Deep Trade Agreements' Provisions, International Trade, and Foreign Direct Investment

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Gravity, Trade Agreements, and Policy:
Celebrating the Contributions of Jeff Bergstrand
UND, April 5, 2024

Motivation

- More than fifteen years ago, (Baier & Bergstrand, 2007) asked the question: "Do Free Trade Agreements *Actually* Increase Members' International Trade?"
  - Providing unbiased and precise partial effects on bilateral aggregate international trade flows of the formation of an economic integration agreement (EIA)
- The past 30 years have witnessed the proliferation of "deep trade" agreements, or DTAs, that include many trade and FDI related provisions. ⏩ DTA example
  - These provisions alter bilateral trade costs, but also bilateral FDI costs like employee costs.
- However, little is known on how the "deepness" (or sum of provisions) affect both trade and FDI activities, and less so the effect of individual provisions.

1. Motivation
   - Contributions
2. Background
   - Theoretical Background
   - Related Literature
3. Data
   - WB DTA database
   - MREID
   - Benchmark Results
4. Methodology: Econometric Problems and Solutions
   - A stylized model
   - Simulations
5. Econometric Specifications and Empirical Results
   - SV Results
6. Conclusion

Contributions

1. We aim to move beyond the estimation of a single partial effect representing a DTA (or EIA)
   - FDI (MREID): including foreign affiliates' revenues, employment, investment (assets) and costs
2. "Which provisions matter for trade and which for FDI?"
   - We use the Shapley Value approach from cooperative game theory to estimate the heterogeneous effects of set provisions on trade and FDI.
3. We examine the effects on FDI (trade) of provisions that positively affect trade (FDI), and the effects on FDI (trade) of provisions that negatively affect trade (FDI).
   - We find evidence that sets of provisions that positively (negatively) affect trade also negatively (positively) affect FDI.
4. Mechanisms: provisions that positively affect the number of affiliates lower affiliates' cost per employee (and increase employment)
   - provisions that positively affect trade, raise affiliates' cost per employee (and decrease employment)

Theoretical Background

1. Theoretical MNE Models with Homogeneous Firm Productivities
   - "Knowledge-Capital" model (Markusen, 2002 & more)
   - "Knowledge-*and*-*Physical*-Capital" (Bergstrand & Egger, 2007)
   - Structural Armington model with physical capital accumulation (Anderson et al., 2019)
2. Theoretical MNE Models with Heterogeneous Firm Productivities (Ramondo, 2014; Ramondo & Rodriguez-Clare, 2013 and Arkolakis et al., 2018)
3. Property-Rights Issues (Antràs & Helpman, 2008)
   - "... deep (PTA) provisions may increase or decrease vertical FDI, depending on whether they improve the contractibility of inputs provided by headquarters (headquarter services) or by the suppliers (components)" (Osnago et al., 2019)
   - Export-platform FDI (Antràs et al., 2024)

Related Literature

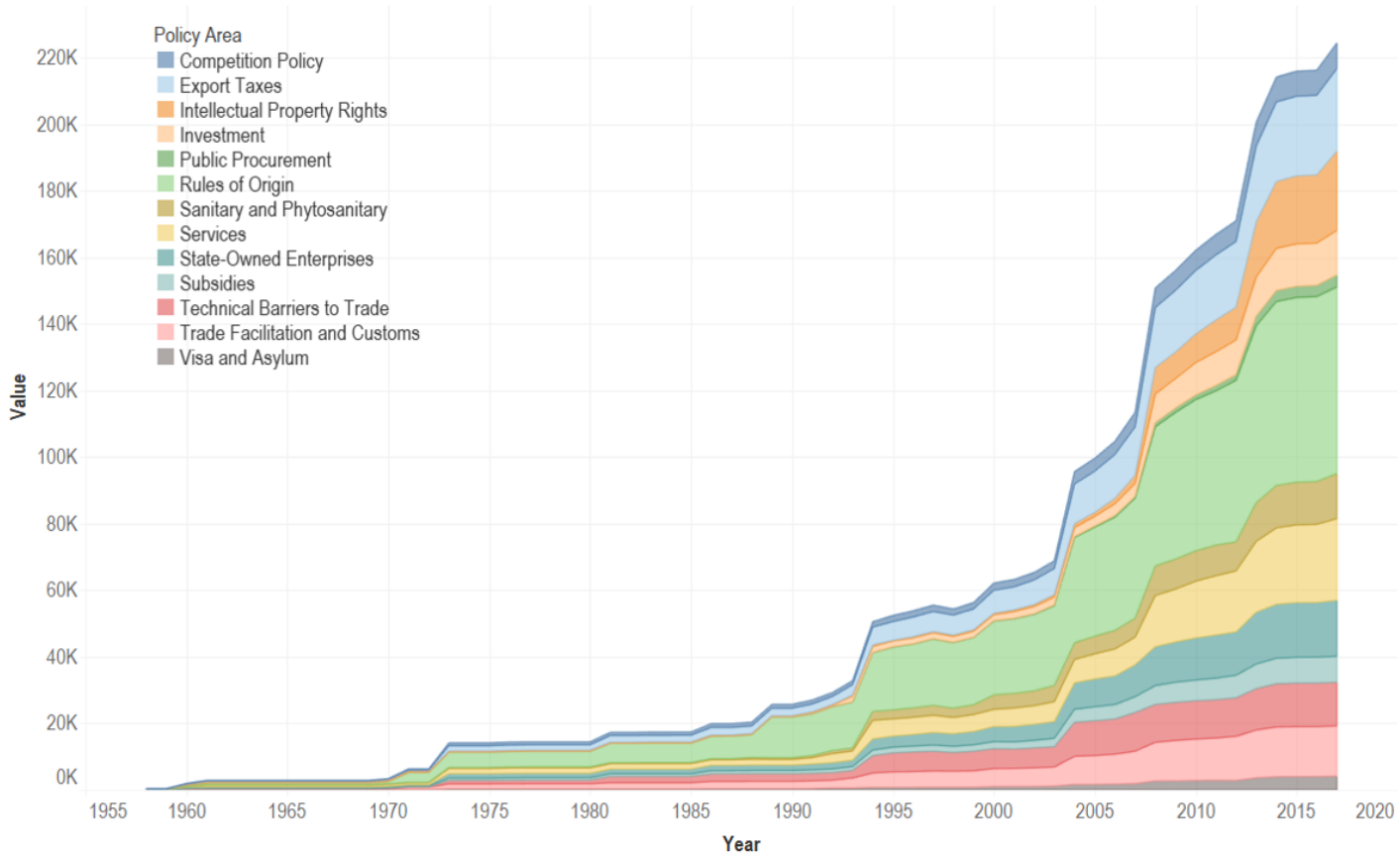
1. Quantitative (partial) impacts of EIAs on bilateral trade (Baier & Bergstrand, 2007) and "deepness" of DTAs with:
   - Dummies (Baier et al., 2014, 2018)
   - Provision counts (Mattoo et al., 2017; Kohl et al., 2016; Mulabdic et al., 2017; Dhingra et al., 2018)
   - Classification algorithms & ML (Fontagne et al., 2022; Breinlich et al., 2021; Regmi & Baier, 2020)
2. Impact of EIAs on MNEs' bilateral FDI and/or FAS (Bergstrand & Egger, 2007; Mistura & Roulet, 2019; Buthe & Milner, 2014; Paniagua et al., 2015) and
   - "deepness" of DTAs (Grounder et al., 2019; Kox & Rojas-Romagosa, 2019; Laget et al., 2021; Larch & Yotov, 2022; Osnago et al., 2019)

Data

- The data for our analysis come from three data sets:
  - The DTA database of the World Bank,
  - the International Trade and Production Database for Estimation v2 (ITPD-E) at the U.S. International Trade Commission (USITC) (Borchert et al., 2022), and
  - a new Multinational Revenue, Employment, and Investment Database (MREID) at the USITC (Ahmad et al., 2023)

Deep Trade Agreements Database (World Bank)

We limit our analysis to the 164 provisions denoted by the World Bank as "Substantive Provisions", which "require specific integration/ liberalization commitments and obligations/ conditions."



⏩ World Map ⏩ Policy Areas ⏩ Provisions ⏩ Popular ⏩ Unpopular ⏩ Time Series ⏩ Multi

MREID (USTIC)

1. Time span: 12 years (2010-2021)
2. Bilateral
3. Countries: 185
4. Sectors: 25
5. Domestic data for all variables
6. FDI variables
   1. Extensive margin: (number of affiliates)
   2. Revenues and costs
   3. Employees and cost per employee
   4. Investment: Assets (tangible and intangible)
7. FDI types
   1. Total
   2. Greenfield
   3. Mergers and Acquisitions

overview search variables Affiliates flows world map

MREID Summary Statistics

Table: Summary statistics at the host country by ownership (per affiliate)

	Panel A: Domestic			Panel B: Foreign		
	mean	max	sd	mean	max	sd
Revenue	76	970	171	93	1,224	188
Employees	250	3,829	624	282	5,095	697
Total assets	424	11,394	1,224	431	5,505	749
Fixed assets	51	1,490	160	94	3,915	428

Notes: Revenue and assets in million USD
Foreign statistics at the host country level, year averages
Averages per affiliate

The combined use of ITPD-E & MREID, imposes several limitations in terms of countries (138) and time coverage (2010 to 2019). Summary stats

	Panel A: trade			Panel B: FDI (affiliates)		
	(1)	(2)	(3)	(4)	(5)	(6)
DTA provisions	0.0006*			0.0001**		
	(0.00)			(0.00)		
DTA substantive provisions		0.0032*			0.0006**	
		(0.00)			(0.00)	
DTA non-substantive provisions			0.0008*			0.0002**
			(0.00)			(0.00)
Observations	190440	190440	190440	190440	190440	190440
R^2	0.998	0.998	0.998	0.998	0.998	0.998
OriginxYear FE	Yes	Yes	Yes	Yes	Yes	Yes
DestinationxYear FE	Yes	Yes	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
FTA/BIT controls	Yes	Yes	Yes	Yes	Yes	Yes

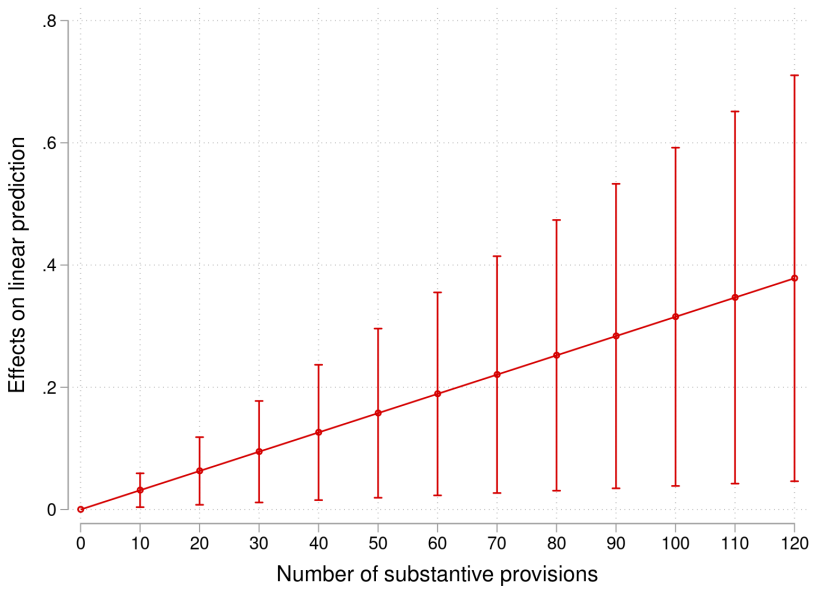
PPML. Robust standard errors in (), clustered by country pair

Domestic data included

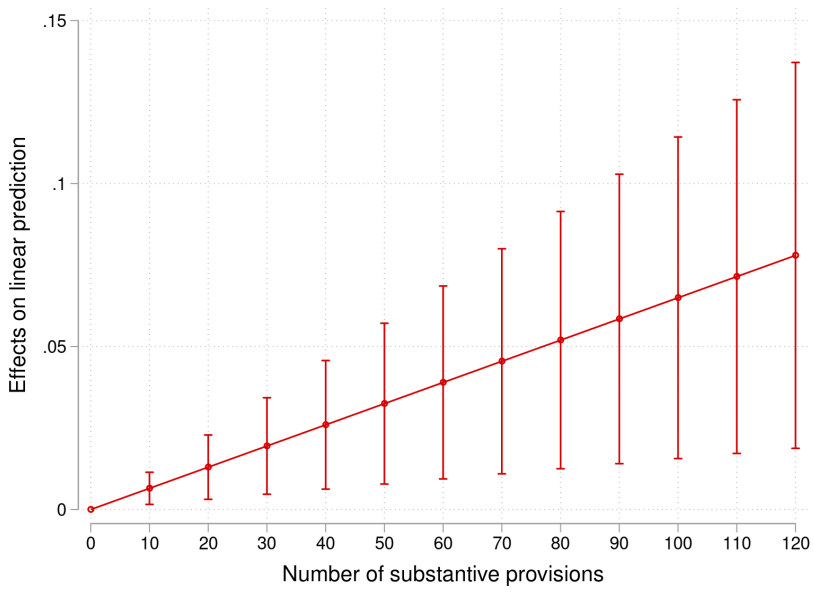
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Conditional Marginal Effects of the sum of substantive provisions

(a) Trade



(b) FDI (affiliates margin)



A stylized model

- To illustrate the problems of estimating "deepness" (OVB, MC, and OAB) in our context, we consider a hypothetical world of:
  - six countries: ESP, DEU, USA, CAN, BRZ, and ARG.
  - four provisions:
    - D_1 INV ($\times 0.5$)
    - D_2 EXP, D_3 CPP, D_4 TBT ($\times 2$)
  - three DTAs:
    - EU: D_1, D_2, D_3, D_4
    - NAFTA: D_1, D_2
    - MSUR: D_2, D_4

$$X_{ijt} = \left(\prod_{p=1}^{P} e^{\beta_p D_{p,ijt}} \right) \varepsilon_{ijt}.$$

OVB, MC

homogenous

	D_1 halves trade, the rest double trade				
	(1)	(2)	(3)	(4)	(5)
D_1 INV	0.586**				0.000
	(0.24)				(.)
D_2 EXP		0.925***			-0.000
		(0.14)			(0.00)
D_3 CPP			1.388***		1.390***
			(0.00)		(0.00)
D_4 TBT				1.286***	-0.004
				(0.26)	(0.00)
N	36	36	36	36	36
R^2	0.178	0.615	1.000	0.463	1.000

Standard errors in parentheses

Over-Aggregation Bias (OAB)

- "Deepness"

$$\ln X_{ij} = \beta_{SP} SPROV_{ij} + \ln \varepsilon_{ij}$$

$$\hat{\beta}_{SP} = \frac{\beta + \beta + \beta - \beta}{4} = \frac{1}{2}\beta$$

	(1)	(2)
SPROV	0.346***	
	(0.04)	
D_{NA}		-0.002
		(0.00)
D_{EU}		1.384***
		(0.00)
D_{MS}		1.387***
Observations	36	36
$R^2 2$	0.68	1.00

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

- "Deep" trade agreements estimates:

$$\begin{aligned} E[\ln X_{ij} | D_{NA}, SPROV = 2] &= 2 \times \hat{\beta}_{SP} = \beta \neq \beta_{NA} = 0 \\ E[\ln X_{ij} | D_{EU}, SPROV = 4] &= 4 \times \hat{\beta}_{SP} = 2 \times \beta = \beta_{EU} = 2\beta \\ E[\ln X_{ij} | D_{MS}, SPROV = 2] &= 2 \times \hat{\beta}_{SP} = \beta \neq \beta_{MS} = 2\beta \end{aligned}$$

Shapley Value

- First Step

$$\ln X_{ij} = \beta_{SP} SPROV_{ij} + \ln \varepsilon_{ij} \tag{1}$$

$$\ln X_{ij} = \beta_n D_{n,ij} + \beta_{SP-n} \cdot (SPROV - D_n)_{ij} + \ln \varepsilon_{ij}. \tag{2}$$

$$ShapV(D_n) \equiv \underbrace{\hat{\beta}_{SP} \overline{SPROV}}_{\hat{\beta}_{DTA}} - \underbrace{\hat{\beta}_{SP-n} \cdot (\overline{SPROV - D_n})}_{\hat{\beta}_{DTA-n}} \tag{3}$$

- Second Step:

$$\ln X_{ij} = \underbrace{\beta^{+}_{SP} SPROV^{+}_{ij}}_{ShapV(D_n)>0} + \underbrace{\beta^{-}_{SP} SPROV^{-}_{ij}}_{ShapV(D_n)<0} + \ln \varepsilon_{ij} \tag{4}$$

Shapley Values in a toy world

	(1)	(2)	(3)	(4)	(5)
		First Step			Second step
D_1 INV	-0.696***				
	(0.00)				
PROV w/o INV	0.693***				
	(0.00)				
D_2 EXP		0.346			
		(0.21)			
PROV w/o EXP		0.346***			
		(0.10)			
D_3 CPP			1.388***		
			(0.00)		
PROV w/o CPP			-0.001*		
			(0.00)		
D_4 TBT				0.346	
				(0.25)	
PROV w/o TBT				0.346***	
				(0.07)	
$SPROV^+$					0.693***
					(0.00)
$SPROV^-$					-0.696***
					(0.00)
$Shapv(D_n)$	-0.464	0.346	0.925	0.115	

Simulations on a full dataset

Second stage First Stage | Data generation

	(1) All individual	(2) Shapley individual	(3) Shapley Grouped
Positive provisions	-0.1762***	0.2767***	0.5107***
	(0.06)	(0.01)	(0.05)
Negative provisions	0.2415***	-0.1338***	-0.4201***
	(0.07)	(0.01)	(0.04)
Distance	-0.8851***	-0.5842***	-0.6808***
	(0.07)	(0.07)	(0.08)
N	16628	16628	17074
OriginFE	Yes	Yes	Yes
DestinationFE	Yes	Yes	Yes
First Stage success (%)	39.02	67.07	90.91

Standard errors in parentheses

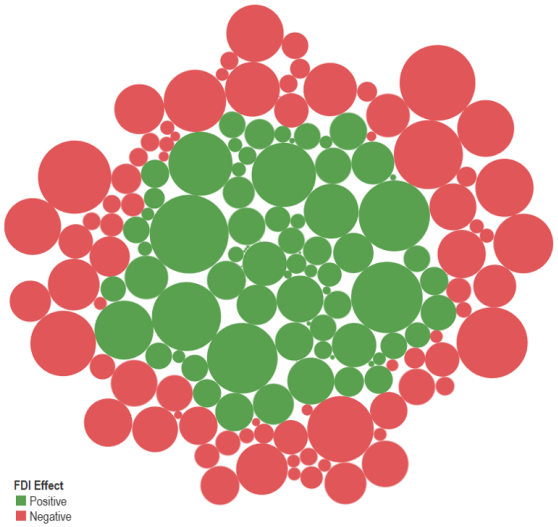
OLS Robust standard errors in (), clustered by country pair

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

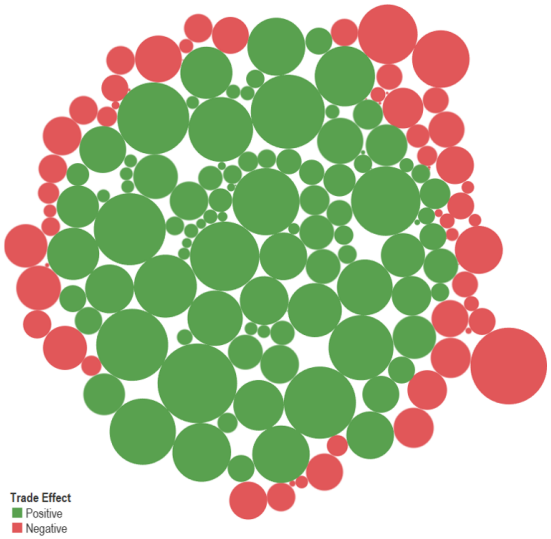
First Stage: Positive and Negative Shapley Values by Provisions & popularity

first stage

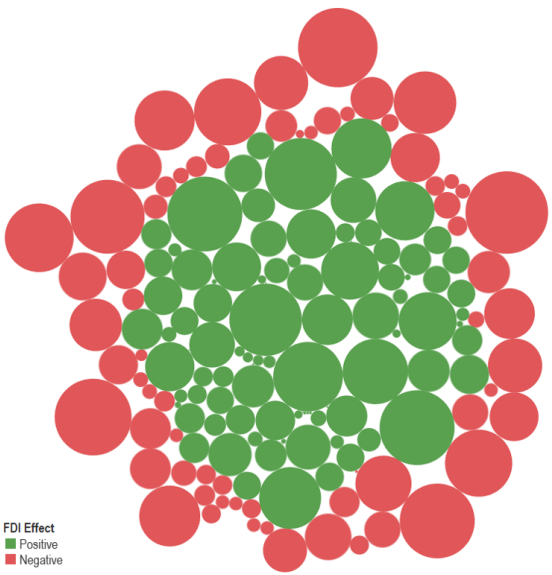
(a) Shapley Values (indv) trade



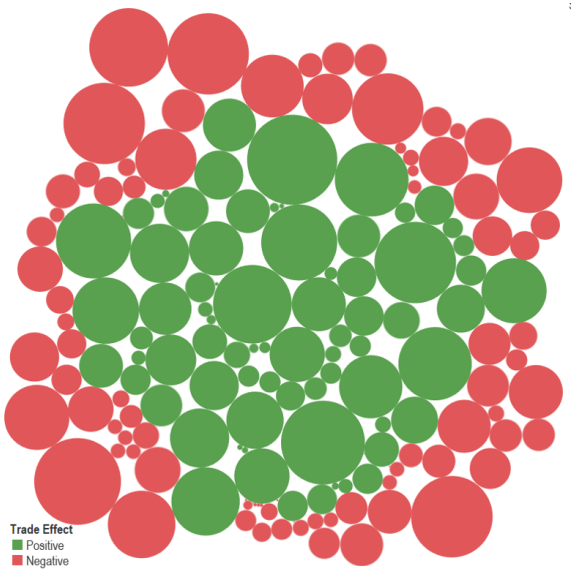
(b) Shapley Values (group) trade



(c) Shapley Values (indv) FDI



(d) Shapley Values (group) FDI



First stage: Shapley values by policy area Back

Policy Area	Shapley Value (indv)		Shapley Value (group)	
	trade	FDI	trade	FDI
Public Procurement	-0.136	0.009	-0.166	0.011
Investment	-0.079	-0.006	-0.122	-0.008
Trade Facilitation	-0.048	-0.001	-0.056	0.001
Sanitary	-0.029	0.004	-0.046	0.020
Export Taxes	-0.026	0.002	-0.048	-0.005
IPR	-0.016	0.003	-0.031	0.007
Subsidies	-0.015	-0.003	0.028	-0.003
Tech Barriers	0.000	0.000	-0.001	0.001
Rules of Origin	0.004	-0.000	0.098	-0.002
Migration	0.025	0.002	0.099	0.006
Services	0.053	-0.006	0.125	-0.013
State Owned Enter.	0.089	-0.007	0.189	-0.015
Competition Policy	0.124	-0.004	0.155	-0.006

Notes: averages of Shapley Values

Second stage: individual Shapley method

SV gravity | Group SV

	Panel A: trade		Panel B: FDI (affiliates)	
	(1)	(2)	(3)	(4)
Positive-trade provisions (indv. Shapley)	0.0177***		-0.0008	
	(0.00)		(0.00)	
Negative-trade provisions (indv. Shapley)	-0.0106***		0.0014	
	(0.00)		(0.00)	
Positive-FDI provisions (indv. Shapley)		-0.0171***		0.0043***
		(0.01)		(0.00)
Negative-FDI provisions (indv. Shapley)		0.0161***		-0.0024**
		(0.00)		(0.00)
Observations	190440	190440	190440	190440
R^2	0.998	0.998	0.998	0.998
OriginxYear FE	Yes	Yes	Yes	Yes
DestinationxYear FE	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes
FTA/BIT controls	Yes	Yes	Yes	Yes

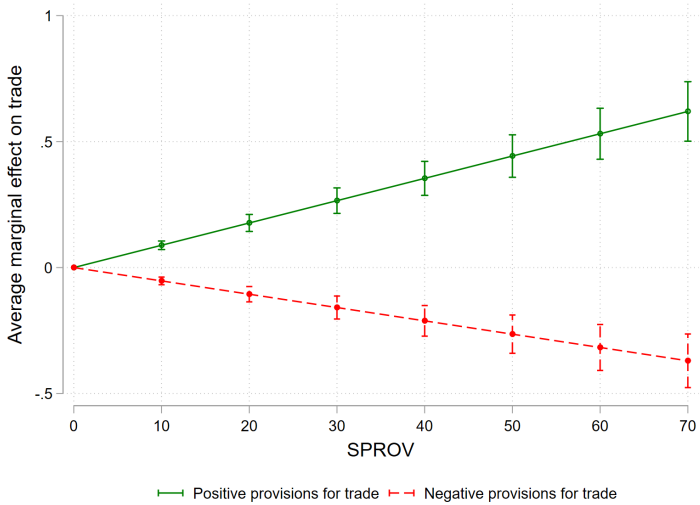
PPML, Robust standard errors in (), clustered by country pair

Domestic data included

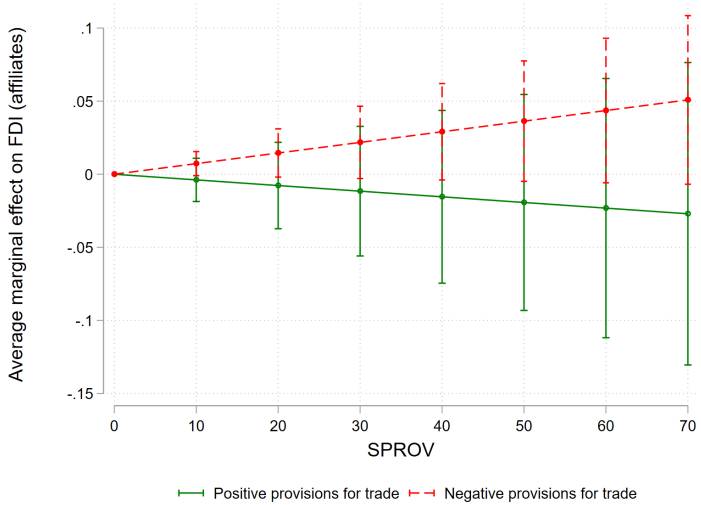
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Second stage: individual Shapley method

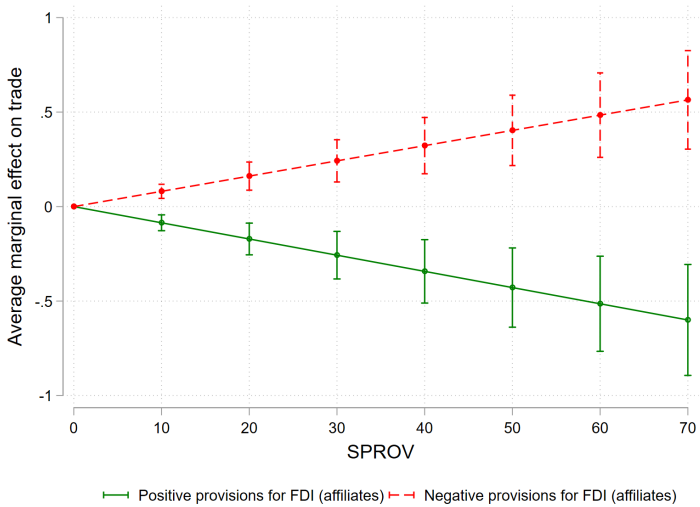
(a) Trade effects using SV of trade



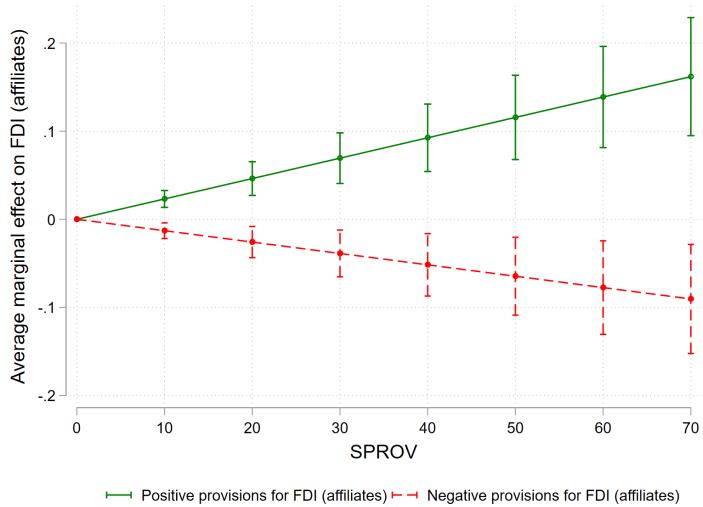
(b) FDI effects using SV of trade



(c) Trade effects using SV of FDI



(d) FDI effects using SV of FDI



Second stage: Effects on Various MNE Variables (indv SV)

plots Group SV

	(1) Employee costs	(2) Costs per employee	(3) Employees	(4) Tangible Assets	(5) Intangible Assets	(6) Revenues
			Panel I			
Positive-FDI provisions (indv. Shapley)	-0.0394*** (0.01)	-0.0277* (0.01)	0.0120** (0.01)	-0.0010 (0.01)	0.0111 (0.01)	-0.0010 (0.01)
Negative-FDI provisions (indv Shapley)	0.0293*** (0.01)	0.0287** (0.01)	-0.0116** (0.00)	0.0002 (0.01)	-0.0138* (0.01)	0.0027 (0.00)
			Panel II			
Positive-trade provisions (indv. Shapley)	0.0205 (0.02)	-0.0187 (0.02)	-0.0065* (0.00)	-0.0057 (0.01)	-0.0038 (0.01)	0.0009 (0.00)
Negative-trade provisions (indv Shapley)	-0.0163 (0.01)	0.0162 (0.01)	0.0034 (0.00)	0.0031 (0.00)	-0.0024 (0.01)	0.0013 (0.00)
Observations	18784	16187	190440	190440	190440	190440
OriginxYear FE	Yes	Yes	Yes	Yes	Yes	Yes
DestinationxYear FE	Yes	Yes	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
FTA/BIT controls	Yes	Yes	Yes	Yes	Yes	Yes

PPML, Robust standard errors in parenthesis, clustered by country pair

Domestic data included

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Conclusions

- We develop a new methodology to estimate the effect of DTA with heterogenous provisions
- When we apply the Shapley value method to trade and FDI datesets we discover that:
  - Over-aggregated estimates of "deepness" underestimate (overestimate) the effect of "positive" ("negative") provisions
  - positive provisions for trade affect negatively FDI and viceversa
  - Unravel the puzzle of non-significant estimates of FDI/MNE variables
- We provide a useful guide for policymakers:
  - Which provisions (or group of provisions) matter for trade and which for FDI?
- Roadmap
  - Alternative Econometric Specifications
  - Multilateral vs. Bilateral Provisions
  - FDI Types: Greenfield and M&As, Vertical vs. Horizontal
  - FDI: Averages per Affiliate
  - Numerical Comparative Statics counterfactuals

Thank you, Jeff!!!

DTAs beyond trade: obligations & liberalizations

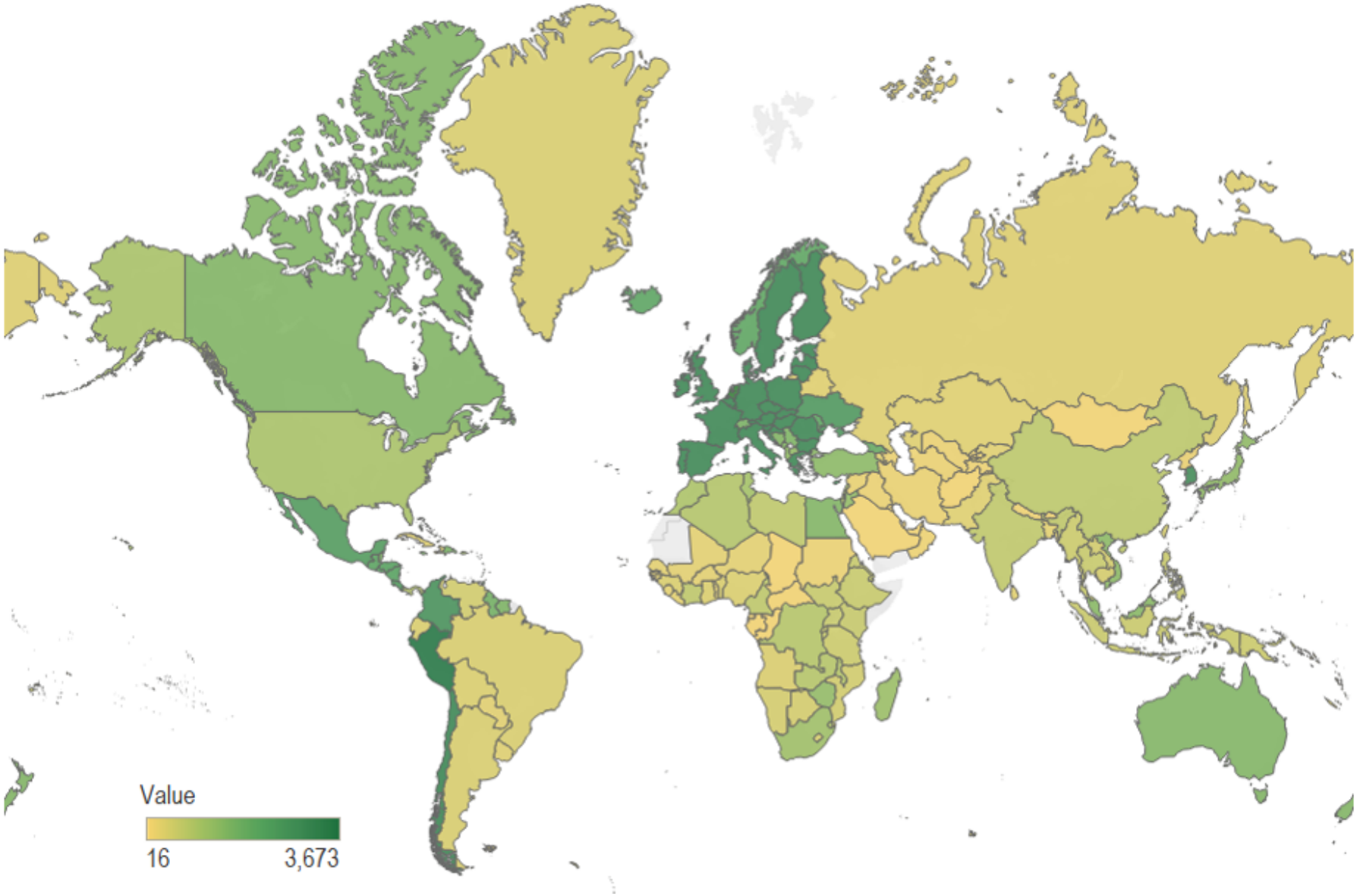
Back

"Deep trade agreements... are fundamentally different than the previous generation of PTAs. They aim not only to create market access between members but also to establish broader economic integration rights in goods, services, and factor markets." (Pascal Lamy, DG WTO)

"The United States recognizes the importance of intellectual property ***protection****. China recognizes the importance of establishing and implementing a comprehensive legal system of intellectual property* ***protection and enforcement*** *as it transforms from a major intellectual property consumer to a major intellectual property producer."*
Economic and Trade Agreement Between the Government of the United States of America and the Government of the People's Republic of China, (2020, boldface added)

DTA Substantive Provision Concentration

Back

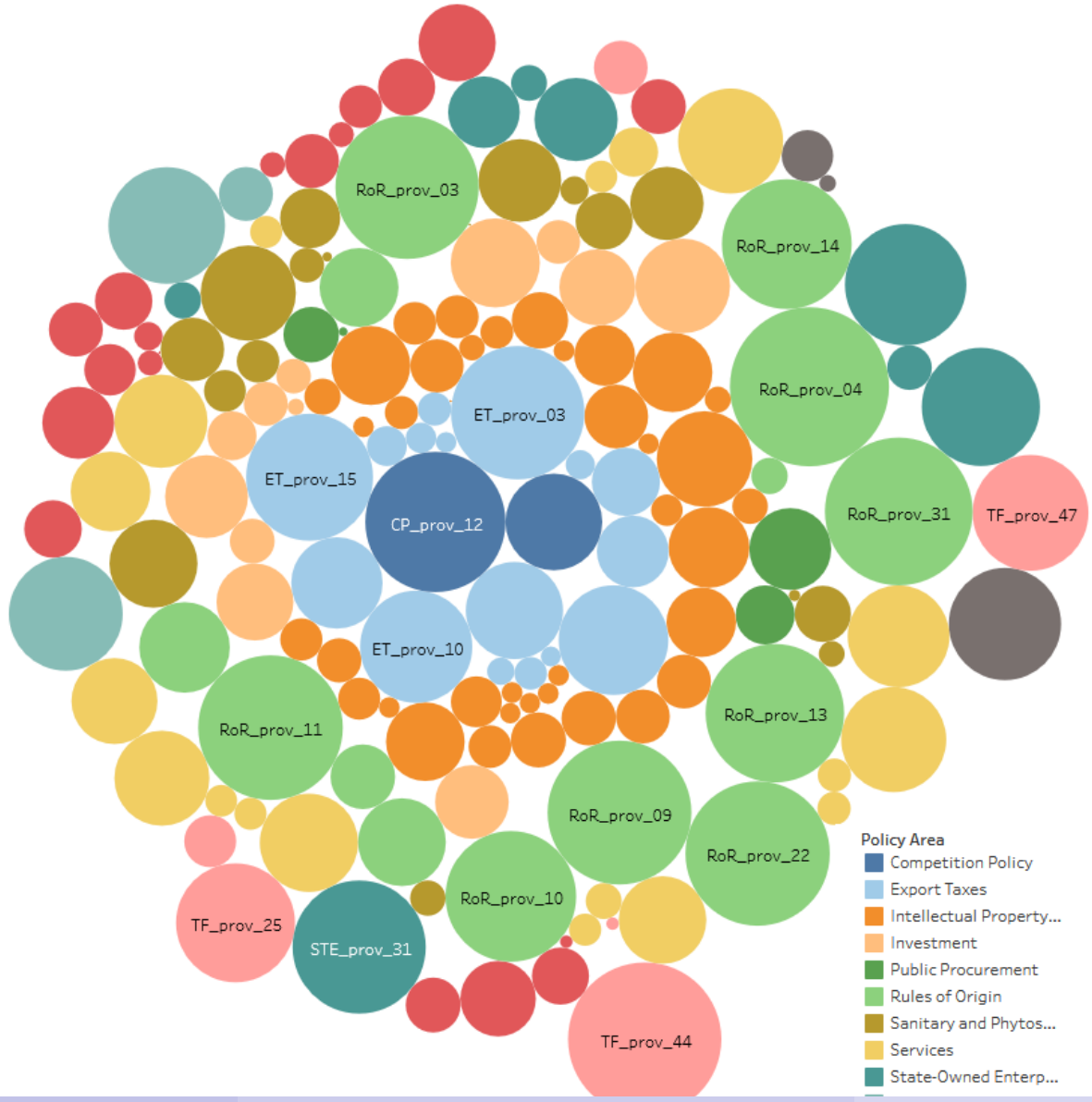


Policy Area Popularity

Back

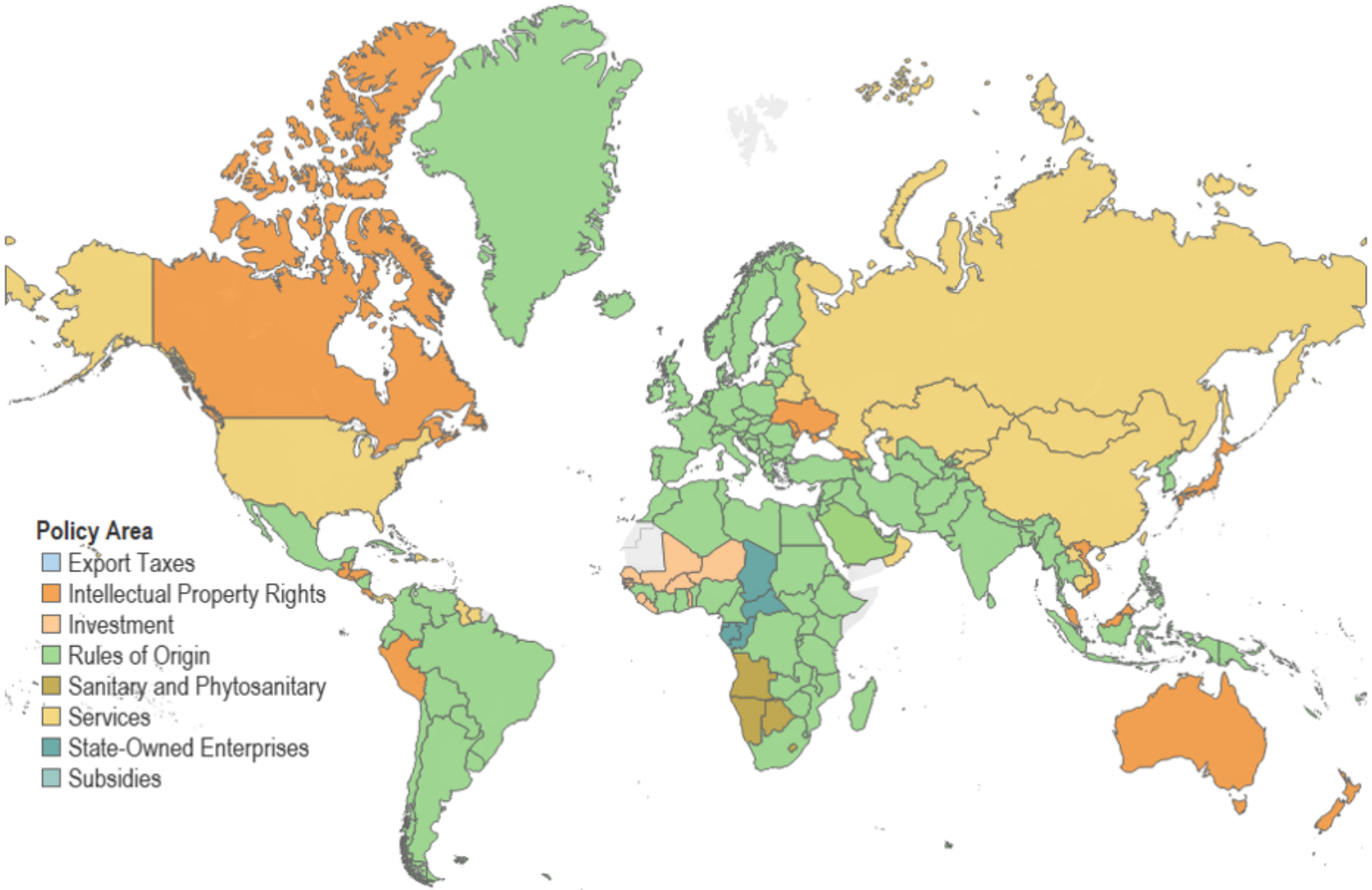
Substantive Provision Popularity

Back



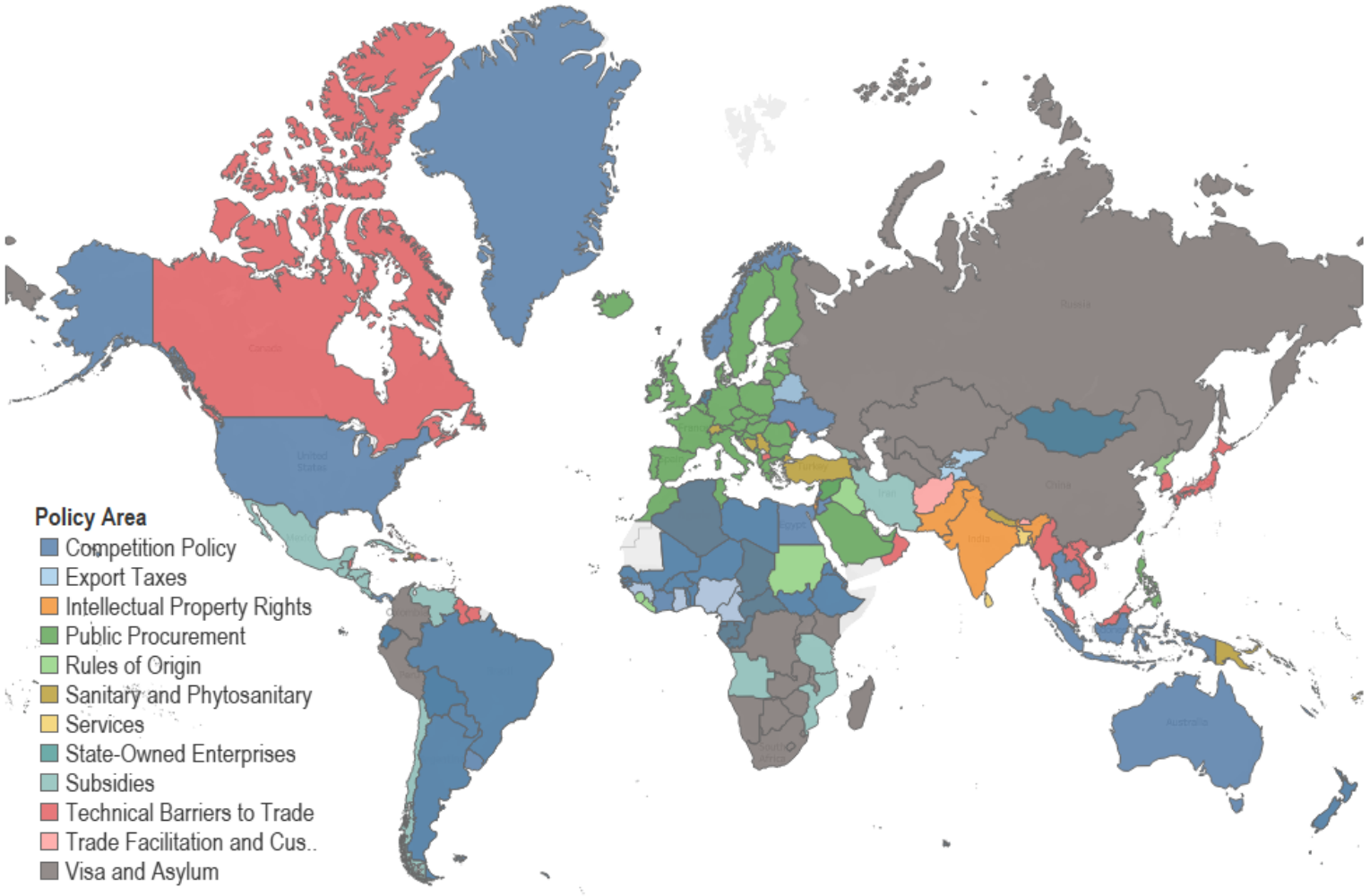
Most Popular Substantive Provision in a Country

Back



Least Popular Substantive Provision in a Country

Back



Total Adoption of Substantive Provisions by Policy Area and Year

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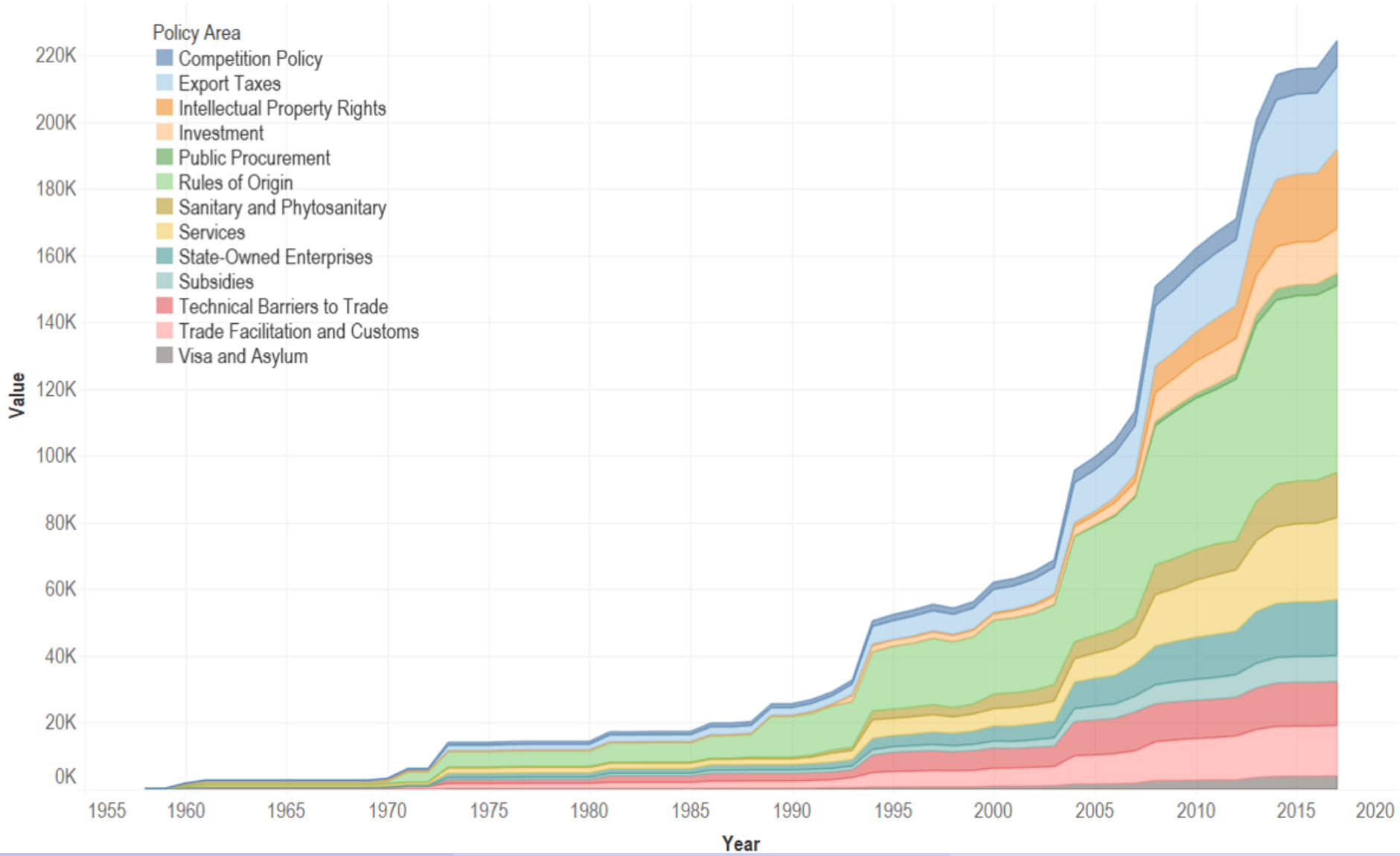
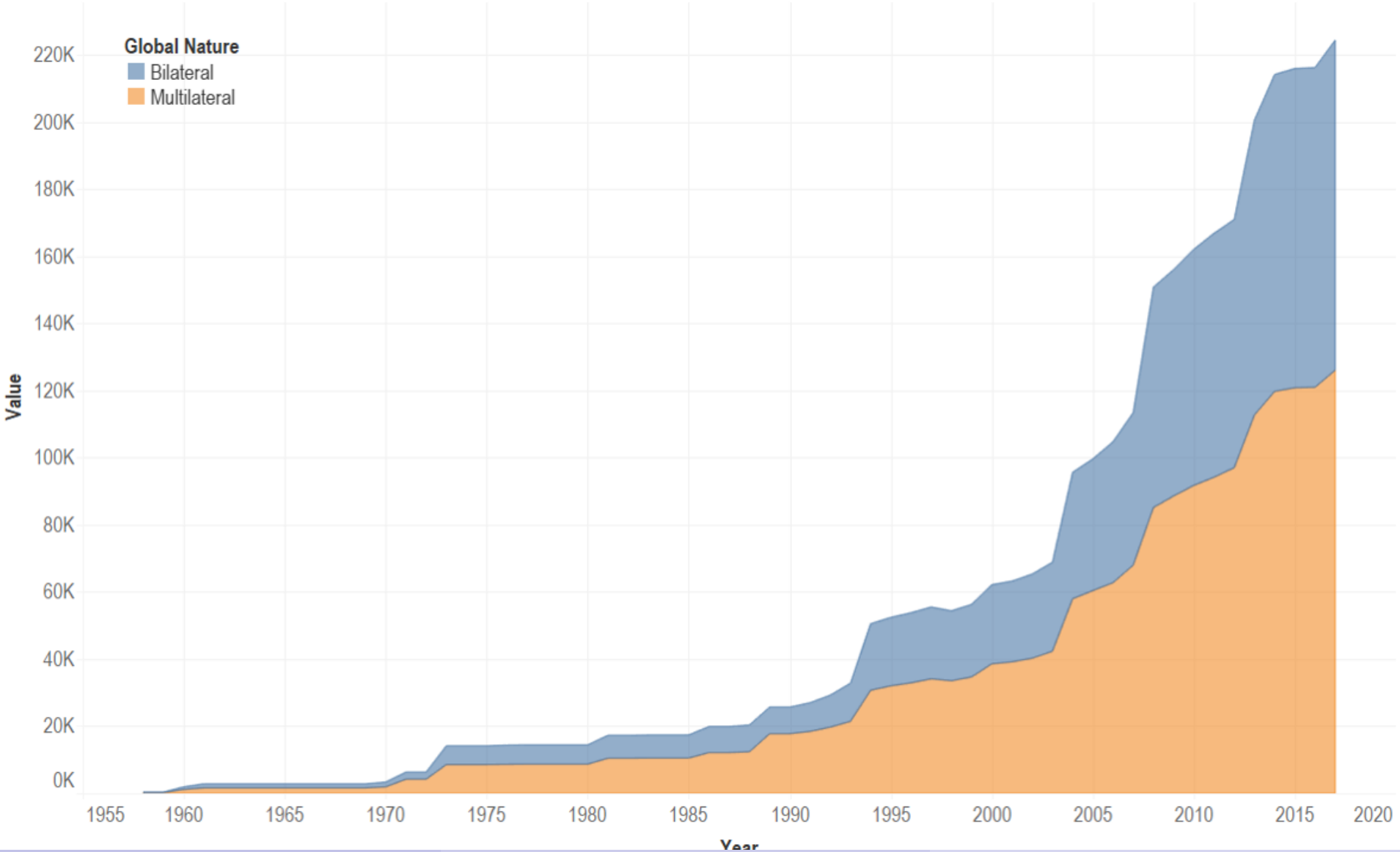


Total adoption of substantive provisions by multilateral vs. bilateral "nature"

Back



MREID Overview

Back

- MREID spans 12 years from 2010 through 2021
- 362,845 parent companies (or Global Ultimate Owner) and 1,132,707 affiliates.
  - 351,600 are foreign affiliates from 70,661 parent companies
- 186 countries
  - 11 countries that only have outward FDI
  - 14 countries that only have inward FDI
  - 139 countries with domestic data
- 25 sectors (two digits)
- 1,132,000 raw observations per year at the firm level
  - 27,340 at the country-sector level
  - 4410 at the country pair level

Search strategy

Back

- Keep companies with more than 1 million USD in Revenue or Assets.
- Majority control threshold (50.01%)
- Active companies
- Mistakes are corrected
- Select domestic and foreign affiliates
- Entry and exit
  - Entry: Date of incorporation
  - Exit: Affiliates with more than four or more consecutive years without reports on any of the key financials.

MREID Variables

Back

- Affiliates: Count of foreing affiliates and domestic opertations
- Revenue: Total operating revenues (= net sales + other operating revenues + stock variations) excluding taxes.
- Employees: Total number of employees included in the company's payroll.
- Investment: Total assets and fixed assets.
  - Total assets: The sum of total current assets (e.g., financial assets) and fixed assets.
  - Fixed assets: Tangible fixed assets, intangible fixed assets, and other fixed assets.

Summary Statistics

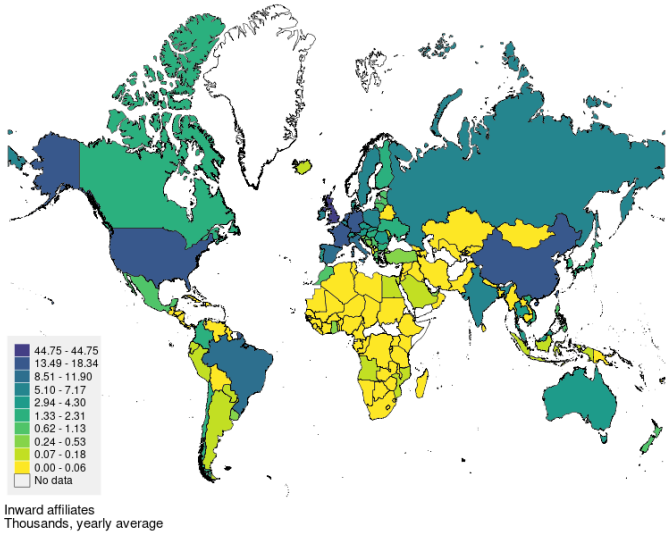
Back

Table: Summary statistics at the country-pair (foreign affiliates)

	Panel A: Totals			Panel B: Average per affiliate		
	mean	max	sd	mean	max	sd
Affiliates	90	25,299	536			
Revenue	3,940	609,312	20,362	57	5,772	236
Employees	7,029	1,735,375	43,965	191	156,239	2,619
Total assets	14,480	6,309,828	132,300	221	56,616	1,432
Fixed assets	5,198	1,615,221	48,817	60	15,276	507
Revenue/emp	48,251	65,794,332	1,282,092			
4410 pairs						

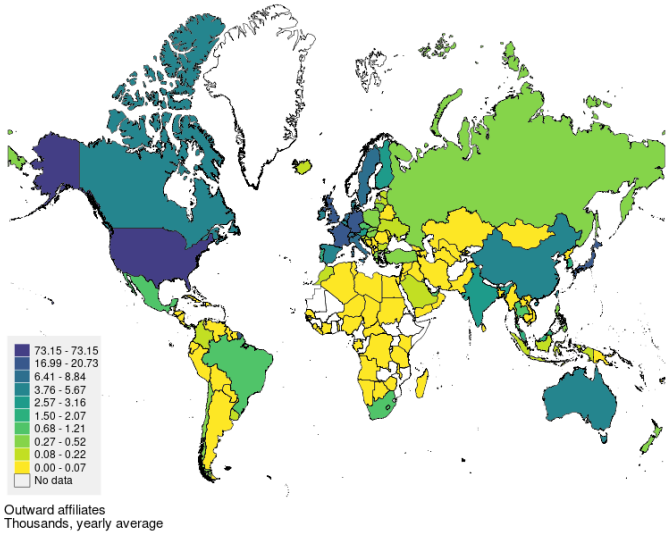
Notes:Revenue and assets in million USD . Rev/emp th. USD.
Statistics at the host country-pair level, yearly averages

(a) Inward affiliates



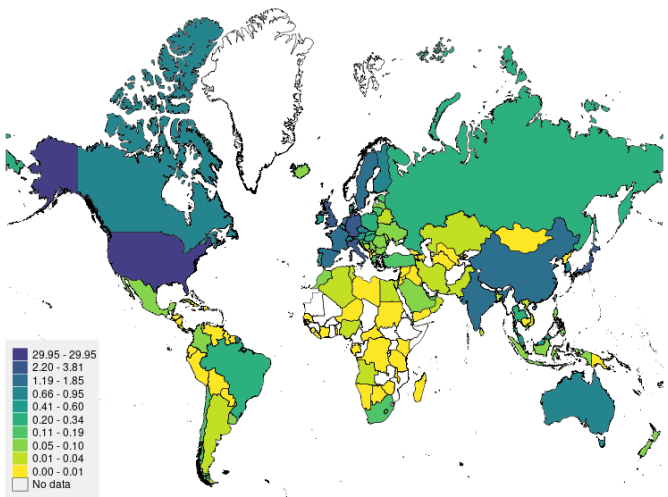
Inward affiliates
Thousands, yearly average

(b) Outward affiliates



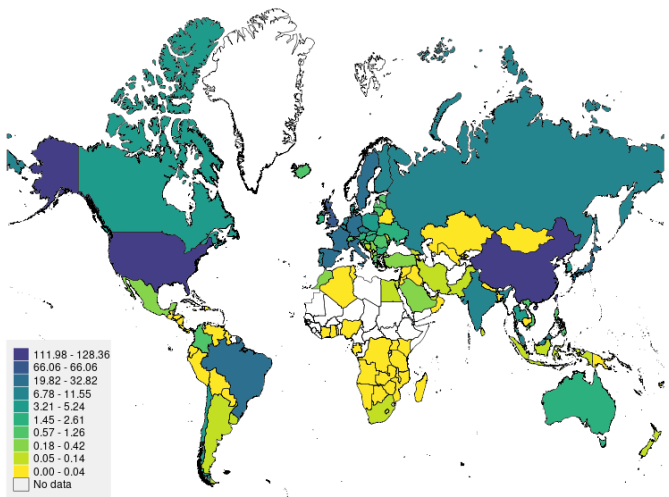
Outward affiliates
Thousands, yearly average

(c) Parent firm (GUO)



Parent companies (Global Ultimate Owner)
Thousands, yearly average

(d) Domestic Affiliates

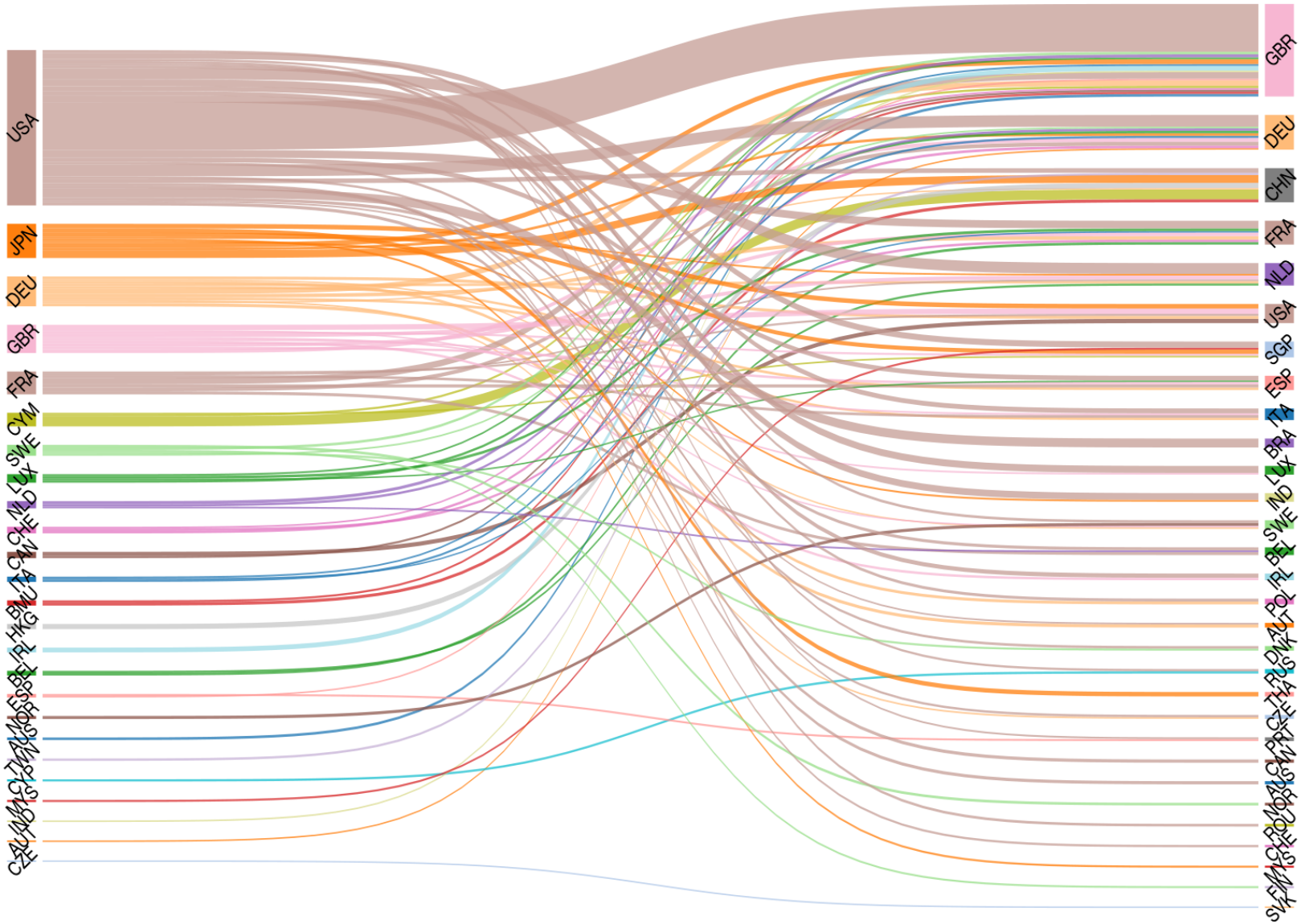


Domestic Affiliates
Thousands, yearly average

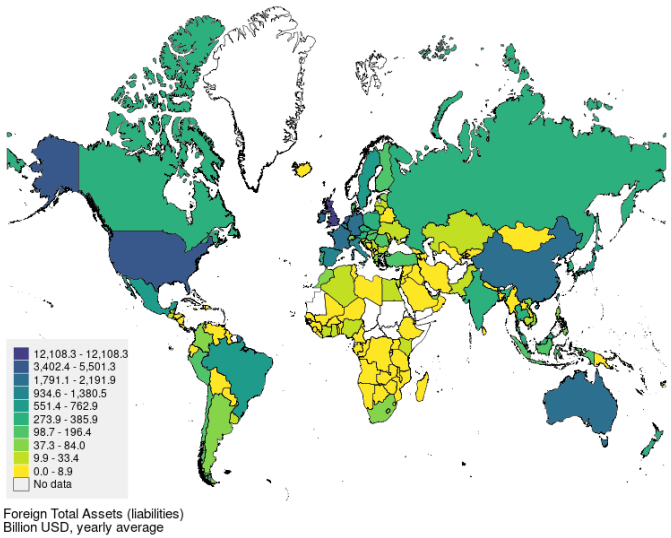
Back

Foreign investment flows (affiliates)

Back

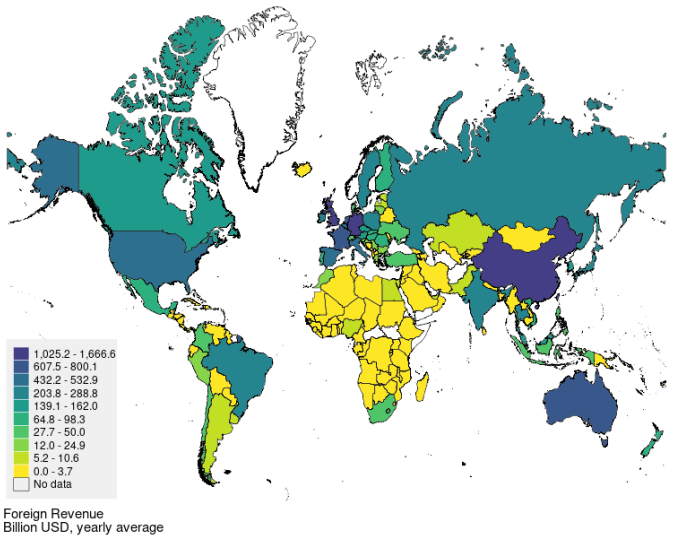


(a) Foreign Total Assets (liabilities)



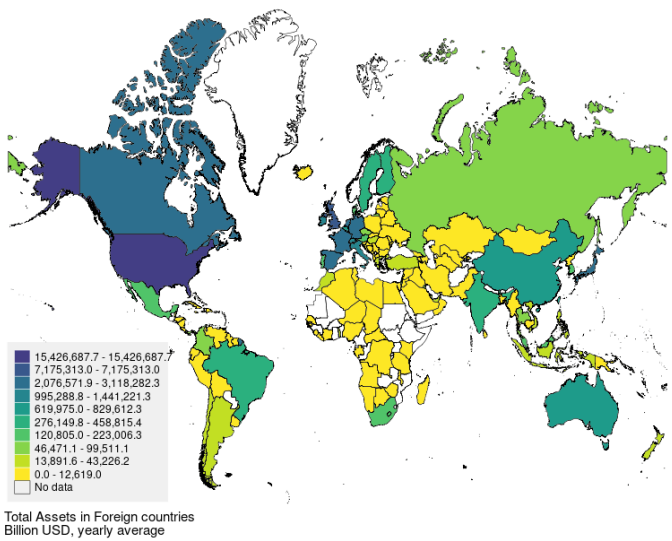
Foreign Total Assets (liabilities)
Billion USD, yearly average

(b) Revenue in foreign countries



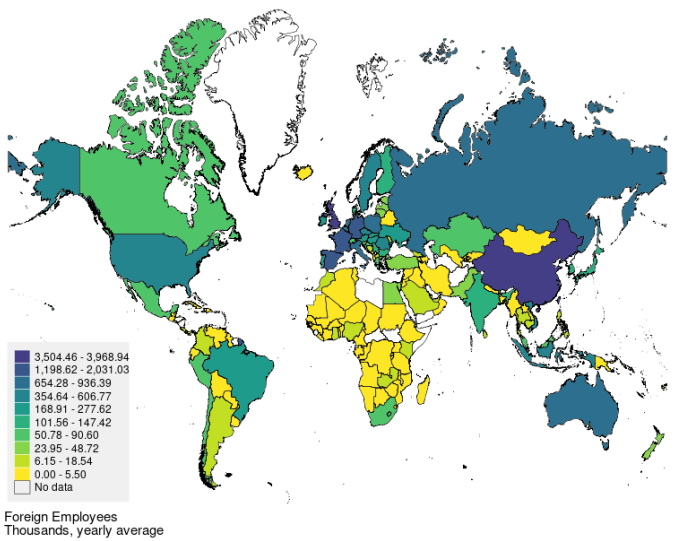
Foreign Revenue
Billion USD, yearly average

(c) Total Assets in Foreign Countries



Total Assets in Foreign countries
Billion USD, yearly average

(d) Employees in foreign countries



Foreign Employees
Thousands, yearly average

Back

ITPD-E

Back

	mean	sd	min	max	units
Trade	4424.3	182238.3	0	25e+06.1	Million USD
FDI (affiliates)	45.47	1420.8	0	0.16e+06	Number
Employee Costs	1021919.0	10530676.4	0.00480	656991234.5	Thousand USD
Cost per Employee	371.3	8535.3	0.00000357	0.814e+06	Thousand USD
Employees	2790.4	68677.1	0	6.15e+06	Number
Tangible Assets	471045.8	14339034.6	0	1.96e+09	Thousand USD
Intangible Assets	133920.6	4680586.6	0	811e+06.4	Thousand USD
Revenues	1580736.2	41027474.3	0	4.48e+09	Thousand USD
DTA (dummy)	0.195	0.396	0	1	
Substantive provisions	7.871	16.00	0	120	
+1	27.95	18.64	2	120	
All provisions	46.60	96.61	0	595	
+1	165.1	116.6	16	595	
Non-substantive provisions	38.73	80.94	0	480	
+1	137.1	98.91	13	480	
Observations	190440				

OVB, MC

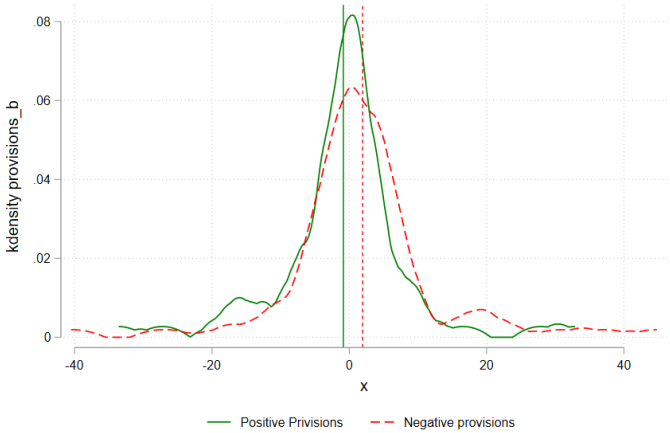
Back

	All provisions double trade				
	(1) × 7.19	(2) × 6.36	(3) × 7.20	(4) × 13.11	(5)
D_1 INV	1.972***				0.000
	(0.24)				(.)
D_2 EXP		1.849***			1.386***
		(0.14)			(0.00)
D_3 CPP			1.974***		0.004
			(0.24)		(0.00)
D_4 TBT				2.574***	1.382***
				(0.36)	(0.00)
N	36	36	36	36	36
R^2	0.711	0.865	0.712	0.652	1.000

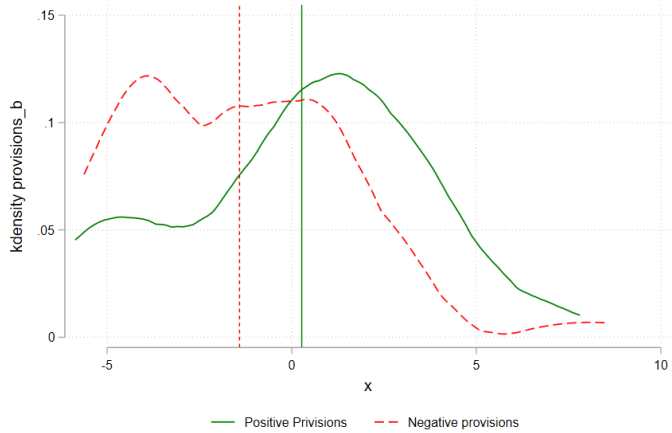
Simulations on the full dataset

Back

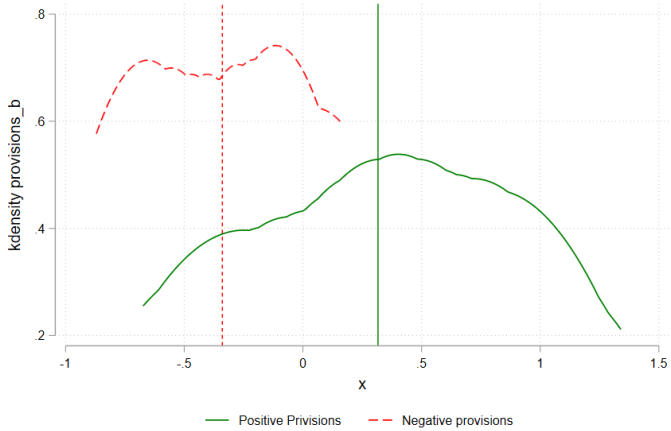
(a) All individual provisions



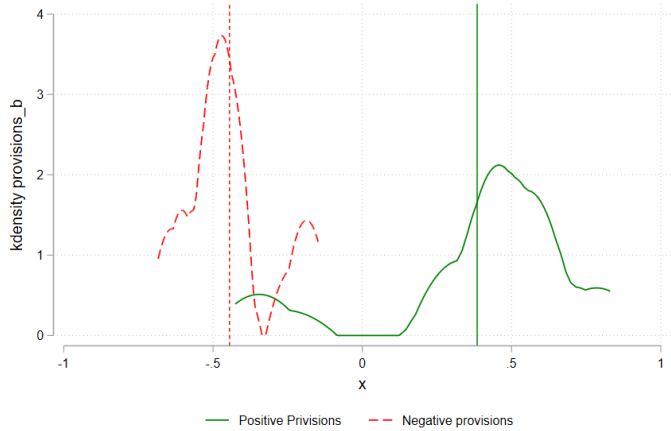
(b) Shapley individual provisions



(c) All grouped provisions (obligations, liberalizations)



(d) Shapley grouped provisions (obligations, liberalizations)



Simulations: Data generating process

Back

We perform simulations on a cross-section of our full dataset. We have constructed theoretically-driven fictitious trade according to the following algorithm:

$$\begin{aligned} \ln SX_{ij} \quad = \quad & \left(\begin{array}{c} \sum_{n=1}^{N/2}(2+e_{1,ij})D_{n,ij}^{+} + \sum_{n=N/2+1}^{N}(1/2+e_{2,ij})D_{n,ij}^{-} \\ +e_{3,i}\lambda_i + e_{4,j}\lambda_j - 0.7\ln Dist_{ij} \end{array} \right) \times \\ & \times(100+e_5), \end{aligned}$$

Structural gravity with Shapley Value

Back

- First Step

$$X_{ijt} = \exp\left(\beta_{SP}(SPROV_{ijt} \times BRDR_{ij}) + \lambda_{it} + \lambda_{jt} + \lambda_{ij} + \chi_{ijt}\right) \times \varepsilon_{ijt},$$

$$X_{ijt} = \exp\left(\begin{array}{c}\left(\ \beta_n \cdot D_{n,ijt} + \beta_{SP-n} \cdot (SPROV_{ijt} - D_{n,ijt})\ \right) \times BRDR_{ij} \\ +\lambda_{it} + \lambda_{jt} + \lambda_{ij} + \chi_{ijt}\end{array}\right) \times \varepsilon_{ijt}.$$

$$ShapV(D_n) \equiv \underbrace{\hat{\beta}_{SP}\overline{SPROV}}_{\hat{\beta}_{DTA}} - \underbrace{\hat{\beta}_{SP-n} \cdot (\overline{SPROV - D_n})}_{\hat{\beta}_{DTA-n}}$$

- Second Step:

$$X_{ijt} = \exp\left(\begin{array}{c}\left(\ \underbrace{\beta^{+}_{SP}SPROV^{+}}_{ShapV(D_n)>0} + \underbrace{\beta^{-}_{SP}SPROV^{-}}_{ShapV(D_n)<0}\ \right) \times BRDR_{ij} \\ +\lambda_{it} + \lambda_{jt} + \lambda_{ij} + \chi_{ijt}\end{array}\right) \times \varepsilon_{ijt},$$

15+1 Reasons Why Gravity Should Be Estimated with Domestic Trade (Yotov, 2022)

Back

- The use of domestic trade flows in gravity estimations is:

1. consistent with trade theory of the intensive margin of trade,
2. available and
    1. it does not matter much which to use! (Campos et al., 2021),
3. consistent with trade theory of the extensive margin of trade.
4. The use of domestic trade flows allows:
    - for estimation of the effects of international borders and home biases,
5. for estimation of heterogeneous domestic and regional trade costs,
6. for a systematic analysis of the determinants of domestic trade costs,
7. for country-specific asymmetries in the vector of international trade costs,
8. for identification of the trade-diversion effects of bilateral trade policies,
9. for identification of the effects of non-discriminatory trade policies on bilateral trade flows,
10. for identification of the effects of country-specific characteristics on bilateral trade flows,
11. for identification of the country-specific effects of trade policies,
12. to a solution to "The Distance Puzzle of International Trade",
13. for solving "The Missing Globalization Puzzle",
14. for solving the puzzle that "Larger Countries Should Be Richer than Smaller Countries",
15. for solving the puzzle of "The Missing WTO Effects".

	Panel A: trade		Panel B: FDI (affiliates)	
	(1)	(2)	(3)	(4)
DTA dummy	0.2577***	0.1060**	0.0503*	0.0561*
	(0.08)	(0.05)	(0.03)	(0.03)
Observations	190440	190440	190440	190440
R^2	0.998	0.998	0.998	0.998
OriginxYear FE	Yes	Yes	Yes	Yes
DestinationxYear FE	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes
FTA/BIT controls	No	Yes	No	Yes

PPML, Robust standard errors in (), clustured by country pair

Domestic data included

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Log of provisions

Back

	Panel A: trade			Panel B: FDI (affiliates)		
	(1)	(2)	(3)	(4)	(5)	(6)
log provisions	0.0370**			0.0090**		
	(0.02)			(0.00)		
log substantive provisions		0.0608**			0.0121**	
		(0.03)			(0.01)	
log non-substantive provisions			0.0381**			0.0093**
			(0.02)			(0.00)
Observations	190440	190440	190440	190440	190440	190440
R^2	0.998	0.998	0.998	0.998	0.998	0.998
OriginxYear FE	Yes	Yes	Yes	Yes	Yes	Yes
DestinationxYear FE	Yes	Yes	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
BIT/FTA control	Yes	Yes	Yes	Yes	Yes	Yes

PPML, Robust standard errors in (), clustered by country pair

Domestic data included

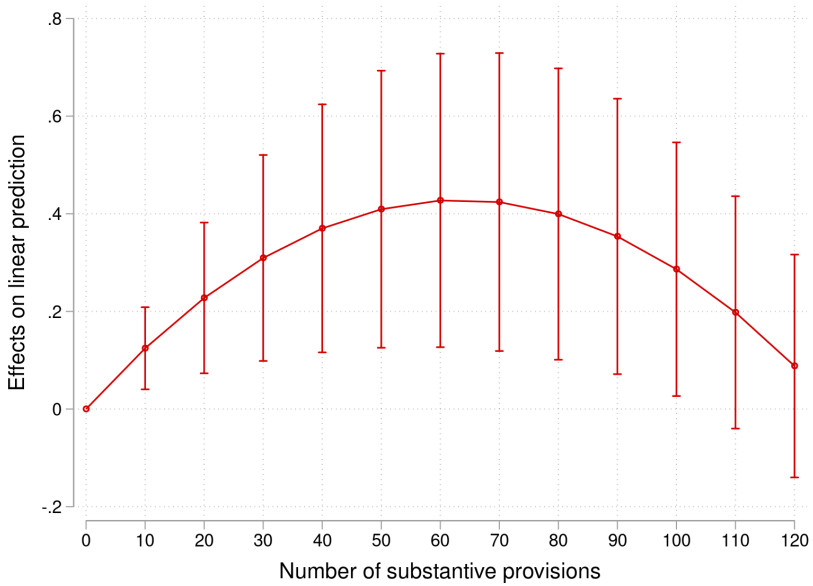
Log stands for inverse hyperbolic sine

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

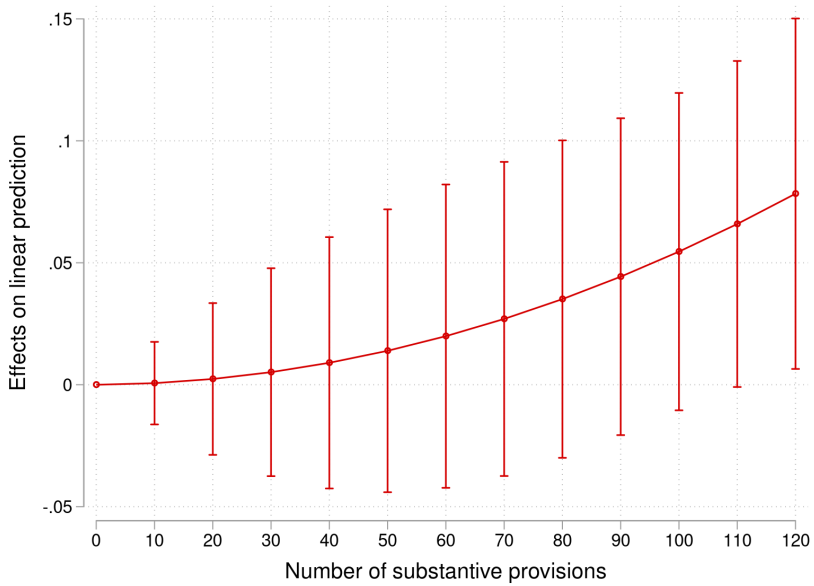
Conditional Marginal Effects of the number of substantive provisions (non-linear)

Back

(a) Trade



(b) FDI (affiliates margin)



	(1) trade	(2) FDI (affiliates)
substantive provisions	0.0135***	-0.00004
	(0.00)	(0.00)
substantive provisions squared	-0.0001***	0.00001
	(0.00)	(0.00)
Observations	190440	190440
R^2	0.998	0.998
OriginxYearFE	Yes	Yes
DestinationxYearFE	Yes	Yes
PairFE	Yes	Yes
FTA/BIT control	Yes	Yes

PPML, Robust standard errors in (), clustered by country pair

Domestic data included

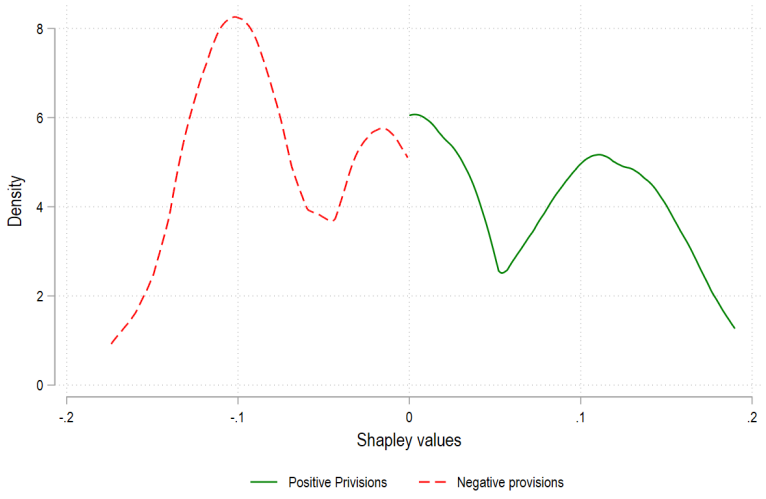
Log stands for inverse hyperbolic sine

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

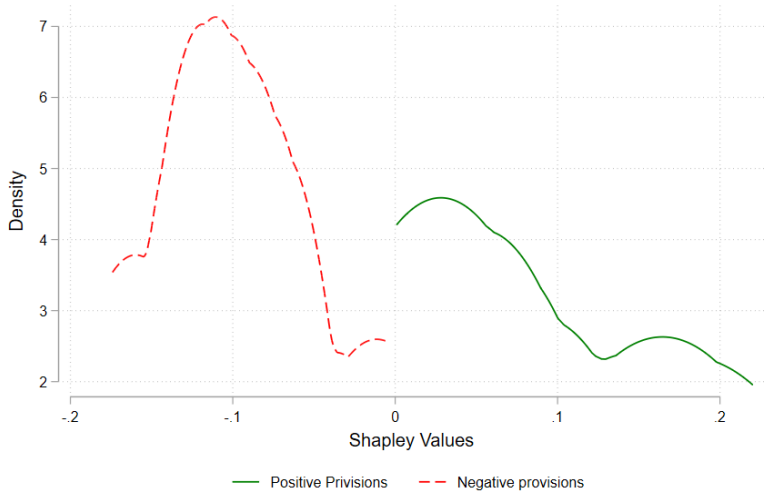
First stage: Distribution of Shapley Values

Back

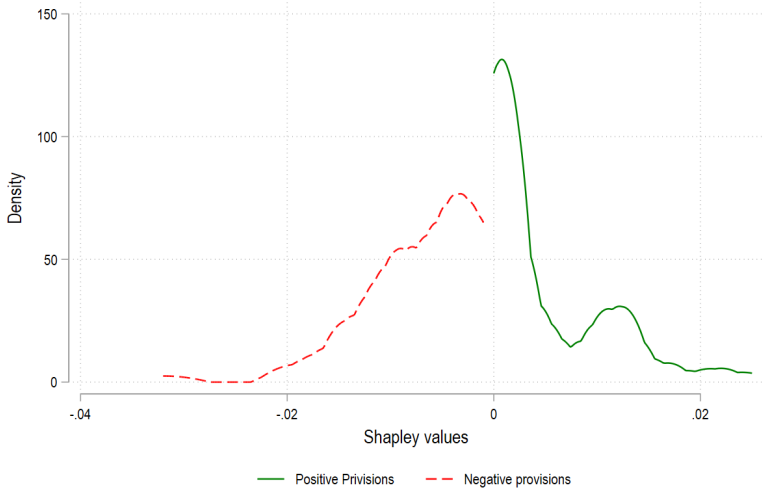
(a) Shapley values on Trade (indv)



(b) Shapley values on Trade (group)



(c) Shapley values on FDI (indv)



(d) Shapley values on FDI (group)

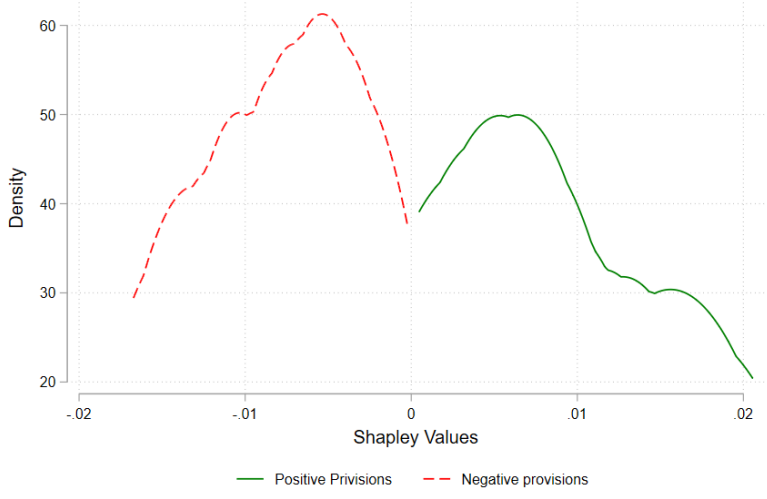


Table: Descriptive Statistics

	Panel I: SV Individual			Panel II: SV Group		
	Number	mean	sd	Number	mean	sd
positive-trade SV	79	0.0677	0.0621	100	0.0665	0.0790
negative-trade SV	85	-0.0726	0.0487	64	-0.0784	0.0540
positive-FDI SV	97	0.00426	0.00599	82	0.0102	0.00751
negative-FDI SV	67	-0.00696	0.00583	82	-0.00886	0.00603

Table: Correlation matrix of Shapley values

	SV trade (indv)	SV FDI (indv)	SV trade (group)
SV FDI (indv)	-0.550**	1	
SV trade (group)	0.925***	-0.527*	1
SV FDI (group)	-0.370	0.819***	-0.421

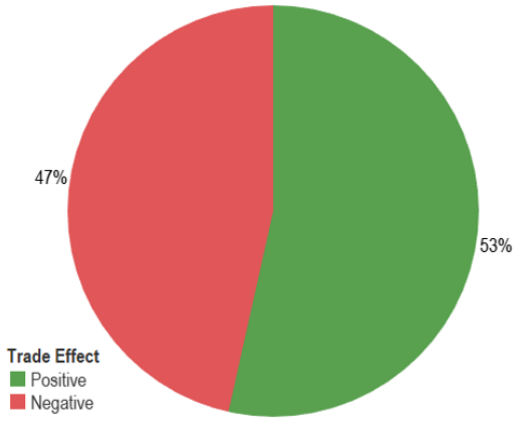
Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The individual Shapley values are the averages per type and policy area group

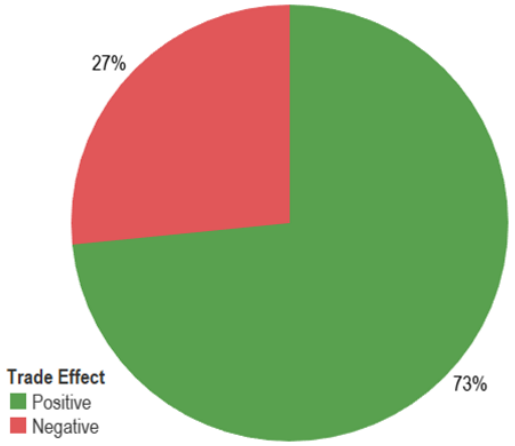
Distributions of the Shapley Values of Provisions Using Pie Charts

Back

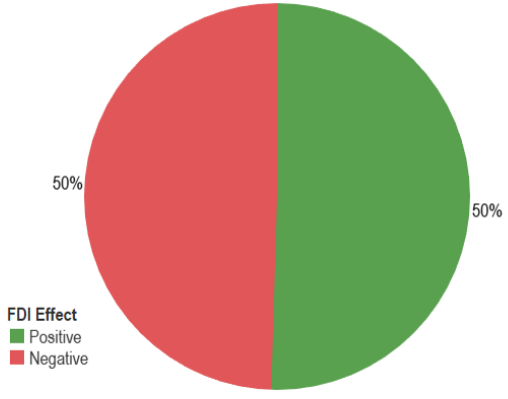
(a) Shapley Values (indv) trade



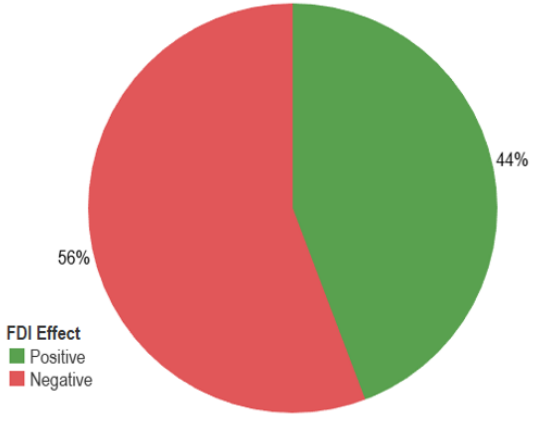
(b) Shapley Values (group) trade



(c) Shapley Values (indv) FDI



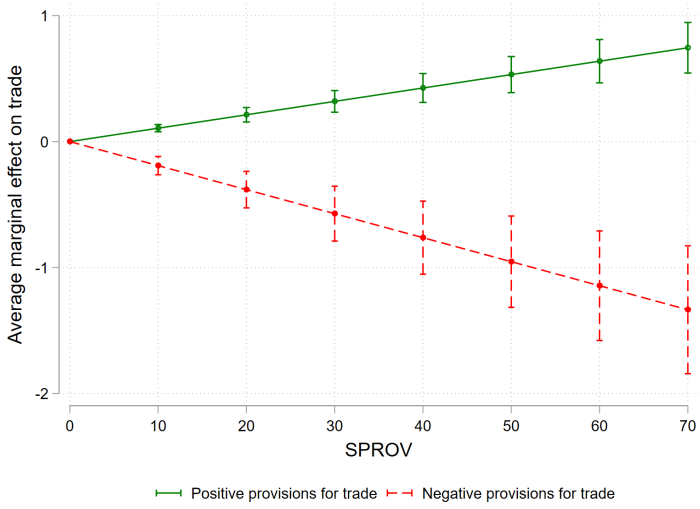
(d) Shapley Values (group) FDI



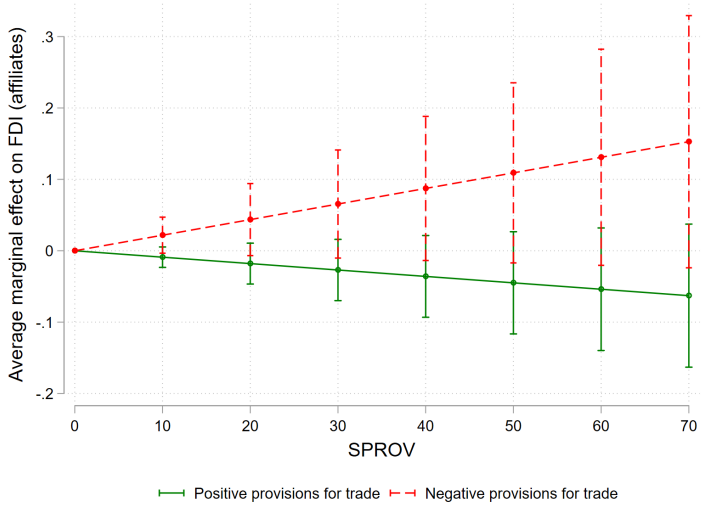
Positive and Negative Substantive Provisions (grouped Shapley effects)

Back

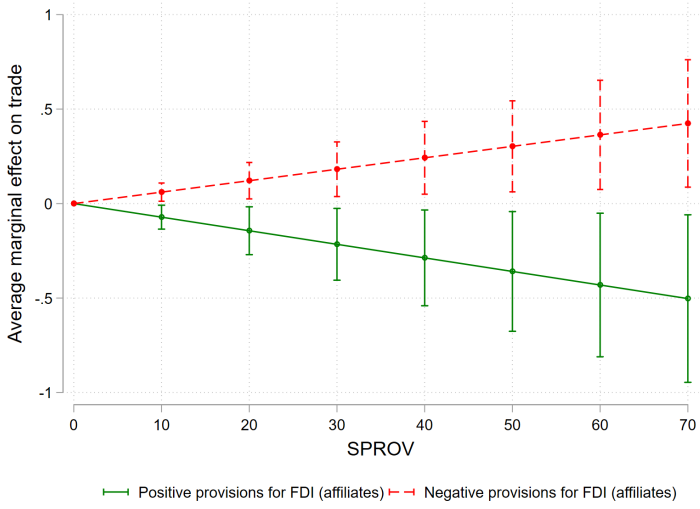
(a) Trade effects using SV of trade



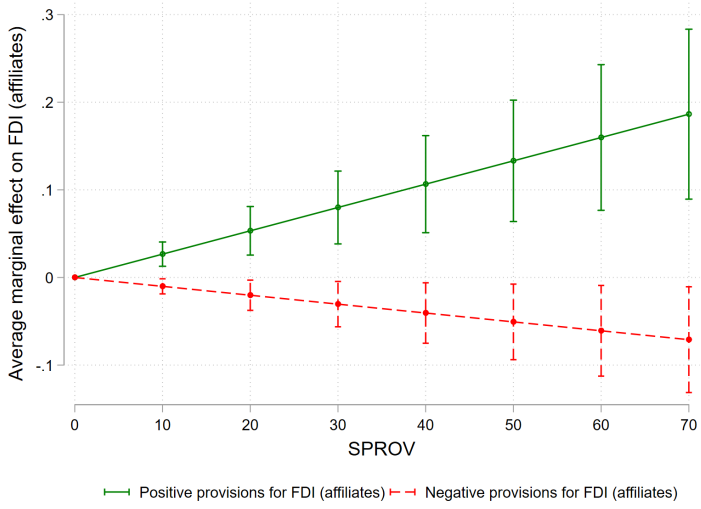
(b) FDI effects using SV of trade



(c) Trade effects using SV of FDI



(d) FDI effects using SV of FDI



Positive and Negative Substantive Provisions (grouped Shapley effects)

Back

	Panel A: trade		Panel B: FDI (affiliates)	
	(1)	(2)	(3)	(4)
Positive-trade provisions (group Shapley)	0.0209***		-0.0017	
	(0.01)		(0.00)	
Negative-trade provisions (group Shapley)	-0.0358***		0.0048**	
	(0.01)		(0.00)	
Positive-FDI provisions (group Shapley)		-0.0020*		0.0049***
		(0.01)		(0.00)
Negative-FDI provisions (group Shapley)		0.0121**		-0.0017*
		(0.01)		(0.00)
Observations	190440	190440	190440	190440
R^2	0.998	0.998	0.998	0.998
OriginxYear FE	Yes	Yes	Yes	Yes
DestinationxYear FE	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes
FTA/BIT controls	Yes	Yes	Yes	Yes

PPML, Robust standard errors in (), clustered by country pair

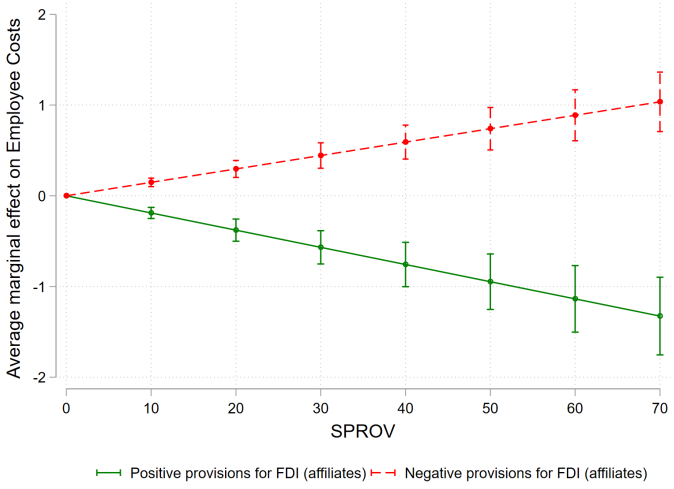
Domestic data included

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

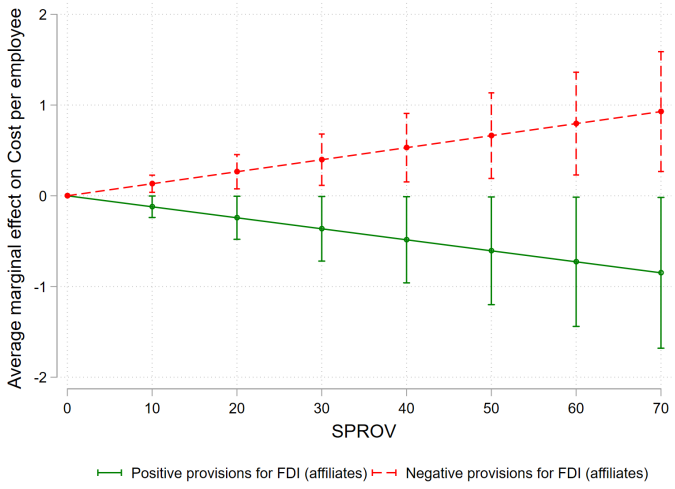
Second stage: Effects on Various MNE Variables (indv SV)

Back

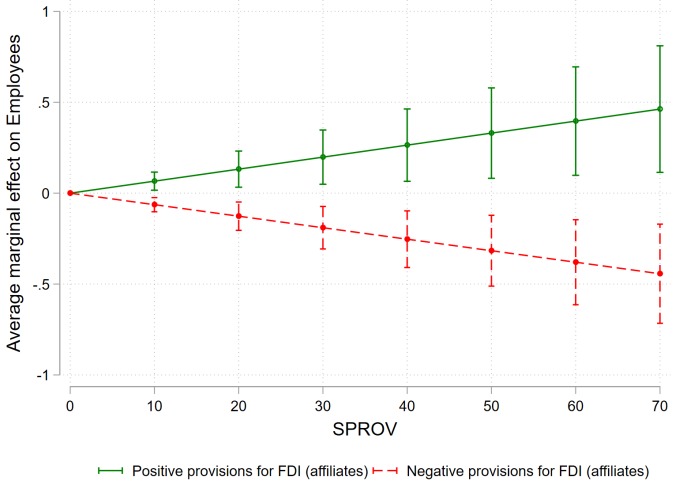
(a) Employee costs



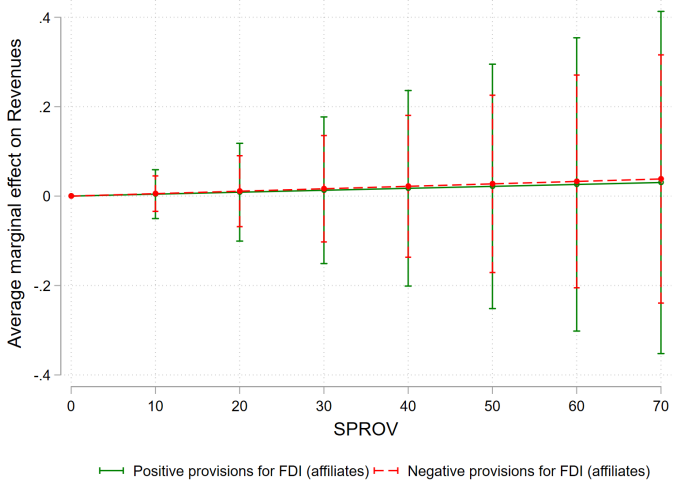
(b) Cost per employees



(c) Number of Employees



(d) Revenues



Second stage: Effects on Various MNE Variables (group SV)

Back

	(1) Employee costs	(2) Costs per employee	(3) Employees	(4) Tangible Assets	(5) Intangible Assets	(6) Revenues
			Panel I			
Positive-FDI provisions (group Shapley)	-0.0508***	-0.0566**	0.0123	-0.0041	0.0148	-0.0067
	(0.01)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
Negative-FDI provisions (group Shapley)	0.0287***	0.0382**	-0.0092	0.0018	-0.0135*	0.0055
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
			Panel II			
Positive-trade provisions (group Shapley)	0.0436***	0.0106	-0.0109***	-0.0051	-0.0231**	0.0015
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)
Negative-trade provisions (group Shapley)	-0.0859***	-0.0100	0.0187**	0.0087	0.0353*	0.0004
	(0.03)	(0.03)	(0.01)	(0.01)	(0.02)	(0.01)
Observations	18784	16187	190440	190440	190440	190440
OriginxYear FE	Yes	Yes	Yes	Yes	Yes	Yes
DestinationxYear FE	Yes	Yes	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
FTA/BIT controls	Yes	Yes	Yes	Yes	Yes	Yes

PPML, Robust standard errors in parenthesis, clustered by country pair

Domestic data included

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Shapley Values, Deepnes & DTA estimates

- We can now reconcile the "deepness" measure of equation (2) with the individual effect of each DTA:

$$\begin{aligned} E[\ln X_{ij}|SPROV^{+}=1, SPROV^{-}1=1] &= E[\ln X_{ij}|D_{NA}] = \beta - \beta = 0 \\ E[\ln X_{ij}|SPROV^{+}=3, SPROV^{-}1=1] &= E[\ln X_{ij}|D_{EU}] = 3\beta - \beta = 2\beta \\ E[\ln X_{ij}|SPROV^{+}=2, SPROV^{-}1=0] &= E[\ln X_{ij}|D_{MS}] = 2\beta \end{aligned}$$

- The deepness measure of (1) (OAB) is the weighted average marginal effects of (2):

$$\beta_{SP} = \frac{1}{2}\left(\beta_{SP}^{+}\overline{SPROV}_{ij}^{+} - |\beta_{SP}^{-}|\overline{SPROV}_{ij}^{-}\right). \tag{5}$$

- We can recover the DTA coefficient from the positive and negative SV coefficients:

$$\hat{\beta}_{DTA} \cong \overline{SPROV}_{ij} \times \frac{1}{2}\left(\beta_{Sb}^{+}\overline{SPROV}_{ij}^{+} - |\beta_{Sb}^{-}|\overline{SPROV}_{ij}^{-}\right). \tag{6}$$