On the widely differing effects of free trade agreements: Lessons from twenty years of trade integration

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(*preliminary and incomplete*)

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Motivation

Going back 60+ years, economists have been consistently interested in understanding the effects of free trade agreements (FTAs)

- Viner (1950); Tinbergen (1962)

The proliferation of new trade agreements over the past three decades has been unprecedented:

- >350 RTAs have been reported to the WTO since the mid-1980s.

TTIP & TPP "mega-deals" have sparked yet another wave of renewed interest in the effects of economic integration

- Will collectively make 60% of the world's production more interdependent by eliminating barriers to trade
- Policymakers and observers both inside and outside member countries are understandably anxious regarding the uncertainty surrounding their consequences.

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Our motivation: The question of how to project the effects of new agreements *ex ante* remains open and, we argue, more relevant than ever.

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Currently, economists wishing to project the *partial* effects of forthcoming FTAs generally adopt 1 of 2 approaches:

1. Use direct observable measures of trade policy barriers (e.g., tariffs) which are observable *ex ante* and specifically eliminated per terms of the agreement.
2. Estimate an average partial effect from past FTAs and use that to capture "deep" integration (i.e., beyond tariff reductions)

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Neither approach is without its drawbacks.

It is now well-known both empirically and by casual observation that FTAs have succeeded at promoting economic integration that goes beyond tariff reductions

(Baier & Bergstrand 2007; Anderson & Yotov 2016)

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Neither approach is without its drawbacks.

On the other hand, the effects of new agreements may be very different from an "average" constructed from past FTAs.

Furthermore, not all countries signing the agreement are affected in the same way!

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1. We construct a novel data set w/ international trade, gross output, and consistently measured internal trade for the period 1986 to 2006.
   - ◇ Trade between FTA-signing countries may come at the expense of their domestic sales/internal trade

     (Dai, Yotov, & Zylkin, 2014; Bergstrand, Larch, & Yotov, 2015)
   - ◇ It will also allow us to perform GE comparative statics for the prediction analysis

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1. Novel data set: manufacturing trade and production, 1986-2006
2. We expand on the original methods of Baier & Bergstrand (2007) to allow for and obtain both agreement-specific and direction-of-trade-specific partial effects for FTAs signed between 1986 and 2006.
   - ◇ Agreement-specific: unique effects for NAFTA, Mercosur, EU, etc.
   - ◇ "Direction-of-trade"-specific: How much did the EU Accession of Austria affect Austria's exports vs. its imports *vis a vis* each of its new EU partners?
     (Key idea: trade liberalization may be *asymmetric*.)

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1. Novel data set: manufacturing trade and production, 1986-2006
2. Agreement-specific and direction-of-trade-specific FTA effects.
3. We use our "1st stage" direction-specific FTA estimates as our "2nd stage" dependent variable in order to study the determinants of FTA partial effects.
   - ◇ Some bilateral 2nd stage regressors with intuitive signs: geographic distance, whether or not the two countries have previously integrated via a prior agreement.
   - ◇ However, we also find that country-specific variables (esp. GDP per capita / development) play a relatively larger role.

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2. Agreement-specific and direction-of-trade-specific FTA effects.
3. Two-stage methodology for studying determinants of FTA partial effects.
4. We use our econometric model from the second stage to generate out-of-sample predictions for the partial effects of all the agreements in our sample.
   - ◇ A "machine-learning" approach to making *ex ante* predictions
   - ◇ As an illustration, we use our prediction model to predict the GE welfare effects of **TTIP** on all member and non-member countries.

What we have learned so far

A surprising insight (to us):

FTA partial effects have been strongly country-specific.

Out-of-sample validation shows a country's past experience with FTAs provides a simple, yet relatively rich source of predictive power for projecting the partial effects of its future FTAs

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Heterogeneity *within* agreements versus *across* agreements

We also found it surprisingly difficult to model heterogeneous effects *within* agreements, which comprise a substantial portion (~2/3) of the overall variance we observe in our FTA estimates.

An increasingly important channel to consider as trade blocs get larger and larger

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Still work in progress; much left to explore

Right now, our groundwork is purely empirical/predictive. We'd like to incorporate more "Economics", i.e., testing specific theories that might relate to the *partial* effects of FTAs

(e.g. Bagwell & Staiger "Terms of Trade" theory; Maggi & Rodriguez-Clare "domestic commitments" theory)

Related Literature

- More papers on heterogeneity in FTA effects
  - Heterogeneity across individual FTAs: Soloaga & Winters (2001); Cipollina & Salvatici (2010); Kohl (2014); Kohl, Brakman, & Garretsen (2015)
  - Heterogeneity within FTAs based on (symmetric) observables: Baier, Bergstrand, & Clance (2015)
  - "Direction of trade"-specific (asymmetric) FTA effects: Zylkin (2015)
- Simulating/predicting welfare impact of FTAs...
  - ...using **tariffs**: Brown, Deardorff, & Stern (1992); Romalis (2007); Shikher (2012); Caliendo & Parro (2015)
  - ...using data on **non-tariff measures**: Brown, Deardorff, & Stern (1992); Shikher (2012)
  - ...using **estimated FTA effects**: Anderson & Yotov (2016); Anderson, Larch, and Yotov (2015a)
- Predicting the effects of "mega-deals"...
  - ...using an **estimated "average" FTA effect**: Aichele, Felbermayr, & Heiland (2014) (TTIP); Egger, Francois, Manchin, & Nelson (2014) (TTIP); Anderson, Larch, and Yotov (2015b) (TTIP); Robert-Nicoud, Carrere, & Grujovic (2015) (TTIP & TPP)
  - ...using **"heterogeneous" FTA estimates**: Baier, Bergstrand, & Clance (2015)

Our starting point: **Structural Gravity...**

$$X_{ij} = \frac{A_i w_i^{-\theta} \tau_{ij}^{-\theta}}{\sum_l A_l w_l^{-\theta} \tau_{lj}^{-\theta}} E_j. \tag{1}$$

As is now well known, (1) can be generated by any number of trade models which share the same essential structure

- e.g., Armington (1969); Krugman (1980); Eaton & Kortum (2002).
- (with a slightly more general form): Melitz (2003); Melitz & Ottaviano (2008)...

For more, see: Arkolakis, Costinot, & Rodríguez-Clare (2012) ("**ACR**"); Costinot & Rodríguez-Clare (2014); Head & Mayer (2014).

FTA Effects: From Theory to Estimation...

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X_{ij} :nominal value of exports from origin i to destination j; E_j: j's expenditure

The share of j's expenditure on goods from i directly depends on the following:

- A_i: the overall "quality" of the available production technologies in i
- w_i: production costs in i
- τ_{ij}: iceberg trade cost requirement to send goods from i to j
- $\theta(>0)$: the "trade elasticity"
  - reflects degree of product differentiation/imperfect substitutability across origins
  - (exact interpretation depends on which model)

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The "direct" cost term $A_i w_i^{-\theta} \tau_{ij}^{-\theta}$ only weighs on bilateral trade relative to the overall degree of competition in j's import market, $\sum_l A_l w_l^{-\theta} \tau_{lj}^{-\theta}$

Because $\sum_l A_l w_l^{-\theta} \tau_{lj}^{-\theta}$ is specific to import market j, just call it "$P_j^{-\theta}$"

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A more compact way of writing (1) is then

$$X_{ij} = \frac{A_i w_i^{-\theta} \tau_{ij}^{-\theta}}{P_j^{-\theta}} E_j, \tag{2}$$

where $P_j^{-\theta} \equiv \sum_l A_l w_l^{-\theta} \tau_{lj}^{-\theta}$ aggregates the overall "buyers' price level" in country j

(a.k.a. the "inward multilateral resistance" from Anderson & van Wincoop 2003).

Panel implementation

Our baseline for estimating the *average* partial effect of FTAs (β) is

$$X_{ij,t} = \exp\left(\eta_{i,t} + \psi_{j,t} + \gamma_{ij} + \beta FTA_{ij,t}\right) + \varepsilon_{ij,t}. \tag{3}$$

$\eta_{i,t}$ and $\psi_{j,t}$: *time-varying* exporter and importer fixed effects

- Absorb $\ln A_{i,t} w_{i,t}^{-\theta}$, $\ln E_{j,t}/P_{j,t}^{-\theta}$, all other endogenous country-specific factors (e.g., including exchange rate changes)

γ_{ij} : *time-invariant* pair fixed effect: absorbs all time-invariant bilateral factors

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Interpretation of β: identified by changes in *relative* trade flows over time. Not simply an "average treatment effect", rather an "average partial effect", via the effect of $FTA_{ij,t}$ on $\tau_{ij}^{-\theta}$ specifically.

Additional GE effects contained in $\eta_{i,t}$ and $\psi_{j,t}$.

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Finally: Following the econometric arguments of Santos Silva & Tenreyro (2006, 2011), we estimate (3) using PPML.

PPML also ensures a tighter connection between empirics and theory (see: Fally, 2014)

Key feature: we allow for FTA Heterogeneity...

...across different agreements (A):

$$X_{ij,t} = \exp\left(\eta_{i,t} + \psi_{j,t} + \gamma_{ij} + \sum_{A} \beta_A FTA_{ij,t}\right) + \varepsilon_{ij,t}, \tag{4}$$

...for each trading pair (p) within an agreement:

$$X_{ij,t} = \exp\left(\eta_{i,t} + \psi_{j,t} + \gamma_{ij} + \sum_{A}\sum_{p\in A} \beta_{A:p} FTA_{ij,t}\right) + \varepsilon_{ij,t}, \tag{5}$$

...and, lastly, for the "direction-of-trade" (d) within pairs:

$$X_{ij,t} = \exp\left(\eta_{i,t} + \psi_{j,t} + \gamma_{\overrightarrow{ij}} + \sum_{A}\sum_{d\in A} \beta_{A:d} FTA_{ij,t}\right) + \varepsilon_{ij,t}. \tag{6}$$

$\{\beta_A\}$: "new" estimates of agreement-specific effects; $\{\beta_p\}$: intermediate step; $\{\beta_d\}$: our "dependent variable" for the 2nd stage.

...And Back to Theory Again

Note that "β" is just the *partial* effect of an FTA on trade. What about the "full" (GE) effect?

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With computed equilibrium changes in $\widehat{w}_i$ and $\widehat{P}_i$ in hand, the GE effects of an FTA are:

$$\textit{GE "Terms of Trade" Impact}: \quad \widehat{W}_i = \widehat{w}_i / \widehat{P}_i = \widehat{\pi}_{ii}^{-\theta} \tag{9}$$

$$\textit{GE Trade Impact}: \quad \widehat{X}_{ij} = \frac{\widehat{w}_i^{-\theta} e^{\beta FTA_{ij,t}}}{\widehat{P}_j^{-\theta}} \cdot \widehat{E}_j, \tag{10}$$

$$\textit{GE Welfare Impact}: \quad \widehat{W}_i = \widehat{E}_i / \widehat{P}_i, \tag{11}$$

where $\widehat{E}_i = \left(Y_i \widehat{w}_i + D_i\right) / E_i$

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Upshot: All else equal, an FTA between i and j should raise wages and lower buyer prices in both countries ("gains from trade"), making it more difficult for outside countries to trade with them ("trade diversion").

Data description

Trade Data

Manufacturing trade between 70 countries for 1986-2006. Non-FTA active countries combined into a single aggregate "RoW" region, (53 trading regions total). Notably includes internal trade values.

Data sources: COMTRADE, TradeProd, UNIDO, World Bank "Trade Production and Protection".

FTA Data

Primary source: Baier and Bergstrand NSF-Kellogg database. Our data covers 65 FTAs in all, which we decompose into 910 unique direction-by-agreement effects.

2nd Stage Regressors

"Gravity" variables are from CEPII. Country-specific data sources: ICRG, PWT. Agreement-specific data ("provisions", etc.): Kohl, Brakman, & Garretsen (2015)

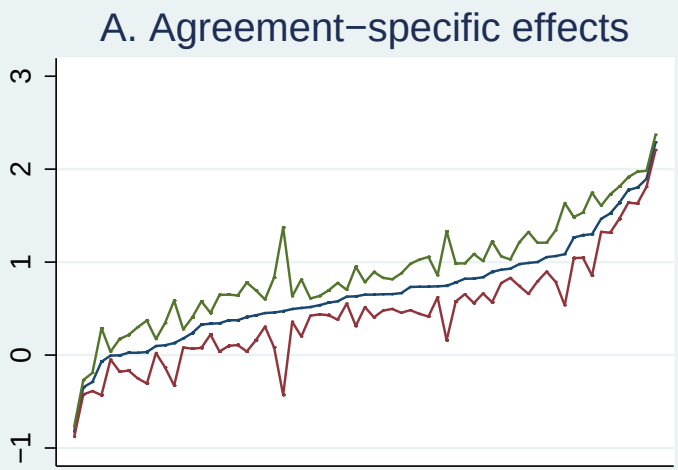
Summary

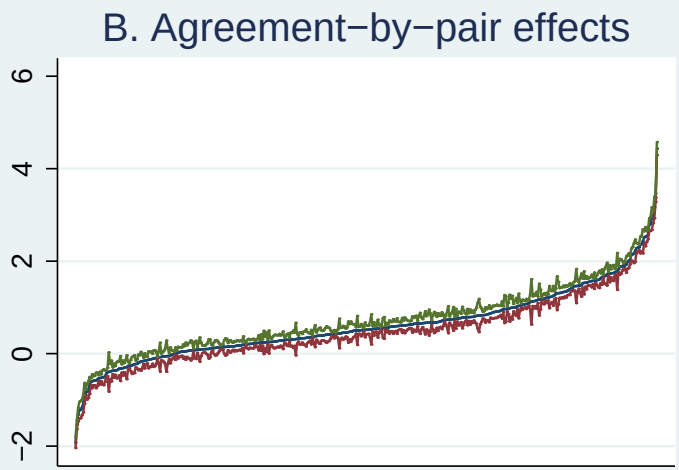
- "Average" partial FTA effect (easy to show): $\beta_{avg} = 0.482$ ($p < .01$)
- Agreement-specific FTA effects: 77% of FTAs in our sample have positive and significant signs.
  - Significantly more "optimistic" finding than similar studies by Soloaga & Winters (2001); Kohl (2014); many others
  - Increased "optimism" depends crucially on: (i) inclusion of internal trade; (ii) PPML
  - Broad heterogeneity patterns do not depend on either of these assumptions, however.
- Agreement-by-pair and agreement-by-direction FTA effects: high degree of heterogeneity, difficult to summarize
  - Large outliers apparent. Fortunately, 2nd stage estimates not sensitive to these.
  - The majority of the heterogeneity in our estimates ($\sim 2/3$) occurs *within* agreements (usually ignored, but important for large trade blocs!).

First Stage Results: Agreement-specific estimates

Agreement	β_A	s.e.	Agreement	β_A	s.e.	Agreement	β_A	s.e.
Positive effects:			(*cont'd*)			**Insignificant effects** ($p > .05$):		
Bulgaria-Turkey	1.658	0.069	EFTA-Morocco	0.557	0.056	CEFTA	0.591	0.450
EU-Romania	1.644	0.096	Australia-Thailand	0.536	0.060	EFTA-Turkey	0.276	0.153
Andean Community	1.559	0.079	Mercosur-Chile	0.527	0.119	Mercosur-Bolivia	0.257	0.161
EU-Bulgaria	1.504	0.111	Israel-Romania	0.504	0.113	Pan Arab Free Trade Area	0.252	0.158
Romania-Turkey	1.488	0.075	Mercosur-Andean Community	0.494	0.102	EU-Chile	0.151	0.100
Israel-Turkey	1.447	0.068	EU-Tunisia	0.485	0.074	EFTA-Mexico	0.142	0.107
EU-Poland	1.295	0.056	Egypt-Turkey	0.483	0.064	Canada-U.S.	0.101	0.108
Mercosur	1.234	0.203	Canada-Costa Rica	0.480	0.143	EFTA-Israel	0.062	0.080
Costa Rica-Mexico	1.221	0.243	Chile-Mexico	0.454	0.095	EU-Israel	0.034	0.099
EU-Hungary	1.034	0.101	Chile-China	0.452	0.058	ASEAN	0.000	0.175
Jordan-U.S.	1.026	0.073	EU-EFTA	0.441	0.143	EU-Cyprus	-0.032	0.116
Canada-Chile	0.949	0.047	Chile-Costa Rica	0.422	0.135	EFTA-Singapore	-0.051	0.053
Poland-Turkey	0.893	0.069	EU-Mexico	0.419	0.116			
EFTA-Romania	0.892	0.274	Mexico-Uruguay	0.416	0.053	**Negative effects**:		
EFTA-Poland	0.889	0.082	Tunisia-Turkey	0.382	0.061	Australia-U.S.	-0.041	0.017
Bulgaria-Israel	0.874	0.107	EU-Morocco	0.375	0.106	Singapore-U.S.	-0.244	0.056
Colombia-Mexico	0.849	0.129	Chile-South Korea	0.344	0.046	Chile-Singapore	-0.828	0.028
EFTA-Bulgaria	0.848	0.093	Agadir Agreement	0.340	0.140			
Israel-Mexico	0.842	0.107	EU	0.301	0.052	**How many $>$ 0 and significant?**		
Hungary-Turkey	0.823	0.129	Chile-U.S.	0.247	0.047	PPML & internal trade		77%
EU-Turkey	0.773	0.093	EU-Egypt	0.236	0.078	PPML, no internal trade		37
Israel-Poland	0.764	0.059	Morocco-U.S.	0.191	0.034	OLS		37%
Canada-Israel	0.707	0.076	Australia-Singapore	0.122	0.057			
Hungary-Israel	0.705	0.138						
NAFTA	0.655	0.135						
EFTA-Hungary	0.602	0.154						
Japan-Mexico	0.573	0.066						

First Stage Results: Distributions of FTA Estimates





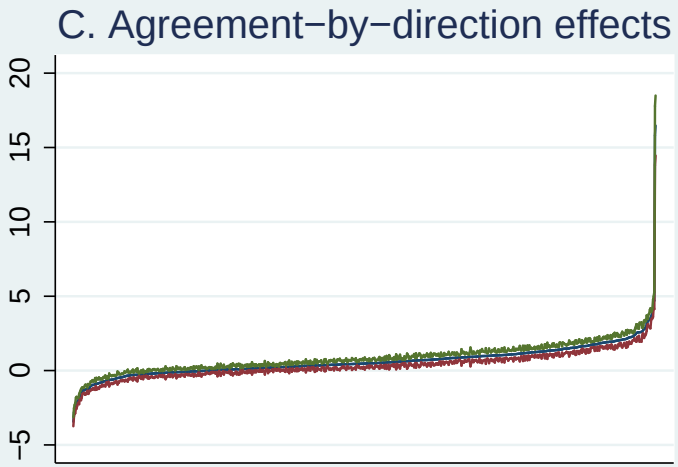


Figure: Variation in FTA Effects

First Stage Results

Heterogeneity *across* agreements versus *within* agreements

Table: Decomposition of Variance in FTA Effects

	Source of variance:		
Estimation:	Across agreements	Pairs within agreements	Within pairs
OLS	0.327	0.372	0.301
WLS	0.374	0.322	0.304
FGLS	0.338	0.352	0.310

Our dependent variable, $\beta_{A:d}$, is estimated with error. "WLS" and "FGLS" are different ways of weighting to account for this. Reference: Lewis & Linzer (2005)

Exploring the determinants of FTA effects

- We start with a "gravity"-based approach to explaining determinants of FTA effects using bilateral variables.
  - (shown by Baier, Bergstrand, & Clance (2015) to be relatively successful in explaining FTA heterogeneity)
- We were intrigued, however, by how much of the variation in our FTA effects is seemingly due to country-specific factors
  - motivates a "brute force" approach using exporter- and importer- FEs in the 2nd stage
  - FEs boost predictive power enormously (FTA effects are highly country-specific!)
  - ...but difficult to interpret economically
- FTA effects appear to be stronger for less-developed countries (lower GDP per capita).
  - This finding helps explain heterogeneity *within* agreements

Second Stage Results: First Pass

	Dependent variable: First stage directional FTA estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln DIST	-0.227***	-0.238***	-0.116**	-0.120**				-0.026
	(0.038)	(0.038)	(0.049)	(0.049)				(0.079)
COLONY	-0.063	-0.026	-0.030	-0.054				0.125
	(0.091)	(0.091)	(0.101)	(0.101)				(0.114)
COMCOL	-0.846***	-0.934***	-0.096	-0.086				0.068
	(0.134)	(0.154)	(0.157)	(0.158)				(0.200)
CONTIG	-0.010	-0.009	-0.187*	-0.173*				-0.066
	(0.094)	(0.087)	(0.106)	(0.104)				(0.117)
LANG	-0.084	-0.103	0.072	0.120				-0.088
	(0.083)	(0.082)	(0.094)	(0.096)				(0.098)
LEGAL	0.041	0.022	0.022	0.007				0.104
	(0.072)	(0.074)	(0.069)	(0.070)				(0.081)
GATT/WTO		-0.656***		0.055				0.417**
		(0.121)		(0.167)				(0.177)
Prior Agreement		-0.331***		-0.227***				0.078
		(0.057)		(0.061)				(0.130)
Exporter FEs			x	x		x	x	x
Importer FEs			x	x	x		x	x
Agreement FEs								x
Observations	910	910	910	910	910	910	910	910
R^2	0.049	0.097	0.428	0.434	0.188	0.254	0.425	0.517

Estimated using OLS. Robust standard errors are reported in parentheses.
* $p < 0.10$, ** $p < .05$, *** $p < .01$

More on 2nd Stage Fixed Effects

Table: Exporter and Importer Fixed Effects from Second Stage Regressions

Country	*f.e.*	Country	*f.e.*	Country	*f.e*	Country	*f.e*
Exporter fixed effects from the second stage (*by country, largest to smallest*):							
Qatar	0.683	Spain	-0.234	France	-0.542	Ireland	-0.827
Iceland	0.653	Mexico	-0.292	Philippines	-0.543	Switzerland	-0.835
Bulgaria	0.504	Belgium-Luxembourg	-0.320	Netherlands	-0.581	Denmark	-0.877
Romania	0.392	Egypt	-0.326	Germany	-0.610	Israel	-0.918
Hungary	0.062	South Korea	-0.344	Costa Rica	-0.612	Sweden	-0.926
Turkey	0.053	Portugal	-0.363	Thailand	-0.615	Indonesia	-0.941
Poland	0.038	Japan	-0.433	United States	-0.633	Malta	-1.027
Argentina	0.000	Canada	-0.460	Norway	-0.645	Cyprus	-1.037
Ecuador	-0.004	Tunisia	-0.503	Finland	-0.662	Australia	-1.113
Colombia	-0.058	United Kingdom	-0.510	Italy	-0.683	Malaysia	-1.190
China	-0.067	Jordan	-0.510	Greece	-0.706	Singapore	-1.342
Bolivia	-0.102	Uruguay	-0.534	Austria	-0.749	Kuwait	-1.343
Brazil	-0.198	Morocco	-0.536	Chile	-0.766	Myanmar	-2.843

Note: Both sets of fixed effects are measured relative to that of Argentina.

* marks countries that only formed one FTA pair during the period.

More on 2nd Stage Fixed Effects

Table: Exporter and Importer Fixed Effects from Second Stage Regressions

Country	*f.e.*	Country	*f.e.*	Country	*f.e*	Country	*f.e*
Importer fixed effects from the second stage (*by country, largest to smallest*):							
Romania	1.602	Costa Rica	0.473	France	0.299	Chile	0.063
Bulgaria	1.323	Australia	0.470	Netherlands	0.284	Switzerland	0.058
Thailand	0.941	Portugal	0.462	Sweden	0.258	Malta	0.018
Canada	0.805	United Kingdom	0.458	Qatar	0.187	Argentina	0.000
Indonesia	0.742	Japan	0.426	Italy	0.186	Singapore	-0.031
United States	0.711	Colombia	0.406	Finland	0.186	Denmark	-0.073
South Korea	0.688	Germany	0.395	Myanmar	0.185	Greece	-0.085
China	0.675	Poland	0.375	Brazil	0.140	Kuwait	-0.122
Belgium-Luxembourg	0.651	Austria	0.352	Israel	0.127	Egypt	-0.185
Ecuador	0.642	Ireland	0.345	Hungary	0.121	Cyprus	-0.200
Malaysia	0.530	Mexico	0.343	Norway	0.086	Tunisia	-0.245
Iceland	0.529	Philippines	0.315	Morocco	0.082	Uruguay	-0.411
Spain	0.517	Turkey	0.310	Bolivia	0.074	Jordan	-0.422

Note: Both sets of fixed effects are measured relative to that of Argentina.

* marks countries that only formed one FTA pair during the period.

Country-specific factors in More Detail

	Dependent variable: First stage FTA estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(*bilateral variables also included but not shown here.*)								
Exporter (log) Real GDP	0.012	0.024	-0.144	0.009	0.026			
	(0.040)	(0.043)	(0.450)	(0.054)	(0.045)			
Importer (log) Real GDP	0.037	0.029	-0.462	-0.006	0.030			
	(0.023)	(0.021)	(0.325)	(0.026)	(0.022)			
Exporter (log) GDP per capita		-0.330***	-0.364	-0.632***	-0.336***	-0.274***		-0.224***
		(0.051)	(0.486)	(0.069)	(0.055)	(0.083)		(0.060)
Importer (log) GDP per capita		-0.125*	-0.055	-0.408***	-0.131**	-0.065	0.149**	
		(0.069)	(0.253)	(0.112)	(0.062)	(0.074)	(0.060)	
Exp. (log) Physical Capital / Labor ratio			-0.111					
			(0.104)					
Exp. (log) Human Capital / Labor ratio			-0.157					
			(0.401)					
Imp. (log) Physical Capital / Labor ratio			0.113					
			(0.193)					
Imp. (log) Human Capital / Labor ratio			-0.471					
			(0.321)					
$\lvert\Delta$(log) Physical Capital / Labor ratio$\rvert$				0.183*				
				(0.100)				
$\lvert\Delta$(log) Human Capital / Labor ratio$\rvert$				-0.002				
				(0.042)				
$\lvert\Delta$(log) GDP per capita$\rvert$					-0.027			
					(0.068)			
Agreement FEs						x	x	x
Observations	874	874	654	654	874	900	905	905
R^2	0.120	0.159	0.274	0.275	0.160	0.345	0.333	0.344

Robust standard errors are reported in parentheses.
* $p < 0.10$, ** $p < .05$, *** $p < .01$

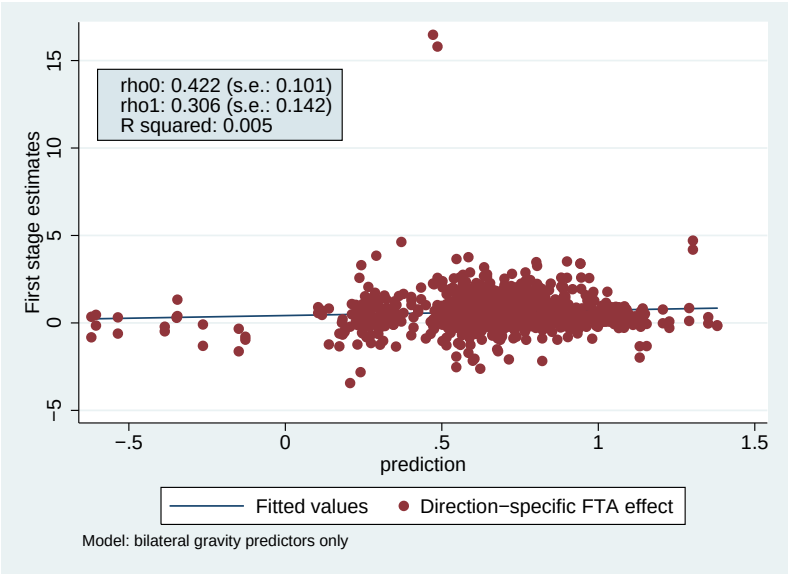
Out-of-sample Prediction Analysis

Overview

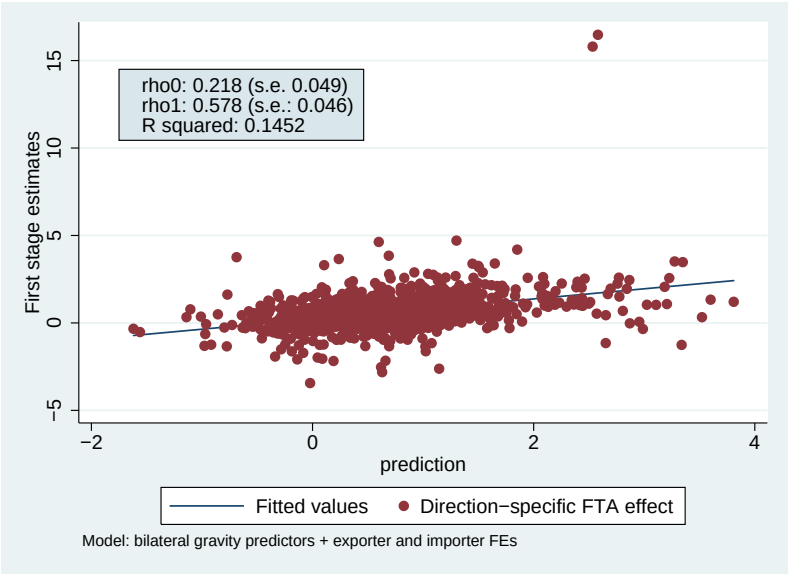
Our procedure for the out-of-sample analysis is as follows:

1. Drop 1 agreement from our sample at a time (e.g., drop NAFTA)
2. Try to predict the effects of that agreement "out-of-sample" using a fitted second stage model based solely on the remaining "in-sample" agreements.
3. Compare the fit between "predicted" vs. "actual" FTA partial effects across all the FTA estimates from our first stage.

Out-of-sample Prediction Analysis: Results



(a)



(b)

Figure: Out-of-sample Validation

Simple linear fit to assess "predictive power":

$$\beta_{A:d} = \rho_0 + \rho_1 \cdot \widetilde{\beta}_{A:d} + e, \tag{12}$$

Out-of-sample Prediction Analysis: Results

Table: Out-of-sample Validation Results

Models without Exporter and Importer Fixed Effects							
Model	*Gravity variables*†	*Exporter FEs*	*Importer FEs*	*Other regressors*	ρ_0	ρ_1	R^2
1	Yes	No	No	None	0.422***	0.306**	0.0005
2	Yes	No	No	Prior Agreement, GATT/WTO	0.116	0.792***	0.0600
3	Yes	No	No	Prior Agreement, GATT/WTO, Index IQ	0.294***	0.543***	0.0481
4	Yes	No	No	Prior Agreement, GATT/WTO, Exp. & Imp. (log) Real GDP/capita	0.120*	0.786***	0.0740
Models with Exporter and/or Importer Fixed Effects							
Model	*Gravity variables*†	*Exporter FEs*	*Importer FEs*	*Other regressors*	ρ_0	ρ_1	R^2
5	Yes	Yes	Yes	None	0.218***	0.578***	0.1452
6‡	Yes	Yes	Yes	Prior Agreement, GATT/WTO	0.232***	0.577***	0.1568
7	Yes	Yes	Yes	Prior Agreement, GATT/WTO, Index IQ	0.335***	0.462***	0.1275
8	Yes	Yes	Yes	Prior Agreement, GATT/WTO, Exp. & Imp. (log) Real GDP/capita	0.276*	0.561***	0.1631
9	No	Yes	Yes	None	0.208***	0.594***	0.1482

†Refers to Ln DIST, COLONY, COMCOL, COMLANG, and LEGAL. ‡Preferred prediction model.

* $p < 0.10$, ** $p < .05$, *** $p < .01$

Predicting the Effects of TTIP: Partial Effects

We construct two sets of "partial effects" to predict the GE effects of TTIP:

An "average" scenario: Simply put, $\widehat{\tau}_{ij}^{-\theta} = e^{\beta_{avg}} = e^{0.482}$, for all TTIP pairs

Predicting the Effects of TTIP: Partial Effects

We construct two sets of "partial effects" to predict the GE effects of TTIP:

An "average" scenario: Simply put, $\widehat{\tau}_{ij}^{-\theta} = e^{\beta_{avg}} = e^{0.482}$, for all TTIP pairs

A "heterogeneous" scenario: We model $\widehat{\tau}_{ij}^{-\theta} = e^{\beta_{ij}}$, where

$$\beta_{ij} = \underbrace{0.232}_{\rho_0} + \underbrace{0.577}_{\rho_1} \cdot \widetilde{\beta}_{TTIP:d}, \tag{13}$$

and $\widetilde{\beta}_{TTIP:d}$ is the fitted value for each directional pair d within TTIP computed from our second stage model.

Note that:

1. $\widetilde{\beta}_{TTIP:d}$ specifically incorporates "country-specific" FTA partial effects (via the FEs)
2. Our ρ's from the OOS validation provide guidance on how much confidence we should have in our ability to "predict" heterogeneity in FTA effects.

Predicting the Effects of TTIP: GE Results I

	Scenario	
	"Average" Scenario	*"Heterogeneous" Scenario*
	$\Delta\%$ Welfare	$\Delta\%$ Welfare
(selected countries)		
Australia	-0.02	-0.02
Bulgaria	0.11	0.63
Canada	-0.02	-0.03
China	-0.04	-0.13
Germany	0.76	1.33
France	0.42	0.62
United Kingdom	0.66	1.26
Greece	-0.02	-0.44
Japan	-0.04	-0.12
South Korea	-0.04	-0.10
Mexico	-0.03	-0.09
Philippines	-0.04	-0.10
Poland	0.08	0.24
Portugal	0.21	0.20
Romania	0.04	0.34
Turkey	-0.06	-0.17
USA	0.72	0.99
EU	0.52	0.86
TTIP	0.60	0.92
Non-TTIP	-0.04	-0.09
World	0.30	0.44

Note: Following the recommendations of Simonovska & Waugh (2014), we assume $\theta = 4$.

Closing remarks

- Surprising and useful insight: FTA effects tend to be very country-specific. Provides a simple way of making sharper *ex ante* predictions.
- Potential for better predictions is nice... but we still need to beef up the "Economics"
- We would like to move more towards incorporating theories of trade integration in our second stage.
  - e.g., "terms of trade" / "market power" motivations for trade concessions (Bagwell & Staiger), "domestic commitments" (Maggi & Rodriguez-Clare)
  - We are also open to suggestions!

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Competitive Equilibrium

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Take our "gravity" equation for trade flows, (1), in "trade share" form.

$$X_{ij} = \pi_{ij} \cdot (Y_j + D_j) .$$

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$$X_{ij} = \pi_{ij} \cdot (Y_j + D_j) .$$

To get the *initial competitive equilibrium*, sum X_{ij} over all destinations j to get $Y_i = \sum_j X_{ij}$:

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Competitive Equilibrium

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The *equilibrium in changes* is

$$Y_i \widehat{w}_i = \sum_j \widehat{\pi}_{ij} \cdot (Y_j \widehat{w}_j + D_j) ,$$

or

$$Y_i \widehat{w}_i = \sum_j \frac{\pi_{ij} \cdot \widehat{w}_i^{-\theta} \cdot \widehat{\tau}_{ij}^{-\theta}}{\widehat{P}_j^{-\theta}} \cdot (Y_j \widehat{w}_j + D_j) .$$

back

Panel implementation

Panel implementation

Panel implementation

Panel implementation

Panel implementation

Our baseline for estimating the *average* partial effect of FTAs (β) is

$$X_{ij,t} = \exp\left(\eta_{i,t} + \psi_{j,t} + \gamma_{ij} + \beta FTA_{ij,t}\right) + \varepsilon_{ij,t}. \tag{15}$$

$\eta_{i,t}$ and $\psi_{j,t}$: *time-varying* exporter and importer fixed effects

- Absorb $\ln A_{i,t} w_{i,t}^{-\theta}$, $\ln E_{j,t}/P_{j,t}^{-\theta}$, all other endogenous country-specific factors
- (e.g., including exchange rate changes)

γ_{ij} : *time-invariant* pair fixed effect: absorbs all time-invariant bilateral factors (distance, etc.)

Interpretation of β: identified by changes in *relative* trade flows over time. Not simply an "average treatment effect", rather an "average partial effect". Additional GE effects contained in $\eta_{i,t}$ and $\psi_{j,t}$.

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Our baseline for estimating the *average* partial effect of FTAs (β) is

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Finally: Following the econometric arguments of Santos Silva & Tenreyro (2006, 2011), we estimate (**??**) using PPML.

PPML also ensures a tighter connection between empirics and theory (see: Fally, 2014)