THE IMPACT OF EU ACCESSION ON AGRICULTURAL TRADE PATTERNS IN CEE COUNTRIES

by

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Abstract

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Following the onset of Russia's full-scale invasion of Ukraine, the European Union introduced Autonomous Trade Measures (ATMs) to support the Ukrainian economy. These measures eliminated tariffs and tariff-rate quotas while leaving non-tariff barriers intact, such as Technical Barriers to Trade (TBT) and Sanitary and Phytosanitary (SPS) measures. However, the resulting trade growth was unevenly distributed across commodity groups. For instance, products like poultry, wheat, and dairy were eventually subjected to tariff quotas due to surging import volumes from Ukraine.

To estimate the impact of full EU integration on Ukraine's agricultural trade patterns, this study examines the historical outcomes of EU accession for Central and Eastern European (CEE) countries. Specifically, were analyzed the effects of EU integration on CEE trade patterns across all 24 agricultural commodity groups at the 2-digit Harmonized System (HS) level, using these empirical insights to forecast Ukraine's external trade.

The gravity model of trade is standard in this literature and this study adopts a novel commodity-level estimation framework of it. This approach incorporates

country-time-commodity fixed effects to account for multilateral resistance and country-pair-commodity fixed effects for bilateral resistance. The empirical results indicate that EU accession increases intra-union agricultural trade by 97% on average. This effect is statistically significant for 17 out of 24 commodity groups, ranging from a 441% surge for Meat & Offal (HS 02) to a 50.3% increase for Processed Vegetables (HS 20).

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AI USE DECLARATION

During the preparation of this thesis, Generative AI (Gemini) was used as a supplementary tool to support grammar correction and improvement of sentence clarity in all chapters of this thesis, and for coding to build figures 1-4 in R.

Any suggestions produced by the AI tool were critically evaluated and substantially modified by the author before being incorporated into the thesis.

The tool was not used to generate research findings, produce literature summaries used directly in the thesis, create citations, or conduct any form of data analysis. All research questions, theoretical framing, methodology, analysis, interpretation of results, and conclusions were developed independently by the author. The author takes full responsibility for the originality, validity, and academic integrity of the work presented in this thesis.

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Chapter 1

INTRODUCTION

Over the last 13 years Ukraine has significantly advanced in its primary goal of joining EU. This, in turn, will open a free access to the Single Market. However, this entry will not come with sole benefits. It requires full alignment with the EU's policies. The agricultural exports stand for 56% in Ukraine (I.Us. NISS. 2026), while it accounts only for 11,7% of annual GDP, which represent the export-oriented approach of local agricultural producers. The industry is expected to be highly influenced by policy alignment, especially the export directions. In 2025, 47,5% (UkrAgroConsult. 2026, February 5) of total agricultural exports from Ukraine went to European Union. This number is lower than the average 50% share during 2022-2024 period, when Autonomous Trade Measures (ATM) were in place. These measures provided Ukraine a duty-free and quota-free access to EU single market. After substitution of it with new DCFTA (European Commission, 2025) in October 29, Ukrainian local producers have reoriented their exports to the countries of Middle East and Southeast Asia (I.Us. NISS. 2026). This step has its own pros and cons in comparison to EU market like lower quality standards but higher contract uncertainty. As we can see, the changes in trade measures have already showed an impact on agricultural export directions.

Within the European single market, the Common Agricultural Policy (CAP), established under Article 38 of the Treaty on the Functioning of the European Union, provides the primary regulatory architecture designed to govern agricultural production and ensure regional food security. The operational instruments of the CAP are deployed through three core pillars: direct income support to producers, comprehensive rural development programs, and market-stabilization measures (O.Nivievskyi 2025). This third pillar is operated via the Common Market

Organisation (CMO), a specialized framework that applies direct regulatory interventions to agricultural markets.

According to EU regulations (European Parliament and Council of the European Union. (2013)), the CMO operates through five primary functional mechanisms: internal market intervention and support systems, including public storage and production volume management; crisis management protocols funded by a dedicated market-stabilization reserve; marketing standards and competition rules (European Commission. (2020)) designed to eliminate unfair commercial practices; specific-sector aid and promotional initiatives; and comprehensive external trade measures. These external trade measures encompass centralized tariff frameworks, export refund mechanisms, and border quality controls. In practice, these marketing standards and external boundary controls intersect directly with international trade agreements, functioning as Technical Barriers to Trade (TBT) and Sanitary and Phytosanitary (SPS) measures that govern product characteristics, consumer safety, and biosecurity at the union's external frontiers. These barriers together represent the trade diversion effect, according to J.Viner theory (1950).

Evaluating the impact of these external trade regulations and market controls is particularly critical when analyzing the long-term trade trajectories of the Central and Eastern European (CEE) states, which represent the most recent completed enlargement waves of the European Union (2004, 2007, and 2013). While traditional trade theory generally predicts net welfare gains driven by internal trade creation following integration into a customs union, the historical record of the CEE accessions demonstrates a complex economic reality characterized by an asymmetric distribution of benefits across product sectors (Martínez-Zarzoso et al., 2020). Preliminary empirical evidence indicates that alignment with CAP mechanisms does not exert a uniform policy shock across agricultural lines. Instead, the framework frequently accelerates trade in high-value, processed goods

such as dairy, animal fats, and prepared meats. While simultaneously introducing structural frictions or regulatory interventions that can suppress traditional, lower-processed exports like primary cereals. What has been concluded from literature review section is that majority of academic papers mainly fail to capture these heterogenous dynamics because it treats agricultural integration as a uniform policy shock, using aggregate trade dataset which masks the divergence between individual commodity groups. A massive trade boom in processed foods can easily hide a sharp decline in primary grain exports. The articles that studied the commodity-specific heterogeneity lack full spectrum of commodities like 6 or 12 out of 24.

Furthermore, early studies on CEE accession frequently relied on standard methodological approaches that are now considered outdated for trade models (Yotov et al. 2016), failing to account for the prevalence of zero trade flows in specific niche markets or effectively control for unobservable multilateral resistances. This research resolves these systemic biases by estimating a high-dimensional structural gravity model estimated via the Poisson Pseudo Maximum Likelihood (PPML) with fixed effects. This disaggregated approach isolates the trade creation and diversion effects of EU membership from broader global trends and inward protectionist barriers across 24 distinct agricultural commodity groups.

Understanding this commodity-specific heterogeneity should narrow the focus of the main sector specific policy integrations regarding implementation of CAP. The rest of the thesis is structured in the following way: Chapter 2 discusses the existing literature tangent to the topic of research and the potential gap, Chapter 3 provides clear description of implemented methodology, Chapter 4 gives the data sources and the transformed final dataset description, Chapter 5 discusses the estimation results finalizing with Chapter 6 that translates results into conclusions and policy implications.

Chapter 2

LITERATURE REVIEW

The economic integration of Central and Eastern European (CEE) countries into the European Union represents one of the most transformative trade events of the post-Cold War era. As Ukraine currently establishes its own policy path toward full EU accession, evaluating the long-term trade implications of the 2004, 2007, and 2013 enlargement waves serves as an essential empirical precedent rather than a purely theoretical exercise. Accordingly, this chapter synthesizes the established literature regarding the macroeconomic and sector-specific impacts of EU accession, with a distinct emphasis on identifying product-level heterogeneity within agricultural trade.

The subsequent review is organized around a methodological narrative that traces the evolution of the econometric frameworks used to assess regional trade integration. The discussion begins by examining the foundational Vinerian concepts of trade creation and trade diversion, alongside alternative univariate and panel frameworks used to observe trade dynamics. Following this overview, the focus shifts to the technical transition in trade literature toward structural gravity modeling. As highlighted by Yotov et al. (2016), the structural gravity equation has become the primary quantitative tool for ex-post international trade policy analysis due to its rigorous microeconomic foundations. Finally, this chapter isolates a critical empirical gap in the existing body of work, establishing the comprehensive theoretical and methodological framework necessary to analyze how alignment with EU market structures systematically redefines agricultural trade patterns across transition economies.

2.1. The Theoretical Foundation of Trade Effects

European integration fundamentally influences the direction of global trade flows via a complex interplay of tariff and non-tariff measures like SPS (Sanitary and Phytosanitary) and TBT (Technical Barriers to Trade). To evaluate the systemic impact of CEE accession, the analysis must begin with the foundational economic theory of regional trade agreements (RTAs) and customs unions. This conceptual framework was established by Jacob Viner (1950), who introduced the dual concepts of trade creation and trade diversion. Viner demonstrated that participation in a customs union does not inherently guarantee welfare maximization. Economic welfare is enhanced only if the agreement induces trade creation by shifting domestic consumption toward more efficient producers within the trade bloc. Conversely, if the agreement merely causes trade diversion by shifting import sources from highly efficient non-member nations to less efficient, tariff-protected member states, net economic welfare is reduced.

Subsequent literature has introduced critical structural nuances to this classic Vinerian dichotomy. First, the trade effects of an agreement are frequently characterized by anticipation dynamics that manifest prior to formal implementation. Magee (2008) demonstrated this phenomenon empirically, calculating that while regional agreements expand trade by a cumulative 1.101 log points, a significant portion of this expansion (0.362 log points) occurs in the preparatory years preceding the active enforcement of the RTA. Second, the vast majority of empirical RTA literature focuses primarily on trade creation effects. This asymmetric focus arises because typical RTA dummy variables equal one when both partners maintain an active agreement and zero otherwise, effectively omitting the mechanisms required to trace external trade diversion. This choice is conceptually logical for basic free trade areas, given that standard RTAs rarely

mandate the imposition of uniform external trade restrictions on third-country partners.

Customs unions and deeply integrated common markets, however, represent a distinct exception because they impose centralized external tariff walls and uniform regulatory standards. Crucially, these Vinerian dynamics do not apply uniformly across an economy. Urata and Okabe (2014) applied a Poisson Pseudo-Maximum Likelihood (PPML) estimator to sector-level gravity models and revealed profound structural contrasts across industries. While the EU meat sector experienced a substantial trade creation coefficient of 1.51, it simultaneously generated a negative trade diversion coefficient of -0.65, demonstrating a severe displacement of third-country trade channels. This sector-level variation emphasizes the necessity of evaluating policy shifts, such as Common Agricultural Policy (CAP) integration, across highly disaggregated commodity groups rather than relying on broad sectoral aggregates.

2.2. Gravity model alternatives

Before stepping in the detailed discussion of gravity model methodology, I would like to examine alternative approaches to measure the effects on trade. Time-series models, such as Autoregressive Integrated Moving Average (ARIMA) and various structural break tests, have been employed to track trade dynamics over time. For example, V.Matskul et al. (2019) utilized Box-Jenkins additive models to predict the trade balance between Ukraine and the EU, uncovering structural trade deficits ranging from -100 to -400 million USD. In this study they found that while classical time-series models could forecast dynamics by decomposing trends, seasonality and random noise, more complex methods like Automated Neural Networks showed poor prognostic ability for short dynamic series. While useful for

forecasting, predicting what will happen based on past values, still cannot explain why trade patterns shift in response to specific policy interventions like CAP alignment.

Similarly, Ketenci (2016) employed the Bai and Perron tests to detect structural breaks in the trade balances of the EU. The study detected breaks in export and import demand functions, confirming that structural changes occurred. The catch is that a break in the timeline is not proof of causality. A spike in 2004 might look like EU effect, but it could simply be a reaction to global prices. Hegerty (2022) proved this ambiguity when analyzing the Baltics. He found that the majority of 'structural breaks' in the data didn't even align with events like the EU accession, financial crisis or Euro adoption. This proves that while the methodology is good at flagging changes, it lacks the nuance to separate policy impacts from external noise. Morina et al, (2020) utilized panel data regression to estimate the inflation, exchange rate volatility and interest rate effects on economic growth of CEE countries and found them to be negative and significant. A we can see, simple ARIMA model forecasting trade volumes would fail to measure the impact of such significant events as the panel regression, leading to omitted variable bias where changes in trade caused by currency fluctuations might be erroneously attributed to trade or monetary policy.

2.3. Gravity model and the evolution of methodology

One of the most widespread methods to quantitatively estimate the effects on trade is the gravity model, which was developed by Jan Tinbergen (1962). He stated that trade between two countries is proportional to their economic mass and inversely proportional to the distance between them, resembling the law of gravity force. And indeed, his estimation results were aligned with expectations and statistically

significant. However, when comparing predictions of his model and actual trade volumes, he found high discrepancy, indicating an omitted variable bias. Later researchers tried to close this gap by introducing the dummy variables of common border, language or other trade hindrances proxies. Still, there were some cases of overestimation results due to omitted variables as explained James Anderson et al (2003). He and van Wincoop (2003) famously solved the "border puzzle." They proved mathematically that bilateral trade is dictated not just by the absolute barriers between two countries, but by their relative barriers compared to the rest of the world. They termed this "multilateral resistance." Failing to account for multilateral resistance became known as the "Gold Medal Mistake" of trade econometrics (Yotov et al., 2016).

This revelation triggered a rapid evolution in how gravity models were estimated. Initially, researchers used simple dummy variables without proper accounting the multilateral resistances (Anderson and van Wincoop, 2003). Later, Christofer Macgee (2008) estimated several variants of gravity model, where he switched between standard gravity variables such common language, being a colony and GDP, and the fixed effects of multilateral and bilateral resistances. He demonstrated that fixing country-time effects increased R squared by 19% from 0.62 to 0.74 and the cumulative RTAs effect dropped from 0,621 to 0,147 supporting the results of J.Anderson and van Wincoop (2003). The fixation of the country-pair effects (or the bilateral resistances) resulted in R-squared of 0,802 and the cumulative effect of RTAs reduced from 0,621 to only 0,467. The results of C.Magee (2008) indicate that the multilateral resistances absorb the majority of the trade effect of having an RTA.

While country-time fixed effects theoretically solve the multilateral resistance problem, they create a hidden empirical trap (Hornok 2012). She warns that these fixed effects act as a restrictive filter, netting out too much unilateral data variation.

Because they absorb all importer and exporter characteristics, distinguishing mutual club membership from unilateral policy changes becomes impossible due to perfect collinearity. Consequently, these unilateral effects "mirror" themselves, yielding estimates that are mere multiples of the same vector by a factor of 1, -1, or -2. This ultimately blinds the gravity model to specific regional agreement impacts. C.Hornok (2012) recommended to exand the dataset by adding the outsider-outsider or insider-insider bilateral trade data. Still, Yotov et al. (2016) and Jackson and Shepotylo (2024), insists on a high-dimensional fixed-effects structure. Jackson and Shepotylo (2024) proved that combining country-pair fixed effects (to control for historical and political ties) with reporter-time and partner-time fixed effects (to capture macroeconomic shocks) is the only way to cleanly isolate policy impacts. Using this exact structure, they quantified that a geopolitical shock, such as the disintegration of NATO, would trigger a 12.46% drop in EU exports.

The final pieces of the gravity puzzle were handling zero trade flows and the necessity of disaggregation. Standard logarithmic OLS models had to drop zero-trade observations, blinding them to niche commodity dynamics. The adoption of the Poisson Pseudo-Maximum Likelihood (PPML) estimator cured this, seamlessly handling zeros and heteroskedasticity (Yotov et al., 2016). Furthermore, Chen and Novy (2009) proved that treating trade costs as a uniform blanket across an economy is a fiction. They demonstrated that while the aggregate coefficient for distance might be -3.589, industry-specific estimations yield wide variances, ranging from -4.204 to -4.653. Trade barriers are intensely heterogeneous; thus, the story of integration must be told at the disaggregated commodity level.

2.4. The impact of CEE accession and agricultural trade heterogeneity

Understanding the empirical methodologies and inherent challenges of measuring policy effects provides essential context for analyzing the economic integration of post-Soviet Central and Eastern European (CEE) states into the European Union. Prior to the Eastern enlargements, expectations regarding trade expansion were substantial. Applying a gravity model framework, Nilsson (2000) estimated that Poland's potential trade volume with the EU stood at 51,235 million USD, compared to an actual baseline volume of 40,487 million USD. This indicated a trade potential ratio of approximately 1.27, suggesting significant room for trade deepening prior to official integration.

Subsequent ex-post empirical studies confirmed substantial trade expansion following accession, validating those initial expectations but revealing nuanced underlying mechanics. Bussière, Fidrmuc, and Schnatz (2005) supported baseline gravity model assumptions by reporting economic size coefficients ranging between 0.562 and 0.928. Similarly, Cieślik, Michałek, and Mycielski (2012) demonstrated that early regional agreements, such as the Central European Free Trade Agreement (CEFTA), significantly stimulated trade flows, with coefficients between 0.276 and 0.322. However, they noted that formal entry into the Exchange Rate Mechanism II (ERM II) yielded statistically insignificant trade effects during the initial implementation periods.

Beyond these broad aggregate effects, the directional trajectory of post-enlargement trade patterns presented unexpected dynamics. Hornok (2010) identified a distinct pattern in the post-2004 expansion, observing that the most pronounced growth manifested as a resurgence in bilateral trade among the new entrant states themselves (East-East trade or Entrant-Entrant), which experienced a 14% overall acceleration. Following formal accession, Jambor A. (2014) found

that EU membership exerted a statistically significant positive trade effect, reporting a general policy coefficient of 0.038 and a New Member State dummy between 0.062 and 0.097, which specifically fostered vertical intra-industry trade. This structural deepening occurred despite tendencies highlighted in peripheral literature regarding export composition, such as the initial concentration of CEE nations in lower-processed or lower-quality agricultural and food products (Łapińska, 2014).

More recent retrospective literature emphasizes that these macroeconomic gains were distributed unevenly across the acceding economies, leading to localized differences in performance. Jambor and Gorton (2025) demonstrate that the region fractured into distinct convergence clubs based on how effectively domestic institutions implemented EU regulations and capitalized on market opportunities. The Baltic states of Estonia, Latvia, and Lithuania, alongside Poland, emerged as highly successful adaptors, leveraging Single Market access to modernize agricultural infrastructure and expand processing capabilities. In contrast, countries such as Slovenia and Croatia progressed at a slower rate, remaining within a lower-speed convergence trajectory. This institutional divergence helps explain the broader heterogeneity observed in trade outcomes, complementing established commodity-level variations.

This performance variance raises the question of whether the underlying agricultural markets demonstrate a parallel split between high-value processed goods and raw commodities. To add depth to this picture, Martínez-Zarzoso et al. (2020) examined international production networks using difference-in-differences and gravity analyses. Their findings revealed that the 2004 enlargement expanded bilateral trade in final goods by 28%, compared to a 24% increase for intermediate products. These outcomes support the hypothesis that a reduction in behind-the-border trade barriers facilitates the exchange of final value-added goods more

effectively than intermediate inputs, which is critical for designing value-added agricultural strategies, such as those currently under consideration for Ukraine.

The integration of these transitioning, fragile agricultural sectors into the Common Agricultural Policy (CAP) and the Common Market Organisation (CMO) represented a substantial regulatory and economic shift. Using partial equilibrium simulations, Münch (2002) accurately anticipated these pressures, forecasting that price alignment under CAP market guarantees could incur up to 15 billion EUR in budgetary outlays while driving CEE cereal net exports to approximately 24.198 million tons by 2008. This sudden shift underscored the structural friction involved when merging developing agricultural structures into a highly protected, subsidized framework.

Evaluating these agricultural outcomes requires balancing internal trade expansion against external distortions, an analytical perspective rooted firmly in Vinerian trade theory. Jacob Viner's (1950) original framework posits that the formation of a customs union induces a trade-off between trade creation among members and trade diversion away from more efficient non-members. The most relevant methodological template for capturing these dynamics is the work of Sarker and Jayasinghe (2007). Unlike general CEE trade studies, Sarker and Jayasinghe uncovered granular details that aggregate models tend to miss, demonstrating that while EU integration accelerated internal trade creation, it caused trade diversion across five of the six agri-food commodities examined. For instance, internal trade in red meat surged due to preferential policy support, while external imports decreased. Conversely, oilseeds resisted this trend, maintaining steady third-country import volumes due to the EU's low external boundary protections for that specific product group.

This pattern of structural trade diversion in sensitive sectors is heavily corroborated by recent retrospective studies of the fifth enlargement. Utilizing a fixed-effects Poisson Pseudo-Maximum Likelihood (FE-PPML) estimator across 12 agri-food categories, Zolin and Uprasen (2018) observed robust internal trade creation for live animals (0.368) and cereals (0.159). However, they also identified severe negative import coefficients from third countries in heavily protected categories, including cereals (-0.152), feedstuffs (-0.097), and sugars (-0.150). These estimates indicate that while the CAP effectively institutionalized and expanded trade among its new Eastern members, it simultaneously created significant trade barriers for non-member agricultural competitors, establishing a critical empirical precedent for ongoing expansion frameworks.

2.5 Analyzing specific gap

This evolving body of literature outlines a clear framework regarding the macroeconomic trade effects of European integration. The overarching theoretical principles of trade creation and diversion are well established, and empirical applications have been significantly advanced by the utilization of the Poisson Pseudo-Maximum Likelihood (PPML) structural gravity model incorporating high-dimensional fixed effects. Consequently, while the aggregate trade dynamics of Central and Eastern European integration are well documented, the disaggregated sector-level impacts require further empirical clarification, particularly within agriculture.

A primary limitation of existing literature stems from the high level of product aggregation used in past studies, which often obscures specific regulatory impacts. For instance, Sarker and Jayasinghe (2007) restricted their analysis to six broad commodity groups and did not account for the specific post-Soviet transition

dynamics of the CEE states. Although Zolin and Uprasen (2018) expanded their scope to twelve agricultural product groups, their model did not capture the full granularity of product-specific trade barriers and included potentially redundant bilateral resistance controls. This lack of disaggregation is problematic because the Common Agricultural Policy (CAP) do not regulate the agricultural sector as a single entity. Instead, the framework imposes highly differentiated policy instruments across commodities, such as localized quotas for dairy, intervention price mechanisms for grains, and specific external tariffs for animal fats. Under high aggregation, substantial export expansions in a highly protected sector can easily mask localized structural declines in primary commodity markets within the same economy.

Accordingly, the empirical gap this research addresses centers on analytical resolution and commodity-level methodology. By applying the standardized structural gravity specifications with fixed effects proposed by Yotov (2016) and applied by Jackson and Shepotylo (2024), this thesis evaluates twenty-four highly disaggregated agricultural commodity groups across the CEE acceded states. This disaggregated approach aims to isolate how specific CAP mechanisms modified the agricultural comparative advantages of these transition economies. Ultimately, the analysis identifies which product markets experienced net expansion as a result of policy alignment, and which primary or non-member sectors faced increased market insulation.

Chapter 3

METHODOLOGY

As have been concluded earlier, this research will focus on gravity model with accounting for commodity level data. Here I would like to describe how the econometric model specification, used in estimation, was derived from structural gravity model. The structural gravity equation from Yotov et al. (2016) is defined as (1):

$$X_{ij,t}^{k} = \frac{Y_{i,t}^{k} E_{j,t}^{k}}{Y_{t}^{k}} \left(\frac{t_{ij,t}^{k}}{P_{j,t}^{k} \Pi_{i,t}^{k}} \right)^{1-\sigma_{k}} \quad (1)$$

Where:

i – exporter;

j – importer;

t – period;

k – commodity;

$X_{ij,t}^{k}$- export trade volumes of exporter *i* to importer *j* in period *t* of commodity *k*;

$\Pi_{i,t}^{k}$– exporter *i* outward multilateral resistances of commodity *k* in year *t*;

$Y_{i,t}^{k}$– exporter *i* aggregate domestic production of commodity *k* in year *t*;

Y_{t}^{k}– world aggregate domestic production of commodity *k* in year *t*;

$E_{j,t}^{k}$– importer *j* aggregate domestic expenditure on commodity *k* in year *t*;

$P_{j,t}^{k}$ – importer *j* inward multilateral resistances of commodity *k* in year *t*;

σ_k – the trade elasticity of substitution of commodity k;

$t_{ij,t}^{k}$ – the bilateral trade costs from country i to j in period t per commodity group k;

While early studies often linearized the gravity equation using natural logarithms and estimated it via Ordinary Least Squares (OLS), this approach is unsuitable for disaggregated agricultural trade for two reasons:

First, logarithmic transformations cannot account for zero trade flows, as these observations are systematically dropped from the estimation sample (Yotov et al. 2016). This issue is particularly problematic because the presence of zero trade flows becomes increasingly pronounced the more disaggregated the trade data are, which is highly characteristic of commodity-level agricultural trade.

Second, trade data are intrinsically plagued by heteroscedasticity. When heteroscedasticity is present, estimating a log-linearized gravity equation via OLS violates Jensen's inequality (Yotov et al. 2016), leading to estimates of trade costs and policy effects that are not only biased but strictly inconsistent.

To definitively resolve both of these issues, this research applies the Poisson Pseudo Maximum Likelihood (PPML) estimator, which evaluates the structural gravity equation in its native multiplicative form rather than a linearized logarithmic state. The PPML estimator naturally incorporates zero trade flows and remains robust and consistent in the presence of heteroscedasticity.

Furthermore, properly estimating the structural gravity model requires translating theoretical variables such as unobservable multilateral resistances into an econometric specification. Failing to properly control for multilateral resistances has been characterized in the literature as the "Gold Medal Mistake" of gravity estimation (Yotov et al. 2016). In the work of Shepotylo et al. 2024, they also used

the bilateral country-pair fixed effects to control for historical and long-run political factors that shape bilateral relationships. Therefore, following the best practices of structural gravity estimation, the theoretical variables of the structural model are systematically absorbed by a high-dimensional fixed-effects structure.

In this research, the transition from the theoretical structural gravity equation to this specific econometric model is achieved through the use of three distinct variables of fixed effects, which absorb the structural elements as follows:

$P_{j,t}^{k}$ Importer-Time-Commodity Fixed Effects: These fixed effects strictly absorb the unobservable inward multilateral resistances as well as the importer's aggregate domestic expenditure on the commodity *k*. They also account for any other time-varying, destination-specific characteristics, such as domestic consumption policies or aggregate demand shocks.

$\Pi_{i,t}^{k}$ Exporter-Time-Commodity Fixed Effects: These fixed effects entirely absorb the unobservable outward multilateral resistances, the exporter's aggregate domestic production $Y_{i,t}^{k}$, and the world aggregate domestic production Y_{t}^{k}. This comprehensively controls for any time-varying, source-country specific factors like aggregate supply capacity or domestic subsidies.

χ_{ij}^{k} Country-Pair-Commodity Fixed Effects: This dummy variable corresponds to the bilateral trade costs in the structural gravity model $t_{ij,t}^{k}$ of exporting commodity k from country i to country j in period t. By grouping data at the specific bilateral pair and commodity level, this term acts as the most flexible and comprehensive measure of time-invariant bilateral trade costs (Shepotylo et al. 2024). Because it absorbs all time-invariant bilateral frictions (such as geographical distance, shared borders, and historical ties), standard gravity proxy variables are no longer required in the equation. Pair fixed effects account for the potential endogeneity of trade

policies by absorbing the unobservable linkages between the policy variables and the error term.

By allowing the fixed effects to absorb the structural country-level sizes and multilateral resistances, the model is perfectly calibrated to isolate the specific impact of the time-varying trade policy shock of EU accession. Finally, the specification includes an error clustering parameter. Because the dataset is a panel observing the same pairs of countries trading the same commodities repeatedly over time, intra-cluster correlations naturally arise. Clustering standard errors at the country-pair-commodity level must prevent from the potential serial correlation and ensure the statistical validity of the estimated policy coefficients.

This leads us to the basic econometric model specification to estimate the impact of EU accession on agricultural trade of Central and Eastern European countries:

$$X_{ij,t}^{k} = exp\left[\Pi_{i,t}^{k} + P_{j,t}^{k} + \chi_{ij}^{k} + EU_{both} \right] \times \epsilon_{ijtk} \qquad (2)$$

The estimation of this model (1) gives the single coefficient of EU membership impact on the agricultural trade patterns in CEE countries. This model measures the impact of the presence of both exporter and importer in European Union on the export volumes $X_{ij,t}^{k}$. This notion is vital to understand that the coefficient will show the change in trade of intra-EU in comparison to others. In this case, treatment observations also include the trade of EU15-EU15, that are not the target of this research. Still, they will not influence the estimate since they will be treated as time-invariant country-pair fixed effects.

To understand the separate effect on each single commodity group, the interaction term should be implemented. For this case we expanded the model (1) in the model (2):

$$X_{ij,t}^{k} = exp\left[\Pi_{i,t}^{k} + P_{j,t}^{k} + \chi_{ij}^{k} + EU_{both} \times Commodity \right] \times \epsilon_{ijtk} \qquad (3)$$

There are also some articles that discuss the Trade Creation and Trade Diversion effects of joining the customs union. Originally these variables were proposed by J.Viner in his Customs Union Issue from 1950 (J.Viner 1950). The Trade Creation is defined as the increase in the intra-union exports from new members due to the elimination of trade barriers. While Trade Diversion is the decrease in the imports of new members from the non-union members. This is explained by the inward protection of the union by setting additional tariff and non-tariff barriers to secure the internal market. We designed the variables in the following way: trade export creation is equal to 1 if the exporter is the CEE country and the exporter with importer are both in EU, otherwise it is 0. The trade import diversion is equal to 1 if the importer is CEE country and part of EU, and the importer is outside the EU, otherwise it is 0. For studying such effects, we set up the model (3) for single effects and model (4) for commodity-specific effects:

$$X_{ij,t}^{k} = exp\left[\Pi_{i,t}^{k} + P_{j,t}^{k} + \chi_{ij}^{k} + Td_{Creation} + Td_{Diversion} \right] \times \epsilon_{ijtk} \qquad (4)$$

$$X_{ij,t}^{k} = exp\left[\begin{matrix} \Pi_{i,t}^{k} + P_{j,t}^{k} + \chi_{ij}^{k} + Td_{Creation} \times Commodity + \\ + Td_{Diversion} \times Commodity \end{matrix} \right] \times \epsilon_{ijtk} \qquad (5)$$

The CEE countries underwent significant preparations and had a plenty of years to align their legislations with EU requirements. During this transition period, CEE countries developed Free Trade Agreements and Economic Integration Agreements with EU. They were implemented 7-12 years prior to accession. After accession CEE countries implemented the CUEIA (Customs Union and Economic Integration Agreement by WTO classification). However, it shows the perfect correlation with variable EU_Both, therefore the latter will be included in the next models. The trade agreement variable FTAEIA is defined the following way: 1 if the exporter is CEE country and importer is EU member with active bilateral FTAEIA_CEE with exporter, or the importer is the CEE country and exporter is EU member with active FTAEIA with importer, otherwise 0. We also account the increase in exports from EU to the CEE countries after implementation FTAEIA. The possible combination of having the bilateral FTAEIA and one of the countries is not a CEE or EU member is excluded (false positive).

To study their effects separately, we have constructed the next two models for single effects (5) and for commodity-specific effects (6):

$$X_{ij,t}^{k} = exp\left[\Pi_{i,t}^{k} + P_{j,t}^{k} + \chi_{ij}^{k} + EU_{both} + FTAEIA_{CEE}\right] \times \epsilon_{ijtk} \qquad (6)$$

$$X_{ij,t}^{k} = exp\left[\begin{matrix}\Pi_{i,t}^{k} + P_{j,t}^{k} + \chi_{ij}^{k} + EU_{both} \times Commodity + \\ + FTAEIA_{CEE} \times Commodity\end{matrix}\right] \times \epsilon_{ijtk} \qquad (7)$$

The suggested models were summarized below in the Table 1.

Table 1.The summary of estimated models using PPML

Model	Purpose	Key Independent Variables	Fixed effects
Model 1	Estimation of aggregate trade effects from EU accession.	EU_both	$\Pi i,tk+Pj,tk+\chi ijk$
Model 2	Estimation of commodity-specific trade effects from EU accession.	$EU_both \times Commodity$	$\Pi i,tk+Pj,tk+\chi ijk$
Model 3	Estimation of single trade creation and diversion effects.	$Td_Creation+Td_Diversion$	$\Pi i,tk+Pj,tk+\chi ijk$
Model 4	Estimation of commodity-specific trade creation and diversion effects.	$Td_Creation \times Commodity + Td_Diversion \times Commodity$	$\Pi_{i,t}^{k} + P_{j,t}^{k} + \chi_{ij}^{k}$
Model 5	Estimation of single effects between pre-accession agreements (FTAEIA) and EU accession.	$EU_both + FTAEIA_CEE$	$\Pi_{i,t}^{k} + P_{j,t}^{k} + \chi_{ij}^{k}$
Model 6	Estimation of commodity-specific effects between FTAEIA and EU accession.	$EU_both \times Commodity + FTAEIA_CEE \times Commodity$	$\Pi_{i,t}^{k} + P_{j,t}^{k} + \chi_{ij}^{k}$

Chapter 4

DATA

4.1. Data Sources

In order to estimate the commodity-level model I relied on a highly disaggregated dataset of agricultural trade flows from the United Nations Comtrade database (comtradeplus.un.org). The data was iteratively collected using the Harmonized System (HS) classification, with focusing specifically on annual bilateral trade flows (both imports and exports) of goods.

In the downloaded data the reporters were selected as the 12 CEE countries: Poland, Czechia, Cyprus, Hungary, Latvia, Lithuania, Slovakia, Slovenia, Bulgaria, Romania, Croatia, and Estonia. To capture multilateral resistances fixed effects into the global economy, the partner scope was set to "All" (the rest of the world), so we are able to separate the commodity trades by partner. The timeframe spans a 29-year period from 1990 to 2019, which accounts for pre- and post-accession phases of the 2004, 2007 and 2013 EU enlargements. At first the disaggregation level was agreed to be set to the first 2-digit HS codes, the extracted data was restricted to the 24 distinct commodity groups covering agricultural and food products, so to analyze the scope of the EU agricultural external and internal trade policy. Due to the massive size of the disaggregated data and the constraints of standard free UN Comtrade accounts, the raw data was downloaded in separate batches before being merged into a single comprehensive panel.

The dataset of bilateral trade agreements was downloaded from "Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008).

4.2. Dataset Transformation

When the CEE countries joined the European Union, they underwent a structural shift, abandoning their individual national trade policies to adopt the EU's Common Market Organization and Customs Union. This transition involved two simultaneous mechanisms: eliminating internal tariffs with other EU members, and creating a common external tariff wall against third-party nations. Moreover, the structure of the initial dataset included the reporter-reporter-flow format, which was then transformed in exporter-importer format. When there were duplicates of the same exporter-importer-year pair, the one with flow equals to import was selected, since imports are usually recorded more accurately.

4.3. Data Overview and Descriptive Statistics

After the performing merging, cleaning, and transformation processes, the resulting dataset had 553 325 observations. A structural overview of the categorical data shows that the panel has exactly zero missing or NA values across the key identifiers. The dataset includes exactly 24 distinct HS commodity groups, 255 unique exporting countries and their territories, and 254 unique importing countries and their territories.

The dataset descriptive statistics is represented in Table 2 below. Speaking about the dummy variables, EU_both represents the average of 22,1% were between countries, that were EU members in the that year. FTAEIA_CEE shows only 8,8% of trade between CEE country and EU members with active FTAEIA agreement. Trade Creation represents that 13,6% of trade in our dataset is the exports of CEE

countries to EU after accession, while trade diversion shows 21,4% where there was an import from non-EU country to CEE after their accession.

Table 2. Descriptive statistics of main variables of the dataset used for estimations

Column	mean	median	min	max
Year	2007.5	2008	1990	2019
Trade	3030802.3	102542	0.12	1.18E+09
IS_EUjoin_exp	0.480	0	0	1
IS_EUjoin_imp	0.475	0	0	1
EU_both	0.221	0	0	1
rta	0.541	1	0	1
fta	0.144	0	0	1
cueia	0.234	0	0	1
ftaeia	0.154	0	0	1
Td_Creation	0.136	0	0	1
Td_Diversion	0.214	0	0	1
FTAEIA_CEE	0.088	0	0	1

The superposition of mean and median year of 2008 indicates the uniformly distributed data. The average Trade volume of single commodity group was 3,030M USD, while its median is 30 times smaller and equal to 102,5 thousand USD. This means that the majority of our data is centered around 100 000 USD per country pair-year commodity with heavy tails reaching up to 1,18 billion USD.

Chapter 5

ESTIMATION RESULTS

5.1. Single effect estimation results

The estimation results of the model (1) show a positive and highly significant effect of EU membership on agricultural trade. Significant coefficient for EU_both of 0,680 suggests that intra-EU trade volumes increase substantially compared to non-member pairs (see Table 3 below).

Table 3. Estimation results of the single effect models (1), (3) and (5)

	Model 1	**Model 3**	**Model 5**
Dependent Var.:	Trade	Trade	Trade
EU_both	0.680***		0.646***
	(0.061)		(0.067)
Trade Creation		0.280***	
		(0.055)	
Trade Diversion		-0.645***	
		(0.071)	
FTAEIA_CEE			-0.038
			(0.041)
Fixed-Effects:			
exporter-year-commodity	Yes	Yes	Yes
importer-year-commodity	Yes	Yes	Yes
exporter-importer-commodity	Yes	Yes	Yes
S.E.: Clustered	by: exp..	by: exp..	by: exp..
Observations	506,520	506,520	506,520
Squared Cor.	0.97449	0.97455	0.97449
Pseudo R2	0.96248	0.96252	0.96249
BIC	2.77e+11	2.77e+11	2.77e+11

The next model (3) results demonstrate that both variables are statistically significant and their signs are aligned with predictions and Customs union theory. Trade creation coefficient of 0,280 is significant and confirms that EU membership indeed favor increase in exports of CEE countries to the members on average by 32,31%. While trade diversion with the same level of significance has even larger magnitude of impact on imports from non-EU members, the estimate is -0,645 and significant. This corresponds to 47,53% of decrease of non-EU imports to CEE countries after accession indicating strong protectionism and implementation tariff and non-tariff measures, exactly the function of CAP.

The model (5), in turn, showed no significant effect of presence Free trade and economic integration agreement prior to full EU accession. The coefficient of FTAEIA_CEE is -0.038, that suggests no impact on the agricultural trade stimulation as from full CAP alignment and membership.

5.2. Commodity-Specific estimation results

The commodity-specific externalities of the previous 3 single-effect models already reveal that the EU-membership effect is not uniform across different commodity groups, supporting the initial hypothesis of this research.

Below I will discuss the results of each model separately (models 2,4 and 6) that are represented in Table 4 below. The coefficients of model two represent the scale by how far accession to the EU increased bilateral trade with new members, encompassing both imports and exports. Out of twenty-four commodities, seventeen show statistically significant estimates for the EU_both variable, supporting the initial hypothesis. The magnitude of this effect can be clustered into three distinct groups: a high-impact group with estimated coefficients above 1.0, a

medium-impact group with coefficients ranging from 0.50 to 0.99, and a low-impact group with coefficients below 0.50.

Table 4. Estimation results of the commodity-specific effect models (2), (4) and (6)

Commodity Code	Commodity Description	Model 2	Model 4		Model 6	
		EU_both	Trade Creation	Trade Diversion	EU_both	FTAEIA_CEE
1	Animals; live	1.071*** (0.251)	0.764** (0.260)	-0.411 (0.329)	1.334*** (0.279)	0.210 (0.162)
2	Meat and edible meat offal	1.689*** (0.314)	0.640** (0.232)	-2.237*** (0.362)	1.611*** (0.344)	-0.082 (0.200)
3	Fish and crustaceans, molluscs and other aquatic invertebrates	0.908** (0.277)	-0.418 (0.254)	-1.426*** (0.266)	0.602. (0.357)	-0.334* (0.140)
4	Dairy produce; birds' eggs; natural honey; edible products of animal origin,	1.001*** (0.209)	0.639*** (0.175)	-0.914*** (0.245)	0.971*** (0.242)	-0.036 (0.132)
5	Animal originated products; not elsewhere specified or included	-0.050 (0.196)	-0.577. (0.349)	-0.010 (0.212)	0.425 (0.301)	0.481* (0.204)
6	Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage	0.855*** (0.187)	-0.386* (0.167)	-1.070*** (0.182)	0.514** (0.199)	-0.329** (0.115)
7	Vegetables and certain roots and tubers; edible	0.415** (0.145)	0.036 (0.142)	-0.562*** (0.148)	0.422* (0.186)	0.007 (0.152)
8	Fruit and nuts, edible; peel of citrus fruit or melons	1.128*** (0.175)	0.535* (0.263)	-1.006*** (0.190)	1.123*** (0.193)	-0.005 (0.100)
9	Coffee, tea, mate and spices	0.564** (0.178)	0.283 (0.339)	-0.539** (0.192)	0.531. (0.280)	-0.037 (0.232)

Table 4 – Continued

Commodity Code	Commodity Description	Model 2	Model 4		Model 6	
		EU_both	Trade Creation	Trade Diversion	EU_both	FTAEIA_CEE
10	Cereals	0.830*** (0.217)	0.376. (0.195)	-0.854* (0.353)	0.880** (0.272)	0.060 (0.194)
11	Products of the milling industry; malt, starches, inulin, wheat gluten	0.974*** (0.281)	0.164 (0.216)	-0.787** (0.294)	0.865* (0.351)	-0.139 (0.238)
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, industrial or medicinal plants; straw and fodder	0.305 (0.190)	0.019 (0.218)	-0.491** (0.185)	0.549* (0.251)	0.282. (0.164)
13	Lac; gums, resins and other vegetable saps and extracts	0.546* (0.223)	0.157 (0.317)	-0.529* (0.229)	0.573. (0.299)	0.032 (0.200)
14	Vegetable plaiting materials; vegetable products	0.689 (0.474)	0.391 (0.551)	-0.786. (0.435)	0.943. (0.511)	0.319 (0.253)
15	Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes	0.470* (0.223)	0.599* (0.293)	-0.174 (0.228)	0.587* (0.283)	0.139 (0.165)
16	Meat, fish or crustaceans, molluscs or other aquatic invertebrates; preparations thereof	0.863*** (0.178)	0.405* (0.177)	-0.795*** (0.198)	0.741*** (0.204)	-0.146 (0.125)
17	Sugars and sugar confectionery	0.551* (0.258)	0.345. (0.195)	-0.261 (0.270)	0.247 (0.249)	-0.305 (0.193)
18	Cocoa and cocoa preparations	0.069 (0.167)	-0.022 (0.179)	-0.052 (0.213)	0.262 (0.196)	0.213 (0.168)

Table 4 – Continued

Commodity Code	Commodity Description	Model 2	Model 4		Model 6	
		EU_both	Trade Creation	Trade Diversion	EU_both	FTAEIA_CEE
19	Preparations of cereals, flour, starch or milk; pastrycooks' products	0.192. (0.109)	0.208. (0.109)	0.002 (0.129)	0.085 (0.144)	-0.116 (0.120)
20	Preparations of vegetables, fruit, nuts or other parts of plants	0.408** (0.129)	0.119 (0.109)	-0.564*** (0.137)	0.239 (0.152)	-0.188* (0.095)
21	Miscellaneous edible preparations	0.193 (0.138)	0.130 (0.110)	-0.254. (0.154)	-0.012 (0.154)	-0.234* (0.107)
22	Beverages, spirits and vinegar	0.780*** (0.167)	0.269 (0.197)	-0.614** (0.189)	0.600** (0.206)	-0.210 (0.147)
23	Food industries, residues and wastes thereof; prepared animal fodder	0.792. (0.432)	0.146 (0.334)	-0.693 (0.505)	0.862* (0.433)	0.076 (0.264)
24	Tobacco and manufactured tobacco substitutes	0.631* (0.292)	0.278 (0.442)	-0.777* (0.352)	0.920** (0.357)	0.353 (0.292)

The first cluster consists of commodities that experienced the most substantial increase in bilateral trade. This group includes live animals (HS 01) with a coefficient of 1.071, representing a 191.8% increase in bilateral trade between Central and Eastern European countries and the EU15. Meat and edible meat offal (HS 02) shows the largest effect within this category, with a significant estimate of 1.689, which translates to a 441.4% increase. Dairy produce, birds' eggs, natural honey, and edible products of animal origin (HS 04) also fell into this tier with an estimate of 1.001, reflecting a 172.1% increase, while the final commodity in this

high-impact cluster is edible fruit and nuts (HS 08), yielding a coefficient of 1.128, or a 208.9% increase.

The medium-impact group is led by products of the milling industry, malt, starches, inulin, and wheat gluten (HS 11), with an estimate of 0.974, indicating a 164.8% trade expansion. This is followed closely by fish and crustaceans, molluscs, and other aquatic invertebrates (HS 03), which has a coefficient of 0.908, representing a 147.9% increase. Several processed and prepared food categories also fall within this bracket, such as preparations of meat or fish (HS 16) with a highly significant coefficient of 0.863, live trees and plants (HS 06) at 0.855, and cereals (HS 10) at 0.830. The remaining commodities in this cluster demonstrate moderate but steady growth, where beverages, spirits, and vinegar (HS 22) has a coefficient of 0.780, vegetable plaiting materials (HS 14) shows a coefficient of 0.689, and tobacco and manufactured tobacco substitutes (HS 24) yields an estimate of 0.631. Rounding out the medium-impact cluster are coffee, tea, mate, and spices (HS 09) at 0.564, sugars and sugar confectionery (HS 17) at 0.551, and lac, gums, resins, and other vegetable saps and extracts (HS 13) with a coefficient of 0.546.

The final group comprises commodities where EU accession had a relatively minor or statistically insignificant impact on trade volumes. Among the sectors that registered a statistically significant but low-magnitude positive effect are animal or vegetable fats and oils (HS 15) with a coefficient of 0.470, vegetables and certain roots and tubers (HS 07) at 0.415, and preparations of vegetables, fruit, or nuts (HS 20) at 0.408. The remaining commodities within this group did not meet standard thresholds for statistical significance, indicating that their trade baseline was largely unaltered by integration. These include oil seeds and oleaginous fruits (HS 12) at 0.305, miscellaneous edible preparations (HS 21) at 0.193, preparations of cereals, flour, starch, or milk (HS 19) at 0.192, and cocoa and cocoa preparations (HS 18) with a negligible estimate of 0.069. Notably, animal originated products not

elsewhere specified (HS 05) returned a minor, statistically insignificant negative coefficient of -0.050.

Moving beyond these baseline effects, model four shifts the analysis toward decomposing integration dynamics by concurrently evaluating export creation to the EU and import diversion from the rest of the world. Because total export variables would create perfect collinearity with the country-time fixed effects, the model is specifically structured so that trade creation isolates the growth of exports directed to the EU, while trade diversion captures changes in imports sourced from third countries. Looking at the export side, several commodities demonstrate clear, statistically significant trade creation, indicating that EU membership generated entirely new export volumes for the acceding countries. For instance, live animals (HS 01) shows a significant export creation coefficient of 0.764, while its third-country import flows remained statistically unaffected at -0.411, suggesting that integration primarily boosted outbound trade to the EU without reducing import reliance on external suppliers. Similarly, animal or vegetable fats and oils (HS 15) experienced strong export-creating forces with a significant coefficient of 0.599, while its import diversion from the rest of the world remained small and insignificant at -0.174. On the other hand, core high-impact categories like meat (HS 02), dairy (HS 04), and fruit and nuts (HS 08) display significant export expansion to the EU, with coefficients of 0.640, 0.639, and 0.535, respectively, meaning accession heavily stimulated outbound shipments in these sectors.

However, these outward export gains often occurred alongside a noticeable contraction in imports from non-member states, as captured by the trade diversion coefficients. This import side of the ledger reveals that meat and edible meat offal (HS 02) experienced the most severe drop in imports from the rest of the world, with a prominent negative coefficient of -2.237, showing that the opening of EU export markets coincided with a substantial reduction in inbound shipments from

third countries. Fish and crustaceans (HS 03) and live trees and plants (HS 06) exhibit a pattern where export creation to the EU is statistically insignificant or even negative, while third-country import contraction is pronounced and highly significant at -1.426 and -1.070, respectively. For these products, the institutional alignment with the EU primarily manifested as a reduction in global import sourcing rather than an outbound export driver. A similar trend is observed for milling industry products (HS 11), cereals (HS 10), and beverages (HS 22), where export creation coefficients fail to clear standard significance thresholds, yet they show distinct, statistically significant import diversion from the rest of the world of -0.787, -0.854, and -0.614, respectively. This implies that while full accession did not significantly boost outbound exports to the EU for these specific chapters, it was strongly associated with a contraction of inbound trade from global markets.

Finally, model six evaluates the transitional dynamics by comparing full accession against the preliminary trade agreements represented by the FTAEIA variable, illustrating whether the trade-stimulating effects occurred gradually during the transitional phase or materialized only upon achieving full political and institutional EU membership. The most striking finding from this final model is that for the vast majority of commodities, the preliminary trade agreements had a negligible impact on trade volumes, whereas full EU accession remained a powerful and significant driver of trade expansion. Even when controlling for the pre-accession agreements, the post-accession variable remains highly significant and large in magnitude for core sectors such as live animals (HS 01) at 1.334, meat (HS 02) at 1.611, dairy (HS 04) at 0.971, and fruit and nuts (HS 08) at 1.123. This trend holds true for mid-tier items like cereals (HS 10) at 0.880, milling products (HS 11) at 0.865, and meat or fish preparations (HS 16) at 0.741, indicating that the removal of tariffs via preliminary free trade agreements was insufficient on its own and that

full integration into the Single Market was required to unlock substantial trade growth.

The coefficients for the transitional agreement variable are predominantly statistically insignificant, confirming that early frameworks did not structurally alter trade paths for most agricultural products, with only a few exceptions. Animal originated products (HS 05) presents a unique case where full EU accession had no significant impact, but the preliminary agreements yielded a positive and statistically significant coefficient of 0.481, suggesting that early trade frameworks provided temporary or niche benefits to this sector that did not persist after full market integration. In contrast, for fish and crustaceans (HS 03), live trees and plants (HS 06), preparations of vegetables and fruits (HS 20), and miscellaneous edible preparations (HS 21), the preliminary agreements actually returned statistically significant negative coefficients of -0.334, -0.329, -0.188, and -0.234, respectively. These negative estimates during the transitional phase may reflect the asymmetrical nature of early liberalizations, where stricter EU quality standards or quota restrictions were introduced prior to the implementation of full market access and support mechanisms that accompanied final membership.

5.3. Predictions of Ukrainian trade patterns using model (4) estimates

Ukraine case predictions are presented in the Table 5 below. The average trade volumes from 2018 to 2021 were used to mitigate the negative impacts of the ongoing war and to observe the clear policy effects. Baselines were separated and aggregated by the exports to EU and imports from non-EU to apply model (4) estimates for prediction. The projected impact was divided into relative and absolute terms for comparison.

Table 5. Baseline and predictions of the commodity specific trade diversion and creation effects using model (4) estimates

Commodity Code	Commodity Description	Average exports to EU (2018-2021), mln USD	Average import from non-EU (2018-2021), mln USD	Trade export creation, %	Trade import diversion, %
1	Animals; live	0.811	1.668	114.62	-33.67
2	Meat and edible meat offal	187.852	13.061	89.63	-89.32
3	Fish and crustaceans, molluscs and other aquatic invertebrates	25.511	586.409	-34.17	-75.97
4	Dairy produce; birds' eggs; natural honey; edible products of animal origin,	130.628	18.118	89.51	-59.92
5	Animal originated products; not elsewhere specified or included	8.011	18.048	-43.86	-0.98
6	Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage	2.589	9.107	-32.05	-65.70
7	Vegetables and certain roots and tubers; edible	73.548	135.117	3.63	-43.00
8	Fruit and nuts, edible; peel of citrus fruit or melons	192.305	594.922	70.66	-63.43
9	Coffee, tea, mate and spices	3.554	144.337	32.71	-41.69
10	Cereals	2 058.137	73.598	45.58	-57.44
11	Products of the milling industry; malt, starches, inulin, wheat gluten	21.119	27.538	17.81	-54.50
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, industrial or medicinal plants; straw and fodder	1 285.492	271.290	1.89	-38.79
13	Lac; gums, resins and other vegetable saps and extracts	0.717	14.729	17.02	-41.08
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included	36.025	0.852	47.82	-54.45
15	Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes	1 634.067	238.226	82.12	-15.97
16	Meat, fish or crustaceans, molluscs or other aquatic invertebrates; preparations thereof	4.428	83.750	49.89	-54.86

Table 5 – Continued

Commodity Code	Commodity Description	Average exports to EU (2018-2021) , mln USD	Average import from non-EU (2018-2021), mln USD	Trade export creation , %	Trade import diversion, %
17	Sugars and sugar confectionery	75.364	43.515	41.17	-22.95
18	Cocoa and cocoa preparations	62.622	150.911	-2.19	-5.04
19	Preparations of cereals, flour, starch or milk; pastrycooks' products	101.913	33.244	23.18	0.22
20	Preparations of vegetables, fruit, nuts or other parts of plants	93.620	94.735	12.59	-43.12
21	Miscellaneous edible preparations	56.499	149.371	13.83	-22.42
22	Beverages, spirits and vinegar	63.744	228.614	30.80	-45.90
23	Food industries, residues and wastes thereof; prepared animal fodder	482.603	46.749	15.71	-49.99
24	Tobacco and manufactured tobacco substitutes	6.306	219.168	32.09	-54.03

Analyzing projected impact on the Figure 1, we can observe certain relative export winners. Live Animals (+114.62%) and Meat products (+89.63%) are projected to see the largest percentage increases in exports to the EU. Speaking about the inward protection, Ukraine should also expect a sharp decline in imports from non-EU countries in sectors like Meat (-89.32%) and Fish (-75.97%) as it aligns with EU external barriers.

In absolute terms, the largest net changes are expected in Animal or vegetable fats (HS 15) and Cereals (HS 10), driven by already established Ukraine's comparative

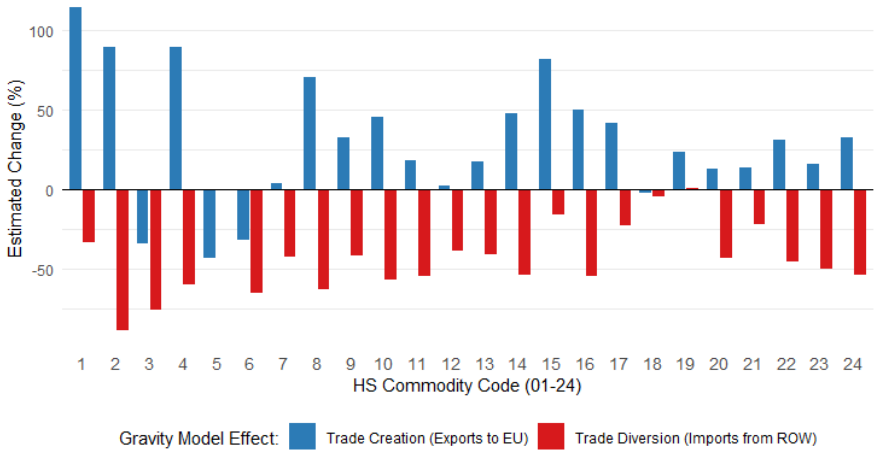


Figure 1. Baseline and predictions of the commodity specific trade diversion and creation effects using model (4) estimates. Percentage changes (%).

01 - Live Animals; 02 - Meat & Offal; 03 - Fish & Seafood; 04 - Dairy, Eggs & Honey; 05 - Other Animal Prods.; 06 - Live Plants & Flowers; 07 - Vegetables; 08 - Fruits & Nuts; 09 - Coffee, Tea & Spices; 10 - Cereals (Grains); 11 - Milling & Starches; 12 - Oilseeds & Ind. Plants; 13 - Gums, Resins & Saps; 14 - Veg. Plaiting Materials; 15 - Fats & Oils; 16 - Processed Meat & Fish; 17 - Sugars & Confectionery; 18 - Cocoa & Preparations; 19 - Cereal & Baking Preps; 20 - Processed Veg & Fruits; 21 - Misc. Edible Preparations; 22 - Beverages & Spirits; 23 - Animal Feed & Waste; 24 – Tobacco

advantages in these sectors. For the Cereals the trade is expected to rise by 938 million USD as we can see on the Figure 2 below, while for Animal or vegetable fats the increase in exports to EU is projected to be 1 341 million USD.

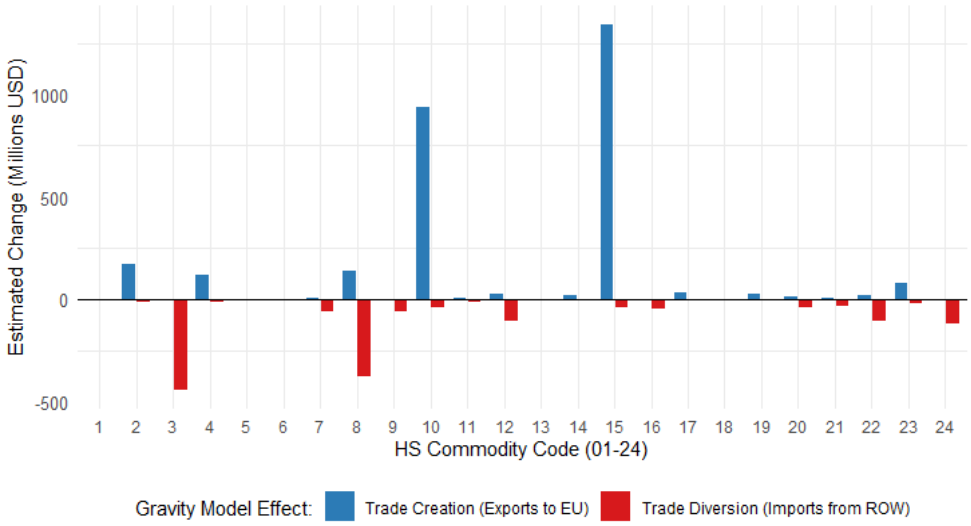


Figure 2. predictions of the commodity specific trade diversion and creation effects using model (4) estimates. Nominal changes (in millions USD).

01 - Live Animals; 02 - Meat & Offal; 03 - Fish & Seafood; 04 - Dairy, Eggs & Honey; 05 - Other Animal Prods.; 06 - Live Plants & Flowers; 07 - Vegetables; 08 - Fruits & Nuts; 09 - Coffee, Tea & Spices; 10 - Cereals (Grains); 11 - Milling & Starches; 12 - Oilseeds & Ind. Plants; 13 - Gums, Resins & Saps; 14 - Veg. Plaiting Materials; 15 - Fats & Oils; 16 - Processed Meat & Fish; 17 - Sugars & Confectionery; 18 - Cocoa & Preparations; 19 - Cereal & Baking Preps; 20 - Processed Veg & Fruits; 21 - Misc. Edible Preparations; 22 - Beverages & Spirits; 23 - Animal Feed & Waste; 24 – Tobacco

5.4. Reality check of predictions

Below on the Figure 3 is shown the comparison of the predicted net change in exports to the EU and the actual average annual change of Ukraine`s exports to EU in the period of 2022-2024. The most performing commodities over the span of 3 years were edible meat (HS 02), Dairy products (HS 04), Cereals (HS 10), Oilseeds (HS 12), Vegetable and animal fats (HS 15) and Sugars, confectionery (HS 17). Speaking of them, for the first group of meat edible (HS 02) the model predicted 168.4 mln USD increase in exports to the European Union, while the actual increase due to the Autonomous Trade Measures was 102.4 mln USD. Then

comes the dairy products (HS 04), which was predicted to be exported by 116.9 mln USD more, however happened to be only 64.6 mln USD increase. Cereals (HS

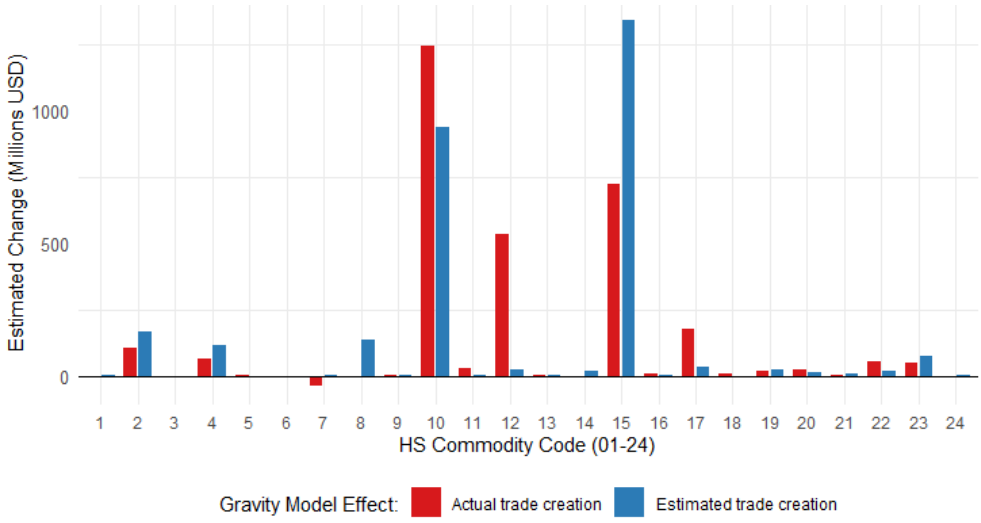


Figure 3. Comparison of predictions and actual of the commodity specific trade creation effects using model (4) estimates. Nominal changes (in millions USD).

01 - Live Animals; 02 - Meat & Offal; 03 - Fish & Seafood; 04 - Dairy, Eggs & Honey; 05 - Other Animal Prods.; 06 - Live Plants & Flowers; 07 - Vegetables; 08 - Fruits & Nuts; 09 - Coffee, Tea & Spices; 10 - Cereals (Grains); 11 - Milling & Starches; 12 - Oilseeds & Ind. Plants; 13 - Gums, Resins & Saps; 14 - Veg. Plaiting Materials; 15 - Fats & Oils; 16 - Processed Meat & Fish; 17 - Sugars & Confectionery; 18 - Cocoa & Preparations; 19 - Cereal & Baking Preps; 20 - Processed Veg & Fruits; 21 - Misc. Edible Preparations; 22 - Beverages & Spirits; 23 - Animal Feed & Waste; 24 – Tobacco

10), one of the most advantageous sectors in Ukraine, surpassed their predictions of 938.02 mln USD with actual annual increase of 1 246.5 mln USD. This discrepancy can be explained by the higher risk of marine traffic amid war, which forced traders to transit their cargo via EU. The same can be said about the Oilseeds exports (HS 12), where the actual trade of 533.5 mln USD far surpassed the forecasted value of 24.31 mln USD. However, the predicted exports of 1 341.9

mln USD had not been reached and demonstrated only 723.02 mln USD of actual increase. Speaking about the sugar and confectionery it has far surpassed the predicted value of 31.03 mln USD, showing 175.3 mln USD of actual increase in exports.

Another point in review is the studying of the trade diversion effect of EU enlargement on the new entrants and how it can potentially describe the trade flows of Ukraine. So I used the model 4 estimates to simulate the situation when Ukraine joins EU and aligns with its agricultural acquis, then this effect was compared to the period of acting ATM during 2022-2024 periods. On the Figure 4 below is

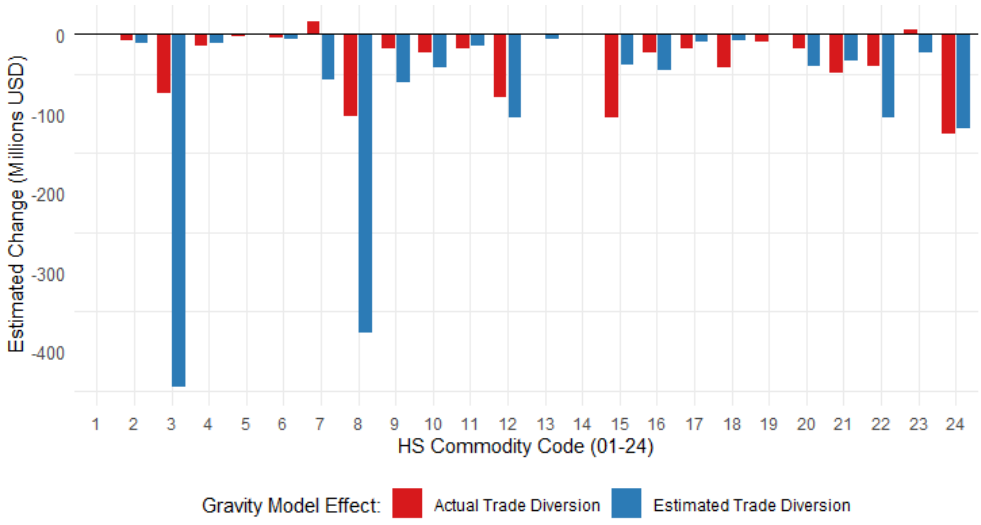


Figure 4. Comparison of predictions and actual of the commodity specific trade diversion effects using model (4) estimates. Nominal changes (in millions USD).

01 - Live Animals; 02 - Meat & Offal; 03 - Fish & Seafood; 04 - Dairy, Eggs & Honey; 05 - Other Animal Prods.; 06 - Live Plants & Flowers; 07 - Vegetables; 08 - Fruits & Nuts; 09 - Coffee, Tea & Spices; 10 - Cereals (Grains); 11 - Milling & Starches; 12 - Oilseeds & Ind. Plants; 13 - Gums, Resins & Saps; 14 - Veg. Plaiting Materials; 15 - Fats & Oils; 16 - Processed Meat & Fish; 17 - Sugars & Confectionery; 18 - Cocoa & Preparations; 19 - Cereal & Baking Preps; 20 - Processed Veg & Fruits; 21 - Misc. Edible Preparations; 22 - Beverages & Spirits; 23 - Animal Feed & Waste; 24 – Tobacco

shown the comparison between the actual decrease in non-EU imports and the predicted ones.

Obvious leaders on the chart are the fruits and nuts (HS 08) that demonstrated a drastic decrease in imports from non-EU of 102.72 mln USD while the predicted outcome was a 377.35 mln USD decrease. Then on the second place comes the Fish and seafood (HS 03) ranking by predicted volumes, with predictions of 445.48 mln USD decrease in imports, while the actual data show only 74.33 mln USD decrease. Quite interesting fit shows the 24th group of Tobacco, that was predicted to decrease by 118.41 mln USD and in reality, was decreased by the 125.74 mln USD, demonstrating an almost 94.17% accuracy. Further comparison draws attention to the Oilseeds (HS 12), that actually were decreased in imports by 80.0 mln USD, and the predicted ones was 105.24 mln USD. Overall, these results tend to be more uniformly distributed than the trade creation, assuming the substitution effect driving the decrease in non-EU imports, since not all SPS and TBT from EU agricultural acquis were implemented by EU.

Chapter 6

CONCLUSIONS AND POLICY RECOMMENDATIONS

The empirical results lead to several key conclusions about how European accession shapes agricultural trade patterns across the CEE region, providing a clearer picture of what we can expect for Ukraine. By combining the structural gravity framework from Yotov et al. (2016), validated later country-pair fixed effects approach from Shepotylo et al. (2024), we set up a robust, commodity-specific methodology. These fixed effects setup helped reduce model complexity and cut down on coefficient bias. It also let us move away from traditional, time-invariant gravity variables like shared borders, distance, or language, which often skewed estimations in earlier papers.

The main novelty here was applying country-pair-commodity and country-time-commodity fixed effects to highly disaggregated data, something that hasn't been done based on our literature review. This approach gave us highly significant results, where seventeen out of twenty-four commodity groups showed significant estimates. Overall, this method reduces the complexity of studying trade effects at a specific commodity level and gives us a very good model fit with trustworthy results.

On the product level, the results support the idea of CAP heterogeneity suggested by Martínez-Zarzoso et al. (2020), who pointed out that processed commodities usually face more robust growth in bilateral trade volumes than raw goods. When converting our PPML coefficients into exact percentage effects using the $(e^{\beta} - 1) \times 100\ \%$ formula, the differences between sectors become clear. Highly processed items like meat and edible meat offal (HS 02) and dairy produce (HS 04) benefited the most from integration, showing massive trade surges of 441.4% and

172.1%, respectively. This confirms that reducing behind-the-border barriers within the Single Market works much better for final goods than for primary goods. On the flip side, traditional raw exports like cereals (HS 10) saw a more moderate gain of 129.3%, while niche sectors like animal originated products (HS 05) stayed flat with an insignificant drop of -4.9%.

Our third claim is that CAP alignment acts non-uniformly across different products, which we justified by studying trade export creation to the EU and trade import diversion from non-EU countries. On the export side, processed sectors showed substantial export boosts directly to the EU, led by meat (HS 02) at 89.6%, dairy (HS 04) at 89.5%, and processed meat or fish preparations (HS 16) at 49.9%. However, even more commodities showed negative trade diversion effects on the import side. This stands out clearly in categories like meat (HS 02), where imports from the rest of the world plummeted by -89.3%, alongside heavy import drops for fish and crustaceans (HS 03) at -76.0% and live trees and plants (HS 06) at -65.7%. This happens mainly due to the strict SPS and TBT measures of the EU acting as a barrier for third countries. Interestingly, Magee (2008) showed almost no trade diversion effects of RTAs on trade, which is logical since standard agreements usually don't assume implementing heavy regulatory barriers against non-members the way the EU acquis does.

Lastly, model six showed that preliminary FTAs had no significant impact on trade volumes in comparison to full EU accession. In fact, during that transitional phase, a few sectors like fish (HS 03) and live trees (HS 06) even saw negative effects of -28.4% and -28.0%. Meanwhile, the full accession variable stayed highly significant and large, yielding strong trade increases like 279.6% for live animals (HS 01) and 400.8% for meat (HS 02). This shows that just cutting tariffs through basic free trade agreements isn't enough to drive agricultural trade. Real trade expansion only

happens when a country undergoes full integration and aligns itself with the EU agricultural acquis.

Policy Recommendations for Ukraine

The empirical results yield several critical insights regarding the trajectory of Ukraine's agricultural trade under European integration. First, the estimation models indicate that high-value-added sectors possess the highest relative potential for growth, with meat and dairy projected to experience the most prominent export increases. Alongside these emerging sectors, the model highlights established drivers, most notably vegetable and animal fats (HS 15), which show a projected export growth of 1.34 billion dollars to the EU.

However, a comparison between these theoretical predictions and the actual annual trade data during the active Autonomous Trade Measures (ATMs) reveals a stark structural divergence. Ukraine's current agricultural export portfolio remains highly skewed toward three traditional baseline groups, cereals, oilseeds, vegetable fats, and sugars which constitute the country's primary historical competitive advantage. While the model indicates that meat and dairy possess the highest potential for growth, the gap between these projections and actual trade volumes suggests that Ukraine is currently underutilizing its full export potential. To bridge this gap and develop domestic production, policymakers should prioritize strategic investments in processing capacity for these high-value-added sectors.

When evaluating these trade predictions, a second vital factor to consider is the superposition of the ongoing war and the activation of the ATMs. This dual reality introduces a complex substitution effect: the observed redirection of trade toward the EU was heavily accelerated by the forced closure of Ukraine's marine traffic

and traditional Black Sea routes, rather than being solely driven by structural trade creation via the ATMs.

On the import side, the model warns of significant trade diversion effects from non-EU countries, with imports projected to decrease sharply in specific sectors. Local manufacturers who rely on non-EU inputs particularly in the fish and meat sectors must prepare for supply shifts or substantially higher costs due to an expected 75% to 89% trade diversion in those categories (or decrease in imports from non-EU). Moreover, the high discrepancy between predicted and actual diversion can be explained by the policy architecture of the temporary ATMs, which did not oblige Ukraine to impose external third-country trade barriers. This regulatory distinction explains why the actual data shows an almost five-fold difference from the model's predictions for Fish (HS 03).

Ultimately, the most consequential takeaway comes from the model (5) specifications evaluating the comparative effects of a Free Trade Area (FTA) versus complete EU membership. The finding that the FTA frameworks have no significant or substantial effect suggests that the true economic benefits for Ukraine will not stem from partial trade liberalization, but from deep, complete integration into EU Common Agricultural Policy frameworks and subsequent EU membership. This result aligns closely with the findings of Magee (2008), who demonstrated that the anticipation effects of Customs Union agreements are typically minor and insignificant prior to formalization.

Consequently, these findings pivot the strategic narrative away from basic market access and toward comprehensive institutional alignment. Achieving rapid implementation of pre-accession reforms and maximizing institutional readiness must be treated as the highest priority. Failing to do so risks trapping Ukraine in a

lower-speed convergence club, delaying the comprehensive benefits that come with full integration into the EU Customs Union.

WORKS CITED

Anderson, James E., and Eric van Wincoop. (2003). "Gravity with Gravitas: A Solution to the Border Puzzle." *The American Economic Review* 93, no. 1: 170–92.

Bussière, Matthieu, Jarko Fidrmuc, and Bernd Schnatz (2005). "Trade Integration of Central and Eastern European Countries: Lessons from a Gravity Model." *ECB Working Paper No. 545*. Frankfurt am Main: European Central Bank.

Chen, Natalie, and Dennis Novy (2009). "International Trade Integration: A Disaggregated Approach." *CESifo Working Paper No. 2595*. Munich: CESifo.

Cieślik, Andrzej, Jan Jakub Michałek, and Jerzy Mycielski. (2012)"Euro and Trade Flows in Central Europe." Equilibrium. Quarterly Journal of Economics and Economic Policy 7, no. 3: 7–25.

Egger, Peter, and Mario Larch (2008). "Interdependent preferential trade agreement memberships: An empirical analysis." *Journal of International Economics* 76 (2): 384–399.

European Commission. (2025). *Upgraded EU-Ukraine Deep and Comprehensive Free Trade Area (DCFTA) enters into force*. European External Action Service. https://www.eeas.europa.eu/eeas/upgraded-eu-ukraine-trade-agreement-enters-force_en

European Commission. Evaluation of Marketing Standards. (2020). (Contained in the CMO Regulation, the 'Breakfast Directives' and CMO Secondary Legislation). Commission Staff Working Document SWD 230 final. Brussels: European Commission, 2020.

European Parliament and Council of the European Union. (2013). "Regulation (EU) No 1308/2013 of the European Parliament and of the Council of 17 December 2013 establishing a common organization of the markets in agricultural products." *Official Journal of the European Union* L 347: 671–854.

Hegerty, Scott W. (2022)."Time-Series Dynamics of Baltic Trade Flows: Structural Breaks, Regime Shifts, and Exchange-Rate Volatility." *Journal of Economics & Management* 44: 96–118.

Hornok, Cecília (2012). "Gravity or Dummies? The Limits of Identification in Gravity Estimations." *Department of Economics Working Papers* No. 2012/11. Budapest: Central European University.

Hornok, Cecília. (2010). "Trade-Enhancing EU Enlargement and the Resurgence of East-East Trade." Focus on European Economic Integration Q3: 79–94.,

Jackson, Karen, and Oleksandr Shepotylo. (2024)."Political Alliances and Trade: Europe in a Polarized World." *European Journal of Political Economy* 85: 102612.

Jambor, Attila, and Matthew Gorton. (2025)."Twenty Years of EU Accession: Learning Lessons from Central and Eastern European Agriculture and Rural Areas." *Agricultural and Food Economics* 13, no. 1: 1-17.

Jambor, Attila. (2014)."Country-Specific Determinants of Horizontal and Vertical Intra-industry Agri-food Trade: The Case of the EU New Member States." *Journal of Agricultural Economics* 65, no. 3: 663–682.

Ketenci, Natalya. (2016). "The Bilateral Trade Flows of the EU in the Presence of Structural Breaks." *Empirical Economics* 51, no. 4: 1369–98.

Łapińska, Justyna. (2014)."Determinants of Intra-Industry Trade in Agricultural and Food Products Between Poland and EU Countries." Danube: Law and Economics Review 5, no. 3: 159–172.

Magee, Christopher S. P. (2008). "New measures of trade creation and trade diversion." *Journal of International Economics* 75 (2): 349–362.

Martínez-Zarzoso, Inmaculada, Anca M. Voicu, and Martina Vidovic. (2020). "Production Networks in Europe: A Natural Experiment of the European Union Enlargement to the East." Review of International Economics 28, no. 5: 1143–1163.

Matskul, Valerii, Diana Okara, and Nataliia Podvalna. (2019). "The Ukraine and EU Trade Balance: Prediction via Various Models of Time Series." SHS Web of Conferences 65: 04005.

Morina, Fatbardha, Eglantina Hysa, Uğur Ergün, Mirela Panait, and Marian Catalin Voica. (2020). "The Effect of Exchange Rate Volatility on Economic Growth: Case of the CEE Countries." *Journal of Risk and Financial Management* 13, no. 8: 177.

Münch, Wolfgang (2002). *Effects of EU Enlargement to the Central European Countries on Agricultural Markets*. Frankfurt am Main: Peter Lang

Nilsson, Lars. (2000). "Trade Integration and the EU Economic Membership Criteria." *European Journal of Political Economy* 16, no. 4: 807–827.

Nivievskyi, Oleg. (2025). Integration of Ukraine into the Single EU Food Market: Challenges of the Common Market Organisation System. Agricultural Policy Report APD/APB/06/2025. Kyiv: Німецько-український агрополітичний діалог (German-Ukrainian Agricultural Policy Dialogue)

Sarker, Rakhal, and Sampath Jayasinghe. (2007). "Regional Trade Agreements and Trade in Agri-Food Products: Evidence for the European Union from Gravity Modeling Using Disaggregated Data." *Agricultural Economics* 37, no. 1: 93–104.

Tinbergen, Jan. (1962). *Shaping the World Economy: Suggestions for an International Economic Policy*. New York: The Twentieth Century Fund

UkrAgroConsult. (2026). *Ukraine's agricultural exports exceeded 22 billion in 2025: Market diversification and EU quotas*. UkrAgroConsult.

Urata, Shujiro, and Misa Okabe (2014). "Trade Creation and Diversion Effects of Regional Trade Agreements: A Product-level Analysis." *The World Economy* 37 (2): 267–289.

Us, Ivan. (2026). "Ukraine's Foreign Trade in Goods: 2025 Summary." National Institute for Strategic Studies. February 18, 2026. https://niss.gov.ua/en/doslidzhennya/mizhnarodni-vidnosini/ukraines-foreign-trade-goods-2025-summary.

Viner, Jacob (1950). *The Customs Union Issue*. New York: Carnegie Endowment for International Peace.

Yotov, Yoto V., Roberta Piermartini, José-Antonio Monteiro, and Mario Larch. (2016). *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model*. Geneva: World Trade Organization.

Zolin, M. Bruna, and Utai Uprasen (2018). "Trade creation and diversion: effects of EU enlargement on agricultural and food products and selected Asian countries." *Asia Europe Journal*.

APPENDIX.

Table 6. Robustness checks on increased dataset. Comparison of unilateral effects with bilateral

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Dependent Var.:	Trade	Trade	Trade	Trade	Trade
EU_both	0.680***	0.626***	0.646***	0.608***	
	(0.061)	(0.049)	(0.067)	(0.046)	
FTAEIA_CEE			-0.038	-0.025	
			(0.041)	(0.032)	
Td_Creation_expToEU					-27.7
					(1,350.1)
Td_Diversion_impFromROW					-3.42
					(680.5)
Td_Creation_impFromEU					-2.99
					(680.5)
Td_Diversion_expToROW					-28.1
					(1,350.1)
Fixed-Effects:					
exporter-year-commodity	Yes	Yes	Yes	Yes	Yes
importer-year-commodity	Yes	Yes	Yes	Yes	Yes
exporter-importer-commodity	Yes	Yes	Yes	Yes	Yes
S.E.: Clustered	by: exp..	by: exp..	by: exp..	by: exp..	by: exp..
Observations	506,520	1,192,796	506,520	1,192,796	1,192,796
Squared Cor.	0.97449	0.97453	0.97449	0.97453	0.97446
Pseudo R2	0.96248	0.97496	0.96249	0.97496	0.97485
BIC	2.77e+11	1.12e+12	2.77e+11	1.12e+12	1.12e+12

Table 6 – continued

	Model 6	**Model 7**	**Model 8**	**Model 9**	**Model 10**
Dependent Var.:	Trade	Trade	Trade	Trade	Trade
EU_both	0.309**	0.641***			
	(0.095)	(0.049)			
Td_Creation_expToEU			0.451***	0.280***	
			(0.063)	(0.055)	
Td_Diversion_impFromROW			-0.432***	-0.645***	
			(0.077)	(0.071)	
Td_Creation_impFromEU					0.432***
					(0.077)
Td_Diversion_expToROW					-0.451***
					(0.063)
Td_Div_Imp_exp	-0.292***	0.018			
	(0.061)	(0.045)			
Fixed-Effects:					
exporter-year-commodity	Yes	Yes	Yes	Yes	Yes
importer-year-commodity	Yes	Yes	Yes	Yes	Yes
exporter-importer-commodity	Yes	Yes	Yes	Yes	Yes
S.E.: Clustered	by: exp..	by: exp..	by: exp..	by: exp..	by: exp..
Observations	506,520	1,192,796	1,192,796	506,520	1,192,796
Squared Cor.	0.97454	0.97453	0.97446	0.97455	0.97446
Pseudo R2	0.96252	0.97496	0.97485	0.96252	0.97485
BIC	2.77e+11	1.12e+12	1.12e+12	2.77e+11	1.12e+12

In the appendix section I would like to discuss potential limitations and weak points of estimating such a high-dimensional fixed effects model on commodity level. To

ensure a robust empirical evaluation, ten distinct model specifications with varying sets of explanatory variables were estimated across two alternative datasets. The results are represented in the Table 6 above.

The initial dataset was constructed by restricting the reporting countries to a panel of 12 Central and Eastern European (CEE) nations, yielding four directional trading blocks consisting of CEE–EU, CEE–ROW, EU–CEE, and ROW–CEE flows. Following data transformation, this first dataset comprised approximately 553,000 observations; however, it excluded critical intra-regional and global trading pairs such as EU15–EU15, EU15–ROW, ROW–EU15, and ROW–ROW. To address this limitation, a second dataset was compiled to incorporate the EU15–EU15, EU15–ROW, and ROW–EU15 pairs, which expanded the sample size to 1.26 million observations. During the econometric estimation process, the statistical software dropped 46,000 observations from the first dataset and 67,000 observations from the second, which represents a standard outcome typically caused by collinearity or missing values within high-dimensional fixed effects.

To evaluate the completeness of this empirical sample, the datasets were benchmarked against a theoretically complete, fully balanced trade matrix. For a global panel encompassing 24 commodity groups, 252 countries and their territories (31,626 unique undirected country pairs), 30 years, and 2 directional trade flows, the total potential observations equal 31,626*24*30*2, or 45,541,440 rows. When isolating the specific dimensions of the second dataset—which involves 27 reporting countries, 251 partner countries, 2 trade flows, 30 years, and 24 commodities—the theoretical upper bound is calculated as 27*251*2*30*24, yielding 9,758,880 rows. Consequently, the actual empirical sample within the second dataset captures approximately 12.9% of this theoretical maximum. This data truncation is primarily attributable to the fact that the UN Comtrade database natively omits country-commodity-year combinations where no trade occurred

rather than recording explicit zero values. Furthermore, technical limitations within the free tier of the UN Comtrade API restrict data extraction to a maximum of 100,000 rows per query, thereby complicating the aggregation of seamless macro-level datasets and contributing to the restricted density of the final sample.

In light of these data limitations, comparative single-effect models were estimated. First, the overall effect on bilateral trade (EU_both) was compared between model (1) and model (2) in the table. The coefficient decreased slightly but insignificantly, while the standard error decreased, indicating that trade expanded by 87% rather than the initial estimate of 97.3%. Next, the impact of EU accession was evaluated in the presence of a free trade agreement by comparing models (3) and (4). The coefficient for bilateral trade decreased from 0.646 to 0.608, but the coefficient for the free trade agreement variable remained statistically insignificant, suggesting that modifying the baseline dataset for the thesis may not be necessary.

Regarding the simultaneous estimation of four distinct effects, Model 5 presents an interesting methodological framework for analyzing unilateral trade creation and trade diversion. Here, the aggregate integration effect was decomposed into four separate components: trade creation via exports to the EU Td_Creation_expToEU and imports from the EU Td_Creation_impFromEU, alongside trade diversion via exports to the rest of the world Td_diversion_expToROW and imports from the rest of the world Td_Diversion_impFromROW. When included simultaneously in the specification, they did not yield any statistically significant effects. However, when evaluated in pairs—such as exports to the EU and imports from the rest of the world in Model 8, or imports from the EU and exports to the rest of the world in Model 10—the coefficients became statistically significant but functioned as exact structural mirrors. Specifically, exports to the EU equaled exports to the rest of the world multiplied by (-1), and imports from the EU equaled (-1) multiplied by imports from the rest of the world, indicating a pattern

of perfect substitution. This phenomenon aligns with the findings in the working paper by Hornok (2012), "Gravity or Dummies," which explains why estimating all four effects simultaneously is unfeasible.

Finally, concerning the application of bilateral trade creation and diversion effects, models 6 and 7 incorporate an additional variable Td_Div_imp_exp representing the control group's trade with the rest of the world. Interestingly, within the initial dataset of 553,000 observations, both coefficients are statistically significant and reflect near-perfect substitution. Conversely, within the expanded dataset, the external trade restriction effect becomes statistically insignificant, and the internal trade stimulation effect converges toward the baseline estimates of Model 2. This divergence complicates the decision of whether to include these comparative results in the final thesis or to rely solely on the single-effect framework of Model 9.