Global Supply Chains and Trade Policy

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Introduction

Global supply chains (GSCs) are important conduits of trade.

- Foreign value added $> 20\%$ of final manufacturing in many countries, $> 50\%$ in some countries and industries.
- Imported final goods contain significant domestic content.

GSCs are front and center in trade policy discussions.

- WTO "Made in the World Initiative"
- Lobbying on Trans-Pacific Partnership focuses on supply chains.

Yet, GSCs are absent in most theory and empirical work on trade policy.

1. How do GSC linkages modify incentives to impose protection?
2. Are GSC linkages empirically important drivers of trade policy?

The Argument (in a nutshell)

$\diamond$ Focus on final goods tariffs. Look for the shadow of GSCs.

$\Rightarrow$ Supply chain linkages alter incentives to manipulate final goods prices.

Consider US tariffs on imported final goods.

1. Higher US value added in foreign goods
   $\Rightarrow$ Optimal US tariff is lower...
   - Tariff pushes down prices that foreign producers receive.
   - Lower foreign prices are passed upstream to US input suppliers.

2. Higher foreign value added in US goods
   $\Rightarrow$ Optimal US tariff is lower...
   - Tariff pushes up prices that US producers receive.
   - Higher domestic prices are passed upstream to foreign input suppliers.
   - If foreign suppliers are politically weak, optimal US tariff is lower.

Roadmap

1. Integrate supply chains into terms-of-trade model of trade policy.
   - Final goods produced using domestic and foreign value added
     $\Rightarrow$ changes mapping from prices to income, and thus optimal policy.
   - Derive optimal bilateral tariffs for final goods with many goods/countries, political economy, and institutional constraints.
   - Theory yields testable predictions and guides estimation strategy.

2. Estimate how import protection responds to (a) domestic content in foreign goods, and (b) foreign content in domestic goods.
   - Focus on bilateral applied tariffs and temporary trade barriers.
   - Measure value added content using global input-output tables.
   - Take care to address MFN rule and reciprocally negotiated tariffs.

Preview of Results

1. Higher domestic value added in foreign final goods
   $\Rightarrow$ lower bilateral tariffs, consistent with the theory.
   - Control for confounding factors using fixed effects and proxies.
   - Result holds *only* for non-reciprocal tariffs, as theory predicts.
   - Result strengthens when we instrument and adjust for censoring.

2. Higher foreign value added in domestic final goods
   $\Rightarrow$ lower bilateral tariffs (limited foreign influence on trade policy).

3. Both results also hold for temporary trade barriers (antidumping, safeguards, countervailing duties), especially against China.

Model Overview

Trade policy with political economy [Grossman and Helpman (1994)].

- Homogeneous, freely-tradable outside good (numéraire).
- Quasi-linear preferences.
- Specific factors and rents.
- Politically-motivated government.

Twist 1: final goods = home value added + foreign value added.

Twist 2: characterize *bilateral* applied tariffs on final goods.

- MFN rule is a constraint on bilateral tariffs.
- Reciprocal trade agreements vs. unilateral (non-cooperative) tariffs.

Production

Final goods produced from tradable "value-added inputs":

$$q_s^c = f_s^c(l_s^c, \nu_{sc}^c, \vec{\nu}_{s*}^c)$$

$l_s^c \equiv$ homogenous factor input (also used to produce numéraire).
$\nu_{sc}^c \equiv$ input from country c used to produce q_s^c.
$\vec{\nu}_{s*}^c \equiv$ vector of foreign inputs used to produce q_s^c.

Value-added inputs are sector & destination specific, with inelastic supply.
i.e., sector-specific factors + buyer-seller lock in [Antràs and Staiger (2012)].

Sector-specific rents:

$$\pi_s^i(p_s^i) = p_s^i q_s^i(p_s^i) - w l_s^i(p_s^i) = \sum_{c \in \mathcal{C}} r_{sc}^i(p_s^i) \nu_{sc}^i,$$

National Income

$$I^i = \underbrace{1 + \sum_{s \in \mathcal{S}} \sum_{c \in \mathcal{C}} r^c_{si} \nu^c_{si}}_{\text{labor + VA inputs}} + \underbrace{R(\vec{p}, I^i; \vec{\nu})}_{\text{tariff revenue}}$$

$$= 1 + \underbrace{\vec{p^i} \cdot \vec{q^i}(\vec{p^i}, \vec{\nu^i})}_{\text{final goods revenue}} + \underbrace{R(\vec{p}, I^i; \vec{\nu})}_{\text{tariff revenue}} - \underbrace{\sum_{s \in \mathcal{S}} \sum_{c \neq i \in \mathcal{C}} r^i_{sc} \nu^i_{sc}}_{\equiv FVA^i(\vec{p^i})} + \underbrace{\sum_{s \in \mathcal{S}} \sum_{c \neq i \in \mathcal{C}} r^c_{si} \nu^c_{si}}_{\equiv DVA_i(\vec{p^*})}.$$

- Without GSC linkages, income is $1 + \vec{p^i} \cdot \vec{q^i}(\vec{p^i}, \vec{\nu^i}) + R(\vec{p}, I^i; \vec{\nu})$.
- With GSC linkages: (1) add $DVA_i(\vec{p^*})$ to income,
  (2) subtract $FVA^i(\vec{p^i})$ from final goods revenue.
- Intuition: GSC linkages alter mapping from prices to income.

Political Economy

Government Objective Function:

$$G^i = I^i + \zeta(\vec{p}^i) + \sum_s [\delta_s^i \pi_s^i(p_s^i) + \delta_{s*}^i FVA_s^i(p_s^i) + \delta_{si}^* DVA_{si}(\vec{p}_s^*)]$$

- I^i is income (defined on previous slide).
- $\zeta(\vec{p}^i)$ is consumer surplus.
- $\{\delta_s^i, \delta_{s*}^i, \delta_{si}^*\}$ are political economy weights.

Government's problem:

$$\max_{\{\tau_{sj}^i\}} G^i \quad \text{s.t.} \quad p_s^i = \tau_{sj}^i p_s^j \text{ and } \tau_{sj}^i \leq \tau_s^{i,MFN}.$$

Optimal Bilateral Tariffs

If $\tau^i_{xj} < \tau_x^{i,MFN}$, then it solves the government's FOC:

$$G^i_{\tau^i_{xj}} = \underbrace{\frac{dM^i_x}{d\tau^i_{xj}} t^i_{xj} p^j_x - M^i_{xj} \frac{dp^j_x}{d\tau^i_{xj}}}_{\text{standard TOT motive}} + \underbrace{\delta^i_x q^i_x \frac{dp^i_x}{d\tau^i_{xj}}}_{\text{domestic PE}} + \Omega^{Ri}_{xj}$$
$$- (1 - \delta^i_{x*}) \frac{dFVA^i_x}{d\tau^i_{xj}} + (1 + \delta^*_{xi}) \frac{dDVA_{xi}}{d\tau^i_{xj}} = 0.$$

$\frac{dDVA_{xi}}{d\tau^i_{xj}}$ depends on $\frac{dp^j_x}{d\tau^i_{xj}}$ $\rightarrow$ terms-of-trade externality.

$\frac{dFVA^i_x}{d\tau^i_{xj}}$ depends on $\frac{dp^i_x}{d\tau^i_{xj}}$ $\rightarrow$ local price externality.

DVA & FVA Derivatives

Applied Bilateral Tariffs

$$t_{xj}^{i,\text{applied}} = \min\{t_{xj}^{i}, t_{x}^{i,MFN}\}$$

$$t_{xj}^{i} = \frac{1}{\epsilon_{xj}^{i}}\left(1+\frac{\delta_{x}^{i}p_{x}^{i}q_{x}^{i}}{|\lambda_{xj}|p_{x}^{i}M_{xj}^{i}} - (1+\delta_{xi}^{*})\varepsilon_{xi}^{rj}\frac{DVA_{xi}^{j}}{p_{x}^{j}M_{xj}^{i}} - \frac{(1-\delta_{x*}^{i})\varepsilon_{x*}^{ri}}{|\lambda_{xj}|}\frac{FVA_{x}^{i}}{p_{x}^{i}M_{xj}^{i}} + \tilde{\Omega}_{xj}^{i}\right)$$

with $\varepsilon_{xi}^{rj} \equiv \frac{dr_{xi}^{j}}{dp_{x}^{j}}\frac{p_{x}^{j}}{r_{xi}^{j}} > 0$, $\varepsilon_{x*}^{ri} \equiv \frac{dr_{x*}^{i}}{dp_{*}^{i}}\frac{p_{*}^{i}}{r_{x*}^{i}} > 0$, and $\lambda_{xj} \equiv \frac{dp_{x}^{j}}{d\tau}/\frac{dp_{x}^{i}}{d\tau} < 0$.

Interpretation by parts:

1. No political economy or GSC linkages $\Rightarrow t_{xj}^{i} = \frac{1}{\hat{\epsilon}_{xj}^{i}}$.
2. No value-added linkages $\Rightarrow t_{xj}^{i} = \frac{1}{\hat{\epsilon}_{xj}^{i}}\left(1+\frac{\delta_{x}^{i}q_{x}^{i}}{|\lambda_{xj}|M_{xj}^{i}}\right)$.
3. MFN Rule: applied tariff may deviate from unconstrained optimum.

Reciprocal Trade Agreements (RTAs)

Some bilateral tariffs are set via bilateral trade agreements.
Reciprocity may neutralize the bilateral externality.

Under full reciprocity:

$$t^i_{xj} \to \frac{1}{\tilde{\epsilon}^i_{xj}} \left(\frac{\delta^i_x q^i_x}{\tilde{\lambda}_{xj} M^i_{xj}} - \frac{(1-\delta^i_{x*})}{\tilde{\lambda}_{xj}} \varepsilon^{ri}_{x*} \frac{FVA^i_x}{p^i_x M^i_{xj}} \right).$$

Note: (a) no additive inverse export supply elasticity, (b) no DVA effects.

Do bilateral trade agreements neutralize t-o-t externality empirically?

- We look for the imprint of reciprocity on observed tariffs.
- We take care to document role of DVA for non-reciprocal tariffs.

Contours of the Empirical Exercise

Data

- Collect data on bilateral tariffs and temporary trade barriers.
- Measure DVA^j_{xi} and FVA^i_x using global input-output tables.

Estimation

- Prediction to test: t^i_{xj} is decreasing in DVA^j_{xi}.
  Does this vary inside vs. outside RTAs?
- To be signed: t^i_{xj} may be increasing or decreasing in FVA^i_x, depending on whether $\delta^i_{x*} \lessgtr 1$.
- Econometric concerns:
  - Control for $1/\epsilon^i_{xj}$ and domestic political economy.
  - Correct for MFN-censoring to infer response of optimal tariffs.
  - IV estimation to address possible endogeneity of DVA.

Data

Tariffs

- Simple average applied, bilateral, industry-level tariffs for final goods.
- Final goods defined by BEC classification at HS 6-digit level.
- Sources: bilateral, product-level (HS 6-digit) tariff data from WTO and UNCTAD/TRAINS.

Value-Added Data

- Use global IO table to compute origin of the value added in final goods produced by each country [Los, Timmer, and de Vries (2014)].
- Source: World Input-Output Database.
  - 14 major importers, 14 (same) exporters, 14 industries.
  - Four years: 1995, 2000, 2005, 2009.

More on Data

Testing the Domestic Value Added Prediction

Bilateral Optimal Tariff:

$$t^i_{xjt} = \frac{1}{\epsilon^i_{xj}} + \frac{\delta^i_x p^i_{xt} q^i_{xt} - (1 - \delta^i_{x*})\varepsilon^{ri}_{x*} FVA^i_{xt}}{\epsilon^i_{xj} |\lambda_{xj}| p^i_{xt} M^i_{xjt}} - \beta_{ijxt} DVA^j_{xit}$$

Estimating Equation:

$$t^i_{xjt} = FE_{xit} \times IMdecile_{xijt} + FE_{xjt} + \beta \ln(DVA^j_{xit}) + e_{xijt}$$

Comments:

- Start with OLS.
- Pool RTA and non-RTA tariffs; look for heterogeneous coefficients.
- For non-RTA tariffs: correct for censoring, instrument for DVA, and break out GSP preferences.

Bilateral Tariffs and DVA

Dependent Variable: Applied Bilateral, Industry-Level Tariff (t^i_{xjt})

	(1)	(2)	(3)	(4)
Log DVA: $\ln(DVA^j_{xit})$	-0.92***	-0.46***		
	(0.27)	(0.16)		
Log DVA Outside RTAs: $[1-RTA_{ijt}]\times\ln(DVA^j_{xit})$			-0.55***	-0.66**
			(0.19)	(0.32)
Log DVA Inside RTAs: $RTA_{ijt}\times\ln(DVA^j_{xit})$			0.26	
			(0.42)	
Reciprocal Trade Agreement: RTA_{ijt}		-3.68***	-7.86**	-7.00***
		(0.82)	(3.28)	(2.07)
Observations	8,853	8,853	8,853	8,853
R-squared	0.988	0.990	0.991	0.991

Note: Importer-Industry-Year-Decile and Exporter-Industry-Year fixed effects included in all columns. Standard errors (in parentheses) are clustered by importer-exporter pair. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

Broad RTA Definition

Non-RTA Tariffs: Instrumenting for DVA

Endogeneity Concerns:

- Concern 1: DVA^{j}_{xit} might depend on t^{i}_{xjt} [simulteneity bias].
  e.g., US DVA in Thai TVs rises when US tariffs on Thai TVs fall.
- Concern 2: Measurement error in DVA.

Instrument: DVA from i in services produced by j ($DVA^{j}_{services,it}$).

- Relevance: $DVA^{j}_{services,it}$ is determined by non-tariff factors (e.g., determinants of input sourcing) that also influence DVA^{j}_{xit}.
- Exogeneity: $DVA^{j}_{services,it}$ is not a function of the tariff t^{i}_{xjt}.

Alternative Instrument: DVA in 1970 [Johnson and Noguera (2014)], before preferences in our data were introduced. Logic is similar.

Details: 2 composite industries; not available for all countries; no time variation.

Non-RTA Tariffs: Instrumenting for DVA

	OLS		IV: DVA-in-Services		IV: DVA-in-1970	
	(1)	(2)	(3)	(4)	(5)	(6)
Log DVA: $\ln(DVA^{j}_{xit})$	-0.17**	-0.24***	-0.21***	-0.28***	-0.87***	-1.22***
	(0.07)	(0.08)	(0.05)	(0.08)	(0.16)	(0.26)
Observations	8,187	8,187	8,187	8,187	6,055	6,055
Importer-Industry-Year-Decile	Y	N	Y	N	Y	N
Importer-Industry-Year	N	Y	N	Y	N	Y
Exporter-Industry-Year	Y	Y	Y	Y	Y	Y

Note: Standard errors (in parentheses) are clustered by importer-exporter pair.
Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

Robustness Checks

Non-RTA Tariffs: Correcting for MFN-Censoring

Recall: $t_{xj}^{i,\text{applied}} = \min\{t_{xj}^{i}, t_{x}^{i,MFN}\}$.

Correcting for censoring yields response of *optimal* tariff to DVA.

	Baseline (1)	Tobit (2)	Tobit-IV (3)
Log DVA: $\log(DVA_{xit}^{j})$	-0.24***	-0.78***	-0.83***
	(0.08)	(0.23)	(0.26)
Observations	8,187	4,431	4,431
R-Squared	0.994		

Note: Censored regressions use one-sided Tobit, with tariff preferences ($t_{xjt}^{i} - t_{xjt}^{i,MFN}$) as the dependent variable. Instrument is DVA-in-Services. Importer-industry-year and exporter-industry-year fixed effects included in all columns. Standard errors (in parentheses) are clustered by importer-exporter pair. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

Foreign Value Added in Domestic Final Goods Production

Bilateral Optimal Tariff:

$$t^i_{xjt} = \frac{1}{\epsilon^i_{xj}} + \gamma^{IP}_{ijx}\left(\frac{FG^i_{xt}}{p^i_{xt}M^i_{xjt}}\right) + \gamma^{FVA}_{ijx}\left(\frac{FVA^i_{xt}}{p^i_{xt}M^i_{xjt}}\right) + \gamma^{DVA}_{ijx}\left(\frac{DVA^j_{xi}}{p^j_{xt}M^i_{xjt}}\right)$$

Estimating Equation:

$$t^i_{xjt} - t^{i,MFN}_{xt} = FE_{xi} + FE_{it} + FE_{xt} + FE_{xjt} + \gamma^{IP}\ln\left(\frac{FG^i_{xt}}{IM^i_{xjt}}\right) + \gamma^{DVA}\ln\left(\frac{DVA^j_{xit}}{IM^i_{xjt}}\right) + \gamma^{FVA}\ln\left(\frac{FVA^i_{xt}}{IM^i_{xjt}}\right) + u_{ijxt}$$

Comments:

- Sign predictions: $\gamma^{DVA} < 0$, $\gamma^{FVA} \lessgtr 0$, $\gamma^{IP} > 0$.
- Tariff preferences on LHS; use more time variation on RHS. Robustness: re-estimate with importer-industry-year FE.

Bilateral Tariffs and FVA

	OLS		Tobit	
	(1)	(2)	(3)	(4)
Log DVA-Ratio: $\ln(DVA^j_{xit}/IM^i_{xjt})$	-0.48***	-0.55***	-1.32***	-1.40***
	(0.18)	(0.21)	(0.43)	(0.46)
Log FVA-Ratio: $\ln(FVA^i_{xt}/IM^i_{xjt})$	-0.31**		-0.51	
	(0.15)		(0.36)	
Log Inv. IP-Ratio: $\ln(FG^i_{xt}/IM^i_{xjt})$	0.88***		1.95***	
	(0.30)		(0.70)	
Log IP-Ratio + Log FVA Ratio ($\gamma^{IP} + \gamma^{FVA}$)		0.63***		1.53***
		(0.22)		(0.50)
Reciprocal Trade Agreement: RTA_{ijt}	-4.59***	-4.50***	-7.19***	-7.13***
	(0.89)	(0.90)	(1.34)	(1.33)
Observations	8,707	8,707	7,643	6,229
R-Squared	0.520	0.536		
Importer-Year, Industry-Year, Importer-Industry	Y	N	Y	N
Importer-Industry-Year	N	Y	N	Y

Note: Exporter-industry-year fixed effects included in all columns. Standard errors (in parentheses) are clustered by importer-exporter. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

Comments

RTA vs. non-RTA Tariffs and FVA

	OLS		Tobit	
	(1)	(2)	(3)	(4)
Log DVA Ratio Outside RTA: $[1 - RTA_{ijt}] \times \ln(DVA^j_{xit}/IM^i_{xjt})$	-0.48***	-0.54***	-1.34***	-1.43***
	(0.18)	(0.20)	(0.42)	(0.45)
Log DVA Ratio Inside RTA: $RTA_{ijt} \times \ln(DVA^j_{xit}/IM^i_{xjt})$	0.16	0.10	-0.23	-0.29
	(0.53)	(0.55)	(0.68)	(0.70)
Log FVA Ratio Outside RTA: $[1 - RTA_{ijt}] \times \ln(FVA^j_{xit}/IM^i_{xjt})$	-0.17		0.025	
	(0.16)		(0.44)	
Log FVA Ratio Inside RTA: $RTA_{ijt} \times \ln(FVA^j_{xit}/IM^i_{xjt})$	-2.87*		-5.38**	
	(1.49)		(2.38)	
Log FVA-Ratio Inside RTA − Outside RTA		-2.74*		-5.24**
		(1.56)		(2.55)
Observations	8,707	8,707	7,643	6,229
R-Squared	0.536	0.552		
Importer-Year, Industry-Year, Importer-Industry	Y	N	Y	N
Importer-Industry-Year	N	Y	N	Y

Note: Coefficients on Inverse IP-Ratio and RTA are omitted from the table (see the paper). Exporter-industry-year fixed effects included in all columns. Standard errors (in parentheses) are clustered by importer-exporter. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

Endogeneity in the DVA/FVA/FG Ratio Specification

New Endogeneity Concerns:

- Concern 1: FVA^{j}_{xit} might depend on t^{i}_{xjt} [simulteneity bias, again]. e.g., US tariff on imported TV's raises FVA in US-produced TV's.
- Concern 2: FG^{i}_{xt} and IM^{i}_{xjt} are also potentially endogenous.

Reply 1: Our main concern is endogeneous FVA.

- Endogeneity suggests we would find a positive coefficient for FVA.
- We find a negative coefficient (attenuated toward zero?).

Reply 2: We check our results via IV [See Appendix C].

- Tricky: multiple endog. variables, correlated for structural reasons.
- Supply push IV for FVA; demand pull IV for FG.
- Signs go through; point estimates are pushed away from zero, but confidence intervals are wide.

Temporary Trade Barriers (TTBs)

TTBs are another good testing ground:

- TTB = antidumpting, safeguard, and countervailing duties.
- Set with unilateral discretion and targeted bilaterally.
- Increasingly important discretionary trade policy instruments.
- NTBs are responsive to terms-of-trade concerns [Broda, Limão, and Weinstein (2008), Bown and Crowley (2013)].

Empirical specification:

- Dependent variable: TTB coverage ratio for final goods.
- Use the "ratio specification" discussed previously.
- TTB coverage ratio is stock (not flow), so TTBs today reflect past decisions $\Rightarrow$ lag DVA and FVA to proxy for information at time when policy was adopted.

TTBs and Value Added Content

Dependent Variable: Bilateral, Industry-Level TTB Coverage Ratio (TTB^i_{xjt})

	(1)	(2)
Log DVA-Ratio: $\ln(DVA^j_{xi,t-5}/IM^i_{xj,t-5})$	-0.40***	-0.19***
	(0.079)	(0.065)
Log FVA-Ratio: $\ln(FVA^i_{x,t-5}/IM^i_{xj,t-5})$	-5.96***	
	(1.29)	
Log Inv. IP-Ratio: $\ln(FG^i_{x,t-5}/IM^i_{xj,t-5})$	6.29***	
	(1.31)	
Log IP-Ratio + Log FVA Ratio ($\gamma^{IP} + \gamma^{FVA}$)		0.17***
		(0.063)
Reciprocal Trade Agreement: RTA_{ijt}	0.12	-0.056
	(0.13)	(0.080)
Observations	5,912	5,912
R-Squared	0.371	0.761
Importer-Year, Industry-Year, Importer-Industry	Y	N
Importer-Industry-Year	N	Y

Note: Exporter-industry-year fixed effects included in all columns. Standard errors (in parentheses) are clustered by importer-exporter. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

TTBs on China

Dependent Variable: Bilateral, Industry-Level TTB Coverage Ratio (TTB^i_{xjt})

	(1)	(2)
$\ln(DVA^j_{xi,t-5}/IM^i_{xj,t-5}) \times$ exporter $=$ China	-1.27***	-0.62*
	(0.41)	(0.33)
$\ln(DVA^j_{xi,t-5}/IM^i_{xj,t-5}) \times$ exporter $\neq$ China	-0.27***	-0.16**
	(0.073)	(0.062)
$\ln(FVA^i_{x,t-5}/IM^i_{xj,t-5}) \times$ exporter $=$ China	-5.16***	
	(1.37)	
$\ln(FVA^i_{x,t-5}/IM^i_{xj,t-5}) \times$ exporter $\neq$ China	-6.03***	
	(1.30)	
Observations	5,912	5,912
R-Squared	0.376	0.762
Importer-Year, Industry-Year, Importer-Industry	Y	N
Importer-Industry-Year	N	Y

Note: DVA and FVA are interacted with indicator $\mathbf{1}$(exporter $=$ China). Coefficients on Inverse IP-Ratio and RTA are omitted from the table (see the paper). Exporter-industry-year fixed effects included in all columns. Standard errors (in parentheses) are clustered by importer-exporter. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

Conclusion

New framework to analyze impact of global supply chains on trade policy.

- Tariffs $\rightarrow$ final goods prices $\rightarrow$ prices of VA $\rightarrow$ income $\rightarrow$ welfare.
- Optimal bilateral tariffs depend on value-added content.

The evidence:

- Import protection falls with DVA in foreign goods, consistent with the theory.
- Import protection also falls with FVA in domestic goods.

Future work: we focused on *final* goods tariffs, but governments set *input* tariffs too. Government should care about *value-added terms of trade*.

The Government's FOC

$$G^i_{\tau^i_{xj}} = \text{ToT} + \text{DPE} + \Omega^{Ri}_{xj} - (1-\delta^i_{x*})\frac{dFVA^i_x}{d\tau^i_{xj}} + (1+\delta^*_{xi})\frac{dDVA_{xi}}{d\tau^i_{xj}} = 0.$$

$$\frac{dFVA^i_x}{d\tau^i_{xj}} = \sum_{c\neq i}\left[\frac{r^i_{xc}\nu^i_{xc}}{p^i_x}\underbrace{\left(\frac{dr^i_{xc}}{dp^i_x}\frac{p^i_x}{r^i_{xc}}\right)}_{\equiv\varepsilon^{ri}_{x*}\geq 0}\right]\frac{dp^i_x}{d\tau^i_{xj}} = \varepsilon^{ri}_{x*}\frac{FVA^i_x}{p^i_x}\frac{dp^i_x}{d\tau^i_{xj}}$$

$$\frac{dDVA_{xi}}{d\tau^i_{xj}} = \underbrace{\frac{r^j_{xi}\nu^j_{xi}}{p^j_x}\underbrace{\left(\frac{dr^j_{xi}}{dp^j_x}\frac{p^j_x}{r^j_{xi}}\right)}_{\equiv\varepsilon^{rj}_{xi}\geq 0}\frac{dp^j_x}{d\tau^i_{xj}}}_{\frac{dDVA^j_{xi}}{d\tau^i_{xj}}} + \underbrace{\Omega^{DVAi}_{xj}}_{\frac{dDVA^{-j}_{xi}}{d\tau^i_{xj}}} = \varepsilon^{rj}_{xi}\frac{DVA^j_{xi}}{p^j_x}\frac{dp^j_x}{d\tau^i_{xj}} + \Omega^{DVAi}_{xj}$$

Back

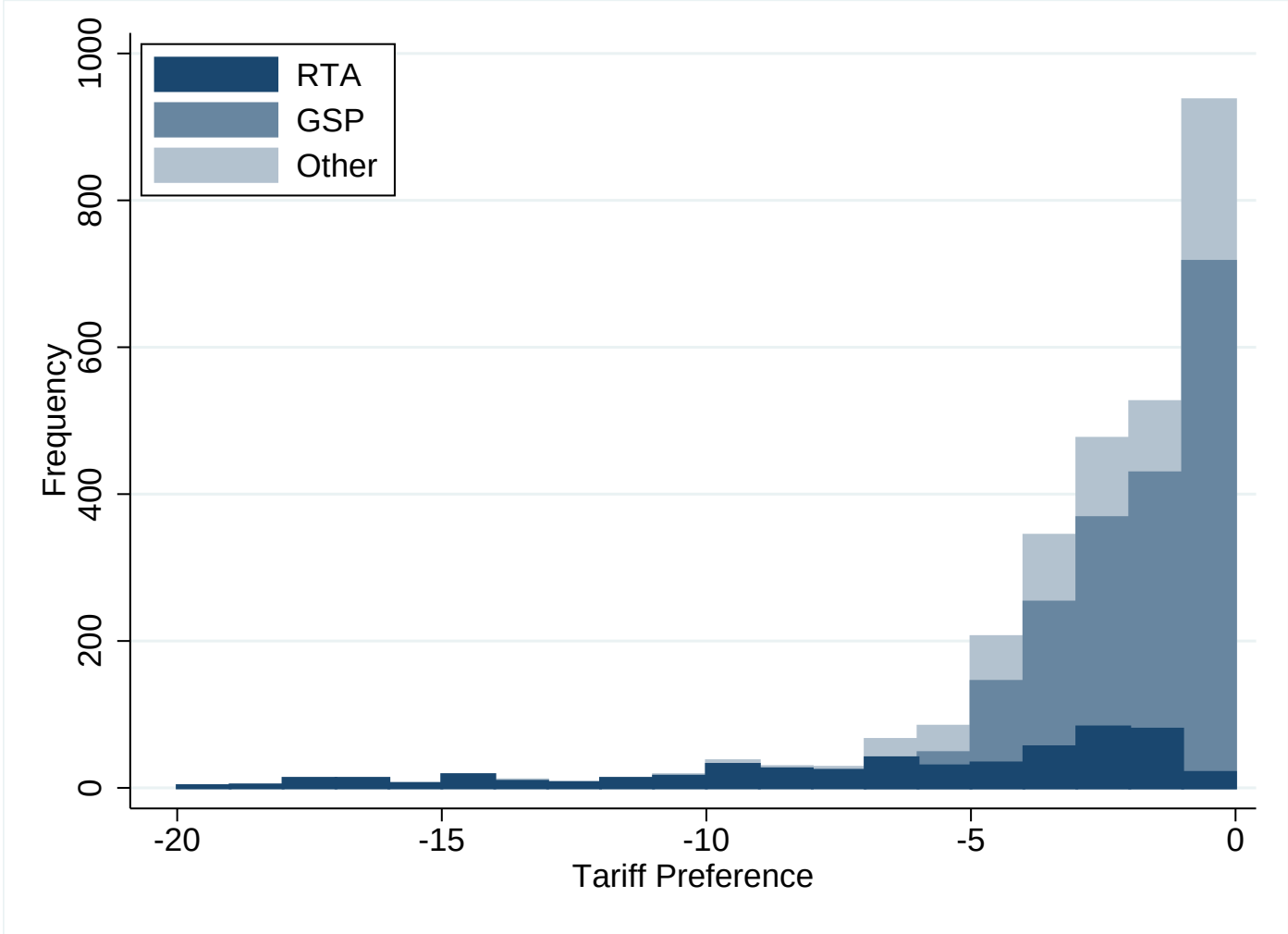
Tariff Preferences

One-third of importer-exporter-industry-year cells have preferential tariffs.

Three Institutional Sources of Preferences:

1. Generalized System of Preferences (GSP) $\approx$ 69%.
   - 'Advanced' countries extend preferences to 'developing' countries under the GATT Enabling Clause.
   - Unilateral preferences: importers have discretion over (a) eligible countries and sectors, and (b) tariffs.
2. Reciprocal Trade Agreements (RTA) $\approx$ 20%
   - Authorized by GATT Article XXIV.
   - Comprehensive, bilaterally negotiated (i.e., cooperative) preferences.
3. Other Preferences $\approx$ 11%
   - 'Partial Scope' trade agreements among developing countries.
   - Miscellaneous, idiosyncratic preferences.

The Distribution of Tariff Preferences



Note: Tariff preference: $t^{i}_{xjt} - t^{i,MFN}_{xjt}$. Figure excludes preferences < -20 for legibility. Bin width = 1pp. Median preference $\approx$ -2 pp. 10th-90th range = $[-6.21, -.13]$.

Back

Broad Definition of RTAs

Broad RTA $\equiv$ Article XXIV Agreement + Other Comprehensive Agreements (e.g., ASEAN-CHN FTA, BRA-MEX PTA).

	(1)	(2)	(3)
Log DVA: $\ln(DVA^{j}_{xit})$	-0.43**		
	(0.17)		
Log DVA Outside RTAs: $[1-RTA_{ijt}]\times\ln(DVA^{j}_{xit})$		-0.49**	-0.50*
		(0.20)	(0.29)
Log DVA Inside RTAs: $RTA_{ijt}\times\ln(DVA^{j}_{xit})$		0.030	
		(0.30)	
Reciprocal Trade Agreement: RTA_{ijt}	-3.73***	-6.26**	-6.17***
	(0.65)	(2.47)	(1.76)
Observations	8,853	8,853	8,853

Note: Importer-Industry-Year-Decile and Exporter-Industry-Year fixed effects included in all columns. Standard errors (in parentheses) are clustered by importer-exporter pair. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

Back

Additional Controls in DVA Regression

	(1)	(2)	(3)	(4)
Log DVA: $\ln(DVA^{j}_{xit})$	-0.16***	-0.21***	-0.16***	-0.13**
	(0.058)	(0.053)	(0.059)	(0.060)
Log Distance	0.90		0.12	0.13
	(0.082)		(0.094)	(0.097)
Colony		0.05	0.17	0.18
		(0.16)	(0.19)	(0.19)
Contiguity				0.32
				(0.24)
Common Language				-0.24*
				(0.14)
Observations	8,187	8,104	8,187	8,187

Note: Importer-Industry-Year-Decile and Exporter-Industry-Year fixed effects included in all columns. All columns include IV estimates, with DVA-in-Services as the instrument. The sample includes non-RTA preferences only. Standard errors (in parentheses) are clustered by importer-exporter pair. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

Back

Non-RTA Tariffs: GSP vs. Other Preferences

	No RTA	No RTA & GSP Eligible	No RTA & GSP Ineligible
	(1)	(2)	(3)
Log DVA: $\log(DVA^j_{xit})$		-0.23**	-0.23**
		(0.10)	(0.11)
Log DVA (GSP eligible): $[1-GSP_{ijt}]\times\log(DVA^j_{xit})$	-0.32***		
	(0.09)		
Log DVA (GSP ineligible): $GSP_{ijt}\times\log(DVA^j_{xit})$	-0.18**		
	(0.08)		
GSP eligible: GSP_{ijt}	-0.40		
	(0.26)		
Observations	8,187	3,039	5,148

Note: All columns include Linear-IV estimates using DVA-in-Services as the instrument, with importer-industry-year-decile and exporter-industry-year fixed effects. A country pair is GSP eligible if the importer grants GSP preferences to any exporter and the exporter receives GSP preferences from any importer. Standard errors (in parentheses) are clustered by importer-exporter pair. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.