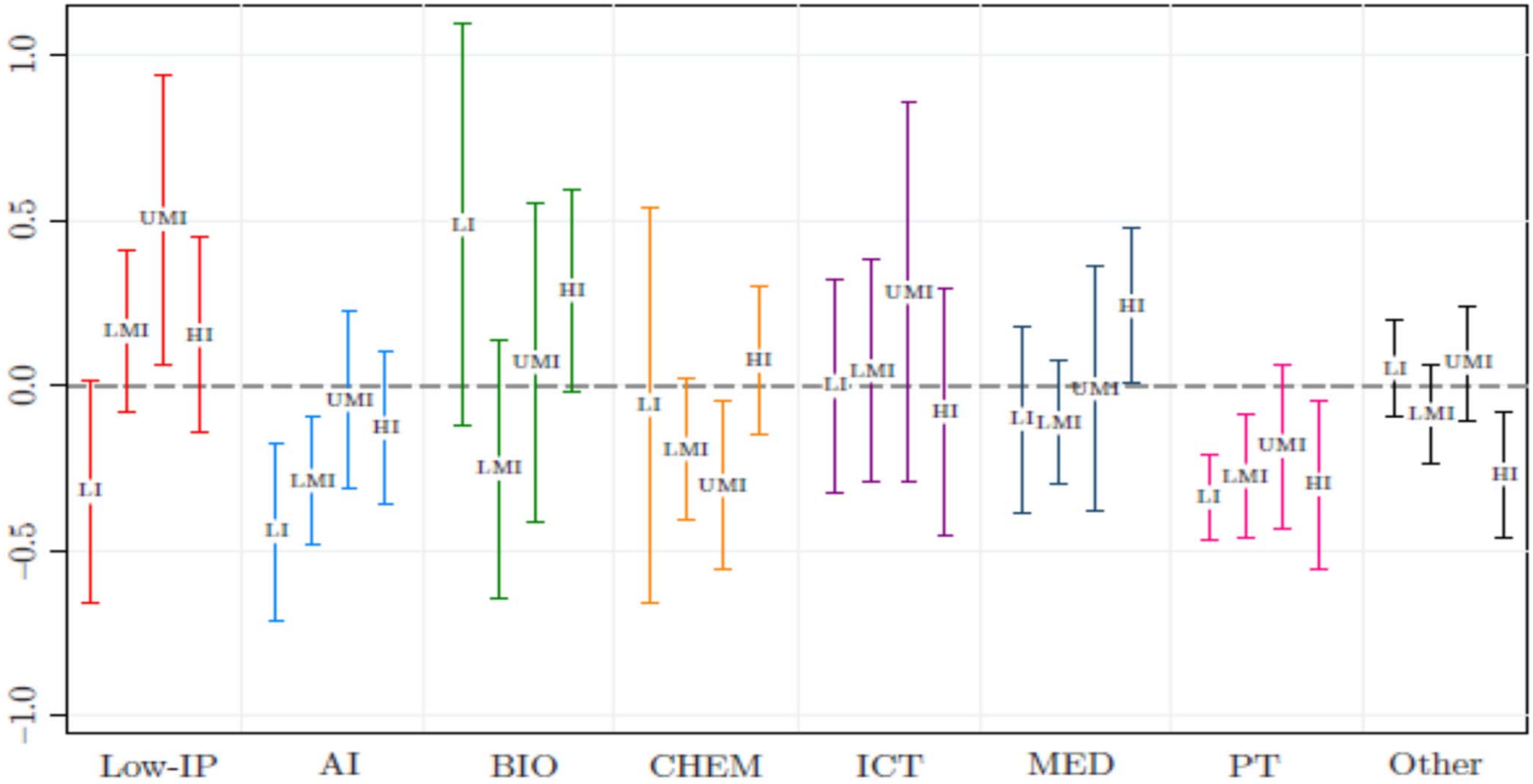
Table 5: Aggregate Imports of High-IP Clusters

	(1) Low-IP	(2) AI	(3) BIO	(4) CHEM	(5) ICT	(6) MED	(7) PT	(8) Other
log(GDP)	0.487***							
	(0.042)							
Sector × log(GDP)		0.195***	0.127***	0.226***	0.132***	0.120***	0.151***	0.047***
		(0.020)	(0.030)	(0.020)	(0.022)	(0.020)	(0.019)	(0.016)
Sector × LI × IPA	–0.321*	–0.441***	0.488	–0.058	–0.001	–0.101	–0.338***	0.053
	(0.171)	(0.136)	(0.309)	(0.304)	(0.163)	(0.144)	(0.067)	(0.075)
Sector × LMI × IPA	0.166	–0.288***	–0.251	–0.192*	0.046	–0.113	–0.274***	–0.088
	(0.125)	(0.097)	(0.198)	(0.110)	(0.170)	(0.095)	(0.094)	(0.076)
Sector × UMI × IPA	0.504**	–0.043	0.072	–0.302**	0.284	–0.009	–0.184	0.069
	(0.224)	(0.135)	(0.245)	(0.130)	(0.292)	(0.189)	(0.127)	(0.088)
Sector × HI × IPA	0.154	–0.128	0.290*	0.075	–0.079	0.242**	–0.300**	–0.268***
	(0.151)	(0.117)	(0.155)	(0.113)	(0.189)	(0.120)	(0.128)	(0.097)
Sector × LI × TRIPS	0.095	0.044	–0.182	0.165*	0.065	–0.152	0.091	0.072
	(0.115)	(0.129)	(0.144)	(0.099)	(0.120)	(0.135)	(0.103)	(0.081)
Sector × LMI × TRIPS	0.036	–0.220**	–0.154	0.147	0.155	–0.219**	–0.280***	–0.054
	(0.098)	(0.100)	(0.147)	(0.093)	(0.113)	(0.087)	(0.091)	(0.062)
Sector × UMI × TRIPS	–0.008	0.057	0.033	0.075	0.435***	0.071	–0.291***	–0.023
	(0.101)	(0.142)	(0.157)	(0.173)	(0.158)	(0.132)	(0.103)	(0.134)
Sector × HI × TRIPS	–0.167	0.291**	–0.225	0.033	0.144	0.161	0.024	0.035
	(0.171)	(0.144)	(0.197)	(0.193)	(0.189)	(0.138)	(0.148)	(0.119)
Observations								28,528
Country trends								Y
Group-sector-year FEs								Y

Notes: The dependent variable is log(Imports), and the estimation method is OLS. Columns (1)–(8) are from a single regression corresponding to equation (4). Robust standard errors clustered by country are reported in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Figure 4: Aggregate Imports of High-IP Clusters

4a: IPA Importer Effects



Bilateral exporter, importer effects

We also estimate these cluster regressions incorporating bilateral trade with non-member countries for low-IP goods and high-IP industry clusters. Imports and exports are together in one large regression in which we incorporate exporter-importer pair fixed effects.

The GDP's of both partners included, making this a gravity specification.

Export outcomes (first part of Table 6) are consistent with prior findings but considerably more precisely estimated:

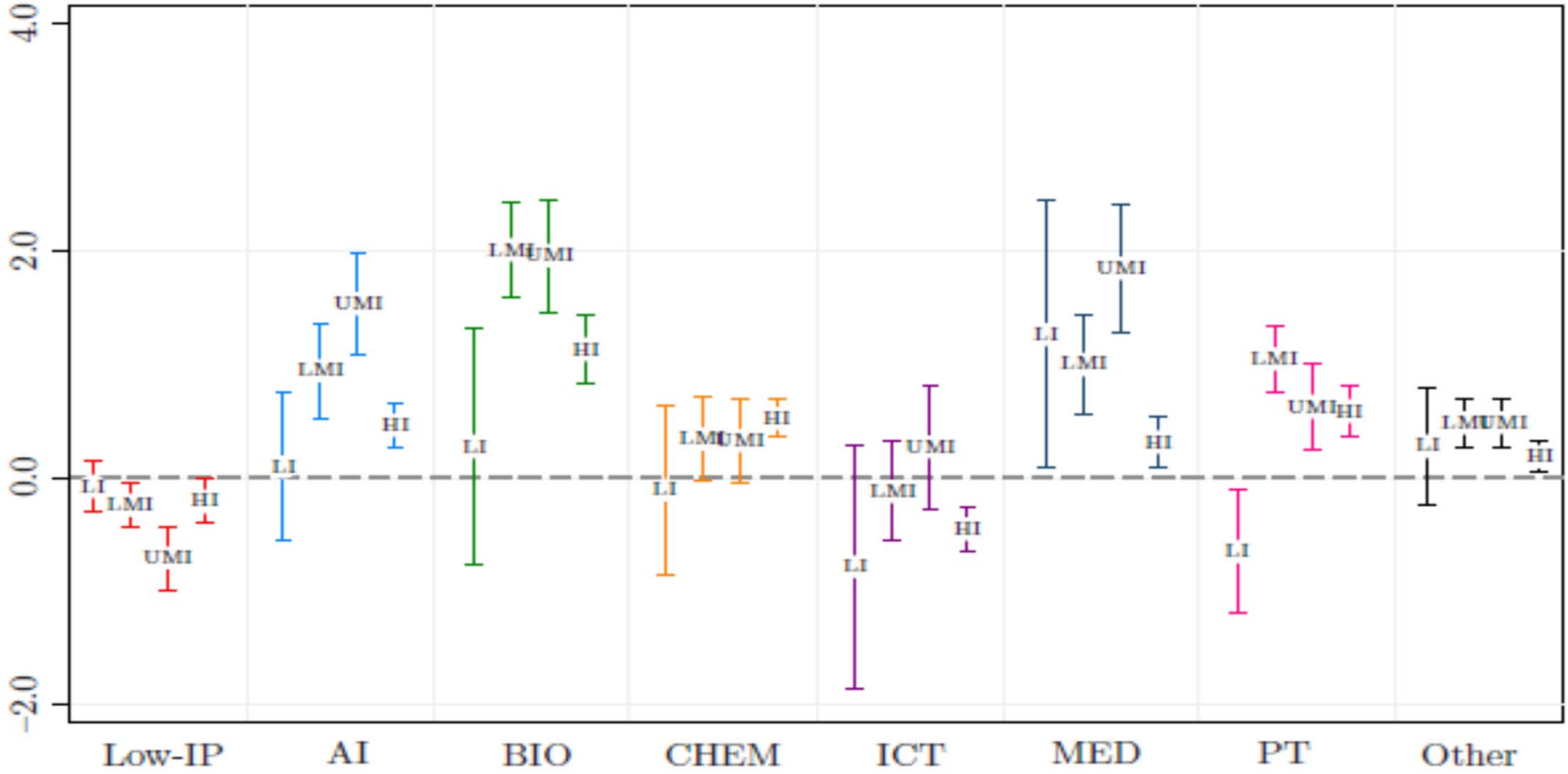
- Both IPA membership and TRIPS compliance diminish low-IP exports in nearly all income groups.
- IPAs generate significant increases in exports of AI, BIO, MED, and PT in LMI, UMI, and HI countries.
- The increases in BIO exports from HI countries seems to be a consistent and robust outcome.
- TRIPS has similar effects and also encourages CHEM and ICT exports from emerging countries.

Table 6: Bilateral Exports and Imports of High-IP Clusters

	(1) Low-IP	(2) AI	(3) BIO	(4) CHEM	(5) ICT	(6) MED	(7) PT	(8) Other
Exporter effects								
log(GDP)	0.124***							
	(0.036)							
Sector × log(GDP)		0.610***	0.362***	0.405***	0.282***	0.623***	0.532***	0.383***
		(0.043)	(0.065)	(0.039)	(0.039)	(0.055)	(0.038)	(0.032)
Sector × LI × IPA	–0.079	0.092	0.272	–0.113	–0.791	1.260**	–0.655**	0.274
	(0.111)	(0.334)	(0.532)	(0.383)	(0.546)	(0.602)	(0.279)	(0.264)
Sector × LMI × IPA	–0.246**	0.939***	2.007***	0.338*	–0.121	0.995***	1.045***	0.482***
	(0.099)	(0.215)	(0.211)	(0.186)	(0.221)	(0.224)	(0.150)	(0.108)
Sector × UMI × IPA	–0.716***	1.534***	1.952***	0.325*	0.271	1.844***	0.624***	0.485***
	(0.146)	(0.230)	(0.254)	(0.186)	(0.279)	(0.288)	(0.193)	(0.110)
Sector × HI × IPA	–0.212**	0.461***	1.131***	0.523***	–0.453***	0.313***	0.586***	0.181**
	(0.099)	(0.099)	(0.158)	(0.086)	(0.098)	(0.116)	(0.113)	(0.072)
Sector × LI × TRIPS	–0.319***	0.380**	–0.469*	–0.216	1.698***	–0.493**	0.146	0.223*
	(0.078)	(0.167)	(0.283)	(0.183)	(0.160)	(0.207)	(0.157)	(0.120)
Sector × LMI × TRIPS	–0.559***	0.985***	1.227***	0.875***	2.812***	2.137***	1.207***	1.066***
	(0.083)	(0.289)	(0.254)	(0.223)	(0.180)	(0.253)	(0.201)	(0.147)
Sector × UMI × TRIPS	–0.489***	1.273***	1.451***	1.341***	1.624***	1.310***	1.732***	0.773***
	(0.077)	(0.252)	(0.229)	(0.173)	(0.198)	(0.224)	(0.173)	(0.145)
Sector × HI × TRIPS	0.432***	0.166	0.360*	0.149	–0.065	0.566***	0.376***	0.219***
	(0.102)	(0.134)	(0.191)	(0.108)	(0.116)	(0.197)	(0.113)	(0.071)
			⋮					

Figure 5: Bilateral Exports of High-IP Clusters

5a: IPA Exporter Effects



Bilateral exporter, importer effects

Importer coefficients are in Table 6, continued.

IPA membership expands imports from non-member countries in some high-IP goods and reduces them in others, depending on the income groups.

It is interesting that BIO, CHEM, and MED imports in LI countries rise significantly but ICT imports fall. ICT imports into UMI countries rise.

TRIPS seems to expand imports of CHEM and ICT in emerging countries.

These cluster results indicate that the earlier findings on aggregate trade masked the effects on more detailed sectors.

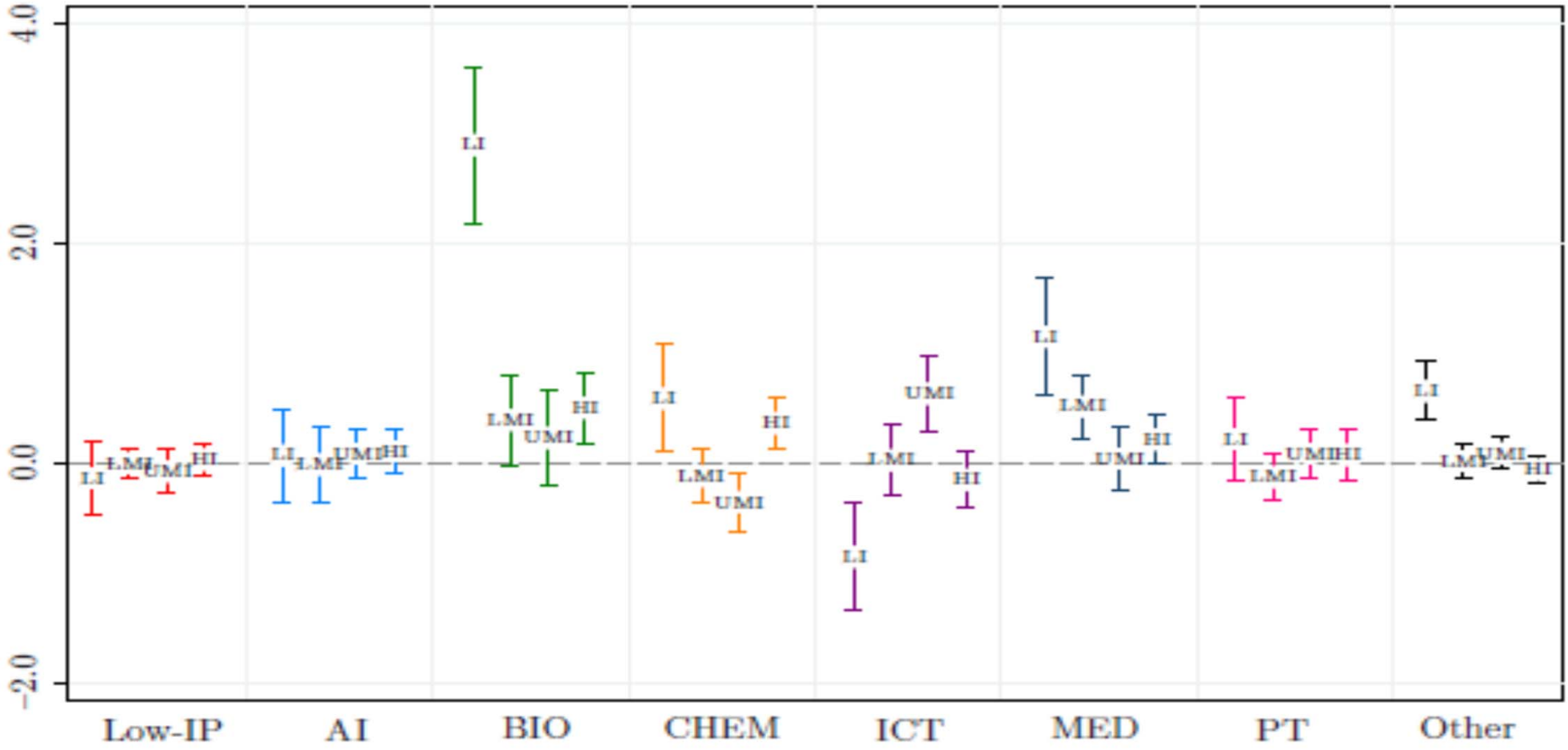
Table 6 (continued)

	(1) Low-IP	(2) AI	(3) BIO	(4) CHEM	(5) ICT	(6) MED	(7) PT	(8) Other
Importer effects								
log(GDP)	0.527***							
	(0.032)							
Sector × log(GDP)		0.142***	0.146***	0.070**	–0.046	0.159***	0.079**	0.032
		(0.033)	(0.045)	(0.028)	(0.053)	(0.038)	(0.033)	(0.030)
Sector × LI × IPA	–0.139	0.065	2.893***	0.585**	–0.858***	1.147***	0.213	0.652***
	(0.168)	(0.218)	(0.365)	(0.250)	(0.248)	(0.273)	(0.190)	(0.136)
Sector × LMI × IPA	–0.004	–0.018	0.388*	–0.123	0.022	0.511***	–0.132	0.017
	(0.068)	(0.175)	(0.211)	(0.127)	(0.162)	(0.150)	(0.105)	(0.080)
Sector × UMI × IPA	–0.082	0.080	0.225	–0.358***	0.629***	0.037	0.082	0.086
	(0.102)	(0.110)	(0.218)	(0.137)	(0.174)	(0.149)	(0.113)	(0.076)
Sector × HI × IPA	0.027	0.102	0.498***	0.358***	–0.155	0.211*	0.069	–0.063
	(0.079)	(0.104)	(0.166)	(0.116)	(0.127)	(0.115)	(0.121)	(0.063)
Sector × LI × TRIPS	0.207*	0.078	–1.414***	0.213*	1.376***	–0.501***	0.144	0.094
	(0.106)	(0.137)	(0.271)	(0.129)	(0.175)	(0.160)	(0.147)	(0.089)
Sector × LMI × TRIPS	0.141**	–0.064	–0.331**	0.309***	0.455***	–0.478***	–0.290***	–0.157***
	(0.058)	(0.120)	(0.161)	(0.070)	(0.131)	(0.108)	(0.081)	(0.050)
Sector × UMI × TRIPS	–0.171**	0.251***	–0.019	0.312***	0.526***	–0.018	0.025	–0.018
	(0.078)	(0.078)	(0.156)	(0.088)	(0.125)	(0.122)	(0.058)	(0.046)
Sector × HI × TRIPS	0.052	–0.022	0.150	–0.197**	0.162	0.428***	–0.259**	–0.023
	(0.095)	(0.114)	(0.145)	(0.099)	(0.141)	(0.107)	(0.113)	(0.066)
Observations								4,220,144
Country trends								Y
Group-sector-year FEs								Y
Pair FEs								Y

Notes: The dependent variable is the value of unidirectional bilateral trade by sector, and the estimation method is PPML. Columns (1)–(8) present coefficients from the same regression corresponding to equation (5). Robust standard errors clustered by bilateral pair are reported in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Figure 6: Bilateral Imports of High-IP Clusters

6a: IPA Importer Effects



Economic significance

To give some sense of the magnitudes of trade changes estimated by this approach, Table 8 shows the implied changes in the bilateral regressions for low-IP, AI, BIO, and MED.

Statistically significant impacts are in bold.

The implied impacts are large relative to average existing bilateral exports from IPA members to non-members, and from TRIPS.

Table 8: Implied Economic Magnitudes of Bilateral Trade Effects (Thousand USD)

		(1) Low–IP	(2) AI	(3) BIO	(4) MED
Panel A: Exports					
IPA	LI	−4766.25	36.36	227.50	**1213.91**
		−12.28%	9.64%	31.26%	**252.54%**
	LMI	**−12641.57**	**335.52**	**2976.85**	**536.88**
		−23.28%	**155.74%**	**644.10%**	**170.47%**
	UMI	**−47846.35**	**3952.61**	**9112.00**	**5599.48**
		−52.67%	**363.67%**	**604.28%**	**532.18%**
	HI	**−35262.13**	**4632.38**	**58338.36**	**3643.64**
		−19.91%	**58.57%**	**209.88%**	**36.75%**
TRIPS	LI	**−10003.53**	**174.44**	−272.47	**−187.08**
		−25.77%	**46.23%**	−37.44%	**−38.92%**
	LMI	**−23315.92**	**361.46**	**1114.30**	**2353.84**
		−42.94%	**167.78%**	**241.10%**	**747.40%**
	UMI	**−35079.10**	**2794.94**	**4926.95**	**2847.39**
		−38.61%	**257.16%**	**326.74%**	**270.62%**
	HI	**100938.11**	1428.28	**12045.11**	**7546.68**
		56.99%	18.06%	**43.33%**	**76.12%**

Conclusions and extensions

The economic effects of the proliferation of IP-related PTAs since 1990s have not been systematically studied.

These results stand out from our analysis.

1. With aggregate data there is evidence of a sorting effect of IPAs: exports fall in low-IP goods but rise in high-IP goods. TRIPS has similar effects.

2. There are notable impacts in specific high-IP sectors, especially with analysis of bilateral trade.
   - The sorting effect in exports remains: low-IP industries see diminished exports.
   - IPAs expand third-party exports of AI, BIO, MED, and PT. TRIPS does also and adds CHEM and ICT from emerging countries.
   - Effects on third-country imports are less systematic but they expand significantly in BIO, MED and ICT. These sectors are those with the strongest IPR provisions in IPAs.

We therefore find that IPRs in IP-related PTAs are “trade related” in this limited but important context.

Conclusions and extensions

Potential directions for additional research.

Distinguish between final goods and intermediate goods within supply chains.

Extend bilateral analysis to a consideration of whether IPAs have differential effects on trade creation versus trade diversion (recall the discriminatory nature of tariff cuts versus MFN nature of IPRs.)

Try to incorporate measures of channels through which IPAs may be operating on trade. One example: are tariff cuts and IPRs standards interrelated in such agreements?

Bring in detailed bilateral patents data to study potential innovation impacts.