Is the WTO Passé? The Impact of Multilateral Economic Integration on Agri-Food Global Value Chains*

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Abstract

This paper assesses the impact of multilateral and preferential trade commitments on agri-food global value chains (GVCs). We evaluate whether multilateral economic integration remains effective amidst the proliferation of regional trade agreements (RTAs). Relying on the isomorphic gravity framework, we find that GATT/WTO membership promotes agricultural GVC flows, increasing backward linkages by 56.7% and forward linkages by 43.9%, surpassing the effects of RTAs, which enhance backward and forward GVC linkages by only 7.9% and 4.1%, respectively. These results underscore the dominant role of multilateralism in driving agri-food GVC integration, while RTAs serve a complementary role by facilitating connections between countries with substantial income disparities. The transition from GATT to WTO, marked by a more robust institutional framework and binding dispute resolution mechanisms, has further enhanced global agri-food GVC integration. Our study highlights the continued relevance of multilateral economic integration in fostering agri-food GVC integration, offering critical insights for policymakers in addressing global trade and food security challenges.

Keywords: Multilateral economic integration, agri-food global value chains, three-way gravity model, event studies

JEL codes: F14; Q17; Q18

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1. Introduction

The World Trade Organization (WTO) and its predecessor, the General Agreement on Tariffs and Trade (GATT), have promoted member countries to cooperate in addressing terms-of-trade externalities through reciprocal tariff concessions (Nicita, Olarreaga and Silva 2018). Consequently, both multilateral trade frameworks have played a key role in the formation of agri-food global value chains (GVCs). The rise of regional trade agreements (RTAs), which extend the policy scope considerably beyond tariff concessions to implement deeper integration through various policy areas among member countries, has further promoted the integration of the global agri-food system (Kim, Steinbach and Zurita 2024). RTAs are regional or bilateral arrangements that often introduce preferential trade terms. They have altered the established trade order under the GATT/WTO and threaten multilateral trade concessions (Hirsch and Oberhofer 2020), which could affect trade flows and GVC integration. This paper explores the GATT/WTO role in the global agri-food value chain system and investigates whether multilateral economic integration remains effective amidst the rise of regionalism resulting from the proliferation of RTAs.

The historical dominance of trade in commodities and final products has largely given way to a new era that emphasizes the trade of individual components and services that contribute additional value during the production process (Aichele and Heiland 2018). This shift highlights the importance of backward linkages, which involve importing inputs for domestic production, and forward linkages, which include exporting domestically produced inputs for use in other countries' production processes (Koopman, Wang and Wei 2014). Those linkages illustrate the interconnected nature of modern production systems, where intermediate goods and services cross multiple borders, adding value at each stage before reaching the final consumer. Johnson and Noguera (2012) estimates that trade in intermediate inputs now constitutes two-thirds of world trade, allowing the movement of services, raw materials, components, and parts across borders. Consequently, the traditional practice of labeling

products with their country of origin needed to be updated, as the complex fragmentation of production processes across different countries has become a defining feature of the modern economy (Antràs and Chor 2013). Agri-food GVCs have significantly evolved since the 1950s, transitioning from traditional, localized operations to larger, more organized industries (Lim 2021). This transformation accelerated in the early 1990s, notably with China's increased participation in global trade, prompting many countries to be involved in GVCs (Reardon et al. 2009). Antràs and Chor (2022) pinpoint the late 1980s as the beginning of GVC integration in the agri-food sector.[1] Key factors contributing to the rise of agri-food GVCs include the information and communication technology revolution, accelerated reduction of trade barriers, and socio-political changes that expanded capitalist participation globally (Antràs 2016). Additionally, increased production in developing regions, global income growth, fluctuating international market prices, and shifts in trade policy have driven the development of agri-food GVCs (Greenville, Kawasaki and Beaujeu 2017). The rapid rise of major global food processors and retailers has also played a critical role, as these entities have utilized vertical integration to dominate the agri-food GVC landscape, effectively linking upstream farmers with downstream consumers (Sexton 2013).

The emergence of GVCs coincided with the considerable reduction of trade barriers, notably through the establishment of the GATT/WTO (Aichele and Heiland 2018). GATT, a multilateral trade forum, became the dominant international trade agency when the International Trade Organization, outlined in the 1947 Havana Charter, was abandoned by President Truman due to opposition from the U.S. Congress. In 1995, the WTO, a more powerful successor to GATT, aimed to address non-tariff barriers and trade disparities between countries. These multilateral commitments shaped the current structure of agri-food GVCs (Greenville, Kawasaki and Beaujeu 2017). However, the effectiveness of GATT/WTO

[1] Hummels, Rapoport and Yi (1998) and Hummels, Ishii and Yi (2001) argue that the rise of manufacturing GVCs might date back to the early 1970s.

has been challenged by the emergence of RTAs and protectionist policies (Baldwin 2016; Grant and Boys 2012; Sheldon, Chow and McGuire 2018; Carter and Steinbach 2019; Grant et al. 2021). RTAs have shifted the global integration landscape by superseding many of the WTO regulations (Gereffi and Fernandez-Stark 2016). This has led to increased agri-food globalization among RTA members and corresponding developments in global linkages within the sector (Grant and Lambert 2008; Sun and Reed 2010; Disdier, Fontagné and Cadot 2014; Mujahid and Kalkuhl 2016; Scoppola, Raimondi and Olper 2018). Additionally, the residual effects of globalization policies have fueled protectionist tendencies across the globe (Autor, Dorn and Hanson 2016; Di Tella and Rodrik 2020; Fajgelbaum et al. 2020; Kim and Steinbach 2024). Some have argued that partial compliance with WTO commitments, especially among developed nations, has created economic disparities resulting in an uneven playing field (Grant and Boys 2012; Subramanian and Wei 2007). Consequently, recent trade disputes and retaliatory actions have hindered global agri-food trade and limited the further integration of agri-food GVCs (Carter and Steinbach 2018, 2019; Grant et al. 2021). Accordingly, the decline of multilateralism has raised concerns about the potential impact on agri-food GVCs, but only limited research has quantified the impact of this trend and the role of the WTO in GVC integration (e.g., Baldwin 2016; Flentø and Ponte 2017; Bacchetta et al. 2021).

This paper investigates the impact of multilateral and preferential trade commitments on agri-food GVCs. We rely on the isomorphic structural gravity framework to assess the GVC impact of multilateral economic integration. The gravity model has been widely utilized to study how trade cost shocks alter international trade (Head and Mayer 2014; Anderson, Larch and Yotov 2020). Specifically, our analysis extends the theoretical framework introduced by Shepherd (2022), which conceptualizes bilateral flows within global value chains in a multi-country, multi-sector Ricardian model. This model combines a standard structural gravity equation with a multi-sector general equilibrium model, providing a theoretical basis for assessing how changes in trade costs affect GVC flows. Therefore, we can analyze

agri-food-specific GVC flows in response to the changes in trade costs from trade policy implementations. We rely on the multi-sectoral empirical specification of a three-way gravity model. The model captures bilateral GVC flows, accounting for trade resistance terms and unobserved trade costs with high-dimensional fixed effects. The trade shock vector includes WTO membership, RTAs, and trade dispute actions. We also employ an event study design to capture trade policy dynamics. By considering six lags and twelve leads, we account for policy anticipation and examine post-event treatment dynamics (Freyaldenhoven, Hansen and Shapiro 2019; Freyaldenhoven et al. 2021).

Our analysis reveals that GATT/WTO membership promotes agricultural GVC flows by 56.7% for backward linkages and 43.9% for forward linkages after controlling for globalization effects. These increases are substantially larger than those attributed to RTAs, which enhance backward and forward GVC linkages by 7.9% and 4.1%, respectively. Similarly, GATT/WTO membership increases food GVC flows more than RTAs. These findings suggest that multilateralism remains the primary driver of agri-food GVC integration, while RTA plays a lesser role. The event study results indicate that the effects of GATT/WTO on agri-food GVCs increase over time. We also observe significant differences between the impacts of GATT and WTO. The institutional and structural improvements following the transition from GATT to WTO played a key role in advancing agri-food GVC integration (Baldwin 2016). Our findings reveal that global agri-food linkages have been primarily driven by countries integrated into the system before the establishment of the WTO. Nonetheless, new member countries have also contributed to GVC integration by strengthening their linkages with existing members. Additionally, we find evidence for complementarity between RTAs and GATT/WTO, implying that trade policy regionalism can better address regional economic needs and disparities (Bagwell, Bown and Staiger 2016). Lastly, the positive effects of GATT/WTO on agri-food GVC integration are indifferent across income levels, whereas RTAs primarily facilitate better GVC connections between developed and developing countries.

This paper contributes to the ongoing debate on the impact of multilateral and regional economic integration on agri-food GVC integration in two ways. First, our paper addresses the question of whether multilateral commitments remain effective in promoting the global economic integration of the agri-food sector. Amidst the proliferation of regionalism and the rise of protectionism, the continued importance of multilateral commitment has been empirically confirmed by a theory-consistent gravity estimation. Aligning with the research by Bagwell, Bown and Staiger (2016) and extending those of Dutt (2020), our study finds that GATT/WTO remains a reliable vehicle for agri-food GVC integration. RTAs help tighten linkages between countries with income gaps by lowering non-tariff barriers, such as standard harmonization and other regulatory measures (Disdier, Fontagné and Cadot 2014; Santeramo and Lamonaca 2022). They also enhance vertical value chain linkages between developed and developing countries, as various policies provide favorable conditions for offshoring (Antràs and Staiger 2012). Second, our study expands on earlier work by focusing on the impact of multilateral economic integration on GVCs, which is the long-term outcome of multilateral linkage. Our findings show that economic linkages in the agri-food sector have been strengthened over time, which is direct evidence of the continued relevance of the GATT/WTO trade policy framework. In particular, our paper adds to the literature on the role of global integration policies in the agri-food sector. While earlier studies utilized static regression frameworks to examine the impact of trade agreements on agri-food trade (e.g., Engelbrecht and Pearce 2007; Grant and Boys 2012; Mujahid and Kalkuhl 2016; Sheldon, Chow and McGuire 2018), we provide additional insights into how agri-food GVCs have developed over time in response to multilateral and regional trade policy changes. Those insights are crucial in understanding various global challenges, such as food security and inequality, during the emergence of economic regionalism and protectionism (Sheldon, Chow and McGuire 2018).

2. Methods and Data

2.1 Empirical Strategy

Our empirical strategy builds on the structural gravity model at the sector level, a widely adopted framework for empirical studies examining the effects of changes in trade costs on international trade (Head and Mayer 2014; Baier, Yotov and Zylkin 2019; Anderson, Larch and Yotov 2020). The isomorphic gravity equation can be derived from various trade models (Arkolakis, Costinot and Rodríguez-Clare 2012). For example, commonly used microeconomic foundations suitable for explaining agri-food trade flows include the Armington-CES model (Anderson and Van Wincoop 2003), the Heckscher-Ohlin model (Bergstrand 1989), and the Ricardian model (Eaton and Kortum 2002). Specifically, we rely on the theoretical framework developed by Shepherd (2022) to conceptualize bilateral GVC flows within a multi-country and multi-sector Ricardian model. This model utilizes a standard structural gravity equation embedded in a multi-sector general equilibrium model, providing a conceptual framework to quantify the impact of changes in trade costs on GVC flows.

The model features representative consumers in each country who consume the final output of each sector based on Cobb-Douglas preferences with fixed expenditure shares. Producers of intermediate goods utilize two input factors. These factors are labor and composite intermediate goods sourced from all sectors from the lowest-cost suppliers. By following standard practice and assuming the Fréhet distribution for Ricardian productivity, one can determine the input sourcing of each intermediate producer (Levchenko and Zhang 2014). Producers can sell their goods domestically and in foreign markets and face iceberg trade costs en route. By introducing trade costs that vary by end-use, intermediate foreign sales face different trade costs than final good sales (Aichele and Heiland 2018).[2] This theoretical

[2] Appendix 1 in Shepherd (2022) derives the utilized GVC flow model and the general equilibrium conditions.

framework yields an expression of bilateral trade flows that aligns with the structural gravity framework:

$$\pi_{ij}^{kv} = \frac{\lambda_j^k \left[c_j^k \kappa_{ij}^{kv}\right]^{-\theta^k}}{\sum_{h=1}^{N} \lambda_h^k \left[c_h^k \kappa_{ih}^{kv}\right]^{-\theta^k}}\,, \tag{1}$$

where π_{ij}^{kv} is the export share of country i in country j's imports for sector k and end use v. The terms λ_j^k and θ^k denote parameters of the Fréchet distribution, c_j^k is the cost of an input bundle, and κ_{ij}^{kv} stands for the iceberg trade costs. For estimation purposes, a common approach is to express the equation in terms of bilateral trade costs. We further simplify Equation 1 into a specification of the bilateral trade relationship between two countries, where backward and forward linkage value chain flows are the sum of value-added content of trade in a specific sector (Kim, Steinbach and Zurita 2024).[3] We then include exporter and importer fixed effects, which are governed by a single trade elasticity that dictates the response to changes in trade costs. A challenge in studying the impact of changes in iceberg trade costs, such as the WTO membership, is the potential correlation between the trade cost variables of interest and other unobserved trade costs (Hillberry and Zhang 2018). To account for this identification challenge, we add an explicit time script t, which leads to the gold standard empirical specification of the three-way gravity model:

$$X_{ijt} = \exp\Big(\phi_{it} + \psi_{jt} + \omega_{ij} + \beta\tau_{ijt}\Big)\epsilon_{ijt}\,, \tag{2}$$

where the dependent variable X_{ijt} is GVC flows from country i to j in year t. We include intra-national and international GVC flows, which are consistent with trade theory and relevant for assessing the response of the trade margins to changes in iceberg trade costs (Yotov 2022). The fixed effects ϕ_{it} and ψ_{jt} capture the inward and outward trade resistance

[3] We further describe the construction of the GVC flow measures in Subsection 2.2.

terms, and the directional dyadic fixed effects ω_{ij} account for time-invariant bilateral trade costs. The vector of indicator variables τ_{ijt} represents the trade policy variables, which takes the value one if both i and j became GATT/WTO members or i and j enforced an RTA and are zero otherwise. This model is sector-specific, and we focus on the agricultural and food sectors.

The potential impact of multilateral and regional economic integration on agri-food GVC integration could vary over time (Egger, Larch and Yotov 2022; Anderson and Ponnusamy 2023). In addition, the potential for policy anticipation and a delayed GVC response to policy changes could introduce non-linearities in the static three-way gravity estimation. To understand the underlying dynamics in the treatment response, we implement an event study design that interacts our treatment measure with event time indicators defined relative to the year of the trade policy change:

$$X_{ijt} = \exp\left(\phi_{it} + \psi_{jt} + \omega_{ij} + \sum_{r \neq 0} \mathbb{1}\{\tau_{ijt} = r\}\beta^r\right)\eta_{ijt}\,, \tag{3}$$

where the general notation is the same as in Equation 2. The dynamic treatment model includes six lags and twelve leads relative to the event of interest, which enables us to capture pre-trends and assess post-event treatment dynamics (Freyaldenhoven, Hansen and Shapiro 2019). Standard event study practices are followed, including binning the endpoints of the event study window. We define the time relative to treatment as $\tau_{ijt} = t - G_\tau + 1$, where we run the summation over all possible realizations of τ_{ijt} except for zero. The central identifying assumption is that the treatment timing is independent of the error term conditional on the high-dimensional fixed effects that control for the inward and outward trade resistance terms and unobserved time-invariant trade costs. The term $\sum_{r \neq 0} \mathbb{1}\{\tau_{ijt} = r\}$ measures the treatment dynamics of WTO and RTA membership for the corresponding GVC outcome. We allow the magnitude of the treatment response to vary before implementing trade policies

and uncover how GVC flows evolve in the post-treatment period.

2.2 Data

We utilize the Eora global supply chain database (Lenzen et al. 2013). This database is constructed from a multi-region input-output (MRIO) model that provides a time series of sectoral IO tables. The database has been widely used in various studies regarding GVC, including GVC integration (Balié et al. 2019; Montalbano and Nenci 2022; Raimondi et al. 2023), GVC flows (Borin, Mancini and Taglioni 2021; Kim, Steinbach and Zurita 2024), disruptions in GVCs (Ayadi et al. 2022; Kejžar, Velić and Damijan 2022), determinants of GVC participation (Kowalski et al. 2015; Fernandes, Kee and Winkler 2022), and economic upgrading in GVCs (Ndubuisi and Owusu 2021). Despite Eora being the best available global input-output dataset, several limitations exist.[4] First, the aggregated values are calibrated for a selected number of countries due to the inconsistent availability of information across countries. To address such shortcomings, we exclude outliers defined as the 99th percentile of the standard deviation of each outcome. Second, the calculation assumes that the imported commodities are proportionally distributed over the target sectors due to data limitations for the destination industries of international trade flows. Third, because Eora relies on aggregated input-output data, the resulting sectoral disaggregation of GVC flows is demanding. Thus, we use a common industry classification to aggregate the sectors into 26 industries, so-called *Eora26*. This aggregation enables us to study a longer horizon and a broader set of countries, which is key to identifying the GVC flow implications of RTAs.[5] The resulting

[4] An in-depth assessment and discussion of the advantages and disadvantages of Eora are provided in Montalbano and Nenci (2022).

[5] Aggregation bias could make the aggregated Eora database less accurate. The primary source of bias is the missing input-output table for some countries. Eora estimated the input-output structure based on an average for Australia, Japan, and the United States (Lenzen et al. 2013). Thus, Eora estimates should be understood as a mean value with an associated confidence level. This constraint confirms the suitability of the dataset for global assessments aimed at identifying long-run trade effects holding on average. Despite its limitations, Eora is widely recognized as the best available GVC data product (Mancini et al. 2023).

data contains symmetric sector-by-sector IO tables measured in current USD and calculated using basic prices. This measurement choice is important because the GVC flow measures are free on board (FOB), which is essential when estimating the GVC implications of DTAs in the three-way gravity setting. Our analysis focuses on the Eora sectors *agriculture* and *food & beverages*.

We rely on the framework introduced by Koopman, Wang and Wei (2014) to construct three common indicators of agri-food GVC flows. These measures are domestic value added (DVA), foreign value added (FVA), and indirect value added (DVX). DVA is the value added within a country, and FVA is the value added by foreign countries in the production of goods and services.[6] DVX refers to the value added by a country's domestic firms that is embedded in intermediate goods and services, which are then exported and used in the production of goods and services in other countries. FVA, therefore, represents backward linkages, while DVX represents forward linkages in the global value chain.[7] This conceptual framework is widely used in empirical studies as it separates a country's gross exports by the source and final destination of their embedded value added, well suited to the bilateral data setting in gravity-type research.[8]

To align with the gold standard of the gravity model, we require both international and intra-national GVC flows in the regression. (Yotov, Piermartini and Larch 2016). For this

[6] High DVA means that a significant portion of the production is processed domestically, while high FVA indicates that such process relies heavily on imported intermediate goods and services.

[7] We rely on the approach by Koopman, Wang and Wei (2014) to decompose value-added trade, which has been utilized for constructing Eora's multi-region input-output (MRIO) database. The embodied value-added flows consist of the value-added share, the Leontief inverse from the standard input-output analysis, and exports. The detailed decomposition of the value-added matrix can be found in Koopman, Wang and Wei (2014) and well summarized in Kim, Steinbach and Zurita (2024).

[8] Later studies extend to distinguish the initial exports absorbed back to the country (Borin and Mancini 2019) or decompose pure and two-sided GVC flows by tracking the borders crossed (Borin, Mancini and Taglioni 2021).

reason, we rely on DVA to serve as the intra-national GVC flows following Kim, Steinbach and Zurita (2024). This allows us to test how policy changes affect the choice between domestic and foreign value-added intermediate inputs for exporting goods. In addition, we can test how policy changes affect the choice of sourcing intermediates between domestic and foreign value-added for exporting goods.[9] Different from the standard terminology, we rely on the definition in (Kim, Steinbach and Zurita 2024) for the total value added (TVA) in the country's exports by combining FVA and DVA and for the total indirect value added (TVX) by combining DVX and DVA. Finally, we measure gross industry exports (GIE) by summing intermediate and final product flows, which are comparable with more traditional trade flow measures. This enables a comparison of GVC flow estimates with previous studies examining the impact of trade policies on agri-food exports (e.g., Grant and Boys 2012; Baylis et al. 2022; Kim, Steinbach and Zurita 2024).[10]

We sourced the trade policy data from the WTO and the Regional Integration Agreement (RIA) database. The number of WTO members reached 164 in 2016 (World Trade Organization 2024). Among those, 128 members originally joined under the GATT framework. Panel (a) of Figure 1 shows the number of GATT/WTO members from 1948 to 2020. Aligning with our data range, which spans from 1991 to 2020, 33 new members joined during the GATT era, and 36 members joined after the establishment of the WTO in 1995. The Regional Integration Agreement (RIA) database covers trade agreements and regional organizations involving 235 countries from 1910 to 2021 (Miller and Standaert 2023). The database contains information on 898 economic integration agreements, which we classified using a multichotomous index (zero to six), where zero denotes no existing economic inte-

[9] The inclusion of intra-national trade ensures the estimated trade effects are consistent with the structural gravity model (Yotov, Piermartini and Larch 2016).

[10] Kim, Steinbach and Zurita (2024) discuss the consistency of Eora-based GIE measures with alternative data sources. They find that the GIE flows reported in Eora closely align with other trade data sources. Table 1 provides the descriptive statistics of the different regression outcomes.

gration agreement, and six is an economic union. We focus on RTAs that are reciprocal. RIA is the most comprehensive source of DTA data because it combines the main trade policy dataset. These are the Design of Trade Agreements database (Dür, Baccini and Elsig 2014), the Regional Trade Agreements Database (World Trade Organization 2024), the Global Preferential Trade Agreements Database (World Bank 2024*a*), the Regional Integration Knowledge System (United Nations University 2024), and the Comparative Regional Organizations Project (CROP 2024). Those databases have been widely used to study the reasons why countries engage in economic integration agreements and assess their implications for international trade and GVC integration (see, e.g., Sun and Reed 2010; Baldwin and Jaimovich 2012; Freeman and Pienknagura 2019; Kim, Steinbach and Zurita 2024). The final dataset covers 189 countries from 1991 to 2020, with over 70,000 exporter-importer pairs being part of the WTO and around 20,000 bilateral country pairs having signed an RTAs by 2020, as illustrated in Panel (b) of Figure 1.

3. Main Results

3.1 Static Gravity Estimates

Table 2 presents estimates of the impact of multilateral and regional economic integration on agri-food GVC flows based on the static three-way gravity framework. The estimates for GIE flows are shown in Columns (2) and (3), which are compared with TVA and TVX flows in Columns (4) through (7). The upper panel of the table details the results for the agricultural sector, while the lower panel shows the results for the food sector. Model (1) includes only the GATT/WTO membership variables, whereas Model (2) incorporates both GATT/WTO membership and Regional Trade Agreement (RTA) enforcement. This comparison aims to assess whether the inclusion of RTAs alters the estimated effects attributed to GATT/WTO membership. For Model (1), we find that agricultural backward linkages (TVA) increase by

106.7%, and forward linkages (TVX) by 94.8% after joining GATT/WTO.[11] The estimates for agricultural GIE indicate an increase of 103.2%. When the RTA measure is included in the estimation, the GATT/WTO effect for GIE, TVA, and TVX decreases slightly to 90.4%, 93.7%, and 85.9%, respectively. Additionally, with the enforcement of RTAs between a country pair, GIE increases by 21.2%, TVA by 17.0%, and TVX by 19.8%. The estimates for the food sector are similar. We find that GIE increases by 71.4%, TVA by 110.0%, and TVX by 71.4% with GATT/WTO membership. These effects are slightly smaller but remain statistically indistinguishable from the baseline estimates after accounting for RTA membership. Even with the inclusion of the RTA measure, GATT/WTO membership continues to be positively associated with our GVC integration measures. Our findings for GIE align with those in Grant and Boys (2012), which also found a positive association between both GATT/WTO and RTA with GIE. However, while Grant and Boys (2012) found similar effects in terms of magnitude between the two trade policy frameworks, our results suggest a more substantial role for multilateral than regional or bilateral economic integration. Two factors might contribute to this difference. First, our study employs intra-national trade flows, which provide a theoretically consistent framework for structural gravity estimation. Second, our data window does not cover the trade dynamics associated with GATT/WTO membership before 1990. To further explore this mechanism, we analyze the heterogeneity in the effects based on membership type in Subsection 5.1.

3.2 Treatment Dynamics

Figure 2 shows event studies that reveal how GVC flows adjust to trade policy shifts over time. Each sub-figure plots the dynamic treatment parameters, 95 percent confidence intervals, and uniform sup-t bands for the event-time of the outcome (Montiel Olea and Plagborg-Møller 2019; Freyaldenhoven et al. 2021). All event studies incorporate both GATT/WTO

[11] The estimated coefficients are semi-elasticities, which can be transformed into elasticities using the formula: $\exp(\beta) - 1$.

and RTA measures, but for simplicity, only the parameters for GATT/WTO effects are presented in the figures. We overlaid the static effects from Table 2 onto the event study parameter estimates as a dotted line. The figure notes report the corresponding p-value of Wald tests for pre-event trends and anticipatory behavior. For the agricultural sector, we find no evidence of significant short-run pre-trends for both backward and forward linkages. Because the treatment effect could be dynamic at the endpoints of the event window, we also conduct Wald tests for the null hypothesis that the treatment dynamics level off. The Wald tests provide some statistical support for elevated long-run treatment effects for both GVC outcomes. We find that the treatment dynamics reveal a delayed response to GATT/WTO membership, especially for the TVA flow measure. The backward linkage effect is indifferent from zero up to four years after both trade partners become GATT/WTO members. Afterward, the treatment effects gradually increase over time. This positive effect is more immediate for the TVX flows, but its magnitude also increases over time. For the food sector, we find significant short-run pre-trends for both GVC outcomes. The significant upward trend in the pre-treatment period led to a gap between the static and the long-term event study parameter estimates, which indicates the potential estimation bias based on the static model specification. Because this estimation gap also exists for the agricultural GVC measure, we address this issue in the following section for both sectors.

4. Robustness Checks

4.1 Accouting for Globalization Effects

Globalization has profoundly influenced the global economic landscape through increased market integration and the diffusion of technology and knowledge (Yotov, Piermartini and Larch 2016). Bergstrand, Larch and Yotov (2015) highlight the importance of understanding the effects of globalization, particularly in the context of trade policy decisions. Our baseline empirical results underscore this relevance, revealing pre-trends in the GVC flow measures that predate the GATT/WTO membership. This suggests that broader global trends influ-

ence the structure and function of agri-food GVCs, which must be considered to differentiate the effects of GATT/WTO interventions from these underlying trends. Addressing the impact of globalization is essential to accurately assess the GATT/WTO role and its impact on agri-food GVC integration. To do so, we consider a dummy variable, taking the value of one for intranational trade in each year t and zero otherwise. This adjustment helps us to capture common trends and changes in the global trading environment that affect all countries similarly each year. Such trends as technological advances and transportation cost reductions (Bergstrand, Larch and Yotov 2015). Table 3 replicates our main results after controlling for globalization effects. The estimated coefficients of the policy variables remain positive, even though they all decrease in magnitude after accounting for globalization effects. We find that GATT/WTO membership increases agricultural TVA by 60.2% and TVX by 44.6% in Model (1). When accounting for RTAs in Model (2), these estimates slightly decrease to 56.7% and 43.9%, respectively. The effects of RTAs are 7.9% for TVA and 4.1% for TVX. A similar pattern is observabal for the food sector. GATT/WTO membership increases TVA by 63.1% and TVX by 55.6% in Model (1). The estimates slightly decrease to 61.6% and 53.0% in Model (2). The estimates for RTA effects are 4.1% for TVA and 9.5% for TVX. These results suggest that while RTAs also contribute to global agri-food integration, GATT/WTO plays a more significant role in shaping agri-food GVCs.

4.2 Controlling for Pre-Trends

Figure 3 replicates the event studies after adjusting globalization effects. The estimated treatment pathways confirm that the adjusted model significantly reduces the pre-trends. We find no evidence of significant short-run pre-trends for the four agri-food GVC flow measures. Since the pre-trend tests are statistically insignificant and the short-run treatment pathways in the pre-treatment period are flat, the pre-trend tests validate the research design. The Wald tests for the potential dynamic at the endpoints provide some statistical support for elevated long-run treatment effects for all GVC outcomes. The treatment dynamics reveal

several patterns for all four GVC outcomes. First, we find that the effects of GATT/WTO on agri-food GVC gradually increase over time. Second, we observe no significant anticipation effects, but we do observe some delayed treatment effects. For the agriculture sector, the impact of GATT/WTO on forward linkage (TVX) flows appears more immediate, while there is a four-year delay in the backward linkage (TVA) flows. Conversely, for the food sector, we find that there are relatively immediate effects for backward linkage (TVA) flows. In contrast, forward linkage (TVX) flows experience a delay of five years after joining GATT/WTO. In light of those findings, adjusting for globalization effects is crucial to understanding the impact of multilateral and regional economic integration on GVC flows.

It is essential to be cautious when interpreting the treatment effects in a causal manner due to the potential for pre-trends and treatment anticipation preceding the trade policy shift (Freyaldenhoven, Hansen and Shapiro 2019). Despite finding no evidence of short-run pre-trends in our model, potential long-run pre-trends may not be captured within our data range. To address this, we assume that the short-run linear pre-trends of the treated units would have continued along their pre-event paths (Dobkin et al. 2018). The linearity assumption seems reasonable for our research, as the estimated trend growth falls within the 95% confidence intervals of the non-parametric event study estimates in the pre-treatment periods. By assuming that these pre-trends persist in the long run, we can adjust the treatment pathways by subtracting the linear pre-trends from the estimated post-event treatment effects (Freyaldenhoven, Hansen and Shapiro 2019; Freyaldenhoven et al. 2021). Appendix Figure A.1 overlays the linear pre-trends on the event study results, while Appendix Figure A.2 shows the event study estimates after accounting for those short-run pre-trends. The de-trended event study results indicate that the long-run effects of GATT/WTO are smaller in magnitude than those in our main regressions. Since we cannot completely rule out that pre-trends drive some of the estimated post-event growth, the actual treatment effects likely lie between the main results and the pre-trend adjusted estimates (Kim, Steinbach and Zurita 2024).

5. Heterogeneity Analysis

5.1 Comparing GATT and WTO Membership Effects

Several institutional and structural changes were made when transitioning from GATT to WTO. The WTO introduced a more robust and binding dispute settlement mechanism, which increased compliance and enforcement of trade agreements (Bagwell, Bown and Staiger 2016). Additionally, the WTO's more inclusive framework facilitated comprehensive agricultural negotiations and agreements, addressing non-tariff barriers and subsidies that were less considered under GATT (Baldwin 2016). This shift toward a more structured and enforceable multilateral trade environment enhanced the positive effects of multilateral economic integration on agricultural trade under the WTO (Grant and Boys 2012). This differential impact of GATT and WTO could be more pronounced for value chain linkages due to the increased complexity and integration of agricultural markets in the global economy under the WTO framework. To capture this difference, we construct a new variable that distinguishes the memberships between 'old' (GATT) and 'new' (WTO) and estimate the association with GVC flows in the globalization-adjusted regression specification. Precisely, we classify a GV flow as 'both old' if both the exporter and importer joined under the GATT era, 'both new' if both joined under the WTO era, and 'old + new' if one joined under the GATT regime, and the other under the WTO regime.

Table 4 presents estimates that differentiate between GATT and WTO membership effects. We find that agri-food linkages increased the most between existing GATT members and countries that joined after the WTO establishment. This result is consistent across backward and forward linkage measures, with agricultural TVA increasing by 37.4%, TVX by 31.3%, food TVA by 36.3%, and food TVX by 34.2%, respectively. Within our data range, 33 countries joined GATT, and their agri-food global linkages with existing GATT members have also increased significantly. Agricultural TVX increased by 21.2%, food TVA by 11.3%,

and food TVX by 31.1%. In contrast, global agri-food linkages among countries that joined during the post-WTO era are largely insignificant, while only food TVX shows a statistically significant increase of 12.4%. These results suggest that global agri-food GV integration has been led by the countries that had already economically integrated into the system prior to the WTO establishment. Nonetheless, new member countries have also contributed to globalization by solidifying their linkages with existing members. To better understand the treatment dynamics, we estimate the same model specification in the event study framework. The results of this analysis are presented in Appendix Figures A.3 and A.4. Similar to our earlier event study results. we find that the impact of GATT/WTO increases over time, suggesting that multilateralism is an essential driver of GVC integration in the long term.

5.2 North-South Integration and GVC Integrtation

The GATT/WTO system has been instrumental in lowering trade barriers on a global scale, thereby enabling countries to participate in the global market more actively. While GATT/WTO promotes globalization multilaterally, RTAs enhance trade and integration regionally or on a bilateral level. Therefore, such trade agreements may complement the multilateral approach of GATT/WTO and global trade architecture by more directly addressing regional economic needs and disparities (Bagwell, Bown and Staiger 2016). In addition, RTAs focus on removing barriers between specific groups of countries, often fostering closer economic ties between developed (north) and developing (south) nations (Disdier, Fontagné and Cadot 2014). They typically offer deeper integration in certain policy areas, such as regulatory standards, which can help bridge the economic disparities between member countries (Santeramo and Lamonaca 2022). Moreover, Limão (2006) and Antràs and Staiger (2012) emphasize the importance of regional agreements between northern and southern countries, as they target to integrate economies by addressing non-trade issues such as cooperation on migration, investment and global political agendas, which are critical for offshoring and global production lines. These potential differences in objectives between GATT/WTO and

RTAs are likely to result in differential impacts across regional transactions by income level.

To better understand the differential impact of multilateral economic integration on GVC flows, we classified countries into north and south countries using the World Bank's income category (World Bank 2024*b*). We used four groups, which are north-to-south, north-to-north, south-to-north, and south-to-south. By interacting the measures with the policy variables, we can compare the role of GATT/WTO and RTA across income levels. Table 5 shows the results of this exercise. We find that the impact of GATT/WTO on agricultural GVCs varies across income levels. Despite the fact that the estimated effects on north-to-south global linkages are smaller than those for other pairs, the overall positive impacts are statistically significant at a 1% level, as reflected in the first two columns. GATT/WTO increases agricultural TVA by 40.4% to 61.4% and TVX by 38.4% to 48.4%, depending on the income level of countries involved in these GVC flows. Similarly, we find no substantial differences in the impact of GATT/WTO on the food sector's global linkages according to the income level of the involved countries. GATT/WTO increases food TVA by 49.9% to 61.6% and TVX by 49.9% to 58.6%. This outcome aligns with the multilateral integration goal of GATT/WTO, which aims to enhance the integration and formation of a global value chain among all member states.

In contrast, we observe significant differences in the impact of RTAs based on the income classification. Overall, the promoting effect of RTAs on agri-food global linkages is largest between developed and developing countries. Both north-to-south and south-to-north agri-food GVC flows increase significantly in the presence of an RTA. North-to-south agri-food GVC flows increase by 5.1% to 9.5%, whereas south-to-north flows experience a more substantial increase, ranging from 8.8% to 17.2%. For north-to-north, only the food sector TVX experiences a statistically significant increase of 12.2%. In contrast, all GVC linkages except agricultural TVX show statistically significant increases for south-to-south, but by a lesser degree compared to south-to-north, ranging from 4.0% to 8.4%. These results sug-

gest that RTAs primarily enhance global linkages by reducing barriers between developed and developing countries, which is consistent with findings in previous studies (e.g., Disdier, Fontagné and Cadot 2014; Santeramo and Lamonaca 2022). Although the RTA effects are estimated to be smaller compared to the GATT/WTO effects, they contribute to globalization by strengthening connections between countries with different income levels (Grant and Lambert 2008; Mujahid and Kalkuhl 2016; Kim, Steinbach and Zurita 2024).

6. Conclusion

This paper investigates the impact of multilateral economic integration on agri-food GVC integration, addressing the critical question: Is the relevance of the WTO passé for the agri-food sector? Our study answers this question with a decisive *no*. Consistent with the research by Bagwell, Bown and Staiger (2016) and extending on Dutt (2020), we find that GATT/WTO remains a reliable channel for promoting the integration of global agri-food systems. Membership in the GATT/WTO promotes agri-food GVC flows, leading to substantial increases in both backward and forward economic linkages. The growing impact of the GATT/WTO over time underscores the continued relevance of the multilateral economic integration framework in fostering global trade connections. In contrast, RTAs are beneficial but have a relatively modest effect, highlighting their complementary role within the broader multilateral system (Sheldon, Chow and McGuire 2018). RTAs are particularly crucial in connecting countries with significant income disparities (Disdier, Fontagné and Cadot 2014). The distinction between GATT and WTO membership also reveals critical insights. The transition to the WTO, with its more robust institutional framework and binding dispute settlement mechanisms, has markedly enhanced global agri-food GVC integration (Grant and Boys 2012). This transition facilitated more comprehensive agricultural negotiations and more effectively addressed non-tariff barriers and subsidies compared to the GATT. Our findings suggest that countries integrated into the system before the WTO establishment have primarily driven the intensification of global agri-food linkages between 1990 to 2020.

However, new member countries have also strengthened these connections, contributing to the overall globalization trends in the agri-food sector.

Our study provides important insights for policymakers promoting resilient and inclusive agri-food GVCs. Understanding the roles of different integration policies and tracking their dynamic impacts is essential for addressing potential trade policy challenges (Greenville, Kawasaki and Beaujeu 2017; Sheldon, Chow and McGuire 2018; Balié et al. 2019). The positive effects of GATT/WTO underscore the importance of multilateral economic integration policies for the agri-food system. At the same time, the significant role of RTAs in linking agri-food GVCs between developed and developing countries highlights the need for harmonizing non-tariff standards, as these can lower trade barriers beyond tariffs (Limão 2006; Santeramo and Lamonaca 2022; Kim and Steinbach 2023). Moreover, trade agreements provide favorable conditions for offshoring, enhancing vertical linkages between countries with income gaps (Limão 2006; Antràs and Staiger 2012). By fostering stronger economic linkages between countries within a multilateral platform and leveraging the complementary role of regional agreements, the global agri-food system can become more inclusive and resilient, potentially enhancing global food security. Policymakers are thus encouraged to develop strategies that address specific challenges and opportunities within regional and bilateral contexts, building upon the multilateral economic framework (Greenville et al. 2019).

Several potential limitations of our research design provide room for future research. First, our empirical strategy assumes that integration policies are exogenously determined, which may overlook endogeneity concerns due to policy anticipation and contagion. While our event studies provide limited evidence for such concerns in the pre-event period, the parallel trend assumption may not be valid if the treatment effects are compounded (Callaway and Sant'Anna 2021; Roth and Sant'Anna 2023). This might be an empirical challenge for estimating the impact of RTA membership but less so for GATT/WTO. Second, our study covers a shorter period than the entire history of GATT/WTO development. Although

many countries joined after 1990, which is the starting point of our data, more countries joined under GATT before 1990. As a result, our study does not capture the dynamics of the earlier period. Previous research by Dutt (2020) provides evidence that the impacts of GATT/WTO on bilateral trade flows have increased over time, indicating that our results could overestimate the overall effects by focusing on more recent periods. Third, our empirical model captures only the direct impact of policy changes and does not consider the effects on third countries, where potential trade diversion might occur. Incorporating the general equilibrium properties of our empirical framework could offer a more comprehensive understanding of agri-food GVC integration. Lastly, the domestic value-added (DVA) measured used is an imperfect proxy for intra-national domestic value (DVX) flows by definition. Although we utilize the best available GVC measures, developing a more reliable definition for this measure could enhance future studies aiming to further dissect the impact of economic integration policies on GVC flows.

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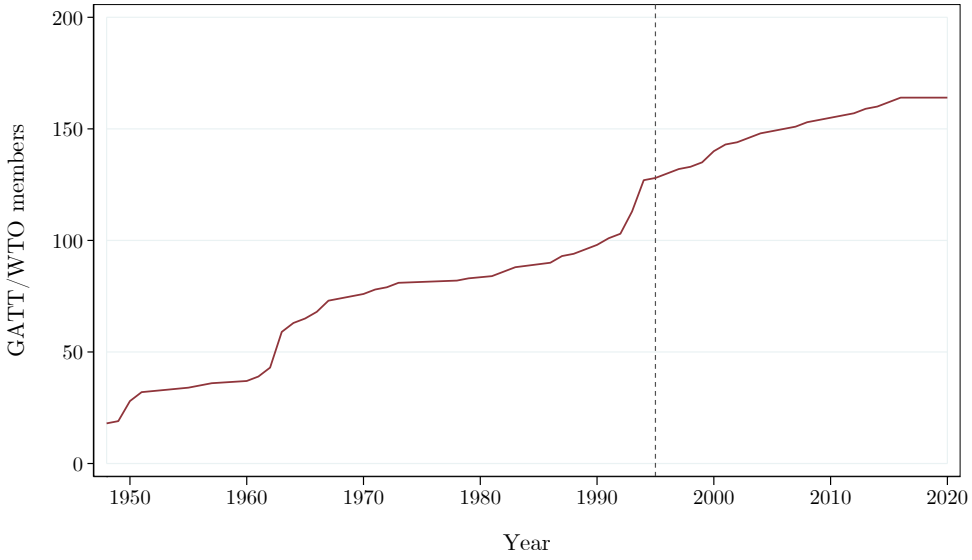
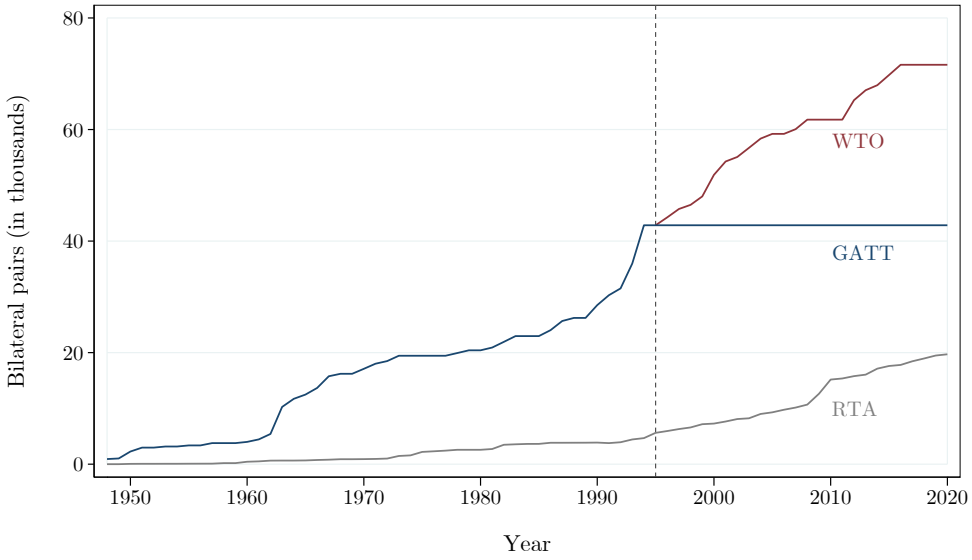
Figures and Tables



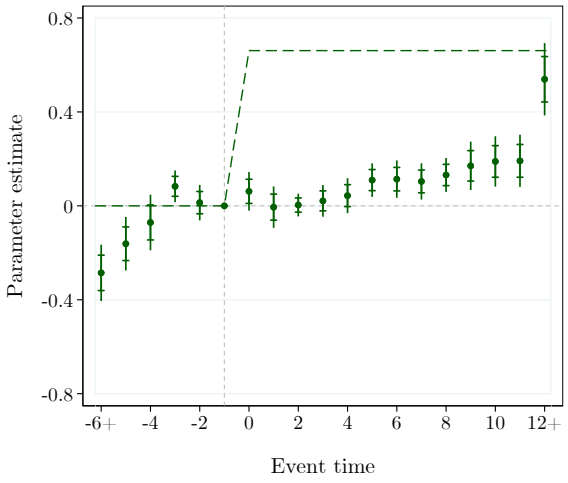
(a) GATT/WTO Membership.



(b) Country Pairs Part of GATT, the WTO, and RTAs.

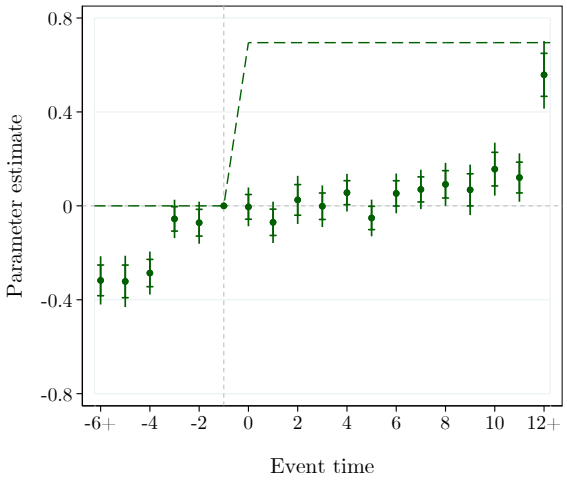
Figure 1: Multilateral and Regional Trade Integration Policies Over Time.

Note. The figure shows the evolution of multilateral and regional trade integration policies over time. Panel (a) shows the number of GATT/WTO members over the years and Panel (b) the number of exporter-importer pairs who joined GATT, the WTO, and RTAs. The WTO was established in 1995 as the successor to the GATT.



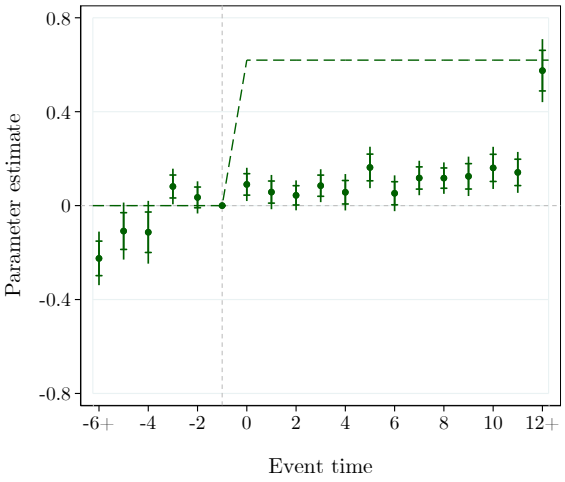
Pre-trends p-value: 0.167 -- Leveling off p-value: 0.000 -- Static effect p-value: 0.000
Pseudo R-squared: 0.999 -- Observations: 1,048,696

(a) Agricultural TVA.



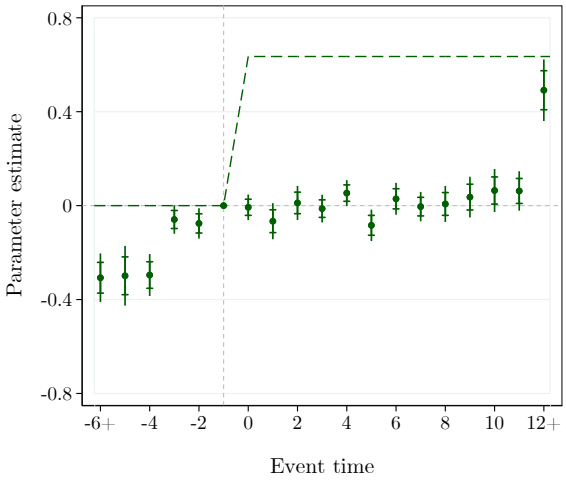
Pre-trends p-value: 0.000 -- Leveling off p-value: 0.000 -- Static effect p-value: 0.000
Pseudo R-squared: 0.999 -- Observations: 1,047,950

(b) Food TVA.



Pre-trends p-value: 0.347 -- Leveling off p-value: 0.000 -- Static effect p-value: 0.000
Pseudo R-squared: 0.999 -- Observations: 1,048,136

(c) Agricultural TVX.

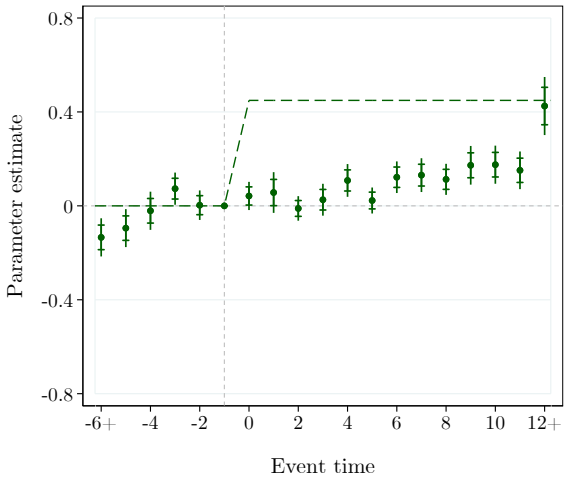


Pre-trends p-value: 0.000 -- Leveling off p-value: 0.000 -- Static effect p-value: 0.000
Pseudo R-squared: 0.999 -- Observations: 1,047,950

(d) Food TVX.

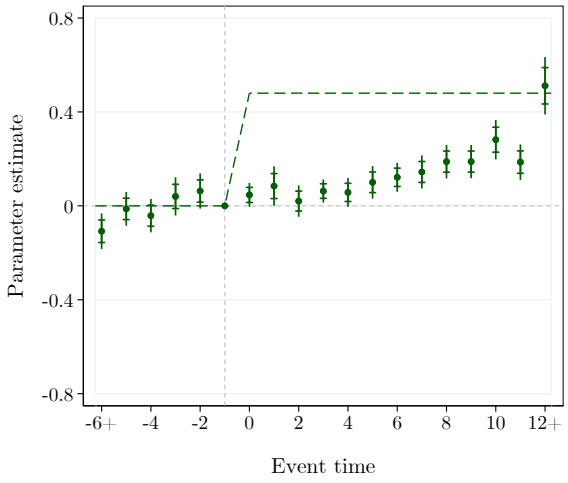
Figure 2: Event Studies for the Impact of Multilateral Economic Integration on Agri-food GVC Flows.

Note. The figure shows dynamic treatment parameters, 95 percent confidence intervals, and uniform sup-t bands for the event-time coefficients. Both GATT/WTO and RTA effects are included in the regression, but only the GATT/WTO effects are reported in this figure. We report several Wald tests and regression statistics in each sub-figure note and overlay static estimates as dashed lines. All standard errors are clustered at the exporter-importer level.



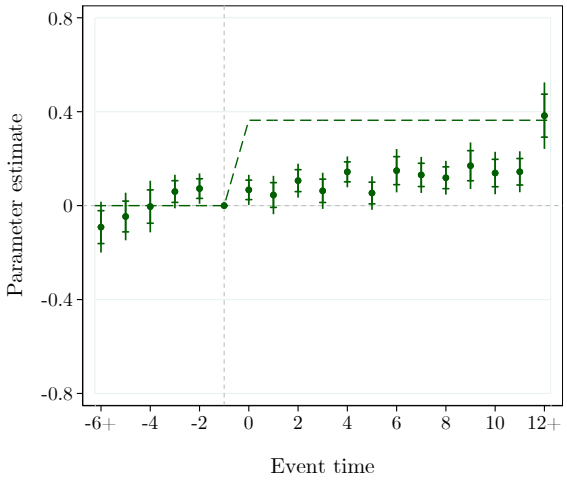
Pre-trends p-value: 0.549 -- Leveling off p-value: 0.000 -- Static effect p-value: 0.000
Pseudo R-squared: 0.999 -- Observations: 1,048,696

(a) Agricultural TVA.



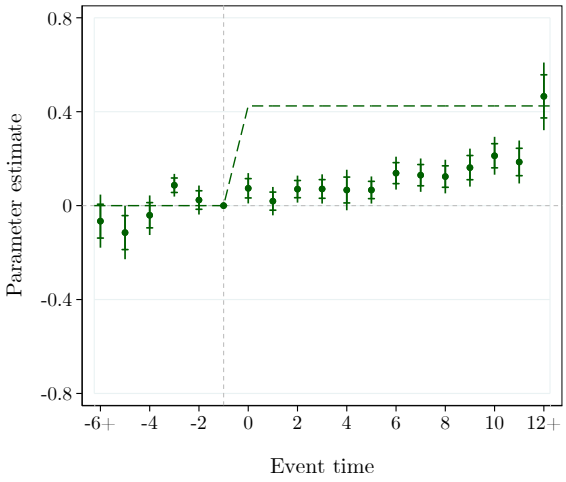
Pre-trends p-value: 0.479 -- Leveling off p-value: 0.000 -- Static effect p-value: 0.000
Pseudo R-squared: 1.000 -- Observations: 1,047,950

(b) Food TVA.



Pre-trends p-value: 0.397 -- Leveling off p-value: 0.000 -- Static effect p-value: 0.000
Pseudo R-squared: 0.999 -- Observations: 1,048,136

(c) Agricultural TVX.



Pre-trends p-value: 0.590 -- Leveling off p-value: 0.000 -- Static effect p-value: 0.000
Pseudo R-squared: 0.999 -- Observations: 1,047,950

(d) Food TVX.

Figure 3: Event Studies with Globalization Effects.

Note. The figure shows dynamic treatment parameters, 95 percent confidence intervals, and uniform sup-t bands for the event-time coefficients. We account for globalization effects and include both GATT/WTO and RTA effects in the regressions but only report estimates for the GATT/WTO effects. We report several Wald tests and regression statistics in each sub-figure note and overlay static estimates as dashed lines. All standard errors are clustered at the exporter-importer level.

Table 1: Descriptive Statistics.

	Mean	SD	Min	Max	Total
(a) Agricultural Sector					
GIE (intra-national)	14,936.1	74,043.8	0	1,461,486	82,895,290
GIE (international)	8.9	124.9	0	15,874	9,171,369
DVA	1,370.2	3,794.7	0	56,923	7,604,860
DVX	1.0	14.7	0	2,758	1,055,786
FVA	2.5	29.5	0	6,559	2,512,154
(b) Food Sector					
GIE (intra-national)	20,850.8	86,090.2	0	1,479,780	115,721,925
GIE (international)	17.7	235.5	0	25,417	18,205,698
DVA	2,296.7	6,613.5	0	68,288	12,746,785
DVX	3.9	46.3	0	5,397	3,959,124
FVA	1.0	12.1	0	1,921	1,010,968

Note. The table presents descriptive statistics for the outcome variables. We report the intra-national and international trade in the table separately, with the sum of these variables representing GIE, TVA, and TVX. The Total presents the sum of all bilateral transactions from 1991 to 2020. The units for the statistics are expressed in millions of US dollars (current).

Table 2: The Impact of Multilateral and Regional Economic Integration on Agri-food GVC Flows.

	GIE		TVA		TVX	
	(1)	(2)	(1)	(2)	(1)	(2)
(a) Agricultural Sector						
GATT/WTO	0.709***	0.644***	0.726***	0.661***	0.667***	0.620***
	(0.071)	(0.072)	(0.056)	(0.052)	(0.046)	(0.045)
RTA		0.192***		0.157***		0.181***
		(0.025)		(0.017)		(0.016)
Observations	1,049,069	1,049,069	1,048,696	1,048,696	1,048,136	1,048,136
Pseudo R-squared	0.999	0.999	0.999	0.999	0.999	0.999
(b) Food Sector						
GATT/WTO	0.539***	0.509***	0.742***	0.695***	0.697***	0.635***
	(0.078)	(0.079)	(0.050)	(0.049)	(0.055)	(0.051)
RTA		0.112***		0.133***		0.193***
		(0.019)		(0.015)		(0.016)
Observations	1,047,950	1,047,950	1,047,950	1,047,950	1,049,069	1,049,069
Pseudo R-squared	0.999	0.999	0.999	0.999	0.999	0.999

Note. The table shows estimates for the impact of multilateral and regional economic integration on agri-food GVC flows. Heteroskedasticity-robust standard errors clustered at the exporter-importer level are reported in parenthesis. Asterisks denote statistical significance at < 0.10 (*), < 0.05 (**), or < 0.01 (***).

Table 3: Adjusting the Main Results for Globalization Effects.

	GIE		TVA		TVX	
	(1)	(2)	(1)	(2)	(1)	(2)
(a) Agricultural Sector						
GATT/WTO	0.401***	0.388***	0.471***	0.449***	0.369***	0.364***
	(0.065)	(0.065)	(0.049)	(0.046)	(0.049)	(0.048)
RTA		0.058**		0.076***		0.040**
		(0.023)		(0.016)		(0.018)
Observations	1,049,069	1,049,069	1,048,696	1,048,696	1,048,136	1,048,136
Pseudo R-squared	0.999	0.999	0.999	0.999	0.999	0.999
(b) Food Sector						
GATT/WTO	0.390***	0.385***	0.489***	0.480***	0.442***	0.425***
	(0.071)	(0.072)	(0.043)	(0.042)	(0.054)	(0.051)
RTA		0.033*		0.040**		0.091***
		(0.018)		(0.016)		(0.016)
Observations	1,049,069	1,049,069	1,047,950	1,047,950	1,047,950	1,047,950
Pseudo R-squared	0.999	0.999	0.999	0.999	0.999	0.999

Note. The table shows estimates for the impact of multilateral and regional economic integration on agri-food GVC flows adjusting for globalization effects. Heteroskedasticity-robust standard errors clustered at the exporter-importer level are reported in parenthesis. Asterisks denote statistical significant at < 0.10 (*), < 0.05 (**), or < 0.01 (***).

Table 4: Differential GVC Integration Effects of GATT and WTO Membership.

	Agricultural Sector		Food Sector	
	TVA	TVX	TVA	TVX
GATT/WTO				
– *Both old*	0.055	0.192***	0.107**	0.271***
	(0.042)	(0.068)	(0.043)	(0.063)
– *Old + new*	0.318***	0.272***	0.310***	0.294***
	(0.054)	(0.054)	(0.054)	(0.045)
– *Both new*	0.118	0.127	0.066	0.117*
	(0.098)	(0.096)	(0.099)	(0.067)
RTA	0.076***	0.041**	0.039**	0.090***
	(0.016)	(0.018)	(0.016)	(0.016)
Observations	1,048,696	1,048,136	1,047,950	1,047,950
Pseudo R-squared	0.999	0.999	0.999	0.999

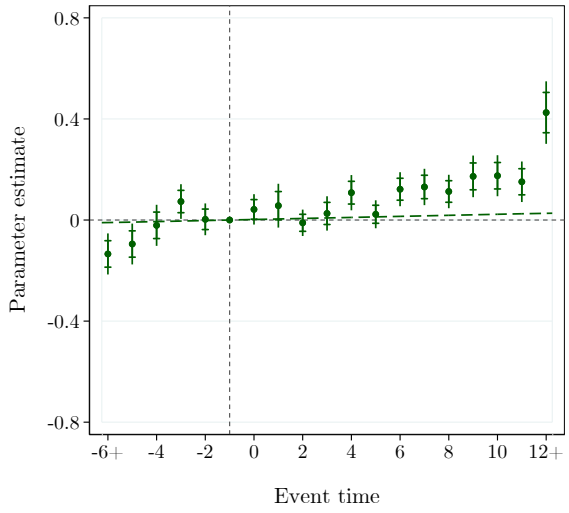
Note. The table shows estimates for the impact of multilateral and regional economic integration on agri-food GVC flows accounting for GATT and WTO membership. We specify the GVC flow as 'both old' if both the exporter and importer joined under the GATT regime, 'both new' if both joined under the WTO regime, and 'old + new' if one joined under the GATT regime and the other under the WTO regime. Heteroskedasticity-robust standard errors clustered at the exporter-importer level are reported in parenthesis. Asterisks denote statistical significant at < 0.10 (*), < 0.05 (**), or < 0.01 (***).

Table 5: Differential Impact of Multilateral and Regional Economic Integration on GVC Flows Across Income Levels.

	Agricultural Sector		Food Sector	
	TVA	TVX	TVA	TVX
GATT/WTO				
– *North-to-south*	0.339***	0.325***	0.405***	0.439***
	(0.057)	(0.065)	(0.049)	(0.077)
– *North-to-north*	0.479***	0.338***	0.480***	0.405***
	(0.062)	(0.054)	(0.062)	(0.053)
– *South-to-north*	0.445***	0.370***	0.455***	0.459***
	(0.060)	(0.057)	(0.062)	(0.056)
– *South-to-south*	0.421***	0.395***	0.472***	0.461***
	(0.053)	(0.060)	(0.047)	(0.065)
RTA				
– *North-to-south*	0.091***	0.055**	0.050**	0.072***
	(0.024)	(0.028)	(0.021)	(0.023)
– *North-to-north*	0.013	0.023	-0.025	0.115***
	(0.025)	(0.029)	(0.030)	(0.024)
– *South-to-north*	0.159***	0.084***	0.092***	0.103***
	(0.030)	(0.026)	(0.031)	(0.025)
– *South-to-south*	0.039**	0.015	0.050**	0.081**
	(0.019)	(0.029)	(0.024)	(0.040)
Observations	1,026,080	1,026,263	1,026,080	1,026,080
Pseudo R-squared	0.999	0.999	0.999	0.999

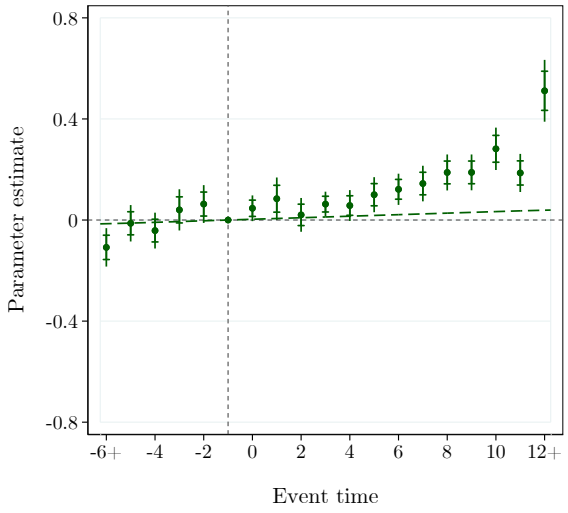
Note. The table shows estimates for the impact of multilateral and regional economic integration on agri-food GVC flows accounting for GATT and WTO membership accounting for income differences across GVC partners. We classified countries into developed (south) and developing countries (south). Heteroskedasticity-robust standard errors clustered at the exporter-importer level are reported in parenthesis. Asterisks denote statistical significant at < 0.10 (*), < 0.05 (**), or < 0.01 (***).

Appendix



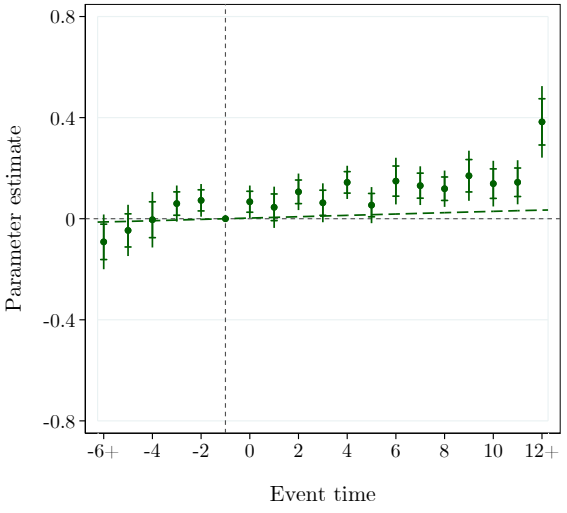
Linear trend: 0.002 (0.006) - Pseudo R-squared: 0.999 - Observations: 1,048,696

(a) Agricultural TVA.



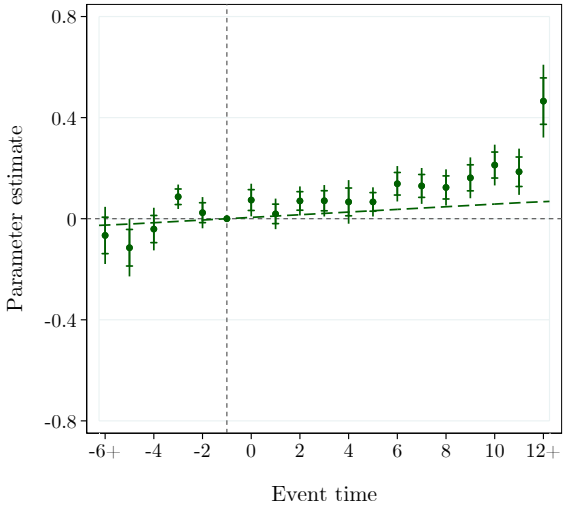
Linear trend: 0.003 (0.005) - Pseudo R-squared: 1.000 - Observations: 1,047,950

(b) Food TVA.



Linear trend: 0.003 (0.008) - Pseudo R-squared: 0.999 - Observations: 1,048,136

(c) Agricultural TVX.

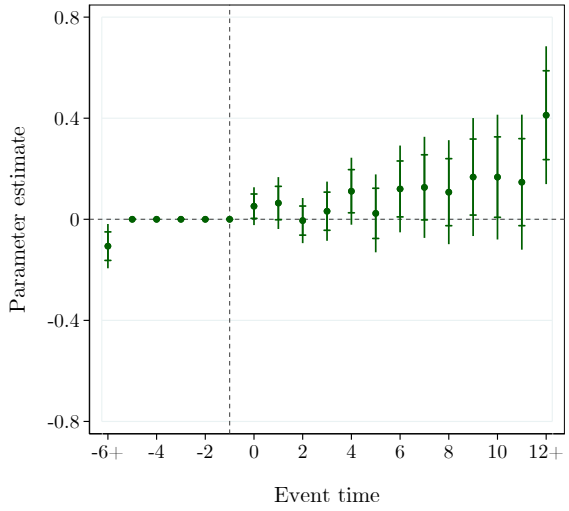


Linear trend: 0.005 (0.008) - Pseudo R-squared: 0.999 - Observations: 1,047,950

(d) Food TVX.

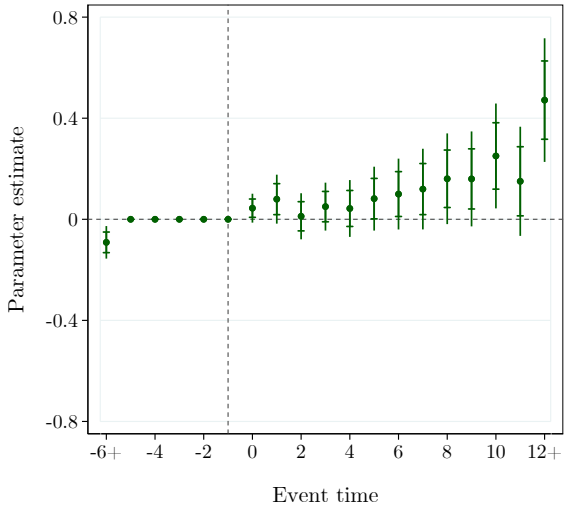
Figure A.1: Event Studies with Overlaid Pre-trends.

Note. The figure shows dynamic treatment parameters, 95 percent confidence intervals, and uniform sup-t bands for the event-time coefficients. We overlay linear pre-trends in each figure. The regressions account for globalization effects and include both GATT/WTO and RTA effects, but we only report estimates for the GATT/WTO effects. We report the slope and standard error of the linear pre-trend and several Wald tests and regression statistics in each sub-figure note. All standard errors are clustered at the exporter-importer level.



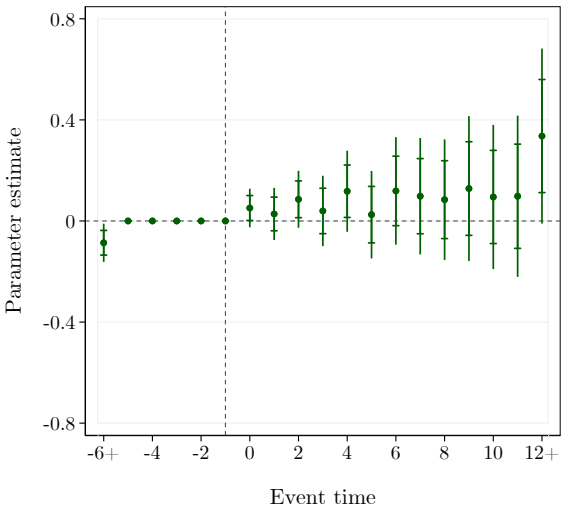
Linear trend: 0.002 (0.006) - Pseudo R-squared: 0.999 - Observations: 1,048,696

(a) Agricultural TVA.



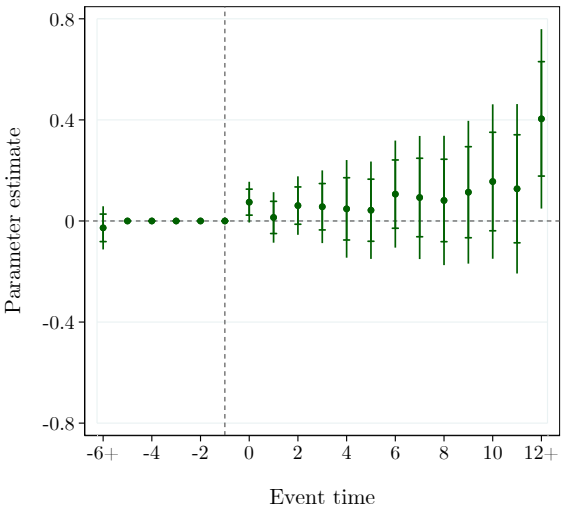
Linear trend: 0.003 (0.005) - Pseudo R-squared: 1.000 - Observations: 1,047,950

(b) Food TVA.



Linear trend: 0.003 (0.008) - Pseudo R-squared: 0.999 - Observations: 1,048,136

(c) Agricultural TVX.



Linear trend: 0.005 (0.008) - Pseudo R-squared: 0.999 - Observations: 1,047,950

(d) Food TVX.

Figure A.2: Event Studies with Pre-trend Adjusted Post-event Estimates.

Note. The figure shows dynamic treatment parameters, 95 percent confidence intervals, and uniform sup-t bands for the event-time coefficients adjusted for linear pre-trends. The regressions account for globalization effects and include both GATT/WTO and RTA effects, but we only report estimates for the GATT/WTO effects. We report the slope and standard error of the linear pre-trend and several Wald tests and regression statistics in each sub-figure note. All standard errors are clustered at the exporter-importer level.

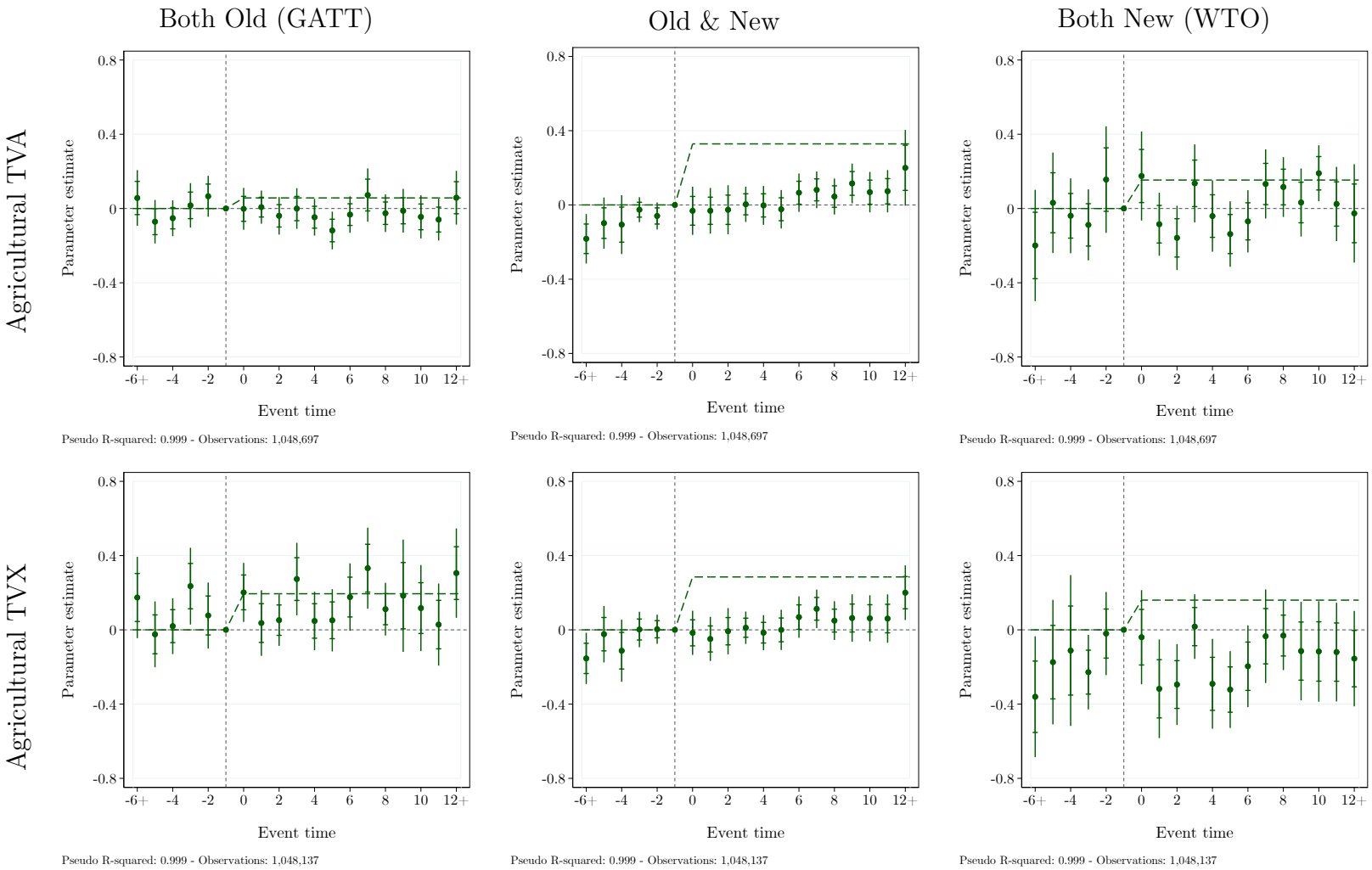


Figure A.3: Event Studies by GATT/WTO Membership Type for Agricultural GVCs Flows.

Note. The figure shows dynamic treatment parameters, 95 percent confidence intervals, and uniform sup-t bands for the event-time coefficients according to the GATT/WTO membership type for agricultural GVCs. We account for globalization effects and include both GATT/WTO and RTA effects in the regressions but only report estimates for the GATT/WTO effects. We report several Wald tests and regression statistics in each sub-figure note and overlay static estimates as dashed lines. All standard errors are clustered at the exporter-importer level.

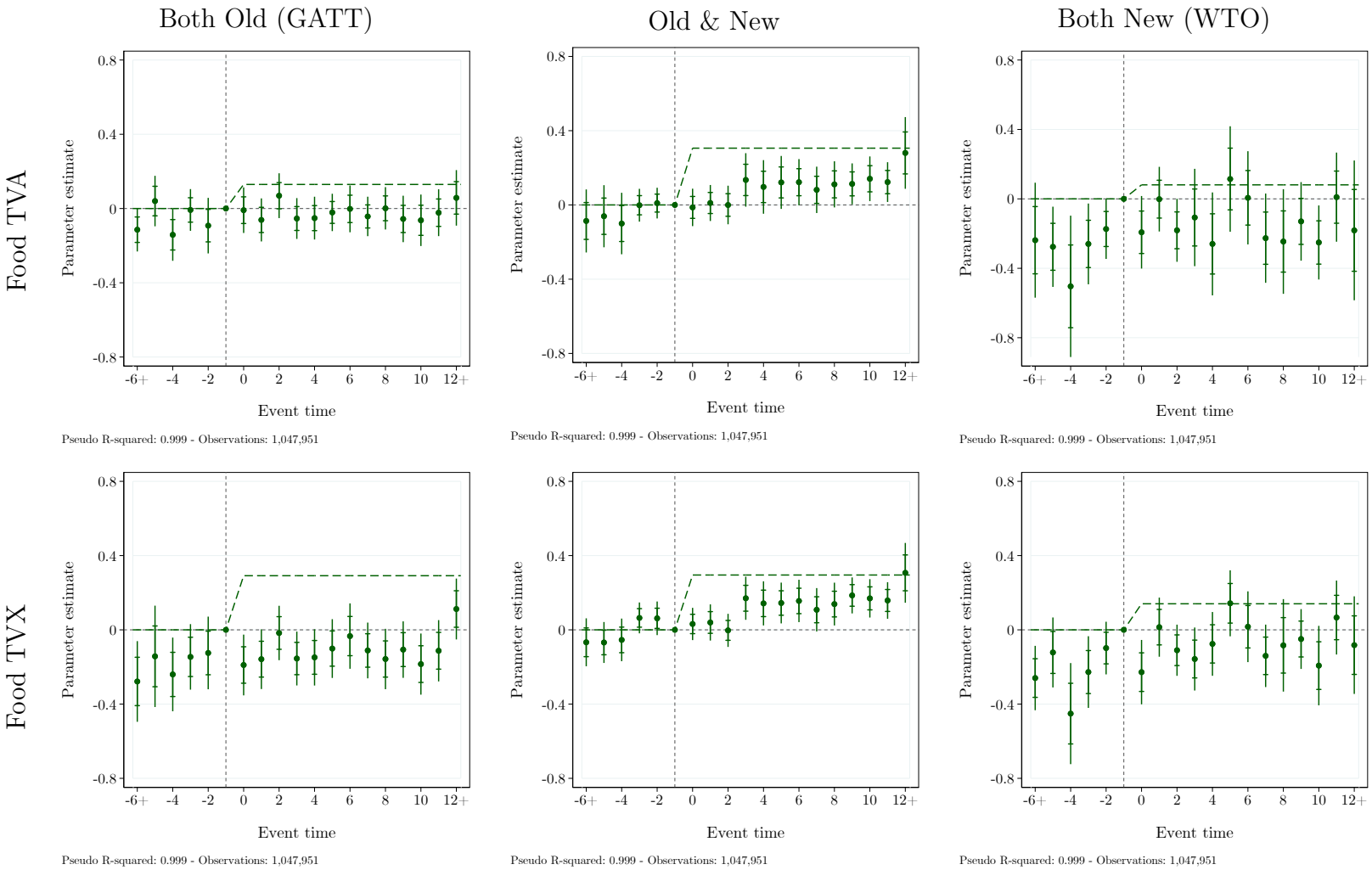


Figure A.4: Event Studies by GATT/WTO Membership Type for Food GVCs Flows.

Note. The figure shows dynamic treatment parameters, 95 percent confidence intervals, and uniform sup-t bands for the event-time coefficients according to the GATT/WTO membership type for food GVC integration. We account for globalization effects and include both GATT/WTO and RTA effects in the regressions but only report estimates for the GATT/WTO effects. We report several Wald tests and regression statistics in each sub-figure note and overlay static estimates as dashed lines. All standard errors are clustered at the exporter-importer level.