

The Impacts of IP-Related Trade Agreements on Bilateral Patent Applications

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Introduction

IPRs are inherently trade-related, as shown in many prior studies.

- Protection for knowledge assets – through patents, copyright and related rights, trademarks, etc. – govern the costs and benefits faced by rights holders in international commerce.
- Beyond trade, other forms of technology transfer, including FDI, licensing, and patenting, are related to the protection of intellectual property in different countries.

A primary policy objective of the United States, followed later by the European Union (EU) and members of the European Free Trade Association (EFTA), (and increasingly others, such as Japan and the Republic of Korea), has been to induce stronger standards in developing and emerging countries for protecting IPRs.

A primary channel for such upgrades is the increasingly comprehensive treatment of IPRs in preferential trade agreements (PTAs).

- We consider in this paper the impacts on bilateral patenting flows of deeply IP-Related PTAs, which we call IPAs.
- We distinguish between flows among IPA member countries versus applications coming into member countries from non-members.
- Estimated for total patent applications and those in high-IP industry clusters.

Increasing focus over time on IPRs in PTAs; moving to TRIPS-Plus IPAs

US-Israel (1985): Single paragraph mentioning national treatment and MFN;

NAFTA (1994): the precursor to TRIPS;

US-Jordan (2001): Elevated patent standards, pharmaceutical test data protection, copyrights for digital goods;

US-Chile (2004): Regularized test-data protection periods, required plant variety patentability.

US-Australia (2005): Further pharmaceutical protections, linkage rules, limits on copyright exceptions.

US-Korea (2012): further limits on copyright exceptions, patents for new uses, extensive enforcement.

Original TPP: biologics test-data protection, trade-secrets obligations, criminal enforcement requirements, much of it retained in CPTPP.

EU agreements: increasing emphasis on IP issues, including TRIPS-Plus.

Prior literature

IP reforms expand trade in high-technology goods:

- Ivus, JIE 2010.
- Delgado, et al J Ind Econ 2013.
- Maskus and Yang, CJE 2018.

Trade agreements with enforceable IP chapters expand trade:

- Campi and Duenas, Res Policy 2019.
- Maskus and Ridley, World Bank 2021.

Trade and patent flows are correlated:

- Brunel and Zylkin, CJE 2022.
- De Rassenfosse, et al, working paper 2020.

Membership in international IP treaties encourages international patenting:

- Coleman, working paper 2022.

Figure 1: The Number of Legally Enforceable IP-Related Trade Agreements and Number of Countries with Membership in at least One such Agreement by Year, 1990–2015

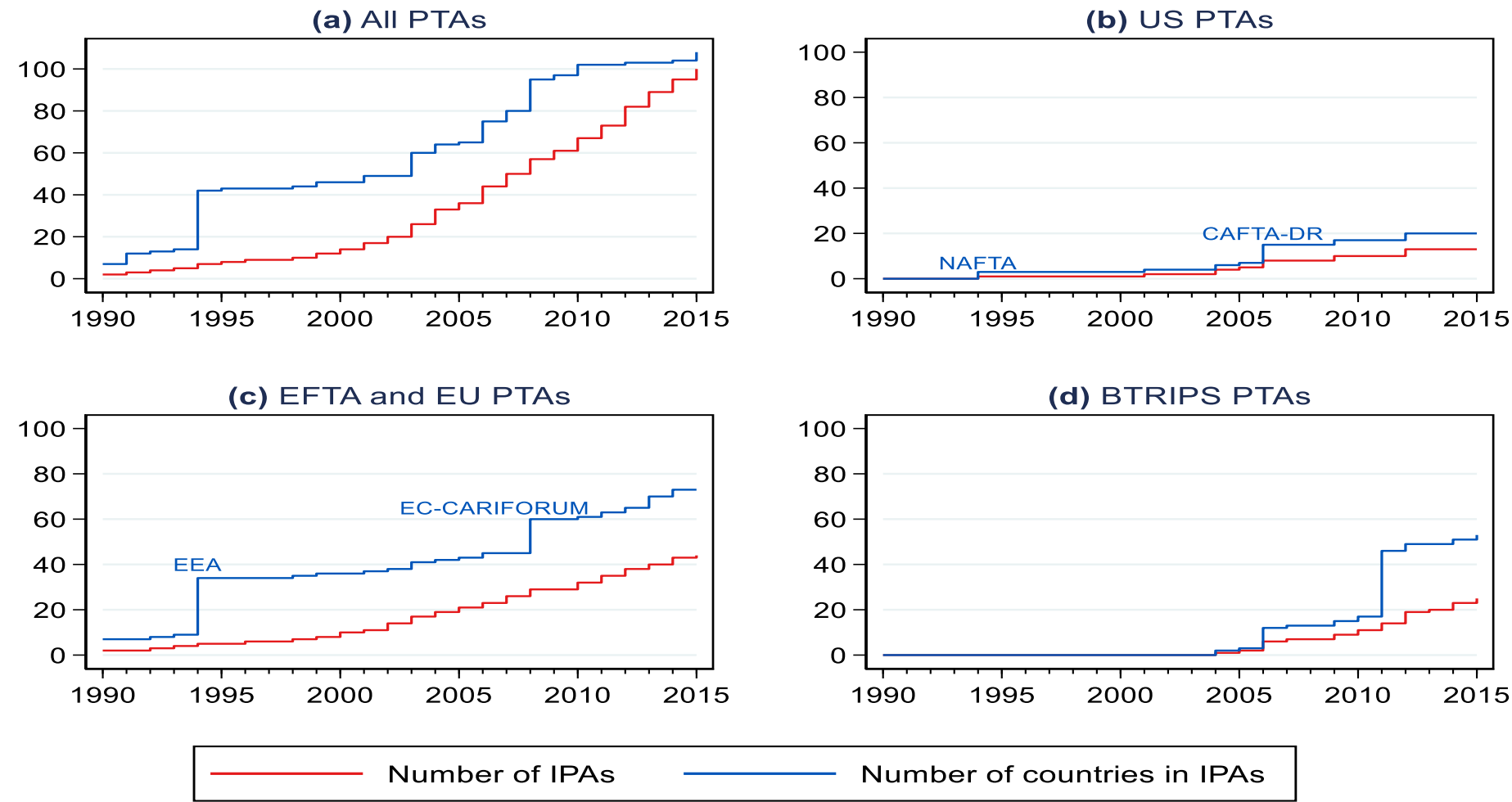


Table 1: Summary of IPRs Provisions in Legally Enforceable IP-Related PTAs as of 2015

| Panel A: all IPR provisions as of 2015 | <u>US LE IPAs (13)</u> | | | <u>EU/EFTA LE IPAs (45)</u> | | | <u>Other LE IPAs (42)</u> | | |
|---|-------------------------------|-----|-----|------------------------------------|-----|-----|----------------------------------|-----|-----|
| | Avg | Min | Max | Avg | Min | Max | Avg | Min | Max |
| Accession/Ratification (n = 15) | 11.5 | 2 | 14 | 3.3 | 0 | 13 | 2.0 | 0 | 13 |
| National Treatment (n = 2) | 2.0 | 2 | 2 | 0.9 | 0 | 2 | 0.6 | 0 | 2 |
| Trademarks (n = 15) | 9.4 | 4 | 15 | 1.6 | 0 | 7 | 1.5 | 0 | 11 |
| Geographical Indications (n = 7) | 2.6 | 0 | 4 | 2.0 | 0 | 7 | 0.7 | 0 | 3 |
| Patents (n = 14) | 4.8 | 1 | 13 | 1.0 | 0 | 3 | 0.7 | 0 | 10 |
| Data Protection (n = 5) | 2.8 | 0 | 5 | 0.9 | 0 | 2 | 0.1 | 0 | 5 |
| Copyrights (n = 14) | 10.5 | 4 | 14 | 2.0 | 0 | 12 | 1.9 | 0 | 12 |
| Enforcement (n = 23) | 17.2 | 4 | 20 | 7.6 | 0 | 17 | 4.8 | 0 | 17 |

| Panel B: BTRIPS provisions as of 2015 | <u>US LE IPAs (13)</u> | | | <u>EU/EFTA LE IPAs (45)</u> | | | <u>Other LE IPAs (42)</u> | | |
|--|-------------------------------|-----|-----|------------------------------------|-----|-----|----------------------------------|-----|-----|
| | Avg | Min | Max | Avg | Min | Max | Avg | Min | Max |
| Trademarks (n = 4) | 2.3 | 2 | 4 | 0.2 | 0 | 2 | 0.4 | 0 | 4 |
| Geographical Indications (n = 3) | 0.9 | 0 | 1 | 0.8 | 0 | 3 | 0.3 | 0 | 2 |
| Patents (n = 5) | 1.2 | 0 | 4 | 0.4 | 0 | 1 | 0.2 | 0 | 3 |
| Data Protection (n = 5) | 2.8 | 0 | 5 | 0.9 | 0 | 2 | 0.1 | 0 | 5 |
| Copyrights (n = 6) | 5.6 | 1 | 6 | 1.0 | 0 | 6 | 0.8 | 0 | 6 |
| Enforcement (n = 10) | 7.1 | 1 | 9 | 3.1 | 0 | 7 | 2.0 | 0 | 7 |

Data sources

Patent applications

Universe of bilateral patent filings from source countries to destination (patent office) countries, taken from PATSTAT database (187 identified sources, 82 identified destinations).

- Sample period 1995-2015.
- All patent destinations in a family are counted as applications.
- Those listed in PCT and EPO filings are counted only in ultimate destinations.
- Domestic (within-country) filings are included to support accuracy of the gravity estimates.

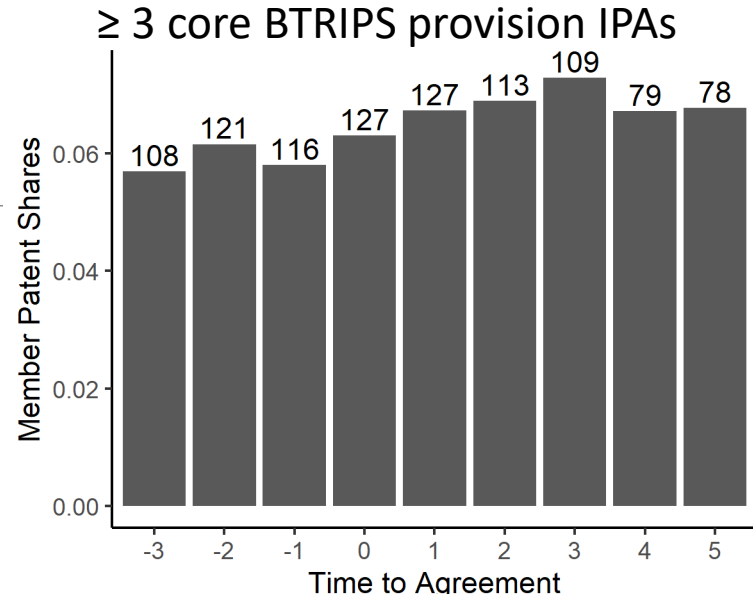
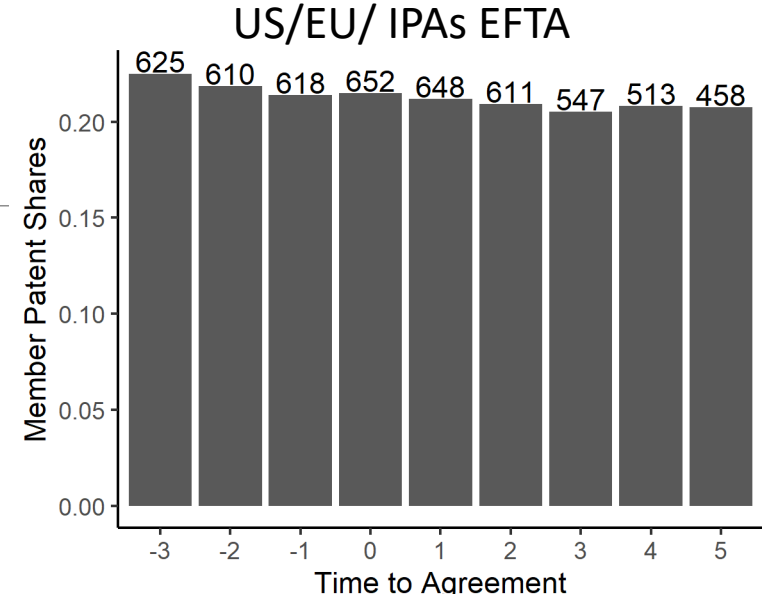
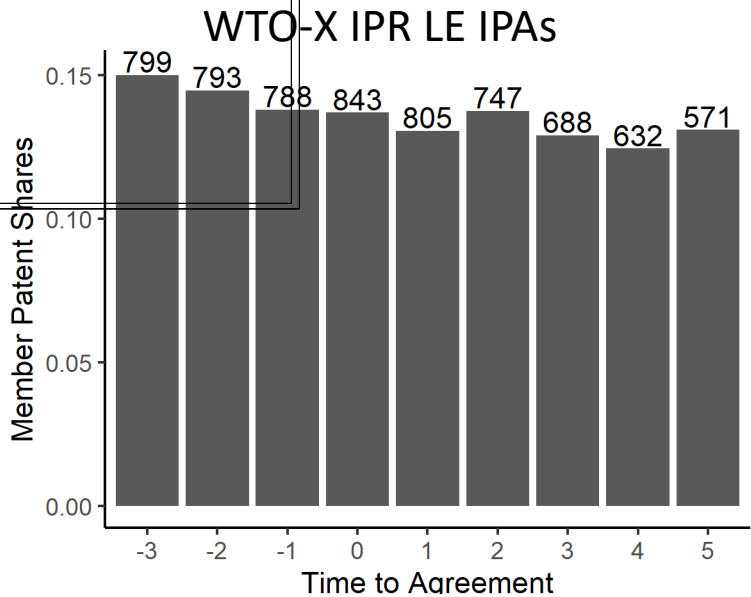
IP-intensive industry clusters

Definitions of these clusters are analogous to those in Delgado, et al (2013) used for analyzing trade effects. They are adjusted here to NAICS industries designated by US Department of Commerce (2012) as above-mean patenting sectors.

Clusters include analytical instruments (AI), biopharmaceuticals (BIO), chemicals (CHEM), information and communication technologies (ICT), medical devices (MED), production technology (PT), and a group of other patent-sensitive sectors (OTHER).

Figure 2. Evolution of Patent Application Shares before and after IPA Implementation

Agreement Member Flows



Agreement Non-Member Flows

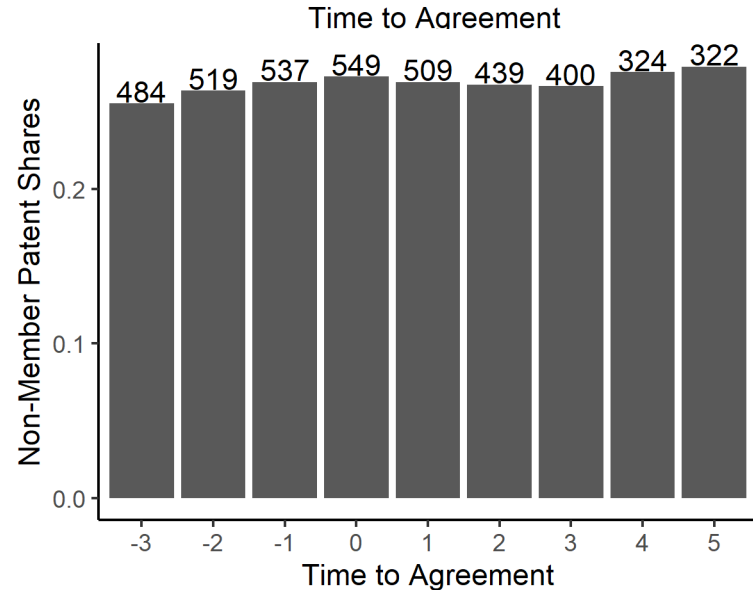
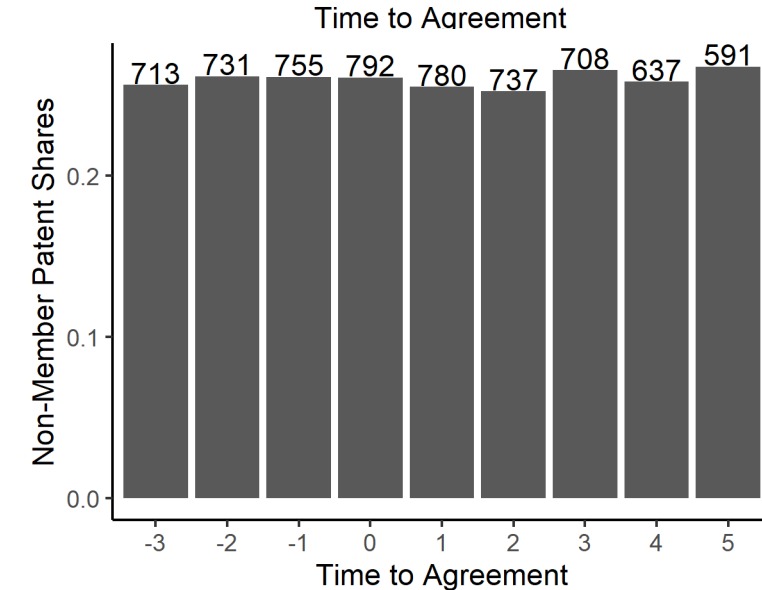
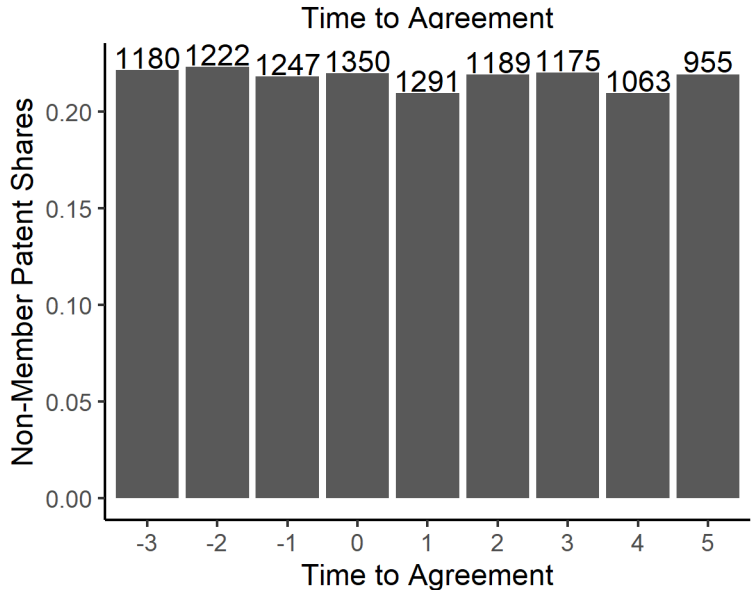
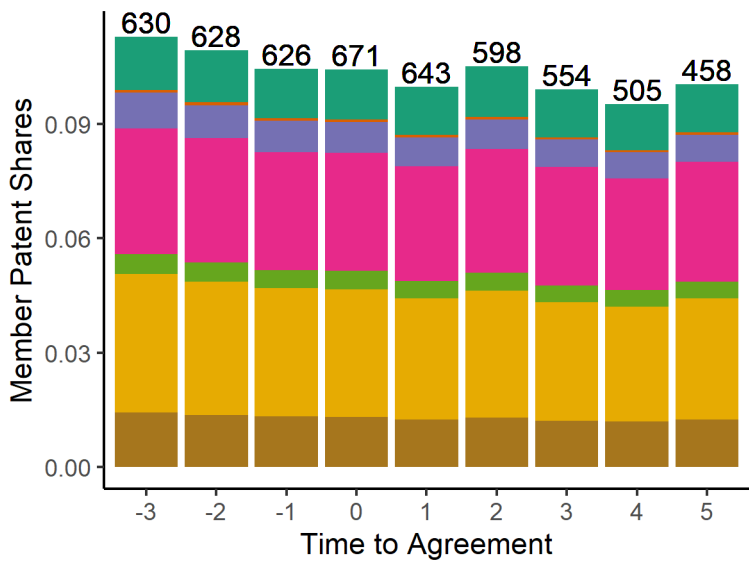


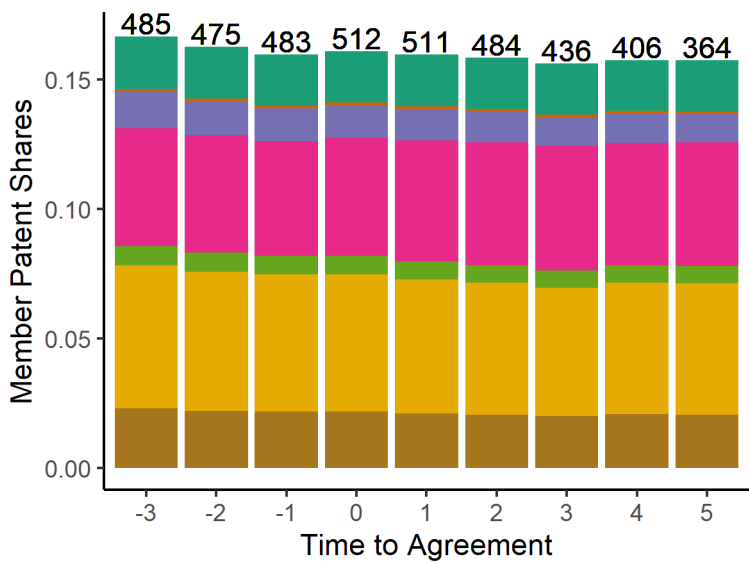
Figure 3. Evolution of Patent Application Shares before and after IPA Implementation by High-IP Clusters

Agreement Member Flows

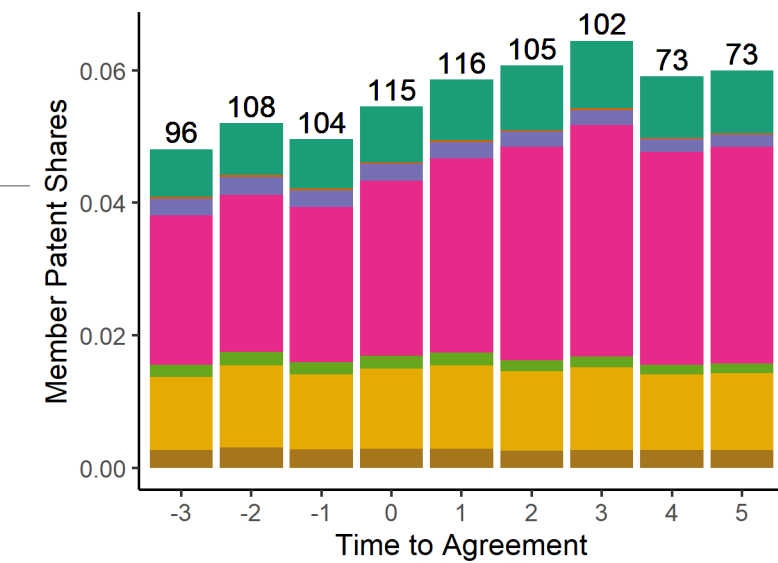
WTO-X IPR LE IPAs



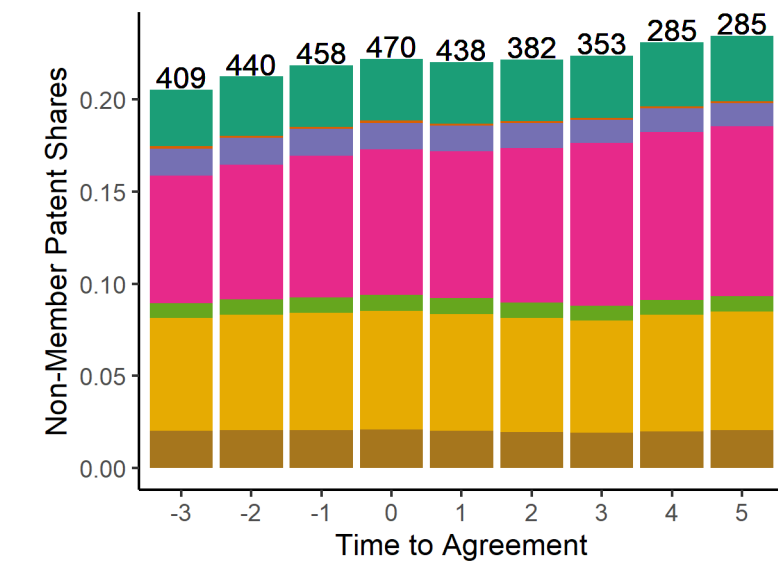
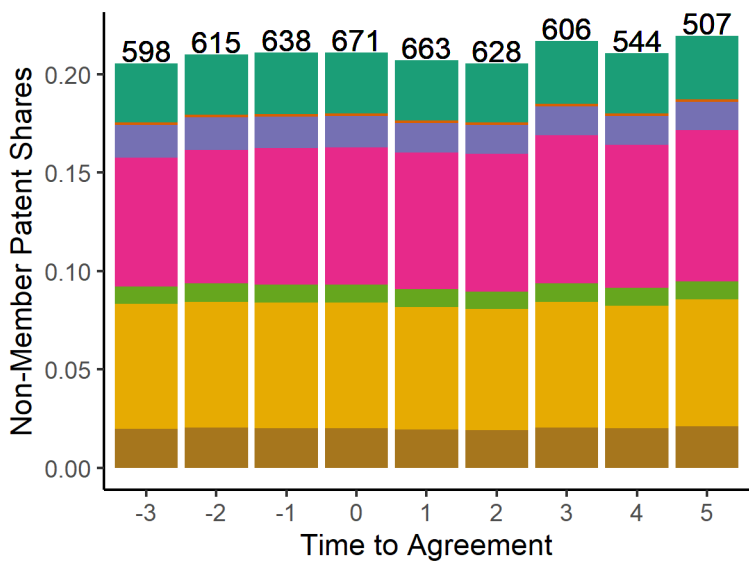
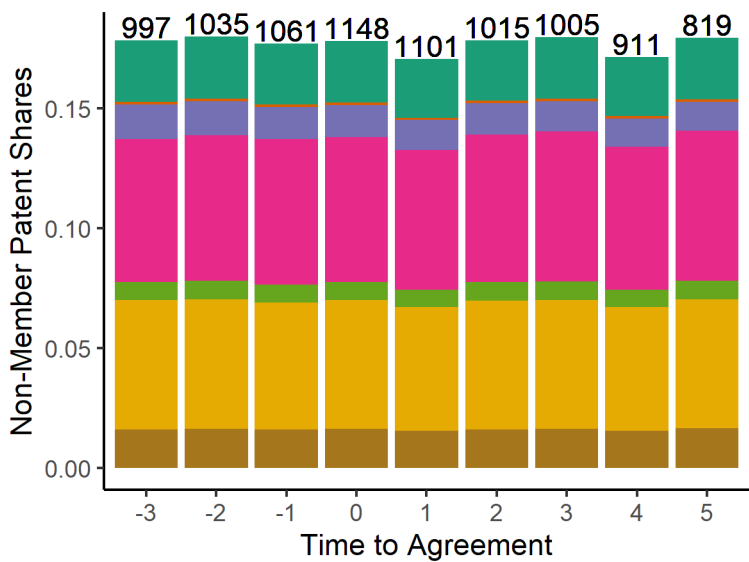
US/EU/ IPAs EFTA



≥ 3 core BTRIPS provision IPAs



Agreement Non-Member Flows



(flows in thousands)

Econometric approach

In a gravity framework, estimate the impacts of the formation of strong IPAs on bilateral patent applications:

- Bilaterally between member countries (both i and j are in the same IPA(s);
- Bilaterally from non-member sources to within-IPA destinations;
- Include domestic applications to avoid biasing international coefficients.

Candidate choices of “strong” IPAs:

- Those with IPR norms that are considered enforceable in the World Bank database (WTO-X IPR LE IPAs);
- Those with primary *demandeur* countries, the US and EU/EFTA (US/EU/EFTA IPAs);
- Those with at least 3 of the core TRIPS Plus provisions (Three or More Core TRIPS Plus Provisions IPAs).

Table A2. List of TRIPS-Plus (“BTRIPS”) Provisions in the World Bank Database

Core BTRIPS (18):

| | | | |
|----|--|-----|--|
| 59 | Stipulates the scope of protection for a GI | 101 | Requires protection against persons seeking to circumvent technological protection measures |
| 66 | Requires patent be made available for new uses of a known product | 102 | Requires protection against persons altering rights management information |
| 67 | Requires patent be made available for new methods of a known product | 103 | Requires protection against persons who distribute, import, make available product with altered rights management info |
| 68 | Requires patent be made available for new processes of a known product | 112 | Stipulates that judicial authorities shall have authority to order injunctive relief |
| 75 | Requires patent term adjustment be given for unreasonable delays by granting authority | 124 | Requires parties to provide for criminal procedures & penalties for willful TM counterfeiting on a commercial scale |
| 77 | Includes rules governing patent linkage | 125 | Requires parties to provide for criminal procedures & penalties for willful copyright or related rights piracy on a commercial scale |
| 80 | Provides minimum term of protection for undisclosed test or other data for a new agricultural chemical | 126 | Requires parties to provide for criminal procedures & penalties for unauthorized disclosure/misappropriation of a trade secret |
| 81 | Provides minimum term of protection for undisclosed test or other data for a new pharmaceutical product | 127 | Requires parties to make it a criminal offense to unlawfully decode an encrypted program-carrying satellite signal |
| 83 | Provides minimum term of protection for undisclosed test or other data for a pharmaceutical product containing a chemical entity not previously approved by either party | | |
| 84 | Provides minimum term of protection for undisclosed test or other data for a new pharmaceutical product that is or contains a biologic | | |

Econometric approach -Structural Gravity

$$\text{Patents}_{ijt} = \exp[\beta_1 \text{Intra}_{ijt} + \beta_2 \text{Extra}_{ijt} + \gamma_{it} + \delta_{jt} + \eta_{ij} + \varepsilon_{ijt}]$$

Patents measures annual flows of patent applications from i to j .

Intra = 1 if i and j are both in an IPA of a particular type.

Extra = 1 if i is not in an IPA type to which j belongs.

β_1 measures the average effect of joint membership on within-agreement patents.

β_2 measures the average effect on external patenting in the IPA type.

Specification includes *origin-year*, *destination-year*, and *country-pair* fixed effects

- These control for time-varying country characteristics (e.g., size), bilateral long-run characteristics.
- Also control for multilateral resistance factors. Mitigate concerns over endogenous selection into IPAs.

The error terms incorporate two-way clustering (destination and source countries).

Regressions are estimated with PPML.

IP-cluster specification

TRIPS-Plus provisions are often focused on certain sectors, such as BIO, MED, and ICT.

We wish to estimate a structural gravity model across all sectors, permitting individual cluster coefficients:

$$\text{Patents}_{ijst} = \exp \left[\sum_s \beta_1^s \text{Sector}_s \times \text{Intra}_{ijt} + \sum_s \beta_2^s \text{Sector}_s \times \text{Extra}_{ijt} + \gamma_{ist} + \delta_{jst} + \eta_{ijs} + \varepsilon_{ijst} \right]$$

Sector is a dummy for a particular cluster, including an additional grouping of low-IP industries for comparison purposes.

We now incorporate origin-year-sector, destination-year-sector, and country pair-sector fixed effects.

Results: total applications

In the total bilateral patenting equations an interesting pattern emerges:

- The WTO LE and US/EU/EFTA IPAs have positive but insignificant impacts on within-IPA patenting.
- However, there are positive and highly significant effects on applications from outside the IPAs in those types of agreements. The coefficients translate into an increase of 16.5% for WTO LE IPAs and 22.2% for US/EU/EFTA IPAs.
- Thus, there is little indication of any diversion effects associated with these IPA types. Instead, they encourage external patent applications.
- In contrast, the TRIPS Plus IPAs considerably strengthen within-agreement patent flows, with no impact on external applications.

Table 4: Impacts of IPAs on Bilateral Patent Applications

| | (1) | (2) | (3) |
|-----------------------|---------------------|---------------------|----------------------------------|
| | WTO-X IPR LE IPAs | US/EU/EFTA IPAs | 3 or more BTRIPS Provisions IPAs |
| Intra _{ijt} | 0.111 (0.146) | 0.053 (0.157) | 0.279*** (0.068) |
| Extra _{ijt} | 0.153*** (0.042) | 0.201*** (0.063) | 0.079 (0.099) |
| Observations | 110,264 | 110,264 | 110,264 |
| Origin-year FEs | Y | Y | Y |
| Destination-year FEs | Y | Y | Y |
| Pair FEs | Y | Y | Y |
| Pseudo R ² | 0.997 | 0.997 | 0.997 |

Notes: Dependent variable is total bilateral patent flows between origin and destination countries. Estimation method is PPML. Robust standard errors two-way clustered by origin and destination reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1

Results: IP-cluster applications

The same pattern exists at the cluster level:

- The first two IPA types encourage patent flows from outside the agreement and have little effect on within-agreement flows, though both applications are expanded in ICT.
- The core TRIPS-Plus IPAs encourage within-IPA patents far more than external patents, with highly significant effects.

Impacts of IPAs on Sectoral Applications

| | (1) Low-IP | (2) AI | (3) BIO | (4) CHEM | (5) ICT | (6) MED | (7) PT | (8) Other |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Panel A: WTO-X IPR LE IPAs | | | | | | | | |
| Sector × Intra _{ij} | 0.079 (0.141) | 0.063 (0.141) | 0.068 (0.098) | 0.113 (0.092) | 0.330*** (0.121) | 0.247* (0.139) | -0.026 (0.169) | 0.036 (0.159) |
| Sector × Extra _{ijt} | 0.173** (0.068) | 0.048 (0.056) | 0.120** (0.050) | 0.140*** (0.054) | 0.268*** (0.061) | 0.202*** (0.047) | 0.092* (0.052) | 0.088** (0.036) |
| | Low-IP | AI | BIO | CHEM | ICT | MED | PT | Other |
| Panel B: US/EU/EFTA IPAs | | | | | | | | |
| Sector × Intra _{ij} | -0.007 (0.152) | -0.019 (0.155) | 0.105 (0.132) | 0.106 (0.124) | 0.235 (0.165) | 0.223 (0.173) | -0.036 (0.181) | -0.022 (0.166) |
| Sector × Extra _{ijt} | 0.138* (0.073) | 0.141*** (0.047) | 0.191*** (0.070) | 0.156* (0.095) | 0.412*** (0.093) | 0.233*** (0.053) | 0.113*** (0.042) | 0.119** (0.055) |
| | Low-IP | AI | BIO | CHEM | ICT | MED | PT | Other |
| Panel C: Three or more BTRIPS provisions IPAs | | | | | | | | |
| Sector × Intra _{ij} | 0.239*** (0.068) | 0.284*** (0.077) | 0.260*** (0.067) | 0.230*** (0.063) | 0.433*** (0.063) | 0.418*** (0.087) | 0.177* (0.090) | 0.277*** (0.072) |
| Sector × Extra _{ijt} | 0.102 (0.117) | 0.027 (0.081) | 0.157* (0.090) | 0.118 (0.076) | 0.211*** (0.079) | 0.124 (0.121) | -0.011 (0.123) | 0.028 (0.096) |

Notes: The dependent variable in each specification is total bilateral patent flows between origin and destination countries by industry cluster. Each specification includes origin-cluster-year, destination-cluster-year, and country-pair-sector fixed effects. Estimation method is PPML. Robust standard errors two-way clustered by origin and destination reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. For all regressions: Observations- 664,665; Pseudo R² - 0.994

What might be underlying these results?

Additional work is needed to try to track down the sources of these impacts.

But considering the data, the following is a potential explanation:

- The core TRIPS-Plus IPAs include most agreements involving the US, not many of the EU/EFTA, and a few others. The US has been the strongest *demandeur* nation in pushing TRIPS-Plus provisions.
- Moreover, the US IPAs incorporating TRIPS-Plus are almost entirely negotiated with developed countries or emerging countries with significant imitative and innovative capacities.
- The core TRIPS-Plus provisions often are regulations focused on specific industries, including those in our IP clusters.
- The evidence suggests that such US-dominated IPAs aim more at increasing sector-specific IP protection in emerging and developed economies within the agreements than on inviting more IP registrations from external actors.
- In contrast, the other WTO legally enforceable agreements and the bulk of the EU/EFTA agreements seem to focus more on broader transparency and enforceability in the IPR space, rather than deep commitments to TRIPS-Plus. The EU agreements are shallower in the IP sense and mostly negotiated with small emerging and developing countries. These emphases may attract greater external applications.