Gravity estimations with FDI bilateral data: FDI effects of deep preferential trade agreements

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Overview

- Simple idea: use panel data gravity model to estimate the effect of heterogenous preferential trade agreements (PTAs) on FDI inward stocks/inflows
- What is the expected FDI shock of signing a PTA with a specific "depth"?
- PTAs are country-pair specific and time-variant: this eases the gravity analysis
- Input for original report on Pacific Alliance and later on, for applied general equilibrium models dealing with trade and investment policy changes (eg. Brexit, new PTAs)
- Work in progress: including new FDI data and revising PTA depth indicators

Motivation

- PTAs focus on trade, but new generation of "deep" FTAs include provisions directly related to investment, and others that indirectly affect FDI –e.g. IP rights and public procurement
- Different FDI/MNE theoris predict different FDI-impact of PTAs
  - In general, vertical FDI complements trade and horizontal FDI substitutes for trade (Markusen, 2002; Blonigen, 2005).
  - Baldwin and Okubo (2014) distinguish six types of FDI: export platforms and global value chains (GVCs) increasingly important to establish a complementarity relation between FDI and trade
- FDI data is not divided between horizontal and vertical, so we are indirectly testing for importance of both FDI types and the magnitude of the net effect

Related literature

- Blonigen et al. (2007) survey FDI determinants, and find partial evidence of tariff jumping FDI (so trade protection increases FDI), but do not explicitly mention PTAs
- Related literature use foreign affiliate sales (FAS) to test for MNE activities (e.g. Kleinert and Toubal, 2010), but do not testing of PTAs
- Bergstrand and Egger (2007) use 3-country model and find a negative relation between PTA and FDI
- Our paper is closest to Anderson, Larch and Yotov (2016, 2017): use UNCTAD FDI bilateral database and a dummy for PTAs: they find a positive and significant effect
- We follow Anderson et al. (2016, 2017), but employ a "depth" PTA variable, extended FDI dataset and we do not attempt a GE approach given the inherit theoretical problems of simultaneously dealing with two or more types of FDI

Gravity specification

- Current draft follows the gravity model derived from Anderson et al. (2016)
- We implement a standard country-pair fixed effect gravity specification:

$$FDI_{ijt} = \exp\left(\gamma \mathbf{P}_{ijt} + \mu_{it} + \mu_{jt} + \mu_{ij}\right) + \epsilon_{ijt} \tag{1}$$

- Our main specification uses FDI inward stocks (from country i in country j) and the DESTA PTA depth indicator and a EU single-market dummy as the policy variables ($\mathbf{P}_{ijt}$)
- We also use FDI inward flows and other policy definitions: PTA dummies, World Bank indicators, and BITs
- We also run a "standard" gravity approach where the country-pair fixed effects (μ_{ij}) are substituted by the usual control variables (distance, language, border, etc.)

Gravity specification

- We follow the recommendations for best practices in gravity estimations from (Yotov et al., 2016):
  - Employ a PPML estimator with country-pair-fixed effects
  - Use exporter-time and importer-time fixed effects to account for multilateral resistance terms
  - We use domestic capital stock data to estimate the effects of non-discriminatory trade policy
  - Since FDI flows and stocks do not respond immediately to trade policy changes we use 3-year average FDI stocks
- PTA indicators
  - Large heterogeneity of PTAs (Horn et al., 2010), from "shallow" to "deep".
  - To account for depth and provisions coverage we use the DESTA database, which provides a depth index of PTAs (from one to seven) and World Bank depth of PTA database (52 provisions)
  - We construct dummy variables and depth indicators from both databases, and also use Larch's database on regional trade agreements

FDI data

- Initially: we used the UNCTAD global database on bilateral FDI stocks and flows (UNCTAD, 2014)
  - Data for 206 countries for 12 years: 2001-2012
  - Covers FDI inflows, outflows, inward stocks ("instock") and outward FDI stocks ("outstock").
  - Collected mainly from national sources when available, if not available it is complemented with data from partner countries (mirror data) as well as data from other international organisations.
- Now: include bilateral OECD FDI stocks database (OECD, 2018)
  - Observations for the years 2003-2012 and 2016
  - OECD countries and some non-OECD, so less country coverage
  - Contains more data on verified zeros in bilateral FDI stocks
- Unified database
  - Near perfect correlation for overlapping observations (same source?)
  - We take OECD as main source, and thus complement with UNCTAD database
  - Resulting database has 153,300 obs. of which 89,900 are zeros

Policy variables data

- PTA depth: DESTA database (Dür et al., 2014) and more recent World Bank database (Hofmann et al., 2017)
  - DESTA needed some adjustments: within EU treatment and revised, entry dates of some agreements (Pacific Alliance, some Central American / Mexican PTAs)
  - WB database is richer: 52 provisions that need to be "reduced":
    1. The first two indexes are the "total depth" indexes, which are the simple count of all provisions and the legally enforceable provisions
    2. The "core depth" variable: counts the total number of "core" provisions (Baldwin, 2008; Damuri, 2012) that are included and legally enforceable in a PTA.
    3. The "PCA depth" index based on principal component analysis
  - Are DESTA and WB databases independent?
  - We also use dummy RTA variables from Mario Larch's database (Egger and Larch, 2008)

Main results

Table: Main FDI gravity regressions using 3-year average inward FDI stocks

	eq. 4: country-pair FE			eq. 5: standard gravity		
variables	(1)	(2)	(3)	(4)	(5)	(6)
PTA_depth	0.051***	0.043**			0.268***	
	(0.017)	-0.017			(0.017)	
PTA_dummy			0.314***			0.645***
			(0.120)			(0.098)
EU single mkt		0.944***				
		(0.148)				
ln_DIST				-0.808***	-0.437***	-0.712***
				(0.059)	(0.050)	(0.057)
CNTG				0.850***	0.523***	0.707***
				(0.124)	(0.122)	(0.122)
LANG				1.285***	1.198***	1.269***
				(0.083)	(0.086)	(0.083)
CLNY				2.658***	2.645***	2.649***
				(0.081)	(0.080)	(0.078)
Observations	35,301	35,301	35,301	57,285	57,285	57,285

Notes: Dependent variable: FDI inward stocks, using 3-year averages. PPML estimations. Columns 1 and 2 use automatic three-way clustering by exp-id, imp-id, and time-id. Standard errors in parentheses: *** p¡0.01, ** p¡0.05, * p¡0.1. Origin-country-time (μ_{it}), destination-country-time (μ_{jt}), and country-par (μ_{ij}) fixed effects are not reported. FTA and FTA_depth are taken from the DESTA database.

Source: Own estimations using UNCTAD bilateral FDI, DESTA and CEPII databases.

PTA coefficient interpretation

Table: FDI impact of different policy variables

variable	estimated coefficient	significance levels	FDI effect (percentage)
DESTA depth index			
depth=1	0.043	***	4.4
depth=2	0.086	***	9.0
depth=3	0.129	***	13.8
depth=4	0.172	***	18.8
depth=5	0.215	***	24.0
depth=6	0.258	***	29.4
depth=7	0.301	***	35.1
DESTA PTA dummy	0.254	***	28.9
EU single market	0.944	***	157.0

World Bank depth of PTA database

Table: Main FDI gravity regressions using 3-year average inward FDI stocks and FTA indicators the World Bank database

	eq. 4: country-pair FE					eq. 5: standard gravity				
Variables:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FTA_wb	0.398***					0.880***				
	(0.083)					(0.098)				
wb_tot_le		0.030***					0.066***			
		(0.008)					(0.003)			
wb_tot_pr			0.026***					0.054***		
			(0.007)					(0.002)		
wb_core				0.033***					0.095***	
				(0.008)					(0.007)	
wb_pca					0.163***					0.388***
					(0.040)					(0.021)
ln_DIST						-0.755***	-0.167***	-0.302***	-0.538***	-0.373***
						(0.073)	(0.061)	(0.062)	(0.067)	(0.062)
CNTG						0.624***	0.524***	0.671***	0.569***	0.593***
						(0.125)	(0.137)	(0.137)	(0.133)	(0.133)
LANG						1.464***	1.437***	1.366***	1.409***	1.460***
						(0.079)	(0.083)	(0.083)	(0.081)	(0.079)
CLNY						2.610***	1.800***	1.981***	2.607***	2.341***
						(0.086)	(0.075)	(0.074)	(0.085)	(0.074)
Observations	26,320	26,320	26,320	26,320	26,320	27,291	27,291	27,291	27,291	27,291

Notes: Dependent variable: FDI inward stocks, using 3-year averages. PPML estimations. Columns 1 to 5 use automatic three-way clustering by exp-id, imp-id, and time-id. Robust standard errors in parentheses: *** p¡0.01, ** p¡0.05, * p¡0.1. Host-country-time (μ_{it}) and origin-country-time (μ_{jt}) fixed effects are not reported. The FTA_wb dummy and the FTA depth indicators (wb_tot_le, wb_tot_pr, wb_core, and wb_pca) are estimated using the World Bank database (Hofman et al. 2017).

Other policy variables

Table: FDI impact of different policy variables

variable	estimated coefficient	significance levels	Number of observations	FDI effect (percentage)
DESTA database:				
PTA_depth	0.043	***	35,301	n.a. \1
D_full	0.224	***	35,301	25.1
D_stds	0.195	***	35,301	21.5
D_inv	0.227	*	35,301	25.5
D_serv	0.185	**	35,301	20.3
D_proc	0.111		35,301	11.7
D_comp	0.218	***	35,301	24.3
D_ip	0.280	***	35,301	32.4
Larch's database:				
Customs Union (CU)	0.472	***	29,985	60.3
Free trade agreement (FTA)	0.064		29,985	6.6
Economic Integration Agreement (EIA)	0.247	***	29,985	28.0
Partial scope agreement (PS)	0.191	**	29,985	21.1
CU & EIA	0.479	***	29,985	61.5
FTA & EIA	0.095		29,985	10.0
RTA_dummy	0.183	***	29,985	20.1

Using BITs

Table: FDI gravity regressions using BITs for different econometric specifications and inward FDI stocks for 3-year averages

	eq. 4: country-pair FE			eq. 5: standard gravity		
variables	(1)	(2)	(3)	(4)	(5)	(6)
BITs	0.484**	0.485**	0.470**	-0.040	-0.014	-0.018
	(0.220)	(0.205)	(0.205)	(0.069)	(0.057)	(0.067)
PTA_depth		0.041***			0.276***	
		(0.027)			(0.017)	
PTA_dummy			0.307***			0.696***
			(0.063)			(0.096)
ln_DIST				-0.814***	-0.433***	-0.717***
				(0.063)	(0.052)	(0.059)
CNTG				0.847***	0.455***	0.664***
				(0.129)	(0.123)	(0.122)
LANG				1.279***	1.249***	1.275***
				(0.083)	(0.086)	(0.082)
CLNY				2.680***	2.635***	2.658***
				(0.083)	(0.079)	(0.081)
Observations	35,301	35,301	35,301	57,285	57,285	57,285

Notes: Dependent variable: FDI inward stocks. PPML estimations using automatic three-way clustering by exp-id, imp-id, and time-id for the country-pair fixed effects. Standard errors in parentheses: *** p¡0.01, ** p¡0.05, * p¡0.1. Origin-country-time (μ_{it}) and destination-country-time (μ_{jt}) fixed effects are not reported. BITs data are taken from UNCTAD.

Source: Own estimations using UNCTAD bilateral FDI, DESTA and CEPII databases

Additional sensitivity analysis

- We use yearly and 4-year average FDI stocks
- Using OECD and UNCTAD databases separately
- Using FDI inward flows, instead of stocks (for UNCTAD only)
- Exclude 2016 (single year)

- Currently revising/comparing DESTA-WB databases; there is more recent data by IMF on bilateral FDI stocks

FDI inflows

Table: FDI gravity regressions using 3-year average FDI inflows

	eq. 4: country-pair FE		**eq. 5: standard gravity**		
variables	(1)	(2)	(3)	(4)	(5)
FTA_depth	0.039*			0.203***	
	(0.022)			(0.057)	
FTA		0.187**			0.687**
		(0.088)			(0.282)
ln_DIST			-0.533***	-0.250	-0.427**
			(0.164)	(0.162)	(0.166)
CNTG			1.028**	0.826**	0.880**
			(0.416)	(0.369)	(0.358)
LANG			0.898***	0.846***	0.867***
			(0.233)	(0.226)	(0.223)
CLNY			3.106***	3.124***	3.147***
			(0.257)	(0.236)	(0.232)
Observations	20,069	20,069	26,436	26,436	26,436

Notes: Dependent variable: FDI inflows, using 3-year averages. PPML estimations. Columns 1-2 use automatic three-way clustering by exp-id, imp-id, and time-id, other columns use robust standard errors. All SE reported in parentheses: *** p¡0.01, ** p¡0.05, * p¡0.1. Origin-country-time (μ_{it}), destination-country-time (μ_{jt}) and country-pair (μ_{ij}) fixed effects are not reported. FTA and FTA_depth are taken from the DESTA database.

Source: Own estimations using UNCTAD bilateral FDI, DESTA CEPII and WDI databases.

Summary of results

- PTA depth has a positive and increasing impact on bilateral FDI stocks and flows
- Signing deep PTAs –i.e. with provisions on investments, standards, IP protection– can increase FDI stocks by more than one-third (35%)
- These results are robust to using different PTA-depth indicators, including other policy variables, FDI data combinations, and different specifications
- This points to FDI and trade being associated more with vertical / GVC relations
- However, our specification does not analyse GE effects nor the precise mechanisms at work (via PTA provisions, trade links, signalling)

- Thank you for your attention!

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