

**ESTIMATING TRADE CREATION, TRADE DIVERSION,
AND TRADE BALANCE EFFECTS OF THE EURASIAN ECONOMIC UNION
WITH A PARTIAL AND GENERAL EQUILIBRIUM GRAVITY MODEL**

A dissertation presented by

Madi Umbetaliyev

to

The Graduate School of Public Policy

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

in the subject of Public Policy

Nazarbayev University

Astana, Kazakhstan

May 2023

Acknowledgments

I sincerely thank my supervisor, Assistant Professor Simeon Nanovsky, for his time, support, and guidance throughout my dissertation. I am incredibly thankful for his advice on incorporating a trade balance framework into my research. Without his help and encouragement, I could not have completed this research. I am deeply grateful to Associate Professor and Vice Dean for Academic Affairs Riccardo Pelizzo, Associate Professor Omer F. Baris, Assistant Professor Hyesong Ha, and Assistant Professor Dina Sharipova for their insightful comments and invaluable support in thesis preparation and writing. My special thanks to Assistant Professor Huanhuan Zheng from the Lee Kuan Yew School of Public Policy, National University of Singapore. I express my gratitude to my instructors and the faculty of GSPP for their help and support during the four years of the Ph.D. program. I have gained much theoretical and practical knowledge from them that will help my future academic career. I acknowledge Nazarbayev University for providing me with a doctoral scholarship to pursue a Ph.D. at the Graduate School of Public Policy. Finally, I thank God for guiding me in the right direction and letting me through all the difficulties. You are the one who let me finish my degree and the one whom I always trust upon in my life.

Abstract

Author's name: Madi Umbetaliyev

Topic: Estimating trade creation, trade diversion, and trade balance effects of the Eurasian Economic Union with a partial and general equilibrium gravity model

Dissertation advisor: Simeon Nanovsky, Assistant Professor

This study evaluates the impact of the Eurasian Economic Union by estimating trade creation, trade diversion, and trade balance effects with the gravity model in partial and general equilibrium frameworks. In addition to aggregated goods, partial equilibrium trade effects are estimated with trade flows disaggregated into consumer, capital, and intermediate goods. The results suggest that the EEU has a strong positive trade creation effect driven by increased intra-region trade in consumer goods. In a general equilibrium framework, all the EEU members have experienced a positive impact on their exports and GDP. The general equilibrium effects for non-members are mixed. However, they suggest that the most negatively affected non-members are the post-Soviet Central Asian countries. In a trade balance framework, trade creation, trade diversion, and trade balance effects, estimated in a partial equilibrium framework for each EEU member, support the hypothesis that smaller and diversified countries gain more from regional integration than their larger and less diversified trading partners. The trade balances of Armenia, Belarus, and the Kyrgyz Republic have improved in consumer goods and deteriorated in capital goods, implying a positive economic effect. The EEU impact on trade is positive but less significant for resource-rich Kazakhstan and Russia, the largest EEU member. The findings show the consistency between the partial and general equilibrium effects of the EEU and suggest that the trade balance effects could be a useful macroeconomic framework to evaluate the impact of economic integration in the gravity model of trade.

Keywords: gravity model of trade, partial equilibrium, general equilibrium, economic integration, trade creation effect, trade diversion effect, trade balance effect

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List of Abbreviations

BEC	Broad Economic Categories
BRI	Belt and Road Initiative
CES	Constant Elasticity of Substitution
CU	Customs Union
EEU	Eurasian Economic Union
FE	Fixed Effects
GDP	Gross Domestic Product
GE	General Equilibrium
IMF	International Monetary Fund
IMR	Inward Multilateral Resistances
MR	Multilateral Resistances
OLS	Ordinary Least Squares
OMR	Outward Multilateral Resistances
PE	Partial Equilibrium
PPML	Poisson Pseudo-Maximum Likelihood
RTA	Regional Trade Arrangement
RVC	Regional Value Chain
TB	Trade Balance
TC	Trade Creation
TD	Trade Diversion
WB	World Bank
WTO	World Trade Organization

Chapter 1 Introduction

The purpose of this study is to evaluate the economic impact of the Eurasian Economic Union (EEU) using the structural gravity model of trade under a partial and general equilibrium framework. The history of the EEU began immediately after the dissolution of the former USSR in 1991 when the newly independent post-Soviet states encountered a sharp economic downturn due to political and economic disintegration and the break-up of their close bilateral relations. In July 2010, three former Soviet republics, Belarus, Kazakhstan, and Russia, created a customs union. In 2015, it was transformed into the Eurasian Economic Union (EEU), and in the same year, Armenia and the Kyrgyz Republic acceded to it as the new members. As an advanced regional trade arrangement (RTA), the EEU establishes a common market and ensures the free flow of goods, services, capital, and labor between its member states. Since the beginning, Eurasian economic integration has been consistent with a classic linear regional integration model, starting with a free trade zone, moving to a customs union and then to a common market, and finally reaching a fully-fledged economic union. However, the EEU stands out from other RTAs worldwide as its member countries had already existed in a political and economic union for several centuries, first as part of the Russian Empire and then of the former Soviet Union. Hence, the steps the post-Soviet states have taken to integrate their economies are the process of economic *reintegration*.

Economic integration is a public policy issue as the decision to create or accede to an RTA is made by a national government. Bilateral trade liberalization represents a pivotal change in a country's trade policy with far-reaching consequences. It inevitably involves political and economic costs as it could weaken RTA member states' political and economic sovereignty and damage some domestic industries and small businesses. At the same time, each country acceding to an RTA expects that removing bilateral trade barriers would boost trade, facilitate investment, improve productivity, create more jobs, and support economic growth. Therefore,

it is no surprise that the policy evaluation of an RTA draws much attention from policymakers and academia. Researchers use various empirical methods to estimate the economic effects of RTAs. Plummer et al. (2010) provide an overview of these methods and divide them into two broad groups: ex-ante and ex-post. Ex-ante evaluation methods use historical data to predict or simulate the potential effects of an RTA. They include regional trade interdependence and comparative advantage indicators, the partial equilibrium SMART model, and the computable general equilibrium (CGE) model. Among ex-post evaluation methods that use actual data and include preference indicators (such as coverage, utility, and utilization rates), and quantitative and qualitative analysis of trade effects, the most popular one and the one applied in this study is the structural gravity model of trade.

For more than 50 years, starting with the works of Tinbergen (1962), Pöyhönen (1963), and Linnemann (1966), the gravity model of trade has been the workhorse of trade policy analysis. It requires a limited number of assumptions, has a simple framework with a single regression equation and a high explanatory power, and is applied to estimate the impact of various factors that are supposed to affect bilateral trade. Depending on research objectives, these factors may include transportation costs and “natural trading partners,” exchange rates and foreign direct investments, trade regulation and the rules-of-origin, institutions and the role of export promotion agencies, democracy and trade union rights, and tariff and non-tariff barriers. The gravity model borrowed its name from Newton’s law of universal gravitation and was initially based on intuition rather than a solid theory. After two decades, theoretical microeconomic foundations were developed and confirmed the empirical framework of the model.

A significant contribution to the theoretical foundation of the gravity model was made by Anderson and Van Wincoop (2003), who developed the concept of multilateral resistances that transmit the partial equilibrium effects of a change in bilateral trade costs to other countries not directly affected by a change in trade policy. Ignoring the multilateral resistances may cause a

significant bias in the estimates of the gravity variables (Anderson & Van Wincoop, 2003). However, since they are unobservable theoretical constructs, accounting for them by estimating a gravity equation with exporter-time and importer-time fixed effects has become a standard approach. This method for panel data was developed by Olivero and Yotov (2012), who followed the approach of Hummels (1999) and Feenstra (2016) for cross-sectional data. Another standard approach to estimating a gravity equation developed by Baier and Bergstrand (2007) accounts for the endogeneity inherent in trade policy by controlling for country-pair fixed effects. To address the presence of heteroscedasticity and zero values in trade data, Silva and Tenreyro (2006) suggest using the Poisson Pseudo Maximum Likelihood (PPML) estimator, which yields more accurate results than the ordinary least squares (OLS) method.

One of the widely used applications of the gravity model in empirical studies, pioneered by Aitken (1973), is the analysis of economic integration. The theoretical framework of the gravity model in evaluating RTAs is based on Viner's trade creation and trade diversion effects (Viner, 1950). In his model, a customs union produces two trade effects (which work in opposite directions): trade diversion and trade creation. The trade creation effect arises when a reduction or elimination of bilateral trade barriers between two RTA member countries increases production efficiency because a home country switches from a less efficient producer to a more efficient one. Trade diversion has the opposite effect, decreasing the bilateral trade between member and non-member countries. To estimate trade creation and trade diversion effects, the gravity model includes, in addition to traditional gravity variables (such as GDP, distance, contiguity, common language, and colonial relationship), an RTA dummy variable, which reflects the membership status in a trade bloc of two countries engaged in bilateral trade. Depending on the number of RTA dummy variables (as their number can vary from one to three), researchers estimate the coefficient of the trade creation dummy variable, which is expected to be positive, and the coefficient of the trade diversion dummy variable, which is

expected to be negative. The evaluation of an RTA is based on whether the trade creation or trade diversion effect dominates.

Thousands of scholarly articles have been published on applying the gravity model to RTAs worldwide. There are several gravity model studies on Eurasian economic integration, but their number is much lower than scholarly publications on other RTAs. Borodin and Stokov (2015), Isakova et al. (2015), Mukhamediyev and Khitakhunov (2018) apply the gravity model to examine the Customs Union of Belarus, Russia, and Kazakhstan, which was created in 2010. Other studies focus on the EEU, including the new members Armenia and the Kyrgyz Republic, which joined the trade bloc in 2015. Tumanyan (2018) uses the gravity model to estimate the trade effects of the EEU. Adarov (2018) and Mukhamediyev et al. (2020) apply the synthetic control method (SCM). Golovko and Şahin (2021) use the panel data for 86 countries for the period of 1994–2018 to find out the factors that affect the process of integration of Eurasian countries¹ into world trade. The variable of interest in their model is not the trade creation or trade diversion effect but “the level of integration of the Eurasian countries into the world trade system” (Golovko & Şahin, 2021, p. 532). Vasudevan and Manalaya (2021) focus their analysis on the exports of machinery goods and machinery parts and components from the EEU member countries to their 28 trading partners over the period of 2010-2017. Aituar and Akhmediyarova (2021) investigate the impact of non-tariff barriers on intra-EEU trade. Aituar and Kemelbayeva (2022) use an average import tariff as an independent variable instead of an RTA dummy variable and demonstrate that an increase in import tariffs after the creation of the customs union has reduced the imports of Kazakhstan by 10.7%. The overall results of estimating trade effects of the EEU are mixed, which is not uncommon in gravity model studies since researchers apply different methodological techniques. Carrère (2006) and Magee (2008)

1 The set of the Eurasian countries in the study includes Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenistan, and Uzbekistan.

show that gravity model estimates are sensitive to equation specification, sampling strategy, and estimation method.

While trade creation and diversion effects have been widely used to evaluate the impact of economic integration, a more detailed analysis can be done if the estimated trade effects are combined with some macroeconomic variables to provide a better assessment for policymakers who are concerned with the macroeconomic performance of their national economies and public opinion in their home countries. Since the gravity model has a solid microeconomic foundation and remains a powerful tool for RTA impact evaluation studies, this research introduces a macroeconomic framework of trade balance, which is based on the valuable property of an RTA dummy variable that effectively captures in the gravity model the changes in exports and imports that occur in response to the creation of an RTA.

This study contributes to the literature in three strands. First, it adds to the existing literature that applies the gravity model of trade to evaluate Eurasian economic integration. The number of publications on this topic has been steadily growing. However, it is still much less than the number of gravity model studies on other RTAs. In the existing literature on the EEU, most studies use the OLS method to estimate the trade creation and trade diversion effects. However, in their seminal paper, Silva and Tenreyro (2006) show that in the presence of heteroskedasticity and zero-value observations in trade data, the PPML estimator produces robust estimation results compared with the OLS estimator. This study uses both the OLS and the PPML methods to estimate the trade creation and trade diversion effects. Also, some gravity studies that regress independent variables on disaggregated trade flows in goods usually use either the Harmonized Commodity Description and Coding System (HS) of the World Customs Organization (WCO) or the Standard International Trade Classification (SITC) of the United Nations (UN). Such an approach to disaggregating commodities in the gravity model is widely

used for conducting the microeconomic analysis of an RTA by investigating the impact of regional integration on bilateral trade in specific sectors or products.

This study uses the international classification by Broad Economic Categories (BEC), which groups commodities into three categories by their main end-use: consumer goods, capital (investment) goods, and intermediate goods, and is widely used for the macroeconomic analysis of international trade data. Using the BEC classification, changes in exports and imports captured by RTA dummy variables in the gravity can be evaluated within a macroeconomic framework of the trade balance. An increase in exports of consumer goods is traditionally regarded as having a positive economic effect as it indicates that domestic goods are competitive in foreign markets. An increase in imports of investment goods also has a positive economic effect because it leads to capital accumulation and technology transfer that ensures future economic growth, as the theory of real-business cycles developed by Backus et al. (1995) suggests. Trade in intermediate goods has become one of the defining characteristics of international trade over the past few decades. The global commodity chain (GCC) concept pioneered by Gereffi (1994) predicts that economic integration through increasing bilateral trade in intermediate goods between RTA member countries would contribute to developing a regional value chain or a regional production network. Hence, as RTA member countries become more integrated and engaged in production relocation, intra-region trade in intermediate goods will eventually increase.

The second contribution to the literature relates to the general equilibrium gravity analysis, developed by Anderson et al. (2015b) and formalized by Larch and Yotov (2016). The general equilibrium framework extends a partial equilibrium gravity analysis by translating the change in bilateral trade costs on output and expenditure via the changes in factory-gate prices. Generally, a partial equilibrium gravity equation estimated with exporter-time and importer-time fixed effects is supposed to capture the trade effect of an RTA on non-member countries.

In the literature, this effect is called “conditional general equilibrium”² because the partial equilibrium effects now capture the impact of a change in bilateral trade costs on non-member countries through multilateral resistances, but output and expenditure remain constant. However, without a market-clearing condition, this approach cannot produce the full general equilibrium effects of a change in bilateral trade costs. Since the general equilibrium approach is relatively new in the literature, only a few studies have been conducted on its application to Eurasian economic integration. Adarov (2018) and Mukhamediyev et al. (2020) use the synthetic control method (SCM), which was developed by Abadie and Gardeazabal (2003), to conduct the gravity analysis of the EEU. However, the SCM method, used to define a counterfactual scenario in a general equilibrium framework, does not estimate the impact of an RTA on output and expenditure through a price adjustment mechanism. This study attempts to fill in the gap in the research that estimates the trade effects of Eurasian economic integration in a general equilibrium setting.

The third contribution to the literature relates to applying a trade balance framework, an essential concept in macroeconomics, to the gravity model, one of the leading empirical tools for trade policy studies. Until recently, macroeconomists have been reluctant to use the gravity model in their research because they cast doubt on the relevance of trade policy to a country's macroeconomic performance. They argue that a country's overall trade balance is determined by the balance of savings and investment and is unaffected by bilateral trade. On the contrary, trade economists believe that changes in trade policy (for instance, a tariff change) can improve or worsen a country's trade balance. Two influential papers explain trade imbalances in the gravity model, each representing the opposite side of the debate. Davis and Weinstein (2002) found that a gravity model poorly performed in explaining trade balance fluctuations. They

² Instead of the “conditional general equilibrium effect,” which is widely used in the literature, this study uses the term “quasi-general equilibrium effect” as it reflects its relative position to general and partial equilibria.

called this phenomenon “the mystery of the excess trade balances.” However, in their critical response to Davis and Weinstein's paper, Felbermayr and Yotov (2021) modified the gravity equation specification by using aggregate trade balances (bilateral trade flows plus domestic trade flows) and incorporating the multilateral resistances as asymmetric trade costs and showed that the gravity model performed well in predicting trade imbalances. So, there was no "mystery of the excess trade balances" for them. Nevertheless, the debate is still open as they emphasize the need for "...potentially fruitful research that combines the structural gravity model of trade with macroeconomic frameworks" (Felbermayr & Yotov, 2021, p. 15).

By contributing to this debate and bringing a macroeconomic perspective into the gravity analysis, this study estimates the trade balance effects using the coefficients of the RTA dummy variables. The trade balance, or net exports, defined as the difference between exports and imports, has theoretical and practical significance as a macroeconomic variable in theoretical models and an indicator used by economists, governments, and international organizations to assess the health of an economy. While Davis and Weinstein (2002) calculate the trade balance as the difference between exports and “reverse” exports, which are the dependent variables in their gravity model, this study builds upon the property of the RTA dummy variables that capture changes in bilateral trade, in which reversed exports can be considered as imports. Given that, it derives the “trade balance effects” for an RTA member country vis-a-vis the trade bloc as the difference between trade creation and “reverse” trade creation effects and against the rest of the world as the difference between export trade diversion and import trade diversion effects. Also, because an aggregated trade deficit or surplus does not provide sufficient information to evaluate an economic stance of a country, trade flows are grouped into three categories by the BEC classification: consumer goods, investment goods, and intermediate goods, and the trade balance effects are estimated in each product group. Improving or deteriorating trade balances can provide a better understanding of the structural changes

triggered by regional integration and their implications for growth, productivity, and development. Since the trade balance is a widely used economic indicator, the trade balance effects estimated in the gravity model could be an appropriate framework to extend the gravity analysis and provide an additional indicator, along with trade creation and trade diversion effects, for economists and policymakers to evaluate changes in a country's trade policy, including regional integration.

There are six chapters in the paper structured in the following way. Chapter 1 begins with the research's problem statement, purpose, and subject. Then it provides an overview of the empirical approaches to evaluating RTAs with the gravity model of trade, raises the issues that the study aims to address, and outlines the structure of the dissertation. Chapter 2 begins with a theoretical overview of trade creation and trade diversion effects, two essential concepts that gravity model economists use to assess the impact of regional integration. Then it provides a methodological overview of the empirical framework applied in the gravity model to estimate trade creation and trade diversion effects with RTA dummy variables. Since the subject of the study is the EEU, Chapter 2 also provides a descriptive overview of the EEU member countries. The gravity model, the empirical tool in this study, relates countries' economic masses and geographical and cultural factors to their bilateral trade and captures the redirection of trade flows in response to regional integration. Hence, attention is given to the relative economic power of the EEU member countries, the direction of their bilateral trade, and the product composition of their foreign trade patterns. Chapters 3 through 5 together constitute the core part of the dissertation. Each of them can be considered a separate empirical analysis on its own, but together, they provide a single analytical framework to evaluate the economic impact of the EEU. Chapters 3 through 5 follow the same structure, including the research question, literature review, conceptual framework, gravity model specification, choice of estimation methods, interpretation of estimation results, and conclusion. Chapter 3 estimates

the trade creation and trade diversion effects of the EEU in a partial equilibrium setting for aggregate exports and exports disaggregated in consumer, investment, and intermediate goods using both the OLS and the PPML estimators. Chapter 4 conducts the general equilibrium gravity analysis and evaluates the general equilibrium effects of the EEU on the member and non-member countries. Chapter 5 derives the trade balance framework for the gravity model and estimates the trade balance effects for each EEU member state using the estimates of the export and import trade creation and export and import trade diversion effects. Chapter 6 consolidates the estimation results from Chapters 3 through 5, discusses and summarizes the main findings, highlights the study's limitations, and makes suggestions for future research.

Chapter 2 Economic integration and the gravity model of trade

2.1. Introduction

This Chapter begins with an overview of the gravity model of trade, which has been the workhorse in empirical studies of international trade for more than 50 years with many practical applications. The structural gravity model has a simple structure, a strong microeconomic foundation, and a solid reputation of empirical robustness. It has been one of the leading empirical tools for evaluating trade policy, including regional integration. The gravity model evaluates the impact of an RTA by estimating trade creation and trade diversion effects, two key theoretical concepts developed by Viner (1950). This Chapter highlights Viner's contribution to the theory of a customs union and explains the rationale for using trade creation and trade diversion effects in RTA impact evaluation studies. Then, it provides an overview of the gravity model under a partial equilibrium framework and describes the gravity equation specification that estimates trade creation and trade diversion effects with a special dummy variable, indicating the RTA membership status of trading partners in bilateral trade.

Since this study focuses on the Eurasian Economic Union, this Chapter provides a brief history of the Eurasian integration process and a descriptive overview of the five EEU member countries (Armenia, Belarus, Kazakhstan, the Kyrgyz Republic, and Russia). Attention is given to their relative economic power, the direction of bilateral trade flows, the product composition of foreign trade, and main trading partners. Since the EEU is evaluated in the context of the gravity model, such data convey valuable information that can be used for interpreting the redirection of bilateral trade flows of the EEU member countries in response to regional integration and the magnitude of the changes in trade captured in the gravity model. Since every RTA in the world is unique, understanding the distinctive features of the EEU is essential for interpreting the estimation results and the implications of the estimated trade effects.

2.2. Trade creation and trade diversion in the gravity model

Among various methods for estimating the economic impact of an RTA, the gravity model of trade has been the most popular one (Porojan, 2001). The gravity model borrows its name from Newton's law of universal gravitation, which states that the gravitational force between two objects, which is always attractive, is directly proportional to their masses and inversely proportional to the squared distance between them:

$$F_{ij} = G \frac{M_i M_j}{D_{ij}^2} \quad (2-1)$$

where F_{ij} - gravitational force between objects i and j , G - gravitational constant, M_i - object i 's mass, M_j - object j 's mass, and D_{ij} - distance between objects i and j .

Applying the same logic to international trade, the gravity model of trade predicts that the two countries, which are large in terms of economic size and geographically close to each other, will have a higher volume of bilateral trade than the two countries, which are smaller in terms of GDP and located far from each other. The relationship between these economic variables is expressed in the following form:

$$X_{ij} = G \frac{Y_i E_j}{D_{ij}} \quad (2-2)$$

where X_{ij} - exports (or imports) from country i to country j ; G - inverse of world production $G \equiv 1/Y$; Y_i - country i 's output; E_j - country j 's expenditure; D_{ij} - distance between countries i and j . Distance matters since transportation costs can sometimes take up a large share of the value of a product, especially if a country is landlocked.

While Tinbergen (1962) is usually considered among the first economists who conceptualized the gravity equation for analyzing international trade, it should be noted that before him, Ravenstein (1885) and Zipf (1946) used the gravity concept to study migration flows. In his gravity model, Tinbergen (1962) takes exports from country i to country j (X_{ij}) as the dependent variable and specifies the gravity equation in a logarithmic form in the following way:

$$\ln X_{ij} = G + \alpha_1 \ln M_i + \alpha_2 \ln M_j + \alpha_3 \ln \varphi_{ij} + \alpha_4 N_{ij} + \alpha_5 V_{ij} + \varepsilon_{ij} \quad (2-3)$$

Tinbergen uses two dummy variables, in addition to the economic sizes of an exporter and an importer measured in terms of GNP (M_i and M_j , respectively) and the distance between the two countries (φ_{ij}). N_{ij} indicates whether the countries shared a common land border, and V_{ij} is equal to one if imported goods were exempted from tariffs. Also, in Tinbergen's gravity equation, G is a constant, and ε_{ij} is an error term. He estimates the model by the ordinary least squares method with the data for 18 countries. He finds that the coefficients of GNPs are positive, and the coefficient of distance is negative, as they are expected, and all of them are statistically significant. Independently of Tinbergen (1962), Pöyhönen (1963) uses a similar approach in a cross-sectional analysis of ten European countries with trade data for 1958. Tinbergen's student Linnemann (1966) includes more variables in the gravity model, which are not based on intuitive arguments as in Tinbergen's model as he attempts to justify the theoretical part of his model based on the Walrasian general equilibrium theory (Deardorff, 1998).

In the first wave of gravity model studies (Anderson, 1979; Caves, 1981; Krugman, 1997; Pagoulatos & Sorensen, 1975; Pöyhönen, 1963; Tinbergen, 1962; Toh, 1982), the notion of distance had a direct meaning as a geographic distance, measured in kilometers or miles, between trading partners. Later, researchers began to view distance in terms of cultural and linguistic differences (Eichengreen & Irwin, 1998; Rauch, 1999). The gravity model specification most used today explains bilateral trade flows by exporter's output and importer's income, the geographical distance between them, the common border, language, and colonial history. Over the years, the gravity model has become one of the leading research tools for examining international trade. Although it did not have a solid theoretical foundation for nearly twenty years, many empirical studies proved its significant robustness and explanatory power. Bergstrand (1985) reports that "despite the model's consistently high statistical explanatory power, its use for predictive purposes has been inhibited owing to an absence of strong

theoretical foundations.” Filippini and Molini (2003) make a similar conclusion about the empirical robustness of the atheoretical gravity model, noting that “while the gravity model has been often characterized as facts without theory, consistency of its results with facts makes it very popular for practical applications.”

Initially, the gravity model was primarily based on intuition without a theoretical foundation, and trade economists used the elements of other theories to explain it. Only in the mid-70s did the model start developing its theoretical underpinnings. In his econometric study of trade flows, Leamer (1974) used the gravity model and the Heckscher-Ohlin model of international trade to provide a theoretical justification for the explanatory variables included in the regression equation. The first significant contribution to developing the theoretical gravity model was made by Anderson (1979). Based on the model with two countries, which assumes complete specialization, identical preferences, and no trade barriers, he derived the so-called “simple” or “frictionless” gravity equation under the assumption of the heterogeneity of traded goods, which are differentiated by the country of origin, (“the Armington assumption”) and the assumption of constant elasticity of substitution (CES preferences) (Anderson, 1979, p. 108). Bergstrand (1985) followed Anderson (1979) and derived the so-called “reduced form gravity equation.” Helpman and Krugman (1985), the founders of the “new trade theory,” developed the model around the Heckscher-Ohlin framework by incorporating two main assumptions: (1) monopolistic competition and (2) increasing returns to scale. The model was successfully tested by Helpman (1987) with both cross-sectional and time series data. Based on the Heckscher-Ohlin model of inter-industry trade and the Helpman-Krugman model of intra-industry trade with monopolistic competition, Bergstrand (1989) derived the so-called “generalized gravity equation.” Deardorff (1998) also used the Heckscher-Ohlin model approach, which assumes that countries with an excessive labor force would export labor-intensive products while capital-intensive goods would be imported.

A significant contribution to improving the gravity model was made by Anderson and Van Wincoop (2003), who theoretically developed and introduced the concept of multilateral resistance terms. They argue that the original gravity equation is incorrectly specified as it excludes a relative price change. However, trade between two countries is affected not only by a change in bilateral trade costs but also by a relative price change vis-a-vis the rest of the world. So, estimating the impact of a change in bilateral trade costs between two countries on their mutual trade with a gravity equation without considering a relative price change produces only partial but not general equilibrium effects. Anderson and Van Wincoop (2003) introduced two key structural terms into the gravity model: inward and outward multilateral resistances, which measure the importer's and exporter's ease of market access, respectively. The structural gravity model has the following form:

$$X_{ij} = \frac{Y_i E_j}{Y} \cdot \left(\frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \quad (2-4)$$

$$\Pi_i^{1-\sigma} = \sum_j \left(\frac{t_{ij}}{P_j} \right)^{1-\sigma} \cdot \frac{E_j}{Y} \quad (2-5)$$

$$P_j^{1-\sigma} = \sum_i \left(\frac{t_{ij}}{\Pi_i} \right)^{1-\sigma} \cdot \frac{Y_i}{Y} \quad (2-6)$$

where X_{ij} is exports from country i to country j ; Y_i is the total output of country i ; E_j is the total expenditure of country j ; Y is the world output; t_{ij} denotes bilateral trade costs between country i and country j ; Π_i is the outward multilateral resistances (OMR); P_j is the inward multilateral resistances (IMR); σ is the elasticity of substitution among goods ($\sigma > 1$).

At the core of the structural gravity model are the outward and inward multilateral resistances described by equations (2-5) and (2-6), respectively. Unlike bilateral trade costs, which are observable, multilateral resistances are theoretical constructs that translate the changes in bilateral trade costs between country i and country j to the rest of the world and reflect a weighted average aggregate level of all trade costs that a country's producers and consumers face vis-a-vis a unified world market. Intuitively, multilateral resistances imply that the closer

two countries get to each other in trade, the more remote both become from the third countries. When two countries create an RTA and reduce bilateral trade costs, the multilateral resistances decrease between the RTA trade partners as they become “closer” to each other and increase vis-a-vis the rest of the world as the RTA member countries become “more remote” from non-members. The outward and the inward multilateral resistances can be seen as they separate trade costs between a country’s producers and consumers. In this view, the outward and the inward multilateral resistances reflect exporters’ and importers’ ease of market access, respectively. The former is the weighted average of trade costs incurred by producers in country i , and the latter is the weighted average of trade costs incurred by consumers in country i . Including multilateral resistances into the gravity model allows for examining the trade effects of an RTA on producers and consumers not only in RTA member countries but also in non-member countries. In equation (2-4), a change in bilateral trade costs between two RTA member countries has a direct and strong effect on their bilateral trade flows, but according to equations (2-5) and (2-6), it also has indirect effects on non-member countries through multilateral resistances with possible reverse effects via equation (2-4) on the bilateral trade between the two RTA member countries. Both the direct and indirect effects of a change in bilateral trade costs in a partial equilibrium framework are depicted in Figure 2-1.

Anderson (2011) reviewed the most important modifications of the gravity model and its various empirical applications in trade studies based on a particular set of explanatory variables. While the multilateral resistances terms are valid theoretical concepts, and the failure to include them in the gravity model is considered the “gold medal error” (Baldwin & Taglioni, 2006, p. 7), it has been difficult to apply them in practice. Anderson and Van Wincoop (2003) used an iterative process, now one of the steps in the general equilibrium gravity analysis. First, they estimate a gravity equation without multilateral resistances. The estimated trade costs are then used to build an initial set of multilateral resistances. Then, initial multilateral resistances

are used to re-estimate the gravity equation to produce new trade costs, which are used to get new multilateral resistances. This process is repeated several times until trade costs stop changing. Another approach, which is computationally less complex and is most often used in a partial equilibrium gravity analysis with panel data, is to control exporter-time and importer-time fixed effects, which account for outward and inward multilateral resistances, respectively. This method was developed by Olivero and Yotov (2012), who followed the approach of Hummels (1999) and Feenstra (2016) for cross-sectional data.

Since the works of Tinbergen (1962) and Pöyhönen (1963), the gravity model of trade has been widely used in empirical trade research due to its relatively simple framework and the limited number of assumptions required. Its flexible structure allows researchers to include, in addition to standard gravity variables, many other factors that are supposed to help explain bilateral trade fluctuations. These factors include transportation costs, exchange rates, “the domino effect” (when countries, which have not signed an RTA in the first place, then become eager to join it), foreign direct investments, the rules-of-origin (that is, the location of goods production), “natural trading partners” hypothesis, the effects of trade union rights and democracy, the role of export promotion agencies, the role of trade rules and regulatory framework, the impact of non-tariff barriers. Some studies consider aggregate exports or imports a dependent variable, while others focus on the trade flows in certain products.

The gravity model has many applications in studies on international trade. The application of the gravity model to investigate the impact of regional integration started with Aitken (1973), who estimated with cross-sectional data the impact of the EEC³ and the EFTA⁴ on trade between the member states. Since then, numerous studies have been published on the subject matter. The gravity model that investigates the trade effects of an RTA is based on the

³ European Economic Community

⁴ European Free Trade Association

theoretical concepts of trade creation and trade diversion that were first coined by Jacob Viner (1950), who defined them in his seminal book “The Customs Union Issue” in the following way: “There will be commodities, however, which one of the members of the customs union will now newly import from the other but which it formerly did not import at all because the price of the protected domestic product was lower than the price at any foreign source plus the duty. This shift in the locus of production as between the two countries is a shift from a high-cost to a lower-cost point ... There will be other commodities which one of the members of the customs union will now newly import from the other whereas before the customs union it imported them from a third country, because that was the cheapest possible source of supply even after payment of the duty. The shift in the locus of production is now ... between a low-cost third country and the other, high-cost, member country...” (Viner, 1950, p. 43). So, according to Viner, a customs union causes two possible effects: trade creation and trade diversion. He argues that trade creation, a shift from a high-cost supplier to a low-cost supplier, increases the productive efficiency of the customs union’s members and the rest of the world and has a positive economic effect. On the contrary, trade diversion, described by Viner as a shift from a low-cost supplier to a high-cost supplier, creates productive inefficiency, decreases bilateral trade, and has a negative economic effect. The overall effect of a customs union depends on whether the trade creation effect or the trade diversion effect dominates.

The main contribution of Viner to the trade theory is that he has demonstrated that a customs union is not always beneficial. By defining two possible outcomes of a customs union, trade creation and trade diversion, he showed that their net effect could be negative. Before him, the conventional view in the international trade theory was that a customs union, which meant a certain degree of trade liberalization, would always be beneficial. One of the famous economists, who held this view, was Gottfried von Haberler. He and Viner were the most respected trade economists of the first half of the twentieth century. Haberler belonged to the

Austrian school of economics, so it was not surprising that he defended free trade without government restrictions, opposed trade protection measures, and believed that a customs union would increase productivity and profits. As an advocate of a customs union, he wrote in his book “The Theory of International Trade” that “the custom unions are to be wholeheartedly welcomed even when they are not between neighboring or complementary States” (Haberler, 1937, p. 390). Haberler’s view of a customs union originated in David Ricardo’s labor theory of value and was based on the theory of comparative advantage.

Viner’s trade creation and trade diversion effects are depicted in Figure 2-2. The model assumed infinite supply elasticity and zero demand elasticity. There are three countries. Countries A and B are potential members of a customs union. A is a home country, and C represents the rest of the world. The three countries trade in steel with A importing and B exporting. In Figure 2-2, demand for steel is the vertical line D . Producers in countries A, B, and C supply steel at constant prices P_A , P_B , and P_C , respectively. Under the assumption of perfect competition, these prices equal the average and marginal costs of production. Country A is assumed to be the least cost-efficient supplier of steel, and country C is the most cost-efficient one. The costs of producing a ton of steel in countries A, B, and C are \$250, \$150, and \$100, respectively. Hence, $P_A = \$250 > P_B = \$150 > P_C = \$100$, as shown in the hypothetical example in Table 2-1. Before a customs union, country A imposes a non-discriminatory import tariff (t_I) at the rate of 100 percent. In this case, country A imports the entire quantity of steel demanded from C. When countries A and B create a customs union and set a discriminatory import tariff (t_I^d) against country C, the price of steel from country B to country A falls from \$300 to \$150. Country A diverts imports from the more efficient producer (C) to the less efficient one (B). Since no new trade is created, the customs union is trade-diverting. The loss for country A is the tariff revenue (areas M and N), but since M is a gain in A’s consumer surplus, the net negative effect from the customs union for A and the world is area N.

If initially, a non-discriminatory import duty (t_2) is so high that it is prohibitive (for instance, at the rate of 200 percent), then the domestic demand in country A is satisfied by its domestic producers at price $P_A = \$250$. When a customs union is created, country C pays an import tariff, but country B is exempted from the tariff. Now, country A switches the supply source to B and buys the entire amount of steel from its customs union partner. Because the price of steel falls from P_A to P_B , consumer surplus in country A increases by areas L and M. Since new trade is created and the source of supply shifts from the less efficient producer (A) to the more efficient one (B), a customs union is trade-creating. While there is no benefit or loss to countries B and C, country A and the world gain (areas L and M). Because trade creation and trade diversion effects can arise simultaneously, the net impact of a customs union depends on which effect dominates.

In Viner's model, trade creation and trade diversion are explained in terms of production efficiency. However, they can also be explained in terms of consumption efficiency, as illustrated in Figure 2-3. In this framework, trade creation and trade diversion effects can be associated with consumer substitution and expenditure effects, respectively. Initially, a home country consumes a composite quantity of q_0 imported from countries A and B. The downward line represents the relative prices of goods imported from countries A and B. When an RTA is created between a home country and country A, the slope of the line becomes steeper, implying that the goods from country A become cheaper than those from country B. The change in relative prices leads to a new equilibrium, where a home country increases its imports from country A from A_0 to A_1 and decreases imports from country B from B_0 to B_1 . This change represents the trade diversion effect as estimated in the gravity model. The reduction of bilateral trade costs between a home country and country A due to a customs union decreases the price of goods imported from country A and causes a wealth effect. Consumers in a home country can now move to a higher indifference curve from E_1 to E_2 , and for the same level of

expenditure, they can consume more goods. Figure 2-3 shows that the trade diversion effect does not change the overall quantity of goods consumed by a home country. It only diverts the trade from non-member country B to country A, a home country's RTA trade partner. The total trade effect for exporters (countries A and B) includes trade creation and diversion. Member country A benefits from a positive trade diversion effect (A_0 to A_1) and a positive trade creation effect (A_1 to A_2), whereas non-member country B is hurt by negative trade diversion (B_0 to B_1). Although Viner's theory of a customs union was simplistic and based on strict assumptions, it was a big step forward in international trade theory. Over time it has been modified and extended as the new developments in the theory of economic integration incorporated the effects of product differentiation and production specialization, imperfect competition in the factor and goods markets, increasing returns to scale, and economies of scale. Advanced models of international trade, incorporating these effects, have deepened the understanding of economic integration, a complex and multi-factor process that has been difficult to capture in empirical models. However, Viner's trade creation and trade diversion effects are still widely used by researchers as a valuable and practical analytical framework to study the economic impact of regional integration.

The gravity model estimates the economic impact of regional integration by using an RTA dummy variable, which takes the value of one if either an exporter or an importer, or both are members of an RTA. The rationale for using it is that it reflects the level of protection provided by an RTA. The protection level is determined by bilateral trade costs and considered a "friction" that impedes international trade and is embedded in the notion of "distance" in the original concept of the gravity model. Creating an RTA changes trade costs among trading partners and redistributes the level of protection by lowering or eliminating it among RTA members and raising it between RTA members and non-members. There are several ways in the literature to specify an RTA dummy variable in the gravity equation. In earlier years, gravity

model studies used one RTA dummy variable equal to one if both exporter and importer were RTA members and 0 otherwise. The log-linearized gravity model with a single RTA dummy variable can be presented in the following reduced form:

$$\ln X_{ijt} = A_{ijt} + \beta_1 RTA_GTC_{ijt} \quad (2-7)$$

where A_{ijt} represents a vector of standard gravity model independent variables (importer and exporter GDP, distance, common border and language, colonial links), and X_{ijt} represents exports of country i to country j at time t . The dummy variable RTA_GTC_{ijt} takes the value of one if both countries i and j are members of the same RTA at time t . Statistically, coefficient β_1 is the degree to which the intra-bloc trade level is higher or lower than the hypothetical trade level between an RTA and the rest of the world and between the countries outside the trade bloc. In terms of economic meaning, it is interpreted as a combined effect of trade creation and trade diversion, which Balassa (1967) calls “gross trade creation” (Balassa, 1967, p. 5). Among those who used the one-dummy approach were Aitken (1973), Pelzman (1977), and Frankel et al. (1995). Aitken (1973) investigates the impact of the EEC and EFTA on member trade using cross-sectional trade data between 1959 and 1967. Pelzman (1977) examines the trade effects of the CMEA. Frankel et al. (1995) find that the MERCOSUR member countries traded with each other eight times higher as would similar neighbors elsewhere in the world.

A single RTA dummy variable captures the impact of an RTA only on intra-region trade but leaves bilateral trade vis-à-vis the rest of the world outside of the analysis. Since Viner’s model has two trade effects, starting with Bayoumi and Eichengreen (1995), Frankel et al. (1997), and Haveman and Hummels (1998), gravity model studies also use two RTA dummy variables, one for trade creation and another for trade diversion. Because this approach estimates trade creation and trade diversion effects separately, it has eventually become standard in empirical

research. The log-linearized gravity model with two RTA dummy variables can be presented in the following reduced form:

$$\ln X_{ijt} = A_{ijt} + \beta_1 RTA_TC_{ijt} + \beta_2 RTA_TD_{ijt} \quad (2-8)$$

In equation (2-8), RTA_TD_{ijt} is the trade diversion RTA dummy variable that takes the value of one if one of the two countries i and j is an RTA member, and another country is a non-member. Equation (2-8) does not specify which of the two countries i and j is an exporter and which of them is an importer. If, for example, the dependent variable is exports, country j is an importer and an RTA member, and country i is a non-member exporter, then coefficient β_2 measures the degree to which imports of country j from country i are higher or lower than expected because country j is now in a trade bloc and country i is not. A negative and statistically significant coefficient of this dummy variable suggests that exports from non-member countries to trade bloc members are lower than expected by the model. Since this coefficient measures a change in imports of a member country from a non-member caused by an RTA, it is interpreted as a trade diversion effect and is expected to be negative. A positive and statistically significant coefficient β_1 of the trade creation dummy variable indicates trade creation. Researchers separate cases when an RTA is trade-creating or trade-diverting by comparing the coefficients of the two dummy variables (intra-bloc trade and extra-bloc trade). Endoh (1999) suggested a new approach with three RTA dummy variables: one that captures intra-bloc trade, a second that captures imports by members from non-members, and a third that captures exports by members to non-members. He termed the last RTA dummy variable “export trade diversion” (Endoh, 1999, p. 210). The gravity model with a set of three RTA dummy variables has the following log-linearized form:

$$\ln X_{ijt} = A_{ijt} + \beta_1 RTA_TC_{ijt} + \beta_2 RTA_MTD_{ijt} + \beta_3 RTA_XTD_{ijt} \quad (2-9)$$

where *MTD* and *XTD* stand for import trade diversion and export trade diversion, respectively. *RTA_MTD_{ij}* is an import trade diversion dummy variable. It equals one if country *j* (importer) is an RTA member, and country *i* (exporter) is a non-member. *RTA_XTD_{ij}* is an export trade diversion dummy variable, which equals one if country *i* (exporter) is an RTA member and country *j* (importer) is a non-member. The coefficient of the export trade diversion dummy variable is expected to be negative to reflect the diversion of exports of an RTA member country from its RTA trading partner to non-members. “Negative and statistically significant coefficients of these [export trade diversion] variables indicate that integration has caused members to prefer member countries to nonmember economies in their exporting activities” (Endoh, 1999, p. 210). Endoh (1999) studied trade effects of the European Economic Community (EEC), the Latin American Free Trade Association (LAFTA), and the Council for Mutual Economic Assistance (CMEA) using a sample of 80 countries over 35 years (1960-1994), taking cross-sectional data of five-year intervals. Soloaga and Winters (2001) estimate trade creation, import and export trade diversion for several RTAs in the sample of 58 countries over the period of 1980–1996. Yang and Martínez-Zarzoso (2013) use three RTA dummy variables to examine trade effects of the ASEAN-China Free Trade Area (ACFTA). For the sample of 31 countries over 16 years, they find that the coefficients for β_1 and β_2 are both positive and statistically significant, indicating “pure trade creation” in imports of an RTA member country from member and non-member countries. Also, in their study, β_3 is positive and statistically significant, which, given the positive coefficient for β_1 , indicates “pure trade creation” in exports from an RTA member country to the rest of the world. The summary of specification of RTA dummy variables is presented in Table 2-2. It should be noted that the specification of the trade diversion RTA dummy variables depends on whether the dependent

variable is exports or imports whereas the specification of the trade creation RTA dummy variable is the same for exports and imports.

An RTA causes a relative change in bilateral trade costs and redirects trade flows as a one-time structural shock. Four types of trade flows described in Table 2-3 emerge in response to an RTA depending on whether a country of origin or a country of destination, or both or neither of them belongs to a trade bloc. They differ in the degree of trade protection provided by trade barriers between trade partners. Type I trade flow is intra-RTA trade. When the dependent variable is the exports, it is measured as an export flow, but under Viner's framework, it is imports of a home country from its RTA trade partner. An increase in Type I trade flow is Viner's trade creation. Imports of a home country from the rest of the world are captured by Type II trade flow. The reduction in Type II trade flow is Viner's trade creation. Type III trade flow reflects exports of an RTA member country to non-member countries. Finally, Type IV trade flow is the hypothetical level of trade between non-members not directly observed in the gravity model. Three RTA dummy variables included in a gravity equation are supposed to capture changes in the first three types of trade flows. The coefficients of three dummy variables measure the degree to which the new trade levels involving an RTA member country (Type I, Type II, Type III) are higher or lower than the hypothetical trade level (Type IV).

The estimated coefficients of the RTA dummy variables can take either positive or negative values. Viner's theory predicts that when bilateral trade costs are reduced between the member states in response to an RTA, the intra-region trade will increase. Therefore, the estimated coefficient of the trade creation dummy variable is expected to be positive, which means that an RTA positively affects the intra-region trade. Also, in Viner's model, when a customs union is created, one RTA member switches the supply source from a non-member to another RTA member country. The same reasoning applies to the export trade diversion effect. Its expected estimate is negative as the RTA member countries, which now face lower multilateral resistance

between them (the access to the intra-region market for them becomes easier) and higher multilateral resistances against the non-member states (the access of RTA members to non-members' markets become more difficult), switch their exports from the rest of the world toward the trade bloc. In both cases of negative import and export trade diversion effects, an RTA causes a reduction in bilateral trade flows between the RTA member and non-member countries.

Gravity model researchers studying the impact of regional integration generally expect positive trade creation and negative trade diversion estimates. However, in empirical results, as shown in Table 2-4, the trade creation effect can be negative, while the import and export trade diversion effects can be positive, and both trade creation and trade diversion effects can be either positive or negative. Positive values of import and export trade diversion imply that RTA member countries have increased their imports from and exports to non-member countries, respectively, in response to regional integration. Positive estimates of trade diversion can be found in many empirical studies. Baldwin (2011) calls trade diversion with a positive value "reverse trade diversion." He explains it by non-tariff trade liberalization reforms "that could lead to trade creation without trade diversion, or trade diversion that works in the 'wrong' direction" (Baldwin, 2011, p. 19). Soloaga and Winters (2001) explain the positive import trade diversion effect by the increased "propensity to imports" from non-members. Endoh (1999), Carrère (2006), Lee and Park (2006), Magee (2008), and Acharya et al. (2011) all find reverse trade diversion in their studies. Endoh (1999) explains negative export trade diversion by changes in trade preferences as "integration has caused members to prefer member countries to nonmember economies in their exporting activities" (Endoh, 1999, p. 210). Magee (2008) and Acharya et al. (2011) estimate positive trade diversion for AFTA⁵, EFTA⁶, and NAFTA⁷.

⁵ ASEAN Free Trade Area

⁶ European Free Trade Association

⁷ North American Free Trade Agreement

Lee and Park (2006) observe reverse trade diversion from the panel of 175 countries from 1948 to 1999. Richardson (1993), Bagwell and Staiger (1999), Bond et al. (2004), Ornelas (2005), and Saggi and Yildiz (2010) argue that positive trade diversion arises because RTA member countries faced with trade distortions tend to reduce external tariffs and increase their imports from non-member countries. However, this hypothesis, called “trade complementarity,” has weak empirical support. Naito (2021) uses an asymmetric three-country Melitz trade model to show that faster economic growth in RTA member countries, in the long run, increases their demand for imports from non-member countries, causing a “reverse trade diversion” effect. Since there is no uniform way of interpreting the negative estimate of trade creation and the positive estimates of export and import trade diversion in the gravity model literature, this study follows the most commonly used practice, when researchers interpret the negative estimate of trade creation as a reduction in intra-region trade and the positive estimate of trade diversion as an increase in trade between RTA member and non-member states.

There seems to be no uniform approach to selecting the number of RTA dummy variables, and a researcher’s choice most likely depends on the study’s objectives. However, this study suggests that including all three RTA dummy variables could provide a more detailed analysis of the trade effects of an RTA. Also, it assumes that including trade diversion dummy variables would not considerably affect the trade creation estimate, especially if RTA member countries trade more with non-member countries than with each other, as in the case of the EEU. This assumption is tested in Chapter 3, where a comparative analysis of the estimates of trade effects depending on the number of dummy variables in the gravity model equation will be conducted.

Another reason for including three RTA dummy variables is related to the trade balance effects, which are explained in detail and derived in Chapter 5. The overview of the empirical framework of the gravity model in this Chapter has demonstrated that the import trade diversion effect, which is captured by the import trade diversion RTA dummy variable, can be

viewed as an additional change in imports of an RTA member country from non-members that occurs in response to the creation of an RTA. Similarly, the export trade diversion effect, which is captured by the export trade diversion RTA dummy variable, can be viewed as an additional change in exports of an RTA member country to non-members that occurs in response to the creation of an RTA. Therefore, the estimates of export and import trade diversion effects can be used to construct the change in the trade balance of an RTA member country against the rest of the world. Following the approach of Endoh (1999), who split the trade diversion dummy variable into export and import trade diversion dummies, this study splits the trade creation RTA dummy variable into two parts. As shown in Table 2-2, the trade creation RTA dummy variable is generally specified as equal to one if both countries i and j are RTA members. The specification does not depend on whether the dependent variable is exports or imports. However, if it is specified (for exports as the dependent variable) as being equal to one if country i is an exporter *and* an RTA member, and country j is an importer *and* an RTA member, then it captures the additional change in exports from one RTA member i to another RTA member j due to regional integration. If it is specified (for exports as the dependent variable) as being equal to one if country j is an exporter *and* an RTA member, and country i is an importer *and* an RTA member, then it captures the additional change in imports of one RTA member i from another RTA member j due to regional integration. Therefore, the estimates of export and import trade creation effects can be used to construct the change in the trade balance of an RTA member country i against the trade bloc. It is not possible to construct the trade balance effects of an RTA member country against another RTA member because they cancel each other if they are derived for two bilateral trade partners (exports of country i are imports for country j , and vice versa). Since the changes in exports and imports captured by the RTA dummy variables reflect marginal changes in trade flows in response to the creation of an RTA, they are termed the “trade balance effects.”

2.3. Economic integration and the Eurasian Economic Union

The Eurasian Economic Union (EEU) is an advanced regional trade arrangement established to ensure the free flow of goods, services, capital, and labor between its member states and to coordinate their economic policies. It currently includes five post-Soviet countries: Armenia, Belarus, Kazakhstan, Kyrgyzstan, and Russia, with Armenia being the only member with no common border with the other EEU states. The EEU is one of the largest RTAs in the world. As of January 1, 2022, 184 million people lived on its territory. In 2021, the bilateral trade volume between EEU members was \$72.6 billion, and their total GDP was \$2 trillion (Eurasian Economic Commission, 2022, p. 13). The EEU Treaty was signed on May 29, 2014, and entered into force on January 1, 2015.

All RTAs in the world share almost the same goals. Nations remove bilateral trade barriers to facilitate trade and investment, improve productivity, create more jobs, support economic growth, and increase GDP. Politicians and policymakers make difficult political decisions, face economic trade-offs, and go through a complicated multi-step process of economic integration from a free trade zone through a common market to a full-fledged economic union, albeit they can stop at any stage if they find their nations not yet ready for deeper integration. At the same time, every RTA is unique, and the EEU is no exception. In empirical studies, understanding the EEU's specific character, determined not only by the economic structure of its member states but also by their political and historical background, is essential for adequately interpreting research results and making reasoned conclusions. The EEU is probably the only RTA in the world where member countries had already existed in a political and economic union for several centuries, first as part of the Russian Empire and then the former Soviet Union. The newly independent states, which functioned as a single economic mechanism for years and were dependent on each other, began to face a sharp decline in GDP due to economic disintegration and the collapse of close bilateral production ties. So, it is no surprise that the

economic “reintegration” process in the post-Soviet space started immediately after the dissolution of the former Soviet Union in 1991. In this study, the terms “post-Soviet countries” and “former Soviet republics” refer to all countries of the former USSR except for the three Baltic states, namely Latvia, Lithuania, and Estonia. Immediately after gaining independence, these three countries quickly drifted away from the other former Soviet republics and chose integration with the European Union as their top priority.

Economic reintegration among the post-Soviet states was complex and internally contradictory. On the one hand, they wanted to avoid the break-up of strong intra-regional production and logistics ties that existed over the years. On the other hand, they tried to strengthen their newly gained political independence and economic sovereignty. In the first years after the collapse of the former USSR, the post-Soviet states traded with each other mainly under bilateral preferential trade agreements. No single multilateral trade agreement existed at that time. The process of economic reintegration of the former Soviet republics started on the platform of the Commonwealth of Independent States (CIS), which is a regional intergovernmental organization formed right after the disintegration of the USSR. The CIS was founded by Russia, Ukraine, and Belarus on December 08, 1991. On December 21, 1991, Armenia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan⁸, Uzbekistan, and Ukraine signed a Protocol to the CIS Agreement and became members. In 1993, when Azerbaijan and Georgia⁹ acceded the organization, the CIS united all former Soviet republics except Latvia, Lithuania, and Estonia. The CIS was primarily a political organization that helped its members prevent the risks of confrontation and conflicts and jointly respond to the challenges brought about by the break-up of the USSR. At the same time, the CIS Agreement provided that member countries

⁸ In August 2005, Turkmenistan withdrew from the CIS Agreement and received the status of an associate observer member.

⁹ Georgia withdrew from the CIS Agreement on August 18, 2009

would “cooperate on creating and developing a common economic space, the pan-European and Eurasian markets, and in the area of customs policy.”

The first attempt to create a multilateral free trade zone instead of dozens of bilateral preferential trade agreements in place among the post-Soviet states was made in 1993, when Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, and Uzbekistan signed the Treaty on the Economic Union. Two countries, Turkmenistan and Georgia, acceded to the Treaty later (but Georgia withdrew from it in 2009). Under the Treaty, the member countries agreed to establish a common market with the free flow of goods, services, labor, and capital; to coordinate monetary, tax, price, customs, and foreign trade policy; to harmonize regulatory rules and to create favorable conditions for developing direct production chains between enterprises. However, after a couple of years, it became clear that the first economic integration attempt was unsuccessful despite some progress. The ratification process was protracted, and the negotiation process was complex. Even though Russia was the main driving force behind regional trade liberalization, it was the last country to ratify the Treaty (on February 27, 1995). The Treaty laid the groundwork for future economic integration in the post-Soviet space, but at the same time, its broad scope, which went beyond free trade in goods to include services, capital, and labor, was also its weakness. Some member states were unwilling to make serious concessions on trade liberalization in goods, let alone the free flow of services, people, and capital. The text of the Treaty was drafted in a vague and declarative form, full of ambitious goals, but without a clear roadmap and binding commitments. To break the impasse in trade negotiations, the CIS member states adjusted the process of regional economic integration and split it into two parallel tracks. Most of them decided to concentrate on developing a free trade zone covering only trade in goods. As a result, in 1994, a new multilateral free trade agreement (FTA) removing all tariff and non-tariff barriers in bilateral trade was signed by Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan,

Kyrgyz Republic, Moldova, Russia, Tajikistan, Ukraine, and Uzbekistan. However, member countries, including Russia, could not agree on a common list of goods exempted from the duty-free regime. As a result, they failed to create a multilateral free trade zone, and bilateral preferential trade agreements continued to prevail in trade relations between the CIS countries. It took several years before the CIS countries became willing to make mutual concessions on trade liberalization in goods. On April 2, 1999, was signed by Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Ukraine, and Uzbekistan signed a protocol on amendments and additions to the FTA. The CIS bilateral free trade regime was about to be replaced with a multilateral FTA, which provided that all duties and quotas in bilateral trade between the FTA member states would be abolished. However, the FTA lacked credible mutual commitments of member countries, so the free trade regime was not fully implemented. Another attempt to establish a free trade zone was made in 2011 when the new Free Trade Zone (FTZ) Treaty was drafted and signed by all CIS countries except Azerbaijan and Turkmenistan. The FTZ Treaty member countries agreed to reduce and subsequently remove existing bilateral tariffs and exemptions from the free trade regime, to freeze and then abolish export duties, and to eliminate quantitative trade restrictions (quotas). The FTZ Treaty replaced several multilateral trade agreements, including the Free Trade Agreement of 1994 and the Protocol to the FTA of 1999, and about 100 bilateral preferential trade agreements, which were in effect between CIS countries.

In 1995, the three CIS countries, Belarus, Kazakhstan, and Russia, seeking deeper economic integration, formed a separate group, eventually becoming the core of the future Eurasian common market. On January 20, 1995, they concluded the Customs Union Agreement, which the Kyrgyz Republic and Tajikistan signed in 1996 and 1999, respectively. Under the Customs Union Agreement, the member countries agreed to create a common customs territory by removing tariffs and quantitative restrictions in their bilateral trade, setting a common external

tariff vis-a-vis the rest of the world, and applying uniform non-tariff measures. The first steps in implementing the CU Agreement confirmed that the member countries were interested in seeking compromise and making significant progress toward closer economic integration. By mid-1995, customs controls on the Russian-Belarusian border were abolished. However, due to the financial crisis, Russia stopped implementing the CU Agreement and partially reversed its trade liberalization policy. In April 2000, it restored customs control on its border with Belarus and in 2001 with Kazakhstan. On February 26, 1999, Belarus, Kazakhstan, Kyrgyzstan, Russia, and Tajikistan signed the Treaty on the Customs Union and the Common Economic Space. However, a year and a half later, the customs union members overhauled the regional integration process and decided to institutionalize it. On October 10, 2000, Russia, Belarus, Kazakhstan, Kyrgyzstan, and Tajikistan signed the Treaty on Establishing the Eurasian Economic Community (EAEC Treaty), which came into force on May 30, 2001. The Treaty kept all the goals set in the other trade agreements but now had more clearly established measures to achieve them and a mechanism for monitoring the implementation.

Under the Treaty, the member countries remained committed to the goals of the Treaty on the Customs Union and the Common Economic Space of 1999. At the same time, they agreed to strengthen their cooperation by taking more decisive steps toward deeper economic integration and building a mechanism for monitoring the implementation of their mutual obligations under the Treaty. The member countries also decided to create the Eurasian Economic Community (EAEC) – a regional intergovernmental organization with supranational governing institutions such as the Interstate Council, the Integration Committee, and the EAEC Inter-Parliamentary Assembly. In addition, the statute of the EAEC Court was approved in April 2003. The previously created Customs Union did not cease to exist but was transformed into the EAEC.

In September 2003, Belarus, Kazakhstan, Russia, and Ukraine signed the Agreement on the Common Economic Space and the Concept of the Common Economic Space (CES). It was

their first step to creating “four freedoms” - the free movement of goods, services, capital, and labor. Despite Ukraine's withdrawal from the Eurasian economic integration process in 2004, Belarus, Kazakhstan, and Russia continued working on developing a common market. As a result of their negotiations, by June 2005, the first package of 29 agreements, which were the core of the Customs Union, was prepared. On October 6, 2007, Russia, Belarus, and Kazakhstan signed the Treaty on Establishing a Common Customs Area and Creating a Customs Union. This Treaty became the starting point for the future Eurasian Economic Union. Since the beginning, the Eurasian economic integration process has been consistent with a linear regional integration model, moving from a customs union via a common market to a fully-fledged economic union. On January 1, 2010, Belarus, Kazakhstan, and Russia set a common external customs tariff, and on July 6, 2010, they approved the Customs Code of the Customs Union. Starting from July 1, 2011, when the member countries placed their customs controls on their external borders, the Customs Union became fully operational.

On December 9, 2010, the customs union members signed several documents on their common market, paving the way for their next step towards deeper economic integration. On November 18, 2011, Russia, Belarus, and Kazakhstan signed the Declaration on Eurasian Economic Integration and committed themselves to move up to the next integration level, the Single Economic Space, starting January 1, 2012, and to set up the Eurasian Economic Union by 2015. On May 29, 2014, Belarus, Kazakhstan, and Russia signed the Treaty on the Eurasian Economic Union. On October 10, 2014, the EEU replaced the Eurasian Economic Community as a new regional intergovernmental organization and became the legal successor to the Customs Union and the Common Economic Space. Armenia and the Kyrgyz Republic joined the EEU on January 2, 2015, and August 12, 2015, respectively.

The brief history of the development of the EEU depicted in Table 2-5 is intended not only to demonstrate the complexity of the process of regional integration, behind which are almost

always and everywhere in the world complex political and economic decisions and difficult and protracted trade negotiations, and where policymakers achieve their goals only through compromise and mutual concessions. It also shows the distinctive feature of the EEU, whose members were once already in a single economic union, which is the highest degree of integration. Therefore, Eurasian integration is, in fact, a process of economic *reintegration*.

In addition to highlighting the major milestones in the EEU history depicted in Table 2-5, this Chapter conducts a comparative analysis of some foreign trade indicators of the EEU member countries and their relative economic sizes. Since the gravity model derives its framework from the physics law of gravitational force and describes the redirection of bilateral trade flows between RTA member and non-member countries, consideration is given to the relative economic power of the EEU member states and their product-group-based and direction-based foreign trade patterns. These indicators are most relevant as they could shed light on the potential impact of the EEU on its member states and provide additional inputs to the interpretation of trade creation and trade diversion effects in the gravity model.

Due to its sheer size, Russia was central to the former Soviet Union, and now after several decades, it keeps playing the role of a chief integrator in the EEU. Table 2-6 demonstrates that economic power within the EEU member countries is heavily skewed towards Russia. Russian GDP accounts for 84 percent of the EEU's total GDP and is seven times the GDP of the second-largest member country, Kazakhstan, while the GDPs of Armenia and Kyrgyzstan, taken together, account only for just over one percent. The uneven distribution of economic power implies that the EEU is an asymmetric trade bloc dominated by only one country. It makes the EEU different from major RTAs in the world, such as the EU or NAFTA, in which the difference in their member states' economic masses is less significant than in the EEU. The gravity model of trade is based on the physics law of gravitation, whose logic implies that a smaller body is attracted to a larger body more strongly than a larger body to a smaller one.

Therefore, due to its relative size and great gravitational force, Russia is expected to be less responsive to economic integration, and the economic impact of the EEU on Russia would be much smaller than on other member states. So, it is no surprise that the EEU is often viewed as a politically driven project for Russia to keep its influence in the post-Soviet countries.

The next economic dimension of the EEU relates to the structure of its foreign trade broken down by the direction of trade flows. The endogeneity hypothesis, often cited in gravity model studies, states that two countries already actively trading with each other are more likely to establish an RTA. It means that trade between RTA member countries has increased not because the two countries have removed bilateral trade barriers, but rather because of increased bilateral trade, the countries have decided to form an RTA. The “natural trading partners” hypothesis predicts a significant bilateral trade for geographically proximate countries. Table 2-7 shows the exports and imports of the EEU member countries to and from the other EEU member countries and to and from the rest of the world. Figures are given for 2015, the year of the establishment of the EEU. In 2015 the EEU member countries traded more with non-member countries than with each other, with Belarus being the only exception. It indicates that the EEU is an *outward-looking* trade bloc. Russia has the lowest dependence on intra-region trade as the other EEU member countries account for only 7 percent of its foreign trade. The degree of outward trade orientation of the EEU member states is greater in imports than in exports, except for Russia, whose shares of exports to and imports from the other EEU member countries are the same.

Given its economic power relative to the other EEU member countries, Russia is the core of the Eurasian integration and, if the wording of the law of physics is applied, the central gravitational force in the EEU. Table 2-8 shows that bilateral trade flows within the EEU are heavily skewed in favor of Russia, with most intra-EEU trade being conducted between Russia, on the one hand, and other EEU member countries, on the other hand. The fact that the EEU

member countries are engaged in much more trade with Russia than with each other suggests that the EEU operates not as a genuine multilateral RTA but as a set of bilateral RTAs, in which one counterpart is Russia.

Table 2-9 shows the trade pattern of the EEU member countries, disaggregated by the BEC classification into consumer goods, investment goods, and intermediate goods (including raw materials). The rationale for analyzing the product structure of exports (or imports) is related to tariff escalation, a common practice in international trade. Tariff escalation means that tariffs are relatively low or even zero on raw materials (since they are used as inputs in producing final goods). Then they increase (or escalate) for intermediate goods and become high for manufactured goods. Tariff escalation helps countries ensure an adequate supply of inputs for their domestic manufacturing industries. Also, it is used to protect domestic producers of finished goods from foreign competition. Removing bilateral trade barriers in an RTA would likely significantly affect manufactured goods (for example, furniture or cars) more than intermediate goods or raw materials (such as timber or steel). Because of the presence of tariff escalation, it is common in gravity model studies to disaggregate trade flows by commodities or commodity groups using various classifications of foreign trade statistics such as the Harmonized System (HS) or Standard International Trade Classification (SITC) to find out which sectors have been most affected by an RTA. Tariff escalation also has an important macroeconomic implication for the economic assessment of regional integration. Since the distribution of benefits and losses from an RTA depends on the structure of the RTA member countries' economies, countries with higher value-added exports are expected to reap the most benefits from bilateral trade liberalization than their less developed or resource-based RTA counterparts.

Table 2-9 shows that the EEU member countries significantly differ in terms of value-added in their exports. Finished goods account for 60 percent of merchandise exports from Belarus,

whereas 66 percent of products that Kazakhstan exports are raw materials, with the other EEU members being between them. Based on the product structure of exports of the EEU member countries, one could expect that economic integration would bring more benefits to Belarus than to Armenia, with a negligible effect on Kazakhstan and the Kyrgyz Republic. For Russia, which has almost the same share of exports of finished products in its exports as Armenia, but with the size of its economy and the relatively low percentage of its exports to the EEU member countries, the trade effect would be almost zero.

Table 2-10 shows that intermediate goods dominate the export structure of the EEU. They account for more than 60 percent of intra-region trade and more than 90 percent of trade with the rest of the world. The composition of imports by BEC product groups is relatively balanced, but the largest share still belongs to intermediate goods. It means that in the international division of labor, the EEU is positioned as a supplier of intermediate outputs, mainly raw materials, to the rest of the world, and its member states are heavily dependent on imports of finished goods, especially investment goods, from non-member countries. This asymmetric product composition of bilateral trade between the EEU and the rest of the world implies a possible adverse effect of economic integration on the EEU member countries since they could face increased costs for imported final goods, which the other EEU member countries cannot easily replace as they are primarily engaged in trade in intermediate goods. A significant share of intermediate goods in intra-region trade also indicates that the economies of the EEU member countries complement each other rather than compete. The complementary nature of the EEU can be attributed to the Soviet legacy of the EEU member states, which were integral parts of a single economy for several decades before the break-up of the former Soviet Union severely disrupted their close economic relations. The complementary nature of the EEU implies that economic integration would rebuild production cooperation rather than increase competition between its members, with a more considerable impact on intra-region trade in

intermediate goods rather than investment or consumer goods. Eventually, the EEU would transform into a regional value chain that could resemble the production cooperation and division of labor that once existed in the economic model of the former Soviet Union.

2.4. Conclusion

This Chapter has shown why the gravity model of trade has been and remains one of the most popular empirical tools among researchers to evaluate trade policy. It has a simple and flexible structure, solid theoretical underpinnings, high explanatory power and empirical robustness, and many practical applications. When applied to the evaluation of regional integration, the gravity model employs the famous Viner's model of a customs union and estimates trade creation and trade diversion effects by using a set of RTA dummy variables that reflect the membership status of the trading partners in bilateral trade. In the initial application of the gravity model to estimate regional integration, only one RTA dummy variable was used, which estimated the trade creation effect. The trade creation dummy variable takes the value of one if both an exporter and an importer belong to the same RTA. Nowadays, most researchers use two or three RTA dummy variables to estimate not only the trade creation effect but also the trade diversion effect (in exports and imports). The trade diversion dummy variable equals one if either exporter or importer is an RTA member country. With the contribution of Endoh (1999), who split the trade diversion dummy variable into export and import trade diversion dummies, some researchers now use three RTA dummy variables to conduct a more detailed analysis of the impact of an RTA on intra-region trade between RTA member countries and also on their exports to and imports from non-members countries. There seems to be no uniform approach to selecting the number of RTA dummy variables, and a researcher's choice most likely depends on the study's objectives. However, this study suggests that including all three RTA dummies could provide a more detailed analysis of the trade effects of an RTA. Also, it assumes that including trade diversion dummy variables would not considerably affect the

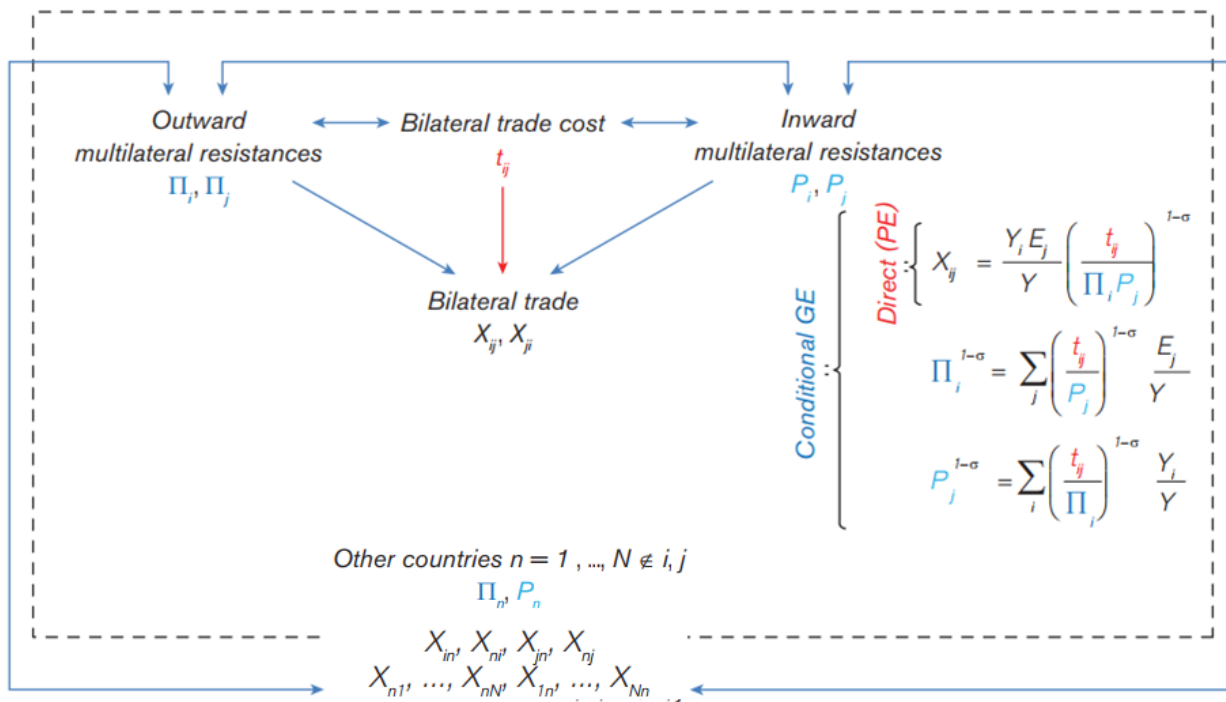
trade creation estimate, especially if RTA member countries trade more with non-member countries than with each other, as in the case of the EEU. This assumption will be tested in Chapter 3, where a comparative analysis of the estimates of trade effects depending on the number of dummy variables in the gravity model equation will be conducted.

Another reason for including three RTA dummy variables is related to the trade balance effects, which are explained in detail and derived in Chapter 5. The overview of the empirical framework of the gravity model in this Chapter has demonstrated that the import trade diversion effect, which is captured by the import trade diversion RTA dummy variable, can be viewed as an additional change in imports of an RTA member country from non-members that occurs in response to the creation of an RTA. Similarly, the export trade diversion effect, which is captured by the export trade diversion RTA dummy variable, can be viewed as an additional change in exports of an RTA member country to non-members that occurs in response to the creation of an RTA. Therefore, the estimates of export and import trade diversion effects can be used to construct the change in the trade balance of an RTA member country against the rest of the world. Following the approach of Endoh (1999), who split the trade diversion dummy variable into export and import trade diversion dummies, this study splits the trade creation RTA dummy variable into two parts. As shown in Table 2-2, the trade creation RTA dummy variable is generally specified as equal to one if both countries i and j are RTA members. The specification does not depend on whether the dependent variable is exports or imports. However, if it is specified (for exports as the dependent variable) as being equal to one if country i is an exporter *and* an RTA member, and country j is an importer *and* an RTA member, then it captures the additional change in exports from one RTA member i to another RTA member j due to regional integration. If it is specified (for exports as the dependent variable) as being equal to one if country j is an exporter *and* an RTA member, and country i is an importer *and* an RTA member, then it captures the additional change in imports of one RTA

member i from another RTA member j due to regional integration. Therefore, the estimates of export and import trade creation effects can be used to construct the change in the trade balance of an RTA member country i against the trade bloc. It should be noted that it is not possible to construct the trade balance effects of an RTA member country against another RTA member country because they cancel each other if they are derived for two bilateral trade partners (exports of country i are imports for country j , and vice versa).

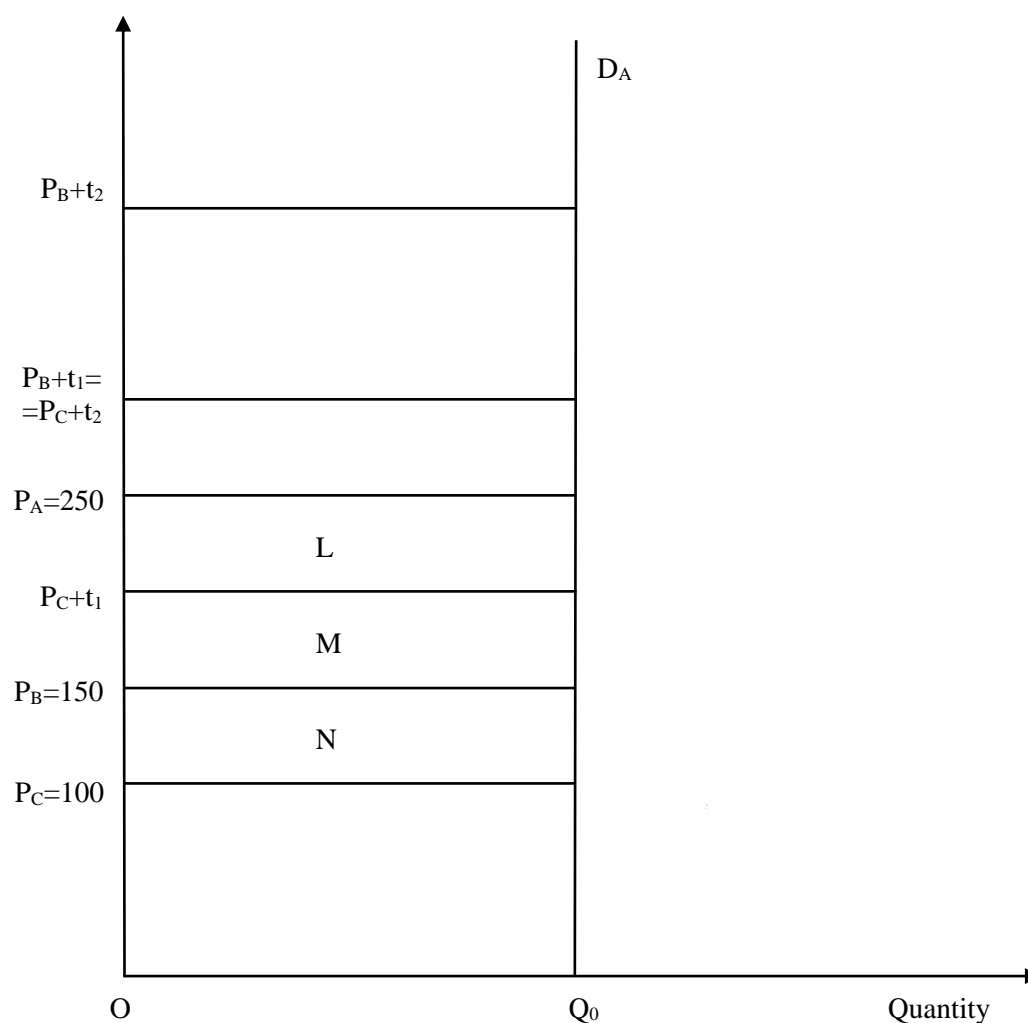
This Chapter also highlights the major milestones in the history of the EEU, which suggest that the EEU member countries, as the post-Soviet republics that once were in a single economic union, are, in fact, in the process of economic *reintegration* rather than integration. The relative power of the EEU member states and their product-group-based and direction-based foreign trade patterns underline the distinctive features of the EEU that need to be considered when interpreting the estimation results. First, it is an asymmetric trade bloc dominated by Russia. Second, it is *outward-looking* rather than *inward-looking*, as its member countries are engaged in more trade with the rest of the world than with each other. Third, intra-region trade flows are highly skewed towards Russia, so the EEU operates as a set of bilateral RTAs with Russia rather than a single multilateral RTA. Fourth, bilateral trade within the region is mostly in intermediate goods, so the EEU member countries complement each other rather than compete. At the same time, they export mainly low-value-added products to the rest of the world and heavily depend on imports of finished products from non-member countries. Fifth, the EEU member countries significantly differ in the share of value-added products in their exports.

Figure 2-1. Partial and quasi-general trade effects in the structural gravity model



Note. The figure shows the direct and indirect effects of a change in bilateral trade costs on trade flows. From *An Advanced Guide to Trade Policy Analysis* (p. 76), by Y. V. Yotov, R. Piermartini, J. Monteiro & M. Larch, 2016, United Nations EBooks

Figure 2-2. Trade creation and trade diversion in Viner's model

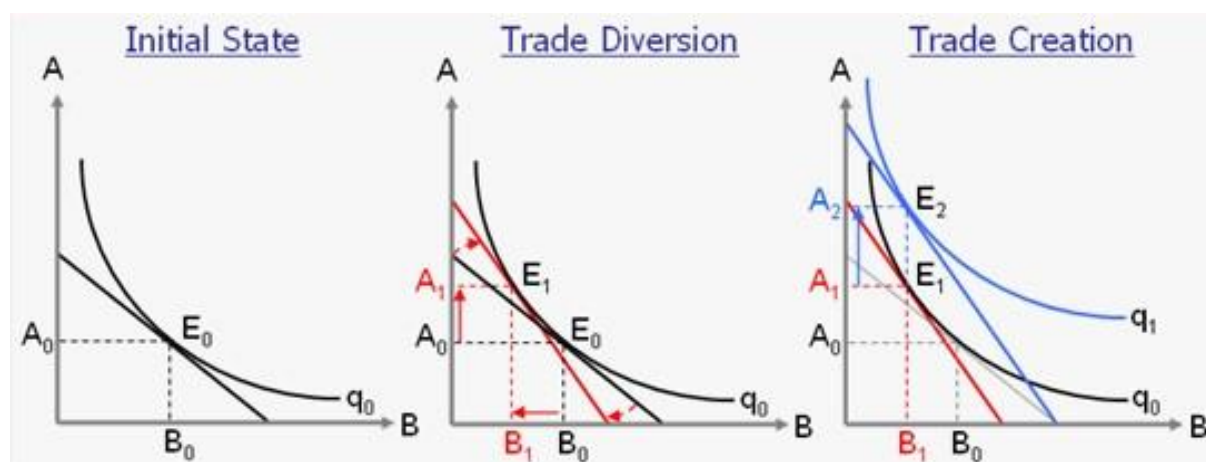


Source: adapted from Panagariya, A. (2000). Preferential Trade Liberalization: The Traditional Theory and New Developments. *Journal of Economic Literature*, 38(2), p. 291. <https://doi.org/10.1257/jel.38.2.287>

Table 2-1. The hypothetical example of trade creation and trade diversion

Country	Price (P_i), \$	P_i+t_1	$P_i+t_1^d$	P_i+t_2	$P_i+t_2^d$
(1)	(2)	(3)	(4)	(5)	(6)
A	250	250	250	250	250
B	150	300	150	450	150
C	100	200	200	300	300

Figure 2-3. Trade creation and trade diversion with consumption effects



Note. The figure shows trade creation and trade diversion effects in the SMART modeling framework. The World Bank, 2010 (<https://wits.worldbank.org/wits/wits/witshelp/Content/SMART/Trade%20Effects.htm>).

Table 2-2. Specification of RTA dummy variables in the gravity model

Trade effect	Notation of RTA dummy variable	Description	
		Dependent variable is exports	Dependent variable is imports
Trade creation	RTA_TC_{ijt}	It equals one if both country i and country j belong to the same RTA at time t , and zero otherwise.	
Import trade diversion	RTA_MTD_{ijt}	It equals one if country j (importer) is an RTA member and country i (exporter) is a non-member at time t , and zero otherwise.	It equals one if country i (importer) is an RTA member and country j (exporter) is a non-member at time t , and zero otherwise.
Export trade diversion	RTA_XTD_{ijt}	It equals one if country i (exporter) is an RTA member and country j (importer) is a non-member at time t , and zero otherwise.	It equals one if country j (exporter) is an RTA member and country i (importer) is a non-member at time t , and zero otherwise.

Table 2-3. Redirection of trade flows

		Country of destination	
		RTA member	Non-member
Country of origin	RTA member	Type I (between RTA members)	Type III (from RTA member to non-member)
	Non-member	Type II (from non-member to RTA member)	Type IV (between non-members)

Table 2-4. Estimation outcomes of RTA dummy variables

Type of trade flow	Sign of estimated coefficients	
	positive	negative
Type I	Trade creation	“Reverse trade creation”
Type II	“Reverse import trade diversion”	Import trade diversion
Type III	“Reverse export trade diversion”	Export trade diversion

Table 2-5. Timeline of major steps in Eurasian economic integration

Year of agreement	1991	2000	2007	2011	2014
Year of entry into force	1991-1994	2001	2011	2012	2015
Agreements	CIS Agreement	Treaty on Eurasian Economic Community	Treaty on Common Customs Territory and Customs Union	Declaration on Eurasian Economic Integration	Treaty on Eurasian Economic Union
				Eurasian Common Market	Eurasian Economic Union
			Customs Union		
		Eurasian Economic Community			
Commonwealth of Independent States (CIS)					

Table 2-6. Relative economic power of the EEU member countries, in percent, 2015

EEU member country	Share in total EEU GDP
Armenia	0.7
Belarus	3.5
Kazakhstan	11.4
Kyrgyz Republic	0.4
Russia	84.1
TOTAL	100.0

Source: author's calculations from the EEU Commission database

Table 2-7. Direction of trade flows between the EEU and the rest of the world, 2015

Country	Trade flow	EEU	Non-EEU
Armenia	Export	16%	84%
	Import	31%	69%
Belarus	Export	41%	59%
	Import	56%	44%
Kazakhstan	Export	11%	89%
	Import	37%	63%
Kyrgyz Republic	Export	28%	72%
	Import	49%	51%
Russia	Export	7%	93%
	Import	7%	93%

Source: author's calculations from the EEU Commission database

Table 2-8. Trade flows between Russia and the other EEU member countries, 2015

Country	Intra-EEU trade flow	Russia	Other EEU members
Armenia	Export	95%	5%
	Import	97%	3%
Belarus	Export	94%	6%
	Import	100%	0%
Kazakhstan	Export	89%	11%
	Import	94%	6%
Kyrgyz Republic	Export	39%	61%
	Import	63%	37%

Source: author's calculations from the EEU Commission database

Table 2-9. Composition of foreign trade of the EEU member countries, 2015

Country	Trade flow	BEC Product Group		
		Consumer goods	Capital goods	Intermediate goods
Armenia	Exports	39%	2%	59% (31%)
	Imports	52%	16%	22% (11%)
Belarus	Exports	47%	13%	40% (9%)
	Imports	31%	19%	19% (30%)
Kazakhstan	Exports	10%	1%	89% (66%)
	Imports	38%	35%	21% (6%)
Kyrgyzstan	Exports	14%	5%	81% (18%)
	Imports	51%	19%	24% (6%)
Russia	Exports	39%	5%	55% (35%)
	Imports	35%	39%	17% (10%)

Source: author's calculations from the EEU Commission database

Table 2-10. Direction of disaggregated trade flows of EEU member countries, 2015

	Intra-EEU trade	Trade with non-EEU countries	
		Exports to non-EEU countries	Imports from non-EEU countries
Consumer goods	26.9%	4.3%	32.8%
Investment goods	8.8%	2.7%	23.5%
Intermediate goods	64.3%	93.0%	43.7%
Total	100.0%	100.0%	100.0%

Source: author's calculation from the EEU Commission database

Chapter 3 Partial equilibrium gravity model analysis

3.1. Introduction

The gravity model of trade has been widely used in empirical research to study international trade due to its relatively simple and flexible framework, solid microeconomic foundation, empirical robustness and high explanatory power, and the limited number of assumptions required. It allows researchers to include, in addition to standard gravity variables, many other factors that are supposed to help explain bilateral trade between countries. These factors include but are not limited to transportation costs, exchange rates, oil prices, “the domino effect” (when countries, which have not signed an RTA in the first place, then become eager to join it), foreign direct investments, the rules-of-origin (that is, the location of goods production), “natural trading partners” hypothesis, the effects of trade union rights and democracy, the role of institutions and export promotion agencies, the role of trade rules and regulatory framework, the impact of non-tariff barriers. Some studies consider aggregate exports or imports a dependent variable, while others focus on the trade flows in certain products.

This Chapter begins with a literature review of empirical studies on regional integration that applies the gravity model of trade. Since thousands of scholarly articles have been published on this topic, the literature review section highlights the main methodological approaches researchers use for gravity equation specification, estimation procedure, and interpretation of the results. It also outlines the best practice for estimating the structural gravity model established in the literature. Then, the Chapter presents the empirical model for estimating the trade creation and trade diversion effects of the EEU in a partial equilibrium setting and describes the sample and estimation techniques. In this Chapter, the trade effects are estimated only for the EEU as a trade bloc. Trade creation and trade diversion effects for each EEU member country will be estimated in Chapter 5, along with the estimation of the trade balance effects. Finally, the empirical results are reported and discussed.

3.2. Literature review

Applying the gravity model to examining the trade effects of regional integration started with Aitken (1973), who estimated with cross-sectional data the impact of the EEC¹⁰ and the EFTA¹¹ on trade between the member states. Since then, numerous studies have been published on the subject matter, albeit with mixed results. Endoh (1999), who was the first to estimate export trade diversion in the gravity model, finds neither trade creation nor trade diversion between the LAFTA¹² and Japan. Soloaga and Winters (2001) show negligible trade diversion in the trade between the EU¹³ and EFTA. Fukao et al. (2003) find minor trade diversion in NAFTA¹⁴. Roberts (2004) evaluates the potential trade effects of the draft preferential trade agreement between China and ASEAN¹⁵ countries and concludes that it would produce neither trade creation nor trade diversion. Egger (2004) argues that the trade effects of RTAs are much more significant in the long run than in the short run. He finds that the NAFTA member states could increase intra-region trade by 15 percent in the long run. Musila (2005) finds neither trade diversion nor trade creation for African RTAs (COMESA¹⁶, ECCAS¹⁷, ECOWAS¹⁸). Péridy

¹⁰ European Economic Community

¹¹ European Free Trade Association

¹² Latin American Free Trade Association. Established in 1960 by Argentina, Brazil, Chile, Mexico, Paraguay, Peru, and Uruguay. Transformed in 1980 into Latin American Integration Association (ALADI) with 13 members (Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Ecuador, Mexico, Panama, Paraguay, Peru, Uruguay, and Venezuela).

¹³ European Union

¹⁴ North American Free Trade Agreement

¹⁵ Association of Southeast Asian Nations with 10 members (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam).

¹⁶ Common Market for Eastern and Southern Africa includes 19 countries: Burundi, Comoros, Congo, Dem Rep., Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia, and Zimbabwe.

¹⁷ Economic Community of Central African States (Angola, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Rwanda, and Sao Tome and Principe).

¹⁸ ECOWAS (Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo).

(2005a) and Rojid (2006) have similar results for the AGADIR¹⁹ and the COMESA, respectively. Tang (2005) investigates the trade effects of NAFTA, ANZCERTA²⁰, and ASEAN FTA and finds that intra-region trade within each trade bloc has increased, the ANZCERTA has diverted trade away from non-member countries, and the ASEAN FTA members have increased their trade with non-member countries. Péridy (2005b) argues that the EU-Mediterranean FTA (the EMFTA) is trade-creating because it has increased exports from the Mediterranean countries to the EU. Carrère (2006) concludes that "...regional trade agreements generate a significant increase in trade between members, often at the expense of the rest of the world". Lee and Park (2007), in their study of East Asian countries, suggest that new FTAs in the region would decrease trade diversion and increase intra-region trade. Kalirajan (2007) argues that the IOC-ARC²¹ would benefit Australia by boosting its exports. Péridy and Abedini (2008) estimate that the GAFTA²² agreement has increased intra-region trade by 20%. Grant and Lambert (2008) report in their study on the trade in agricultural products that even though RTAs would not bring benefits in the short run, they would still have a considerable positive impact on agricultural trade in the long run. Adam and Moutos (2008) evaluate the trade effects of the EU-Turkey Customs Union and find that trade effects are asymmetric as the Customs Union has decreased the intra-EU trade and increased bilateral trade between the EU and Turkey in both directions, that is, from the EU to Turkey and vice versa. García et al. (2013) find a moderately positive trade effect of Mercosur²³ on its member countries. Zidi and Dhifallah (2013) analyze the impact of the Euro-Mediterranean Agreement

¹⁹ Agreement on the Establishment of the Free Trade Area between the Arab Mediterranean States. Established in 2004 by Egypt, Jordan, Morocco, and Tunisia.

²⁰ The Australia New Zealand Closer Economic Agreement

²¹ Indian Ocean Rim - Association for Regional Cooperation. Established in 1997 and later transformed into the Indian Ocean Rim Association (IORA).

²² The Greater Arab Free Trade Area

²³ Mercado Común del Sur – The South American Common Market with five members: Argentina; Brazil; Paraguay; Uruguay, and Venezuela (suspended since December 2016).

between the EU and the South-Eastern Mediterranean countries on Tunisia and find export trade diversion but neither trade creation nor import trade diversion.

Urata and Okabe (2013) argue that the trade effects of RTAs depend on the type of RTA. With bilateral trade data disaggregated at SITC two-digit product level, they find that customs unions have more products with trade creation and fewer products with trade diversion than FTAs. They conclude that a customs union is preferred over a free trade area in terms of wealth creation. Kahouli and Maktouf (2014) analyze trade creation and trade diversion effects of different RTAs for 27 developed and developing Euro-Mediterranean countries. They focus on four RTAs (EU-15, the Economic and Monetary Union (eurozone), the Arab Maghreb Union (AMU), and AGADIR Agreement) and find significant trade creation effects for all FTAs in the sample and negligible trade diversion effects, except for the AMU. Deme and Ndrianasy (2016) estimate the trade effects of the ECOWAS, both at the group and individual member country levels. They find that regional integration benefits the trade bloc as a whole, for most member countries, and for some non-member countries. The authors conclude that economic integration “among (a) small countries, (b) low-income countries, and (c) countries that have a small share of their total trade with each other may have a positive impact on both member countries and third countries” (Deme and Ndrianasy (2016), p. 2200). Jie and Zhihong (2020) find no significant trade effect for China-ASEAN FTA. Chandran (2018) and Singh (2021) investigate the impact of the India – ASEAN FTA (IAFTA) and find a positive and statistically significant intra-FTA trade creation effect. While Chandran (2018) uses only one RTA dummy variable, Singh (2021) estimates trade effects with three RTA dummy variables. Obtaining positive and statistically significant results, he concludes that both IAFTA members and non-members benefit from regional integration because of trade creation within the IAFTA and export and import trade creation vis-a-vis the rest of the world. Stanojevic et al. (2021) analyze the “16 + 1 Cooperation” Agreement between China and Central and Eastern European (CEE)

countries, using a panel dataset consisting of 167 countries and covering the period of 2001-2019. Their results show a statistically significant negative impact on CEE's imports from China with no effect on exports from CEE countries to China. Tskhomelidze (2022) investigates the trade effects of the Deep and Comprehensive Free Trade Area (DCFTA) between each of the three former Soviet republics, Georgia, Moldova, Ukraine, and the EU. The estimation results are different for each country. She finds that the DCFTA has increased trade between Georgia and the EU by 18%. For Moldova, the trade creation effect is half as much and negative, but for Ukraine, it is statistically insignificant.

Geda and Yimer (2022) examine the possible effects of the African Continental Free Trade Area (AfCFTA). Since AfCFTA has not yet been fully implemented, the authors derive the results from the main African RTAs such as COMESA, EAC (East Africa Community), and SADC (Southern African Development Community). They estimate that the AfCFTA could potentially increase intra-African trade by a minimum of 42.6 percent and a maximum of 60.75 percent. Cieřlik and Gurshev (2023) investigate the degree of interdependence of bilateral trade flows of Tajikistan and Uzbekistan, whose trading partners are grouped into six pools consisting of one or several countries and defined as "potential integration partners" - China, the EEU, Iran, SPECA²⁴, Turkey, and the WTO. They use the gravity model to capture the causal relationship between the trade flow between the country of interest (Tajikistan or Uzbekistan) and one of its "potential integration partners," on the one hand, and the total trade turnover (exports plus imports) of the "potential integration partner," excluding trade with the country of interest, on the other hand. A positive link indicates a positive trade interdependence implying that trade flows are complementary. Negative trade interdependence means that trade flows are substitutes. The authors find that trade is complementary between Uzbekistan, on the

²⁴ The UN Special Program for the Economies of Central Asia (SPECA) was launched in 1998. The countries of SPECA are Afghanistan, Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.

one hand, and the EEU, China, and Turkey, on the other hand. Tajikistan's trade is dependent on the EEU, SPECA, and Turkey. They predict that a deeper integration within the EEU would bring additional trade benefits for both Tajikistan and Uzbekistan, while trade with China would remain an alternative option for them. Dursun (2023) analyzes the impact of the customs union between the EU and Turkey on aggregate and disaggregated, by sector and by product, bilateral trade flows. The estimation results show no effect on EU-Turkey bilateral trade for 1996-2016, but the author finds a positive impact on Turkey's exports and imports over the period of 1996-2006, which disappeared in the following decade (2007-2016). At the sectoral level, a positive effect is found only in Turkey's agricultural exports and fuel imports. The results are mixed at the product level (69 products at the SITC two-digit level).

Eurasian economic integration has also been the subject of gravity model research. Borodin and Stokov (2015) examine the Customs Union of Belarus, Russia, and Kazakhstan for 2002-2010 and find no trade creation within the region. Extending their model by disaggregating trade flows by product group (at SITC two-digit level), they find some trade creation effect in specific commodities such as iron and steel. They explain the insignificant impact of the Customs Union by the resource-based structure of the economies of Russia and Kazakhstan, which import manufactured goods from countries outside of the Customs Union, mainly from the EU and China, to meet their domestic demand. Isakova et al. (2015) find that the Customs Union of Belarus, Kazakhstan, and Russia has increased trade between Russia and non-member countries and reduced imports of Chinese goods to Russia and Kazakhstan. Mukhamediyev and Khitakhunov (2017) explain why regional economic integration among Central Asian countries has failed despite preferential trade agreements between them. Mukhamediyev and Khitakhunov (2018) analyzed the impact of the customs union between Belarus, Kazakhstan, and Russia using the gravity model for 17 countries. With a full set of fixed effects (country, time, and country pair), the estimation results in a negative but statistically insignificant trade

creation effect. Tumanyan (2018) uses the gravity model with the data on exports from the EEU countries to their 58 trading partners for the period of 2005-2016 and finds significant trade diversion and negligible trade creation. Vakulchuk and Knobel (2018) analyze the impact of non-tariff barriers on the imports of Belarus, Kazakhstan, and Russia for the period of 2010–2015. They follow Haveman and Thursby (1999) and disaggregate imported goods at HS 10-digit level. Their results show that, on average, a one percent decrease in non-tariff barriers causes an increase of 1.6–1.7% in trade, with agriculture and food having the highest growth potential. They conclude that smaller EEU member countries engaged in active trade with each other would benefit most from lowering or removing non-tariff barriers between them. Abakumova and Primierova (2020) use the “globalization index” as the variable of interest in the gravity model to examine the impact of globalization on bilateral trade as well as on distance. They find that globalization has a positive impact on trade but including the “globalization index” does not affect the elasticity of exports with respect to distance. To estimate the impact of the EEU on the bilateral trade between Kazakhstan and the other EEU member countries, Mukhamediyev et al. (2020) use the synthetic control method (SCM). This method was developed by Abadie and Gardeazabal (2003) and then expanded by Abadie et al. (2010). It estimates the effect of intervention in comparative case studies by comparing a change in the variable of interest over time in a treatment group affected by intervention to a change in the same variable of interest in a control group. Mukhamediyev et al. (2020) show that due to economic integration, Kazakhstan has increased bilateral trade with other EEU member countries by 18.5 percent, and the impact of the EEU intra-region trade has been positive. Adarov (2018) also applies the synthetic control method in his analysis of the EEU trade effects at the country and industry levels. He finds that the Eurasian Customs Union has caused a significant trade creation effect, especially in commodities and chemicals; the net trade impact has been positive for Belarus, generally positive for Russia, and mixed for

Kazakhstan. Golovko and Şahin (2021), using the panel data for 86 countries for the period of 1994–2018, seek to find out the factors that affect the process of integration of Eurasian countries²⁵ into world trade. The variable of interest in their model is “the level of integration of the Eurasian countries into the world trade system” (Golovko & Şahin, 2021, p. 532). By estimating the difference between predicted (potential) and actual levels of trade, the authors conclude that “the Eurasian countries were 35% less integrated with the world trade than the predicted potential level” (Golovko & Şahin, 2021, p. 539). Vasudevan and Manalaya (2021) focus their analysis on the exports of machinery goods and machinery parts and components from the EEU member countries to their 28 trading partners over the period of 2010-2017. They argue that the EEU has created significant trade diversion and reduced intra-region trade in machinery, spare parts, and components. Aituar and Akhmediyarova (2021) investigate the impact of non-tariff barriers on intra-EEU trade. They estimate that a reduction in non-tariff barriers has increased the imports of Kazakhstan from the EEU member countries by 33% with no effect on the country’s exports to the EEU. Aituar and Kemelbayeva (2022) have obtained similar results from the study on tariff measures. They use a gravity model with an average import tariff as an independent variable instead of an RTA dummy variable and demonstrate that an increase in import tariffs after the creation of the customs union has reduced the imports of Kazakhstan by 10.7%. Both studies (Aituar & Akhmediyarova, 2021; Aituar & Kemelbayeva, 2022) conclude that Kazakhstan has not benefited from Eurasian integration because the Kazakh domestic producers gained less than the producers in the other EEU member countries.

Several gravity model studies exist on the trade between the EEU and its main trading partners. Miljković (2018) suggests that economic integration and foreign direct investments could

25 The set of the Eurasian countries in the study includes Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenistan, and Uzbekistan.

potentially have a positive impact on bilateral trade between the EEU and Serbia. Adarov and Ghodsi (2021) estimate that a preferential trade agreement between the EEU and Iran would potentially increase EEU exports to Iran by 19.1 percent and Iranian exports to the EEU by up to 7 percent. Bui and Ha (2022) investigate the impact of a similar agreement with Vietnam and find a possible trade creation effect. Lei et al. (2022) study the growth potential of bilateral trade between China and the EEU and argue that although China is already a major trading partner for Kazakhstan and Russia, the actual level of trade between China and the EEU is far below its potential level.

The literature review has revealed several points that are worth mentioning. First, empirical studies on RTA evaluation that estimate trade creation and trade diversion effects in the gravity model typically yield mixed results. Kepaptsoglou et al. (2010) review over 50 papers that use the gravity model, including those that estimate the trade effects of RTAs, and come to the same conclusion as Baier and Bergstrand (2007), who find no convincing evidence of significant trade creation and trade effects of RTAs. The prevalence of mixed results in applying the gravity model to evaluate an RTA can be attributed to the different methodological techniques in the research. Carrère (2006) and Magee (2008) show that the estimation results are sensitive to gravity equation specification, sampling strategy, and estimation method. Indeed, as the literature review demonstrates, there is no unified approach to the gravity equation specification in empirical studies as the choice of the independent variables (including the number of RTA dummy variables), sample size, timeframe, and the use of exports or imports as the dependent variable are determined mainly by the research question.

Second, the number of publications that use the gravity model to estimate the trade effects of the EAEU is steadily growing. However, there are still few compared to publications on other RTAs worldwide. The EAEU is one of the largest RTAs in the world and has considerable potential for more research work that also has practical relevance for policymakers. Of all the

gravity model studies on Eurasian economic integration mentioned in this Chapter, only Golovko and Şahin (2021) use the PPML method, while the rest apply the traditional OLS estimator. However, although Golovko and Şahin (2021) use the gravity model, they do not estimate the trade creation and trade diversion effects of the EEU. They use one dummy variable for WTO, one for RTA, and one for trade with the Eurasian region. The latter equals one if a country belongs to the Eurasian region (which includes Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Russia, Tajikistan, Turkmenistan, and Uzbekistan). So, Golovko and Şahin (2021) do not specifically focus on the EEU but have a broader research scope covering almost all the CIS countries. This study attempts to address this literature gap and contribute to the existing research by assessing the trade creation and trade diversion effects of the EEU using not only OLS but also the PPML estimator, which is supposed to produce more accurate results in the presence of heteroscedasticity and zero-value observations in trade data (Silva & Tenreyro, 2006).

3.3. Empirical model and estimation

The specification of the gravity equation in this study has a set of standard gravity variables such as bilateral exports, GDP of an exporter and an importer, geographical distance between them, and geographic and cultural dummy variables. In addition, the model includes RTA dummy variables, which are generally assumed to represent trade creation, import trade diversion, and export trade diversion effects. The log-linear form of the gravity equation is expressed as follows:

$$\begin{aligned} \ln X_{ijt} = & \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln E_{jt} + \beta_3 \ln DIST_{ij} + \beta_4 CNTG_{ij} + \beta_5 CLNY_{ij} + \\ & + \beta_6 LANG_{ij} + \beta_7 EEU_{ijt}^{XM} + \beta_8 EEU_{ijt}^M + \beta_9 EEU_{ijt}^X + \varepsilon_{ijt} \end{aligned} \quad (3-1)$$

where X_{ijt} is the exports (in millions of US dollars) from country i to country j in year t ; Y_{it} is the nominal GDP of an exporting country i in year t (in millions of US dollars); E_{jt} is the

nominal GDP of an importing country j in year t (in millions of US dollars); $DIST_{ij}$ is the distance between country i and country j defined as the geographical distance between the most populated cities of a country pair and expressed in km; $CNTG_{ij}$ is a dummy variable, which equals one if countries i and j share a common border and zero otherwise; $CLNY_{ij}$ is a dummy variable, which equals one if country i and country j have ever been in a colonial relationship, either vertical or horizontal, and has zero value otherwise; $LANG_{ij}$ is a dummy variable, which equals one if country i and country j share a common official or primary language, and zero otherwise. EEU_{ijt}^{XM} is a dummy variable, which equals one if both countries i and j are members of the EEU at time t and zero otherwise. EEU_{ijt}^M is a dummy variable, which takes the value of one if country j is a member of the EEU but country i is not at time t and is zero otherwise. EEU_{ijt}^X is a dummy variable, which equals one if country i is a member of the EEU, but country j is not, at time t , and zero otherwise. Finally, ε_{ijt} is the normally distributed error term.

This study follows the generally accepted practice of empirical research, according to which the choice of time in the specification of dummy RTA variables is usually determined by the year of RTA establishment. Therefore, RTA dummy variables are equal to one for Belarus, Kazakhstan, and Russia, starting from 2010, and for Armenia and the Kyrgyz Republic - starting from 2015. It should be noted that even though the EEU was established in 2015, it was a continuation of the regional integration policy and a transition step from a customs union to a common market, which includes, in addition to goods, free flows of services, capital, and labor. The customs union between Belarus, Kazakhstan, and Russia began to operate in 2010. Since this study covers only trade in goods, it considers Belarus, Kazakhstan, and Russia as member countries starting from 2010 rather than from 2015. Since Armenia and Kyrgyzstan joined the EEU in 2015 and immediately became members of the common market, including the customs union, their RTA membership is assumed to start from 2015.

The dependent variable in the gravity equation can be expressed in either exports or imports. There is no standard approach in the literature because, in bilateral trade, exports from country i to country j are equivalent to imports of country j from country i . So, the choice of the dependent variable depends primarily on the research question. There may be discrepancies between import and export data due to statistical reporting standards or tax evasion. The standard practice of foreign trade statistics records exports on a FOB basis and imports on a CIF basis (cost and freight included). Thus, import data, which include insurance and transportation costs, are usually higher than export data. Also, since customs tariffs are mostly levied on imported goods, statistics and customs authorities keep more careful records of imported goods than exported goods, implying that import data should be more reliable than export data. However, this is not always the case, as the reliability of foreign trade statistics also depends on the quality of institutions and the level of tax evasion in a country. For example, for many years, one of the problems of Kazakhstan's foreign trade statistics has been the discrepancy between the import data from China recorded by Kazakh customs authorities and export data registered by China. According to the IMF's Direction of Trade Statistics database, in 2020, Kazakhstan imported goods from China to the amount of 6.3 billion US dollars (according to Kazakh authorities). However, exports from China to Kazakhstan amounted to 11.7 billion US dollars (according to Chinese authorities). Given the long-standing problem of import data reported by Kazakh authorities, this study uses exports as the dependent variable. At the same time, data on imports are also used to check the robustness of the estimation results. Frankel (1999) argues that the GDP variable reflects a country's economic development level, production capacity and export potential, and the amount its consumers spend on imported goods. Krugman (1991) explains that large countries can use economies of scale to produce lower-cost goods and constantly improve their competitiveness. Large countries have higher purchasing power and more resilient economies than small ones, so they are better prepared to

absorb external shocks. Since all these factors contribute to GDP growth and positively correlate with trade, the coefficients of GDP variables (β_1 and β_2) are expected to have a positive sign. The dummy variables for geographical distance ($DIST_{ij}$), contiguity ($CNTG_{ij}$), colonial relationship ($CLNY_{ij}$), and common language ($LANG_{ij}$) have no time dimension, so they are assumed to remain constant throughout the period covered in this study. Since longer distance implies higher transportation and time costs, the coefficient (β_3) of the distance variable is expected to be negative. This variable may include other factors that impede trade, such as market access, regulation, and other non-tariff barriers. Adjacent countries with a shared land border are assumed to be engaged in active bilateral trade, so the coefficient (β_4) on the contiguity variable is expected to be positive. Since the subject of this research is economic integration, one composite dummy variable ($CLNY_{ij}$) to reflect the colonial past of the EEU member countries is deemed sufficient. It is constructed by borrowing from the CEPII database and combining the dummy variable *comcol*, which indicates that two countries were or are under the same colonial rule, and the variable *col45*, which shows that two countries were and are in a colonial relationship. Vertical colonial ties mean that one country is a colony, and the other is a colonizer. Horizontal colonial ties mean that country *i* and country *j* are under the same colonial rule established by a third country (a colonizer). Institutional economists agree that shared history and close cultural ties between countries reduce transaction costs and positively affect business and trade. Therefore, the coefficients of the variables $LANG_{ij}$ (β_5) and $CLNY_{ij}$ (β_6) are expected to be positive.

The variables EEU_{ijt}^{XM} , EEU_{ijt}^M , and EEU_{ijt}^X indicate the RTA membership status of either an exporter or an importer, or both with respect to the EEU. EEU_{ijt}^{XM} and EEU_{ijt}^M reflect Viner's theoretical constructs and are supposed to estimate trade creation and trade diversion effects, respectively. Positive estimates of EEU_{ijt}^{XM} are generally interpreted as trade creation, whereas negative estimates of EEU_{ijt}^M as (import) trade diversion. The variable EEU_{ijt}^X , introduced by

Endoh (1999), is supposed to capture export trade diversion effect. Like import trade diversion, the coefficient of this dummy variable is expected to be negative.

Throughout this study, the gravity equations are estimated for the sample of 50 countries listed in Table 3-1. These countries are selected based on the following sampling strategy. First, since the primary focus of this research is the EEU, only those countries, which are engaged in trade with the EEU member states, are included in the sample. Second, small offshore jurisdictions like the Bermudas and the British Virgin Islands are excluded from the analysis since the EEU member countries do not actually trade with them. Third, only those trade partners with shares in the foreign trade of the EEU member states exceeding 0.1 percent are selected. Fourth, one-time trade transactions are excluded from the sample. As a result, the sample generated upon these selection criteria is deemed representative of the population, corresponds to the study's objectives, and gives adequate coverage of most trade partners of the EEU member states.

The description of variables and the data sources are listed in Table 3-2. The sample in the form of panel data covers the period from 2000 to 2020 with 51,450 observations. Panel data are usually preferred over cross-sectional data because they improve estimation efficiency and help address the issue of endogeneity using country-pair fixed effects (Baier & Bergstrand, 2007). The period 2000-2020 is selected to ensure that the sample adequately covers years before and after the formation of the EEU. Data on bilateral trade flows are taken from IMF's Direction of Trade Statistics database (<https://data.imf.org>). The GDP data are from the World Bank database (<https://databank.worldbank.org>). In the World Bank database, the GDP data are missing for Afghanistan (2000 and 2001), Turkmenistan (2020), Syrian Arab Republic (2020), Venezuela (from 2015 to 2020), and Yemen (2019 and 2020). The data on the geographical distance between two countries, contiguity, colonial relationship, and common language are taken from CEPII's database (http://www.cepii.fr/cepii/en/bdd_modele/bdd.asp). The

information on the EEU member countries is taken from the official website of the EEU Commission (<http://www.eaeunion.org>).

To estimate the gravity equations, this research uses the ordinary least squares (OLS) and Poisson Pseudo Maximum Likelihood (PPML), the most common estimation methods applied in gravity model studies. The PPML method directly estimates the non-linear form of the gravity model with trade flows taken in levels rather than logs. In their seminal paper, Silva and Tenreyro (2006) show that compared with the OLS estimator, which produces a significant bias in the presence of heteroskedasticity, the usual case with trade data, the PPML estimator ensures more robust estimation results. Since trade statistics are presented as panel data, two approaches are usually used to deal with panel data: fixed effects and random effects. Choosing between random and fixed effects involves a trade-off between consistency and efficiency. Researchers typically conduct the Hausman specification test, which shows which of the two approaches is more preferred for a gravity model. However, many empirical studies have demonstrated the superiority of fixed effects over random effects. Glick and Rose (2002), in their research on the trade impact of a monetary union, use both fixed and random effects. They estimate the gravity model with a panel dataset for 217 countries from 1948 through 1997 and find that fixed effects provide more robust results.

Antonucci and Manzocchi (2006) also prefer fixed effects over random effects in their analysis of the bilateral trade between Turkey and the EU. Egger (2002) suggests that a researcher, who decides between fixed and random effects, should consider the study's objectives, sample size, data characteristics, and the model's specification. He argues that most empirical studies show that fixed effects provide better results than random effects despite the latter being more efficient than the former, provided that individual-specific effects are uncorrelated with independent variables. He concludes that a study should use the random effects method if the research objective is to evaluate country-specific effects, given that the data are consistent.

However, if explanatory variables vary with time, the fixed effects method is the only option to estimate a gravity model with panel data (Egger, 2002). The best practice established in the literature suggests including a complete set of fixed effects in a gravity equation (Yotov et al., 2016). Following this recommendation, this study estimates the gravity model with the OLS and PPML methods using exporter-time, importer-time, and country-pair fixed effects. Exporter-time and importer-time fixed effects account for the outward and inward multilateral resistances, respectively (Anderson & Van Wincoop, 2003). In this case, equation (3-1) is modified in the following way to be estimated with the OLS method:

$$\begin{aligned} \ln X_{ijt} = & \pi_{it} + \chi_{jt} + \beta_1 \ln DIST_{ij} + \beta_2 CNTG_{ij} + \beta_3 CLNY_{ij} + \beta_6 LANG_{ij} + \\ & + \beta_5 EEU_{ijt}^{XM} + \beta_6 EEU_{ijt}^M + \beta_7 EEU_{ijt}^X + \varepsilon_{ijt} \end{aligned} \quad (3-2)$$

where π_{it} is the vector of exporter-time fixed effects to capture the outward multilateral resistances; χ_{jt} is a set of importer-time fixed effects that account for the inward multilateral resistances. Since exporter-time and importer-time fixed effects incorporate exporter's output and importer's expenditure, variables Y_{it} and E_{jt} are excluded from the gravity equation. The other variables are as defined in gravity equation (3-1).

In addition, to address the problem of endogeneity, a common issue in the studies on economic integration (Trefler, 1993), country-pair fixed effects are included in gravity estimation (Baier & Bergstrand, 2007). Also, Egger and Nigai (2015) and Agnosteva et al. (2014) note that pair fixed effects can approximate time-invariant bilateral trade costs. The estimates of country-pair, exporter-time, and importer-time fixed effects are used to perform a general equilibrium gravity analysis (Anderson & Yotov, 2016; Anderson et al., 2015a; Larch & Yotov, 2016).

While the OLS method, because of its simplicity, has been widely used to estimate the gravity model, it has significant methodological shortcomings. A gravity equation to be estimated by the OLS is log linearized, and the assumption is made that an error term has a constant variance

(homoscedasticity assumption). An error term must be independent of the explanatory variables. Otherwise, the assumption of homoscedasticity is violated, and the standard errors of the OLS estimators become biased and inconsistent. Silva and Tenreyro (2006) argue that trade statistics are heteroscedastic by their nature and also contain a lot of zero-value observations. In this case, log linearizing a gravity equation and estimating it with the OLS method causes two problems. First, the logarithmic transformation makes the issue of heteroscedasticity worse because, as Silva and Tenreyro (2006) note, “expected values of the log linearized error term will depend on the covariates of the regression and, hence, OLS will be inconsistent even if all observations of the dependent variables are strictly positive”. The second problem arises due to zero-value observations in trade statistics. Mathematically, the logarithm of zero is not defined. However, in economics, even the lack of trade between two countries may convey valuable information and make economic sense. This issue becomes more acute if zero-value observations account for more than 50 percent of a panel dataset. These factors produce inconsistent OLS estimators with a significant bias, which does not diminish even if the sample size increases (Silva & Tenreyro, 2010).

Golovko and Şahin (2021) note that two adjustments are made to mitigate the problem of zero values in trade data. The first approach assumes the economic unimportance of zero-value observations and excludes them from the dataset. The second approach assumes that zero values result from statistical errors and replace them with small positive numbers. However, excluded zero values may have some essential economic information, which, if lost, may negatively affect the estimation results (Eichengreen & Irwin, 1998). Likewise, replacing zero values with small positive numbers is not without shortcomings since it may be difficult to justify, theoretically and practically, why these positive numbers have been chosen (Linders & De Groot, 2006). Also, Burger et al. (2009) argue that even small changes made to correct the

dataset of the dependent variable in the gravity model (e.g., exports) may alter the model estimation results.

To address the issues of zero-value observations in trade statistics and the logarithmic transformation of the gravity model's variables, Silva and Tenreyro (2006, 2010) have developed an alternative estimation method: the Poisson Pseudo Maximum Likelihood (PPML). Silva and Tenreyro (2010) suggest that such an approach is more appropriate than the OLS. First, the PPML method is much better prepared than the OLS method to accommodate the non-constant variance of an error term. Second, because the PPML equation specification is expressed in a non-linear multiplicative form, all zero-value trade observations in the sample are counted adequately during the estimation procedure, and the information they contain is fully reflected in the results. Third, because the PPML method estimates the dependent variable in levels and not in logs, the model becomes free from under-prediction bias, which arises in the OLS method due to zero values. Silva and Tenreyro (2006) conclude that “the PPML estimator is the best performing estimator that naturally deals with zero trade flows, consistent and gives the lowest bias among the other estimators.” Siliverstovs and Schumacher (2007) find in their study of trade in manufactured goods that the PPML produces much better results than the OLS. Another empirical support for the PPML method comes from Henderson and Millimet (2008), who argue that the proper estimation of the gravity model requires several strong assumptions. However, since some do not correspond to the trade theory, the authors recommend estimating a gravity model in levels and not in logs. Over time, with more empirical support in the literature, the PPML method has become the preferred option for trade scholars in gravity model studies (Arvis & Shepherd, 2013).

To apply the PPML method, the gravity equation (3-1) is reformulated with a set of exporter-time, importer-time, and country-pair fixed effects in a multiplicative form as follows:

$$X_{ijt} = \exp [\pi_{it} + \chi_{jt} + \mu_{ij} + \beta_7 EEU_{ijt}^{XM} + \beta_8 EEU_{ijt}^M + \beta_9 EEU_{ijt}^X] \times \varepsilon_{ijt} \quad (3-3)$$

where exp denotes the exponential function, π_{it} is the vector of exporter-time fixed effects to capture the outward multilateral resistances; χ_{it} is a set of importer-time fixed effects that account for the inward multilateral resistances; μ_{ij} denotes country pair fixed effects. Since exporter-time and importer-time fixed effects incorporate exporter's output and importer's expenditure, variables Y_{it} and E_{jt} are excluded from gravity equation. In addition, because of country pair fixed effects, the paired time-invariant standard gravity variables (distance, common border, common language, and colonial relationship) drop out of the gravity equation. No constant term is allowed due to the presence of fixed effects. The RTA dummy variables are as defined in gravity equation (3-1), and the dependent variable, exports, is now expressed not in logs but in levels.

3.4. Empirical results

As Anderson and Van Wincoop (2003) demonstrate, ignoring the multilateral resistances in a gravity equation may cause significant biases in the estimates of the variables. Also, Silva and Tenreyro (2006) suggest estimating a gravity model with the PPML method to address the presence of heteroscedasticity and zero values in trade data. Nevertheless, the partial equilibrium gravity analysis of the EEU starts with an OLS estimation without fixed effects to check the coherence of the gravity equation specification and obtain the results for the traditional gravity variables (which drop out of the gravity equation in the case of fixed effects), given that the estimates of GDP and geographical distance have proved remarkably stable across numerous empirical studies. Since distance, output, and expenditure variables are expressed in natural logarithms, their coefficients are interpreted directly as elasticities. Dummy variables are not logarithm-linearized, so their interpretation differs from continuous variables. To interpret the estimates of the coefficients of dummy variables ($\hat{\beta}_{dummy}$), they are recalculated in percentage terms using the following formula: $[e^{\hat{\beta}_{dummy}} - 1] \times 100$.

The OLS estimation results for the gravity equation without fixed effects for total exports reported in column (1) of Table 3-3 are as expected. With $R^2 = 0.714$, the econometric specification has a strong fit typically found in most gravity model studies. Regarding sign and magnitude, the estimates of the traditional gravity variable correspond to the summary indexes developed by Head and Mayer (2014). The estimated coefficients of output and expenditure are statistically significant, positive as expected, and close to one as predicted by theory. However, they generally deviate from one in most studies because, as Olivero and Yotov (2012) demonstrate in a dynamic structural gravity model, output and expenditure are autocorrelated with their previous values in a panel dataset. The estimated coefficient of the output variable means that a one percent increase in the exporter's GDP is associated with an increase of 1.136 percent in exports. Also, the elasticity of importer GDP is usually lower than that of exporter GDP, which is evidence of home market effects, as Feenstra et al. (2001) explain. The coefficient estimate on the importing country's GDP is equal to 0.863, which implies that a one percent increase in the GDP of the importing country is associated with an increase of imports by 0.863 percent.

The estimate of the coefficient on distance is negative as expected, statistically significant, close to the benchmark estimate of (-1), and confirms that distance significantly impedes international trade. A one percent increase in distance between the trading partners reduces bilateral trade by 1.297 percent. The estimates of the effects of contiguity (0.487), common language (0.982), and colonial relationship (0.780) are positive, statistically significant, and in line with the literature. The least significant effect is that of the common border. As mentioned in Chapter 2, the EEU can be seen as a set of bilateral preferential agreements between Russia and the other EEU member states because the bilateral trade within the EEU is heavily skewed toward Russia. It implies that the contiguity effect in the gravity model is affected by the number of members that share a common border with Russia. Because Armenia does not share

a common border with the other EEU member states, and the Kyrgyz Republic does not border Russia, the contiguity effect is about half the effect of the colonial relationship. Common language and colonial ties strongly impact bilateral trade as they reflect close historical and cultural relations between the EEU member states that have evolved through many centuries, first in the Russian Empire and then in the former Soviet Union. Overall, the OLS estimates of the traditional gravity variables are within the accepted ranges in the empirical literature and confirm the sample's representativeness and the gravity model's empirical robustness.

The results for the RTA dummy variables are mixed. While the estimated coefficient of the trade creation RTA dummy variable is not statistically significant, the positive and statistically significant estimates of the trade diversion effects suggest a trade contraction between the EEU and the rest of the world as the exports of the EEU member countries to and their imports from non-member countries have fallen by $(e^{-0.703} - 1) \times 100 = 50.5$ percent and $(e^{-0.289} - 1) \times 100 = 25.1$ percent, respectively. This trade contraction is theoretically expected as reducing bilateral trade costs between the EEU member states due to regional integration raises the outward and inward multilateral resistances they face vis-à-vis the rest of the world. Reducing bilateral trade costs between members with a higher common external tariff tends to raise the relative prices of non-members' goods and reduce domestic demand of the EEU for them. Also, the EEU exporters getting access to the intra-region market may divert their trade flows away from non-members toward their EEU trade partners.

Estimating the gravity equation with trade flows decomposed into consumer, capital, and intermediate goods shows the contribution of each product group to the observed decline of bilateral trade between the EEU and the rest of the world. The results in columns (2) - (4) of Table 3-3 indicate that the import trade diversion is associated with the decrease of imports across all product groups. The imports of consumer, investment, and intermediate goods by the EEU member states from non-members have decreased by $(e^{-0.453} - 1) \times 100 = 36.4$ percent,

$(e^{-0.441} - 1) \times 100 = 35.7$ percent, and $(e^{-0.920} - 1) \times 100 = 60.1$ percent, respectively. Given the product composition of the EEU imports from the rest of the world from Table 2-10, the reduction of imports in each product group is reflected in the overall weighted-average change in imports of aggregated goods from non-members. The contribution of each product group to the change of the EEU exports to non-members is different for the estimated export trade diversion effect. The exports of consumer and capital goods from the EEU to the rest of the world have increased by 68.8 and 84.2 percent, respectively. However, because the trade pattern of the EEU exports to non-members is dominated by intermediate goods (93 percent), the overall decline in aggregated goods exports is not so significant (22 percent). The OLS estimation results for trade creation and trade diversion effects imply that the economic integration has negatively affected the EEU member states with no impact on the intra-region trade but with negative economic implications for consumers and producers in the EEU member states as they substantially depend on imports of consumer and capital goods from non-member countries. While the estimation of the OLS without fixed effects has proved the empirical robustness of the gravity model regarding the traditional gravity variables, the estimates of trade creation and trade diversion should be interpreted with caution, given that the gravity equation does not include fixed effects, which may cause the results to be biased.

As mentioned in the previous section of this Chapter, the OLS method without fixed effects produces biased results. The main reason for using the OLS estimator without fixed effects is to check the stability of the model by estimating the traditional gravity variables, which drop out of the gravity equation when fixed effects are introduced. The redirection of trade bilateral flows and the magnitude of their changes described by the estimates of the RTA dummy variables may be misleading, indicating that the gravity equation (3-1) does not account properly for the multilateral resistances. As Anderson and Van Wincoop (2003) demonstrate in their influential paper, ignoring the multilateral resistances in the gravity model may cause

significant biases in the estimates of the variables. To account for the multilateral resistances, the gravity equation specification (3-2) is estimated with a set of exporter-time and importer-time fixed effects using both the OLS and the PPML estimators.

The OLS estimation results controlling for multilateral resistances terms are reported in Table 3-4. The coefficient of the distance variable (-1.281) has practically not changed compared with the OLS estimation results without fixed effects. While the coefficient of the contiguity variable has decreased, and coefficients of the language and colonial relationship variables have increased, all of them are still positive and statistically significant. Including the multilateral resistance terms into the gravity equation captures the effects of a change in bilateral trade costs between the RTA members on non-member countries. The creation of an RTA reduces the trade barriers between the member states, and at the same time, it increases, in relative terms, the overall trade costs between the member and non-member states. In other words, regional integration decreases the outward and inward multilateral resistances between the RTA member countries and increases the outward and inward multilateral resistances between the RTA member countries and the rest of the world.

The OLS estimation controlling for the multilateral resistances demonstrates no considerable change in the trade creation effect (-0.05). This result is comparable with the OLS estimation results without fixed effects (-0.09) in magnitude and sign and is also statistically insignificant. This result can be explained in the following way. The reduction of bilateral trade costs due to an RTA has a direct effect on bilateral trade. This effect, which has already been captured in the OLS estimation without fixed effects, is stronger than the indirect effect through multilateral resistances. As a result, the trade creation effect does not change substantially when multilateral resistances are accounted for in the OLS estimation by including exporter-time and importer-time fixed effects. However, as reported in column (1) of Table 3-4, the import trade diversion effect is much stronger (-1.041) than in the OLS without fixed effects and statistically

significant. At the same time, the export trade diversion effect, which was negative and statistically significant in the OLS estimation without fixed effects, now becomes statistically insignificant.

To provide a robustness check, in addition to the OLS, the gravity equation is estimated with the PPML method, including exporter-time and importer-time fixed effects to control for the multilateral resistances. The results are reported in Table 3-5. The estimated trade creation effect is statistically insignificant, and its magnitude (-0.0947) is almost the same as in the estimation with the OLS method without fixed effects (-0.0922) and is comparable with the result of the OLS estimation with exporter-time and importer-time fixed effects (-0.05). The estimates of import and export trade diversion effects are also comparable with the previous OLS results. The estimated coefficient of the import trade diversion dummy variable is negative and statistically significant. The imports of the EEU members from non-member states have decreased by 64.7 percent in the OLS estimation with fixed effects and by 63.0 percent in the PPML estimation with fixed effects. The estimated coefficient of the export trade diversion dummy variable in both OLS and PPML with fixed effects is insignificant. The OLS and PPML results are also similar with respect to the composition of the change in trade flows. In both cases, the import trade diversion effect arises because the EEU member countries reduce their imports of each product group. The only difference between the OLS and PPML results is that the reduction of imports of investment and intermediate goods is statistically significant in the latter case.

One of the challenges that researchers face in using the gravity model to evaluate the impact of an RTA is endogeneity. Regional integration is unlikely to be an exogenous trade policy decision. Countries that have traded with each other for many years and have longstanding close political, economic, historical, and cultural ties are likely to establish an RTA (according to the "natural trading partners" hypothesis). In this case, on the right-hand side of the gravity

equation, RTA dummy variables are correlated with the error term. Besides reverse causality, endogeneity may occur due to the omitted variable bias. Regional integration is a multi-factor process, and some of the unobserved factors may directly affect bilateral trade but are omitted in the gravity equation. In RTA evaluation studies with panel data, researchers typically address the issue of endogeneity by using country-pair pair fixed effects. Given the best practice in the empirical literature, the gravity equation is modified and estimated with a full set of fixed effects (exporter-time, importer-time, and country-pair fixed effects).

The OLS estimation results with a full set of fixed effects are reported in Table 3-6. The most significant change is observed in the estimate of the trade creation effect. This change implies that in the case of the EEU, the endogeneity is indeed the issue that has been addressed by estimating the gravity equation with country-pair fixed effects. As shown in Chapter 2, the EEU member states, which have longstanding close bilateral ties, had once been in a single political and economic union. Eurasian economic integration, which started immediately after the dissolution of the former Soviet Union and took many years, can be regarded as the economic reintegration of the post-Soviet republics. Although the estimate of the trade creation is statistically insignificant, it has increased substantially in magnitude from (-0.05) in the OLS estimation controlling for multilateral resistances to 0.582. In other words, the OLS results with a full set of fixed effects suggest that the trade between EEU member countries has increased by 79 percent due to the creation of the customs union. As for their trade with non-members, the estimates of the import and export trade diversion effects are statistically insignificant. Compared to the OLS estimation with multilateral resistances, the estimate of import trade diversion increased from (-1.041) to (-0.0769), while the estimate of export trade diversion practically remained unchanged (0.514). As shown in columns (2) - (4) of Table 3-6, the intra-region trade increase is associated with trade creation in all product groups. However, the estimated coefficient of the trade creation in consumer goods (0.956) is the only statistically

significant outcome in the OLS estimation with a full set of fixed effects. It implies that intra-EEU trade in consumer goods has increased 1.6 times due to regional integration. The results of the OLS estimation accounting for multilateral resistances demonstrate that the EEU has positively affected intra-region trade. The EEU member countries have increased their bilateral trade in consumer goods 1.6 times due to removing trade barriers in the customs union and easing access to each other's domestic markets. However, there has been no impact on trade between the EEU member states and non-members, which can be explained by the high dependence of the EEU on trade with the rest of the world, especially in consumer and investment goods.

For making an overall conclusion about the impact of the EEU in a partial equilibrium setting, the gravity equation is estimated with a full set of fixed effects using the PPML method to account for heteroscedasticity and zero-value observations, which are supposed to yield more accurate results than the OLS estimator. The results of the PPML estimation with a full set of fixed effects for total exports are reported in column (1) of Table 3-7. The estimated coefficients of the three RTA dummy variables differ significantly in magnitude, sign, and statistical significance from the previous PPML estimation with only exporter-time and importer-time fixed effects. The results are also comparable with the OLS estimation with a full set of fixed effects. The estimates of all trade effects, especially the trade creation effect, increased. These results are consistent with Baier and Bergstrand (2007), who suggest that estimating the trade effects of an RTA without accounting for endogeneity produces a downward bias. The estimated coefficient of the trade creation RTA dummy variable (0.459) is positive and statistically significant. It means that the EEU leads to an increase of about $(e^{0.459} - 1) \times 100 = 58$ percent in intra-region trade. It is also comparable with the trade creation effect estimated with the OLS method with a full set of fixed effects (0.582). However, the PPML estimates of the trade diversion effects are statistically insignificant. The results of regressing the gravity

equation on disaggregated goods are reported in columns (3) - (5) of Table 3-7. They show that the trade creation effect in aggregated goods is primarily driven by the expansion of intra-region trade in consumer goods, which has increased by $(e^{0.318} - 1) \times 100 = 37$ percent. The estimate of the trade creation effect is statistically significant.

However, there is no EEU impact on trade in investment goods as they account for a low share in foreign trade patterns of the EEU member states. The estimated coefficients of the import trade diversion and export trade diversion RTA dummy variables for trade in intermediate goods are negative (-0.344) and positive (0.403), respectively, and both are statistically significant. They indicate that the EEU member countries have diverted their imports of intermediate goods from non-members by 29.1 percent. At the same time, they have expanded their exports of intermediate goods to the rest of the world by 49.6 percent. These results are comparable in sign and magnitude to the estimates of import trade diversion (-0.203) and export trade diversion (0.141) in trade in intermediate goods in the OLS estimation with a full set of fixed effects (although the OLS estimates are not statistically significant). In line with the theory, negative import trade creation is the expected outcome of a customs union as RTA member countries divert their sources of supply from non-members toward their RTA trading partners. However, the estimates of export trade diversion can also be positive, as shown in the literature review. An increase in EEU exports of intermediate goods to non-members can be explained by the composition of intermediate goods, which include a wide range of products from raw materials to high-tech semiconductors. While raw materials dominate the EEU exports of intermediate goods, they account for a much less share in the EEU imports. In this case, a reduction of the EEU imports of intermediate goods from non-members reflects an increased common import tariff on semi-finished intermediate goods after the creation of the customs union. At the same time, in response to regional integration, some non-members may have reduced their import tariffs and increased their demand for raw materials from the EEU.

However, this proposition needs further investigation. Estimating the gravity equation using both the OLS and the PPML estimators with a full set of fixed effects has found no significant trade creation effect in bilateral trade between EEU member countries in capital and intermediate goods. In the case of investment goods, this can be explained by the low share of investment goods in trade between EAEU member countries (8.8 percent, according to Table 2-10). As for intermediate goods, although they dominate intra-region trade (64.3 percent, according to Table 2-10), most of them are raw materials, which are currently exempted from EEU regulation.

As mentioned in Chapter 2, in empirical studies, researchers, depending on the research question, can use one, two, or three RTA dummy variables according to equations (2-7), (2-8), and (2-9), respectively. Although this study estimates the baseline gravity equation (3-1) with three RTA dummy variables, it is worthwhile to check how the regression results are affected if the number of RTA dummy variables is changed. The results of estimating the gravity equation by including consecutively one, two, and then three RTA dummy variables are reported in Table 3-8. It demonstrates that the estimates of the traditional gravity variables are insensitive to the number of RTA dummy variables. The estimated coefficients of output, expenditure, distance, common border and language, and colonial relationship have the expected signs in all three cases. They are statistically significant, with no considerable change in their magnitude. There is also a slight improvement in the goodness-of-fit measure of the model, which is expected, since as the number of independent variables increases, the coefficient of determination (R^2) usually tends to increase. The estimation results for the trade effects show that the trade creation effect is statistically insignificant for all three cases regardless of the number of RTA dummy variables. However, with one RTA dummy variable, the trade creation effect is positive (0.0050) and then decreases when the trade diversion dummy variables are included. The way the trade effect estimates change when more RTA

dummy variables are added to the gravity equation suggests that the change in the estimate of the trade creation effect depends on whether the trade diversion effects are positive or negative. Adding a trade diversion effect with a negative value pulls down the trade creation effect. Conversely, adding a trade diversion effect with a positive value pulls the trade creation effect upward. Thus, in the case of a single RTA dummy variable (for the trade creation effect), the gross trade creation effect overestimates the impact of an RTA in the case of negative trade diversion because it does not consider that bilateral trade between RTA member states and non-members has declined. Conversely, the gross trade creation effect underestimates the impact of an RTA if trade diversion is positive because it does not account for increased trade between an RTA and the rest of the world. However, the estimates of the trade effects should be considered with caution as the OLS method without the fixed effects yields biased results.

The same exercise is conducted with both the OLS and the PPML estimators with a full set of fixed effects. Its results reported in Table 3-9 confirm the conclusion made in the OLS estimation without fixed effects concerning the impact of adding more RTA dummy variables on the trade creation effect. The results of the OLS estimation with a full set of fixed effects reported in columns (1) - (3) of Table 3-9 show that with the import trade diversion RTA dummy variable, whose estimated coefficient has a negative value, the new estimate of the trade creation effect is lower than in the case of one RTA dummy variable. In the case of three RTA variables, the estimate of import trade diversion is negative, and that of export trade diversion is positive. However, the estimate of export trade diversion in absolute terms is several times larger than the estimate of import trade diversion. So, the new estimate of the trade creation effect (with three RTA variables) is higher than in the first (one RTA dummy variable) and in the second (two RTA dummy variables) cases. The PPML estimator yields the same results reported in columns (4) - (6) of Table 3-9. They show that using two and three RTA variables yields positive export and import trade diversion effects. As a result, the new estimates of the

trade creation effect are much higher than the gross trade creation effect estimated with one RTA dummy variable. It should be noted that the choice of the number of RTA dummy variables depends on the research question. Hence, if research (like this study) needs not only to analyze the overall change in the intra-RTA market (implied by the gross trade creation effect) but also to investigate how trade between RTA member and non-member countries has changed, using three RTA dummy variables can provide a more detailed picture of RTA impact on trade.

As mentioned before, the dependent variable in the gravity equation can be expressed in either exports or imports with no conceptual difference between them because, in bilateral trade, exports from country i to country j are equivalent to imports of country j from country i . So, the choice of the dependent variable depends primarily on the research question. The dependent variable in this study's baseline gravity equations is bilateral exports. However, it is worthwhile to estimate the trade creation and trade diversion effects of the EEU using imports as the dependent variable to conduct a robustness check. The OLS and PPML estimation results with a full set of fixed effects and using imports as the dependent variable are reported in Table 3-10. There are three cases with one, two, and three RTA dummy variables to trace the changes in the trade creation effect. In contrast to the estimation with exports as the dependent variable, both the OLS and the PPML estimators now yield positive values of trade diversion effects. Adding the import trade diversion RTA dummy variable and then the export trade diversion RTA dummy variable increases the OLS estimate of the trade creation effect. The same result is obtained with the PPML estimator.

More importantly, with three RTA dummy variables, the baseline case in this study, the PPML estimate of the trade creation effect (0.536) is comparable to the trade creation effect estimated with exports as the dependent variable (0.459), both being statistically significant. It implies that the EEU member countries have increased their trade within the EEU common market by 70.9 percent due to eliminating bilateral trade barriers. With two RTA dummy variables, the

OLS estimate of the trade creation effect (0.383) suggests that the intra-EEU trade has increased by 46.7 percent due to regional integration. It has the same positive sign as the trade creation effect in the OLS estimation with exports as the dependent variable (0.582 or 79 percent). Both OLS estimates imply the positive impact of the EEU on intra-region trade. Although they are statistically insignificant, perhaps due to heteroscedasticity and zero-value observations in the sample data, they could still add some value to the analysis. They support the results of the PPML estimation with both exports and imports as the dependent variable, suggesting that the EEU has positively affected the intra-region trade, which has increased by 58.2 percent (exports) and by 70.9 percent (imports).

The PPML estimation of the trade diversion effects in the gravity equation with imports as the dependent variable also lends some support for the PPML results when exports are the dependent variable (Table 3-7). In both cases, the estimates of export trade diversion are statistically insignificant. With three RTA dummy variables, the estimate of import trade diversion (0.369) is now statistically significant. It implies that the bilateral trade between the EEU and the rest of the world has increased by 44.6 percent. More interesting are the results with two RTA dummy variables reported in column (5) of Table 3-10, which show results close to the results when exports are the dependent variable reported in column (5) of Table 3-9. When exports are taken as the dependent variable, the PPML estimation results suggest that the EEU has positively affected the intra-region trade, which has increased by 55 percent, and the trade between EEU members and non-members, which has increased by 51 percent. When the gravity equation is regressed with imports as the dependent variable, the PPML estimation results show that the trade between the EEU member states has increased by 57.9 percent, and the trade between the EEU and the rest of the world has increased by 74.5 percent.

Overall, the results of estimating the trade effects of the EEU in the gravity model under a partial equilibrium framework with the OLS and PPML estimators, including a full set of fixed

effects, and then conducting robustness checks changing the number of RTA dummy variables and using imports as the dependent variable instead of exports have demonstrated that the EEU has positively affected the intra-region trade. The estimation results also indicate that the EEU member countries may have increased their imports from non-members due to regional integration. However, there is insufficient evidence of the EEU's impact on the exports of the EEU member countries to the rest of the world.

3.5. Conclusion

The purpose of this Chapter is to estimate the trade effects of the EEU with the gravity model in a partial equilibrium setting. The literature review in the first part of the Chapter has demonstrated that researchers use different methods of specifying and estimating the gravity equation. The choice of the independent variables (including the number of RTA dummy variables), sample size, and the use of exports or imports as the dependent variable are determined mainly by the study's objectives and the research question. At the same time, over time, the best practice has been established in empirical studies concerning the estimation procedure based on the following recommendations. First, the gravity equation is estimated with exporter-time and importer-time fixed effects to control for observable and unobservable characteristics that vary over time for each exporter and importer (Anderson & van Wincoop, 2003) and account for outward and inward multilateral resistances, respectively (Feenstra, 2016; Hummels, 1999; Olivero & Yotov, 2012). Second, since endogeneity is a serious issue in RTA impact evaluation studies that understates the trade effect estimate (Baier & Bergstrand, 2007), it should be addressed by estimating the gravity equation with country-pair fixed effects. Third, in addition to the traditional OLS estimation, it is recommended to use the PPML estimator, which is supposed to produce more accurate results in the presence of heteroscedasticity and zero-value observations in trade data (Silva & Tenreyro, 2006).

This study follows all the recommendations listed above on estimating the gravity equation. As to the specification of the gravity equation, it uses three RTA dummy variables since it is interested not only in the gross trade creation effect in the intra-EEU market but also in the impact of regional integration on bilateral trade between the EEU member countries and non-members. The sample size includes 50 countries and adequately covers more than 99 percent of the foreign trade of the EEU member countries. Also, the period of 2000-2020 is selected to ensure that the sample covers ten years before and ten years after the customs union was established between Belarus, Kazakhstan, and Russia in 2010. The dependent variable in this study is aggregate exports and exports disaggregated into consumer, investment, and intermediate goods. To disaggregate trade data, gravity model researchers typically use the HS or the SITC classification to analyze the impact of an RTA on specific sectors or products. However, since this study attempts to bring a macroeconomic perspective into the gravity model, export commodities are grouped based on the BEC classification, which is widely used for the macroeconomic analysis of international trade and the most suitable for this study, which examines, among other things, the effect of regional integration on the trade balances of the EEU member states.

Overall, the results of estimating the trade effects of the EEU in the gravity model under a partial equilibrium framework with the OLS and PPML estimators, including a full set of fixed effects, and then conducting robustness checks by changing the number of RTA dummy variables and using imports as the dependent variable instead of exports suggest the EEU has a strong positive trade creation effect driven by increased intra-region trade in consumer goods. Concerning other product groups, the only statistically significant result has been obtained by the PPML estimation for trade in intermediate goods. The results suggest that the EEU member countries have decreased imports of intermediate goods from non-members and increased their exports of intermediate goods to non-members.

Table 3-1. List of countries in the sample

Country name	ISO3	Country name	ISO3
Afghanistan	004	Japan	392
Armenia	051	Kazakhstan	398
Austria	040	Korea, Republic of	410
Azerbaijan	031	Kyrgyz Republic	417
Belarus	112	Latvia	428
Belgium	056	Lithuania	440
Brazil	076	Moldova	498
Bulgaria	100	Netherlands	528
Canada	124	Poland	616
China	156	Portugal	620
Cyprus	196	Romania	642
Czech Republic	203	Russian Federation	643
Egypt, Arab Republic	818	Slovak Republic	703
Estonia	233	Spain	724
Finland	246	Sweden	752
France	250	Switzerland	756
Georgia	268	Syrian Arab Republic	760
Germany	276	Tajikistan	762
Greece	300	Turkey	792
Hungary	348	Turkmenistan	795
India	356	Ukraine	804
Iran, Islamic Republic	364	United Arab Emirates	784
Iraq	368	United Kingdom	826
Israel	376	United States	840
Italy	380	Uzbekistan	860

Table 3-2. Description of variables and data sources

Variable	Description	Source
X_{ijt}	Total exports from country i to country j at time t (expressed in \$US)	IMF Direction of Trade Statistics
Y_{it}	Nominal GDP of country i at time t (expressed in \$US)	World Bank
E_{jt}	Nominal GDP of country j at time t (expressed in \$US)	World Bank
$DIST_{ij}$	Geographical distance between country i and country j (defined as the distance between the most populated cities of the country pair and expressed in km)	CEPII
$CNTG_{ij}$	Dummy for contiguity (common border). It equals one if the two countries are contiguous and zero otherwise.	CEPII
$LANG_{ij}$	Dummy for a common language. It equals one if country i and country j share a common official or primary language and zero otherwise.	CEPII and author's adjustment for CIS countries
$CLNY_{ij}$	Dummy for colonial relationship. It equals one if country i and country j have been in a colonial relationship, either vertical or horizontal, and zero otherwise.	The author's calculations are based on variable <i>comcol</i> (horizontal colonial ties) and variable <i>col45</i> (vertical colonial ties) from the CEPII.
EEU_{ijt}^{XM}	Trade creation dummy variable. It equals one if both country i and country j are EEU members at time t and zero otherwise.	Author's calculations
EEU_{ijt}^M	Import trade diversion dummy variable. It equals one if country j is an EEU member and country i is not at time t , and zero otherwise.	Author's calculations
EEU_{ijt}^X	Export trade diversion dummy variables. It equals one if country i is an EEU member and country j is not at time t , and zero otherwise.	Author's calculations

Note. Belarus, Kazakhstan, and Russia are considered member countries starting from 2010 (the year of establishing the customs union). Armenia and the Kyrgyz Republic are considered member states starting from 2015 (when they joined the EEU).

Table 3-3. OLS estimation without fixed effects

	Total	Consumer goods	Investment goods	Intermediate goods
	(1)	(2)	(3)	(4)
Log output (Y)	1.136*** (0.0156)	1.223*** (0.0178)	1.418*** (0.0190)	0.976*** (0.0158)
Log expenditure (E)	0.863*** (0.0142)	0.800*** (0.0160)	0.795*** (0.0176)	0.884*** (0.0132)
Log distance (dist)	-1.297*** (0.0358)	-1.628*** (0.0400)	-1.440*** (0.0460)	-1.186*** (0.0337)
Contiguity (cntg)	0.487*** (0.120)	0.135 (0.147)	0.202 (0.145)	0.829*** (0.112)
Language (lang)	0.982*** (0.133)	1.319*** (0.173)	0.907*** (0.165)	0.752*** (0.123)
Colony (clny)	0.780*** (0.153)	0.784*** (0.205)	0.985*** (0.203)	0.765*** (0.144)
EEU ^{XM}	-0.0922 (0.272)	-0.191 (0.366)	-0.0854 (0.402)	-0.00914 (0.275)
EEU ^M	-0.703*** (0.106)	-0.453*** (0.113)	-0.441*** (0.127)	-0.920*** (0.0793)
EEU ^X	-0.289** (0.109)	-1.164*** (0.140)	-1.848*** (0.129)	0.0595 (0.131)
Constant	-16.23*** (0.418)	-15.49*** (0.476)	-21.18*** (0.540)	-15.52*** (0.404)
<i>N</i>	46138	43497	41918	39695
<i>R</i> ²	0.714	0.711	0.671	0.705
adj. <i>R</i> ²	0.714	0.711	0.671	0.705
Exporter-time FE	no	no	no	no
Importer-time FE	no	no	no	no
Country pair FE	no	no	no	no

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3-4. OLS estimation controlling for multilateral resistances terms

OLS with exporter-time and importer-time fixed effects				
	Total	Consumer goods	Investment goods	Intermediate goods
	(1)	(2)	(3)	(4)
Log distance (dist)	-1.281*** (0.0569)	-1.483*** (0.0638)	-1.229*** (0.0582)	-1.356*** (0.0537)
Contiguity (cntg)	0.282* (0.128)	0.164 (0.150)	0.221 (0.134)	0.496*** (0.118)
Language (lang)	1.203*** (0.139)	1.690*** (0.177)	1.535*** (0.173)	0.838*** (0.134)
Colony (clny)	1.014*** (0.161)	0.913*** (0.212)	1.167*** (0.203)	0.846*** (0.153)
EEU ^{XM}	-0.0500 (0.836)	-0.329 (0.754)	-0.0663 (0.765)	0.646 (0.842)
EEU ^M	-1.041* (0.440)	-1.372* (0.540)	-0.358 (0.502)	-0.521 (0.713)
EEU ^X	0.593 (0.919)	0.0258 (0.727)	-1.170 (0.662)	0.421 (0.727)
<i>N</i>	47615	44646	43002	40633
<i>R</i> ²	0.807	0.818	0.858	0.811
adj. <i>R</i> ²	0.799	0.809	0.851	0.802
Exporter-time FE	yes	yes	yes	yes
Importer-time FE	yes	yes	yes	yes
Country pair FE	no	no	no	no

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3-5. PPML estimation controlling for multilateral resistances terms

PPML with exporter-time and importer-time fixed effects				
	Total	Consumer goods	Investment goods	Intermediate goods
	(1)	(2)	(3)	(4)
Log distance (dist)	-0.716*** (0.0275)	-0.759*** (0.0335)	-0.686*** (0.0351)	-0.740*** (0.0298)
Contiguity (cntg)	0.515*** (0.0752)	0.573*** (0.0817)	0.296*** (0.0883)	0.628*** (0.0814)
Language (lang)	0.243** (0.0810)	0.299*** (0.0876)	0.421*** (0.0874)	0.0825 (0.122)
Colony (clny)	0.550** (0.203)	0.665** (0.210)	0.376 (0.252)	0.590*** (0.156)
EEU ^{XM}	-0.0947 (0.772)	-1.490* (0.596)	-1.465* (0.577)	1.122 (0.831)
EEU ^M	-0.993* (0.427)	-1.814*** (0.337)	-1.590** (0.490)	-0.987* (0.448)
EEU ^X	-0.177 (0.656)	-0.780 (0.527)	-2.759*** (0.413)	1.124 (0.721)
<i>N</i>	47615	44688	43347	40646
<i>R</i> ²	0.9351	0.9390	0.9528	0.8990
Exporter-time FE	yes	yes	yes	yes
Importer-time FE	yes	yes	yes	yes
Country pair FE	no	no	no	no

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3-6. OLS estimation with a full set of fixed effects

	Total exports	Consumer goods	Investment goods	Intermediate goods
	(1)	(2)	(3)	(4)
EEU ^{XM}	0.582 (0.322)	0.956** (0.351)	0.943 (0.578)	0.657 (0.364)
EEU ^M	-0.0769 (0.199)	0.147 (0.231)	0.822 (0.519)	-0.203 (0.405)
EEU ^X	0.514 (0.433)	0.442 (0.426)	0.00279 (0.372)	0.141 (0.261)
<i>N</i>	47611	44592	42950	40579
<i>R</i> ²	0.939	0.940	0.941	0.940
adj. <i>R</i> ²	0.932	0.934	0.934	0.933
Exporter-time FE	yes	yes	yes	yes
Importer-time FE	yes	yes	yes	yes
Country pair FE	yes	yes	yes	yes

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3-7. PPML estimation with a full set of fixed effects

	Total exports	Consumer goods	Investment goods	Intermediate goods
	(1)	(2)	(3)	(4)
EEU ^{XM}	0.459*** (0.124)	0.318** (0.118)	-0.00252 (0.116)	0.0360 (0.0838)
EEU ^M	0.267 (0.155)	0.00427 (0.159)	-0.152 (0.173)	-0.344* (0.174)
EEU ^X	0.160 (0.133)	-0.0340 (0.180)	0.189 (0.160)	0.403* (0.166)
<i>N</i>	47615	44687	43339	40648
<i>R</i> ²	0.995	0.994	0.995	0.980
Exporter-time FE	yes	yes	yes	yes
Importer-time FE	yes	yes	yes	yes
Country pair FE	yes	yes	yes	yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3-8. OLS without fixed effects for one, two, and three RTA dummy variables

Variable (exports as dependent variable)	Number of RTA dummy variables		
	One (trade creation)	Two (trade creation and import trade diversion)	Three (trade creation, import trade diversion, and export trade diversion)
	(1)	(2)	(3)
Log output (Y)	1.132*** (0.0157)	1.137*** (0.0157)	1.136*** (0.0156)
Log expenditure (E)	0.864*** (0.0142)	0.861*** (0.0141)	0.863*** (0.0142)
Log distance (dist)	-1.301*** (0.0359)	-1.298*** (0.0358)	-1.297*** (0.0358)
Contiguity (cntg)	0.466*** (0.121)	0.481*** (0.120)	0.487*** (0.120)
Language (lang)	0.977*** (0.130)	0.981*** (0.132)	0.982*** (0.133)
Colony (clny)	0.723*** (0.150)	0.766*** (0.152)	0.780*** (0.153)
EEU ^{XM} (trade creation)	0.0050 (0.271)	-0.0669 (0.272)	-0.0922 (0.272)
EEU ^M (import trade diversion)		-0.680*** (0.107)	-0.703*** (0.106)
EEU ^X (export trade diversion)			-0.289** (0.109)
Constant	-16.19*** (0.419)	-16.23*** (0.418)	-16.23*** (0.418)
<i>N</i>	46138	46138	46138
<i>R</i> ²	0.712	0.713	0.714
adj. <i>R</i> ²	0.712	0.713	0.714
Exporter-time FE	no	no	no
Importer-time FE	no	no	no
Country pair FE	no	no	no

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3-9. Exports as a dependent variable with one, two, and three RTA dummies

Variable (exports as dependent variable)	OLS			PPML		
	1-RTA	2-RTA	3-RTA	1-RTA	2-RTA	3-RTA
	(1)	(2)	(3)	(4)	(5)	(6)
EEU ^{XM} (trade creation)	0.202 (0.150)	0.189 (0.167)	0.582 (0.322)	0.0848 (0.0822)	0.438*** (0.127)	0.459*** (0.124)
EEU ^M (import trade diversion)		-0.0150 (0.211)	-0.0769 (0.199)		0.412** (0.161)	0.267 (0.155)
EEU ^X (export trade diversion)			0.514 (0.433)			0.160 (0.133)
<i>N</i>	47611	47611	47611	47615	47615	47615
<i>R</i> ²	0.939	0.939	0.939	0.995	0.995	0.995
adj. <i>R</i> ²	0.932	0.932	0.932	0.993	0.993	0.993
Exporter-time FE	yes	yes	yes	yes	yes	yes
Importer-time FE	yes	yes	yes	yes	yes	yes
Country pair FE	yes	yes	yes	yes	yes	yes

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3-10. Imports as a dependent variable with one, two, and three RTA dummies

Variable (imports as dependent variable)	OLS			PPML		
	1-RTA	2-RTA	3-RTA	1-RTA	2-RTA	3-RTA
	(1)	(2)	(3)	(4)	(5)	(6)
EEU ^{XM} (trade creation)	0.120 (0.157)	0.378 (0.208)	0.383 (0.234)	-0.0178 (0.0877)	0.457*** (0.108)	0.536*** (0.121)
EEU ^M (import trade diversion)		0.297 (0.269)	0.296 (0.268)		0.557*** (0.132)	0.369** (0.120)
EEU ^X (export trade diversion)			0.00618 (0.178)			0.273 (0.144)
<i>N</i>	47892	47892	47892	47895	47895	47895
<i>R</i> ²	0.936	0.936	0.936	0.994	0.994	0.994
adj. <i>R</i> ²	0.929	0.929	0.929	0.993	0.993	0.993
Exporter-time FE	yes	yes	yes	yes	yes	yes
Importer-time FE	yes	yes	yes	yes	yes	yes
Country pair FE	yes	yes	yes	yes	yes	yes

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Chapter 4 General equilibrium gravity model analysis

4.1. Introduction

A gravity equation estimated in a partial equilibrium setting captures only the effect of a change in bilateral trade costs on trade between RTA member countries. However, regional integration also affects non-member countries because their goods become more expensive for RTA countries in relative terms. This relative price change reallocates trade flows between RTA and the rest of the world. To address this issue, Anderson and van Wincoop (2003) introduced the concept of multilateral resistances and developed the structural gravity model, in which changes in bilateral trade costs between countries i and j affect all trade partners, not only countries i and j . In empirical studies, multilateral resistances are accounted for by estimating the gravity equation with exporter-time and importer-time fixed effects. This approach is termed the conditional general equilibrium because it considers a relative price change and extends a partial equilibrium gravity analysis to cover the impact of a change in bilateral trade costs on non-member countries through multilateral resistances. However, this approach holds output and expenditure constant, and there is no market-clearing condition.

This Chapter applies the gravity model under a general equilibrium framework to estimate the impact of the EEU. First, it highlights the main features of the GE gravity analysis and its difference from the partial equilibrium approach. Also, it explains how the GE gravity model differs from computable GE models, which have been widely used in research to study regional integration. Then, it reviews the literature that applies a GE approach to RTA impact evaluation. The second part describes the GE structural gravity system and explains how an RTA affects trade flows, prices, output, and expenditure of all trade partners, including RTA member states. The third part of this Chapter estimates the GE structural gravity system to examine the impact of the EEU on member and non-member countries, then reports and interprets the results.

4.2. Literature review

One of the main shortcomings of the standard gravity model discussed in Chapter 3 is that it is limited only to the RTA market and does not consider the impact of changes in bilateral costs across all trade partners, including non-member countries. Suppose two countries create an RTA and remove bilateral trade barriers. In this case, the standard gravity model predicts an impact on intra-region trade but not on trade between RTA member and non-member countries. Similarly, a higher common external tariff would increase import prices and reduce imports from non-member countries. In a partial equilibrium framework, no consideration is given to broader economic effects, as a tariff hike would affect the demand for substitutes or complementary goods and domestic production. Even for a single product, the indirect effects of a tariff change can be substantial. The tariff impact increases significantly and produces spillover effects across sectors when economic integration affects the entire domestic markets of RTA member countries. Removing bilateral tariffs between RTA member countries tends to increase intra-region trade as it becomes cheaper for one RTA member country to import goods from the other RTA members. At the same time, even if a common external tariff remains unchanged, goods produced outside the trade bloc become relatively more expensive. The relative price change reallocates trade flows between RTA and the rest of the world.

Anderson (1979), Bergstrand (1985), Deardorff (1998), Eaton and Kortum (2001), and Anderson and Van Wincoop (2003) all suggest that the standard gravity model is misleading because it assumes that prices are endogenous and, thus, they do not appear in the gravity equation even though they affect bilateral trade flows in the theoretical foundations of the gravity model. The main contribution to the theoretical framework of the gravity model that incorporated the price effect into the gravity equation was made by Anderson and van Wincoop (2003), who developed the concept of multilateral resistances, which now are the key components of the structural gravity system defined in the following way:

$$X_{ij} = \frac{Y_i E_j}{Y} \left(\frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \quad (4-1)$$

$$\Pi_i^{1-\delta} = \sum_j \left(\frac{t_{ij}}{P_j} \right)^{1-\sigma} \frac{E_j}{Y} \quad (4-2)$$

$$P_j^{1-\delta} = \sum_i \left(\frac{t_{ij}}{\Pi_i} \right)^{1-\sigma} \frac{Y_i}{Y} \quad (4-3)$$

In equation (4-1) of the structural gravity system, the first term $\left(\frac{Y_i E_j}{Y} \right)$ is referred to as a size term, which is interpreted as the trade between countries i and j with no trade costs and implies that larger countries trade relatively more than smaller ones. The second term represents trade costs that impede trade and consists of three components. Bilateral trade cost between countries i and j (t_{ij}) usually reflects bilateral distance, tariff and non-tariff barriers, RTAs, and other trade policies in the gravity specification. In equation (4-1), Π_i and P_j are the outward and inward multilateral resistances, respectively. It follows from equations (4-2) and 4-3) that changes in bilateral trade costs between countries i and j affect all trade partners, and not only countries i and j . Anderson and Van Wincoop (2003) term Π_i the outward multilateral resistances because they reflect the aggregated level of friction that country i faces when it exports its goods to all countries, including country j . Similarly, the inward multilateral resistances (P_j) are considered an aggregation of all trade barriers that country j faces when importing goods from all trade partners and not only from country i .

In gravity model studies, ignoring multilateral resistances is considered the “gold medal error” (Baldwin & Taglioni, 2006, p. 7). However, as theoretical constructs, they are unobservable in practice, so estimating them in the gravity equation has been challenging for researchers. Feenstra (2016) suggests three approaches to estimating the gravity equation to reflect the price effect on trade flows. The first approach developed by Bergstrand (1985) and Baier and Bergstrand (2007) uses price indices to approximate price changes. In the second approach, “remoteness indexes” are constructed as the logarithms of GDP-weighted averages of bilateral

distance (Baier & Bergstrand, 2009; Wei, 1996). The third approach, most widely used in empirical studies, approximates the multilateral resistances with exporter-time and importer-time fixed effects in gravity equation estimation. This approach was developed by Hummels (1999) and Feenstra (2016) for cross-sectional data and later extended by Olivero and Yotov (2012) for panel data.

Equation (4-1) shows that the change in bilateral trade costs between countries i and j affects bilateral trade. This effect estimated in equation (4-1) while keeping output, expenditure, world output, and multilateral resistances constant is treated in the literature as a *partial equilibrium effect* since it does not include the impact on non-member countries. Solving equation (4-1) with the PPML estimator with exporter-time and importer-time fixed effects, which account for the multilateral resistances, produces a so-called *conditional general equilibrium effect*. In the literature, this effect is termed “conditional” because it extends a partial equilibrium analysis to cover the impact of a change in bilateral trade costs on non-member countries through multilateral resistances channels in equations (4-2) and (4-3) but at the same holds output and expenditure constant. However, even with accounting for price effects using the multilateral resistances, solving equations (4-1) - (4-3) still cannot produce the full general equilibrium effects of a change in bilateral trade costs without a market-clearing condition. So, this study suggests naming “conditional GE” as a “quasi-general equilibrium framework.”

The partial equilibrium gravity analysis describes the impact of an RTA by estimating the trade creation and trade diversion effects. By contrast, a general equilibrium (GE) framework measuring does not estimate them explicitly. The trade creation effect is implied by a reduction in outward and inward multilateral resistances between the RTA members. The trade diversion effect is implied by increased outward and inward multilateral resistances between the RTA member countries and non-members. The general equilibrium gravity model provides a deeper understanding of the impact of regional integration on both member and non-member

countries. That was not to say that a partial equilibrium framework is inferior to a general equilibrium one, but rather both should be used to perform a comprehensive analysis. Two types of general equilibrium models are used for estimating an RTA's trade effects: ex-ante and ex-post. One example of an ex-ante general equilibrium model is the Global Trade Analysis Project (GTAP) model. It belongs to the family of computable general equilibrium (CGE) models, which use actual data to simulate how an economy would react to some exogenous shock, for instance, a change in trade policy. The GTAP model was formulated by Hertel (1997), and its theoretical framework was formulated by Dixon et al. (1982). It is a complex model with several markets, such as markets for final goods, intermediate goods, traded goods, and factors of production. The standard GTAP model is based on standard microeconomic theory and assumes full labor employment, perfect competition, and constant returns to scale. It also employs the Armington assumption that goods are differentiated by country of origin and imperfectly substitute each other. It uses several parameters that must be estimated in advance, such as goods substitution elasticities, factor substitution elasticities, factor transformation elasticities, investment parameters, and consumer demand elasticities. The model also requires high-quality data, which are difficult to get, especially for developing countries. De Souza (2011) uses the GTAP model to estimate the effects of the Customs Union of Belarus, Kazakhstan, and Russia on GDP and trade flows. By simulating tariff changes in response to the creation of the Customs Union, the model predicts negative results for all three member countries, with a GDP reduction of 2.77% for Belarus, 0.54% for Kazakhstan, and 0.66% for Russia. The author explains that because the member countries already traded freely under bilateral preferential agreements before the customs union, there is no trade creation effect after it. However, there is a trade diversion effect due to the common external tariff. Given the limitations of the GTAP model, the author concludes that “the results of the GTAP model are more indicative than prescriptive” (De Souza, 2011, p. 5).

In contrast to computable general equilibrium models, the application of a general equilibrium framework for the gravity model is relatively new as its methodology was summarized in 2016 (Larch & Yotov, 2016), based on the contribution of Anderson et al. (2015b), and then extended by Baier, Yotov, and Zylkin (Baier et al., 2019). Anderson et al. (2020) have revised their dynamic general equilibrium model by introducing the concept of the dynamic path multiplier, which magnifies the effect of an RTA on the capital accumulation process. Like the CGE models, the GE gravity model considers the indirect effects of an exogenous shock across markets and countries and includes a market-clearing condition. However, it is less complex to run as it does not involve the prior estimation of numerous model parameters, has a less strict requirement for data quality, and produces more accurate results because, as an ex-post model, it uses not predicted but actual data. Unlike a partial equilibrium gravity analysis, the GE approach generates a more extensive set of outcomes as it estimates the indirect effects of a change in trade policy on prices and GDP, in addition to trade flows, for all countries in the sample. The GE framework also requires data on intra-national trade flows as the literature suggests that this is consistent with the theoretical underpinnings of the structural gravity model and yields more accurate estimation results (Baier et al., 2019; Dai et al., 2014; Vaillant et al., 2020; Yotov, 2022).

Since the methodology for a general equilibrium gravity analysis is relatively new, there are few studies on the impact of economic integration as opposed to partial equilibrium, but their number is constantly growing. In their seminal paper, Anderson et al. (2015b) developed a structural dynamic general equilibrium gravity model with an additional equation for capital accumulation to examine a relationship between growth and trade. As an empirical application of their theoretical model, they evaluate the impact of NAFTA and find significant positive effects for NAFTA members and small negative effects for non-member states. They also show that when the analysis moves from static GE to dynamic GE, the capital accumulation process

doubles positive trade effects for NAFTA member countries. Anderson and Yotov (2016) use a GE framework to examine the terms of trade effects of RTAs with a sample of 41 trade partners, which includes 40 separate countries and the rest of the world aggregate, consisting of 24 additional countries. They find that income gains increase as the number of RTA members or the trade volume increases, and the larger a country's economic size or pre-RTA trade volume, the smaller the trade effects are.

Brakman et al. (2018) examine the potential trade effects of Brexit on the UK, EU, and major countries worldwide. Using data on trade in value-added (covering both manufacturing and services) instead of gross exports (typically only covering manufacturing), they find that a “hard Brexit” scenario would reduce the UK exports by 39 percent and negatively affect other EU countries, especially France, whose exports would decline by 7 percent, and countries such as Ireland, Belgium, the Netherlands, and Germany, whose exports fall by 4 percent. Value-added exports of other EU countries would decrease by 1-2 percent, with the EU27 (excluding the UK) average at 2 percent. In his study of China’s Belt and Road Initiative (BRI), Kohl (2019) assumes that the infrastructural projects undertaken under the BRI would effectively reduce trade costs (reflected in the distance variable) between China and its trade partners. Using a sample of 64 countries for the period of 2002 – 2011, he estimates the trade and income effects of the BRI in a general equilibrium setting. His findings suggest that the BRI mainly benefits China and its trade partners in Southeast Asia and Russia, but its trade and income gains for EU countries are insignificant.

In his study of the impact of economic integration on Asian countries, Shepherd (2019) reports three main findings. First, the estimation results show that trade effects are much stronger than real income effects. Second, larger RTAs have more significant trade and income effects. Third, the author estimates the model separately, first by sector for trade in agricultural goods, manufactured goods, and services, and then by end-use for trade in final and intermediate

manufactured goods. He notes that RTAs “tend to promote trade in intermediates more strongly than trade in final goods,” and they “deepen value chain in the region” (Shepherd, 2019, p. 33). Shepherd’s conclusion that an RTA has a more substantial impact on trade in intermediate goods, which reflects the development of a regional value chain, is much close to the findings of this study. El-Sahli (2021) uses partial and general equilibrium approaches in his study of the Greater Arab Free Trade Agreement (GAFTA). He finds that the GAFTA has a positive and statistically significant effect on bilateral trade. The estimation results show that income effects (instead of GDP, the author uses changes in nominal and real wages) are insignificant since, as he explains, trade diversion in the GAFTA dominates trade creation. The author uses only one “trade creation” RTA dummy variable but interprets its estimate not as a trade creation but as a change in exports due to the GAFTA. Manzoor and Mir (2022) examine the impact of China’s “One Belt One Road” initiative for a sample of 72 participant countries from 1996 to 2016. The estimation results show positive changes in exports, prices, and GDP and negative changes in outward multilateral resistances for all participating countries, with mixed results for inward multilateral resistances. Based on the results, the authors suggest that those countries with a larger reduction of both outward and inward multilateral resistances also experience a higher increase in GDP. They conclude that opening the economies to the OBOR initiative and removing trade barriers bring trade benefits for participating countries. Spornberger (2021) employs partial and general equilibrium frameworks to estimate the impact of EU integration on trade in manufactured goods. The partial equilibrium gravity analysis results show that the intra-trade between the Central and Eastern European (CEE) countries, which are EU members, has increased 2.6 times since they acceded to the EU. At the same time, bilateral trade between these new and the old EU members (the EC-15) has increased 1.7 times. However, in the GE framework, the results are different. The CEE intra-trade increased by one hundred percent, and bilateral trade between the EU-15 and the CEE countries has increased by 40%. Regarding

the income effect, the results show that EU integration has increased GDP for the EU-15 and the CEE countries by 3.1 and 1.7 percent, respectively. At the country level, Croatia, Luxembourg, Portugal, Latvia, and Greece benefited the most in trade, while Belgium, France, Germany, and the Netherlands benefited the most in terms of GDP. Timini and Viani (2022) estimate the trade and GDP effects of the EU-Mercosur trade agreement. The GE estimation results show that the agreement has benefited Mercosur and EU countries with minor trade diversion effects for the third countries. They find that Mercosur countries have increased their exports by 7 percent, imports by 8 percent, and GDP by 0.2 percent on average; these trade and income gains are much smaller for EU countries. The difference in trade and income effects between Mercosur and the EU is explained by the fact that the EU's share in Mercosur's foreign trade is larger than that of Mercosur in the EU's foreign trade. The authors also show that the transmission of trade effects into income effects is stronger for small open economies, which face higher foreign demand due to trade integration than countries with large domestic markets.

4.3. Empirical model and estimation

The GE structural gravity model in a dynamic form is described by the system of five equations (4-1) - (4-5) as follows:

$$X_{ij} = \frac{Y_i E_j}{Y} \cdot \left(\frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \quad (4-4)$$

$$\Pi_i^{1-\sigma} = \sum_j \left(\frac{t_{ij}}{P_j} \right)^{1-\sigma} \cdot \frac{E_j}{Y} \quad (4-5)$$

$$P_j^{1-\sigma} = \sum_i \left(\frac{t_{ij}}{\Pi_i} \right)^{1-\sigma} \cdot \frac{Y_i}{Y} \quad (4-6)$$

$$p_i = \left(\frac{Y_j}{Y} \right)^{\left(\frac{1}{1-\sigma} \right)} \cdot \frac{1}{\alpha_i \Pi_i} \quad (4-7)$$

$$E_j = \varphi_i Y_i = \varphi_i p_i Q_i \quad (4-8)$$

where X_{ij} is exports from country i to country j ; Y_i is the total output of country i ; E_j is the total expenditure of country j ; Y is the world output; t_{ij} denotes bilateral trade costs between country i and country j ; Π_i is the outward multilateral resistances (OMR); P_j is the inward multilateral resistances (IMR); Q_i is the endowment (total physical amount of goods) in country i ; p_i is the factory-gate prices of goods produced by country i ; σ is the elasticity of substitution among goods ($\sigma > 1$); α_i is the CES preference parameter; φ_i is the exogenous parameter that sets the relationship between output and expenditure.

Equations (4-4) - (4-8) describe the structural gravity model used for estimating the trade effects of the EEU in Chapter 3. At the core of the GE structural gravity model are multilateral resistances in equations (4-5) and (4-6). Unlike bilateral trade costs, which are observable, multilateral resistances are theoretical constructs that translate the changes in bilateral trade costs between country i and country j to the rest of the world and reflect a weighted average aggregate level of all trade costs that a country's producers and consumers face vis-a-vis a unified world market. Intuitively, multilateral resistances imply that the closer two countries get to each other in trade, the more remote both become from the third countries. When two countries create an RTA, the multilateral resistances decrease between RTA trade partners as they become "closer" to each other and increase vis-a-vis the rest of the world as RTA member countries become "more remote" from non-members. The outward and the inward multilateral resistances can be seen as the separation of trade costs between a country's producers and consumers. In this view, the outward and the inward multilateral resistances reflect exporters' and importers' ease of market access, respectively. The former is the weighted average of trade costs incurred by producers in country i , and the latter is the weighted average of trade costs incurred by consumers in country i . This distinction allows examining in a GE framework the trade effect of an RTA on producers and consumers in both RTA member and non-member countries. In equations (4-5) and (4-6), a change in bilateral trade costs between two RTA

member countries has additional effects on non-member countries with possible reverse effects on the bilateral trade between the two RTA member countries.

Equation (4-7) is a market-clearing condition, which works the same way as in any other GE model. After a system in equilibrium experiences an initial shock due to the discontinuous change in bilateral trade costs, factory-gate prices (p_i) begin to adjust. The adjustment process takes place until the system reaches its new equilibrium. Equation (4-8) governs the relationship between domestic output (Y_i) and aggregate expenditure (E_i) and describes how they respond to factor-gate price changes. In the system of equations (4-4) - (4-8), there are several different links between a change in bilateral trade costs (t_{ij}), which causes an initial shock to the system, on the one hand, and the economic outcomes such as trade, output, and expenditure, on the other hand. The causal links among the equation variables are grouped into direct and indirect effects to adequately describe their interaction in the GE structural gravity system. Direct effects, by their definition, are assumed to be stronger than indirect effects.

In equation (4-4), when two countries create an RTA, a change in bilateral trade costs (t_{ij}) *directly* affects their bilateral trade flows ($\Delta t_{ij} \rightarrow \Delta X_{ij}$). Solving this constrained gravity equation while keeping all other independent variables constant is considered a *partial* equilibrium analysis. However, since the direct effect is limited only to RTA members with no impact on non-member countries, a partial equilibrium approach limits the ability to interpret the results of trade effects estimates, especially those that, at first glance, appear to contradict theoretical predictions. This limitation of the partial equilibrium analysis is overcome by including equations (4-5) and (4-6) of the OMR and the IMR, respectively, which represent a transition stage from partial to GE analysis. Equations (4-5) and (4-6) tell that a change in bilateral trade costs between two RTA countries causes a *relative* change in bilateral trade costs between any two countries in the world, regardless of whether they are RTA members or not.

It is typical in partial equilibrium gravity model studies to use the estimates of exporter-time and importer-times fixed effects as an approximation of the outward and inward multilateral resistances, respectively. Hence, estimating a traditional gravity equation with exporter-time and importer-times fixed effects can be considered a *quasi-general* equilibrium gravity analysis. On the one hand, the outward and inward multilateral resistances in the gravity system capture the impact of changes in bilateral trade costs on RTA member and non-member countries (hence the name "general equilibrium"). On the other hand, the system is not yet in equilibrium in the traditional sense since prices, output, and expenditures remain constant (hence the name "quasi-general"). In a quasi-general equilibrium framework, there is an indirect channel by which a change in bilateral trade costs affects the outward and inward multilateral resistances through equations (4-5) and (4-6). For instance, when RTA members reduce bilateral trade costs, their outward and inward multilateral resistances decrease. Equations (4-5) and (4-6) show that the magnitude of the change in outward and inward multilateral resistances depends on the size of the partner country. In other words, the larger the partner country is, the stronger the impact is on the RTA member country.

An RTA between country i and j lowers bilateral trade costs and decreases the IMR for country j in equation (4-6) and the OMR for country i in equation (4-5). In equation (4-4), due to a reduction in the IMR, country j decreases imports from non-member countries as their goods become more expensive relative to the goods from country i . This trade diversion effect arises because, with lower import costs, an RTA member now imports more from its RTA trading partner and less from other countries. A similar effect occurs in the case of the OMR for country i . In equation (4-4), if the OMR decreases, exports of country i to all countries fall. This trade diversion effect occurs as country i increases its exports to its RTA trade partner, but since its output is fixed, it reduces exports to non-member countries. Intuitively, the reduction of IMR and OMR makes countries i and j closer to each other and more remote from the rest of the

world. In other words, accessing the RTA market becomes easier for RTA members and more difficult for all other countries.

The reduction in outward and inward multilateral resistances always affects trade flows in the opposite direction than the direct effect of a reduction in bilateral trade costs. However, equations (4-5) and (4-6) imply that the decrease in OMR and IMR for an RTA member country is smaller in magnitude than the decrease in bilateral trade costs between RTA members, that is, $\Delta t_{ij} > \Delta \Pi_i$ and $\Delta t_{ij} > \Delta P_j$, respectively, because changes in OMR and IMR are calculated as a weighted average of all bilateral trade costs, assuming that the economic sizes of RTA members are relatively small as compared to the rest of the world. It implies that trade diversion due to a reduction in OMR and IMR cannot offset the direct effect, so the net effect on RTA members is trade creation. In equation (4-4), an RTA does not directly affect non-member countries. However, equations (4-5) and (4-6) show that a reduction in bilateral trade costs between two RTA members through changes in their OMR and IMR will increase the OMR and the IMR of non-member countries. From equation (4-4), the trade in the rest of the world will increase as a non-member country redirects its trade away from RTA members towards the other non-member countries. Equations (4-5) and (4-6) imply that the larger are the economic sizes of RTA members, the more significant is the indirect trade effect of an RTA on each non-member country.

To move to a general equilibrium framework, equations (4-4) - (4-6) are combined with equations (4-7) and (4-8), which together trace the effects of an RTA on output and expenditure. Market-clearing equation (4-7) sets factory-gate prices (p_i) free to change in response to the initial trade shock caused by economic integration, after which the supply and demand will come to a new equilibrium. Adding equations (4-7) and (4-8) opens an additional transmission channel and extends the effect of an initial trade shock through a price mechanism up to domestic output (Y_i) and aggregate expenditure (E_i). So, in the general equilibrium system

described by equations (4-4) - (4-8), previously exogenous output (Y_i) and expenditure (E_i) now become endogenous through changes in factory-gate prices (p_i), which, in turn, respond to changes in bilateral trade costs (t_{ij}) through a change in OMR (Π_i).

The impact of factory-gate prices on output and expenditure is demonstrated by Anderson et al. (2015b) in a dynamic general equilibrium model of growth and trade with the following capital accumulation equation:

$$K_{i,t+1} = \left[\frac{\alpha\beta\delta p_{it} A_{it} L_{it}^{1-\alpha}}{(1-\beta+\beta\delta)P_{it}} \right]^{\delta} K_{it}^{\alpha\delta+1-\delta} \quad (4-9)$$

In equation (4-9), p_{it} is the factory-gate prices of a product in country i at time t ; K_{it} is the capital stock in country i at time t ; $K_{i,t+1}$ is the capital stock in country i at time $t+1$; L_{it} is the amount of labor in country i at time t ; A_{it} denotes technology in country i at time t ; $\delta \in [0,1]$ is the depreciation rate; α and β are the output elasticities of capital and labor, respectively. The capital accumulation equation shows a direct relationship between capital accumulation and factory-gate prices and an indirect relationship between capital accumulation and consumer prices reflected in P_{it} . When the outward multilateral resistances fall for RTA member countries, the market clearing condition in equation (4-7), which implies that the output of each country i should equal total expenditure on country i 's goods in the world, including in country i , suggests that factory-gate prices in country i increase. Faced with a higher marginal product of capital ($\alpha p_{it} A_{it} K_{it}^{\alpha-1} L_{it}^{1-\alpha}$), consumers in country i give up current consumption to increase investment and future consumption. An increase in outward multilateral resistance for non-member countries reduces factory-gate prices and the marginal product of capital. As a result, investments in non-member countries fall.

This study divides the indirect effects in a general equilibrium setting into primary and secondary. The primary indirect effects work from changes in bilateral trade costs via changes in factory-gate prices to changes in output and expenditure. The secondary indirect effects arise

when changes in output and expenditure send the impulse of the initial trade shock back into the system and trigger additional changes in outward and inward multilateral resistances and trade flows. Assuming that RTA member countries are small open economies that cannot affect the prices of products in world markets, it follows from equation (4-7) that when an RTA is set up, producers in RTA member countries facing lower outward multilateral resistances can increase their prices to exploit the differential between domestic and international prices due to the removal of tariffs. A rise in factor-gate prices will positively affect output and expenditure in a home country, as equation (4-8) shows. Therefore, the indirect primary effect for RTA member countries is positive. Producers in RTA non-member countries will be forced to reduce their prices to maintain competitiveness as they now face higher outward multilateral resistances. Since lower factory-gate prices decrease output and expenditure, the indirect primary effect on non-member countries will be negative, albeit smaller, in absolute terms, than for RTA members.

Further, as it follows from equations (4-4) - (4-6), changes in output and expenditure bring additional changes into the system. They are called indirect secondary effects since they originate when output and expenditure respond to the initial trade shock. This effect is positive for RTA member countries because as their output and expenditure increase, so do their exports and imports, as equation (4-4) shows. In contrast, the indirect secondary effect for non-member countries is negative because their output and expenditure contraction reduces their trade. The net effect for all countries is likely positive since the positive effect of rising output and expenditure for RTA member countries outweighs the negative effect of falling output and expenditure in non-member countries. Equations (4-5) and (4-6) also imply that changes in output and expenditure have additional effects on trade through outward and inward multilateral resistances. For instance, an increase in output and expenditure in RTA member countries will increase their weight in calculating the outward and inward multilateral

resistances. However, if their shares in the world output are relatively small, then the effect through this channel on trade will be negligible.

In this study, the physical quantity of goods produced in country i (Q_i) in equation (4-8) is assumed to be endogenous. Anderson et al. (2015b) note that if the general equilibrium structural gravity model is expanded by including the equation of the Cobb-Douglas production function ($Q_i=A_iK_i^\alpha L_i^\beta$), then through the capital accumulation process, the production of goods in the model becomes endogenous. However, the dynamic general equilibrium gravity analysis with capital accumulation is beyond the scope of this study.

This study uses the methodology of Larch and Yotov (2016), based on the contribution of Anderson et al. (2015b). The baseline GE gravity equation for estimating the trade effects of an RTA has the following specification, which is similar to the gravity equation in a partial equilibrium framework:

$$X_{ijt} = \exp[\pi_{it} + \chi_{jt} + \mu_{ij} + \beta_1 RTA_{ijt}] \times \varepsilon_{ijt} \quad (4-10)$$

where X_{ijt} is the exports from country i to country j in year t ; π_{it} is exporter-time fixed effects in year t ; χ_{jt} is importer-time fixed effects in year t ; μ_{ij} is country-pair fixed effects between country i and country j ; RTA_{ijt} is an RTA dummy variable, which takes the value of one if both country i and country j belong to the same RTA in year t , and zero otherwise; ε_{ijt} - error term.

Equation (4-10) is estimated with the PPML method because of its special additive property (Arvis & Shepherd, 2013; Fally, 2015). This property allows deriving the values of OMR and IMR directly from exporter-time and importer-time fixed effects, respectively, using the following equations:

$$\exp(\hat{\pi}_{it}) = \frac{Y_{it}}{\hat{\Pi}_{it}^{1-\sigma}} \times \frac{1}{E_{Rt}} \quad (4-11)$$

$$\exp(\hat{\chi}_{jt}) = \frac{E_{jt}}{\hat{P}_{jt}^{1-\sigma}} \times \frac{1}{E_{Rt}} \quad (4-12)$$

where $\hat{\pi}_{it}$ and $\hat{\chi}_{jt}$ are the estimates exporter-time and importer-time fixed effects, respectively, from gravity equation (4-10); Y_{it} and E_{jt} are the exporter's output and the importer's expenditure, respectively, in year t ; $\hat{\Pi}_{it}^{1-\sigma}$ and $\hat{P}_{jt}^{1-\sigma}$ are the estimates of outward and inward multilateral resistances, respectively; E_{Rt} is the expenditure of a reference country R in year t . A reference country is introduced into the gravity model to implement a normalization to ensure the GE system has a unique equilibrium. In this study, the reference country is Germany because it is one of the largest trade partners of the EEU and its foreign trade is not volatile. A normalization is implemented by setting the IMR of the reference country equal to one ($P_{Rt}=1$). As a result, baseline equation (4-10) is estimated without the importer-fixed effects for the reference country (χ_{Rt}). The fixed effects for all other countries are estimated relative to the importer-fixed effects for the reference country.

The estimation of the general equilibrium gravity model consists of five steps.

Step 1. Estimation in the baseline scenario

The first step has two tasks: (1) to construct a complete matrix of the bilateral trade costs (t_{ij}) and (2) to obtain the estimates of OMR and IMR in the baseline scenario (BS). First, based on the sample dataset, the baseline gravity equation (4-10) is solved, and the estimates of the country-pair fixed pair effects ($\hat{\mu}_{ij}$) and the coefficient of the dummy variable (β_l) are obtained. To perform a general equilibrium gravity analysis, it is required to obtain a complete set of country-pair fixed effects estimates. However, if some trade data are often missing in the sample, then it becomes impossible to calculate the estimates of all country-pair fixed effects. To address this problem, Anderson and Yotov (2016) suggest a two-step approach to calculate missing values of country-pair fixed effects. First, the estimates of country-pair fixed effects from non-missing data are used as the dependent variable in a regression equation with standard gravity model variables, such as distance (DIST), common border (CNTG), common language

(LANG), and colonial ties (CLNY), and exporter-time and importer-time fixed effects as independent variables:

$$\exp[\hat{\mu}_{ij}] = \exp[\pi_i + \chi_j + \beta_2 \ln DIST + \beta_3 CNTG + \beta_4 LANG + \beta_5 CLNY] \times \varepsilon_{ij} \quad (4-13)$$

Equation (4-19) is estimated for the base year, which is the year when an RTA is established. The estimated coefficients of the dependent variables obtained from equation (4-13) ($\hat{\pi}_i, \hat{\chi}_j, \hat{\beta}_2, \hat{\beta}_3, \hat{\beta}_4, \hat{\beta}_5$) are used to calculate the predicted (fitted) values of bilateral trade costs:

$$\hat{t}_{ij}^{1-\sigma} = \exp[\hat{\pi}_i + \hat{\chi}_j + \hat{\beta}_2 \ln DIST + \hat{\beta}_3 CNTG + \hat{\beta}_4 LANG + \hat{\beta}_5 CLNY] \quad (4-14)$$

After the bilateral trade costs are recovered for missing data, they are used, along with the bilateral trade costs obtained earlier for non-missing data, to build a complete matrix of bilateral trade costs for the baseline scenario:

$$[\hat{t}_{ij}^{1-\sigma}]^{BS} = \exp[\hat{\mu}_{ij} + \hat{\beta}_1 RTA_{ij}] \quad (4-15)$$

where *BS* stands for “baseline scenario.”

The first stage’s second task is obtaining the OMR and IMR estimates. Based on equations (4-11) and (4-12), the PPML estimates of the exporter-time and importer-time fixed effects from baseline equation (4-10), together with the data on output and expenditure, are used to calculate the baseline scenario values of outward and inward multilateral resistances, respectively:

$$[\hat{\Pi}_{it}^{1-\sigma}]^{BS} = \frac{Y_{it}}{\exp(\hat{\pi}_{it})} \times E_{Rt} \quad (4-16)$$

$$[\hat{P}_{jt}^{1-\sigma}]^{BS} = \frac{E_{jt}}{\exp(\hat{\chi}_{jt})} \times \frac{1}{E_{Rt}} \quad (4-17)$$

where $Y_{it} = \sum_j X_{ijt}$ and $E_{jt} = \sum_i X_{ijt}$.

Step 2. Defining the counterfactual scenario (CS)

At the second stage, the counterfactual scenario is defined as the hypothetical removal of the RTA. The counterfactual scenario is constructed by replacing the values of RTA dummy variable, which were equal one for RTA member country pairs, with zero. Because of the replacement, a new matrix of bilateral trade costs $[\hat{t}_{ij}^{1-\sigma}]^{CS} = \exp[\hat{\mu}_{ij}]$ is obtained (since the value of RTA dummy variable is now zero ($RTA_{ijt} = 0$) for all country pairs i and j in year t). The difference between the baseline bilateral trade costs $[\hat{t}_{ij}^{1-\sigma}]^{BS}$ and the counterfactual bilateral trade costs $[\hat{t}_{ij}^{1-\sigma}]^{CS}$ is the initial trade shock in the general equilibrium system caused by the establishment of the EEU, that is:

$$\varepsilon_{ijt}^{CS} = [\hat{t}_{ij}^{1-\sigma}]^{BS} - [\hat{t}_{ij}^{1-\sigma}]^{CS} \quad (4-18)$$

where *CS* and *BS* stand for “counterfactual scenario” and “baseline scenario,” respectively.

Step 3. Performing quasi-general equilibrium analysis

This step begins with re-estimating the initial structural gravity equation. The quasi-general and general equilibrium analyses are performed only for one year, defined as the base year. The base year is usually the year in which an RTA is formed. Also, the gravity equation in the counterfactual scenario should meet certain conditions. First, because hypothetically, the RTA no longer exists in the counterfactual scenario, the RTA dummy variable is now equal to zero, so the RTA term drops out of the equation. Second, the equation contains the initial trade shock to the system (ε_{ijt}^{CS}). Third, the country-pair fixed effects (μ_{ij}) are equal to the values of bilateral trade costs in the baseline scenario $[\hat{t}_{ij}^{1-\sigma}]^{BS}$. Under these conditions, the initial gravity equation (4-10) takes the following form:

$$X_{ijt} = \exp \left[\pi_{it}^{CS} + \chi_{jt}^{CS} + [\hat{t}_{ij}^{1-\sigma}]^{BS} \right] \times \varepsilon_{ijt}^{CS} \quad (4-19)$$

Using the estimates of exporter-time and importer-time fixed effects $\hat{\pi}_{it}^{CS}$ and $\hat{\chi}_{jt}^{CS}$ from equation (4-19), the values of quasi-general equilibrium OMR $[\hat{\Pi}_{it}^{1-\sigma}]_{QG}^{CS}$ and IMR $[\hat{P}_{jt}^{1-\sigma}]_{QG}^{CS}$ (normalized with respect to the reference country) are obtained:

$$[\hat{\Pi}_{it}^{1-\sigma}]_{QG}^{CS} = \frac{Y_{it}}{\exp(\hat{\pi}_{it}^{CS})} \times E_{Rt} \quad (4-20)$$

$$[\hat{P}_{jt}^{1-\sigma}]_{QG}^{CS} = \frac{E_{jt}}{\exp(\hat{\chi}_{jt}^{CS})} \times \frac{1}{E_{Rt}} \quad (4-21)$$

where QG stands for “quasi-general.”

Using the fitted (predicted) values of exports (\hat{X}_{ij}) from equation (4-19), the quasi-general values of exports for each country i are calculated as $\sum_j \hat{X}_{ij} = [X_i]_{QG}^{CS}$.

Step 4. Performing a general equilibrium analysis

This step is iterative and consists of four sub-steps.

Step 4-1. Factor-gate prices become endogenous.

In sub-step 4-1, the changes in OMR translate to the changes in factory-gate prices through the market-clearing equation (4-7):

$$\Delta p_{it}^{CS} = \frac{p_{it}^{CS}}{p_{it}} = \left(\frac{\exp(\hat{\pi}_{it}^{CS})/E_{Rt}^{CS}}{\exp(\hat{\pi}_{it})/E_{Rt}} \right)^{\frac{1}{1-\sigma}} \quad (4-22)$$

Step 4-2. Output, expenditure, and trade become endogenous.

In sub-step 4-2, the changes in factory-gate prices affect output and expenditure:

$$Y_{it}^{CS} = \left(\frac{p_{it}^{CS}}{p_{it}} \right) Y_{it} \quad (4-23)$$

$$E_{jt}^{CS} = \left(\frac{p_{it}^{CS}}{p_{it}} \right) E_{jt} \quad (4-24)$$

Since the fixed effects account for output, expenditure, and inward and outward multilateral resistances in the initial gravity equation, equation (4-4) is used to endogenize output, expenditure, and exports:

$$X_{ijt}^{CS} = \frac{[\hat{t}_{ijt}^{1-\sigma}]^{CS}}{\hat{t}_{ijt}^{1-\sigma}} \times \frac{Y_{it}^{CS} E_{jt}^{CS}}{Y_{it} E_{jt}} \times \frac{\Pi_{it}^{1-\sigma}}{[\Pi_{it}^{1-\sigma}]^{CS}} \times \frac{P_{jt}^{1-\sigma}}{[P_{jt}^{1-\sigma}]^{CS}} \times X_{ijt} \quad (4-25)$$

In equation (4-25), the changes in output, expenditure, OMR, and IMR caused by the changes in factory-gate prices will directly affect exports. However, this effect on trade so far reflects only the initial changes in OMR and factory-gate prices. The system at this stage is still out of equilibrium. To get the full effects in the general equilibrium system, factory-gate prices will adjust to reach their new equilibrium level.

Step 4-3. Iteration process

The new values of exports (X_{ijt}^{CS}) derived from equation (4-25) are used to re-estimate equation (4-19). After the re-estimation, the new estimates of exporter-time ($\hat{\pi}_{it}^{CS}$) and importer-time fixed effects ($\hat{\chi}_{jt}^{CS}$) are used in equations (4-20) and (4-21) to obtain the new values of OMR and IMR and the new values of factory-gate prices from equation (4-22). In response to the change in factory-gate prices, new values of output and expenditure are calculated from equations (4-23) and (4-24), and then the new values of exports (X_{ijt}^{CS}) are estimated in equation (4-19). These steps are repeated until the changes in factory-gate prices come close to zero, which means that the structural gravity model has now achieved its new equilibrium. In practice, it is difficult to achieve a zero change, so the iteration process usually is stopped when the price change is at most 0.001.

Step 4-4. Computing the GE values of the variables

As soon as the iteration process is complete and the gravity model reaches its new equilibrium, the latest estimates of exporter-time fixed effects ($\hat{\pi}_{it}^{GE}$) and importer-time fixed effects ($\hat{\chi}_{jt}^{GE}$)

with the initial and latest data on output and expenditure are used to calculate the general equilibrium values of outward and inward multilateral resistances:

$$[\hat{\Pi}_{it}^{1-\sigma}]_{GE}^{CS} = \frac{Y_{it}^{GE}}{\exp(\hat{\pi}_{it}^{GE})} \times E_{Rt}^{GE} \quad (4-26)$$

$$[\hat{P}_{jt}^{1-\sigma}]_{GE}^{CS} = \frac{E_{jt}^{GE}}{\exp(\hat{\lambda}_{jt}^{GE})} \times \frac{1}{E_{Rt}^{GE}} \quad (4-27)$$

where GE and CS denote “general equilibrium” and “counterfactual scenario,” respectively.

The general equilibrium values of the other variables are calculated in the following way:

$$\frac{p_{it}^{GE}}{p_{it}^{BS}} = \left(\frac{\exp(\hat{\pi}_{it}^{GE})/E_{Rt}^{GE}}{\exp(\hat{\pi}_{it}^{CS})/E_{Rt}^{CS}} \right)^{\frac{1}{1-\sigma}} \quad (4-28)$$

$$Y_{it}^{GE} = \frac{p_{it}^{GE}}{p_{it}^{BS}} \times Y_{it}^{BS} \quad (4-29)$$

$$E_{it}^{GE} = \varphi_i Y_{it}^{GE} \quad (4-30)$$

$$X_{ijt}^{GE} = \frac{Y_{it}^{GE} E_{jt}^{GE}}{Y^{GE}} \times \frac{(\hat{\tau}_{ijt}^{CS})^{(1-\sigma)}}{[\hat{\Pi}_{it}^{1-\sigma}]_{GE}^{CS} [\hat{P}_{jt}^{1-\sigma}]_{GE}^{CS}} \quad (4-31)$$

Step 5. Reporting the variables of interest

Finally, to report the results of the GE gravity analysis, the GE values of the variables of interest are expressed in terms of percentage change with respect to their baseline scenario values using the following formula:

$$\Delta\%V_i = \frac{(V_i^{GE} - V_i^{BS})}{V_i^{BS}} \times 100 \quad (4-32)$$

where $\Delta\%V_i$ is the percentage change in the variable of interest for country i ; V_i^{BS} is the baseline value of the variable of interest for country i ; V_i^{GE} is the general equilibrium value of the variable of interest for country i .

4.4. Empirical results

The results of estimating the general equilibrium gravity model are reported in Table 4-1. The general equilibrium effects include the impact of the EEU on exports, outward and inward multilateral resistances, factory-gate prices, and GDP, and they are estimated for each country in the sample. The general equilibrium framework differs from the partial equilibrium one in that it does not indicate the reallocation of trade flows between member and non-member countries in response to the creation of the RTA. Therefore, Table 4-1 reports the overall impact of the EEU on a country's exports. Also, in the general equilibrium model, the changes in multilateral resistances, factory-gate prices, output, and expenditure are intermediate results because they act as the transmission channels that translate the initial change in bilateral trade costs to trade flows.

The estimation results for the EEU member countries correspond to the theoretical predictions of the general equilibrium structural gravity model. The trade effects of the EEU reported in column (1) of Table 4-1 suggest that all the EEU member countries have expanded their exports due to regional integration, with the magnitude of change ranging from 0.30 percent for Armenia to 1.46 percent for Belarus. These results are as expected since it follows from the baseline equation (4-4) of the general equilibrium structural gravity system that the change in bilateral trade costs has the strongest effect on trade flows. So, reducing tariff barriers between the EEU member countries has strongly and positively affected their exports. Although the model does not indicate the direction of trade flows, it is possible to assume that the increase in the exports of the EEU member countries is associated with the expansion of the intra-region trade.

However, in terms of magnitude, the estimated changes in the exports of EEU member countries are modest. Two explanations can be provided. First, since the general equilibrium gravity model does not indicate the direction of trade flows, relatively small changes in overall

exports may be due to a reduction in exports of the EEU member countries to non-members. The second explanation relates to the outward-looking foreign trade pattern of the EEU member countries, which was discussed in detail in Chapter 2. In this case, a small change in exports in response to regional integration may reflect that the EEU member countries trade more with non-members than with each other. In addition, the composition of the EEU foreign trade structure, which is dominated by intermediate goods, may explain the relatively low sensitivity of EEU bilateral trade to changes in trade costs due to regional integration.

The change in exports is driven not only by the direct effect of the change in bilateral trade costs but also by the indirect effects of the changes in multilateral resistances and GDP, with GDP being affected by the change in outward multilateral resistances and factory-gate prices. The general equilibrium indirect effects are reported in columns (2) - (5) of Table 4-1. The negative estimates of the inward multilateral resistances for the EEU member countries in column (4) indicate that consumers in these countries have faced lower multilateral resistances. It implies the overall price level reduction for them so they can buy more goods (including those produced by non-members) with the initial level of expenditure. The negative estimates of outward multilateral resistances in column (3) indicate that producers in the EEU member countries have faced lower outward multilateral resistances implying easier access for them to the domestic markets of their EEU trading partners. In response to higher foreign demand for their goods from the EEU consumers, producers in the EEU member countries raise factory-gate prices, shown in column (2), which increases output and expenditure with additional indirect effects on exports.

The income effects of the EEU are reported in column (5) of Table 4-1, which shows that all the EEU member countries have experienced an increase in GDP, with Belarus having the highest trade and income gain among them in the amount of 1.46 and 3.68 percent, respectively. Belarus is a small country with the most diversified economy in the EEU. So, the outcome is

consistent with the hypothesis discussed in Chapter 3 that small and diversified economies benefit most from regional integration. In addition, among the EEC member countries, Belarus and Russia have the closest economic relations as members of the Union State they founded in 1999. Russian exports and GDP increased by 0.78 and 0.44 percent, respectively. The trade and income effects for Russia are less than those for Belarus since Russia is several times larger than Belarus in terms of economic size, and its foreign trade is more oriented towards non-members. Due to regional integration, Kazakhstan's exports and GDP increased by 0.8 and 1.77 percent, respectively. Kazakhstan and Belarus are the most integrated countries with Russia and share a common border with the largest economic power in the EEU. The Kyrgyz Republic and Armenia exports increased by 0.34 and 0.30 percent, respectively. Both countries have experienced income effects of 0.29 percent for the Kyrgyz Republic and 0.14 percent for Armenia. Since these two countries acceded to the EEC in 2015, their income and trade effects are smaller in magnitude than those of the other EEU member countries.

Table 4-2 indicates that the increase in EEU member countries' exports is associated with the rise in GDP. The direct relationship between exports and GDP may suggest that most of the income gains that the EEU member countries have experienced are related to their domestic producers rather than to their domestic consumers. The intuition is that in market-clearing equation (4-7), the changes in factory-gate prices enter directly into the calculation of GDP, while the effects on consumers implied by equation (4-6) for inward multilateral resistances are constructed as a weighted average of the prices across all member and non-member countries in the sample. Overall, the estimated general equilibrium effects of the EEU on its member countries have signs predicted by the theoretical model and suggest that the trade bloc has positively affected its members. The most considerable trade and income gains are reported for Belarus and Kazakhstan since both countries' economies are the most integrated with Russia and share a common border with the largest economic power in the EEU.

Concerning the general equilibrium effects of the EEU on non-members, the theoretical model predicts that reducing bilateral trade costs between the EEU member countries increases the inward and outward multilateral resistances for non-member countries. The first general equilibrium impact of the EEU on non-members is a reduction in their exports due to increased multilateral resistances described by equations (4-4) - (4-6). The change in outward multilateral resistances also causes a change in factory-gate prices through the market-clearing condition in equation (4-7), which generates the second impact of the EEU on non-members. With a relatively higher level of trade barriers against the EEU market, producers in non-member states are forced to decrease their factory-gate prices, negatively affecting non-members' GDP as described by equation (4-8). However, the effect on factory-gate prices for non-member countries is smaller than for the EEU because the initial impact of the change in bilateral costs on multilateral resistances is stronger for the EEU member countries than non-members. The negative income effects of the EEU on non-members are driven by both negative changes in factory-gate prices and positive changes in multilateral resistances.

Among the non-member countries, there is a group of countries whose general equilibrium effects differ in magnitude from those of most non-member countries. The non-member countries are divided into two groups of “close” and “remote” trade partners of the EEU to find a possible explanation for this difference through a more detailed analysis. “Close” does not necessarily mean that a non-member is a major trading partner of the EEU with a large volume of bilateral trade, which is an important, but not the only factor in a relationship between two countries. It rather implies “non-economic proximity,” reflecting the non-member’s close politically motivated relationship with the EEU member states. The “close” trading partners include Tajikistan, Turkmenistan, Uzbekistan, China, and Iran. Among them, Tajikistan, Turkmenistan, and Uzbekistan are the former Central Asian post-Soviet republics that share a common border with the EEU member states and maintain close ties with them, especially with

Russia. China also shares a border with the EEU countries, keeps a good relationship with Russia, and is one of the largest trading partners of Russia and Kazakhstan. Iran and Russia are also politically close and active trading partners. Other non-members are included in the group of politically “remote” trade partners despite some being large trade partners of the EEU member states.

In Table 4-3, the “close” non-members countries are ranked by the value of the income effect. All the general equilibrium effects of the EEU on the “close” trading partners, especially post-Soviet Central Asian countries, are substantial in magnitude. It implies that the EEU has affected these countries more strongly than its member states. The Central Asian CIS non-member countries have experienced the most significant negative effect from the EEU because, as discussed in Chapter 2, the EEU Treaty abolished the bilateral preferential agreements that existed between CIS countries before the Customs Union and instead introduced a common customs tariff that applies to all third countries without exception. Thus, the significant increase in the multilateral resistances for the Central Asian non-members is due not only to changes in relative prices after the creation of the EEU but also to a sharp increase in bilateral trade costs after trade preferences were replaced with a common import tariff. As a result of the EEU, Tajikistan has experienced a reduction of GDP by 3.95 percent, whereas the GDPs of Turkmenistan and Uzbekistan have decreased by 2.34 and 2.44 percent, respectively. The negative income effect of the EEU, which is less than that for Central Asian non-members, but still higher than that for “remote” non-members, has been reported for China and Iran, major EEU trading partners, whose GDP declined by 1.5 and 0.85 percent, respectively.

Concerning the impact of the EEU on non-members’ exports, the theoretical model predicts that the general equilibrium forces tend to increase inward and outward multilateral resistances, reduce factory-gate prices, output, and expenditure, and negatively affect trade flows. In the case of the “close” non-members, despite the positive changes in multilateral resistances and

negative changes in prices and GDP, the changes in their exports are positive, contrary to the theory. In addition, while the “remote” non-members have experienced a small change in exports, the increase in exports of the “close” non-members far exceeds the increase in exports of the other non-members and the EEU member countries. Due to the EEU, the exports of Tajikistan increased by 12.44 percent, which is the most significant change in exports among all countries in the sample, including the EEU member countries. Turkmenistan and Uzbekistan’s exports increased by 8.21 percent and 7.15 percent, respectively. Exports from China and Iran increased by 3.98 and 3.27, respectively, about half as much as those of the Central Asian non-members but still several times higher than those of the “remote” non-members.

Since the general equilibrium framework indicates neither the direction of trade flows nor the changes in imports, it is difficult to provide a straightforward explanation of the strong impact of the EEU on the exports of the “close” non-members. One possible reason assumes that the increase in their exports is directed to the EEU and coupled with increased imports from non-member countries. In this case, the “close” non-members that share a common border with the EEU and have friendly relations with Russia can be considered as additional channels for circumventing Western sanctions imposed by the developed countries on Russia starting in 2014. The “close” non-members can deliver sanctioned goods imported from the “remote” non-members to Russia directly or through other EEU member countries. Iran has no common border with the EEU but is geographically close to the trade bloc. It borders Turkmenistan, and both are non-members with a close relationship with Russia. However, the proposition about the impact of the Russia-related sanction regime on the trade between the EEU and the border non-member countries needs further research.

Table 4-4 demonstrates that the general equilibrium effects of the EEC on the “remote” non-members are much lower in magnitude than on those that are “close” to the EEU. However,

while all the “close” non-members have experienced increased multilateral resistances, reduced factory-gate prices, and a fall in GDP, the estimation results for the “remote” non-members are mixed. The general reason for the mixed results is that the main impact on non-member countries comes from two general equilibrium forces that work in opposite directions. On the one hand, the trade diversion effect, which operates through the multilateral resistances, causes a reduction in trade between the EEU member countries and non-members. On the other hand, some non-members are large in size, and they trade more with all trading partners, including the EEU members and other non-members. The negative estimates of the general equilibrium effects suggest that the negative impact of multilateral resistances on trade may dominate the positive impact of the size of a non-member country. The results also indicate that the net negative effect is stronger for non-member countries more integrated with the EEU market.

In Table 4-4, the “remote” non-members countries are ranked by the value of the income effect estimates. Of the 38 non-members, 18 have experienced a decline in GDP due to the EEC, with India having the largest GDP fall of 0.25 percent. At the same time, income effects have been positive for 16 non-members, with Japan having the largest GDP gain of 0.26 percent. No income effect has been found for the remaining four countries (Austria, Azerbaijan, Bulgaria, and Slovakia). In line with the theoretical model, in most non-member countries, the changes in GDP are inversely correlated with other general equilibrium effects (except exports). Those countries that have experienced a fall in GDP also have faced higher multilateral resistances and decreased factory-gate prices, and vice versa.

This study suggests two possible explanations for the mixed results in the general equilibrium effects of the EEU on “remote” non-members. The first explanation is that the import tariff applied by the EEU member before the customs union may have been higher than the common customs tariff introduced in 2010. In this case, when the customs union is established, the non-member would face lower multilateral resistances that increase factory-gate prices, GDP, and

exports. The second explanation relates to the high dependence of the EEU on imports from non-members, especially in consumer and capital goods, which may imply that the demand of the EEU member states for certain products is inelastic. As mentioned before, regional integration affects trade flows by not only diverting trade from non-members to the EEU but also by reallocating trade among the non-member trade partners engaged in trade with the EEU member countries. In this case, the reallocation of trade flows may occur among the non-members as the EEU member states switch the supply source from one non-member to another non-member. As a result, some non-members with positive income effects (for example, Turkey, South Korea, the USA, and others) have replaced non-members that have experienced negative income effects (for example, the Baltic states, Moldova, Canada).

The results for Afghanistan and Syria have been left without consideration. They are the two non-member countries in the sample, for which the estimated general equilibrium effects are similar to the "close" non-members. First, due to Eurasian regional integration, Afghanistan and Syria have experienced positive changes in multilateral resistances and negative changes in factory-gate prices and GDP. However, contrary to the theory, exports from Afghanistan and Syria increased by 6.15 and 10.04 percent, respectively. Second, the change in their exports in magnitude is several times greater than the change in exports of the "remote" non-member countries. The impact of the EEU on the exports of Afghanistan and Syria could have been explained in the same way as for the "close" non-member countries. However, given that both countries were in a state of armed conflict during the period under study, the reliability of the data for these countries may be questionable. In addition, some external and internal factors may exist in the countries with armed conflicts that affect their trade but are not captured by the gravity variables. Therefore, it is reasonable to suggest that the EEU trade with Afghanistan and Syria needs additional investigation, probably, in a separate study, which is beyond the scope of this research.

4.5. Conclusion

The partial equilibrium gravity model estimates the trade creation and trade diversion effects of an RTA by using a set of RTA dummy variables that reflect the membership status of two trading partners. It is a useful and valuable tool for RTA impact evaluation studies with a simple framework, solid microeconomic foundation, high explanatory power, and empirical robustness. In contrast to partial equilibrium, which estimates the trade effects of regional integration for the RTA and its members, the general equilibrium gravity model estimates the impact of an RTA for all countries in the sample, both RTA members and non-members. It does not explicitly estimate the trade creation and trade diversion effects of an RTA. However, it captures the impact of a change in bilateral costs not only on trade flows but also on factory-gate prices, output, and expenditure of all countries in the sample, including non-members. The trade creation effect in the general equilibrium model is implied by a reduction in outward and inward multilateral resistances between the RTA members. The trade diversion effect is implied by increased outward and inward multilateral resistances between the RTA member countries and non-members.

The general equilibrium gravity model extends the partial equilibrium approach by including the market-clearing condition and endogenizing output and expenditure. In both approaches, the change in trade costs between two countries establishing an RTA has a direct and strong impact on their bilateral trade. A partial equilibrium gravity model estimated with exporter-time and importer-time fixed effects, which account for the outward and inward multilateral resistances, captures the impact of the change in bilateral trade costs between RTA member countries on non-members. In the literature, the indirect trade effect of an RTA on non-members is called the “conditional” general equilibrium effect because output and expenditure are held constant, and there is no market-clearing condition. The general equilibrium framework accounts for the impact of the change in bilateral trade costs on output and expenditure via

changes in factory-gate prices. Then it captures the indirect effects of changes in output and expenditure on trade flows via multilateral resistances. The two frameworks complement each other by providing a broader analytical framework for evaluating the impact of regional integration. Although they share the same microeconomic theoretical foundation, they reflect two perspectives on the same issue. The general equilibrium gravity analysis is relatively new, so the number of RTA impact evaluation studies with its application is much less than those under a partial equilibrium framework. Over time, more researchers are expected to use partial and general equilibrium gravity models in the same study to conduct a more extensive and rigorous RTA evaluation analysis. While the number of publications estimating the general equilibrium effects of an RTA has been constantly growing, to the best knowledge of the author of this paper, this study is the first to apply the general equilibrium gravity model to the EEU.

The general equilibrium effects estimated for the EEU member countries have signs predicted by the theoretical model and suggest a positive impact of regional integration on all the EEU member countries. The most considerable trade and income gain is reported for Belarus, which has experienced an increase in its exports and GDP by 1.46 and 3.68 percent, respectively. Among the EEU members, Belarus has the most significant positive outcome because it is a small country with the most diversified economy in the EEU. In addition, Belarus and Russia have the closest economic relations as members of the Union State they founded in 1999. The outcome is consistent with the hypothesis discussed in Chapter 3 that small and diversified economies benefit most from regional integration. Russian exports and GDP increased by 0.78 and 0.44 percent, respectively. The income effect for Russia is much less than that for Belarus since, in terms of economic size, Russia is several times larger than Belarus, and its foreign trade is more oriented towards non-members. Due to regional integration, the GDP of Kazakhstan increased by 1.77 percent, and its exports by 0.8 percent. Kazakhstan and Belarus are the most integrated countries with Russia and share a common border with the largest

economic power in the EEU. The Kyrgyz Republic and Armenia exports increased by 0.34 and 0.30 percent, respectively. Both countries have experienced smaller income effects of 0.29 percent for the Kyrgyz Republic and 0.14 percent for Armenia, which can be explained by the fact that these two countries acceded to the EEC in 2015.

The estimated general equilibrium effects of the EEU on non-members are mixed. To conduct a more detailed analysis, non-members are divided into “close” and “remote” non-members. The group of “close” members includes the post-Soviet Central Asian non-members (Tajikistan, Turkmenistan, Uzbekistan), China, and Iran. The estimated general equilibrium effects for these countries differ from the overall estimation results in two respects. First, the theoretical model predicts that for non-members, the general equilibrium forces tend to increase inward and outward multilateral resistances, reduce factory-gate prices, output, and expenditure, and negatively affect trade flows. However, in the case of the “close” non-members, despite the positive changes in multilateral resistances and negative changes in prices and GDP, the changes in their exports are positive, contrary to the theory. Second, while the “remote” non-members have experienced small trade and income effects, the changes in exports and GDP of the “close” non-members far exceed the changes in exports and GDP of the other non-members and the EEU member countries.

The income effect estimates for “close” non-members suggest that the EEU has affected these countries more strongly than its member states. The Central Asian post-Soviet non-member countries have experienced the most significant negative effect from the EEU. As discussed in Chapter 2, the EEU Treaty abolished the bilateral preferential agreements between CIS countries that were in place before the Customs Union. Instead, it introduced a common customs tariff that applies to all third countries without exception. Thus, the significant increase in the multilateral resistances for the Central Asian non-members is due not only to changes in relative prices after the creation of the EEU but also to a sharp increase in bilateral trade costs

after trade preferences were replaced with a common import tariff. The explanation for the significant rise in exports of the “close” non-members assumes that their increased exports are directed to the EEU and coupled with increased imports from non-member countries. In this case, the “close” non-members that share a common border with the EEU and have friendly relations with Russia can be considered as additional channels for circumventing Western sanctions imposed by the developed countries on Russia starting in 2014. The “close” non-members can deliver sanctioned goods imported from the “remote” non-members to Russia directly or through other EEU member countries.

The estimation results for the “remote” non-members are theoretically consistent in the sense that the changes in multilateral resistances in one direction are associated with the changes in factory-gate prices, GDP, and exports in the opposite direction. At the same time, the theoretical model predicts that the general equilibrium forces tend to increase inward and outward multilateral resistances, reduce factory-gate prices, output, and expenditure, and negatively affect trade flows. However, due to the EEU, the exports and GDP of some “remote” non-members have increased. This study suggests two possible explanations for these results. The first explanation is that the import tariff applied by the EEU member before the customs union may have been higher than the common customs tariff introduced in 2010. In this case, when the customs union is established, the non-member would face lower multilateral resistances that increase factory-gate prices, GDP, and exports. The second explanation relates to the high dependence of the EEU on imports from non-members, especially in consumer and capital goods, which may imply that the demand of the EEU member states for certain products is inelastic. As mentioned before, regional integration affects trade flows not only by diverting trade from non-members to the EEU but also by reallocating trade among non-members engaged in trade with the EEU member countries. In this case, the reallocation of trade flows may occur among the non-members as the EEU member states switch the supply source from

one non-member to another non-member. As a result, some non-members with positive trade and income effects have replaced non-members that have experienced negative trade and income effects.

Overall, the general equilibrium gravity analysis results suggest that the EEU has positively affected its member countries by increasing their exports and income. At the same time, the results for non-members are mixed. While the EEU has negatively affected some non-members, other non-members have experienced a rise in exports and GDP. No impact has been recorded for four non-members. Among non-members, the most negatively affected countries in terms of GDP are the post-Soviet republics in the Central Asian region.

Table 4-1. General equilibrium effects of the EEU for all countries in the sample

Country	$\Delta\%$ exports (1)	$\Delta\%$ price (2)	$\Delta\%$ OMRs (3)	$\Delta\%$ IMRs (4)	$\Delta\%$ GDP (5)
Afghanistan	6,15	-0,93	1,08	1,07	-1,96
Armenia	0,30	0,06	-0,07	-0,08	0,14
Austria	-0,05	0,03	-0,03	0,03	0,00
Azerbaijan	0,03	0,02	-0,02	0,02	0,00
Belarus	1,46	1,43	-1,66	-2,16	3,68
Belgium	-0,03	0,04	-0,04	0,01	0,02
Brazil	0,04	0,03	-0,04	-0,01	0,04
Bulgaria	-0,04	0,02	-0,03	0,03	0,00
Canada	-0,05	-0,02	0,02	0,04	-0,06
China	3,98	-0,70	0,81	0,82	-1,50
Cyprus	0,00	0,02	-0,02	0,02	-0,01
Czech Republic	-0,04	0,04	-0,05	0,01	0,02
Egypt	0,16	0,04	-0,04	-0,02	0,05
Estonia	-0,02	-0,01	0,01	0,06	-0,07
Finland	-0,02	0,02	-0,02	0,02	-0,01
France	0,03	0,03	-0,04	0,02	0,01
Georgia	0,06	0,02	-0,03	0,00	0,02
Germany	0,02	0,04	-0,05	0,00	0,04
Great Britain	0,26	-0,01	0,01	0,05	-0,06
Greece	0,01	0,03	-0,03	0,02	0,01
Hungary	-0,04	0,03	-0,04	0,02	0,01
India	1,07	-0,11	0,13	0,13	-0,25
Iran	3,27	-0,40	0,47	0,45	-0,85
Iraq	0,62	0,01	-0,01	-0,01	0,02
Israel	0,04	0,01	-0,02	0,02	-0,01
Italy	0,02	0,02	-0,03	0,03	-0,01
Japan	0,28	0,12	-0,14	-0,14	0,26
Kazakhstan	0,80	0,68	-0,80	-1,06	1,77
Kyrgyz Republic	0,34	0,12	-0,14	-0,16	0,29
Latvia	-0,12	-0,07	0,09	0,12	-0,19
Lithuania	-0,12	-0,05	0,06	0,12	-0,17
Moldova	-0,09	-0,06	0,07	0,12	-0,18
Netherlands	0,10	0,01	-0,01	0,04	-0,03
Poland	-0,04	0,02	-0,02	0,03	-0,01
Portugal	0,05	0,02	-0,02	0,04	-0,02
Romania	-0,01	0,02	-0,03	0,04	-0,01
Russia	0,78	0,15	-0,17	-0,30	0,44
Slovakia	-0,05	0,03	-0,03	0,03	0,00
South Korea	0,36	0,11	-0,13	-0,14	0,25
Spain	0,04	0,04	-0,04	0,01	0,02
Sweden	-0,01	0,04	-0,04	0,01	0,03
Switzerland	0,01	0,02	-0,02	0,03	-0,01
Syria	10,04	-1,58	1,85	1,87	-3,36
Tajikistan	12,44	-1,89	2,21	2,18	-3,95
Turkey	0,05	0,04	-0,04	-0,01	0,04
Turkmenistan	8,21	-1,11	1,29	1,28	-2,34
Ukraine	0,01	-0,07	0,08	0,09	-0,16
United Arab Emirates	0,15	-0,01	0,02	0,02	-0,04
USA	0,14	0,09	-0,10	-0,09	0,17
Uzbekistan	7,15	-1,14	1,34	1,34	-2,44

Table 4-2. General equilibrium effects for the EEU member countries

Country	$\Delta\%$ exports	$\Delta\%$ price	$\Delta\%$ outward multilateral resistances	$\Delta\%$ inward multilateral resistances	$\Delta\%$ GDP
	(1)	(2)	(3)	(4)	(5)
Belarus	1,46	1,43	-1,66	-2,16	3,68
Kazakhstan	0,80	0,68	-0,80	-1,06	1,77
Russia	0,78	0,15	-0,17	-0,30	0,44
Kyrgyz Republic	0,34	0,12	-0,14	-0,16	0,29
Armenia	0,30	0,06	-0,07	-0,08	0,14

Table 4-3. General equilibrium effects of the EEU for “close” non-member countries

Country	$\Delta\%$ exports	$\Delta\%$ price	$\Delta\%$ outward multilateral resistances	$\Delta\%$ inward multilateral resistances	$\Delta\%$ GDP
	(1)	(2)	(3)	(4)	(5)
Tajikistan	12,44	-1,89	2,21	2,18	-3,95
Uzbekistan	7,15	-1,14	1,34	1,34	-2,44
Turkmenistan	8,21	-1,11	1,29	1,28	-2,34
China	3,98	-0,70	0,81	0,82	-1,50
Iran	3,27	-0,40	0,47	0,45	-0,85

Table 4-4. General equilibrium effects of the EEU for “remote” non-member countries

Country	$\Delta\%$ exports	$\Delta\%$ price	$\Delta\%$ OMRs	$\Delta\%$ IMRs	$\Delta\%$ GDP
	(1)	(2)	(3)	(4)	(5)
Japan	0.28	0.12	-0.14	-0.14	0.26
South Korea	0.36	0.11	-0.13	-0.14	0.25
USA	0.14	0.09	-0.10	-0.09	0.17
Egypt	0.16	0.04	-0.04	-0.02	0.05
Turkey	0.05	0.04	-0.04	-0.01	0.04
Brazil	0.04	0.03	-0.04	-0.01	0.04
Germany	0.02	0.04	-0.05	0.00	0.04
Sweden	-0.01	0.04	-0.04	0.01	0.03
Iraq	0.62	0.01	-0.01	-0.01	0.02
Georgia	0.06	0.02	-0.03	0.00	0.02
Spain	0.04	0.04	-0.04	0.01	0.02
Belgium	-0.03	0.04	-0.04	0.01	0.02
Czech Republic	-0.04	0.04	-0.05	0.01	0.02
France	0.03	0.03	-0.04	0.02	0.01
Greece	0.01	0.03	-0.03	0.02	0.01
Hungary	-0.04	0.03	-0.04	0.02	0.01
Azerbaijan	0.03	0.02	-0.02	0.02	0.00
Bulgaria	-0.04	0.02	-0.03	0.03	0.00
Austria	-0.05	0.03	-0.03	0.03	0.00
Slovakia	-0.05	0.03	-0.03	0.03	0.00
Israel	0.04	0.01	-0.02	0.02	-0.01
Italy	0.02	0.02	-0.03	0.03	-0.01
Switzerland	0.01	0.02	-0.02	0.03	-0.01
Cyprus	0.00	0.02	-0.02	0.02	-0.01
Romania	-0.01	0.02	-0.03	0.04	-0.01
Finland	-0.02	0.02	-0.02	0.02	-0.01
Poland	-0.04	0.02	-0.02	0.03	-0.01
Portugal	0.05	0.02	-0.02	0.04	-0.02
Netherlands	0.10	0.01	-0.01	0.04	-0.03
United Arab Emirates	0.15	-0.01	0.02	0.02	-0.04
Great Britain	0.26	-0.01	0.01	0.05	-0.06
Canada	-0.05	-0.02	0.02	0.04	-0.06
Estonia	-0.02	-0.01	0.01	0.06	-0.07
Ukraine	0.01	-0.07	0.08	0.09	-0.16
Lithuania	-0.12	-0.05	0.06	0.12	-0.17
Moldova	-0.09	-0.06	0.07	0.12	-0.18
Latvia	-0.12	-0.07	0.09	0.12	-0.19
India	1.07	-0.11	0.13	0.13	-0.25

Chapter 5 Trade balance gravity model analysis

5.1. Introduction

The partial and general equilibrium gravity models applied in this study to evaluate the impact of the EEU have a solid microeconomic foundation and strong empirical robustness. While the gravity model has been a popular empirical tool among trade economists for many years, it is still not so widely used by macroeconomists since they have different perspectives concerning the interaction between aggregate and bilateral trade balances in the gravity model. The "common" view in macroeconomics is that an aggregate trade balance of a country is determined by its balance of saving and investment and is not affected by bilateral trade. Therefore, trade policy has no relevance to a country's macroeconomic performance. On the contrary, trade economists argue that since an overall trade balance is an aggregate of bilateral trade balances, it depends not only on macroeconomic factors but also on bilateral trade costs. In their view, trade measures have an important policy implication since a change in tariff, which affects bilateral trade, can improve or worsen an overall trade balance of a home country. The debate between trade economists and macroeconomists is still open, and there is a need for "...potentially fruitful research that combines the structural gravity model of trade with macroeconomic frameworks" (Felbermayr & Yotov, 2021, p. 15).

This Chapter attempts to combine the structural gravity model with the macroeconomic framework of the trade balance, an important theoretical concept in macroeconomics and an economic indicator used by economists and policymakers worldwide to assess the health of a national economy. It begins with a theoretical overview of the trade balance, defined as the difference between exports and imports, and explains the macroeconomic implications of trade balance fluctuations. It shows that the interpretation of improving or deteriorating trade balance depends to a large extent on whether it has changed in consumer or investment goods, which raises the need for disaggregating trade flows by the BEC classification into consumer, capital,

and intermediate goods. To derive a trade balance framework for the gravity model, this Chapter introduces a new RTA dummy variable by splitting the trade creation dummy variable into import creation and export creation dummies. Then, it estimates import and export trade creation and export and import trade diversion effects, translates them into changes in exports and imports, and constructs the trade balance effect for each EEU member country, defined as the change in the trade balance due to regional integration. Finally, the estimated trade creation, trade diversion, and trade balance effects for each EEU member country are reported and discussed.

5.2. Literature review

One of the main concepts in macroeconomic theory is the balance of trade, which is the difference between the value of a country's exports and imports over a given period. The trade balance is a core component in determining a country's current account. It is also one of the fundamental macroeconomic indicators to assess a nation's economic performance and a key target of a government's economic policy. It is closely watched by economists, governments, and international institutions. When a country's exports exceed its imports, that is, when it sells more goods than it buys, it has a trade surplus. A trade deficit occurs when a country's exports fall short of imports. In other words, it has a trade deficit when it buys more goods than it sells. When describing or explaining changes in the trade balance, economists usually define these changes as improvement and deterioration of the trade balance. A trade balance deterioration means that imports have increased more than exports. Similarly, a trade balance improves when exports have increased more than imports. Since this study focuses on changes in exports, imports, and trade balance in response to regional integration, the terms "trade balance improvement" and "trade balance deterioration" are used more often than the terms "trade surplus" and "trade deficit."

The literature also refers to a trade surplus as a positive or favorable trade balance and a trade deficit as a negative or unfavorable trade balance. Such wording may sometimes lead to misinterpretation of the macroeconomic implications of the trade balance. When a country has a trade balance surplus (alternatively, positive or favorable trade balance), it does not necessarily mean that a country's economy is in good shape. For example, resource-rich countries with a persistent trade surplus may experience the "Dutch disease," which causes exchange rate appreciation and damages the competitiveness of tradable sectors. Similarly, a trade balance deficit (negative or unfavorable) does not necessarily mean that a country faces economic problems. Positive and negative connotations of such terms as "favorable and unfavorable trade balance" or "positive or negative trade balance" are just the legacy of mercantilism in the history of economics. For mercantilists, the wealth of a nation was the available stock of gold, silver, and precious stones. According to this logic, a country becomes rich if it exports more than it imports as it accumulates the stock of gold. To achieve this goal, a nation sought to export more and import less to increase the domestic stock of gold. So, the economic policy of national governments during mercantilism supported exports through subsidies and protected the domestic market through import tariffs. Today economists broadly agree that a trade imbalance does not indicate whether an economy is in good or bad shape, so they examine the underlying causes of a trade surplus or deficit. Generally, a trade surplus is not considered an indicator of macroeconomic imbalances. Even for resource-rich countries with persistent trade surpluses, the main challenge is not a trade imbalance per se but the prudent and efficient use of export revenues. The primary research interest of macroeconomists and the main concern of policymakers is a trade deficit (a trade balance deterioration).

Economists have a broad consensus that a trade deficit in consumer goods, which reflects excessive consumer spending, can become unsustainable, giving rise to economic imbalances and posing macroeconomic risks. In theory, the absorption approach to the trade balance,

described in detail in the next section of this Chapter, demonstrates that a trade deficit in consumer goods reduces domestic savings that can be used to be invested domestically. It slows capital accumulation, one of the drivers of economic growth in the Solow growth model. Therefore, countries are usually advised to find the right balance between commodity exports and imports to maintain a sustainable trade balance and avoid hurting their economic growth. A trade deficit in consumer goods can hurt a domestic economy in several ways: by reducing employment and wages, hindering innovations and R&D, and precipitating the balance of payments crises. Rothstein and Scott (1997) find that the US has lost about 395,000 jobs due to the NAFTA trade deficits. They explain that rising imports of consumer goods, which compete with domestically produced goods, reduce the number of domestic firms and jobs in manufacturing industries. Kletzer (2000) examines the impact of a trade deficit on the US labor market and finds that imports displace some domestic jobs, especially in industries facing increased foreign competition in consumer goods. She also finds that job displacement is less for industries producing capital goods. A trade deficit also depresses wages in domestic labor markets. Although the total unemployment rate may not change, trade can change the composition of employment. Workers who have lost their jobs in manufacturing may move to service industries where wages are much lower, decreasing the overall wage level in the labor market. A prolonged and growing trade deficit in consumer goods may also indicate economic weakness and declining competitiveness of domestic manufacturing industries. The increased competition from foreign goods can negatively affect long-term external competitiveness and economic growth, lowering incentives to invest in manufacturing sectors, especially in high-tech industries, R&D, and innovations. The negative effect of a trade deficit in consumer goods on the country's ability to innovate and compete in global markets has been emphasized by Mayer (2012), who finds that while capital goods are the largest category in exports and imports of the United States trade balance, consumer goods have accounted for over 85 percent of the

increase in the US non-energy trade deficit between 1997 and 2008. He notes that a trade deficit in consumer goods can lead to a decline in investment and a lack of resources for domestic firms, which can hurt their ability to innovate and compete in global markets. Morici (1997) estimates that reducing the US trade deficit would increase US spending on R&D by three percent and lead to productivity growth of about 0.5 to 0.6 percent per year. A similar argument is made by Hooper and Mann (1987), who show that a high dependence on imported consumer goods can lead to a loss of competitiveness in domestic industries and a lack of investment in innovation and technology. They also argue that a trade deficit in consumer goods can increase foreign liabilities, reduce foreign reserves, and increase the country's external vulnerability. A large foreign debt stock could ultimately reduce the country's ability to borrow abroad to finance a current level of consumption spending. A sharp outflow of short-term capital amid foreign investors' concerns about the country's economic prospects would cause the depreciation of a home currency, which can accelerate inflation and hurt the competitiveness of the domestic economy. Short-term interest rates could also increase considerably, pushing the domestic economy into a recession.

While a sizable and long-lasting trade deficit in consumer goods poses risks to macroeconomic stability and growth, a trade deficit in capital goods is usually considered beneficial. In the absorption approach, a trade deficit in investment goods has a positive economic effect since it raises domestic savings and capital stock. As the Solow growth model predicts, the acceleration of capital accumulation positively affects economic growth. When a country borrows from abroad to import capital goods for an investment project, it gets a higher rate of capital accumulation (e.g., equipment, factories, and infrastructure), which cannot be achieved through domestic savings only. Although an importing country runs a temporary trade deficit now, its future exports, productivity, and economic growth will rise. In addition to capital and labor, production is determined by total factor productivity. However, most innovations and

technologies in the world are generated in only a few advanced economies. Other countries, especially developing countries, depend on imported technology to increase their productivity. For them, importing capital goods is a way of transferring technologies that are embedded in these capital goods (Eaton & Kortum, 2001). Many empirical studies have found that technologies embedded in investment goods improve the efficiency of equipment and software used to produce finished goods with a significant positive effect on GDP growth. In the literature, this phenomenon is called “investment-specific technological change.” Lee (1995) demonstrates, using the cross-country data for the period 1960-85, that the ratio of imported to domestically produced capital goods in the composition of investment has a considerable positive effect on economic growth. Cavallo and Landry (2010) estimate that the imports of capital goods have contributed 20 to 30 percent to growth in US output between 1967 and 2008, which implies that the imports of capital goods are an essential source of GDP growth. Li et al. (2022) examine the impact of capital goods imports on labor wages in China and argue that a significant increase in the imports of capital goods experienced by China over the last decade has raised the demand for skilled workers and their wages. In their survey of the relevant literature, Saggi (2002) and Keller (2004) find that most empirical studies indicate that imports of capital goods and inflows of foreign direct investment present an important transmission channel of technology transfer and diffusion through which developing countries can accelerate their growth and catch up with advanced economies. Lawrence (2018) argues that a trade deficit caused by increased imports of investment goods, critical inputs for creating new industries and boosting productivity and innovations, indicates that an importing country is investing in its development and future growth.

One of the widespread explanations for the positive economic impact of a trade deficit in capital goods is based on the theory of international real-business-cycle (IRBC) developed by Backus et al. (1995), who adapted the real-business-cycle (RBC) theory to an open economy

framework with flows of goods between countries. The IRBC theory assumes that individuals and businesses make optimal consumption and production decisions from a long-term perspective. Productivity may differ across countries, and investors seeking profits choose the countries with higher productivity growth. Because the production facilities are relocated to a more efficient country, importing more capital goods deteriorates this country's trade balance. The Solow growth model predicts that an increase in capital stock supports the economic growth of the country, which is currently running a trade deficit. In addition, if investments are channeled into the production of competitive goods, in the future, an increase in exports of these goods may turn a trade deficit into a trade surplus.

The original IBRC model includes only final goods. However, trade flows are not homogeneous, and fluctuations in the trade balance for consumption and capital goods²⁶ may have different patterns over time. Warner (1994) shows that capital goods account for 35% of merchandise exports over the 1967–1990 period and finds that they are several times more volatile than exports of other product groups. Baxter (1995) shows that durable goods account for half the trade balance, and capital goods explain most fluctuations. Burda and Gerlach (1992) attribute most of the 1980's deterioration in the trade balance to capital goods. Given the importance of investment goods for explaining trade balance fluctuations within the IRBC model, researchers extended the model by disaggregating trade flows by product groups. Examples include Canova and Dellas (1993) and Ricketts and McCurdys (1995), who examine the transmission of business cycles across borders via trade in capital goods. Boileau (1999) applies the IRBC model for international trade in capital goods. In a related study, Arvanitis and Mikkola (1996) examine the business cycle fluctuations of the trade balance and the terms of trade in a model with capital goods mobility. In their study, however, capital goods are excluded from the analysis, and the combination of incomplete asset markets and low elasticity

²⁶ In this study, the terms “capital goods” and “investment goods” are used interchangeably.

of substitution between home and foreign final goods explains the higher volatility of net exports and the terms of trade. Martin Boileau (1999) extended the two-country open economy RBC model by including trade in capital goods. Eaton and Kortum (2001), who developed the Eaton-Kortum model of international trade, demonstrated the importance of liberalizing trade in capital equipment for technology and innovation diffusion.

The theory of IRBC explains that a temporary trade deficit in investment goods is favorable because it brings long-term productivity growth to a home country. It also implies the importance for researchers of decomposing trade flows in empirical research that focuses on the impact of trade balance fluctuations on a country's economy. Foreign trade statistics uses several classifications to disaggregate international trade flows in goods. The two principal standards are the Harmonized System (HS) of the World Customs Organization (WCO) and the Standard International Trade Classification (SITC) of the United Nations (UN). There are also other classifications of foreign trade statistics in use. This study uses the classification by Broad Economic Categories (BEC). It groups commodities into three categories by their main end-use: consumer goods, capital (investment) goods, and intermediate goods. Because the BEC classification is widely used for the macroeconomic analysis of international trade data, it is the most suitable for this study, which considers, among other things, the effect of the balance of trade.

The disaggregation of trade flows based on the BEC classification makes it possible for this study to examine trade balance fluctuations not only in consumer or investment goods but also in intermediate goods, which are a crucial factor for economic development and account for a significant share in world trade as well as in the structure of foreign trade of the EEU member countries. As economic globalization has created complex international supply chains that connect different production stages across national borders, today, world trade is dominated by products that are not consumed but are further used to produce other goods and services. De

Backer and Miroudot (2013) show that intermediate goods represent 56% of merchandise trade and 73% of trade in services. Reflecting the global trend of production relocation across national borders and outsourcing business operations to outside foreign-based companies, trade in intermediate inputs increased between 1995 and 2006 at an average annual growth rate of 6.2% for goods and 7% for services. As illustrated in Chapter 3, intermediate goods also dominate the foreign trade pattern of the EEU member countries. In 2021, intermediate goods accounted for 64.3 percent of the EEU merchandise intra-trade and 93.0 percent and 43.7 percent of exports to and imports from non-member countries, respectively.

While a trade deficit in investment goods is generally regarded as favorable, interpreting trade imbalances in intermediate goods is not so unambiguous. Intermediate goods are similar in many respects to investment goods as both are used in producing consumer goods, and the demand for them is derived from the demand for consumer goods. However, while both consumer and investment goods are finished products, intermediate goods are characterized by a high degree of product differentiation, ranging from raw materials to nearly finished goods. Thus, a different approach is needed to assess the changes in the trade balances in intermediate goods caused by economic integration. Trade in intermediate goods is often viewed as a reflection of international supply chains that spread worldwide and are referred to as global value chains or international production networks. Hence, using the global commodity chain (GCC) concept is most appropriate for this study. It is not a single theory but a set of different but related approaches that focus on a commodity chain as a unit of analysis. A commodity chain is "a network of labour and production processes whose end result is a finished commodity" (Hopkins & Wallerstein, 1986, p. 159). The term "global commodity chain" was first introduced by Gereffi (1994). The concept originated within the framework of the political economy of development and underdevelopment and is rooted in world-system theory and dependency theory. Over time, different approaches have emerged, such as value chains, supply

chains, global value chains (GVC), regional value chains (RVC), and international and regional production networks, which all share a common focus on global and regional integration of production and marketing chains. The most relevant approach for this study is the concept of regional value chains and production networks, which predicts that economic integration through increasing bilateral trade in intermediate goods between RTA member countries will promote the development of RVC within an RTA. The RVC concept can be especially valid for the EEU member states, which were once part of a single economy. They have good prerequisites for intra-region integration of production chains to rebuild their close industrial cooperation. Therefore, one could expect that an RTA would increase intra-region trade in intermediate goods. As RTA member states become more integrated into a regional value chain and engaged in the relocation of production, their bilateral trade imbalances in intermediate goods would increase in absolute terms.

A particular interest for this study is the literature that focuses on the role of intermediate goods in developing regional value chains and production networks within a trade bloc. The standard approach to such analysis estimates two gravity equations with RTA dummy variables separately for final and intermediate goods. Following this approach, Cardozo et al. (2021) investigate the impact of free trade agreements between the Middle East and North Africa (MENA) countries, on the one hand, and Turkey, Jordan, and the USA, on the other hand. Two gravity equations, one for final goods and another for intermediate goods, are also used by Márquez-Ramos and Martínez-Zarzoso (2014) in their study on the integration of North African countries in Euro-Mediterranean regional production networks. Martínez-Zarzoso et al. (2015) find a significant impact of the accession of the Central Eastern European countries to the EU on trade in intermediate and final goods. In their “gravity-in-gravity” model, they estimate one gravity equation with intermediate goods as a dependent variable. Then they use the estimates in the second gravity equation, in which the dependent variable is a country’s

exports of final goods. Florensa et al. (2015) examine the effects of the Latin American Integration Association (LAIA) and the Southern Common Market (Mercosur) on trade in both final and intermediate goods. In their study, they hypothesize that economic integration among Latin American countries has led to the development of regional production networks and has caused a production relocation within the region. Using two gravity equations for final goods and intermediate goods, they suggest that an increase in imports of intermediate goods and exports of final goods in the intra-region trade indicates the development of regional production networks. However, within the region, an increase in imports of intermediate goods can be accompanied by a reduction in exports of final goods. The authors define this outcome as a substitution effect. A complementary effect arises if a trade bloc experiences an increase in imports of intermediate goods from the rest of the world and exports of intermediate goods to RTA member countries. A more complicated approach to the gravity model analysis of intermediate goods was developed by Baldwin and Taglioni (2011, 2014), who suggest using the new proxies for economic masses of trading partners instead of traditionally used GDP. Because GDP includes only final goods, they propose to add to it the imports of intermediate goods, which would provide, as they argue, a better measure of an importer's domestic demand. As to an exporter's domestic output, they suggest summing up a country's value-added in manufacturing and its imports of intermediate goods. Nguyen and Wu (2020) use this approach to investigate the development of regional production networks in East Asia and the European Union in the gravity model and find that exports in intermediate goods are more sensitive to trade barriers than aggregate exports.

Since trade balance plays an essential role in the economic policy of developed and developing countries, it has been the subject of many empirical studies. These studies can be divided into two broad groups depending on whether trade balance is a dependent or independent variable in a model. When trade balance is considered an independent variable, researchers try to find

its impact on economic growth, often expressed in GDP. Studies on trade balance effects on economic growth may include other independent variables, depending on the purpose of the study and the theory behind the model. However, most studies focusing on trade balance take it as a dependent variable and seek to determine factors that cause trade balance fluctuations. Three factors widely used as independent variables in the standard trade balance model are exchange rate, domestic GDP, and foreign GDP. Three theoretical approaches explain the determinants of a trade balance: the elasticity approach, absorption approach, and monetary approach. Three prominent economists, Bickerdike (1920), Robinson (1946, 1947), and Metzler (1948), developed the elasticity approach, which is often referred to as the BRM approach after their initials. In the BRM model, the trade balance is affected by the change in the real exchange rate, that is, the relative prices of domestic and foreign goods. It predicts that the nominal devaluation of domestic currency would improve the trade balance (Frankel & Rose, 1994). The absorption approach, developed by Harberger (1950), Meade (1951), and Alexander (1952, 1959), emphasizes the role of aggregate expenditure in determining the trade balance. It states that a country's trade balance will improve if the domestic output exceeds domestic spending. So, in this model, a trade surplus reflects positive savings in a domestic economy. At the core of the monetary approach are money demand and money supply. The most influential papers on this approach were published by Polak (1957), Hahn (1959), Pearce (1961), Prais (1961), Mundell (1968, 1971), Johnson (1972, 1976, 1977), Mussa (1974), Frenkel (1976), Magee (1976). Excess demand for foreign goods requires more demand (supply) for money. If the demand for money exceeds the supply, then the excess demand for money causes capital inflows from abroad, which improves the trade balance. If the money supply exceeds the demand for money, the excess supply leaves the economy as a capital outflow, worsening the trade balance. In this model, a trade imbalance reflects a disequilibrium

between demand and supply in the money market, and the exchange rate is the relative price of domestic and foreign money.

While the gravity model has been a popular empirical tool among trade economists for many years, it is still not so widely used by macroeconomists since they have different perspectives concerning the interaction between aggregate and bilateral trade balances in the gravity model. The "common" view in macroeconomics is that an aggregate trade balance of a country is determined by its balance of saving and investment and is not affected by bilateral trade. Therefore, trade policy has no relevance to a country's macroeconomic performance. On the contrary, trade economists argue that since an overall trade balance is an aggregate of bilateral trade balances, it depends not only on macroeconomic factors but also on bilateral trade costs. In their view, trade measures have an important policy implication since a change in tariff, which affects bilateral trade, can improve or worsen an overall trade balance of a home country. In this regard, two influential papers on this topic are worth mentioning, each representing the opposite side of the debate on the usefulness of the gravity model in explaining trade imbalances. The first paper written by Davis and Weinstein (2002) from Columbia University combines two theories: macroeconomics and international trade. In the macroeconomic theory, trade imbalance is determined by macroeconomic factors such as investment and saving. The authors use the "triangular trade" concept, borrowed from the theory of international trade, which says that a persistent bilateral trade deficit of a country arises from solid demand for essential goods, which need to be imported from its trading partner. In their study, the dependent variable is bilateral exports, and the independent variables are the standard gravity factors such as GDP, remoteness, distance, common border, and participation in an RTA. The trade balance is calculated as the difference between the bilateral exports from country i to country j and the "reverse" bilateral exports from country j to country i (which, in this case, are treated as imports). Comparing the fitted trade imbalances with the actual ones, the authors

find that the gravity model has poorly explained trade balance fluctuations. They call this phenomenon "the mystery of excess trade (balances)." The paper received a critical response from two prominent gravity model experts, Gabriel Felbermayr and Yoto Yotov (Felbermayr & Yotov, 2021). They modify Davis and Weinstein's original gravity equation specification by using aggregate trade balances (bilateral trade flows plus domestic trade flows) and incorporating the structural multilateral resistances as asymmetric trade costs. They show that the gravity model performs reasonably well in predicting trade imbalances and that no "mystery of the excess trade balances" exists. Nevertheless, the debate is still open as Felbermayr and Yotov conclude their work by pointing to the need for "...potentially fruitful research that combines the structural gravity model of trade with macroeconomic frameworks" (Felbermayr & Yotov, 2021, p. 15).

This study aims neither to evaluate the impact of the changes in trade balance on economic growth nor to determine the factors that explain trade imbalances. Neither it seeks to join in the empirical debate between trade economists and macroeconomists on whether trade policy matters for trade balance and whether the gravity model is applicable to find that out. Instead, this study attempts to apply a single macroeconomic framework to the gravity model to explain all the possible values of the estimated coefficients of RTA dummy variables and then use them to make an economic assessment of an RTA. As mentioned in the previous Chapters, RTA dummy variables are generally included in the gravity model to estimate trade Viner's trade creation and trade diversion effects. However, since Viner's model explains only part of the redirection of trade flows, researchers use other theoretical models to describe all possible values of the coefficients of the RTA dummy variables estimated in the gravity model. The study suggests a methodological approach to fill in this gap by using the gravity model to determine the trade balance effect, which is defined for this study in a narrow sense as a change in a trade balance of an RTA member country vis-à-vis the trade bloc caused by an RTA. While

Davis and Weinstein (2002) calculate the trade balance as the difference between bilateral exports and “reverse” bilateral exports ($T_{ij} = E_{ij} - E_{ji}$), which are the dependent variables in their gravity model, this study derives the trade balance effect from a set of three RTA dummy variables. Also, because an aggregated trade deficit or surplus does not provide sufficient information to evaluate an economic position of a country, this research decomposes trade flows into three categories based on the BEC classification: consumer goods, investment goods, and intermediate goods. Trade balance effects estimated in the gravity model over these three product groups are expected to provide a better picture of the impact of an RTA on its member countries than the estimated trade creation and trade diversion effects alone.

5.3. Trade balance framework for the gravity model of trade

This study suggests a new approach to evaluate the economic impact of an RTA by applying a trade balance framework, which is an essential concept in macroeconomic policy, to the gravity model, which is a workhorse in empirical studies on trade policy. To construct a trade balance framework, first, the change in net exports for RTA member country i is expressed as the difference between the change in exports and the change in imports:

$$\Delta NX_i = \Delta X_i - \Delta M_i \quad (5-1)$$

Identity (5-1) implies that economic integration, which changes relative bilateral trade costs and redirects trade flows, would affect a country’s trade balance. However, the changes in an aggregated trade balance of a country convey insufficient information for making an economic assessment of an RTA because the interpretation of these changes is not clear-cut. A trade deficit is not always unfavorable as it can be beneficial if brought about by increased imports of investment goods or if associated with developing a regional value chain. Therefore, a disaggregation of trade flows is required to get more information on the nature of their changes. It is common in empirical studies on the impact evaluation of an RTA to focus on the

commodity structure of trade instead of aggregate exports or imports because different types of goods face different rates of customs duties, and some goods are more sensitive to changes in trade barriers than others. A customs union usually eliminates bilateral trade barriers between its member countries. At the same time, it puts in place a common external tariff, which is, in most cases, higher than the weighted average of the previous tariffs of RTA member countries against the third countries. It implies that *the relative* changes in tariffs are more significant for the goods that were previously taxed at a higher rate than for those that were taxed at a lower rate and would have no impact on the goods that were taxed at a zero rate. Therefore, while estimating trade effects in the gravity model shows neither trade creation nor trade diversion in total bilateral trade, significant redirection of trade may still occur in some goods, providing essential information that needs to be included in the analysis.

In general, researchers use three approaches to disaggregating trade flows depending on the purpose of the study. The first approach, in which trade creation and trade diversion effects are estimated for each commodity group separately, helps identify the industries most affected by economic integration. The second approach focuses on a specific industry (for example, agriculture, metallurgy, or car industry) that occupies a dominant economic position and is strategically important for a country of interest. The third approach excludes from an analysis a specific commodity(s), which, despite its significance in a country's foreign trade, is exempted from RTA regulation (for example, oil and gas in resource-rich countries). Most researchers use the Harmonized System (HS) or the Standard International Trade Classification (SITC) of foreign trade statistics to disaggregate trade flows. In contrast, this study uses the Broad Economic Categories (BEC), a three-digit international classification of foreign trade statistics. It groups commodities according to their main end-use and correlates them to three macroeconomic categories: consumer goods, capital goods, and intermediate goods. Because the BEC classification is aligned with the System of National Accounts (SNA) framework

linking foreign trade statistics with other national and international statistical data, it is widely used in macroeconomic analysis of international trade, including regional integration. Given the purpose of this study, this is the most appropriate way of disaggregating trade flows to evaluate the impact of an RTA on the trade balances of RTA member states.

To explain the implications of trade imbalances in each of the three product groups for an RTA member state, the study provides a theoretical framework based on the absorption approach to the trade balance and uses the income-expenditure identity. In macroeconomics, the aggregate expenditure in the economy of country i is the sum of three components: consumption, investment, and net exports (assuming there is no government):

$$Y_i = C_i + I_i + NX_i \quad (5-2)$$

where Y_i is the total expenditure, C_i is the domestic consumption, I_i is the domestic investment, and NX_i is the net exports. Net exports, also termed trade balance, are the difference between the amount of goods country i exports (X_i) and the amount of goods it imports from the rest of the world (M_i).

Identity (5-2) implies that a change in net exports is associated with a change in GDP. An increase in exports or a reduction in imports is reflected as an increase in GDP and vice versa. The macroeconomic relationship between a country's net exports and GDP provides the theoretical rationale for evaluating in the gravity model the economic impact of an RTA on its member countries based on the changes in their trade balances caused by economic integration. Given that the difference between aggregate expenditure (Y_i) and consumption (C_i) is savings (S_i), it follows from (5-2) that the trade balance can be rewritten as the difference between savings and investment:

$$NX_i = (Y_i - C_i) - I_i = S_i - I_i \quad (5-3)$$

It is generally assumed in macroeconomics that savings are better than consumption because they can be transformed through financial markets into new investments, which raise the production of goods and increase future economic growth and consumption. Therefore, an increase in savings and a corresponding increase in investment are expected to have a positive economic impact. Starting from a balanced trade ($NX_i = 0$), changes in savings or investment can bring about either a trade surplus or a trade deficit. Four outcomes are possible depending on what has caused the change, either consumption or investment. An increase in savings leads to a favorable trade surplus, and an increase in investment leads to a favorable trade deficit. A decline in investment leads to an unfavorable trade surplus, and a decline in savings leads to an unfavorable trade deficit.

Let us assume that an RTA member country i produces both consumer and investment goods. Some are exported, and some consumer and investment goods are imported. So, the total amount of consumer goods available for domestic consumption is given as follows:

$$C_i = C_i^d + C_i^m - C_i^x \quad (5-4)$$

In identity (5-4), C_i is the total amount of consumer goods to be consumed domestically; C_i^d is domestically produced consumer goods, C_i^m is consumer goods imported and C_i^x is consumer goods exported.

The same reasoning applied to investment goods yields the following identity:

$$I_i = I_i^d + I_i^m - I_i^x \quad (5-5)$$

In identity (5-5), I_i is the total amount of investment goods to be invested domestically, I_i^d is domestically produced investment goods, I_i^m is imports of investment goods, and I_i^x is exports of investment goods. It is known that domestic production $Y_i = C_i^d + I_i^d$. If domestic production does not change over time, that is Y_i , C_i^d , and I_i^d remain constant, then it follows that:

$$\Delta S_i = \Delta Y_i - \Delta C_i = \Delta Y_i - \Delta C_i^d - \Delta C_i^m + \Delta C_i^x = \Delta C_i^x - \Delta C_i^m \quad (5-6)$$

Identity (5-6) says that the change in savings equals the change in exports of consumer goods minus the change in imports of consumer goods. The increase in savings that has a positive economic effect arises either from an increase in exports of consumer goods ($\Delta C_i^x > 0$) or from a reduction in imports of consumer goods ($\Delta C_i^m < 0$) or from both. If ΔC_i^x is the change in exports of consumer goods from country i , and ΔC_i^m is the change in imports of consumer goods into country i , then the change in the trade balance of country i in consumer goods (ΔNX_i^{con}) can be defined in the following way:

$$\Delta S_i = \Delta C_i^x - \Delta C_i^m = \Delta NX_i^{con} \quad (5-7)$$

Identity (5-7) says that RTA member country i gets a positive trade balance effect if its exports of consumer goods to other countries increase or its imports of consumer goods from the rest of the world decrease. In both cases, country i improves its trade balance of consumer goods, and savings in the economy of country i increase. It implies that a trade surplus in consumer goods is favorable, and a trade deficit is unfavorable.

A trade balance effect for investment goods can be derived similarly:

$$\Delta I_i = \Delta Y_i - \Delta C_i^d + \Delta I_i^m - \Delta I_i^x = \Delta I_i^m - \Delta I_i^x \quad (5-8)$$

The increase in investment has a positive impact on the economy. It arises from a reduction in exports of investment goods ($\Delta I_i^x < 0$) or from an increase in imports of investment goods ($\Delta I_i^m > 0$) or from both. In each case, the total amount of investment goods available to be invested at home increases ($\Delta I_i > 0$). If ΔI_i^x is the change in exports of investment goods from country i , and ΔI_i^m is the change in imports of investment goods into country i , then the trade balance of country i in investment goods can be defined as follows:

$$\Delta I_i = \Delta I_i^m - \Delta I_i^x = -(\Delta I_i^x - \Delta I_i^m) = -\Delta NX_i^{inv} \quad (5-9)$$

Identity (5-9) says that country i gets a positive economic effect if its exports of investment goods decrease or its imports of investment goods from abroad increase. In both cases, country i 's trade balance in investment goods worsens ($\Delta NX_i^{inv} < 0$) but total amount of investment goods available in the domestic economy goes up ($\Delta I_i > 0$). It implies that an improving trade balance in investment goods is unfavorable, and a deteriorating trade balance in investment goods is favorable. The implication of a favorable trade deficit in investment goods also corresponds to the international real business cycle theory.

For developing a trade balance framework in the gravity model, this study uses the disaggregation of trade flows based on the BEC classification of foreign trade statistics with three product groups: consumer goods, investment goods, and intermediate goods. Unlike consumer and investment goods, in macroeconomics, intermediate goods are not included in the income-expenditure identity to avoid double-counting as they are used to produce final goods. Nevertheless, there is a rationale to include them in a trade balance framework for two reasons. First, intermediate goods occupy a significant share in foreign trade, and second, they show up in the trade balance disaggregated by the BEC classification. However, the interpretation of a trade imbalance in intermediate goods is unclear since they are used in producing final goods and are characterized by a high degree of product differentiation, ranging from raw materials to partially finished high-tech goods such as semiconductors or microprocessors. Trade balance fluctuations in intermediate goods do not necessarily have positive or negative economic effects; rather, they reflect some structural adjustment underway in a country's economy. The concept of global commodity chains explains increased trade in intermediate goods by international and regional production networks or value chains, which are more than likely to emerge between RTA member countries.

The change in the trade balance in intermediate goods is expressed as follows:

$$\Delta NX_i^{int} = \Delta X_i^{int} - \Delta M_i^{int} \quad (5-10)$$

where ΔNX_i^{int} is the change in net exports of country i in intermediate goods; ΔX_i^{int} is the change in exports of intermediate goods from country i ; ΔM_i^{int} is the change in imports of intermediate goods into country i .

By combining net exports identities (5-7), (5-9), and (5-10) for consumption, investment, and intermediate goods, respectively, the change in the trade balance of an RTA member country i can be presented in the following form:

$$\Delta TB_i = \Delta TB_i^{con} + \Delta TB_i^{inv} + \Delta TB_i^{int} \quad (5-11)$$

Davis and Weinstein (2002) were the first to apply a trade balance framework to the gravity model. Since the authors aim to test the predictive power of the gravity model for trade balance fluctuations, they use estimate two gravity equations. In the first equation, the dependent variable is aggregate bilateral exports. In the second equation, they change the direction of bilateral trade flows so that they become imports. They define the trade balance as the difference between exports and “reverse exports” and then compare the predicted and actual values of trade balances. This study differs from that of Davis and Weinstein (2002) in both the purpose and the approach. It does not intend to explain fluctuations in bilateral trade balance but uses them to assess the economic impact of an RTA on its member countries. Also, it derives the trade balance from RTA dummy variables instead of dependent variables.

A change in the trade balance of an RTA member country i can be considered, depending on the membership status of its trading partners, as the sum of a change in the trade balance vis-à-vis the trade bloc and in the trade balance against non-member countries as follows:

$$\Delta TB_i = \Delta TB_i^{RTA} + \Delta TB_i^{ROW} \quad (5-12)$$

Given that trade balance is the difference between exports and imports, identity (5-12) can be rewritten as:

$$\Delta TB_i = \Delta TB_i^{RTA} + \Delta TB_i^{ROW} = (\Delta X_i^{RTA} - \Delta M_i^{RTA}) + (\Delta X_i^{ROW} - \Delta M_i^{ROW}) \quad (5-13)$$

where ΔX_i^{RTA} and ΔX_i^{ROW} are the changes in exports of RTA member country i to other RTA member countries and to non-member countries, respectively; ΔM_i^{RTA} and ΔM_i^{ROW} are the changes in the flow of imported goods to RTA member country i from the trade bloc and from to the rest of the world, respectively. All changes in exports and imports are taken with respect to an RTA.

Generally, gravity model studies on regional integration use up to three RTA dummy variables, which capture the changes in three types of bilateral trade flows that emerge with an RTA with respect to the hypothetical level of trade between non-member countries. In the case with three RTA dummy variables, each of them estimates the trade creation, import trade diversion, and export trade diversion effects, respectively. Since this study defines the trade balance effect as the change in the trade balance of an RTA member country in response to regional integration, applying a trade balance framework to the gravity model uses country-specific rather than bloc-specific RTA dummy variables. The export and import trade creation dummy variables, estimated for an RTA member country, capture the change in its exports to and imports from non-members, respectively, in response to regional integration. Therefore, the estimates can be used to construct the trade balance effect for an RTA member country vis-à-vis the rest of the world. This study modifies the trade creation dummy variable to derive the trade balance effect for an RTA member country against the other RTA member countries. In empirical studies, the trade creation dummy variable is traditionally specified as being equal to one if both trading partners are members of the same RTA. However, it does not indicate which of the two RTA trading partners is an exporter and which is an importer. This study splits the trade creation

dummy variable into the export trade creation and the import trade creation dummy variables. The export trade creation dummy equals one if countries i and j are RTA members and country of interest i is an exporter. The import trade creation dummy equals one if countries i and j are RTA members and the country of interest, now denoted by j , is an importer. Specified in this way, the export trade creation dummy, for example, for Kazakhstan, estimates the change in Kazakh exports to the EEU market in response to regional integration. Similarly, the import trade creation dummy estimates the change in imports of Kazakhstan from the other EEU member states. The estimated changes in exports and imports of RTA member country i to and from the other RTA member countries by using the export and import trade creation dummies are combined with the changes in exports and imports of RTA member country i to and from non-members, which are estimated with the export and import trade diversion dummies.

To specify country-specific RTA dummy variables for deriving a trade balance framework, each EEU member country is denoted with a corresponding two-letter ISO code, then in the country-specific RTA dummy variables, $i, j \in \{AM, BY, KZ, KG, RU\}$, where AM, BY, KZ, KG, RU stand for Armenia, Belarus, Kazakhstan, Kyrgyzstan, Russia, respectively, and $i \neq j$. The export trade creation RTA dummy variable, denoted as EEU_{ijt}^{xm} , equals one if both countries i and j are RTA members in year t , and RTA member country of interest i is an exporter, and zero otherwise. It estimates the change in exports of RTA member country of interest i to the other RTA member countries, and its coefficient is interpreted as an export trade creation effect. The import trade creation RTA dummy variable is denoted as EEU_{ijt}^{mx} . While the export trade creation dummy takes the value of one if RTA member country of interest exports to the other RTA member countries, the import trade creation dummy is equal to one if the same RTA member country of interest (it is now j , not i) now imports from the other RTA member countries. The export and import trade diversion dummy variables are specified in the traditional way. The export trade diversion RTA dummy variable, EEU_{ijt}^x , equals one if exporter

i is RTA member country of interest and importer j is a non-member in year t , and zero otherwise. It estimates the change in exports of an RTA member country of interest i to non-members due to regional integration. The import trade diversion RTA dummy variable, EEU_{ijt}^m , is supposed to capture Viner's trade diversion effect. It takes the value of one if RTA member country of interest j is an importer and exporter i is a non-member and equals zero otherwise. It estimates the change in imports of RTA member country of interest (which is now j , not i) from non-members due to an RTA. The specification of country-specific RTA dummy variables for the case when the dependent variable is exports is summarized in Table 5-1.

The coefficients of the export trade creation, import trade creation, export trade diversion, and import trade diversion RTA dummy variables for RTA member country i to be estimated in the gravity model are denoted as β_i^{xm} , β_i^{mx} , β_i^m , and β_i^x , respectively. Since the coefficient of the export trade creation RTA dummy variable EEU_{ijt}^{xm} (β_i^{xm}) estimates the change in exports from RTA member country i to the other RTA member states, it is used to replace ΔX_i^{RTA} in identity (5-13). The coefficient of the import trade creation RTA dummy variable EEU_{ijt}^{mx} (β_i^{mx}) estimates the change in imports of RTA member country i from the other RTA member states, so it is used to replace ΔM_i^{RTA} in identity (5-13). In a similar way, ΔX_i^{ROW} and ΔM_i^{ROW} are replaced by the coefficients of the export trade diversion and import trade diversion RTA dummy variables (β_i^x and β_i^m), respectively. Table 5-2 illustrates the correspondence of the RTA dummy variables in the gravity model to the trade balance of RTA member country i .

The change in the overall trade balance of RTA member country i , broken down by the direction of trade flows, is rewritten using the coefficients of RTA dummy variables as follows:

$$\begin{aligned}
\Delta TB_i &= \Delta TB_i^{RTA} + \Delta TB_i^{ROW} = \\
&= (\Delta X_i^{RTA} - \Delta M_i^{RTA}) + (\Delta X_i^{ROW} - \Delta M_i^{ROW}) \equiv \\
&\equiv (\beta_{xm} - \beta_{mx}) + (\beta_x - \beta_m)
\end{aligned} \tag{5-14}$$

Identity (5-14) shows that a change in the trade balance of RTA member country i can be estimated in the gravity model using the coefficients of the four RTA dummy variables, each estimating the change in either exports from or imports to an RTA member country i . Since the coefficients of the RTA dummy variables in identity (5-14) reflect *additional* changes in exports and “reverse exports” (imports) of RTA member country i with respect to an RTA, their estimates are termed “trade balance effects.”

The trade balance in identity (5-14) is constructed for the case when the dependent variable in the gravity equation is aggregate exports. However, trade imbalances for aggregate goods are hard to be interpreted in terms of their macroeconomic effect. Therefore, it is reasonable to decompose the overall trade balance in trade balances in consumer, investment, and intermediate goods using identity (5-11). Then, the trade balance framework in the gravity model with bilateral trade flows disaggregated by direction and by BEC commodity groups can be presented in the following form:

$$\begin{aligned}
\Delta TB_i &= \Delta TB_i^{RTA} + \Delta TB_i^{ROW} = \Delta TB_i^{con} + \Delta TB_i^{inv} + \Delta TB_i^{int} = \\
&= \Delta TB_i^{RTA(con)} + \Delta TB_i^{RTA(inv)} + \Delta TB_i^{RTA(int)} + \Delta TB_i^{ROW(con)} + \Delta TB_i^{ROW(inv)} + \Delta TB_i^{ROW(int)} = \\
&= (\Delta X_i^{RTA(con)} - \Delta M_i^{RTA(con)}) + (\Delta X_i^{RTA(inv)} - \Delta M_i^{RTA(inv)}) + (\Delta X_i^{RTA(int)} - \Delta M_i^{RTA(int)}) + \\
&+ (\Delta X_i^{ROW(con)} - \Delta M_i^{ROW(con)}) + (\Delta X_i^{ROW(inv)} - \Delta M_i^{ROW(inv)}) + (\Delta X_i^{ROW(int)} - \Delta M_i^{ROW(int)}) \equiv \\
&\equiv (\beta_i^{xm(con)} - \beta_i^{mx(con)}) + (\beta_i^{xm(inv)} - \beta_i^{mx(inv)}) + (\beta_i^{xm(int)} - \beta_i^{mx(int)}) + \\
&+ (\beta_i^{x(con)} - \beta_i^{m(con)}) + (\beta_i^{x(inv)} - \beta_i^{m(inv)}) + (\beta_i^{x(int)} - \beta_i^{m(int)}) \quad (5-15)
\end{aligned}$$

In identity (5-15), the superscripts $RTA(con)$, $RTA(inv)$, and $RTA(int)$ for expressions ΔTB , ΔX , and ΔM denote the bilateral trade between RTA member country i and the rest of the trade bloc in consumer goods, investment goods, and intermediate goods, respectively. Similarly, the superscripts $ROW(con)$, $ROW(inv)$, and $ROW(int)$ for expressions ΔTB , ΔX , and ΔM denote the

bilateral trade between RTA member country i and non-member countries in consumer goods, investment goods, and intermediate goods, respectively. The coefficients $\beta_i^{xm(con)}$ and $\beta_i^{x(con)}$ estimate changes in exports of consumer goods from RTA member country i to other RTA member countries and non-member countries, respectively. The coefficients $\beta_i^{mx(con)}$ and $\beta_i^{m(con)}$ estimate changes in imports of consumer goods to RTA member country i from the rest of the trade bloc and from the third countries, respectively. Other coefficients $\beta_i^{xm(inv)}$, $\beta_i^{x(inv)}$, $\beta_i^{mx(inv)}$, $\beta_i^{m(inv)}$, $\beta_i^{xm(int)}$, $\beta_i^{x(int)}$, $\beta_i^{mx(int)}$, and $\beta_i^{m(int)}$ have a similar meaning but this time, their superscripts inv and int stand for investment goods and intermediate goods, respectively. All the coefficients of the RTA dummy variables in the trade balance framework are obtained in the gravity model by estimating a gravity equation for each product group. The trade balance framework for the gravity model is depicted in Table 5-3.

An economic assessment of an RTA on its member country i is based on estimated changes in the balance of trade of this country against the rest of a trade bloc as well as against non-member states. As a result of an RTA, the trade balance of country i may improve or deteriorate. The interpretation of trade balance fluctuations depends on the product group and is summarized in Table 5-4. In the case of consumer goods, a positive change in the trade balance is favorable; therefore, it has a positive effect on the economy of country i , while a negative change has a negative effect. Since a trade surplus of country i in consumer goods indicates that these goods are competitive and in demand abroad, its positive economic effect is called "*high competitiveness*." A trade deficit in consumer goods indicates that domestic consumer goods become less competitive abroad, so its negative effect on country i is named "*low competitiveness*." In macroeconomic theory, the improved trade balance in investment goods reflects a savings reduction in a home economy, so its economic effect is negative and called "*capital depletion*." A deterioration of the trade balance in investment goods implies increased

savings in the domestic economy. Therefore, it benefits country i , as both macroeconomics and the international real business cycles theory explain. Since increased imports of machinery and equipment strengthen the production base of an economy and improve its productivity and technological capability, the positive effect of the deterioration of the trade balance in investment goods is named "*capital accumulation*."

In this study, changes in the trade balance of intermediate goods are not interpreted as outcome-based, so they do not have a positive or negative economic effect per se. They instead indicate that a country's economy is in the process of structural change. The commodity chain concept takes the growth of trade in intermediate goods as a reflection of the development of global and regional production networks and value chains, which is driven, among other things, by economic integration. The trade balance of RTA member country i in intermediate goods can improve or deteriorate against its RTA trade partners as they deepen their economic cooperation and relocate production within the region. At the same time, the global commodity chain concept implies that for country i , the magnitude of these trade balance fluctuations would be higher in absolute terms than the changes in its trade balance vis-a-vis the rest of the world.

The trade balance framework presented in this study is not a theoretical concept since it does not explain trade balance fluctuations but is a methodological approach that applies a macroeconomic framework of the trade balance to the gravity model of trade. It assumes that economic integration causes the redirection of bilateral trade flows, which affects countries' trade balances. As a result, the trade balance of an RTA member country may improve or deteriorate with a positive or negative economic effect. These trade balance fluctuations are effectively captured by RTA dummy variables and estimated in the gravity model.

5.4. Empirical model and estimation

Since failure to account for multilateral resistances and address the presence of heteroscedasticity in trade data and the potential endogeneity of an RTA may lead to biased and inconsistent estimation results (Anderson & Van Wincoop, 2003; Baier & Bergstrand, 2007; Silva & Tenreyro, 2006), this study applies the PPML method to the estimation of the trade balance effects and specifies two gravity equations by including exporter-time, importer-time, and country-pair fixed effects in a multiplicative form. The first equation, which estimates the trade balance effects for each EEU member country against the rest of the trade bloc, is specified in the following way:

$$\begin{aligned}
 X_{ijt}^{\omega} = \exp [& \pi_{it} + \chi_{jt} + \mu_{ij} + \beta_{am}^{xm(\omega)} EEU_{am,jt}^{xm(\omega)} + \beta_{by}^{xm(\omega)} EEU_{by,jt}^{xm(\omega)} + \beta_{kz}^{xm(\omega)} EEU_{kz,jt}^{xm(\omega)} + \\
 & + \beta_{kg}^{xm(\omega)} EEU_{kg,jt}^{xm(\omega)} + \beta_{ru}^{xm(\omega)} EEU_{ru,jt}^{xm(\omega)} + \beta_{am}^{mx(\omega)} EEU_{am,jt}^{mx(\omega)} + \beta_{by}^{mx(\omega)} EEU_{by,jt}^{mx(\omega)} + \\
 & + \beta_{kz}^{mx(\omega)} EEU_{kz,jt}^{mx(\omega)} + \beta_{kg}^{mx(\omega)} EEU_{kg,jt}^{mx(\omega)} + \beta_{ru}^{mx(\omega)} EEU_{ru,jt}^{mx(\omega)}] \times \varepsilon_{ijt} \quad (5-16)
 \end{aligned}$$

The second equation estimates the changes in exports and “reverse” exports between each EEU member country and non-members and has the following specification form:

$$\begin{aligned}
 X_{ijt}^{\omega} = \exp [& \pi_{it} + \chi_{jt} + \mu_{ij} + \beta_{am}^{x(\omega)} EEU_{am,jt}^{x(\omega)} + \beta_{by}^{x(\omega)} EEU_{by,jt}^{x(\omega)} + \beta_{kz}^{x(\omega)} EEU_{kz,jt}^{x(\omega)} + \\
 & + \beta_{kg}^{x(\omega)} EEU_{kg,jt}^{x(\omega)} + \beta_{ru}^{x(\omega)} EEU_{ru,jt}^{x(\omega)} + \beta_{am}^{m(\omega)} EEU_{am,jt}^{m(\omega)} + \beta_{by}^{m(\omega)} EEU_{by,jt}^{m(\omega)} + \\
 & + \beta_{kz}^{m(\omega)} EEU_{kz,jt}^{m(\omega)} + \beta_{kg}^{m(\omega)} EEU_{kg,jt}^{m(\omega)} + \beta_{ru}^{m(\omega)} EEU_{ru,jt}^{m(\omega)}] \times \varepsilon_{ijt} \quad (5-17)
 \end{aligned}$$

In equations (5-16) and (5017), exp denotes the exponential function, π_{it} is the vector of exporter-time fixed effects to capture the outward multilateral resistances; χ_{it} is a set of importer-time fixed effects that account for the inward multilateral resistances; μ_{ij} denotes country pair fixed effects. The dependent variable X_{ijt}^{ω} is the exports of goods ω from country i to country j in year t . Subscript ω denotes the aggregated exports or one of the BEC product

groups ($\omega \in (total, con, inv, int)$). *Con*, *inv*, and *int* stand for consumer, investment, and intermediate goods, respectively. It follows that gravity equations (5-16) and (5-17) are regressed on four dependent variables, X_{ijt}^{total} , X_{ijt}^{con} , X_{ijt}^{inv} , and X_{ijt}^{int} , separately.

Estimating the trade balance effects requires country-specific RTA dummy variables. The two-letter ISO country codes, AM, BY, KZ, KG, and RU, denote each EEU member country: Armenia, Belarus, Kazakhstan, Kyrgyzstan, and Russia, respectively. $EEU_{am,jt}^{xm(\omega)}$ is the export trade creation dummy variable, which equals one if trade in goods ω takes place between Armenia, if it is a EEU member in year t , and its EEU trading partner j , and Armenia is an exporter i whereas its trading partner j is an importer, and zero otherwise. $EEU_{am,jt}^{mx(\omega)}$ is the import trade creation dummy variable, which equals one if trade in goods ω takes place between Armenia, if it is a EEU member in year t , and its EEU trading partner i , and Armenia now is an importer j whereas its trading partner i is an exporter, and zero otherwise. $EEU_{am,jt}^{x(\omega)}$ is the export trade diversion dummy variable, which equals one if trade in goods ω takes place if Armenia, which a EEU member in year t , exports to a non-member country j ($j \notin \{AM, BY, KZ, KG, RU\}$), and zero otherwise. $EEU_{am,jt}^{m(\omega)}$ is the import trade creation dummy variable, which equals one if Armenia, if it is a EEU member in year t , imports from a non-member country i ($i \notin \{AM, BY, KZ, KG, RU\}$), and zero otherwise. The RTA dummy variables for other EEU member states are defined similarly.

Equations (5-16) and (5-17) are estimated for the same sample of 50 countries that was used in Chapters 3 and 4 (Table 3-1). From identity 5-15, the trade balance effects for each RTA member country against the EEU are derived as the difference between trade creation and “reverse” trade creation effects, and vis-à-vis non-member states as the difference between export trade diversion and import trade diversion effects for aggregated goods and each product

group. The estimated coefficients of the respective country-specific RTA dummy variables correspond to the trade balance framework, as shown in Table 5-3.

5.5. Empirical results

The changes in exports and imports of the EEU member countries obtained by estimating trade creation and trade diversion effects are reported in Table 5-5 through Table 5-9. Table 5-10 reports the trade balance effects for each EEU member country in aggregate and disaggregated goods. Table 5-5 shows the trade effects for Armenia. Column (1) of Table 5-5 indicates that after acceding to the EEU in 2015, Armenia has experienced a significant trade creation and trade diversion. The estimates of the export and import trade creation effect show that the exports of Armenia to the other EEU member countries and its imports from them have increased by 1.4 and 1.8 times, respectively. At the same time, the estimates of the export and import trade diversion effects indicate that the exports of Armenia to and its imports from non-member countries have decreased by 59.7 and 56.6 percent, respectively. All the estimated coefficients of the export and import creation dummies and export and import trade diversion dummies are statistically significant. The results suggest that Armenia, one of the smallest countries in the EEU in terms of economic size (its share in the EEU's total GDP is 0.7 percent), has become deeply integrated into the EEU and more "remote" from its non-member trading partners. In columns (2) - (4) of Table 5-5, the estimated changes in Armenia's exports and imports disaggregated in consumer, capital, and intermediate goods indicate that Armenia has experienced an increase in bilateral trade with the EEU member countries and a reduction in bilateral trade with non-member countries across all the product groups. However, not all the estimated coefficients of the trade creation and trade diversion dummy variables are statistically significant. The statistically significant results are observed in the exports of consumer and intermediate goods to the EEU and the imports of investment goods from the EEU. They suggest that Armenia's consumer and intermediate goods exports to the EEU member countries

have increased 1.7 and 4.8 times, respectively. At the same time, the imports of investment goods from the EEU have increased 1.5 times. Vis-à-vis the rest of the world, the estimates of the exports of investment and intermediate goods and the imports of all three product groups are also statistically significant. They indicate that Armenia's exports of investment and intermediate goods to non-members have decreased by 48.3 and 64.4 percent, respectively. At the same time, the imports of consumer, investment, and intermediate goods from the rest of the world have decreased by 66.0, 33.3, and 71.9 percent, respectively. Overall, the results for Armenia show that due to regional integration, it has experienced a strong trade diversion effect in all product groups by switching its bilateral trade from non-members toward the EEU member countries. The fall in exports to non-members and imports from them has been replaced by increased exports to the EEU member states and imports from them.

The trade balance effects for Armenia are reported in Table 5-10. Its trade balances in consumer goods against the EEU and the rest of the world have improved 1.7 times and by 66.0 percent, respectively. Thus, the overall trade balance of Armenia in consumer goods due to regional integration has improved 2.4 times. Its trade balances in capital goods against the EEU and the rest of the world, which have deteriorated 1.5 times and by 15 percent, respectively, suggest the overall trade balance in capital goods has deteriorated 1.6 times. As to Armenia's bilateral trade in intermediate goods, its trade balances against the EEU and the rest of the world have improved by 4.8 times and 7.5 percent, respectively. Therefore, the overall trade balance in intermediate goods has improved by 4.9 times. These results seem too high, but it should be noted that only statistically significant estimates have been used for deriving the trade balance. Therefore, the trade balance effects in product groups may be overestimated. The results for the trade balance in aggregate goods provide more accurate results since all the estimates of changes in total exports and total imports are statistically significant. They say that the overall trade balance of Armenia has deteriorated by 36.2 percent due to its accession to the EEU. It

has worsened against the EEU by 33.1 percent and vis-à-vis non-member countries by 3.1 percent. These results support the hypothesis discussed in Chapter 3 that smaller RTA member countries are most affected by regional integration than their larger RTA trading partners. Armenia has experienced substantial trade creation and trade diversion effects due to the EEU. From a macroeconomic perspective, while Armenia's overall trade balance has deteriorated, its trade balance has improved in consumer goods and deteriorated in investment goods, which implies a positive impact of the EEU on the country's economy. The improved trade balance in intermediate goods may indicate that Armenia has become more integrated into the regional value chain developed in the intra-EEU market.

The changes in exports and imports of Belarus estimated with the trade creation and trade diversion dummy variables are reported in Table 5-6. The results are similar to those for Armenia but different in some respects. Like Armenia, Belarus has experienced the export and import trade creation effect of the EEU. Vis-à-vis the rest of the world, an export trade diversion effect is coupled with increased imports from non-member countries. However, the results for Belarus are not statistically significant except for export trade diversion. So, it is possible only to suggest that Belarus has switched the destination of its exports away from non-members to the EEU member countries as it reduced its exports to non-members by 41.5 percent due to regional integration. In columns (2) - (4) of Table 5-6, the estimated changes in Belarus's exports and imports disaggregated in consumer, capital, and intermediate goods indicate that its exports of consumer and intermediate goods to the EEU member countries have increased 1.7 and 4.3 times, respectively. In contrast, the exports of investment goods have decreased by 22.8 percent. All the estimates of export trade creation in disaggregated goods are statistically significant. Since the increase in exports of consumer and intermediate goods to the EEU in absolute terms far exceeds the reduction in exports of capital goods, the estimate of the trade creation effect (0.301) is positive, albeit not statistically significant. The only statistically

significant estimate of the import trade creation effect is for intermediate goods (-1.155). It implies that the imports of intermediate goods from the EEU member countries to Belarus have increased by 68.5 percent. The combined impact of the positive and negative changes in imports from the EEU in all three product groups is reflected in a weak but statistically insignificant import trade creation effect in aggregate goods (0.0459).

Vis-à-vis the rest of the world, the estimated changes in exports of consumer, investment, and intermediate goods are negative, suggesting the presence of export trade diversion in each product group, but they are statistically insignificant. However, since all of them are negative, their combined effect is reflected in the statistically significant export trade diversion effect in aggregate goods (-0.536), which is interpreted as a reduction of 41.5 percent in total exports to non-member countries. The estimated changes in imports of consumer, investment, and intermediate goods from non-members have mixed signs, and only the estimate for intermediate goods (0.465) is statistically significant, which means that Belarus has increased the imports of intermediate goods from non-members by 59.2 percent. The combined effect of the negative change in imports of consumer goods and the positive changes in imports of investment and intermediate goods is reflected in the statistically insignificant increase in total imports from non-members (0.218).

The trade balance effects for Belarus are reported in Table 5-10. In the case of Armenia, all the estimates of the trade creation and trade diversion effects in aggregate goods were strong and statistically significant, so all of them were used to construct the overall trade balance. However, since the trade flows of Belarus in response to the EEU have changed in both directions, except for exports to non-members, the only statistically significant trade effect for Belarus in aggregate goods is export trade diversion (-0.536), which is used to construct the trade balance effect. So, it is estimated that due to the EEU, the overall trade balance of Belarus in aggregate goods has deteriorated by 41.5 percent. Disaggregated by BEC product groups,

its trade balance in consumer goods has improved 1.7 times and deteriorated by 22.8 percent in investment goods. Both results have the same macroeconomic implications as for the case of Armenia. They suggest that the EEU has positively affected the economy of Belarus and support the hypothesis that small countries with diversified economies benefit most from regional integration than their larger RTA trading partners. Also, the results demonstrate that the macroeconomic effect for Belarus is positive, although its overall trade balance has deteriorated. The trade balance of Belarus in intermediate goods against the EEU has improved 2.3 times but worsened vis-à-vis non-members by 59.2 percent, so the overall trade balance in intermediate goods has improved 1.7 times. Similar to the case of Armenia, this result may indicate that Belarus has also become more integrated into the regional value chain developed in the intra-EEU market. As discussed in Chapter 2, bilateral trade flows within the EEU are heavily skewed in favor of Russia, the dominant economic power in the trade bloc. Therefore, strong trade creation effects in intermediate goods observed for Armenia and Belarus not only indicate their deeper integration into the regional value chain but also reflect their increased production cooperation with the Russian economy.

The changes in exports and imports of Kazakhstan obtained by estimating trade creation and trade diversion effects are reported in Table 5-7. Kazakhstan stands out from all member countries because it is a major producer of oil, almost all of which is exported to non-member countries. At the same time, one of its largest trading partners in consumer and capital goods is Russia. The estimation results for the export and import trade creation effects and export and import trade diversion effects in column (1) are all statistically insignificant, suggesting no considerable impact of the EEU on the trade flows of Kazakhstan. These results align with the hypothesis that resource-rich countries are less affected by regional integration than their more diversified RTA trading partners because the imports of raw materials are typically expected

from import tariffs, and the RTA authorities do not regulate their exports. For example, a common petroleum market between EEU countries is expected to be developed only in 2025.

The changes in trade flows of Kazakhstan disaggregated into consumer, investment, and intermediate goods are reported in columns (2) through (4) of Table 5-7. The estimates of export trade creation are positive in investment and intermediate goods but negative in consumer goods, and all are statistically insignificant. Their combined effect is reflected in the statistically insignificant reduction of exports to the EEU market (-0.159). The estimated changes in imports of consumer, investment, and intermediate goods from the other EEU member countries are also mixed, with only the estimate for capital goods (0.492) being statistically significant, which means that Kazakhstan has increased the imports of investment goods from the other EEU member countries by 38.29 percent. The combined effect of reduced imports of consumer and intermediate goods and increased imports of investment goods is reflected in a small and statistically insignificant increase in total imports from the EEU member states (0.0349). The estimated changes in Kazakhstan's bilateral trade with non-members in consumer, investment, and intermediate goods are also mixed. The only statistically significant result (-0.574) indicates that Kazakhstan has reduced the imports of investment goods from non-members by 43.7 percent. Given that the imports of capital goods from the EEU market have increased by 38.29 percent, it is possible to suggest that due to regional integration, Kazakhstan has replaced some imports of capital goods produced in non-members with imports from the EEU member countries.

The trade balance effects for Kazakhstan are reported in Table 5-10. Since the estimates of the trade creation and trade diversion effects of the EEU on Kazakhstan's bilateral trade in aggregate goods are all statistically insignificant, there is no sufficient evidence for the impact of regional integration on its overall trade balance. Similarly, no statistically significant effect of the EEU is found on Kazakhstan's trade balances in consumer and intermediate goods.

However, the imports of investment goods from the EEU member countries have increased by 63.6 percent, and the exports of investment goods to non-members have decreased by 43.7 percent. Therefore, the trade balance in investment goods has deteriorated by 107.2 percent. It implies that the EEU has positively affected the economy of Kazakhstan since increased imports of capital goods with embedded technology will expand the stock of domestic capital, increase productivity, improve the production base, and support economic growth.

The estimated changes in exports and imports of the Kyrgyz Republic due to its accession to the EEU are reported in Table 5-8. It is the smallest member of the EEU in terms of economic size (0.4 percent of the EEU total GDP). At the same time, it is less diversified than Belarus and Armenia. Intermediate goods dominate its foreign trade pattern, and its economy depends on consumer and investment goods imports. So, it is reasonable to expect a mixed impact of the EEU on its bilateral trade. The estimates of export trade creation against the EEU indicate an increase in exports of consumer and intermediate goods to the EEU market and a reduction in investment goods, but they are statistically insignificant. The combined impact of the positive and negative changes in disaggregated exports from the Kyrgyz Republic to the other EEU member countries is reflected in a small and statistically insignificant reduction of aggregate exports (-0.0226). The estimated changes in consumer and intermediate goods imports from the EEU member countries are also statistically insignificant. However, the estimated coefficient of the import trade creation dummy in investment goods (0.626) is statistically significant. It implies that due to regional integration, the Kyrgyz Republic has increased the imports of capital goods from the EEU by 46.5 percent.

The estimates of export trade creation against the EEU indicate an increase in exports of consumer and intermediate goods to the EEU market and a reduction in investment goods, but they are statistically insignificant. The combined impact of the positive and negative changes in disaggregated exports from the Kyrgyz Republic to the other EEU member countries is

reflected in a small and statistically insignificant reduction of aggregate exports (-0.0226). The estimated changes in consumer and intermediate goods imports from the EEU member countries are also statistically insignificant. However, the estimated coefficient of the import trade creation dummy in investment goods (0.626) is statistically significant. It implies that the Kyrgyz Republic has increased the imports of capital goods from the EEU by 87.0 percent due to regional integration. The estimated coefficient of the import trade creation dummy (0.526) is also statistically significant. It indicates that the total imports of the Kyrgyz Republic from the other EEU member states have increased by 69.2 percent due to its accession to the EEU.

The estimated changes in consumer, investment, and intermediate goods exports from the Kyrgyz Republic to non-member countries have mixed signs, and none of them is statistically significant. The combined effect of the negative change in exports of consumer goods and the positive changes in exports of investment and intermediate goods is reflected in the statistically insignificant export trade diversion effect in total exports to non-members (-0.0537). The estimated changes in imports of consumer, investment, and intermediate goods from the rest of the world are negative, suggesting the presence of import trade diversion in each product group. The import trade diversion effects in consumer and intermediate goods are statistically significant and imply that due to the EEU, the imports of consumer and intermediate goods from non-members to the Kyrgyz Republic have fallen by 26.7 and 49.8 percent, respectively. The combined effect of the negative changes in imports from non-members in each product group is reflected in the statistically significant import trade diversion effect in aggregate goods (-0.376), which is interpreted as a reduction of 31.3 percent in total imports from non-member countries. Table 5-8 shows that due to the EEU, the Kyrgyz Republic has experienced strong import trade creation and import trade diversion effects in aggregate goods. While the trade creation effect is related to the increase in imports of investment goods from the EEU member

countries, the trade diversion effect is associated with reduced imports of consumer and intermediate goods from non-members.

The trade balance effects for the Kyrgyz Republic are reported in Table 5-10. Only the estimates of the import trade creation and import trade diversion effects in aggregate goods, which are statistically significant, are used to construct the overall trade balance. The result shows that due to regional integration, the overall trade balance of the Kyrgyz Republic has deteriorated by 37.9 percent. Its trade balance in consumer goods has improved by 26.7 percent and deteriorated by 87 percent in investment goods. Both results have the same macroeconomic implications as for the cases of Armenia and Belarus. They suggest that although the Kyrgyz Republic has experienced a deterioration in the overall trade balance, the EEU has positively affected its economy due to the improved trade balance in consumer goods and deteriorated trade balance in capital goods. The Kyrgyz trade balance in intermediate goods against the EEU has not changed but worsened vis-à-vis non-members by 49.8 percent, so the overall trade balance in intermediate goods has increased by nearly 50 percent. However, while the trade balance effect in intermediate goods is similar to the cases of Armenia and Belarus, there is no sufficient evidence for making the same conclusion about the increased integration of the Kyrgyz Republic into the regional value chain because the export and import trade creation effects in intermediate goods (0.304 and -0.0593, respectively) are statistically insignificant.

Since Armenia, Belarus, and the Kyrgyz Republic are small members of the asymmetric trade bloc with a combined GDP of 4.6 percent of the EEU's total GDP, they seem to share a similar pattern in the response of their bilateral trade flows to regional integration. All three countries have experienced a trade diversion as their bilateral trade with non-members in aggregate goods has decreased. Armenia and the Kyrgyz Republic have also increased their trade with the EEU, which indicates the presence of the trade creation effect. From the macroeconomic perspective, although their trade balances in aggregate goods have deteriorated, they have improved in

consumer goods and deteriorated in investment goods. These changes have positive macroeconomic implications as they indicate that Armenia, Belarus, and the Kyrgyz Republic have increased net exports of their consumer goods and net imports of capital goods, positively affecting their economic growth.

The changes in exports and imports for Russia in response to regional integration, which are obtained by estimating the trade creation and trade diversion dummies in the gravity model, are reported in Table 5-9. The estimates of export trade creation and import trade creation are negative but statistically insignificant, suggesting no impact of the EEU on the Russian bilateral trade with the EEU member countries. The estimate of the export trade diversion effect is also negative and statistically insignificant. However, the estimated coefficient of the import trade diversion dummy is statistically significant and positive (0.409). It implies that Russia has increased its imports from non-member countries by 50.5 percent. The estimated coefficients of the export and import trade creation dummy variables with trade flows disaggregated into consumer, investment, and intermediate goods are mixed, and all of them are statistically insignificant. Estimating the trade diversion effects of the EEU on Russia's disaggregated trade flows have produced similar results. The only statistically significant effect found in the imports of investment goods (0.397) suggests that Russia has increased its imports of investment goods from non-member countries by 48.7 percent. Since the positive and statistically insignificant estimates of Russian imports of consumer and intermediate goods from non-members are small in magnitude, the combined effect of the changes in imports across all three product groups is reflected in a statistically significant import trade diversion effect (0.409).

The trade balance effects for Russia are reported in Table 5-10. Only the estimates of the import trade diversion effects in aggregate goods and investment goods, which are statistically significant, are used to construct the trade balance effects. So, it is estimated that due to the

EEU, the overall trade balance of Russia in aggregate goods has deteriorated by 50.5 percent, which is associated with the deterioration of the trade balance in investment goods by 48.7 percent. This result suggests a positive macroeconomic effect for Russia. However, it should be noted that Armenia, Kazakhstan, and the Kyrgyz Republic have experienced a deterioration of their trade balances in investment goods against the EEU member countries. Since the Russian trade balance in investment goods has deteriorated against the rest of the world, it is reasonable to suggest that the capital goods imported by Russia from non-members may have been reexported to the other EEU member countries, deteriorating their trade balances in investment goods. The overall results for Russia suggest no significant impact of the EEU on its bilateral trade flows and trade balance. As discussed in Chapter 2, Russia is the largest EEU member in terms of economic size. Its share in EEU total GDP is 84.1 percent suggesting that the EEU is a highly asymmetric Russia-dominated trade bloc. All the other EEU member countries trade much more with Russia than with each other. At the same time, the main Russian trading partners are non-members, with the share of the EEU member countries in its foreign trade of only 7 percent. Therefore, in this economic context, it is reasonable to expect no significant impact of the Eurasian economic integration on the largest EEU member country.

5.6. Conclusion

This Chapter has developed a trade balance framework for the gravity model and estimated the trade creation, trade diversion, and trade balance effects for each EEU member country. The trade balance effect, defined as the change in the trade balance of an RTA member country due to regional integration, is derived from the changes in exports and imports captured by the RTA dummy variables in the gravity model. The changes in exports and imports of an RTA member country to and from non-members correspond to the export and import trade diversion dummies, which are widely used in empirical studies. For estimating the changes in exports and imports of an RTA member country to and from the other RTA member countries, this

study splits the trade creation dummy into export and import trade creation dummies. The export trade creation dummy estimates the change in exports of an RTA member country to the other RTA member countries in response to regional integration. Similarly, the import trade creation dummy estimates the change in imports of an RTA member country from the other RTA member states.

For explaining the macroeconomic implications of trade balance changes, the trade balance effects are estimated not only for aggregate trade but also for trade disaggregated into consumer, capital, and intermediate goods. There is a consensus among economists that a trade surplus (trade balance improvement) has a positive macroeconomic effect. In the literature, two main approaches exist to interpreting a trade deficit (trade balance deterioration) depending on the product group. A trade deficit in consumer goods is considered to have a negative macroeconomic effect, whereas a trade deficit in capital goods has a positive macroeconomic effect. Since there is no standard approach to interpreting the trade imbalance in intermediate goods, this study uses the global commodity chain concept since of its relevance for regional integration studies. The concept suggests that as RTA member states become more integrated into a regional value chain and engaged in the relocation of production, their bilateral trade imbalances in intermediate goods would increase in absolute terms.

The trade creation, trade diversion, and trade balance effects estimated in the gravity model for each EEU member country support the hypothesis that small and diversified RTA member countries benefit more from regional integration than their larger RTA trading partners. The estimation results also suggest that the RTA impact depends on the RTA member country's economic structure and foreign trade pattern. Since Armenia, Belarus, and the Kyrgyz Republic are small EEU members with a combined GDP of 4.6 percent of the EEU's total GDP, they seem to share a similar pattern in the response of their bilateral trade to regional integration. All three countries have experienced a trade diversion as their bilateral trade with non-members

in aggregate goods has decreased. Armenia and the Kyrgyz Republic have also increased their trade with the EEU, which indicates the presence of the trade creation effect. From the macroeconomic perspective, although their trade balances in aggregate goods have deteriorated, they have improved in consumer goods and deteriorated in investment goods. These changes have positive macroeconomic implications as they indicate that Armenia, Belarus, and the Kyrgyz Republic have increased net exports of their consumer goods and net imports of capital goods, positively affecting their economic growth. Kazakhstan is the second-largest EEU member country and a major oil producer. The estimated trade creation, trade diversion, and trade balance effects for Kazakhstan demonstrate that it has experienced a less significant impact of the EEU than Armenia, Belarus, and the Kyrgyz Republic. The estimation results indicate the deterioration of its trade balance in capital goods, suggesting that the EEU has positively affected its economy. However, no sufficient evidence has been found for the impact of regional integration on its overall trade balance. For Russia, the impact of the EEU on its bilateral trade has been much less significant than for the other EEU member countries. The only statistically significant effect of regional integration has been found for Russian imports of capital goods from non-members, which have increased, causing a deterioration of its overall trade balance.

Table 5-1. Country-specific RTA dummy variables for trade balance framework

Trade effect	Notation of RTA dummy variable	Specification
Export trade creation	EEU_{ijt}^{xm}	It equals one if both country i and country j belong to the same RTA at time t , and RTA member country of interest (with subscript i) is an exporter, and zero otherwise.
Import trade creation	EEU_{ijt}^{mx}	It equals one if both country i and country j belong to the same RTA at time t , and RTA member country of interest (with subscript j) is an importer, and zero otherwise.
Export trade diversion	EEU_{ijt}^m	It equals one if RTA member country of interest (with subscript i) is an exporter, importer j is a non-member at time t , and zero otherwise.
Import trade diversion	EEU_{ijt}^x	It equals one if RTA member country of interest (with subscript j) is an importer, exporter i is a non-member at time t , and zero otherwise.

Note. This specification is for the case when the dependent variable is exports

Table 5-2. Correspondence between changes in trade flows and RTA dummy variables

Trade balance	Direction-based trade balance	Exports and imports	RTA dummy variable coefficients	RTA dummy variables
ΔTB_i	ΔTB_i^{RTA}	ΔX_i^{RTA}	β_{xm}	Export trade creation
		ΔM_i^{RTA}	β_{mx}	Import trade creation"
	ΔTB_i^{ROW}	ΔX_i^{ROW}	β_x	Export trade diversion
		ΔM_i^{ROW}	β_m	Import trade diversion

Table 5-3. Trade balance framework for the gravity model of trade

Trade balance	Direction-based trade balance	Exports and imports	RTA dummy variable coefficients			RTA dummy variables
			Consumer goods	Investment goods	Intermediate goods	
ΔTB_i	ΔTB_i^{RTA}	ΔX_i^{RTA}	$\beta_i^{xm(con)}$	$\beta_i^{xm(inv)}$	$\beta_i^{xm(int)}$	Export trade creation
		ΔM_i^{RTA}	$\beta_i^{mx(con)}$	$\beta_i^{mx(inv)}$	$\beta_i^{mx(int)}$	Import trade creation”
	ΔTB_i^{ROW}	ΔX_i^{ROW}	$\beta_i^{x(con)}$	$\beta_i^{x(inv)}$	$\beta_i^{x(int)}$	Export trade diversion
		ΔM_i^{ROW}	$\beta_i^{m(con)}$	$\beta_i^{m(inv)}$	$\beta_i^{m(int)}$	Import trade diversion

Table 5-4. Interpretation of trade balance effects in the gravity model

	Product group (BEC classification)		
	Consumer goods	Investment goods	Intermediate goods
Trade balance improvement, $\Delta TB_i > 0$	“High competitiveness”	“Capital depletion”	Regional production network (regional value chain) if $ \Delta TB_i^{RTA(int)} > \Delta TB_i^{ROW(int)} $
Trade balance deterioration, $\Delta TB_i < 0$	“Low competitiveness”	“Capital accumulation”	

Table 5-5. Trade creation and trade diversion effects for Armenia

Armenia	Total exports	Consumer goods	Investment goods	Intermediate goods	
	(1)	(2)	(3)	(4)	
ΔTB^{EEU}	Δ exports (export trade creation)	0.884*** (0.245)	0.998* (0.451)	0.327 (0.291)	1.764*** (0.472)
	Δ imports (import trade creation)	1.012*** (0.189)	0.519 (0.373)	0.905*** (0.169)	0.398 (0.461)
ΔTB^{ROW}	Δ exports (export trade diversion)	-0.909*** (0.236)	-0.440 (0.398)	-0.660* (0.313)	-1.035*** (0.311)
	Δ imports (import trade diversion)	-0.834*** (0.159)	-1.078*** (0.158)	-0.405** (0.130)	-1.271*** (0.201)
<i>N</i>	47615	44687	43339	40648	
<i>R</i> ²	0.995	0.994	0.995	0.980	
Exporter-time FE	yes	yes	yes	yes	
Importer-time FE	yes	yes	yes	yes	
Country-pair FE	yes	yes	yes	yes	

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. ΔTB^{EEU} – trade balance change against the EEU; ΔTB^{ROW} – trade balance change against the rest of the world

Table 5-6. Trade creation and trade diversion effects for Belarus

Belarus	Total exports	Consumer goods	Investment goods	Intermediate goods
	(1)	(2)	(3)	(4)
ΔTB^{EEU}				
Δ exports (export trade creation)	0.301 (0.236)	0.980* (0.429)	-0.259* (0.116)	0.977* (0.388)
Δ imports (import trade creation)	0.0459 (0.224)	0.396 (0.520)	-0.0274 (0.896)	-1.155** (0.416)
ΔTB^{ROW}				
Δ exports (export trade diversion)	-0.536* (0.244)	-0.553 (0.352)	-0.227 (0.209)	-0.245 (0.270)
Δ imports (import trade diversion)	0.218 (0.160)	-0.966 (0.817)	0.726 (0.648)	0.465* (0.224)
<i>N</i>	47615	44687	43339	40648
<i>R</i> ²	0.995	0.994	0.995	0.980
Exporter-time FE	yes	yes	yes	yes
Importer-time FE	yes	yes	yes	yes
Country-pair FE	yes	yes	yes	yes

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. ΔTB^{EEU} – trade balance change against the EEU; ΔTB^{ROW} – trade balance change against the rest of the world

Table 5-7. Trade creation and trade diversion effects for Kazakhstan

Kazakhstan	Total exports	Consumer goods	Investment goods	Intermediate goods
	(1)	(2)	(3)	(4)
ΔTB^{EEU}				
Δ exports (export trade creation)	-0.159 (0.235)	-0.705 (0.384)	0.121 (0.176)	0.524 (0.422)
Δ imports (import trade creation)	0.0349 (0.218)	-0.523 (0.379)	0.492* (0.207)	-0.809 (0.503)
$\Delta\Delta TB^{ROW}$				
Δ exports (export trade diversion)	-0.0485 (0.219)	-0.0906 (0.309)	-0.574* (0.243)	0.197 (0.269)
Δ imports (import trade diversion)	0.210 (0.149)	0.0437 (0.178)	-0.0803 (0.177)	-0.159 (0.211)
<i>N</i>	47615	44687	43339	40648
<i>R</i> ²	0.995	0.994	0.995	0.980
Exporter-time FE	yes	yes	yes	yes
Importer-time FE	yes	yes	yes	yes
Country-pair FE	yes	yes	yes	yes

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. ΔTB^{EEU} – trade balance change against the EEU; ΔTB^{ROW} – trade balance change against the rest of the world

Table 5-8. Trade creation and trade diversion effects for the Kyrgyz Republic

Kyrgyz Republic	Total exports	Consumer goods	Investment goods	Intermediate goods
	(1)	(2)	(3)	(4)
ΔTB^{EEU}				
Δ exports (export trade creation)	-0.0226 (0.515)	0.735 (0.424)	-0.730 (0.457)	0.304 (0.726)
Δ imports (import trade creation)	0.526* (0.214)	-0.294 (0.375)	0.626* (0.249)	-0.0593 (0.473)
ΔTB^{ROW}				
Δ exports (export trade diversion)	-0.0537 (0.478)	-0.226 (0.251)	0.342 (0.454)	0.518 (0.613)
Δ imports (import trade diversion)	-0.376*** (0.0902)	-0.311** (0.118)	-0.263 (0.206)	-0.689** (0.248)
<i>N</i>	47615	44687	43339	40648
<i>R</i> ²	0.995	0.994	0.995	0.980
Exporter-time FE	yes	yes	yes	yes
Importer-time FE	yes	yes	yes	yes
Country-pair FE	yes	yes	yes	yes

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. ΔTB^{EEU} – trade balance change against the EEU; ΔTB^{ROW} – trade balance change against the rest of the world

Table 5-9. Trade creation and trade diversion effects for Russia

Russia	Total exports	Consumer goods	Investment goods	Intermediate goods	
	(1)	(2)	(3)	(4)	
ΔTB^{EEU}	Δ exports (export trade creation)	-0.0604 (0.217)	0.681 (0.391)	-0.500 (0.201)	0.802 (0.496)
	Δ imports (import trade creation)	-0.185 (0.188)	-0.564 (0.342)	0.0668 (0.164)	-0.750 (0.402)
ΔTB^{ROW}	Δ exports (export trade diversion)	-0.205 (0.150)	-0.211 (0.194)	0.0933 (0.161)	0.139 (0.190)
	Δ imports (import trade diversion)	0.409** (0.157)	0.119 (0.204)	0.397* (0.201)	0.0289 (0.230)
<i>N</i>	47615	44687	43339	40648	
<i>R</i> ²	0.995	0.994	0.995	0.980	
Exporter-time FE	yes	yes	yes	yes	
Importer-time FE	yes	yes	yes	yes	
Country-pair FE	yes	yes	yes	yes	

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. ΔTB^{EEU} – trade balance change against the EEU; ΔTB^{ROW} – trade balance change against the rest of the world

Table 5-10. Trade balance effects for the EEU member countries

Country	Trade balance effects	Total exports	Consumer goods	Investment goods	Intermediate goods
		(1)	(2)	(3)	(4)
Armenia	ΔTB^{EEU}	-33.1%	171.3%	-147.2%	483.6%
	ΔTB^{ROW}	-3.1%	66.0%	-15.0%	7.5%
	ΔTB	-36.2%	237.3%	-162.2%	491.1%
Belarus	ΔTB^{EEU}		166.4%	-22.8%	234.1%
	ΔTB^{ROW}	-41.5%			-59.2%
	ΔTB	-41.5%	166.4%	-22.8%	174.9%
Kazakhstan	ΔTB^{EEU}			-63.6%	
	ΔTB^{ROW}			-43.7%	
	ΔTB			-107.2%	
Kyrgyz Republic	ΔTB^{EEU}	-69.2%		-87.0%	
	ΔTB^{ROW}	31.3%	26.7%	0.0%	49.8%
	ΔTB	-37.9%	26.7%	-87.0%	49.8%
Russia	ΔTB^{EEU}				
	ΔTB^{ROW}	-50.5%		-48.7%	
	ΔTB	-50.5%		-48.7%	

Note. ΔTB^{EEU} – the trade balance change against the EEU; ΔTB^{ROW} – the trade balance change against non-member countries; ΔTB – the overall trade balance change

Chapter 6 Discussion and conclusion

This study evaluates the impact of the Eurasian Economic Union (EEU) in the structural gravity model of trade under partial and general equilibrium frameworks. The choice of this research topic is motivated by the fact that regionalization, together with globalization, is one of the major trends in the development of the world economy affecting all countries, both developed and developing. It is especially true for countries on the same continent sharing a common border, language, history, and culture. It is a paradox that globalization goes hand in hand with economic regionalization. To some extent, RTAs may be considered an attempt by a group of countries to respond collectively to the challenges of globalization. Regional integration has both political and economic dimensions. While the politics of Eurasian integration is not the subject of this study, it is worth mentioning that the creation of the EEU has been largely a politically driven decision, which is unlikely to be reversed in the foreseeable future. At the same time, policymakers in countries that establish or accede to a trade bloc expect to reap certain economic benefits from integration. However, the distribution of gains and losses is not even, as some producers and consumers may benefit while others may suffer losses. In this environment, policymakers need increased trade and investment, low unemployment and inflation, high productivity, and GDP growth to keep the support of those who have been for regional integration and not to increase the discontent of those who have opposed it. However, economic integration is a complex process with unpredictable consequences. It is a structural shock that directly affects a country's entire economy and shapes the trajectory of its further development. Unfortunately, many effects cannot be anticipated in advance. Some are felt in the short term, while others may take years to realize. Moreover, the economic impact of an RTA is not limited to its members, as a reduction or elimination of bilateral trade costs between RTA members may have repercussions for their non-member trading partners.

Given the importance of regional integration both as a research question and as a public policy issue, evaluating the impact of an RTA has always received much attention in the empirical literature. Researchers use various theoretical frameworks, methodological approaches, econometric models, estimation methods, and economic indicators. As an empirical tool to evaluate the impact of the EEU, this study applies the gravity model of trade, which is supposed to estimate trade creation and trade diversion effects, two main theoretical concepts in the customs union theory developed by Viner (1950). The gravity model of trade has been and remains one of the most widely used empirical tools for evaluating trade policy because it has a simple and flexible structure, solid theoretical underpinnings, and high explanatory power and empirical robustness.

The EEU impact evaluation in this study is based on three approaches. In the first approach, the gravity equation has been estimated in a partial equilibrium setting to evaluate the trade creation, export trade diversion, and import trade diversion effects of the EEU. While in gravity model studies on regional integration, the HS and the SITC classification are typically used to disaggregate trade flows, this research uses the BEC classification, which groups commodity trade data into consumer, capital, and intermediate goods. The second approach applies a general equilibrium framework to estimate the impact of regional integration on bilateral exports and income of the EEU member and non-member countries. In the third approach, the trade creation dummy variable is split into two parts to estimate export and import trade creation effects. Then, the study estimates for each EEU member country the export and import trade creation effects, which reflect the change in its exports and imports to and from the other EEU members, and export and import trade diversion effects, which reflect the changes in its exports and imports to and from non-members in response to regional integration. In addition, the estimates of the export and import trade creation and export and import trade diversion effects are used to construct the trade balance effects for each EEU member country. In general,

research findings based on all three approaches suggest that Eurasian economic integration has positively affected EEU member countries. However, this main conclusion concerns only trade liberalization in goods. Although the EEU is not only a customs union but also a common market, the study does not consider the regional integration impact on trade in services, labor migration, and capital flows. The rest of this Chapter discusses the main findings of the research, highlights limitations, and provides suggestions for future research.

In a partial equilibrium framework, the results of the OLS and PPML estimation of the gravity equation with a full set of fixed effects accounting for multilateral resistances and endogeneity indicate that the EEU member countries have considerably increased their bilateral trade with each other due to regional integration. At the same time, the trade creation effect estimated with the OLS method without fixed effects and with the OLS and PPML estimators accounting for multilateral resistances is negative and statistically insignificant. However, it is well known that regional integration studies often face the issue of endogeneity, which is also likely present in the case of the EEU for several reasons. Eurasian economic integration began immediately after the collapse of the former Soviet Union. It took several years of negotiations and mutual concessions before Belarus, Kazakhstan, and Russia established the customs union in 2010. Also, the endogeneity issue in the EEU may arise from long-standing close political, economic, and cultural relations between the EEU member countries, first in the Russian Empire and then in the former Soviet Union. Given that the EEU members had once been in a single political and economic union, Eurasian economic integration is, in fact, a process of economic reintegration. So, it is no surprise that accounting for endogeneity in the gravity equation by including country-pair fixed effects has considerably increased the trade creation effect estimate. Both the OLS and PPML estimators have demonstrated a strong trade creation effect for the EEU. However, unlike the OLS estimate, the PPML estimate is statistically significant and more accurate since it accounts for heteroskedasticity and null values in trade data.

The robustness of the results is checked by estimating the gravity equation with one, two, and three RTA dummy variables and using imports as the dependent variable instead of exports. In the case of one RTA dummy variable, the trade creation effect estimated with the OLS and PPML methods is negligible and statistically insignificant. It increases considerably when the second RTA dummy variable for import trade diversion is included. Both the trade creation and import trade diversion effects remain practically unchanged after adding the export trade diversion dummy, implying that two RTA dummy variables may have been sufficient for the analysis. The OLS and PPML estimation results with imports as the dependent variable have confirmed the positive trade creation effect. While the estimates of the trade diversion effects are mixed across various estimation methods, there is sufficient evidence for a strong positive trade creation effect, which implies a positive impact of the EEU on the intra-region trade, which has increased by 58 percent due to regional integration. This result aligns with many empirical studies on RTA impact evaluation and is consistent with the theoretical model, predicting that reducing bilateral costs between RTA member countries increases their mutual trade.

In addition to total exports, the gravity equation in a partial equilibrium framework is estimated for exports disaggregated into consumer, investment, and intermediate goods under the BEC classification, which is widely used in macroeconomic studies on international trade and brings a macroeconomic perspective to the gravity model analysis. Both the OLS and PPML estimators with a full set of fixed effects find a positive and statistically significant trade creation effect in consumer goods. Both consumer goods and capital goods are final goods. However, since capital goods are used to produce other goods, the level of import tariff protection is usually lower for them than for consumer goods, which are levied at higher tariff rates to protect domestic producers. In addition, the share of consumer goods in domestic trade is three times higher than that of capital goods. Intermediate goods are typically taxed at lower

or even zero tariff rates. In international trade, this practice is called tariff escalation. As a result, reducing bilateral trade costs between the EEU member countries has affected the intra-region trade in consumer goods the most.

Concerning other product groups, the only statistically significant result has been obtained by the PPML estimation for trade in intermediate goods. These results suggest that the EEU member countries have decreased imports of intermediate goods from non-members and increased their exports of intermediate goods to non-members. In line with the theory, negative import trade creation is the expected outcome of a customs union as RTA member countries divert their sources of supply from non-members toward their RTA trading partners. However, an export trade diversion is positive, a possible outcome in empirical studies, as shown in the literature review. An increase in EEU exports of intermediate goods to non-members can be explained by the composition of intermediate goods, which include a wide range of products from raw materials to high-tech semiconductors. While raw materials dominate EEU exports of intermediate goods, they account for a much less import share. In this case, a reduction of EEU imports of intermediate goods from non-members reflects an increased common import tariff on semi-finished intermediate goods after the creation of the customs union. At the same time, in response to regional integration, some non-members may have reduced their import tariffs and increased their demand for raw materials from the EEU. However, this proposition needs further investigation. It should also be noted that, except for PPML with a full set of fixed effects, the export trade diversion estimates are statistically insignificant in other estimation methods. Overall, the results of estimating the gravity model in a partial equilibrium framework suggest that the EEU has positively affected the member countries, causing an increase in the intra-region trade, driven mainly by increased bilateral trade in consumer goods. Estimating the structural gravity model in a general equilibrium framework suggests a positive impact of regional integration on exports and income of the EEU member countries. The

general equilibrium effects estimated for the EEU member countries have signs predicted by the theoretical model and indicate that the EEU has positively affected its member countries. The most considerable trade and income gain is reported for Belarus, a small country with the most diversified economy in the EEU. Its exports and GDP due to regional integration have increased by 1.46 and 3.68 percent, respectively. In addition, Belarus and Russia have the closest economic relations as members of the Union State they founded in 1999. The result for Belarus supports the hypothesis that small and diversified economies benefit most from regional integration. Russian exports and GDP increased by 0.78 and 0.44 percent, respectively. The income effect for Russia is much less than that for Belarus since, in terms of economic size, Russia is several times larger than Belarus, and its foreign trade is more oriented towards non-members. Due to the EEU, the GDP of Kazakhstan increased by 1.77 percent, and its exports by 0.8 percent. Kazakhstan and Belarus are the most integrated countries with Russia and share a common border with the largest economic power in the EEU. The exports of the Kyrgyz Republic and Armenia have increased by 0.34 and 0.30 percent, respectively. Both countries experienced smaller income effects (0.29 percent for the Kyrgyz Republic and 0.14 percent for Armenia), which can be explained by their later accession to the EEC in 2015.

While the estimated general equilibrium effects for non-members are mixed, they have three distinct patterns. The first pattern shows a positive impact of the EEU on trade but a negative impact on the GDP of several non-members, grouped as "close" members. The group of "close" members includes the post-Soviet Central Asian non-members (Tajikistan, Turkmenistan, Uzbekistan), China, and Iran. The general equilibrium effects for these countries differ from the results for other non-members in two respects. First, as generally predicted by the theoretical model, due to the EEU, "close" non-members have experienced positive changes in multilateral resistances and negative changes in factory-gate prices and GDP. However, their exports have increased instead of decreasing. Second, while trade and income effects are small

for most non-members, the changes in exports and GDP of "close" non-members in magnitude are much larger than those of other non-members and EEU member countries. Two reasons are provided to explain the general equilibrium effects for "close" non-members, and the most crucial factor in both explanations is their long-standing close political and economic relations with the EEU member countries and geographical proximity to them. As a result, "close" non-members have been affected by the EEU more strongly than other non-members. Among them, the most significant negative income effect has been found for the Central Asian post-Soviet non-member countries: Tajikistan, Turkmenistan, and Uzbekistan. Since the break-up of the former Soviet Union, the newly independent states (except the Baltic states) have maintained their close trade relations through bilateral preferential trade agreements. However, when Belarus, Kazakhstan, and Russia established the Customs Union, they terminated their bilateral preferential agreements with the other CIS countries. They introduced a common customs tariff that applies to all third countries without exception. Thus, the significant increase in the multilateral resistances for the Central Asian non-members is due not only to the changes in relative prices after the creation of the Customs Union but also to a sharp increase in bilateral trade costs after trade preferences were replaced with the common import tariff. Although the general equilibrium gravity model neither shows the direction of exports nor estimates changes in imports (if exports are the dependent variable), it is possible to assume that increased exports of "close" non-members have been directed to the EEU and coupled with increased imports from non-member countries. In this case, the "close" non-members that share a common border with the EEU and have friendly relations with Russia can be considered as additional channels for circumventing Western sanctions imposed by the developed countries on Russia starting in 2014. The possibility that the "close" non-members can deliver sanctioned goods imported from "remote" non-members to Russia, either directly or through other EEU member countries,

can explain a significant rise in exports of the "close" non-members observed in the estimates of the general equilibrium effects.

Two distinct patterns have been identified for "remote" non-members. In both of them, the changes in multilateral resistances in one direction are associated with the changes in factory-gate prices, GDP, and exports in the opposite direction, as predicted by theory. At the same time, it is expected that creating an RTA tends to increase inward and outward multilateral resistances for non-members, reducing their domestic factory-gate prices, output, and expenditure and negatively affecting their trade flows. However, due to the EEU, the exports and GDP of some "remote" non-members have increased. This study suggests two possible explanations for these results. The first possible explanation suggests that import tariff rates applied by the EEU members before the customs union may have been higher than the common import tariff introduced in 2010. In this case, when the customs union was established, the non-members could have faced lower multilateral resistances that increased their factory-gate prices, GDP, and exports. The second explanation relates to the high dependence of the EEU on imports from non-members, especially in consumer and capital goods, which may imply that the demand of the EEU member states for certain products is inelastic. So, while some non-members reduce their exports of consumer and investment goods to the EEU, other non-members can take the opportunity to increase their exports to meet the EEU demand. Regional integration affects trade flows not only by diverting trade from non-members to the EEU but also by reallocating trade among non-members engaged in trade with the EEU member countries. In this case, the reallocation of trade flows may occur among non-members as the EEU member states switch the supply source from one non-member to another. Although the general equilibrium framework does not indicate the redistribution of a country's trade flows in response to the EEU, given the structure of the theoretical gravity model, we can assume that the closer the trading partners are to the EEU, the stronger the negative effect they have.

The results of the study show that among “remote” non-members, such countries as Moldova, Ukraine, Latvia, Lithuania, Estonia, and India, which are close trading partners of EEU countries, primarily Russia, have been negatively affected the most by the EEU. At the same time, Japan, South Korea, and the United States have the most significant positive effect from Eurasian regional integration.

Overall, the general equilibrium gravity analysis results suggest that the EEU has positively affected its member countries by increasing their exports and income. The results for non-members are mixed but have three distinct patterns. The theoretical model suggests two factors contributing to the differences among these trade and income effects patterns. The first important factor is the degree of remoteness or the "multilateral resistances" effect, which reflects how close the relations between non-members and the EEU are. While the gravity equation accounts for distance, common border and language, and colonial relationship, it does not include, for example, political "distance." The importance of political "distance" can be found in bilateral trade between Russia, on the one hand, and Cuba, India, and Vietnam, on the other hand. The second factor is the size effect, which reflects the share of a trading partner in bilateral trade and implies that larger non-member trade partners of the EEU are affected more than smaller ones. As a result, the general equilibrium effects show that while the EEU has negatively affected some non-members, other non-members have experienced a rise in exports and GDP. Among non-members, the most negatively affected countries in terms of GDP are the post-Soviet republics in the Central Asian region.

The main contribution of the study to the existing literature is the development of the trade balance framework for the gravity model, which splits the trade creation dummy into two parts and translates the estimates of export and import trade creation and export and import trade diversion effects into the changes in exports and imports of the EEU member country to and from the EEU and to and from non-members, respectively. These export and import changes

are then used to construct the trade balance effects, defined as the changes in the trade balance of the EEU member country in response to regional integration. The macroeconomic theory and empirical studies on trade imbalances suggest that an improved trade balance in consumer goods and deteriorated trade balance in investment goods tend to increase domestic savings and investments and, therefore, are associated with higher GDP. Since intermediate goods are used as inputs in producing consumer and investment goods, they are not part of the aggregate demand model. To describe changes in the trade balance in intermediate goods, this study employs the commodity chain concept, which explains the development of global and regional value chains or international and regional production networks. In this concept, trade in intermediate goods is one of the driving forces behind the relocation of production across borders. Many empirical studies on regional integration focusing on trade in intermediate goods have demonstrated that economic integration gives rise to a regional value chain, reflected in increased bilateral trade in intermediate goods within the intra-region market. The concept of the regional value chain is especially relevant for the EEU because its member countries historically have close bilateral relations and once were parts of a single economy, playing a complementary role for each other and locating production facilities depending on their geographical location and availability of natural and labor resources. The EEU member countries are in the process of economic reintegration rather than integration, which implies a high probability of a single market being rebuilt in the foreseeable future.

The export and import trade creation, export and import trade diversion, and trade balance effects estimated in the gravity model for each EEU member country support the hypothesis that small and diversified RTA member countries benefit more from regional integration than their larger RTA trading partners. The estimation results also suggest that the RTA impact depends on the RTA member country's economic structure and foreign trade pattern. Since Armenia, Belarus, and the Kyrgyz Republic are small EEU members with a combined GDP of

4.6 percent of the EEU's total GDP, they seem to share a similar pattern in the response of their bilateral trade to regional integration. All three countries have experienced a trade diversion as their bilateral trade with non-members in aggregate goods has decreased. Armenia and the Kyrgyz Republic have also increased their trade with the EEU, which indicates the presence of the trade creation effect. From the macroeconomic perspective, although their trade balances in aggregate goods have deteriorated, they have improved in consumer goods and deteriorated in investment goods. These changes have positive economic effects as they indicate that Armenia, Belarus, and the Kyrgyz Republic have increased net exports of their consumer goods and net imports of capital goods, positively affecting their economic growth. Kazakhstan is the second-largest EEU member country and a major oil producer. The estimated trade creation, trade diversion, and trade balance effects for Kazakhstan demonstrate that it has experienced a less significant impact of the EEU than Armenia, Belarus, and the Kyrgyz Republic. The estimation results indicate the deterioration of its trade balance in capital goods, suggesting that the EEU has positively affected its economy. However, no sufficient evidence has been found for the impact of regional integration on its overall trade balance. For Russia, the effect of the EEU on its bilateral trade has been much less significant than for the other EEU member countries. The only statistically significant impact of regional integration has been found for Russian imports of capital goods from non-members, which have increased, causing a deterioration of its overall trade balance. This result suggests a positive macroeconomic effect for Russia. However, it should be noted that Armenia, Kazakhstan, and the Kyrgyz Republic have experienced a deterioration of their trade balances in investment goods against the EEU member countries. Since the Russian trade balance in investment goods has deteriorated against the rest of the world, it is reasonable to suggest that the capital goods imported by Russia from non-members may have been reexported to the other EEU member countries, deteriorating their trade balances in investment goods. The overall estimation results for Russia suggest no

significant impact of the EEU on its bilateral trade flows and trade balance. Russia is the largest EEU member in terms of economic size, and the EEU is a highly asymmetric Russia-dominated trade bloc. All the other EEU member countries trade much more with Russia than with each other. At the same time, the main Russian trading partners are non-members. Therefore, in this context, it is reasonable to expect no significant impact of the Eurasian economic integration on the Russian economy.

This study's main limitation is that it focuses only on bilateral trade in goods. In other words, estimated trade creation, trade diversion, and trade balance effects reflect only the impact of the customs union. However, the EEU, as an advanced level of regional integration, is a common market with free flows of goods, services, labor, and capital. Extending the gravity analysis by covering, in addition to goods, trade in services, labor migration, and capital flows would provide a more comprehensive picture of the EAEU's impact on member countries.

Another limitation is related to the specification of the gravity equation, which includes, in addition to RTA dummy variables, only the “traditional” gravity variables such as GDP, distance, contiguity, common language, and colonial relationship. However, regional integration is a process protracted over time, complex with many observable and unobservable factors in place. However, the gravity equation in this study does not include time lags to capture potential non-linear and phasing-in or phasing-out effects of the EEU. So, it does not consider the possibility that the impact of regional integration changes over time. In addition, the gravity equation does not include EEU-specific factors that may affect the bilateral trade of the EEU member countries. Since Russia and Kazakhstan are two large oil and gas producers, oil prices could play an important role in determining their trade with other EEU members and the rest of the world. Another essential factor that may have affected the intra-region trade is the Western economic sanctions imposed since 2014 on Russia, the core member country of the EEU. The economic and financial sanctions may have not only reduced trade between the

developed countries and Russia but also profoundly changed the direction and volume of the trade flows between the other EEU members and affected their trade with the rest of the world.

There are several potential areas for future research. This study has developed a trade balance framework for the gravity model analysis and derived the trade balance effects using the estimates of the export and import trade creation and trade diversion effects. This approach, which is the main contribution of this study to the existing literature, could be improved and applied to estimating the trade balance effects of other RTAs. Another potential area of research is to investigate the impact of the EEU on trade in services, labor migration, and capital flows, as this study focuses only on trade in goods. The EEU evaluation in the context of a common market instead of a customs union could provide a more comprehensive picture of the economic impact of the EEU. This study has estimated the trade effects of the EEU with trade flows disaggregated into consumer, investment, and intermediate goods. However, since intermediate goods are characterized by a high degree of product differentiation, ranging from raw materials to partially finished high-tech goods such as semiconductors or microprocessors, they can be grouped into semi-finished goods and raw materials. Such disaggregation could be especially useful for evaluating the impact of an RTA on resource-rich member countries.

The general equilibrium gravity analysis also has some potential for future research. This study has estimated the impact of the EEU on the exports and GDP of member and non-member countries. However, imports can be used as a dependent variable in addition to exports. In this case, the changes in exports and imports estimated in the general equilibrium gravity model could be used to derive the trade balance effects for the EEU member and non-member countries based on the trade balance framework suggested in this study. In addition, applying the trade balance framework could provide more detailed information for investigating the relationship between the changes in exports and imports, on the one hand, and the changes in GDP, on the other hand, implied by the aggregate demand model.

Also, the dependent variable, either exports or imports, disaggregated into consumer, capital, and intermediate goods could allow examining the impact of the EEU on bilateral trade in each product group. Finally, the general equilibrium gravity model applied in this study is static since there is no dynamic process of capital accumulation. However, as Anderson et al. (2015b) demonstrate, the changes in bilateral trade through domestic factory-gate prices and inward multilateral resistances also affect capital accumulation and output in the Cobb–Douglas production function. Therefore, in the future, researchers could apply a dynamic general equilibrium gravity model to estimate the trade and income effects of the EEU with capital accumulation and endogenous production. Overall, this study expects that future research will develop new theoretical frameworks and methodological approaches to evaluating the impact of regional integration in the gravity model of trade.

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