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Unlocking the Trade Facilitation Agreement: Implementation Challenges, GVC Integration, and Implications for Future WTO Negotiations

Sandro Steinbach and Carlos Zurita

Selected presentation for the International Agricultural Trade Research Consortium's (IATRC's) 2023 Annual Meeting: The Future of (Ag-) Trade and Trade Governance in Times of Economic Sanctions and Declining Multilateralism, December 10-12, 2023, Clearwater Beach, FL.

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North Dakota State University
Center for Agricultural Policy and Trade Studies

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- Results also suggest that out of the 12 Articles in Section I of the TFA, only **three articles enhance agri-food GVC flows**.
- We estimate that achieving **full TFA implementation may take at least another 11 years**, roughly equivalent to the duration of its negotiation.

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- The TFA introduces an **“à la carte” approach**, allowing developing countries to make commitments based on their capabilities.

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- Developing countries **categorize provisions as A, B, or C**. In the last two categories, they may request time or assistance for implementation.
- Countries provide **implementation dates for provisions but may request extensions**, introducing uncertainties to the implementation timelines.

Research Questions

Considering the **heterogeneity across TFA measures** and the **special and differential treatment (S&D)** provisions aimed at providing flexibility for developing countries, we propose three research questions.

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- 2 Does the relationship between the level of *notified* TFA implementation and GVC flows differ across articles?
- 3 If the TFA has positive effects on GVC flows, when could its full implementation be crystallized?

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- Large body of literature using the **OECD's Trade Facilitation Indicators (TFI)** and the **UN Global Survey on TF**.

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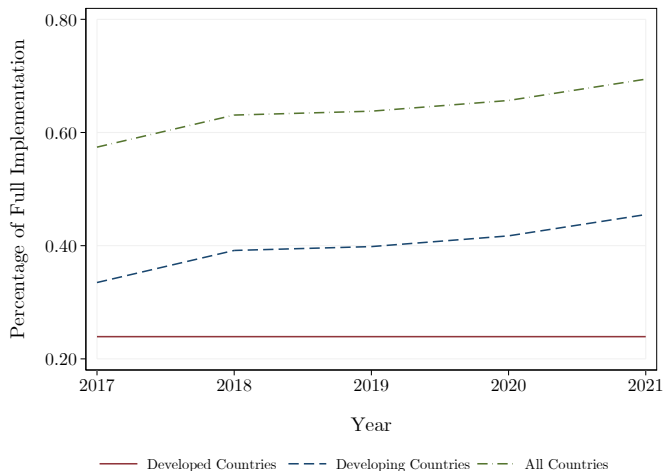
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- To analyze implementation rates, we use **country characteristics**, such as income, obtained from USITC's Dynamic Gravity Dataset (DGD).

Evolution of Notified TFA Implementation



Note. The figure shows the evolution of the notified TFA implementation. We have a total of 163 countries, 40 of which are developed and have full implementation.

Data - GVC Flows

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- We aggregate into 3 sectors: **agriculture, food & beverages** and **all sectors**.
- We have bilateral GVC flows **covering 189 countries and three sectors, from 2000 to 2021**.

◀ Descriptive statistics & Details

TFA implementation rate

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- The **gap to full implementation** ($M_{Max} - M_t$) as a proportion of M_t evolves according to

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TFA implementation rate

- We specify the following **OLS regression**:

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i refers to country member, and $t \geq 0$ is the year of observation (2017 to 2021).

- X_i is a vector of **country characteristics** such as the log of per capita GDP (GDP_{pc}), per capita aid received to support trade facilitation ($AFT_{pc,i}$), or one of the GVC flows (FVA_i, DVX_i, GIE_i).
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- We also estimate (2) using **PPML and fixed effects (FE) Panel Regression**.

TFA implementation rate - Summary of Results

- The estimate of the implementation rate, \hat{r} , is between **-0.181 and -0.385**.
- At the average of 165 measures notified as implemented in 2021, these rates translate to **9 to 18 additional measures notified as implemented in 2022**.

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- At the average of 165 measures notified as implemented in 2021, these rates translate to **9 to 18 additional measures notified as implemented in 2022**.
- We find evidence suggesting that these rates **do not change with country characteristics or GVC flows**.
- For example, **countries with higher incomes are not implementing measures faster**.

◀ Result Details

Gravity Framework

- Following Anderson and Wincoop (2003), we depict trade flows from exporter i to importer j in year t like:

$$X_{ijt} = \frac{Y_{it}E_{jt}}{Y_t} \left(\frac{\varphi_{ijt}}{\Pi_{it}P_{jt}} \right)^{1-\sigma} \quad (3)$$

where X_{ijt} is a **bilateral trade flow (GIE, FVA, or DVX)**.

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- Π_{it} and P_{jt} are the multilateral resistance terms, and $\sigma > 1$ is the elasticity of substitution.

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We define **bilateral trade costs** by

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- $Imp. Art. r_{ijt}$: the share of **provisions in Article r** commonly notified as implemented by i and j at time t .
- t_{TFA} : is the **number of years since i and j had common TFA measures notified as implemented**. We also interact t_{TFA} with $Imp. TFA_{ijt}$.

Gravity Framework

Following Santos Silva and Tenreyro (2006), we use **Poisson pseudo-maximum likelihood (PPML)** to estimate

$$X_{ijt} = \exp(\alpha_0 + \alpha_1 WTO_{ijt} + \alpha_2 \mathbf{TFA}_{ijt} + \zeta_{it} + \eta_{jt} + \theta_{ij}) + \varepsilon_{ijt}. \quad (5)$$

- α_0 , is an intercept term.
- $\alpha_2 = (1 - \sigma)\beta_2$ is **the trade elasticity with respect to \mathbf{TFA}_{ijt}** .
- $\zeta_{it} = -(1 - \sigma) \ln(\Pi_{it}) + \ln(Y_{it})$ and $\eta_{jt} = -(1 - \sigma) \ln(P_{it}) + \ln(E_{jt})$ are exporter-time and importer-time fixed effects, respectively.
- $\theta_{ij} = (1 - \sigma)\lambda_{ij}$ is a country-pair fixed effect that controls for several time-invariant unobservables.
- ε_{ijt} is a mean-zero error term.

Table 1: PPML Gravity Regressions: 2000 - 2021.

	Agriculture			Food			All		
	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>
Panel A: Share of common implementation in levels									
<i>WTO</i>	0.242*** (0.059)	0.270*** (0.036)	0.406*** (0.043)	0.249*** (0.061)	0.321*** (0.034)	0.316*** (0.038)	0.340*** (0.051)	0.192*** (0.040)	0.195*** (0.040)
Imp. TFA	-1.202*** (0.11)	-0.900*** (0.064)	-0.722*** (0.067)	-0.648*** (0.123)	-1.054*** (0.070)	-1.648*** (0.072)	-0.995*** (0.12)	-0.838*** (0.064)	-0.854*** (0.065)
Observations	785,862	785,485	784,542	785,862	784,354	784,354	785,862	784,354	784,354
Pseudo- R^2	0.9996	0.9992	0.9992	0.9993	0.9993	0.9990	0.9995	0.9992	0.9992
Panel B: Share of common implementation by using quartile indicators									
<i>WTO</i>	0.244*** (0.060)	0.262*** (0.035)	0.411*** (0.043)	0.247*** (0.060)	0.324*** (0.034)	0.322*** (0.038)	0.307*** (0.049)	0.175*** (0.040)	0.178*** (0.040)
$0 < \text{Imp. TFA} < 0.25$	-0.104 (0.150)	0.029 (0.072)	-0.192* (0.099)	-0.184 (0.181)	-0.232* (0.134)	-0.0711 (0.085)	0.661*** (0.186)	0.252*** (0.066)	0.246*** (0.065)
$0.25 \leq \text{Imp. TFA} < 0.50$	-0.300* (0.157)	-0.051 (0.083)	-0.169* (0.097)	-0.155 (0.199)	-0.240* (0.134)	-0.178* (0.092)	0.513** (0.202)	0.247*** (0.086)	0.246*** (0.089)
$0.50 \leq \text{Imp. TFA} < 0.75$	-0.599*** (0.159)	-0.299*** (0.078)	-0.094 (0.105)	-0.483*** (0.168)	-0.504*** (0.128)	-0.674*** (0.072)	0.122 (0.190)	0.083 (0.067)	0.072 (0.066)
$0.75 \leq \text{Imp. TFA} \leq 1$	-0.974*** (0.162)	-0.651*** (0.072)	-0.607*** (0.083)	-0.647*** (0.170)	-0.919*** (0.127)	-1.250*** (0.062)	-0.407** (0.189)	-0.422*** (0.057)	-0.434*** (0.055)
Observations	785,862	785,485	784,542	785,862	784,354	784,354	785,862	784,354	784,354
Pseudo- R^2	0.9995	0.9992	0.9992	0.9993	0.9993	0.9990	0.9994	0.9992	0.9992

Note: *WTO* is an indicator that both i and j are WTO members at time t . Imp. TFA represents the share of all TFA measures simultaneously implemented by i and j at time t . $a \leq \text{Imp. TFA} < b$ represents indicator that Imp. TFA is between a and b . All estimates are obtained in panel settings with the PPML estimator, exporter-time and importer-time fixed effects, international border variables, as well as country-pair fixed effects. For presentation purposes, we omit the estimates of all fixed effects and the constant. Standard errors clustered at the importer-exporter level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1: PPML Gravity Regressions: 2000 - 2021.

	Agriculture			Food			All		
	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>
Panel A: Share of common implementation in levels									
<i>WTO</i>	0.242*** (0.059)	0.270*** (0.036)	0.406*** (0.043)	0.249*** (0.061)	0.321*** (0.034)	0.316*** (0.038)	0.340*** (0.051)	0.192*** (0.040)	0.195*** (0.040)
Imp. TFA	-1.202*** (0.11)	-0.900*** (0.064)	-0.722*** (0.067)	-0.648*** (0.123)	-1.054*** (0.070)	-1.648*** (0.072)	-0.995*** (0.12)	-0.838*** (0.064)	-0.854*** (0.065)
Observations	785,862	785,485	784,542	785,862	784,354	784,354	785,862	784,354	784,354
Pseudo- R^2	0.9996	0.9992	0.9992	0.9993	0.9993	0.9990	0.9995	0.9992	0.9992
Panel B: Share of common implementation by using quartile indicators									
<i>WTO</i>	0.244*** (0.060)	0.262*** (0.035)	0.411*** (0.043)	0.247*** (0.060)	0.324*** (0.034)	0.322*** (0.038)	0.307*** (0.049)	0.175*** (0.040)	0.178*** (0.040)
$0 < \text{Imp. TFA} < 0.25$	-0.104 (0.150)	0.029 (0.072)	-0.192* (0.099)	-0.184 (0.181)	-0.232* (0.134)	-0.0711 (0.085)	0.661*** (0.186)	0.252*** (0.066)	0.246*** (0.065)
$0.25 \leq \text{Imp. TFA} < 0.50$	-0.300* (0.157)	-0.051 (0.083)	-0.169* (0.097)	-0.155 (0.199)	-0.240* (0.134)	-0.178* (0.092)	0.513** (0.202)	0.247*** (0.086)	0.246*** (0.089)
$0.50 \leq \text{Imp. TFA} < 0.75$	-0.599*** (0.159)	-0.299*** (0.078)	-0.094 (0.105)	-0.483*** (0.168)	-0.504*** (0.128)	-0.674*** (0.072)	0.122 (0.190)	0.083 (0.067)	0.072 (0.066)
$0.75 \leq \text{Imp. TFA} \leq 1$	-0.974*** (0.162)	-0.651*** (0.072)	-0.607*** (0.083)	-0.647*** (0.170)	-0.919*** (0.127)	-1.250*** (0.062)	-0.407** (0.189)	-0.422*** (0.057)	-0.434*** (0.055)
Observations	785,862	785,485	784,542	785,862	784,354	784,354	785,862	784,354	784,354
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	Agriculture			Food			All		
	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>
Panel A: Share of common implementation in levels									
<i>WTO</i>	0.242*** (0.059)	0.270*** (0.036)	0.406*** (0.043)	0.249*** (0.061)	0.321*** (0.034)	0.316*** (0.038)	0.340*** (0.051)	0.192*** (0.040)	0.195*** (0.040)
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Panel B: Share of common implementation by using quartile indicators									
<i>WTO</i>	0.244*** (0.060)	0.262*** (0.035)	0.411*** (0.043)	0.247*** (0.060)	0.324*** (0.034)	0.322*** (0.038)	0.307*** (0.049)	0.175*** (0.040)	0.178*** (0.040)
0 < Imp. TFA < 0.25	-0.104 (0.150)	0.029 (0.072)	-0.192* (0.099)	-0.184 (0.181)	-0.232* (0.134)	-0.0711 (0.085)	0.661*** (0.186)	0.252*** (0.066)	0.246*** (0.065)
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0.50 ≤ Imp. TFA < 0.75	-0.599*** (0.159)	-0.299*** (0.078)	-0.094 (0.105)	-0.483*** (0.168)	-0.504*** (0.128)	-0.674*** (0.072)	0.122 (0.190)	0.083 (0.067)	0.072 (0.066)
0.75 ≤ Imp. TFA ≤ 1	-0.974*** (0.162)	-0.651*** (0.072)	-0.607*** (0.083)	-0.647*** (0.170)	-0.919*** (0.127)	-1.250*** (0.062)	-0.407** (0.189)	-0.422*** (0.057)	-0.434*** (0.055)
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$0.75 \leq \text{Imp. TFA} \leq 1$	-0.974*** (0.162)	-0.651*** (0.072)	-0.607*** (0.083)	-0.647*** (0.170)	-0.919*** (0.127)	-1.250*** (0.062)	-0.407** (0.189)	-0.422*** (0.057)	-0.434*** (0.055)
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Table 2: PPML Gravity Regressions: 2000 - 2021. Disaggregated by Article.

	Agriculture			Food			All		
	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>
<i>WTO</i>	0.252*** (0.058)	0.278*** (0.034)	0.422*** (0.041)	0.248*** (0.056)	0.335*** (0.033)	0.319*** (0.036)	0.315*** (0.048)	0.183*** (0.039)	0.186*** (0.039)
Imp. Art. 1: Publication of Information	-0.538*** (0.094)	-0.288*** (0.065)	-0.145 (0.096)	-0.970*** (0.127)	-0.274*** (0.082)	-0.273*** (0.076)	-0.365*** (0.092)	-0.270*** (0.082)	-0.264*** (0.081)
Imp. Art. 2: Opp. to Comment and Consultations	-0.031 (0.103)	0.061 (0.071)	0.170* (0.089)	0.344** (0.139)	-0.0168 (0.100)	-0.063 (0.090)	0.140 (0.118)	0.076 (0.090)	0.084 (0.090)
Imp. Art. 3: Advance Rulings	0.018 (0.063)	0.065* (0.038)	-0.079 (0.058)	0.663*** (0.086)	0.074 (0.048)	0.094* (0.050)	0.304*** (0.063)	0.096* (0.051)	0.098* (0.051)
Imp. Art. 4: Appeal or Review Procedures	-0.078 (0.093)	-0.001 (0.052)	-0.278*** (0.084)	0.623*** (0.118)	0.037 (0.076)	0.041 (0.094)	0.286*** (0.089)	0.071 (0.071)	0.080 (0.070)
Imp. Art. 5: Non-Discrim. and Transp. Measures	-0.746*** (0.113)	-0.334*** (0.068)	-0.227*** (0.084)	-0.213* (0.112)	-0.515*** (0.068)	-0.676*** (0.076)	-0.187** (0.091)	-0.139* (0.080)	-0.157** (0.080)
Imp. Art. 6: Disciplines on Fees and Charges	0.733*** (0.133)	0.409*** (0.084)	0.932*** (0.117)	-0.074 (0.132)	0.514*** (0.093)	0.924*** (0.114)	0.571*** (0.129)	0.622*** (0.114)	0.617*** (0.111)
Imp. Art. 7: Release and Clearance of Goods	0.164 (0.152)	0.302*** (0.109)	0.662*** (0.127)	0.286 (0.267)	0.624*** (0.167)	0.356** (0.148)	-0.445** (0.207)	0.0471 (0.193)	0.0422 (0.188)
Imp. Art. 8: Border Agency Cooperation	-0.347*** (0.081)	-0.351*** (0.066)	-0.559*** (0.090)	-0.009 (0.098)	-0.239*** (0.067)	-0.477*** (0.081)	-0.260*** (0.089)	-0.203** (0.084)	-0.219*** (0.085)
Imp. Art. 9: Mov. of Goods under Customs Control	0.080 (0.129)	0.324*** (0.067)	0.329*** (0.111)	0.199 (0.151)	0.276** (0.118)	0.411*** (0.099)	1.100*** (0.163)	0.702*** (0.089)	0.693*** (0.088)
Imp. Art. 10: Import, Export, and Transit Formalities	-0.146 (0.248)	-0.527*** (0.159)	-0.763*** (0.259)	-0.834*** (0.298)	-0.719*** (0.180)	-1.060*** (0.252)	-1.210*** (0.317)	-0.838*** (0.258)	-0.827*** (0.249)
Imp. Art. 11: Freedom of Transit	-0.107 (0.128)	-0.392*** (0.079)	-0.755*** (0.114)	-0.505*** (0.165)	-0.663*** (0.094)	-0.441*** (0.106)	-0.481*** (0.128)	-0.730*** (0.098)	-0.715*** (0.097)
Imp. Art. 12: Customs Cooperation	-0.074 (0.082)	-0.043 (0.054)	0.0970 (0.086)	-0.137 (0.102)	-0.0789 (0.064)	-0.172** (0.071)	-0.0259 (0.087)	0.0177 (0.078)	0.0104 (0.076)
Observations	785,862	785,485	784,542	785,862	784,354	784,354	785,862	784,354	784,354
Pseudo- R^2	0.9996	0.9993	0.9992	0.9994	0.9993	0.9990	0.9995	0.9993	0.9992

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Imp. Art. 2: Opp. to Comment and Consultations	-0.031 (0.103)	0.061 (0.071)	0.170* (0.089)	0.344** (0.139)	-0.0168 (0.100)	-0.063 (0.090)	0.140 (0.118)	0.076 (0.090)	0.084 (0.090)
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- τ_{ijt} represents the number of years at time t **before or after the event.**

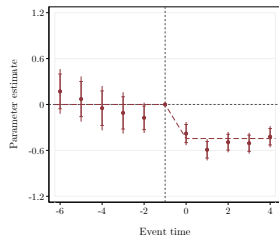
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$$X_{ijt} = \exp \left(\beta_0 + \beta_1 WTO_{ijt} + \sum_{\substack{\ell=-6 \\ \ell \neq -1}}^4 \mathbb{1} \{ \tau_{ijt} = \ell \} \beta_{\tau}^{\ell} + \zeta_{it} + \eta_{jt} + \theta_{ij} \right) + \varepsilon_{ijt}. \quad (6)$$

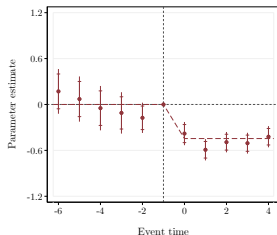
- τ_{ijt} represents the number of years at time t **before or after the event.**
- $\sum_{\substack{\ell=-6 \\ \ell \neq -1}}^4 \mathbb{1} \{ \tau_{ijt} = \ell \} \beta_{\tau}^{\ell}$ measures the **treatment dynamics on GVC outcomes.**

Treatment Dynamics Results - Agriculture



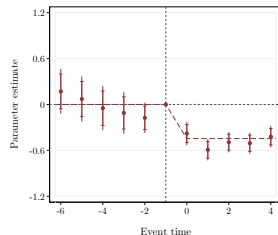
Pre-trends p-value: 0.529 Leveling off p-value: 0.000 Static effect p-value: 0.000
Pseudo R-squared: 0.999 Observations: 784,542

(a) DVX Agriculture.



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(b) FVA Agriculture.

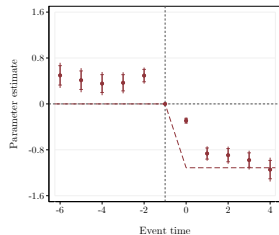


Pre-trends p-value: 0.529 Leveling off p-value: 0.000 Static effect p-value: 0.000
Pseudo R-squared: 0.999 Observations: 784,542

(c) GIE Agriculture.

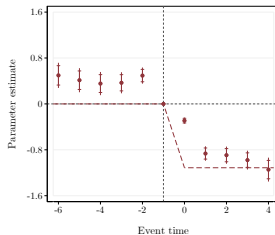
Note. The figure shows the dynamic treatment parameters, 95 percent confidence intervals, and uniform sup-t bands for the event-time coefficients.

Treatment Dynamics Results - Food



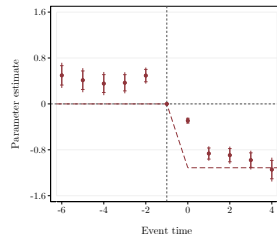
Pre-trends p-value: 0.000 Leveling off p-value: 0.000 Static effect p-value: 0.000
Pseudo R-squared: 0.999 Observations: 784,354

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- If countries initially prioritize the least costly provisions for implementation, **reaching higher levels entails implementing the more costly ones**.
- We find evidence suggesting that only measures found in **Articles 6, 7, and 9 of the TFA have positive effects agri-food GVC flows**.
- Provisions within these articles are conducive to agri-food trade and necessitate minor procedural changes.

Conclusions ii

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- The rate at which countries implement measures is **not affected by country characteristics**.
- We estimate that (close to) full TFA implementation may be achieved by 2034 at the earliest. This is **11 years from the time of writing and 17 years from the agreement's entry-into-force**.
- **TFA negotiations lasted between 10-13 years** (Neufeld, 2014).

- **Event studies** needs further scrutiny. Remove trends?
- **Lasso regression** using 36 policy areas in the TFA.
- Improved model of TFA implementation considering **strategic behavior in the notification of implementation dates** by countries.

Thank you!

Questions and comments are highly appreciated

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Carlos Zurita: carlos.zurita@ndsu.edu

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Appendix - Contribution with Citations

- Extensive literature exploring the connection between **trade agreements and trade flows for agricultural and food products** (Disdier, Fontagné, and Cadot 2014; Duvaleix et al. 2021; Grant and Lambert 2008; Huysmans and Swinnen 2019; Mujahid and Kalkuhl 2016; Scoppola, Raimondi, and Olper 2018; Sun and Reed 2010).
- Other literature using **other data sources**, such as the OECD's Trade Facilitation Indicators (TFI) (Beverelli, Neumueller, and Teh 2015; Fontagné, Orefice, and Piermartini 2020; Hillberry and Zhang 2018; Moisé and Sorescu 2013) and the UN Global Survey on TF (Masood and Martínez-Zarzoso 2023)

Appendix - Measures Notified as Implemented

- The TFA entered into force on February 22, 2017.
- We record a measure as implemented in year $t \geq 2017$ if the *notified* definitive implementation date is on February 22 of year t or before.
- For provisions that have no definitive implementation dates, we consider them as not implemented, even if there is a *tentative* implementation date.

Appendix - Evolution of Implementation by Article

Table 4: Evolution of Implementation Levels by Article in Section I of the TFA

TFA Article	No. of Measures	No. of Imp. Meas. Poss	Implementation by Year (Percent)					Δ 2017-2021 (Percent)
			2017	2018	2019	2020	2021	
Art. 1: Publication of Information	22	3,586	53.3	57.5	58.1	60.5	65.6	12.4
Art. 2: Opportunity to Comment and Consultations	4	652	58.4	64.3	66.0	68.6	72.5	14.1
Art. 3: Advance Rulings	19	3,097	50.4	54.7	54.7	57.3	61.2	10.8
Art. 4: Appeal or Review Procedures	9	1,467	65.8	74.0	74.0	75.2	78.9	13.0
Art. 5: Non-Discrimination and Transparency Measures	8	1,304	53.8	60.4	61.3	62.7	66.5	12.7
Art. 6: Disciplines on Fees and Charges	14	2,282	63.0	69.5	70.0	71.7	75.8	12.8
Art. 7: Release and Clearance of Goods	55	8,965	54.3	58.9	59.6	61.4	65.3	11.0
Art. 8: Border Agency Cooperation	6	978	53.4	53.4	54.1	54.1	58.5	5.1
Art. 9: Movement of Goods under Customs Control	1	163	73.0	87.1	87.7	89.0	90.8	17.8
Art. 10: Import, Export, and Transit Formalities	30	4,890	62.8	70.8	71.3	73.3	75.4	12.6
Art. 11: Freedom of Transit	21	3,423	63.1	69.3	69.7	71.2	75.7	12.6
Art. 12: Customs Cooperation	49	7,987	57.3	63.4	64.6	66.7	70.2	12.9
Total	238	38,794	57.4	63.1	63.8	65.7	69.4	12.0

Note: The Number of Measures by Area is the number of paragraphs in each article. The Number of Implemented Measures Possible (No. of Imp. Possible) is the Number of Implemented Measures by Article multiplied by the total number of countries in the sample (163). Implementation by Year is the share of total measures that are implemented, multiplied by 100 for each year in the sample. The Δ 2017-2021 is the difference between the percentages of implementation (implementation levels) of 2021 and 2017.

Appendix - Descriptive Statistics

Table 5: Descriptive Statistics

	No. of Countries	Mean	SD	Min	Max
Panel A: Measures Notified as Implemented					
2017	163	136.65	97.22	0	238
2018	163	150.14	83.74	0	238
2019	163	151.77	83.54	0	238
2020	163	156.28	82.81	0	238
2021	163	165.23	79.60	0	238
Panel B: GVC Flows in USD millions (2016, excluding intra-national flows)					
<i>GIE Agriculture</i>	189	282.43	585.26	0.00	5,949.27
<i>FVA Agriculture</i>	189	71.03	183.55	0.00	1,974.64
<i>DVX Agriculture</i>	189	28.10	71.78	0.00	583.50
<i>GIE Food</i>	189	441.75	1,059.29	0.00	7,784.48
<i>FVA Food</i>	189	22.98	66.39	0.00	672.45
<i>DVX Food</i>	189	98.54	243.79	0.00	1,696.95
<i>GIE All Industries</i>	189	10,441.67	28,026.87	0.00	2.2e+05
<i>FVA All Industries</i>	189	2,268.24	7,091.04	0.00	64,479.74
<i>DVX All Industries</i>	189	2,633.00	6,684.07	0.00	47,163.29
Panel C: Country Characteristics (2016)					
<i>GDP_{pc}</i> (USD thousands)	163	15.10	22.27	0.28	165.03
<i>ln (GDP_{pc})</i>	163	8.68	1.48	5.64	12.01
<i>landlocked</i>	163	0.20	0.40	0.00	1.00
<i>island</i>	163	0.19	0.39	0.00	1.00
<i>Population</i> (millions)	163	42.68	153.96	0.04	1,378.67
<i>ln (Population)</i>	163	2.02	1.99	-3.28	7.23
<i>AFT_{pc}</i>	163	2.85	6.32	0.00	49.37
<i>Openness</i>	163	0.68	0.41	0.09	2.78

Note: Panel A contains descriptive statistics of the annual number of measures notified as implemented for 163 countries, including 121 countries with article breakdowns in the WTO (2023), 39 developed countries and 2 developing countries with no data (Venezuela and Yemen). Developed countries have full TFA implementation upon the agreement's entry into force. Panel B presents descriptive statistics of 2016 GVC flows for 189 origin countries. Eight countries have data on TFA measures but no data on GVC flows: Dominica, Grenada, Guinea-Bissau, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Solomon Islands, and Tonga. Panel C presents the summary statistics for the country characteristics of the members for which we have data on TFA measure implementation. ITPD-E-R02, provides most of the data for 160 of these countries and does not report data for Taiwan, Liechtenstein and Venezuela. I obtain GDP data for Venezuela and Yemen from the IMF, and import and export data for Liechtenstein from the CIA World Factbook. See text for variable definitions.

Appendix - Eora

- This database is constructed from a multi-region input-output (MRIO) model that provides a time series of sectoral IO tables.
- The first step to decompose GIE is to identify the two main components, which are the domestic and foreign contents.
- The domestic content is share of domestic inputs used in producing exported goods, the foreign content is share of imported inputs used in GIE.
- To obtain the domestic value-added (DVA), the domestic content is multiplied by the value-added shares of all domestic industries.
- In contrast, the foreign value-added (FVA) calculation uses the share of value added by the sector generated in the foreign country and imported by the domestic country to obtain the domestic country's exports.
- "Indirect value-added" (DVX) represents the domestic value-added contained in intermediates exported to a foreign economy that are re-exported to a third economy and incorporated into other products.
- The DVX computation uses the exports by each domestic sector to foreign countries along with the exports of those foreign countries.

Table 6: OLS regression results. $\ln[(M_{Max} - M_t)/M_t]$ on country characteristics.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
t	-0.385*** (0.045)	-0.181*** (0.029)	-0.185*** (0.029)	-0.364*** (0.133)	-0.180*** (0.034)	-0.185*** (0.035)	-0.165*** (0.043)	-0.148*** (0.031)	-0.237*** (0.060)
$\ln[(M_{Max} - M_0)/M_0]$		0.653*** (0.030)	0.665*** (0.032)	0.696*** (0.044)	0.667*** (0.031)	0.656*** (0.029)	0.654*** (0.029)	0.649*** (0.030)	0.652*** (0.030)
$t \times \ln[(M_{Max} - M_0)/M_0]$			-0.005 (0.003)						
$t \times \ln(GDP_{pc})$				0.0211 (0.015)					
$\ln(GDP_{pc})$				0.142 (0.158)					
$t \times landlocked$					-0.005 (0.065)				
$landlocked$					-0.826* (0.437)				
$t \times island$						0.024 (0.055)			
$island$						0.825** (0.330)			
$t \times \ln(Population)$							-0.008 (0.020)		
$\ln(Population)$							-0.156** (0.070)		
$t \times AFT_{pc}$								-0.012* (0.006)	
AFT_{pc}								0.075*** (0.023)	
$t \times openness$									0.0831 (0.063)
$openness$									-0.416 (0.335)
Constant	-1.304*** (0.386)	-1.334*** (0.170)	-1.323*** (0.171)	-2.526* (1.358)	-1.159*** (0.195)	-1.488*** (0.189)	-1.019*** (0.197)	-1.552*** (0.189)	-1.054*** (0.297)
Observations	815	652	652	652	652	652	652	652	652
R^2	0.015	0.801	0.801	0.802	0.807	0.808	0.808	0.807	0.801
Adjusted R^2	0.014	0.800	0.800	0.801	0.806	0.807	0.807	0.805	0.800

Note: The following regressions are based on the logistic growth model. To avoid losing observations with zero or 238 (full) implementation, we correct the dependent variable with a factor of 0.1 in the numerator and the denominator in the following way: $\ln[(M_{Max} - M_t + 0.1)/(M_t + 0.1)]$. Clustered standard errors at the country level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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$\ln[(M_{Max} - M_0)/M_0]$		0.653*** (0.030)	0.665*** (0.032)	0.696*** (0.044)	0.667*** (0.031)	0.656*** (0.029)	0.654*** (0.029)	0.649*** (0.030)	0.652*** (0.030)
$t \times \ln[(M_{Max} - M_0)/M_0]$			-0.005 (0.003)						
$t \times \ln(GDP_{pc})$				0.0211 (0.015)					
$\ln(GDP_{pc})$				0.142 (0.158)					
$t \times landlocked$					-0.005 (0.065)				
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Observations	815	652	652	652	652	652	652	652	652
R^2	0.015	0.801	0.801	0.802	0.807	0.808	0.808	0.807	0.801
Adjusted R^2	0.014	0.800	0.800	0.801	0.806	0.807	0.807	0.805	0.800

Note: The following regressions are based on the logistic growth model. To avoid losing observations with zero or 238 (full) implementation, we correct the dependent variable with a factor of 0.1 in the numerator and the denominator in the following way: $\ln[(M_{Max} - M_t + 0.1)/(M_t + 0.1)]$. Clustered standard errors at the country level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: OLS regression results. $\ln[(M_{Max} - M_t)/M_t]$ on country characteristics.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
t	-0.385*** (0.045)	-0.181*** (0.029)	-0.185*** (0.029)	-0.364*** (0.133)	-0.180*** (0.034)	-0.185*** (0.035)	-0.165*** (0.043)	-0.148*** (0.031)	-0.237*** (0.060)
$\ln[(M_{Max} - M_0)/M_0]$		0.653*** (0.030)	0.665*** (0.032)	0.696*** (0.044)	0.667*** (0.031)	0.656*** (0.029)	0.654*** (0.029)	0.649*** (0.030)	0.652*** (0.030)
$t \times \ln[(M_{Max} - M_0)/M_0]$			-0.005 (0.003)						
$t \times \ln(GDP_{pc})$				0.0211 (0.015)					
$\ln(GDP_{pc})$				0.142 (0.158)					
$t \times landlocked$					-0.005 (0.065)				
$landlocked$					-0.826* (0.437)				
$t \times island$						0.024 (0.055)			
$island$						0.825** (0.330)			
$t \times \ln(Population)$							-0.008 (0.020)		
$\ln(Population)$							-0.156** (0.070)		
$t \times AFT_{pc}$								-0.012* (0.006)	
AFT_{pc}								0.075*** (0.023)	
$t \times openness$									0.0831 (0.063)
$openness$									-0.416 (0.335)
Constant	-1.304*** (0.386)	-1.334*** (0.170)	-1.323*** (0.171)	-2.526* (1.358)	-1.159*** (0.195)	-1.488*** (0.189)	-1.019*** (0.197)	-1.552*** (0.189)	-1.054*** (0.297)
Observations	815	652	652	652	652	652	652	652	652
R^2	0.015	0.801	0.801	0.802	0.807	0.808	0.808	0.807	0.801
Adjusted R^2	0.014	0.800	0.800	0.801	0.806	0.807	0.807	0.805	0.800

Note: The following regressions are based on the logistic growth model. To avoid losing observations with zero or 238 (full) implementation, we correct the dependent variable with a factor of 0.1 in the numerator and the denominator in the following way: $\ln[(M_{Max} - M_t + 0.1)/(M_t + 0.1)]$. Clustered standard errors at the country level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: OLS regression results. $\ln[(M_{Max} - M_t)/M_t]$ on country characteristics.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
t	-0.385*** (0.045)	-0.181*** (0.029)	-0.185*** (0.029)	-0.364*** (0.133)	-0.180*** (0.034)	-0.185*** (0.035)	-0.165*** (0.043)	-0.148*** (0.031)	-0.237*** (0.060)
$\ln[(M_{Max} - M_0)/M_0]$		0.653*** (0.030)	0.665*** (0.032)	0.696*** (0.044)	0.667*** (0.031)	0.656*** (0.029)	0.654*** (0.029)	0.649*** (0.030)	0.652*** (0.030)
$t \times \ln[(M_{Max} - M_0)/M_0]$			-0.005 (0.003)						
$t \times \ln(GDP_{pc})$				0.0211 (0.015)					
$\ln(GDP_{pc})$				0.142 (0.158)					
$t \times landlocked$					-0.005 (0.065)				
$landlocked$					-0.826* (0.437)				
$t \times island$						0.024 (0.055)			
$island$						0.825** (0.330)			
$t \times \ln(Population)$							-0.008 (0.020)		
$\ln(Population)$							-0.156** (0.070)		
$t \times AFT_{pc}$								-0.012* (0.006)	
AFT_{pc}								0.075*** (0.023)	
$t \times openness$									0.0831 (0.063)
$openness$									-0.416 (0.335)
Constant	-1.304*** (0.386)	-1.334*** (0.170)	-1.323*** (0.171)	-2.526* (1.358)	-1.159*** (0.195)	-1.488*** (0.189)	-1.019*** (0.197)	-1.552*** (0.189)	-1.054*** (0.297)
Observations	815	652	652	652	652	652	652	652	652
R^2	0.015	0.801	0.801	0.802	0.807	0.808	0.808	0.807	0.801
Adjusted R^2	0.014	0.800	0.800	0.801	0.806	0.807	0.807	0.805	0.800

Note: The following regressions are based on the logistic growth model. To avoid losing observations with zero or 238 (full) implementation, we correct the dependent variable with a factor of 0.1 in the numerator and the denominator in the following way: $\ln[(M_{Max} - M_t + 0.1)/(M_t + 0.1)]$. Clustered standard errors at the country level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix - Footnote to Estimation of r

Note: The following regressions are based on the logistic growth model. \ln is the natural logarithm. M_t is the number of TFA provisions notified as implemented, and $M_{max} = 238$ is the total number of TFA provisions. In this way, $(M_{max} - M_t)$ is the gap to full implementation, and $[(M_{max} - M_t)/M_t]$ is the gap to full implementation expressed as a ratio of the measures notified as implemented. $(\ln[(M_{max} - M_0)/M_0])$ is the gap to full implementation as a ratio of its level of implementation at $t = 0$. GDP_{pc} is per capita GDP. *landlocked* is an indicator if the country is landlocked. *island* is an indicator if the country is an island. *Population* is population size in millions. AFT_{pc} is a measure of per capita aid received to support trade facilitation between 2012 and 2021. *openness* is the total amount of trade (*imports* + *exports*) over *GDP*. For column 1, we consider all years, for the remaining columns we only consider years $t > 0$ because we include the initial level of notified implementation measures. Clustered standard errors at the country level in parentheses. * $p < 0.10$, ** $p < 0.05$, ***

Table 7: OLS Regression. $\ln[(M_{Max} - M_t)/M_t]$ on GVC Flows.

	OLS				PPML			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
t	-0.181*** (0.029)	-0.291 (0.202)	-0.306* (0.174)	-0.281** (0.123)	-0.009 (0.007)	-0.024 (0.067)	-0.039 (0.065)	-0.045 (0.064)
$\ln[(M_{Max} - M_0)/M_0]$	0.653*** (0.030)	0.607*** (0.039)	0.625*** (0.038)	0.612*** (0.042)	0.663*** (0.079)	0.694*** (0.104)	0.694*** (0.099)	0.768*** (0.115)
$t \times \ln(GIE)$		0.008 (0.015)				0.001 (0.005)		
$\ln(GIE)$		-0.194** (0.080)				0.172 (0.398)		
$t \times \ln(FVA)$			0.010 (0.014)				0.00278 (0.005)	
$\ln(FVA)$			-0.134* (0.073)				0.150 (0.338)	
$t \times \ln(DVX)$				0.008 (0.010)				0.003 (0.005)
$\ln(DVX)$				-0.137** (0.067)				0.430 (0.337)
Constant	-1.334*** (0.170)	1.359 (1.122)	0.280 (0.900)	0.267 (0.800)	0.261** (0.132)	-2.105 (5.566)	-1.561 (4.186)	-4.905 (4.287)
Observations	652	620	620	616	652	620	620	616
R^2	0.801	0.809	0.807	0.808	0.077	0.084	0.088	0.122
Adjusted R^2	0.800	0.808	0.806	0.807				

Note: The following regressions are based on the logistic growth model. \ln is the natural logarithm. To avoid losing observations with zero or 238 (full) implementation, we correct the dependent variable with a factor of 0.1 in the numerator and the denominator in the following way: $\ln[(M_{Max} - M_t + 0.1)/(M_t + 0.1)]$. Clustered standard errors at the country level in parentheses. * $p < 0.10$, ** $p < 0.05$. *** $p < 0.01$

Table 7: OLS Regression. $\ln[(M_{Max} - M_t)/M_t]$ on GVC Flows.

	OLS				PPML			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
t	-0.181*** (0.029)	-0.291 (0.202)	-0.306* (0.174)	-0.281** (0.123)	-0.009 (0.007)	-0.024 (0.067)	-0.039 (0.065)	-0.045 (0.064)
$\ln[(M_{Max} - M_0)/M_0]$	0.653*** (0.030)	0.607*** (0.039)	0.625*** (0.038)	0.612*** (0.042)	0.663*** (0.079)	0.694*** (0.104)	0.694*** (0.099)	0.768*** (0.115)
$t \times \ln(GIE)$		0.008 (0.015)				0.001 (0.005)		
$\ln(GIE)$		-0.194** (0.080)				0.172 (0.398)		
$t \times \ln(FVA)$			0.010 (0.014)				0.00278 (0.005)	
$\ln(FVA)$			-0.134* (0.073)				0.150 (0.338)	
$t \times \ln(DVX)$				0.008 (0.010)				0.003 (0.005)
$\ln(DVX)$				-0.137** (0.067)				0.430 (0.337)
Constant	-1.334*** (0.170)	1.359 (1.122)	0.280 (0.900)	0.267 (0.800)	0.261** (0.132)	-2.105 (5.566)	-1.561 (4.186)	-4.905 (4.287)
Observations	652	620	620	616	652	620	620	616
R^2	0.801	0.809	0.807	0.808	0.077	0.084	0.088	0.122
Adjusted R^2	0.800	0.808	0.806	0.807				

Note: The following regressions are based on the logistic growth model. \ln is the natural logarithm. To avoid losing observations with zero or 238 (full) implementation, we correct the dependent variable with a factor of 0.1 in the numerator and the denominator in the following way: $\ln[(M_{Max} - M_t + 0.1)/(M_t + 0.1)]$. Clustered standard errors at the country level in parentheses. * $p < 0.10$, ** $p < 0.05$. *** $p < 0.01$

Appendix - Panel Regressions to estimate r

Table 8: Fixed Effects (FE) Panel regression results. $\ln(M_{Max} - M_t)$ on t .

	(1) All t	(2) $t > 0$
t	-0.385*** (0.045)	-0.181*** (0.029)
Constant	-1.304*** (0.090)	-1.918*** (0.073)
Observations	815	652
R^2	0.179	0.149
Adjusted R^2	0.177	0.148

Note: The regressions are based on the logistic growth model. Standard errors clustered at the country level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix - PPML regressions

Table 9: Pooled PPML regression results. $\ln[(M_{Max} - M_t)/M_t]$ on Country Characteristics.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
t	-0.845*** (0.273)	-0.009 (0.007)	-0.213*** (0.076)	-0.045 (0.076)	-0.008 (0.006)	-0.008 (0.007)	-0.025 (0.021)	0.003 (0.013)	0.003 (0.018)
$\ln[(M_{Max} - M_0)/M_0]$		0.663*** (0.078)	0.600*** (0.079)	0.909*** (0.155)	0.713*** (0.078)	0.626*** (0.075)	0.639*** (0.078)	0.650*** (0.079)	0.664*** (0.081)
$t \times \ln[(M_{Max} - M_0)/M_0]$			0.027*** (0.010)						
$t \times \ln(GDP_{pc})$				0.00498 (0.010)					
$\ln(GDP_{pc})$				1.057* (0.604)					
$t \times landlocked$					-0.065* (0.039)				
$landlocked$					-3.524*** (0.589)				
$t \times island$						-0.109** (0.049)			
$island$						-2.128*** (0.730)			
$t \times \ln(Population)$							0.005 (0.005)		
$\ln(Population)$							0.302 (0.242)		
$t \times AFT_{pc}$								-0.014 (0.023)	
AFT_{pc}								-0.365 (0.408)	
$t \times openness$									-0.029 (0.049)
$openness$									-3.396 (2.352)
Constant	5.982*** (0.159)	0.261** (0.132)	0.744*** (0.236)	-9.041 (5.498)	0.379*** (0.138)	0.596*** (0.125)	-0.391 (0.741)	0.812*** (0.311)	1.894** (0.927)
Observations	815	652	652	652	652	652	652	652	652
R^2	0.092	0.077	0.077	0.157	0.140	0.082	0.082	0.108	0.122

Note: The following regressions are based on the logistic growth model. Clustered standard errors at the country level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix - Gravity Framework

- $Y_{it} = \sum_j X_{ijt}$ is total export supply and includes intra-national trade
- $E_{jt} = \sum_i X_{ijt}$ is total expenditures from the importer, and it also includes intra-national trade.
- $Y_t = \sum_i Y_{it} = \sum_j E_{jt}$ is Total world production.

Appendix - North-South Trade

Table 10: Pooled PPML Gravity Regressions: 2000 - 2021. North-South Trade

	Agriculture			Food			All		
	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>
<i>WTO</i>	0.233*** (0.059)	0.267*** (0.036)	0.396*** (0.043)	0.256*** (0.060)	0.320*** (0.034)	0.311*** (0.038)	0.336*** (0.051)	0.190*** (0.040)	0.193*** (0.040)
<i>Imp. TFA × North – to – North</i>	-1.057*** (0.117)	-0.784*** (0.069)	-0.580*** (0.064)	-0.838*** (0.119)	-0.940*** (0.076)	-1.428*** (0.071)	-0.863*** (0.132)	-0.716*** (0.060)	-0.731*** (0.061)
<i>Imp. TFA × North – to – South</i>	-0.877*** (0.173)	-0.870*** (0.118)	-0.314** (0.147)	-0.846*** (0.268)	-0.915*** (0.221)	-1.600*** (0.113)	-0.997*** (0.193)	-0.738*** (0.131)	-0.926*** (0.102)
<i>Imp. TFA × South – to – North</i>	-1.279*** (0.136)	-0.802*** (0.0894)	-0.213 (0.153)	-0.784*** (0.193)	-1.133*** (0.097)	-1.536*** (0.125)	-1.254*** (0.176)	-0.924*** (0.103)	-0.744*** (0.132)
<i>Imp. TFA × South – to – South</i>	-1.571*** (0.139)	-1.238*** (0.103)	-0.528*** (0.161)	-0.173 (0.277)	-1.436*** (0.200)	-2.289*** (0.131)	-1.749*** (0.178)	-1.256*** (0.133)	-1.257*** (0.135)
Observations	785,862	785,485	784,542	785,862	784,354	784,354	785,862	784,354	784,354
Pseudo- R^2	0.9995	0.9993	0.9992	0.9993	0.9993	0.9990	0.9995	0.9992	0.9992

Note: WTO_{ijt} is an indicator that both i and j are WTO members at time t . Imp. TFA represents the share of all TFA measures simultaneously implemented by i and j at time t . All countries were divided into two groups, North and South, and we then assessed the treatment heterogeneity using interaction terms. All standard errors are clustered at the exporter-importer-sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

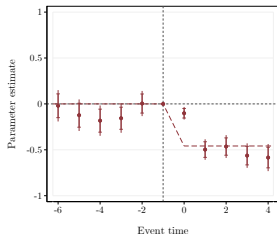
Appendix - Time Since Common TFA Implementation

Table 11: Pooled PPML Gravity Regressions: 2000 - 2021. TFA time index

	Agriculture			Food			All		
	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>	<i>GIE</i>	<i>FVA</i>	<i>DVX</i>
<i>WTO</i>	0.231*** (0.059)	0.262*** (0.035)	0.404*** (0.043)	0.248*** (0.060)	0.320*** (0.034)	0.311*** (0.038)	0.309*** (0.0496)	0.176*** (0.040)	0.179*** (0.040)
Imp. TFA _{ijt}	-1.142*** (0.103)	-0.837*** (0.066)	-0.845*** (0.071)	-0.613*** (0.120)	-0.997*** (0.0792)	-1.523*** (0.073)	-0.982*** (0.105)	-0.771*** (0.065)	-0.772*** (0.066)
Imp. TFA _{ijt} × <i>t</i> _{TFA}	-0.083*** (0.026)	-0.060*** (0.012)	0.057*** (0.019)	-0.025 (0.024)	-0.037* (0.0202)	-0.084*** (0.011)	-0.214*** (0.029)	-0.122*** (0.014)	-0.129*** (0.014)
<i>t</i> _{TFA}	0.095* (0.050)	0.053** (0.025)	0.024 (0.032)	0.016 (0.068)	0.015 (0.0340)	0.060** (0.028)	0.384*** (0.070)	0.181*** (0.028)	0.179*** (0.029)
Observations	785,862	785,485	784,542	785,862	784,354	784,354	785,862	784,354	784,354
Pseudo- <i>R</i> ²	0.9995	0.9992	0.9992	0.9993	0.9993	0.9990	0.9995	0.9992	0.9992

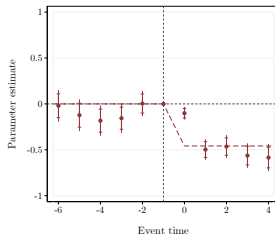
Note: *WTO*_{ijt} is an indicator that both *i* and *j* are WTO members at time *t*. Imp. TFA represents the share of all TFA measures simultaneously implemented by *i* and *j* at time *t*. *t*_{TFA} is a time index that captures the number of years that have passed since the country pairs start having common TFA provisions implemented. All standard errors are clustered at the exporter-importer-sector level. * *p* < 0.10, ** *p* < 0.05, *** *p* < 0.01.

Appendix - Treatment Dynamics Results - All Sectors



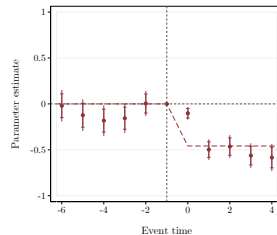
Pre-trends p-value: 0.058 Leveling off p-value: 0.205 Static effect p-value: 0.000
Pseudo R-squared: 0.999 Observations: 784,354

(a) DVX All sectors.



Pre-trends p-value: 0.058 Leveling off p-value: 0.205 Static effect p-value: 0.000
Pseudo R-squared: 0.999 Observations: 784,354

(b) FVA All sectors.



Pre-trends p-value: 0.058 Leveling off p-value: 0.205 Static effect p-value: 0.000
Pseudo R-squared: 0.999 Observations: 784,354

(c) GIE All sectors.

Note. The figure shows the dynamic treatment parameters, 95 percent confidence intervals, and uniform sup-t bands for the event-time coefficients.