ONLINE APPENDIX

Dynamic Gains from Trade Agreements with Intellectual Property Provisions

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A Empirical Analysis: Robustness

Next, I conduct a comprehensive econometric analysis to evaluate the effect of bilateral RTAs with IP provisions on technology transfer, measured as royalty payments, between countries. I follow Baier and Bergstrand (2007) and estimate a reduced-form gravity regression with exporter-time, importer-time, and country-pair fixed effects to identify the role of IP chapters included in RTAs. In particular, I estimate the following specification:

$$RP_{in,t} = \exp\left(\sum_{k\in\{T,NT\}} \text{RTA}^k_{in,t} + S_{nt} + F_{it} + fe_{in}\right) * u_{int} \tag{A.1}$$

with $\text{RTA}^k_{in,t}$, an RTA with technology provisions (specifically, IP provisions) when k = T and without such provisions when k = NT, as classified by Martínez-Zarzoso and Chelala (2021), S_{nt} exporter-time, F_{it} importer-time, and fe_{in} country-pair characteristics. I estimate

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equation (A.1) using PPML methods as recommended by Baier and Bergstrand (2007); Silva and Tenreyro (2006); Yotov et al. (2016); Zylkin (2018). This estimation approach has several advantages. First, as Baier and Bergstrand (2007) show, including time-invariant bilateral dummies allows me to control for potential endogeneity of RTAs (if they are not arbitrarily assigned) as these dummies control for all unobserved heterogeneity related to each country-pair. Second, PPML methods can account for zeros in the dependent variable and can deal with heteroskedasticity of the error term in the gravity equation.

I run the specification for the whole sample of countries in Table A.1 and for four groups of countries classified according to their development level in Table A.2 (N corresponds to North and S corresponds to South).[1] RTAs include those with technology and non-technology provisions, as well as TRIPS, in order to evaluate whether more-recent RTAs have an effect on technology transfer beyond that of TRIPS. The first two columns focus on the effect on royalty payments, whereas the last two columns focus on the effect on international trade. There are two sources of identification in the regression analysis: (i) observations from before and after an agreement enters into force, and (ii) country-pairs never signing any agreement during the period of analysis.

Table A.1 shows that RTAs with technology provisions have a positive and statistically significant effect on bilateral royalty payments. That is, country-pairs that form RTAs that contain IP chapters share more technology. In this case, the results suggest that signing RTAs with IP provisions increases royalty payments between the countries by 19%.[2] RTAs without technology provisions and TRIPS do not have a significant effect. In the case of international trade, both types of RTAs (with and without IP provisions) have a positive and statistically significant effect as in Martínez-Zarzoso and Chelala (2021), but it is smaller than in the case of royalty payments.

Many of the deep trade agreements form between advanced economies and developing

[1] I use GDP per capital data to classify a country as North or South. Countries belong to South if their GDP pc was below 12,500 USD in 2012.

[2] $[exp(\beta) - 1] * 100$.

Table A.1: The effect of RTAs with IP provisions on international technology licensing

	Royalties		Trade	
RTA tech	0.175***	-0.408***	0.0396**	-0.0507
	(0.0349)	(0.0993)	(0.0123)	(0.0375)
RTA notech	-0.00852	0.00390	0.0918***	0.0942***
	(0.0728)	(0.0726)	(0.0196)	(0.0196)
trips	0.0805	0.0819	0.0206	0.0208
	(0.0933)	(0.0940)	(0.0325)	(0.0325)
RTA tech (patents/IP)		0.612***		0.0975*
		(0.105)		(0.0392)
N	43,398	43,398	44,100	44,100
pseudo R^2	0.74	0.74	1.00	1.00

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table captures the effects of RTAs with technology provisions (RTA tech) and without technology provisions (RTA no tech) on bilateral royalty payments (first two columns) and bilateral trade (last two columns) between 1995 and 2012. It controls also for a dummy variable capturing whether the countries are part of TRIPS. The regression is done with PPML methods and it includes exporter time, importer time, and bilateral fixed effects. In columns 2 and 4 it isolates the effect of technology provisions related to patents and IP (RTA tech (patents/IP)).

countries. These agreements are appealing to firms in developed countries because they have a strong interest in protecting and strengthening their IPR in the developing countries where they conduct business. In Table A.2, I report results from running the regression in equation (A.1) considering 4 groups of countries: (i) royalty payments from South to North (NS), (ii) from North to North (NN), (iii) from North to South (SN), and (iv) from South to South (SS). The results show that RTAs containing IP provisions have a positive and statistically significant impact on royalty payments, especially in two scenarios. First, when two advanced economies sign the agreement (NN), there is an observable increase in royalty payments. Second, when a developed and a developing economy sign an agreement, with the developing economy paying royalties to the developed one (NS), we also observe a significant rise in royalty payments. These findings suggest that RTAs with technology provisions lead to more technology licensing from advanced economies (North) to developing economies (South). TRIPS plays a pivotal role in royalty payments in agreements between advanced economies and between advanced economies and developing economies for royalty flows from North to South (SN). This is different from RTAs with tech provisions that matter more for royalty payments from South to North.

Technology-related RTAs could take several forms: technology cooperation, R&D cooperation, or patents and IP protections. The conjecture in the empirical analysis is that it is provisions related to patents and IP protection that matter for technology transfer through licensing. Tables A.1 and A.2 (specifically, columns 2 and 4) present results when we consider patents and IP provisions as integral components of RTAs with technology-related provisions. These findings align consistently with those presented in Table A.1. Notably, provisions related to patents and IP exhibit a positive and statistically significant impact on royalty payments. Furthermore, when we factor in patents and IP provisions alongside other types of technology provisions, the outcomes emphasize that the provisions primarily influencing technology licensing are those associated with patent protection. This observation is consistent with the mechanisms outlined in the model. These results extend to international trade flows, aligning with the findings in Martínez-Zarzoso and Chelala (2021).

In summary, RTAs with IP provisions, particularly those targeting patent protection, emerge as an important channel for technology transfer from advanced economies to developing economies. These findings align with the model presented in the paper and offer external validation of the main measure used to study the impact of IP enforcement within the framework of trade agreements, which is royalty payments.

B RTAs with IP Provisions: FDI and Cross-border patenting

Technology transfers can occur through various channels that are not reflected in royalty payments, such as FDI or cross-border patenting (see Maskus, 2004, for a review of different types of technology transfer and the importance of licensing). Here, I conduct the same analysis from Figure 1, but using data on cross-border patenting and bilateral FDI flows. The data on cross-border patenting are from PATSTAT, whereas the data on FDI are from Larch and Yotov (2022) and Anderson, Larch, and Yotov (2019). Figure B.1 illustrates that the contrasting effects of RTAs with IP provisions versus those without IP provisions are significantly more pronounced in the context of royalty payments, compared with alternative technology transfer channels like cross-border patenting or FDI.

While royalty payments alone do not encompass the entirety of technology transfer activities, they have several advantages: (i) Different from other channels, they are easily accessible and quantifiable data; (ii) unlike alternative channels, such as international trade or foreign direct investment (FDI), royalty payments offer a more direct measure of technology diffusion. This is because international licensing transactions leave behind a clear paper trail—contracts through which a patent owner (the technology inventor or exporter) licenses the patent's use to a foreign firm (the technology importer) for the production of goods, with the technology importer compensating the innovator through royalty fees; and

Table A.2: The effect of RTAs with IP provisions on international technology licensing by level of development

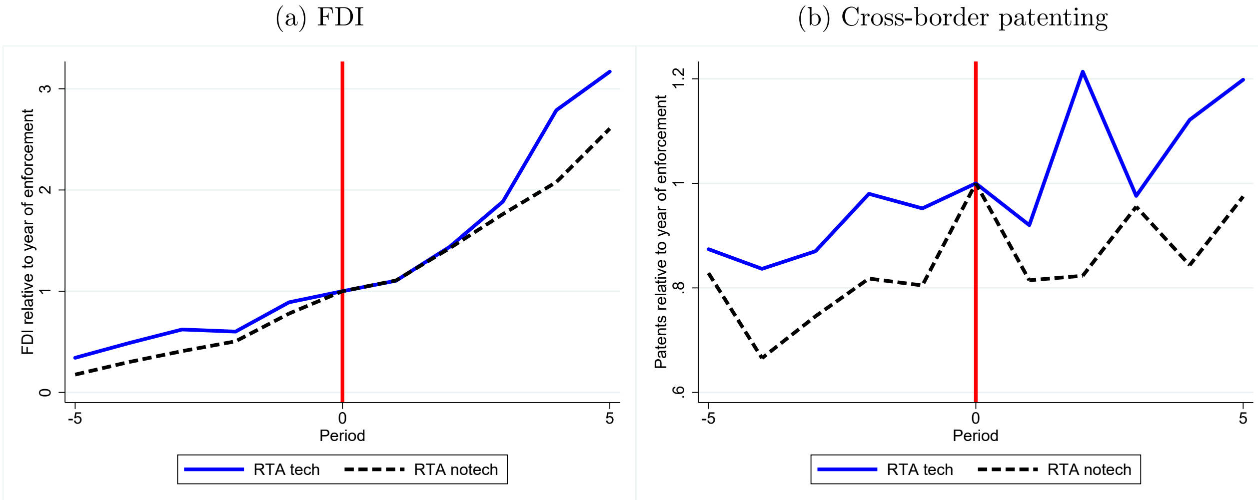
	(1) Royalties	(2) Trade	(3) Royalties	(4) Trade
RTA tech NS	0.136**	0.0646**	-0.541***	-0.0285
	(0.0514)	(0.0212)	(0.110)	(0.0351)
RTA tech NN	0.311***	-0.227***	0.309*	-0.376**
	(0.0507)	(0.0275)	(0.129)	(0.131)
RTA tech SN	0.0588	0.0960***	-0.314	0.152*
	(0.0987)	(0.0245)	(0.188)	(0.0639)
RTA tech SS	-0.111	0.0852***	0.897	0.112
	(0.146)	(0.0198)	(0.487)	(0.0676)
RTA notech NS	-0.284*	0.149***	-0.274*	0.152***
	(0.128)	(0.0382)	(0.126)	(0.0381)
RTA notech NN	0	0	0	0
	(.)	(.)	(.)	(.)
RTA notech SN	0.207	0.0797*	0.211	0.0788*
	(0.147)	(0.0400)	(0.148)	(0.0400)
RTA notech SS	0.0539	0.103***	0.0699	0.103***
	(0.0991)	(0.0235)	(0.0994)	(0.0235)
trips NS	0.0370	-0.0164	0.0385	-0.0162
	(0.0995)	(0.0322)	(0.100)	(0.0322)
trips NN	1.159***	0.180***	1.158***	0.180***
	(0.282)	(0.0464)	(0.282)	(0.0464)
trips SN	1.574***	0.109*	1.574***	0.109*
	(0.328)	(0.0451)	(0.329)	(0.0451)
trips SS	0.227	0.0000591	0.231	0.000293
	(0.207)	(0.0329)	(0.208)	(0.0328)
RTA tech (Patents/IP) NS			0.718***	0.103*
			(0.120)	(0.0401)
RTA tech (Patents/IP) NN			0.00299	0.170
			(0.141)	(0.133)
RTA tech (Patents/IP) SN			0.408	-0.0591
			(0.215)	(0.0681)
RTA tech (Patents/IP) SS			-1.006*	-0.0265
			(0.504)	(0.0700)
N	43,398	44,100	43,398	44,100
pseudo R^2	0.74	1.00	0.74	1.00

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table captures the effects of RTAs with technology provisions (RTA tech) and without technology provisions (RTA no tech) on bilateral royalty payments (first two columns) and bilateral trade (last two columns) between 1995 and 2012. It controls also for a dummy variable that captures whether the countries are part of TRIPS. The regression is done with PPML methods and it includes exporter time, importer time, and bilateral fixed effects. It considers bilateral flows using 4 groups of countries: (i) royalty payments from South to North (NS), (ii) from North to North (NN), (iii) from North to South (SN), and (iv) from South to South (SS). In columns 2 and 4 it isolates the effect of technology provisions related to patents and IP.

Figure B.1: Dynamics of FDI and Cross-Border Patenting During RTAs with IP Provisions



Notes: The figure shows the evolution of FDI flows and cross-border patenting from developing to developed countries 5 years before and 5 years after they sign a trade agreement with technology provisions. It considers all trade agreements signed between 1995 and 2012. The vertical line at zero represents the time at which the agreement enters into force.

(iii) royalty payments increase faster following the enforcement of trade agreements with IP provisions than other channels of technology transfer.

In summary, the empirical evidence indicates that when countries engage in trade agreements with IP provisions, there is a significant surge in royalty payments. This surge is notably more substantial than it is in cases where countries sign trade agreements lacking such IP provisions. This effect is not only statistically significant but also substantially more pronounced when observed in the context of royalty payments, in contrast to its comparatively milder impact on bilateral FDI flows and cross-border patenting activities. These results underscore the important role that IP regulations play in shaping international technology transfer through licensing.

C Derivations

Final Good Price Start from:

$$Y_{nt} = \left(\sum_{i=1}^{M} \Omega_i^{\sigma-1} T_{it} x_{ni,t}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}. \tag{C.1}$$

From the demand of intermediate goods,

$$Y_{nt} = \left(\sum_{i=1}^{M} \Omega_i^{\sigma-1} T_{it} \left(\left(\frac{\bar{m} W_{it} d_{ni} (1+\tau_{ni,t})}{P_{nt}} \right)^{-\sigma} Y_{nt} \right)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \tag{C.2}$$

From here,

$$P_{nt} = \left(\sum_{i=1}^{M} \Omega_i^{\sigma-1} T_{it} \left(\bar{m} W_{it} d_{ni} (1+\tau_{ni,t}) \right)^{1-\sigma} \right)^{\frac{1}{1-\sigma}}. \tag{C.3}$$

Trade share

$$\pi_{in,t} = \frac{X_{in,t}}{\sum_{i=1}^{M} X_{in,t}} = \frac{\Omega_n^{\sigma-1} T_{nt} \left(\frac{\bar{m} W_{nt} d_{in} (1+\tau_{in,t})}{P_{it}} \right)^{1-\sigma} P_{it} Y_{it}}{\sum_{k=1}^{M} \Omega_k^{\sigma-1} T_{kt} \left(\frac{\bar{m} W_{kt} d_{ik} (1+\tau_{ik})}{P_{it}} \right)^{1-\sigma} P_{it} Y_{it}}, \tag{C.4}$$

where $X_{in,t}$ is country i's expenditure on goods from country n.

From here,

$$\pi_{in,t} = \frac{\Omega_i^{\sigma-1} T_{it} \left(W_{nt} d_{in} (1+\tau_{in,t}) \right)^{1-\sigma}}{\sum_{k=1}^{M} T_{kt} \left(W_{kt} d_{ik} (1+\tau_{ik}) \right)^{1-\sigma}}. \tag{C.5}$$

The home trade share is then

$$\pi_{nn,t} = \frac{\Omega_n^{\sigma-1} T_{nt} \left(W_{nt} \right)^{1-\sigma}}{P_{nt}^{1-\sigma}}. \tag{C.6}$$

ACR formula Relative wages take the ACR formula

$$\frac{W_{nt}}{P_{nt}} = \frac{1}{\bar{m}} \left(\frac{\Omega_n^{\sigma-1} T_{nt}}{\pi_{nn,t}} \right)^{\frac{1}{\sigma-1}}. \tag{C.7}$$

From this formula, the growth rate of real wages in the steady state is $\frac{1}{\sigma-1}g_T$.

Profits of intermediate producers In each country i there are $T_{it} = \sum_{n=1}^{M} A_{in,t}$ intermediate producers (as many as adopted technologies). Each intermediate producer makes $\frac{\Pi_{it}}{T_{it}}$ in profits. Profits made with each adopted technology are composed of profits from the domestic and export market:

$$\Pi_{it} = \sum_{m=1}^{M} \frac{\pi_{mi,t}}{1+\tau_{mi}} P_{mt} Y_{mt} - W_{it} L_{it}, \tag{C.8}$$

where $\sum_{m=1}^{M} \frac{p_{mi}x_{mi}}{1+\tau_{mi}} - W_{it}L_{it} = \sum_{m=1}^{M} \bar{m} W_i d_{mi}(1+\tau_{mi}) l_{mi}/(d_{mi}(1+\tau_{mi}) - W_{it}L_{it} = (\bar{m}-1)W_{it}L_{it}$.

Then,

$$\Pi_{it} = (\bar{m}-1)W_{it}L_{it}.$$

What are the profits of all the firms in the economy?

- Innovators:
$$\sum_{i=1}^{M} RP_{in,t} - P_{nt}H^r_{nt}.$$

- Adopters and intermediate producers:
$$-P_{nt}\sum_{i=1}^{M} H^a_{in,t} + \Pi_{nt} - \sum_{i=1}^{M} RP_{ni,t},$$

  where royalties are given by

$$RP_{in,t} = \frac{A_{in,t}}{T_{it}} \chi_{in,t} \Pi_{it}.$$

Note that in the BGP (solving equations for the law of motion of innovation and adoption, respectively):

$$\frac{A_{in}}{T_i}\chi_{in,t}\Pi_i = \frac{\varepsilon_{in}}{\varepsilon_{in}+g}\chi_{in,t}\lambda_n\left(\frac{H_n^r}{Y_n}\right)^{\beta_r}\frac{T_n}{T_i}\Pi_i.$$

In equilibrium, $\Pi_i = (\bar{m}-1)W_iL_i$.

Balance of payments equation For simplicity, let's momentarily ignore the presence of international borrowing and lending and transfers in the derivation. Combining the budget constraint and the feasibility constraint, we obtain the following expression:

$$P_{nt}C_{nt} = P_{nt}Y_{nt} - P_{nt}H_{nt}^r - \sum_{i=1}^{M} P_{nt}H_{ni,t}^a = W_{nt}L_{nt} + \Pi_{nt}^{\text{all}}.$$

The term Π_{nt}^{all} encompasses profits of innovators (royalty payments received from around the world) and adopters/intermediate producers (profits net of royalty payments made globally). Thus,

$$\Pi_{nt}^{\text{all}} = \sum_{i=1}^{M} A_{in,t}\chi_{in,t}\frac{\Pi_{it}}{T_{it}} + \sum_{i=1}^{M} A_{ni,t}(1-\chi_{ni,t})\frac{\Pi_{nt}}{T_{nt}} - P_{nt}H_{nt}^r - \sum_{i=1}^{M} P_{nt}H_{ni,t}^a. \tag{C.9}$$

Eliminating domestic payments and rearranging, we obtain:

$$\Pi_{nt}^{\text{all}} = \sum_{i\neq n}^{M-1} A_{in,t}\chi_{in,t}\frac{\Pi_{it}}{T_{it}} - \sum_{i\neq n}^{M-1} A_{ni,t}\chi_{ni,t}\frac{\Pi_{nt}}{T_{nt}} + \Pi_{nt} - P_{nt}H_{nt}^r - \sum_{i=1}^{M} P_{nt}H_{ni,t}^a.$$

Where the first component of the right-hand side represents royalty payments received by country n from country i, the second component represents royalty payments made by country n to country i, and the third component represents total profits generated by intermediate producers in country n.

Hence, payments to the factor's owners are given by:

$$P_{nt}Y_{nt} = W_{nt}L_{nt} + \sum_{i\neq n}^{M-1} A_{in,t}\chi_{in,t}\frac{\Pi_{it}}{T_{it}} - \sum_{i\neq n}^{M-1} A_{ni,t}\chi_{ni,t}\frac{\Pi_{nt}}{T_{nt}} + \Pi_{nt}.$$

The above expression implies that income is composed of three key components: labor income, net royalties received from the rest of the world (after deducting royalties paid to the rest of the world), and the profits of intermediate producers.

D Equations of the Model

Endogenous variables

$$\{Y_{nt}, P_{nt}, W_{nt}, C_{nt}, \Pi_{nt}, R_t, Z_{nt}, H^r_{nt}, T_{nt}, H^a_{in,t}, A_{in,t}, x_{in,t},$$

$$p_{in,t}, \pi_{in,t}, V_{nt}, J^{\text{innov}}_{in,t}, V^{\text{innov}}_{in,t}, J^{\text{adopt}}_{in,t}, V^{\text{adopt}}_{in,t}, \varepsilon_{in,t}, RP_{in,t}\}$$

Equations:

Resource constraint

$$Y_{nt} = C_{nt} + H^r_{nt} + H^a_{nt}$$

Prices

$$P_{nt} = \left(\sum_{i=1}^{M} \Omega_i^{\sigma-1} T_{it} p_{ni,t}^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$$

Price intermediate goods

$$p_{in,t} = \bar{m} W_{nt} d_{in} (1 + \tau_{in,t})$$

Demand for intermediate goods

$$p_{in,t} x_{in,t} = \left(\frac{\bar{m} W_{nt} d_{in} (1 + \tau_{in,t})}{P_{it}} \right)^{1-\sigma} P_{it} Y_{it}$$

Trade share

$$\pi_{in,t} = \frac{\Omega_i^{\sigma-1} T_{it} \left(W_{nt} d_{in} (1 + \tau_{in,t}) \right)^{1-\sigma}}{\sum_{k=1}^{M} T_{kt} \left(W_{kt} d_{ik} (1 + \tau_{ik}) \right)^{1-\sigma}}$$

Value innovation

$$V_{nt} = \sum_{i=1}^{M} J_{in,t}^{\text{innov}}$$

Profits of intermediate producers

$$\Pi_{nt} = \frac{1}{\sigma - 1} W_{nt} L_n$$

Value of an adopted technology for the adopter

$$V_{in,t}^{\text{adopt}} = (1 - \chi_{in,t}) \frac{\Pi_{it}}{T_{it}} + \frac{1}{R_t} \frac{P_{it}}{P_{i,t+1}} V_{in,t+1}$$

Value of an un-adopted technology for the adopter

$$J_{in,t}^{\text{adopt}} = -\frac{H_{in,t}^{a} P_{it}}{Z_{nt} - A_{in,t}} + \frac{1}{R_t} \frac{P_{it}}{P_{i,t+1}} [\varepsilon_{in,t} V_{in,t+1} + (1 - \varepsilon_{in,t}) J_{in,t+1}]$$

Value of an adopted technology for the innovator

$$V_{in,t}^{\text{innov}} = \chi_{in,t} \frac{\Pi_{it}}{T_{it}} + \frac{1}{R_t} \frac{P_{it}}{P_{i,t+1}} V_{in,t+1}^{\text{innov}}$$

Value of an un-adopted technology for the innovator

$$J_{in,t}^{\text{innov}} = \frac{1}{R_t} \frac{P_{it}}{P_{i,t+1}} [\varepsilon_{in,t} V_{in,t+1}^{\text{innov}} + (1 - \varepsilon_{in,t}) J_{in,t+1}^{\text{innov}}]$$

FOC innovation

$$H_{nt}^{r} = \beta_r \Delta Z_{nt} \frac{V_{nt}}{P_{nt}}$$

FOC adoption

$$P_{it} H_{in,t}^{a} = \beta_a \frac{1}{R_t} \frac{P_{it}}{P_{i,t+1}} (Z_{nt} - A_{in,t}) \varepsilon_{in,t} (V_{in,t+1}^{\text{adopt}} - J_{in,t+1}^{\text{adopt}})$$

Probability of adoption

$$\varepsilon_{in,t} = \bar{\varepsilon}_{in} \left(\frac{H^a_{in,t}}{Y_{it}} \right)^{\beta_a}$$

Royalties

$$RP_{in,t} = \frac{A_{in,t}}{T_{it}} \chi_{in,t} \Pi_{it}$$

Labor market-clearing condition

$$\bar{m} W_{nt} L_{nt} = \sum_{i=1}^{M} \frac{\pi_{in,t}}{1 + \tau_{in,t}} P_{it} Y_{it}$$

Balance of payments equation

$$\sum_{i \neq n}^{M} T_{it} p_{ni,t} x_{ni,t} = \sum_{i \neq n}^{M} T_{nt} p_{in,t} x_{in,t} + \sum_{i=1}^{M} RP_{in,t} - \sum_{i=1}^{M} RP_{ni,t}$$

Law of motion of innovation

$$\Delta Z_{nt} = \lambda_n T_{nt} \left(\frac{H_{nt,r}}{Y_{nt}} \right)^{\beta_r}$$

Law of motion of adoption

$$\Delta A_{in,t} = \varepsilon_{in,t} (Z_{nt} - A_{in,t})$$

Interest rate

$$R_t = \frac{1}{\beta} \frac{C_{n,t+1}}{C_{nt}}$$

Total number of adopted technologies

$$T_{nt} = \sum_{i=1}^{M} A_{ni,t}$$

E Stationary Variables

To ensure that the endogenous variables remain constant along the BGP, I transform them by dividing each variable by its respective trend component. This normalization removes the trend component from the variables, resulting in a stationary system of equations that characterizes the BGP equilibrium. I denote the normalized variables with a hat, omit the time subscripts in the derivations, and use a star to indicate the BGP values of the variables. Here is a list of stationary equations:

From the equation of the home trade share, the growth of the real wage is $T^{\frac{1}{\sigma-1}}$. Also, as is common in these models of diffusion, all countries grow at a common rate. All adopted technologies and newly created technologies grow at the rate of Z.

Resource constraint:

$$\hat{Y}_{nt} = \hat{C}_{nt} + \hat{H}^r_{nt} + \hat{H}^a_{nt}$$

In this expression, $\hat{X}_{it} = \frac{X_{it}}{Z_{Mt}^{1/(\sigma-1)}}$. In this economy, the real wage grows at $Z_{Mt}^{\frac{1}{\sigma-1}}$. Real variables grow at $g_z/(\sigma-1)$. Also note that in the Eaton and Kortum (2002) model, I get something similar, where $\theta = \sigma - 1$.

Prices:

$$\hat{P}_{nt}^{1-\sigma} = \sum_{i=1}^{M} \Omega_i^{\sigma-1} \hat{T}_{it} \left(\bar{m}\hat{\omega}_{it} d_{ni}(1+\tau_{ni,t})\right)^{1-\sigma},$$

where $\hat{\omega}_{nt} = \frac{W_{it}}{W_{Mt}}$ and $\hat{A}_{ni,t} = \frac{A_{ni,t}}{T_{Mt}}$.

Demand for intermediate goods:

$$\hat{x}_{in,t} = \left(\bar{m}\hat{\omega}_{nt} d_{in}(1+\tau_{in,t})\right)^{1-\sigma} \hat{P}_{it}^{\sigma} \hat{Y}_{it} = \pi_{in,t} \hat{Y}_{it} \hat{P}_{it},$$

where $\hat{x}_{in,t} = \frac{\frac{p_{in,t} x_{in,t}}{W_{Mt}}}{Z_{Mt}^{\frac{1}{1-\sigma}}}$.

Trade share:

$$\pi_{in,t} = \frac{\Omega_n^{\sigma-1}\hat{T}_{nt}\left(\hat{\omega}_{nt}d_{in}(1+\tau_{in,t})\right)^{1-\sigma}}{\hat{P}_{it}^{1-\sigma}}$$

Value of innovation:

$$\hat{v}_{nt} = \sum_{i=1}^{M}\hat{j}_{in,t}^{\text{innov}}\frac{\hat{T}_{nt}}{\hat{T}_{it}},$$

where $v_{nt} = T_{nt}V_{nt}/W_{Mt}$ and $j_{in,t}^{\text{innov}} = J_{in,t}T_{it}/W_{Mt}$.

Profits of firms:

$$\hat{\Pi}_{nt} = \frac{1}{\sigma-1}\hat{\omega}_{nt}L_n$$

with $\hat{\Pi}_{it} = \frac{\Pi_t}{W_{Mt}}$.

Value of an adopted technology for the adopter:

$$\hat{v}_{in,t} = (1-\chi_{in,t})\hat{\Pi}_{it} + \frac{1}{r_{it}}\frac{\hat{P}_{it}}{\hat{P}_{i,t+1}}\hat{v}_{in,t+1}\frac{(1+g_{Mt})^{1/\sigma-1}}{1+g_{T,it}}$$

with $\hat{V}_{in,t} = V_{in,t}T_{it}/W_{Mt}$.

Value of an unadopted technology for the adopter:

$$\hat{j}_{in,t} = -\hat{H}_{in,t}^{a}\frac{\frac{\hat{T}_{it}}{\hat{A}_{in,t}}\varepsilon_{in,t}}{g_{in,t}^{a}} + \frac{1}{r_t}\frac{\hat{P}_{i,t+1}}{\hat{P}_{it}}\left[\varepsilon_{in,t}\hat{v}_{in,t+1} + (1-\varepsilon_{in,t})\hat{j}_{in,t+1}\right]\frac{(1+g_{M,t})^{1/\sigma-1}}{1+g_{T,it}},$$

where $r_t = R_t\frac{P_{nt}}{P_{n,t+1}}$ and $g_{T,it} = \hat{T}_{i,t+1}/\hat{T}_{it} - 1 + g_{Mt}$.

Value of an adopted technology for the innovator:

$$\hat{v}_{in,t}^{\text{innov}} = \chi_{in,t}\hat{\Pi}_{it} + \frac{1}{r_t}\frac{\hat{P}_{i,t+1}}{\hat{P}_{it}}\hat{v}_{in,t+1}^{\text{innov}}\frac{(1+g_{Mt})^{1/\sigma-1}}{1+g_{T,it}}$$

Value of an un-adopted technology for the innovator:

$$\hat{j}^{\text{innov}}_{in,t} = \frac{1}{r_t}\frac{\hat{P}_{i,t+1}}{\hat{P}_{it}}\left[\varepsilon_{in,t}\hat{v}^{\text{innov}}_{in,t+1} + (1-\varepsilon_{in,t})\hat{j}^{\text{innov}}_{in,t+1}\right]\frac{(1+g_{Mt})^{1/\sigma-1}}{1+g_{T,it}}$$

FOC innovation:

$$\beta_r\left(\frac{\hat{H}^r_{nt}}{\hat{Y}^w_t}\right)^{\beta_r-1}\hat{v}_{nt} = \hat{P}_{nt}\hat{Y}^w_t$$

FOC adoption:

$$\hat{P}_{it}\hat{H}^a_{in,t}\frac{\frac{\hat{T}_{it}}{\hat{A}_{in,t}}\varepsilon_{in,t}}{g^a_{in,t}} = \beta_a\frac{1}{r_t}\frac{\hat{P}_{i,t+1}}{\hat{P}_{it}}\varepsilon_{in,t}\left[\hat{v}_{in,t+1} - \hat{j}_{in,t+1}\right]\frac{(1+g_{Mt})^{1/\sigma-1}}{1+g_{T,it}}$$

Probability of adoption:

$$\varepsilon_{in,t} = \bar{\varepsilon}_{in}\left(\frac{\hat{H}^a_{in,t}}{\hat{Y}_{it}}\right)^{\beta_a}$$

Royalties:

$$\hat{r}p_{in,t} = \frac{A_{in,t}}{T_{it}}\chi_{in,t}\hat{\Pi}_{it}$$

Labor market-clearing condition:

$$\bar{m}\hat{\omega}_n L_{nt} = \sum_{i=1}^{M}\pi_{in,t}\hat{Y}_{it}\hat{P}_{it}$$

Balance of payments equation:

$$\sum_{i\neq n}^{M-1}\Omega_i^{\sigma-1}\hat{T}_{it}\hat{x}_{ni,t} = \sum_{i\neq n}^{M-1}\Omega_n^{\sigma-1}\hat{T}_{nt}\hat{x}_{in,t} + \sum_{i\neq n}^{M-1}\hat{r}p_{in,t} - \sum_{i\neq n}^{M-1}\hat{r}p_{ni,t} + \hat{B}_{it} - r_t\hat{B}_{i,t-1}$$

Law of motion of innovation:

$$g_{Z,nt}\hat{Z}_{nt} = \lambda_n\hat{T}_{nt}\left(\frac{\hat{H}_{nt,r}}{\hat{Y}_{nt}}\right)^{\beta_r}$$

Law of motion of adoption:

$$g^a_{in,t} = \varepsilon_{in,t}\left(\frac{\hat{Z}_{nt}}{\hat{A}_{in,t}} - 1\right),$$

where $g^a_{in,t} = (\hat{A}_{in,t+1} - \hat{A}_{in,t}) + g$

Bond holdings

$$1 + \eta\left(\hat{B}_{nt} - \bar{B}_n\right) = r_t\beta(1 + g_{c,n,t+1})$$

with $1 + g_{c,t+1} = \hat{C}_{n,t+1}/\hat{C}_{nt} - 1 + (1+g)^{\sigma-1}$. A small quadratic-adjustment cost in bond holding, η, guarantees the existence of a unique BGP value for $B_n = \bar{B}_n$.

Bond-market equilibrium:

$$\sum_{n=1}^{M} \hat{B}_{nt} = 0$$

Total number of adopted technologies

$$\hat{T}_{nt} = \sum_{i=1}^{M} \hat{A}_{ni,t}$$

F BGP

The parameters of the model are $\{\beta, \eta, \beta_a, \beta_r, \sigma, \lambda_n, \bar{\varepsilon}_{in}, \xi_{in,t}, \chi_{in,t}, d_{in}, \tau_{in,t}, g\}$.

To solve for the BGP, I can use the expressions from the previous section, which are stationary and do not grow along the BGP. I drop the time dimension and the hats.

Note that from the law of motion of adopted varieties,

$$A_{in} = \frac{\varepsilon_{in}}{g + \varepsilon_{in}} Z_n.$$

I start by guessing a vector for T_n, a value for g, a matrix for $H^a in$, and a vector for wages and then solve for the equilibrium for wages, prices, trade shares, and income. Wages will be updated using the trade-balance equation, and inside that loop there will be a recursive algorithm to solve for the equilibrium value of $H^a in$. I can then use the Perron-Frobenius theorem to solve for g and T_n/T_M.

To solve for the equilibrium along the BGP, I need the following expressions:

1. Start by guessing w_n, H^a_{in}, g, and T_n

2. $$r = \frac{1 + g/(\sigma - 1)}{\beta}$$

3. $$P_n^{1-\sigma} = \sum_{i=1}^{M} \Omega_i^{\sigma-1} T_i \left(\bar{m}\omega_i d_{ni}(1 + \tau_{ni,t})\right)^{1-\sigma}$$

4. $$\pi_{in} = \frac{T_n \left(\bar{m}\omega_n d_{in}(1 + \tau_{in,t})\right)^{1-\sigma}}{P_i^{1-\sigma}}$$

5. $$\omega_n L_n = \sum_{i=1}^{M} T_n \left(\frac{\bar{m}\omega_n d_{in}(1 + \tau_{in,t})}{P_i}\right)^{1-\sigma} \frac{Y_i P_i}{1 + \tau_{in,t}}$$

   This can be written as

   $$\omega_n L_n = \sum_{i=1}^{M} \frac{\pi_{in}}{1 + \tau_{in,t}} Y_i P_i,$$

   which can be written in matrix form as $\omega L = BY$, with each entry of B being $b_{in} = \frac{\pi_{in}}{1+\tau_{in,t}}$.

6. An update rule for wages: Note that because there are royalties, I will not be able to update wages at this stage without first knowing A_{in}, which enters the equation for royalties. To do that I need to guess for H^a_{in}, which I already did, and then use the growth block of the model to update H^a_{in}:

$$\sum_{i\neq n}^{M} \frac{\pi_{ni}}{1+\tau_{ni,t}} Y_n = \sum_{i\neq n}^{M} \frac{\pi_{in}}{1+\tau_{in,t}} Y_i + \sum_{i\neq n}^{M} rp_{in} - \sum_{i\neq n}^{M} rp_{ni},$$

where

$$\sum_{n\neq i} \frac{RP_{in}T_i}{W_M} = \sum_{n\neq i} \frac{\Delta A_{in}}{A_{in}} \frac{V_{in}T_i}{W_M} \frac{A_{in}}{T_i}$$

$$\sum_{n\neq i} rp_{in} = \sum_{n\neq i} gV_{in} \frac{A_{in}}{T_i}$$

7.

$$v_{in} = \left(1 - \frac{1}{r}\frac{1+g/(1/\sigma-1)}{1+g}\right)^{-1} \Pi_i$$

8. I combine the law of motion for A_{in} with the definition of ε_{in} to obtain

$$\varepsilon_{in} = \bar{\varepsilon}_{in} \left(\frac{H^a_{in}}{Y^w}\right)^{\beta_a}.$$

Note that the law of motion for new varieties tells us that

$$\frac{A_{in}}{Z_n} = \frac{\varepsilon_{in}}{\varepsilon_{in}+g}.$$

9. I combine the expression for the FOC of adoption together with the expression for the value of an unadopted technology to obtain an expression for j_{in}:

$$j_{in} = \left(1 - \beta_a\varepsilon_{in}\frac{1}{r}\frac{1+g/(1/\sigma-1)}{1+g} - \frac{1}{r}\frac{1+g/(1/\sigma-1)}{1+g}(1-\varepsilon_{in})\right)^{-1} (1-\beta_a)\varepsilon_{in}\frac{1}{r}\frac{1+g/(1/\sigma-1)}{1+g} v_{in}$$

10.

$$V_n = \sum_{i=1}^{M} J_{in} \frac{T_n}{T_i}$$

11.

$$H_n^r = \left(\beta_r V_n \lambda_n Y_n^{-\beta_r}\right)^{1/(1-\beta_r)}$$

12. I use the FOC of adoption to update for adoption, but for that I need an expression for $\frac{A_{in}}{T_i}$. I use the following expressions:

$$A_{in} = \frac{\varepsilon_{in}}{g + \varepsilon_{in}}(1+g)Z_n$$

$$Z_n = \frac{\lambda_n}{g} T_n \left(\frac{H_n^r}{Y_n}\right)^{beta_r}$$

$$T_i = \sum_{i=1}^{M} A_{in}$$

13. I plug into the FOC for adoption and update H_{in}^a.

14. I use the trade balance equation to update wages. If there are M countries, I need $M-1$ updating equations because one of the equations is redundant.

15. Update g and T_n with the Perron-Frobenius theorem and equation

$$T_i g = \sum_{n=1}^{M} \frac{\varepsilon_{in}}{\varepsilon_{in} + g} \lambda_n \left(\frac{H_n^r}{Y_n}\right)^{\beta_r} T_n.$$

In matrix form, that expression becomes

$$gT = \Delta(g)T,$$

where $\Delta(g)$ is a $M * M$ matrix with entry $\Delta_{in} = \frac{\varepsilon_{in}}{\varepsilon_{in}+g}\lambda_n \left(\frac{H_n^r}{Y_n}\right)^{\beta_r}$.

From the Perron-Frobenius theorem, as long as matrix Δ is idecomposable, it exists a unique g, which is given by the maximum real eigenvalue of the matrix, and the eigenvector associated with that eigenvalue gives T, which is unique up to a scalar. So I can just compute $\hat{T}_i = T_i/T_M$.

G International Licensing and RTAs with IP Provisions: Examples

Figure G.1 shows the dynamics of royalty payments for a sample of country-pairs. There are two types of vertical lines: The one on the left refers to when TRIPS was ratified by the developing country, and the one on the right refers to when the first RTA with technology provisions enters into enforcement.[3] RTAs with IP chapters seem to increase royalty payments from developing to developed economies, and the effect of these provisions is stronger than the minimum requirements established in TRIPS.

H Quantitative Analysis: Additional Exercises

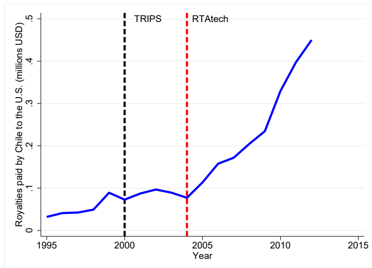
H.1 Calibration of trade costs and productivity

I then follow the two-stage approach proposed by Agnosteva, Anderson, and Yotov (2019) and Anderson and Yotov (2016) to obtain estimates of bilateral trade costs. Agnosteva, Anderson, and Yotov (2019) demonstrate that the "standard" gravity variables (e.g., distance, contiguity, common official language) do well in predicting relative bilateral trade costs; however, they fail to capture the level of bilateral trade costs (e.g., they underpredict

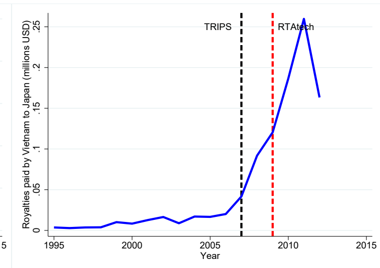
[3]Although TRIPS was established in 1995 as a requirement to be part of the WTO, many developing countries were granted an extension to meet the IP requirements; and in those countries the agreement was ratified after 1995.

Figure G.1: Dynamics of International Technology Licensing During RTAs with IP Provisions

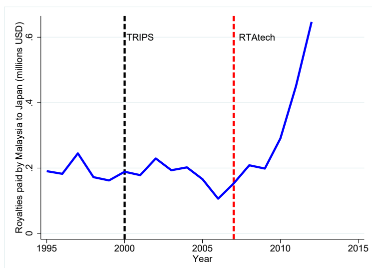
(a) USA to Chile



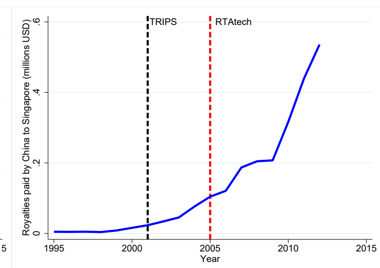
(b) Japan to Vietnam



(c) Japan to Malaysia



(d) Singapore to China



the bilateral trade costs for the poor countries and overpredict them for the more developed countries). The first stage consists of recovering the estimated pair-fixed effects from the following equation:

$$X_{in,t} = \exp\left(\beta_{RTA} RTA_{in,t} + fe_{nt} + \mu_{it} + \kappa_{in}\right)\epsilon_{in,t}, \tag{H.1}$$

where $RTA_{in,t}$ is a dummy that takes the value of 1 if country i and country n had a regional trade agreement in period t and zero otherwise; $fe_{nt} = \Omega_n^{\sigma-1} T_{nt} \left(W_{nt}\right)^{1-\sigma}$ and $\mu_{it} = X_{it}$ are exporter-time and importer-time fixed effects, respectively; and $\kappa_{in} = \left(d_{in}(1+\tau_{in})\right)^{1-\sigma}$ are bilateral fixed effects, including tariffs. The term $\epsilon_{in,t}$ is the error term in the regression.

The second stage consists of estimating the pair-fixed effects on gravity variables, such as geography, common border, or common language. This method allows me to recover estimates of the pair-fixed effects that cannot be identified directly in the first stage due to missing or zero trade flows. Then, trade costs are estimated as

$$\left(d_{in}(1+\tau_{in,2000})\right)^{1-\sigma} = \exp\left(\beta \text{RTA}_{in,2000} + \hat{\kappa}_{in}\right),$$

where $\hat{\kappa}_{in}$ is the predicted value from estimating κ_{in} on standard gravity variables. The use of internal trade allows me to set all internal trade costs to one and all international fixed effects relative to the intra-national ones. I then use data on bilateral tariffs for the year 2000 from the United Nations Conference on Trade and Development (UN-CTAD) to calibrate $\tau_{in,2000}$ and back out the iceberg transport costs, d_{in}, from the gravity estimation results setting $\sigma = 5$. I then aggregate the calibrated d_{in} in three groups: the United States, China, and the rest of the world. To calculate trade costs for both China and the United States with the rest of the world, I use a weighted average of trade costs, weighted by bilateral trade flows.

Finally, using the estimated value for the exporter-time fixed effect, fe_{nt}, when $t = 2000$, as well as data on GDP per capita, and $\sigma = 5$, I follow Waugh (2010) to recover $\Omega_n^{\sigma-1}T_n$. I then aggregate the estimated productivity in three groups: the United States, China, and the rest of the world. To create a measure of productivity for the rest of the world, I compute a weighted average of productivity across countries, with the weights determined by each country's GDP.

I Welfare decomposition

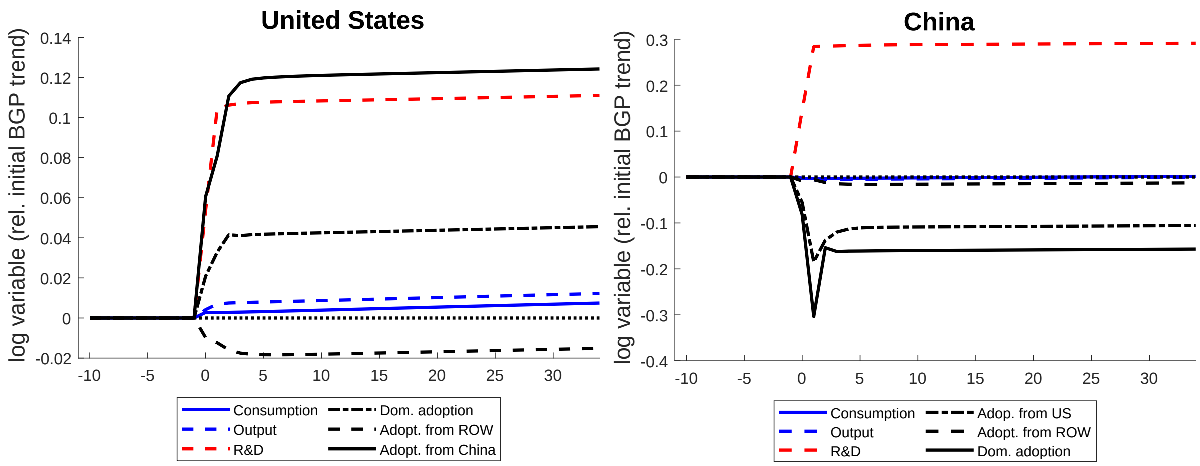
Next, I decompose consumption into its three components and evaluate the effects of the trade agreement on each of them along the transition. From the feasibility condition:

$$C_{nt} = Y_{nt} - H_{nt}^{r} - \sum_{i=1}^{M} H_{ni,t}^{a}.$$

Figure I.1 illustrates the dynamics of each of these components, relative to their initial BGP (in logarithmic scale). All components exhibit the same growth rate. Consumption and output follow a similar trajectory following the agreement. In the United States, there is an initial output increase driven by higher innovation and adoption. China experiences an initial output decrease, which is later compensated for by a higher growth rate.

The agreement leads to increased R&D investment, both in China and the United States. However, adoption displays different dynamics. Adoption increases in the United States (excluding adoption from the rest of the world) and decreases in China, reflecting a reallocation effect away from adoption toward innovation in the latter.

Figure I.1: Components of Welfare



Notes: The figure plots the evolution of the log of consumption, output, R&D spending, and adoption spending, respectively, relative to their initial BGP trend in the United States (left panel) and China (right panel) 10 periods before and 20 periods after signing a trade agreement with IP provisions. The agreement is signed in period 1.

I.1 What characterizes the trade agreement?

The specific terms of a trade agreement resulting from Nash bargaining negotiations are contingent upon various factors. I conduct sensitivity analysis to identify the key characteristics of the negotiating countries that influence the outcomes of the baseline agreement. Specifically, I examine the influence of four critical parameters: (i) the bargaining power of the negotiating parties, (ii) the innovation efficiency in China, (iii) the initial level of tariffs in the US, and (iv) the initial level of IP protection in China. In each of these cases, I impose the new value of each parameter without recalibrating the model and then solve for the Nash bargaining solution. The results are presented in Table I.1.

Table I.1: Nash Bargaining Under Different Parameter Values

	$\Delta\tilde{W}$**(USA)**(%)	$\Delta\tilde{W}$**(China)** (%)	$\tau_{\text{USA,China}}$(%)	$\xi_{\text{China,USA}}$(%)	$\xi_{\text{China,China}}$(%)
Baseline	0.853	0.262	0	18	25
Different Parameter Values					
$\theta = 1$	1.604	0.004	4	25	25
$\theta = 0$	0.022	0.477	0	0	25
Low innov efficiency	0.422	0.091	0	15	25
Low tariffs	0.721	0.189	0	16	25
High tariffs	1.391	0.466	0	25	25
Low IPR	1.320	0.312	0	15	25
Perfect domestic IPR	0.165	0.120	0	11	0

Notes: The table reports welfare gains for the United States and China from signing a trade agreement with IP provisions under different initial conditions: (i) baseline, (ii) different bargaining power, (iii) lower innovation efficiency in China, (iv) lower US tariffs, (v) higher US tariffs, (vi) lower IPR in China, and (vii) perfect IPR on domestic IP. Welfare gains correspond to those from a Nash bargaining agreement where all parties have strictly positive surplus. Columns 4-6 report optimal tariffs and quality of IP enforcement from signing the agreements under each alternative parameterization. The values in the royalty fee columns represent the new royalty fees after the policy changes.

The bargaining power Here, I analyze the role of the bargaining power of the parties involved in the agreement. If the US has all the bargaining power, the trade agreement would consist of an 80% reduction of tariffs and an increase in the royalty fee paid by China to the US from 10% to 25%. The welfare gains for the United States increase significantly to 1.604%, while China experiences virtually zero gains (0.004%). Instead, if China has all the bargaining power, the agreement would involve China only reforming domestic IPR and the US removing all tariffs.

These findings reveal different preferences: China leans toward lower tariffs and strengthened domestic IP enforcement, whereas the United States benefits more when China improves both foreign and domestic IP protection while eliminating tariffs. Tariffs serve as an instrument to incentivize China to enhance its IP protection for foreign IP.

The innovation efficiency in China China's innovation efficiency, which pins down the initial level of R&D intensity, plays a crucial role in determining the extent of IP improvement agreed upon by China during Nash bargaining negotiations. If China's innovation efficiency is set to be one third of that from its calibrated value, the optimal agreement involves a lower improvement of IP enforcement toward foreign firms, resulting in lower welfare gains in both countries. In the extreme case, if China's innovation efficiency is exceedingly low, a viable trade agreement wherein China commits to enhancing its IPR may not materialize. Hence, countries need a minimum innovation efficiency to be willing to enter an agreement that involves improving their IP enforcement on foreign technologies.

The initial level of tariffs in the US When initial tariffs are low, China stands to gain less from the tariff removal aspect of the trade agreement. With initial US tariffs being one half of their initial level, the trade agreement would involve a lower improvement of IP enforcement toward foreign firms and lower gains everywhere.

Conversely, when the US starts with high initial tariffs, the dynamics of the trade agreement change. The potential gains for China from the removal of these high tariffs are substantial. In this scenario, the attractiveness of reducing US tariffs dominates, and China is more willing to make concessions, including significant improvements in IP enforcement toward foreign firms. Both countries, therefore, experience higher overall gains. The rationale here is that the substantial reduction in US tariffs provides a strong incentive for China to reciprocate with concessions in IP enforcement, as the combined effect of reduced tariffs and improved IP protection enhances the overall attractiveness of the trade agreement.

The initial level of IP protection in China Here, I investigate the role of the initial level of IP protection in China. If the US and China sign the trade agreement outlined in the baseline scenario, but with the initial level of IP protection in China being one half of that in the baseline scenario (i.e., $\eta_{\text{China}} = 0.2$), the agreement would result in a substantially smaller improvement of IP enforcement on foreign IP. In this case, the foreign royalty fee would increase from 10% to 16%. If the initial level of IP enforcement is too low, there may not exist an agreement that both parties want to sign, since the US may not be willing to give up tariffs for a small increase in royalty payments. Finally, if China has perfect domestic IPR initially but weak IP protection on foreign IP, the proposed trade agreement would entail the removal of US tariffs, accompanied by only a marginal improvement in foreign IPR. Specifically, the royalty fee is expected to see a modest increase from 10% to 11%. In such a context, if China begins with a state of perfect IPR enforcement, its motivation to participate in the trade agreement diminishes, given the limited gains in foreign IPR improvement.

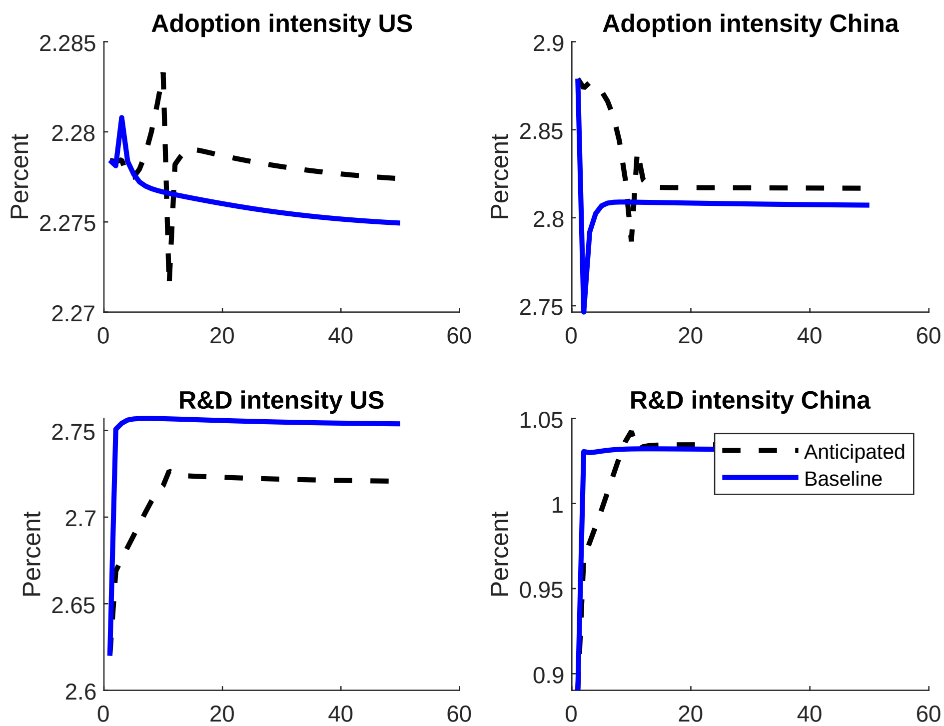
In summary, the results highlight the factors influencing China's openness to improving how it protects foreign and domestic IP. These factors include how much bargaining power each side has, how innovative China is initially, the initial level of US tariffs on Chinese imports, and China's initial IP protection rules. Importantly, China has a consistent reason to make sure its own IP is well-protected, whereas the US can use tariffs strategically to encourage China to improve IP protection for foreign technologies as well. This improvement in protecting foreign IP can lead to higher growth rates on the new BGP. Therefore, the nature and terms of the trade agreement, as well as a country's inclination to engage in such agreements, are contingent on the extent to which a low-enforcement country lags behind the technology frontier. This measurement takes into account two crucial factors: the country's innovation efficiency and the level of IPR protection. The more distant a country is from the technology frontier, the more critical these factors become in shaping the trade agreement landscape and its participants' willingness to participate.

J Additional Figures

This Section reports additional figures from the different counterfactual throughout the paper.

Growth, Innovation, and Adoption Here I show the impact of the trade agreement on innovation and adoption.

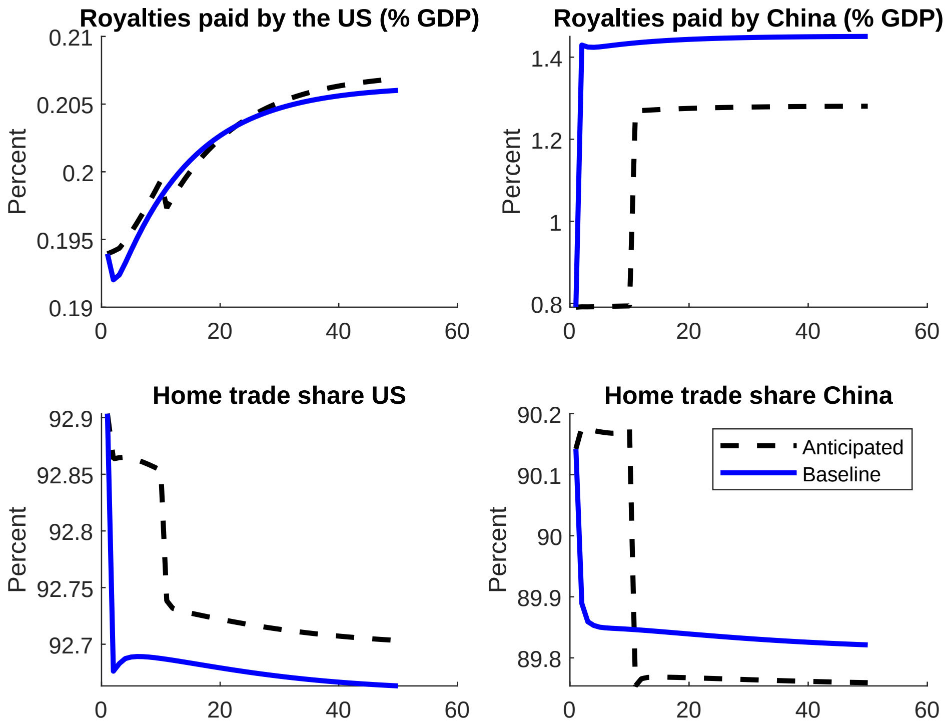
Figure J.1: R&D and adoption intensity



Notes: The figure plots the evolution of adoption and R&D intensity in the United States and China during the 50 years following the signature of a trade agreement with IP provisions designed as Nash bargaining. Period 0 represents the initial BGP. The solid line represents the baseline agreement; the dashed line represents an anticipated agreement.

Trade and Royalties The agreement has an impact on the home trade share and royalty payments across countries.

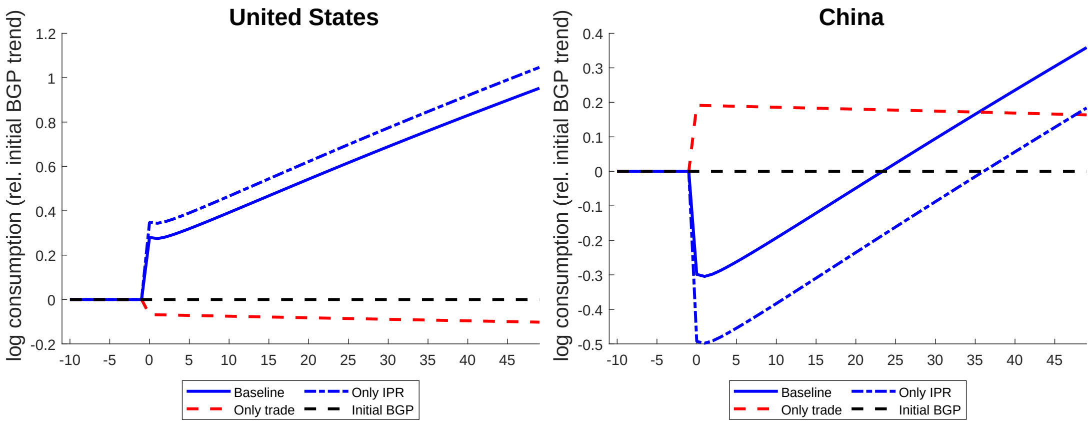
Figure J.2: Trade and royalty payments



Notes: The figure plots the evolution of royalty payments made by the United States and China and their home-trade shares during the 50 years following the signature of a trade agreement with IP provisions designed as Nash bargaining. Period 0 represents the initial BGP. The solid line represents the baseline agreement; the dashed line represents an anticipated agreement.

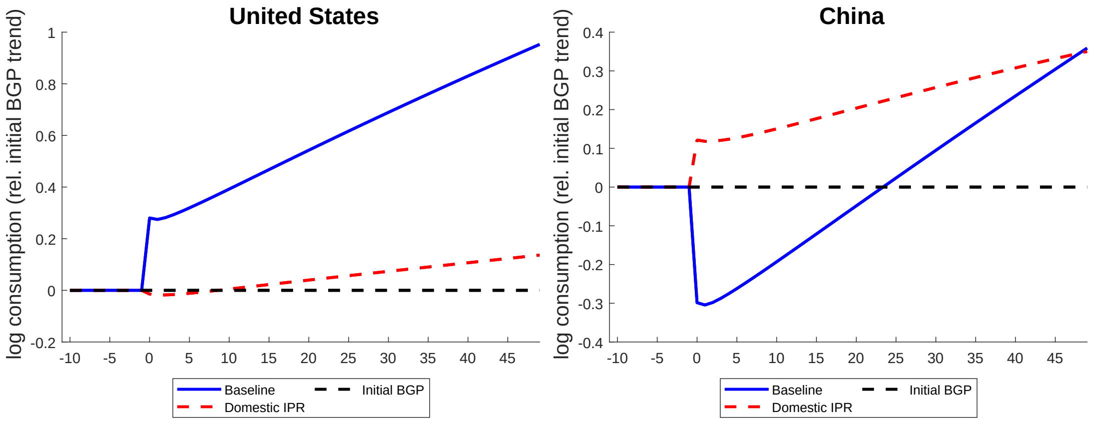
Dynamics of consumption under alternative scenarios Here I show the dynamics of consumption under alternative counterfactual scenarios.

Figure J.3: Log of consumption relative to initial BGP trend: Trade policy and IP reforms



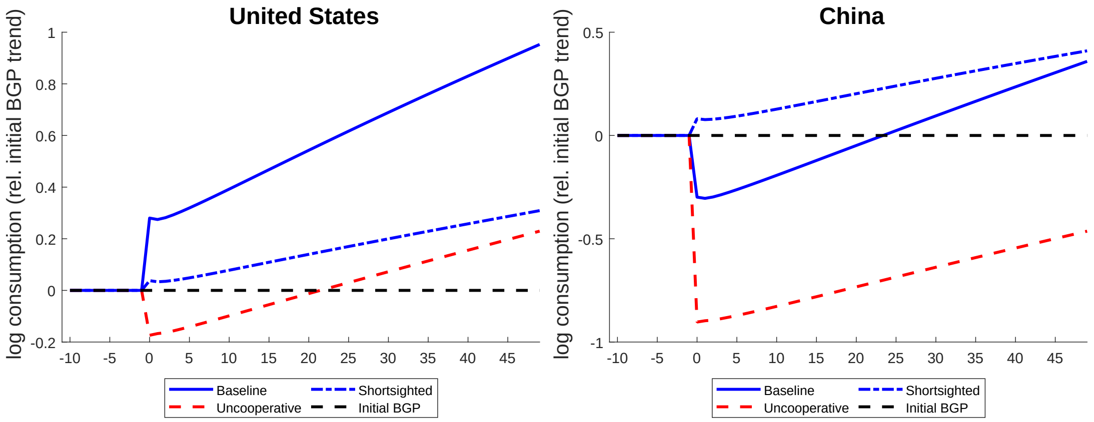
Notes: The figure plots the evolution of the log of consumption relative to its initial BGP trend in the United States (left panel) and China (right panel) 10 periods before and 50 periods after signing an agreement. The agreement is signed in period 1. The solid line represents the baseline trade agreement with IP provisions. The dashed line represents the case in which China improves IPR, but there is not a reduction in US tariffs. The dash-dotted line represents the case in which there is a reduction in US tariffs but China does not improve its IPR.

Figure J.4: Log of consumption relative to initial BGP trend: Unilateral IP reform



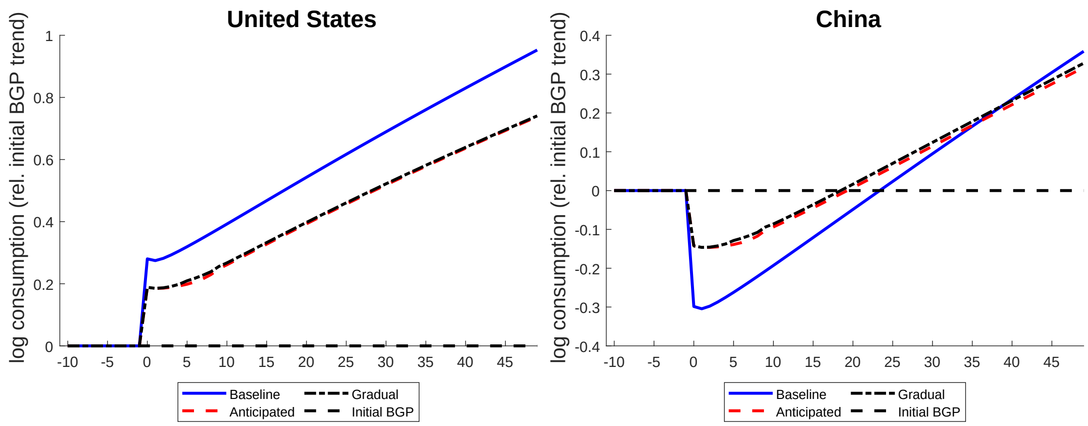
Notes: The figure plots the evolution of the log of consumption relative to its initial BGP trend in the United States (left panel) and China (right panel) 10 periods before and 50 periods after signing an agreement. The agreement is signed in period 1. The solid line represents the baseline trade agreement with IP provisions. The red dashed line represents the case in which China unilaterally improves domestic IP without being part of a trade agreement.

Figure J.5: Log of consumption relative to initial BGP trend: Uncooperative and shortsighted governments



Notes: The figure plots the evolution of the log of consumption relative to its initial BGP trend in the United States (left panel) and China (right panel) 10 periods before and 50 periods after signing an agreement. The agreement is signed in period 1. The solid line represents the baseline trade agreement with IP provisions. The red dashed line represents the uncooperative case. The blue dotted line represents a shortsighted government that wants to avoid short-term losses.

Figure J.6: Log of consumption relative to initial BGP trend: The role of anticipation



Notes: The figure plots the evolution of the log of consumption relative to its initial BGP trend in the United States (left panel) and China (right panel) 10 periods before and 50 periods after signing a trade agreement with IP provisions in the case of unanticipated trade agreement (blue solid line), anticipated 10 periods earlier (red dashed line), or anticipated and gradual agreement (black dotted-dashed line). The agreement is signed in period 1 and enters in force in period 11.

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