

Export Diversification Effects of the WTO Trade Facilitation Agreement

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Structure of the talk

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Motivation and objective I

- The Agreement on Trade Facilitation (TF) is the main result of the WTO's 'Bali Package' agreed upon in December 2013
- The economic literature consistently reports trade-boosting effect and welfare gains from TF
 - TF matters for intensive margin of trade (Moisé et al., 2011)
 - Since it reduces fixed costs, TF matters for extensive margin of trade (Dennis and Shepherd, 2011)
 - Greater product variety leads to higher productivity in exporting sectors and hence overall productivity (Feenstra and Ma, 2014)

Motivation and objective II

- Our novel contribution is threefold:
 - ① We estimate the extensive margin effects using TF indicators that closely **match** the WTO's TF Agreement
 - ② We add to the existing literature by considering an exporter-product, not only a bilateral dimension of trade margins
 - ③ We quantify the potential effects under two implementation scenarios
- We focus on trade facilitation in the exporting country
 - The empirical question of interest concerns the effects of a country's own trade facilitation for given levels of trade facilitation in destination markets

Literature

- Trade facilitation has a significant potential to reduce trade costs
 - Chen and Novy (2009) estimate that technical barriers to trade explain 4.5% of the variation in trade costs across 11 EU member countries
 - Moïsé et al. (2011) estimate a cost reduction potential of around 10% of overall trade costs
- Trade facilitation has an impact on extensive margins
 - Dennis and Shepherd (2011) find that poor trade facilitation has a negative impact on developing country export diversification
 - Persson (2013) finds that trade facilitation has a higher extensive margin impact on differentiated products
 - Feenstra and Ma (2014) show a positive and significant effect of port efficiency on export variety

Data and methodology

Data

- Trade Facilitation Indicators (TFIs) by the OECD for 133 countries, year 2009 (no time variation)
- Comtrade HS6 trade data

Trade margins

- n_{pd} - number of products by destination (ij)
 - How many products (6 digit HS codes) a country i exports to destination j
- n_{dp} - number of destinations by product (ik)
 - How many destinations j a country i exports to, by 6 digit HS code k
- Other measures: Hummels-Klenow extensive margins

Regression equations

- *ij* regressions: standard gravity framework

$$E [npd_{ij} | \mathbf{x}_{1i}, \mathbf{r}_i, \mathbf{g}_{ij}, \mathbf{m}_{ij}, \mathbf{d}_j] = g (\mathbf{x}'_{1i}\beta + \mathbf{r}'_i\theta + \mathbf{g}'_{ij}\delta + \mathbf{m}'_{ij}\eta + \mathbf{d}'_j\gamma) \quad (1)$$

- *ik* regressions: country-sector level regressions

$$E [ndp_{ik} | \mathbf{x}_{2i}, \mathbf{r}_i, \mathbf{h}_k] = g (\mathbf{x}'_{2i}\alpha + \mathbf{r}'_i\phi + \mathbf{h}'_k\lambda) \quad (2)$$

Regression variables

Poisson/Negative Binomial estimation in all cases (since the dependent variable is a count)

- $g(\cdot)$ is the exponential function

Estimation and identification strategy

Addressing omitted variables

- In ij regressions, we include importer fixed effects
- In ik regressions, we include HS6 fixed effects
- In all regressions, we control for exporter characteristics and we include region dummies

Addressing reverse causality

- We compute npd_{ij} and ndp_{ik} using, respectively,
new products and new destinations

Descriptives - npd_{ij} by geographical group

World Bank region	mean	sd	min	max	N	% zeros
Sub-Saharan Africa	61	252.76	0	4525	2962	15%
East Asia and Pacific	612	855.07	0	4224	1564	5%
Europe and Central Asia	257	515.40	0	3788	2813	13%
Latin America and Caribbean	147	363.69	0	3429	2690	9%
Middle East and North Africa	92	164.79	0	1534	1152	7%
South Asia	407	657.61	0	3740	541	6%
Offshore	22	84.03	0	780	93	5%
Industrial	1044	1114.53	0	4831	2467	1%
Total	361	725.95	0	4831	14282	9%

Descriptive statistics computed from estimation sample

Descriptives - ndp_{ik} by geographical group

World Bank region	mean	sd	min	max	N	% zeros
Sub-Saharan Africa	1	4.87	0	128	167008	68%
East Asia and Pacific	16	29.46	0	169	73066	36%
Europe and Central Asia	7	13.49	0	135	125256	39%
Latin America and Caribbean	4	9.12	0	137	125256	50%
Middle East and North Africa	4	9.28	0	122	57409	49%
South Asia	9	20.40	0	166	31314	51%
Offshore	0	1.42	0	63	5219	76%
Industrial	30	34.41	0	167	104380	12%
Total	9	21.16	0	169	688908	45%

Descriptive statistics computed from estimation sample

Descriptives - TFI's by geographical group

World Bank region	mean	median	sd	min	max	N
Sub-Saharan Africa	1.04	1.02	0.36	0.22	1.93	32
East Asia & Pacific	1.36	1.35	0.31	0.81	1.90	15
Europe & Central Asia	1.39	1.43	0.29	0.77	1.91	24
Latin America & Caribbean	1.20	1.28	0.33	0.45	1.65	24
Middle East & North Africa	1.21	1.15	0.28	0.83	1.65	11
South Asia	1.23	1.29	0.17	1.01	1.38	6
Offshore	1.20	1.20		1.20	1.20	1
Industrial	1.50	1.54	0.19	1.13	1.86	20
Total	1.26	1.30	0.33	0.22	1.93	133

Descriptive statistics computed from OECD Trade facilitation Indicators

Regression results - *ij*Dependent variable: $\log(npd_{ij})$ (OLS regression); npd_{ij} (Poisson regressions)

	OLS	Poisson			
	Baseline (1)	Baseline (2)	New HS6 (3)	PCA for TFI (4)	PCA for TFI & new HS6 (5)
Log(TFI)	0.290*** [0.038]	0.549*** [0.057]	0.346*** [0.078]	0.608*** [0.064]	0.319*** [0.081]
Log(pc GDP)	0.113*** [0.018]	0.097*** [0.025]	0.088*** [0.030]	0.093*** [0.025]	0.090*** [0.030]
Log(market access)	0.433*** [0.013]	0.401*** [0.018]	0.304*** [0.021]	0.394*** [0.018]	0.304*** [0.021]
Number of PTAs	-0.002*** [0.001]	0.002*** [0.001]	0.001* [0.001]	0.002** [0.001]	0.001 [0.001]
Log(area)	-0.058*** [0.007]	-0.048*** [0.009]	-0.021** [0.009]	-0.047*** [0.009]	-0.020** [0.009]
Landlocked	-0.248*** [0.024]	0.011 [0.028]	-0.156*** [0.027]	0.015 [0.028]	-0.155*** [0.027]
Log(weighted j 's TFI)	4.718*** [0.291]	1.657*** [0.432]	1.082*** [0.339]	1.796*** [0.431]	1.096*** [0.343]
PTA	0.115*** [0.041]	0.054 [0.039]	0.004 [0.033]	0.051 [0.039]	0.005 [0.033]
Log(distance)	-0.931*** [0.036]	-0.598*** [0.041]	-0.431*** [0.035]	-0.600*** [0.041]	-0.432*** [0.035]
Common border	0.482*** [0.116]	-0.036 [0.086]	-0.110 [0.103]	-0.033 [0.085]	-0.109 [0.103]
Common language	0.757*** [0.051]	0.391*** [0.055]	0.422*** [0.046]	0.383*** [0.055]	0.420*** [0.046]
Colony	0.777*** [0.135]	0.582*** [0.106]	0.371*** [0.108]	0.589*** [0.106]	0.374*** [0.108]
Observations	16,928	21,257	21,388	21,257	21,388
Number of id (j 's)	162	162	163	162	163

Robust (clustered on partner j) standard errors in parentheses* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Partner j fixed effects, region dummies and MR controls always included

Regression results - *ik*

Dependent variable: $\log(npd_{ij})$ (OLS regression); npd_{ij} (Poisson regressions)

	OLS	Poisson			
	Baseline (1)	Baseline (2)	New dest. (3)	PCA for TFI (4)	PCA for TFI & new dest. (5)
Log(TFI)	0.345* [0.200]	0.372*** [0.007]	0.439*** [0.005]	0.484*** [0.007]	0.438*** [0.005]
Log(pc GDP)	0.536*** [0.071]	0.662*** [0.005]	0.475*** [0.004]	0.646*** [0.005]	0.472*** [0.004]
Log(market access)	0.370*** [0.077]	0.491*** [0.003]	0.338*** [0.003]	0.478*** [0.003]	0.336*** [0.003]
Number of PTAs	0.001 [0.002]	0.004*** [0.000]	0.003*** [0.000]	0.004*** [0.000]	0.003*** [0.000]
Log(area)	0.313*** [0.025]	0.380*** [0.002]	0.232*** [0.002]	0.379*** [0.002]	0.232*** [0.002]
Landlocked	-0.238** [0.116]	-0.331*** [0.004]	-0.369*** [0.003]	-0.329*** [0.004]	-0.370*** [0.003]
Log(remote)	-1.185*** [0.136]	-1.237*** [0.009]	-0.591*** [0.006]	-1.245*** [0.009]	-0.595*** [0.006]
Observations	376,095	688,908	689,172	688,908	689,172
Number of id (HS6)	5,216	5,219	5,221	5,219	5,221

Two-way clustered (*ik*) standard errors in parentheses in column (1)

Robust (clustered on HS6 products) standard errors in parentheses in columns (2)-(5)

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

Product (HS6) fixed effects and region dummies always included

Negative Binomial (NB) regressions used for simulations

	<i>ij</i> regressions		<i>ik</i> regressions	
	Baseline	New HS6	Baseline	New dest.
	(1)	(2)	(3)	(4)
Log(TFI)	0.305*** [0.024]	0.230*** [0.028]	0.383*** [0.006]	0.410*** [0.005]
Log(pc GDP)	0.218*** [0.017]	0.102*** [0.019]	0.576*** [0.003]	0.493*** [0.002]
Log(market access)	0.320*** [0.010]	0.237*** [0.009]	0.522*** [0.003]	0.374*** [0.003]
Number of PTAs	0.003*** [0.000]	0.002*** [0.000]	0.002*** [0.000]	0.003*** [0.000]
Log(area)	0.040*** [0.008]	0.015** [0.007]	0.349*** [0.001]	0.246*** [0.001]
Landlocked	-0.078*** [0.023]	-0.200*** [0.012]	-0.394*** [0.004]	-0.383*** [0.003]
Log(weighted <i>j</i> 's TFI)	0.718*** [0.231]	0.708*** [0.186]		
PTA	0.050 [0.030]	-0.002 [0.029]		
Log(distance)	-0.477*** [0.030]	-0.293*** [0.028]		
Common border	-0.184*** [0.066]	-0.526*** [0.133]		
Common language	0.365*** [0.040]	0.306*** [0.040]		
Colony	0.337*** [0.102]	0.259** [0.126]		
Log(remoteness)			-1.326*** [0.008]	-0.684*** [0.006]
Observations	21,257	21,388	688,908	689,172
Number of id_partner / products	162	163	5,219	5,221

Bootstrap standard errors (100 replications) in parentheses

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

Dependent variable: $\log(npd_{ij})$ (*ij* regressions); $\log(npd_{ik})$ (*ik* regressions)

Partner *j* fixed effects, region dummies and MR controls always included (*ij* regressions)

Product (HS6) fixed effects and region dummies always included (*ik* regressions)

Additional estimations

- Hummels-Klenow trade margins (GLM regressions)
- *ij* regressions: income group sub-samples
- Testing for heterogeneous effects: interaction terms with:
 - PTA dummies
 - Language dummies
 - Intermediate inputs dummies
 - Differentiated products dummies

Hummels-Klenow extensive margins

Dependent variable: em_{ij} (ij regressions); em_{ik} (ik regressions)

	<i>ij</i> regressions		<i>ik</i> regressions	
	Baseline (1)	New HS6 (2)	Baseline (3)	New dest. (4)
Log(TFI)	0.457*** [0.054]	0.118 [0.091]	0.339*** [0.015]	-0.180*** red[0.017]
Log(pc GDP)	0.249*** [0.023]	0.134*** [0.041]	0.599*** [0.008]	0.586*** [0.006]
Log(market access)	0.285*** [0.019]	0.155*** [0.030]	0.504*** [0.006]	0.387*** [0.006]
Number of PTAs	-0.001* [0.000]	-0.001 [0.001]	0.004*** [0.000]	0.003*** [0.000]
Log(area)	-0.018** [0.008]	-0.009 [0.012]	0.428*** [0.002]	0.283*** [0.002]
Landlocked	-0.087*** [0.028]	-0.200*** [0.045]	-0.172*** [0.008]	-0.202*** [0.008]
Log(weighted j 's TFI)	0.592 [0.386]	0.219 [0.658]		
Log(remote)			-1.608*** [0.012]	-0.932*** [0.011]
Observations	16,881	18,478	370,035	407,097
Log pseudolikelihood	-3994.8	-2127.7	-118261.8	-94469.8

Generalized Linear Model (GLM) regressions in all columns

Robust (clustered on partner j) standard errors in parentheses in columns (1)-(2)

Robust (clustered on HS6 products) standard errors in parentheses in columns (3)-(4)

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

Partner j dummies, region dummies, pair and MR controls included in columns (1)-(2)

Product (HS6) and region dummies included in columns (3)-(4)

ij regressions: income group sub-samples

Dependent variable: npd_{ij}				
	Poisson baseline (1)	Poisson new HS6 (2)	NB baseline (3)	NB new HS6 (4)
<i>DD subsample: i = developed, j = developed</i>				
Log(TFI)	0.529*** [0.051]	0.589*** [0.067]	0.414*** [0.035]	0.414*** [0.043]
Observations	5,359	5,425	5,359	5,425
Number of id (<i>j</i> 's)	81	82	81	82
<i>DG subsample: i = developed, j = developing</i>				
Log(TFI)	0.514*** [0.192]	0.122 [0.253]	0.480*** [0.055]	0.299*** [0.047]
Observations	5,427	5,427	5,427	5,427
Number of id (<i>j</i> 's)	81	81	81	81
<i>GD subsample: i = developing, j = developed</i>				
Log(TFI)	0.208** [0.096]	0.177*** [0.059]	0.363*** [0.054]	0.200*** [0.035]
Observations	5,265	5,330	5,265	5,330
Number of id (<i>j</i> 's)	81	82	81	82
<i>GG subsample: i = developing, j = developing</i>				
Log(TFI)	0.640*** [0.215]	0.279* [0.144]	0.185* [0.097]	0.057 [0.063]
Observations	5,206	5,206	5,206	5,206
Number of id (<i>j</i> 's)	81	81	81	81

Robust (clustered on partner *j*) standard errors in parentheses in columns (1)-(2)

Bootstrap standard errors (100 replications) in parentheses in columns (3)-(4)

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

Partner *j* fixed effects, region dummies, exporter and MR controls always included

The elusive quest for heterogeneous effects

- There is no heterogeneity of impact between country pairs w/ and w/out PTA in ij regressions
 - Indirect evidence that the TF provisions captured by the OECD TFIs (and disciplined by the WTO TFA) are non-discriminatory
- Same story for common border and common language dummies
 - Only weak evidence that TF matters more for trading partners w/ different languages
- Same story for final vs. intermediate products in ik regressions
 - Interaction term between $\log(TFI_i)$ and intermediate dummy is never significant

Simulation results, ij regressions

% increase in npi_{ij} , geographical group average

	Regional median		Global median	
	Baseline (1)	New HS6 (2)	Baseline (3)	New HS6 (4)
Sub-Saharan Africa	16.9%	12.8%	20.8%	15.7%
East Asia and Pacific	7.5%	5.7%	7.3%	5.5%
Europe and Central Asia	8.2%	6.2%	6.7%	5.1%
Latin America and Caribbean	15.5%	11.7%	16.2%	12.2%
Middle East and North Africa	6.1%	4.6%	8.7%	6.6%
South Asia	6.0%	4.5%	6.4%	4.8%

Simulation results, ik regressions

% increase in ndp_{ik} , geographical group average

	Regional median		Global median	
	Baseline (1)	New dest. (2)	Baseline (3)	New dest. (4)
Sub-Saharan Africa	20.7%	22.1%	26.1%	27.9%
East Asia and Pacific	9.5%	10.1%	9.1%	9.8%
Europe and Central Asia	10.3%	11.0%	8.4%	9.0%
Latin America and Caribbean	19.5%	20.9%	20.3%	21.7%
Middle East and North Africa	7.7%	8.2%	10.9%	11.7%
South Asia	7.6%	8.1%	8.1%	8.6%

Conclusions

- We contribute to the literature on the extensive margins effects of TF
- We measure TF using OECD's indicators that closely match the provisions of the WTO's TF Agreement
- We include various measures of extensive margins, including em_{ik} (not previously used in the literature)
- We simulate the impact of TF on the numbers of products exported and the number of export destinations served under two realistic scenarios
- Countries with poor TF infrastructure in Sub-Saharan Africa (SSA) and in Latin America and the Caribbean (LAC) stand to gain most
 - SSA: 12.8-15.7% increase in npd_{ij} and 22.1-27.9% increase in ndp_{ik}
 - LAC: 11.7-12.2% increase in npd_{ij} and 20.9-21.7% increase in ndp_{ik}

- Baier, S. L., and J. H. Bergstrand, 2009, "Bonus vetus OLS: A simple method for approximating international trade-cost effects using the gravity equation," *Journal of International Economics*, 77, 77–85.
- Chen, N., and D. Novy, 2009, "International Trade Integration: A Disaggregated Approach," CEP Discussion Paper No. 0908, Centre for Economic Performance, LSE.
- Dennis, A., and B. Shepherd, 2011, "Trade Facilitation and Export Diversification," *The World Economy*, 34, 101–122.
- Feenstra, R. C., and H. Ma, 2014, "Trade Facilitation and the Extensive Margin of Exports," *Japanese Economic Review*, 65, 158–177.
- Head, K., and T. Mayer, 2013, "Gravity equations: Workhorse, toolkit, and cookbook," in E. Helpman, K. Rogoff, and G. Gopinath (ed.), *Handbook of International Economics*, 4: 131–195, Elsevier, Oxford and Amsterdam.
- Head, K., T. Mayer, and J. Ries, 2010, "The erosion of colonial trade linkages after independence," *Journal of International Economics*, 81, 1–14.

Hummels, D., and P. J. Klenow, 2005, "The Variety and Quality of a Nation's Exports," *American Economic Review*, 95, 704–723.

Kee, H. L., A. Nicita, and M. Olarreaga, 2009, "Estimating Trade Restrictiveness Indices," *Economic Journal*, 119, 172–199.

Moïsé, E., T. Orliac, and P. Minor, 2011, "Trade Facilitation Indicators: The Impact on Trade Costs," OECD Trade Policy Paper No. 118.

Persson, M., 2013, "Trade facilitation and the extensive margin," *The Journal of International Trade & Economic Development*, 22, 658–693.

Mapping of OECD TFIs into DCNT and TFA provisions

Indicator	DCNT Rev. 18	TFA
A. Information availability	Articles 1 and 2	Articles 1 and 2
B. Involvement of the trade community	Article 2	Article 2
C. Advance Rulings	Article 3	Article 3
D. Appeal Procedures	Article 4	Article 4
E. Fees and charges	Article 6.1 and 6.2	Article 6.1 and 6.2
F. Formalities Documents	Articles 7 and 10	Articles 7 and 10
G. Formalities Automation	Articles 7 and 10	Articles 7 and 10
H. Formalities Procedures	Articles 5, 7 and 10	Articles 5, 7 and 10
I. Cooperation Internal	Articles 9.1 and 12	Articles 8.1 and 12
J. Cooperation External	Articles 9.2 and 12	Articles 8.2 and 12
K. Consularization	Article 8	
L. Governance and Impartiality		

TFI's stand for "Trade Facilitation Indicators"

DCNT stands for (WTO's) "Draft Consolidated Negotiating Text"

TFA stands for (WTO's) "Trade Facilitation Agreement"

Source: Moïsé et al. (2011)

Hummels-Klenow extensive margins

$$EM_{ij} = \frac{\sum_{k \in K_{ij}} x_{wjk}}{\sum_{k \in K} x_{wjk}}$$

- Share of exports to j only in products k that country i exports in total exports of all products to country j
- Previously used in the literature (e.g. Feenstra and Ma, 2013)

$$EM_{ik} = \frac{\sum_{j \in J_{ik}} x_{wjk}}{\sum_{j \in J} x_{wjk}}$$

- Share of exports of k only to destinations j that country i exports to in total exports of product k to all destinations
- Not previously used in the literature (to the best of our knowledge)

New products and new destinations

- npd_{ij} in 2009 computed only in the subset of products for which:
 - 1 There were no exports from i to j (zero or missing) recorded in any of the years between 2002 and 2007
 - 2 There were positive exports from i to j recorded in at least one year between 2008 and 2010
- ndp_{ik} in 2009 computed only in the subset of destinations for which:
 - 1 There were no exports of product k (zero or missing) recorded in any of the years between 2002 and 2007
 - 2 There were positive exports of product k recorded in at least one year between 2008 and 2010
- npd_{ij} and ndp_{ik} calculated this way are less likely to be endogenous to trade facilitation than the indicators calculated using the set of products traded (destinations served) in 2009

[Back to estimation and identification strategy](#)

Variable	Description	Data source
<i>Dependent variables of ij regressions</i>		
npd_{ij}	Number of products by destination	UN Comtrade
em_{ij}	Hummels and Klenow (2005) bilateral extensive margin	UN Comtrade
<i>Dependent variables of ik regressions</i>		
npd_{ik}	Number of destinations by product	UN Comtrade
em_{ij}	Product extensive margin	UN Comtrade
<i>Exporter controls (matrices \mathbf{x}_1, and \mathbf{x}_2)</i>		
TFI	Average Trade Facilitation Index	OECD TFI dataset
Log(pcGDP)	Log of GDP per capita (current US\$)	World Development Indicators (WDIs)
Log(market access)	Log of Market Access Trade Restrictiveness Index	Kee et al. (2009)
Number of PTAs	Number of Preferential Trade Agreements signed	WTO PTAs dataset
Log(area)	Log of area (sq. kms)	CEPII gravity dataset (Head et al., 2010)
Landlocked	Dummy equal one if i is landlocked	CEPII gravity dataset (Head et al., 2010)
Log(weighted j 's TFI) ^a	Inverse distance-weighted average of partners' TFI	OECD TFI and CEPII gravity datasets
Log(remoteness) ^b	Log of remoteness (Head and Mayer, 2013 definition)	CEPII gravity dataset (Head et al., 2010)
<i>Pair controls (matrix \mathbf{w})</i>		
PTA	Dummy equal one if i and j have a Preferential Trade Agreement	WTO PTAs dataset
Log(distance)	Weighted distance between o and d (pop-wt, km)	CEPII gravity dataset (Head et al., 2010)
Common border	Dummy equal one if o and d share a common border	— " —
Common language	Dummy equal one if o and d share an official or primary language	— " —
Colony	Dummy equal one if o and d were in a colonial relation post 1945	— " —
<i>Multilateral resistance (MR) controls (matrix \mathbf{r})</i>		
MR PTA	Baier and Bergstrand (2009) MR term based on PTA dummy	WTO PTAs dataset
MR Log(distance)	Baier and Bergstrand (2009) MR term based on Log(distance)	CEPII gravity dataset (Head et al., 2010)
MR Common border	Baier and Bergstrand (2009) MR term based on Common border dummy	— " —
MR Common language	Baier and Bergstrand (2009) MR term based on Common language dummy	— " —
MR Colony	Baier and Bergstrand (2009) MR term based on Colony dummy	— " —

^a Only in ij regressions

^b Only in ik regressions