

**FOREIGN DIRECT INVESTMENT AND GLOBAL VALUE
CHAINS IN THE CENTRAL AND EASTERN EUROPEAN
COUNTRIES**

A dissertation

Submitted to the faculty of Graduate National University for Policy Studies, (GRIPS) in
Partial Fulfillment of the Requirements for the Degree of

Ph.D. in Public Policy

by

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Abstract

Over the last four decades foreign direct investment (FDI) and global value chains (GVCs) have gradually transformed international trade and significantly enhanced the economic growth of the world economy. Central and Eastern European (CEE) countries have participated in GVCs led by multinational enterprises (MNE's) and have received significant inflows of foreign investment. FDI and GVCs have played a critical role in promoting the exports and the economic growth of those countries.

This study investigates empirically three interrelated sets of questions: 1). What are the main drivers of inward foreign direct investment in Central and East European countries? 2). FDI is stipulated as a means of integrating host countries into GVCs, led by foreign MNEs. Has FDI significantly improved the GVC participation of Central and Eastern European countries? 3). Exports via GVCs typically contain imported intermediate inputs. Only domestic value added embedded in exports represents the true contribution of a country to its exports. Revealed comparative advantages of Central and Eastern European countries measured as trade in value added (TiVA), is significantly different with calculations based on gross exports? To what extent, has participation in international fragmentation of production (IFP) affected each country's trade pattern and revealed comparative advantages?

The research questions are addressed in three core chapters.

Chapter four reports the first empirical analysis, investigating FDI determinants, and focusing on the impact of European Union (EU) membership. Empirical analysis is conducted on panel data retrieved from various sources, such as Eurostat, World Bank, WTO and UNCTAD, covering five years from 1995 to 2015. The methodological

approach follows Bormann, Jungickel & Keller (2005) and includes several independent variables of interest: GDP, GDP growth rate, unit labor cost and regional trade agreement (RTA). The estimated coefficient of EU dummy variable is 0.574 and 0.608, for fixed effect and random effect estimations, respectively, which implies that EU membership increases FDI inflows. The other dummy variable, RTA, which captures entry of CEE countries in bilateral trade agreement, also has impact on investment inflows, but the impact is significant for random effect estimations, and insignificant for the fixed effect estimations.

In chapter five, I measure the GVC participation rate of CEE countries over the period 1995-2009. The participation index is the sum of forward and backward participation, metrics proposed by Hummel and Koopman (2011). Forward participation in the GVCs measures domestic value added embodied in foreign exports, as % of total gross exports of the source country. Backward participation in the GVCs measures foreign content, embodied in exports, as % of total gross exports of the exporting country (OECD, 2016).

Foreign direct investment is argued as one of the most important channels through which GVCs operate. I use regression analysis to test empirically the relationship between FDI inflows and index of participation in GVCs. The regression estimations employ 1) panel data from Eurostat for the main independent variable, FDI stock inflows and 2) OECD TiVA data, from 1995-2009. The study employs the methodology proposed by Kowalski, P. et al, (2015) controlling for country structural characteristics. The estimation coefficient of FDI stock is 1.140 and statistically significant, which implies that foreign investment increased the level of CEE countries' participation in the GVCs. Further, high tariffs are impediments to participation in the international fragmentation of production

(IFP), as a one % tariffs increase results in 0.008 decreases in participation in the global value chains. The result supports the hypothesis that foreign direct investment promotes GVCs participation, but trade barriers such as tariffs, quotas and other protective measures undermine production network involvement.

Also, participation rate, which indicates the degree of involvement in GVCs, suggests that CEE countries have increased significantly its engagement in the GVCs since 1995. On average, participation rate of CEE countries in the global value chains was 38% in 1995, with Slovakia having the highest participation rate, 56%, and Poland with the lowest, 32%. On average global value chains participation rate in CEE countries was 53% in 2009, which is 16% points higher than that in 1995.

In chapter six, I employ TiVA from Organization for Economic Development and Cooperation (OECD), for CEE countries to estimate reveal comparative advantage by sectors. Then I compare the estimates with the results based on gross exports. The data covers 42 manufacturing industries, for the period from 1995-2015 and is retrieved from the OECD's TiVA database (2013 edition and 2018 edition). The comparison shows clear reversals in various manufacturing sectors. In the transport equipment sector, the revealed comparative advantage indexes based on gross exports (RCA1) in 2000 suggest that Bulgaria, Estonia and Lithuania all had comparative advantages in the sector, because the corresponding RCA indexes of those three countries were 2.65, 2.31 and 3.44, respectively and were all much greater than one. However, the RCA2 indices estimated with the domestic value added of exports were 0.69, 0.72 and 0.94, respectively, all smaller than one (indicating that those three countries had no comparative advantages in the sector). In the motor vehicle sector, the RCA1 indices of Poland and Romania were 0.76, and 0.66, respectively based on 2011 gross exports, but changed to 1.16 and 1.01

respectively when domestic value added of exports was used (RCA2). Clearly, calculations based on gross exports and domestic value added of export had contradictory comparative advantages patterns. In the electrical machinery sector for 2015 the RCA1 indices of Bulgaria and Estonia were 0.66 and 0.34, respectively in terms of value added, compared to 1.00 and 1.78 in gross exports values (RCA2). The reversed trade patterns suggested by the RCA indexes measured with trade in value added show that gross export data is not an inappropriate indicator of a country's competitiveness. In the age of GVCs, to a large extent the comparative advantages of foreign countries, that provide critical intermediate inputs, determines the competitiveness of Eastern European countries' exports.

This dissertation makes several main contributions to the knowledge of global value chains and foreign direct investment: 1) Estimation of RCA with TiVA for CEE countries, first study on the issue, which improves understanding of the importance of TiVA, with implications for industrial, trade and investment policy. Revealing the current pattern of revealed comparative advantages, it improves knowledge about the distortion of trade statistics on country competitiveness. A high foreign content of exports (backward participation) in CEE countries leads to reversal of trade competitiveness. 2) Further, this is the first empirical study to link GVC participation with FDI in the context of CEE countries. As shown for the transport equipment and electrical machinery sectors, through foreign investment and GVC engagement countries can change their trade specialization and engage in sectors for which do not have revealed comparative advantages. 3) Measuring and comparing the indices of CEE's countries individual participation in GVCs, foreign content of exports and index of production stages contribute to a better understanding of the position of transition economies' in the GVCs.

4) Lastly, this study contributes to the investigation the foreign direct investment determinants, the result for which results for CEE countries are not conclusive. The political factors of particular cases of European membership are mostly understated but they do have a significant impact on the increase of foreign direct investment inflows.

Acknowledgments

First and foremost, I am delighted to express my sincere gratitude to and respect for my main thesis advisor, Professor XING, Yuqing for his supreme academic guidance, and his continuous encouragement of my researching, writing and refining of this dissertation. His contributions as my Ph.D. advisor, master's thesis advisor, classroom economics course professor and source of inspiration and knowledge have been invaluable. It was a great privilege to work with and learn from him.

I would also like to express my gratitude to my two thesis sub-advisors, Professor OYAMA Tatsuo, for his deepening of my knowledge of quantitative methods and for his genuine understanding and patience; and Professor CHEY, Hyoung-kyu for his wise suggestions and broad expertise in political economy, which greatly enriched my thesis.

Also, I would like to extend my special thanks to Prof. Katerina Petchko, the Director of the Center for Professional Communication. I had the invaluable opportunity to work as a research assistant under her supervision and to participate in several research projects of the CPC; this greatly supported my academic endeavors and led me to an insatiable interest in academic writing.

Thanks also to Professor Gonzales, for generous giving of his time to support my empirical estimations and to enhance my knowledge of econometrics, and to Prof. Lawrie Hunter for his professional support of the writing of my thesis.

Lastly, I would like to dedicate this Ph.D. to my beloved parents, in appreciation of their enlightenment, trust and unconditional love. And heartfelt thanks

and gratitude to my partner for his constant support, encouragement and help with our beloved daughter. I don't know how I could have done this without you!

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Abbreviations

BFTA	–	Bilateral Free Trade Agreements
CU	–	Custom Union
EU	–	European Union
EU15	–	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.
EU 27	–	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden
FDI	–	Foreign Direct Investment
FTA	–	Free Trade Agreement
IPR	–	Intellectual Property Rights
GDP	–	Gross Domestic Product
GVC	–	Global Value Chain
H-O	–	Heckscher-Ohlin
ULC	–	Unit Labor Cost
OECD	–	Organization for Economic Development and Cooperation
OLS	–	Ordinary Least Squares
UNCTAD	–	United Nation Conference of Trade and Development
MNC	-	Multinational Corporations
RCA1	–	Revealed Comparative Advantages calculated with gross export data
RCA2	-	Revealed Comparative Advantages calculated with value added export data
REER	-	Real Effective Exchange Rate

TiVA –	Trade in Value Added
WTO –	World Trade Organization
CEE –	Central and East Europe
BG -	Bulgaria
EE –	Estonia
CZ -	Czech Republic
EU -	European Union
HU -	Hungary
PO -	Poland
RO -	Romania
LT -	Lithuania
LV -	Latvia

Chapter 1 Introduction

In general, the most important feature of the contemporary world economy is globalization of production, investment and international trade. Over the last two decades, there has been an unprecedented increase in foreign direct investment, determined by structural, economic, institutional and others factors of business and the investment climate. The CEE countries, the latest members of the European Union (EU-27) have a lower level of economic development compared to other member countries. For transition countries such as CEE countries, FDI and GVC participation are important drivers of technology advancement, increasing countries' comparative advantage and economic growth. As industrial production has become internationalized and firms have become multinational, the investigation and addressing of the challenges posed by globalization have become central topics for researchers, economists, policy makers, and from international organizations as well. In parallel, since 1990, the main factors which have been moving global value chains forward have been the gradual decline of trade barriers and transportation costs, combined with the development of digitalization and the decrease of cost of the information technologies (OECD, 2013). The introductory part of thesis consists of section 1.1 backgrounds on FDI and GVCs in CEE countries, 1.1.1 theoretical framework, 1.1.2 objectives of the study, 1.1.3 methodologies, 1.1.4 contributions, and 1.1.5 outline of the study.

1.1 Background of FDI and GVCs in Central and East European Countries

Over the last twenty five years two major trends have brought about transformation and restructuring of Central and East Europe (CEE) economies: FDI

increased, accompanied by economic, institutional and legal reforms; and increased participation in global value chains and engagement in different activities along those chains (UNCTAD, 2009).

Central and East European countries are the focus of this thesis, considering the importance of FDI and GVCs, the regional nature of value chains, and the common characteristics of transition economies. Many authors go so far as to argue that in some ways the transformation of former central planned economies to market economies is a driving force of globalization. It is interesting to note that international fragmentation of production is more a regional feature, than a global phenomenon, as supply chains are concentrated in three regional hubs (Pomfred & Sourdin, 2018): the European Union (predominantly CEE countries); East Asia (China, South Korea, Japan & Singapore); and North America (predominantly Mexico).

From the perspective of policy makers, the main motivation of this study comes from the recognition that production network involvement and upgrading are beneficial to an economy. As recognized by international organizations and decision makers, researchers and economists, in the 21st century increasing global value chain participation and economic competitiveness are more appealing than ever before.

Over the last two decades, foreign investment has fostered the economic growth of transition economies and Western European countries. Between 1995 and 2015, FDI in CEE countries increased sixfold from \$103 billion to \$637 billion. CEE countries income per capita in 1990 was 30% of the European Union average income per capita. However, CEE countries income per capita increased to about 50% in 2013, comparable to the EU 15 level (Roaf, J. et al., 2014). For CEE countries, foreign capital is the main source of employment, transfer of technology and GVC participation. Foreign direct

investment has created millions of jobs in the new member countries, and millions of euros in profit for foreign investors (UNCTAD, 2017). On the other hand, following regional integration, post-Soviet countries' GVC participation level increased from 38% in 1995 to 53% in 2011. This intensified international trade within EU, and the rest of the world.

The impact of international trade on welfare has been recognized in the economic theory of Adam Smith and David Ricardo (1776; 1817) absolute and comparative advantage theory respectively. Fragmentation of production renews interest and conversation about comparative advantages. However, in comparison to international trade theories, the impact of participation in global supply chains is more multilayered and complex. The unbundling of production into discrete tasks presents an opportunity for developing economies to integrate effectively in the global economy without having to develop whole products (Baldwin, 2012, Kowalski et al., 2015). As noted by Martinez & Fontura (2013), building the whole value chain of an industry usually takes a decade. Also, GVCs foster transfer of technology and knowledge between North and South, which leads to so called "great convergence" (Baldwin, 2017). Meanwhile, with the blurring of national borders and denationalization of production, globalization becomes more unpredictable and less controllable.

Value chains, coordinated by multinationals, have changed the relationship between trade countries from conventional trade in final goods, to partnerships, and from bilateral partnerships, to regional and multilateral one (Xing, 2016). Today, with the predominance of vertical investment (rather than horizontal investment) and sophistication of export, product that comprises parts or components produced in developed countries, might be assembled in a developing country, and then re-exported

back to end consumers in high-income country. These new trade linkages require reconsideration of some of the basic assumptions and economic implications in trade theory.

1.1.1 Theoretical framework

Classical and neoclassical theories of comparative advantages assume that international trade is horizontal in nature, as only final products cross the borders. However, in a globally fragmented trade scenario where multinational firms disperse production of a single product over several countries, conventional theory of comparative advantages does not apply (Beaudreau, 2011). This complexity of production has challenged the economic implications of conventional gross trade statistics, which became less accurate for measuring revealed comparative advantage, bilateral trade balances, exchange rate and true contribution of exports to national income. For consideration of the flows of inputs where value added is created, a joint OECD-WTO initiative has developed trade in value added database, which covers 42 sectors. OECD trade in value added database divide trade export into domestic and foreign value added components of export, in its compilation of variety of official sources on bilateral trade data, national accounts data and national input-output tables (indirect measurement).

By employing firm-level trade data in value added (direct measurement), Xing & Detert (2010) find that Chinese workers account only \$6.50 of the total unit cost of manufacturing the iPhone. Therefore, it would be misleading to measure PRC's competitiveness in producing iPhone based on gross trade data, as China only contributes about 3.6% of iPhone value before export. On a broader scale, estimates show that about 28% of world trade is exaggerated in this way as it consists of intermediate products which are imported as foreign content of exports and re-exported again as final products

(UNCTAD, 2013). For instance, in 2009 China's bilateral surplus with US was more than 30% smaller with TiVA than that measured by gross trade statistics (OECD, 2013).

Only data based on gross trade hinders the application of rule of origin (ROO), a WTO principle used for determination of preferential treatment. Even though Chinese makers contribute about \$6.50, the tariff rate applied to iPhone exports (e.g. China-European Union) is not only for actual contribution of 3.6%, but also for the other value of 96% that is irrelevant. In the scenario of global fragmentation of production, the tariff of application to the gross trade statistics alone will mistakenly attribute the country of origin the goods final exporter. The same simplistic assumption, that countries export final products, applies to the real effective exchange rate (REER) indices estimations. In that framework, depreciation of the currency in the exporting country would decrease competitiveness in the importing country, but in reality, with trade along value chains, decreasing the price of intermediate products increases importing country competitiveness and increases REER (Patel, Wang & Wei, 2017). These examples show clearly that traditional framework of gross trade measurement is misleading, not only with respect to magnitude or volume of calculated indices in international trade, but also with respect to the direction.

Despite the various avenues for research in which proliferation of GVCs is noteworthy, I focus only on RCA, as the most quoted indicator in international trade. There is a gap in the literature about the impact of GVCs on conventional trade statistics. Trade specialization measured in domestic value added might be very different from traditional gross value added trade analysis (Johnson, 2014). Though well conceptualized, the empirical literatures on GVCs have been inadequate for exploration of the process of

CEE countries' participation in value chains and its impact on trade patterns and comparative advantage.

It has been argued that FDI has been a main channel for countries to plug into GVCs (OECD, 2013). Buelens & Tirpák, (2017) have found positive relationship between bilateral FDI stock and import-content of export in the context of CEE countries. Kaminsky & Ng (2001) also briefly investigate the relationship between FDI and trade in part and components. However, none of these studies examined quantitatively the impact of the foreign investment of GVCs participation. Supply chain and foreign investment have a high level of complementarity, as policies which promote participation in supply chains and upgrading also increase spillover effect of foreign investment. An understanding of the driving forces behind supply chain engagement is of crucial importance for explaining transition economies' GDP growth and faster industrialization within GVCs.

New studies of globalization (Baldwin, 2017) suggest that today's trade is no longer about the physical moving of goods. Decreased information and communication (ICT) costs facilitate transfer of technology and ideas along chains. Multinationals, through their foreign affiliates, became the main source of technological spillover. Similarly, FTA is also no longer about facilitation trade of goods, rather it is an useful tool for attraction of foreign direct investment.

1.1.2 Objectives of the dissertation

This thesis attempts to reveal links between investment and global value chains participation and fill the gap between conventional analysis and new thinking about competitiveness. The contributions of the thesis are made through three empirical

analyses: (1) FDI determination in CEE countries (2) The impact of the FDI on GVC participation and (3) RCA measured in trade in value added (TiVA); based on the following research questions and issues:

1. To conduct empirical investigation of the main driving forces of foreign direct investment in Central and Eastern economies over the period 1995-2015. What are the factors determining FDI inflows in Central and East Europe? What is the empirical relationship between European membership and inward FDI in Central and East European countries?

2. To conduct empirical estimation of the impact of inward foreign direct investment on the GVCs participation of Central and East European countries. The model employ panel dataset covering the period 1995-2011 with index of participation as the dependent variable and inward FDI stock as a main independent variable of interest. Index of participation rate refers to the sum of forward and backward participation, metrics proposed by Hummel & Koopman (2011). What are the levels of backward and forward participation in GVCs? What are the other important factors determining the GVC participation of CEE countries? Analyze the trends and levels of inward foreign direct investment in Central and East European countries. How countries differ in terms of backward and forward participation index in the global value chains?

3. To measure revealed comparative advantages in Central and Eastern countries with both domestic values added of export and gross exports for 42 manufacturing sectors for selected years. What are the differences between RCA, calculated with traditional gross trade data and RCA, calculated with trade in value added? What is the pattern of comparative advantages on sectorial level with trade in value added for CEE countries?

4. To analyse industry sectors with highest change of comparative advantages in terms of value added in trade, in comparison to the results based on gross trade data. To provide further detailed analysis on three sectors - transport equipment, motor vehicles and electrical machinery, which have shown consistent, shift of comparative advantage for all countries and years of observations. How has revealed comparative advantages with TiVA changed over time?

The figure below presents thesis objectives of the dissertation:

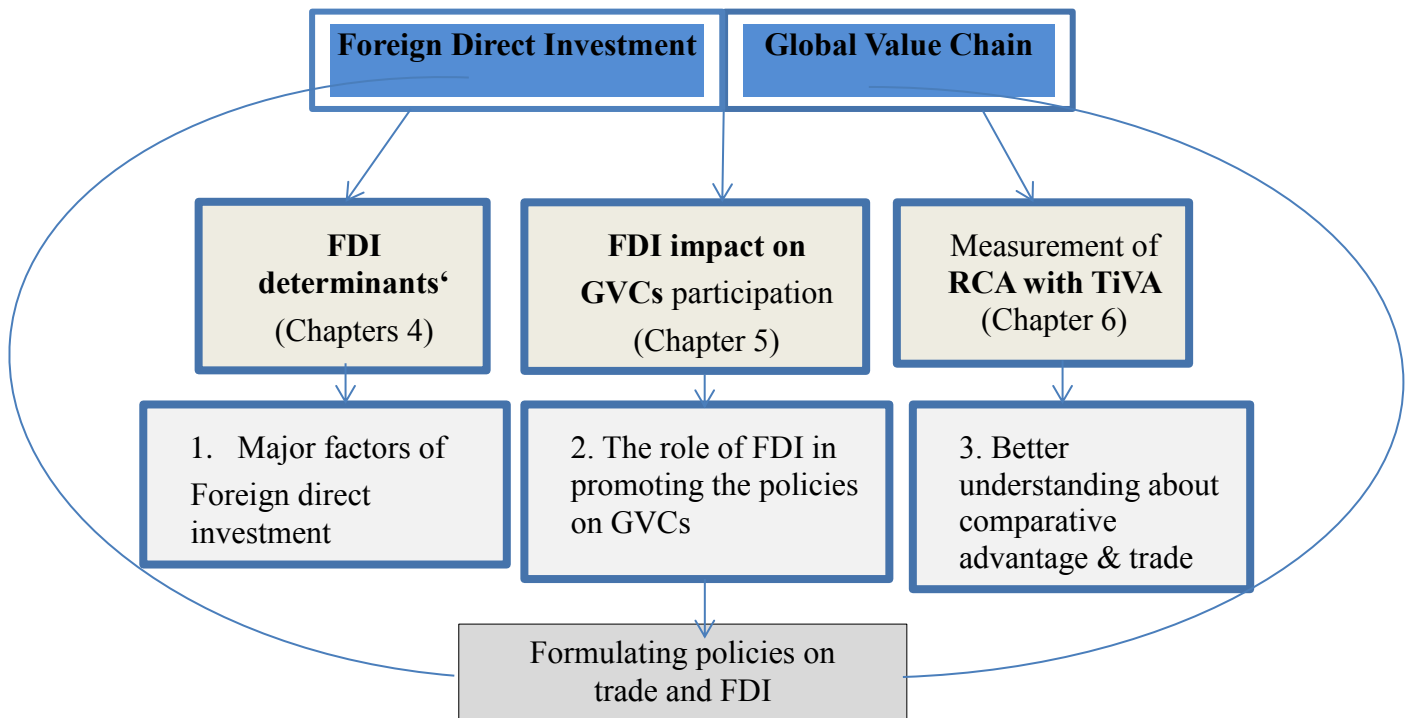


Figure 1-1 Thesis framework

1.1.3 Methodology

This thesis is an empirical study. The first regression estimation of FDI determinants is conducted through regression models with fixed effects computations. The main dependent dummy variable EU takes value 1 if the country entered the

European Union and 0 otherwise. Methodological approach follows Bormann, Jungickel & Keller (2005) and controls for individual country characteristics, such as GDP, GDP growth rate and unit labor cost. Data is based on a panel dataset retrieved from various sources including Eurostat, World Bank (WB), World Trade Organization (WTO), and UNCTAD (United Nations Trade Conference of Trade and Development), for the period 1995-2015.

The second empirical analysis regarding linkages between FDI and GVCs are conducted through regression with fixed and random effects models. In order to avoid large deviations and smooth the data, FDI stock is expressed as a natural logarithm. The study follows methodology, proposed in Kowalski, P. et al, (2015); including structural characteristics. The panel data is taken from Eurostat, WTO and OECD from 1995-2011. The index of participation consists of two components; backward and forward participation index. GVC backward participation index of GVCs is calculated as foreign content, embodied in exports, as a % of total gross exports of the exporting country (Hummels et al., 2001). Forward participation in the GVCs is calculated as domestic value added participation embodied in foreign exports, as% of total gross exports of the foreign country (Koopman, 2010). The data is taken from the OECD indicators database (2013) for 1995 - 2011:

In the third empirical analysis, for measuring revealed comparative advantages, I use the RCA formula defined by Balassa (1985):

$$RCA1 = \frac{x_{ij}/x_i}{x_{wj}/X_W}$$

where the numerator RCA1 is equal to the proportion of country i 's gross export in a particular sector j whereas the denominator is the share of world export in sector j . Then, RCA are calculated with domestic value added content of export

$$RCA2 = \frac{XV_{ij}/XV_i}{XV_{wj}/XV_w}$$

where the numerator RCA2 is equal to the ratio of country i 's value added export in sector j to its total value added export whereas the denominator is the ratio of world value added export in sector j to the total world exports measured in value added. The data is taken from OECD TiVA for 1995 - 2011.

1.1.4 Contribution of the Study

This dissertation makes several main contributions:

1) The estimation of the indexes of RCA2 with TiVA for CEE, the first study of the issue improves understanding of the importance of trade in value added, with implications for industrial, trade and investment policy. The study reveals the pattern of RCA2 for 42 sectors in CEE countries, and thus gives additional evidence on the distortion of official trade statistics about country competitiveness. As mentioned in the previous section, conventional measurement of comparative advantage uses gross value, mistakenly assuming that all the value added of exports is produced by the exporting country, which tends to inflate the results (Johnson, 2014). A particularly high level of foreign content of export (backward participation) in CEE countries leads to reversal of trade competitiveness. The results of RCA2 with trade in value added are important as they reveal the true comparative advantage of CEE countries and correct the distortions

of conventional trade statistics, which are important for formulating export promotion strategies.

2) Further, this is the first empirical study to link GVC participation and FDI. So far empirical literature has not investigated the role of foreign direct investment in individual countries' participation in the global value chains (Kowalski et al, 2015). Literature explains the variation of GVCs participation as a result of structural factors, such as economic size, share of manufacturing, or policy factors such as tariffs, trade liberalization, intellectual property rights (IPR) (OECD, 2015, Anderson&Van Wincoop, 2003, Mirodot, Spinelli&Rouzet, 2013). This thesis demonstrates that through foreign investment and GVC engagement, trade nations can change their trade specialization and engage in sectors for which they do not have RCA (e.g. transport equipment and electrical machinery and apparatus, n.e.c. sector). The empirical analyses give a new avenue for research on the role that multinational corporations have played in the unbundling of production and the emergence of international production networks.

3) Measuring and comparing the index of individual CEE countries participation in GVCs, foreign content of export and index of production stages contribute for better understanding of transition economies involvement in GVCs. The concepts of GVCs and individual country participation have been discussed extensively, but have often been misunderstood. There is a lack of consensus for the definition and measurement of the participation in the GVC. Depending on which part of the value added to focus for GVC measurement, the result can be very different (Banga, 2013). Various indicators that have been employed for calculation of GVCs participation: foreign value added of export (backward participation), domestic value added embodied in foreign exports (forward

participation) (Hummels et al. 2001); foreign value added (for domestic use and export) (FVA); foreign double counted (FDC) (Koopman, Wang and Wei, 2014), etc.

4) Lastly, this study contributes to the literature of investigation of foreign direct investment determinants, for which theoretical and empirical literature have not reached consensus. Mostly understated, political factors, in particular European membership also has significant impact for increasing of foreign direct investment. In contrast to other studies on similar issues related with CEE countries, I have broadened time period and variables of interest with RTA (Regional Trade Agreements) which are usually used for trade creation and trade diversion exploration.

1.1.5 Outline of the study

This dissertation consists of seven parts. Chapter two “Theoretical aspects - global value chains and foreign direct investment” introduces classical and new theories of comparative advantage and foreign direct investment, which serve as starting point for the next chapters.

Chapter three “Foreign direct investment in Central and East European countries” analyses FDI inflows and sectorial distribution since 1996 in order to compare pre-accession inflows and after EU membership inflows. Chapter four “Foreign direct investment determinants and European Union” estimates empirically the role of the European membership on foreign direct investment inflows in CEE countries. The result suggests that European Union membership plays a significant role for increasing inward foreign direct investment in Central and East European countries, for all empirical specifications. European Union membership lead to positive increase in the amount of inward foreign direct investment in the new members countries.

Fifth chapter “Foreign direct investment and participation in the global value chains” investigates the role of FDI for participation in global value chains. With trade in value added data, the result of the study implies that for Central and Eastern European countries foreign direct investment is an important determinant of participation in the global value chains. In addition, panel data analysis with fixed-effect estimations shows that tariffs have a statistically significant negative impact on participation in global value chains. This result is especially important for transition economies from Central and Eastern Europe for whom integration into global value chains is a driver for economic development and job creation.

Chapter Sixth “Measuring revealed comparative advantages with trade in value added” estimates revealed comparative advantages with both gross trade data and trade in value added over 42 sectors, for 1995-2015 and compare the estimations of revealed comparative advantages with two different data sets (RCA1 index and RCA2 index). It reveals that in the presence of global value chain, conventional approaches based on gross export values either overestimate or underestimate comparative advantages of CEE countries. The bias of the estimations of RCA with trade in gross export is especially elevated in sectors with high foreign content of export. In particular, three sectors, transport equipment, electrical machinery and apparatus, n.e.c., and motor vehicle sectors, show a consistent shift of revealed comparative advantages in gross and value added estimations.

The last part concludes and provides policy recommendations with respect to maximizing the benefits from global production network and increase of inward foreign direct investment.

Chapter 2 Theoretical Aspects - Global Value Chains and Foreign Direct Investment

This chapter systemizes prevailing classical and new theories for comparative advantage, foreign direct investment and global value chains, which serves as a starting point for the next five chapters. Various international trade and FDI theories have identified the sources of comparative advantage and motives of FDI. The theories of comparative advantage which date 200 years ago are comprehensive and unified though dynamic whereas the GVCs is a new concept under development which is drawn from various sources of origins (as sociology and business management) at different time. Famous classical trade model of David Ricardo (1817), neoclassical trade model of Heckscher (1919) and Ohlin (1933) has become the base for development new trade models (Paul Krugman, 1979; Melitz, 2003, Helpman et al. 2004). On the other side, the theoretical literature on FDI which evolve since World War II is less comprehensive and systemized. Prevailing theories elaborated by Hymer (1960) market imperfection theory, Vernon (1966) product life cycle theory (PLC), Dunning dominant paradigm (1977) and Japanese FDI theories (Kojima, 1978) are mainstream theories, which add new understanding and enrichment regarding the previous theory. Figure 2-1 illustrates development of the main theories of trade and GVCs.

2.1 Theories of Comparative Advantage, Global Value Chains and Foreign Direct Investment

2.1.1 Classical and Neoclassical Theories of Comparative Advantage

Models based on comparative advantages are the best known tools for analyzing international trade. David Ricardo and Heckscher-Ohlin (H-O) have constructed two different models, making different assumptions regarding the source of comparative advantage, based on technology or factor endowments (Figure 2-1). Comparative advantage theory is widely used as an indicator for competitiveness in international trade theory today. In the beginning of trade liberalization in 1980's CEE countries trade pattern is explained by H-O model based on presence of labor and capital. However Central and East European countries' transition from planned to market economy and increasing of foreign direct investment and intra-firm trade have complicated the predictions about trade pattern and comparative advantages.

Despite being the most elegant and popular theory of trade, classical and neoclassical theories of trade are much criticized. Criticisms have been based on its assumptions of the major role of the labor cost, ignoring other costs of production. Also, according to Ozcelik (2013), it is not possible to measure actual labor and capital endowments (even with the simplest version of comparative advantages, based on the Heckscher-Ohlin model) which make the application of comparative advantage in a real world context difficult.

On the other hand, Leontief (1953) empirical work has opened the debate about the validity of H-O theory. The best known as Leontief paradox discovered that capital abundant countries such as United States exports labor intensive products and imports capital intensive products. Neither the Ricardian model nor H-O model, can explain why

the most capital abundant country, the United States, specializes in labor intensive goods and not capital intensive goods.

For transition economies, predictions of trade, based on comparative advantages and factor endowments are hampered by the inflows of foreign direct investment and development of global value chains (Wangwe, 1993). In general, classical and neoclassical theories of comparative advantage assume that trade is horizontal in nature as final products cross the borders. Classical trade theory focuses on inter-industry trade which in fact explains very small part of the international trade. In response to the limitations of classical trade theories, a new school of thought has emerged. New trade theory aim to explain trade between developed countries, which have similar technology and resources (Helpman & Krugman, 1985).

2.1.2 New Theories of Trade

The classical trade theory of eighteenth century economists David Ricardo and modern Hecksher-Ohlin theory implies that countries which are less similar tend to trade more. But these models left significant portion of today's trade between nations with similar factor of endowment unexplained as trade between European Union countries and Central and East Europe. In addition to technology difference (Ricardian model) and factor endowment theory (H-O), which focus on the country characteristics, new trade theory adds new consideration for trade (Figure 2-1).

Paul Krugman (1979) new theory emphasized on the importance of economies of scale and imperfect competition to explain trade between developed countries. According to the new theory, even if two countries are identically in each aspect, there is still a basis for trade because of increasing return to scale (in addition to love of variety). Economies of scale refer to the production where output grows proportionately more than the increase

in outputs of factor of production (Salvatore, 2004). Another important component of the new trade theory is geographical proximity. Firms locate production near their clients in order to decrease transportation costs and to gain comparative advantage. Krugman (1979) theory provides an explanation of today's intra-firm trade of homogenous goods which is within same industry.

Several studies have examined the case of CEE countries intra-firm trade with European countries to verify the new theory of trade (Fidrmuc, 1990). The Dixit and Norman (1980) model which is based on economies of scale and differentiated products provide additional explanation for trade of European Union which is not supported by factor endowment theory. However, the new trade monopolistic theory which won Paul Krugman the Nobel Prize Laureate is inspired by increased intra-industry trade between developed countries, but this theory is not a response to the GVCs proliferation.

Classical trade theory explains gains from trade based on the country characteristics, new trade theory focus on the industry, and new new trade theory focus on differences of international companies. In particular, multinational firms are often more competitive than domestic one as they have technological and IPR (intellectual property rights) advantages.

2.1.3 New new theories of trade

Main weakness of the H-O theory and Krugman new trade theory is the assumption that all firms have same productivity. In contrast to trade model with homogenous firms and same productivity, the new new theory of trade acknowledges firms heterogeneity. Melitz (2003) builds a model in which firms which engage in international trade tend to be more productive and larger in comparison to firms that do

not participate in international trade. An empirical study estimates that US manufacturing firms which expand their production in international market are about two times larger and have 14% higher productivity in comparison to domestic firms from the same industry (Bernard, Jensen, Redding & Schott , 2011).

Besides, another characteristic of the new new trade theory is the importance of fixed costs. According to Melitz (2003) initial fixed costs are entry barrier which allow relatively productive firms to export in foreign markets. Helpman et al. (2004) elaborate Melitz theory with a model in which overseas investment through FDI require even larger entry costs for implementing an investment project. The elaboration of Melitz base model has created a base for new theoretical and empirical researches from firm level perspective.

2.1.4 GVCs literature

Garry Gereffi describes the global value chain as the full range of activities that firms and workers do to bring a product from conception to end use, i.e. design, production, marketing, distribution to the final consumer and after sales support (Gereffi, G. & Fernandez, K., 2016). The activities along the chain can be performed within a single firm or divided among a number of firms, either domestically or internationally. The term ‘global’ implies that the production is internationally dispersed. Similar explanation is given by WTO (2017) which describes GVC as dividing a production process in different countries. Various terms are used to describe global value chains, e.g., global production network, global commodity chain and global production sharing. Synonyms for GVCs include global production network (Ernst & Kim, 2002), global

commodity chain (Gereffi, 1999; Gereffi & Korzeniewicz, 1994), global production sharing (Yeats, 1997) & business network (Johanson & Vahlne, 2009).

According to the theory of comparative advantage, new trade theory and new new trade theory focus on final goods. GVCs expansion has transformed trade into sequence stages, which have made the assumption for export and import of only completed products irrelevant. GVCs are characterized by trade in tasks and trade in intermediate goods. Even so, as Hummels, Ishii and Yi (2001) noted, David Ricardo, Heckscher-Ohlin, and Paul Krugman monopolistic competition theories can be easily transposed to intermediate products if the latest are assembled into final products cost-freely. However, it is not the case as another important characteristic of GVCs trade is that intermediate products cross multiple borders, often backward and forward before reaching final demand. The concept of vertical specialization captured the stages of production which cross multiple borders (D. Hummels, J. Ishii and K-M Yi, 2001).

Thus, the measurement of trade nation's comparative advantage in final products which are shipped from one country to another is very different from the measurement of comparative advantages of intermediate products which cross more than two borders before final destination. If international trade of final products corresponds with trade models and national trade statistics, GVCs trade contradicts with these theories. China's high-tech export cannot be explained with conventional trade theories (Xing, 2011). On the other hand, global value chains and processed trade which consists of parts and component for assembling account for 82% of China's high-tech export can explain that phenomenon.

The GVC theory hasn't followed linear development (WTO, 2007). Jones and Kierzkowski (1990) proposed initial concept which was further elaborated to global value

chain concept by Gereffi, Humphrey, & Sturgeon (2005). Baldwin (2006) unbundling explanation and waves of globalization as well as Grossman and Rossi-Hansberg (2008) development concept for trade in tasks are among the main strands of the GVC theory. Empirical studies of GVC analysis has been developed recently extended from product case studies (Xing & Detert 2010) to broad input-output analysis by OECD.

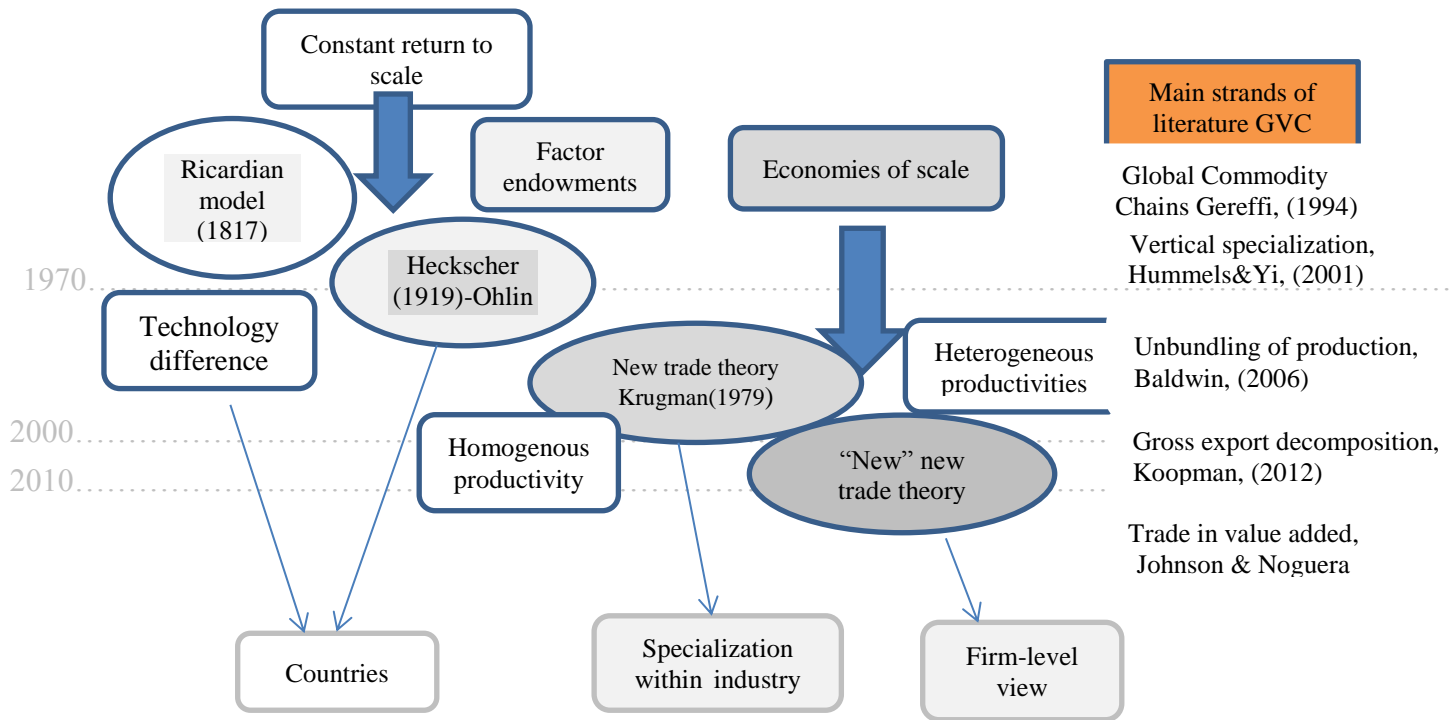


Figure 2-1 Evolution of trade theories

2.2 Theories of foreign direct investment

In contrast to international trade theories, foreign direct investment theories are less comprehensive and unified. However, theories of FDI attempt to address some of the limitations of the prevailing trade theories. This section will briefly discuss a few of dominant FDI theories, market imperfection theory (Hymer, 1960), product life cycle

theory (Vernon, 1966), Dunning eclectic paradigm (Dunning, 1977) and Japanese FDI theories (Kojima, 1978).

2.2.1 Market imperfection theory

Imperfect competition based models address the major weakness of neoclassical theories as assumptions for homogenous products and factors of productions. Instead market imperfection is based on differentiated products, individual preferences as well as entry and exit barriers. In market imperfection theories, Hymer (1960) explain foreign direct investment based on the specific-firm advantages of MNC. Market imperfection theory is grounded on the competitive advantages of some firms where they can control price to certain degree. The accent of the theory is various comparative advantages such as possession of intellectual property rights of the firm, technology and skilled working force.

2.2.2 Theory of Product life cycle

In product life cycle theory (PLC) Vernon (1966) focus on the advantages that first firm acquires when a new product is developed. As well as other theories, the development of life-cycle theory has been stimulated by the criticism of the H-O theory. According to Vernon, H-O thesis of the identity of the sectorial and production functions is particularly imprecise, which implies universal accessibility of technologies from all countries. Vernon describes four stages of a product life cycle: innovation, increase of growth, maturity and decrease. In the first stage, a new product is created on the domestic market. Gradually, the production expands on international market through export and competition emerges on the domestic market. In the stage of maturity multinational

company establish production on the foreign market through FDI. In the last phase, the product is phased out and the product life cycle starts again.

PLC theory well explains the location preferences of foreign companies, but it is criticized for not taking into account ownership aspects and other determinants (Makorni, 2015).

2.2.3 Theories of Japanese Foreign Direct Investment

After World War II, FDI has taken insignificant share of IFP, as the focus was mainly on international trade. In 1960's with flourishing of volumes and importance of foreign investment, main strands of FDI theory attempt to give explanation for the drivers of foreign investment and hence, opening new areas in the economic theory for examination. The very first attempt to create common framework for both foreign direct investment and international trade is suggested by Kojima (1978). He suggests that the theory of comparative advantage is applicable to international trade and FDI. According to Kojima so called Japanese model of FDI combines Japanese technology, production network and brand names with the host countries lower production cost. In principle Japanese FDI uses developing countries as an export platform. Japanese companies relocate their production out of the industries, where Japan has lost comparative advantage into the countries where there is comparative advantage in the industries. However, whether it is export oriented or resource oriented, Japanese FDI are very different from the United States FDI which are primary motivated by extending oligopoly power in developing countries.

Kojima Japanese foreign investment theory is extended to "flying geese" model (Ozawa, 2017). Initially the framework has been created to explain the progress of Japan

after World War 2 (Akamatsu, 1962). Later the model has been reversely extended to explain Japanese FDI expansion spillover effect over developing countries. Agreeable high consistency of explanatory power over Japanese pattern of FDI along East Asia, critiques to the model include: underestimation the role of sovereign source country in designing and controlling FDI policies (Edgington and Hayter, 2000); overestimation of FDI recipients ability to upgrade in GVCs (Bernard and Ravenhill, 1995); and generalization of the effect regardless specific industry group, investment motives and distribution of FDI. In 20th century, along with United States and United Kingdom leading source countries of foreign investment, Japanese FDI increased significantly, which attract discussions about the effect of FDI outflows on the economy.

Bayoumi and Lipworth (1997) investigation on determinants of Japanese outward FDI highlight the importance of macroeconomic factors such as exchange rates for Japanese investment abroad. Also, with respect to the rising concern about exceeded Japanese outbound investment the study explored investment-trade links and found significant effect of outward foreign investment on both exports and imports.

2.2.4 Dunning Eclectic Paradigm

The most well-known theory of FDI, which combines previous theories such as market imperfection theories and location advantage theories, is Dunning eclectic paradigm. Dunning paradigm (1977) explains the internalization of production as he focuses on three key factors. These are ownership advantages, locational advantages and internalization advantages. Trademarks and patents production techniques, which are firm-specific advantages, are the sources of advantages of “ownership”. “Localization” advantages are access to raw materials, low labor wage, preferential taxation and tariff,

etc. “Internalization” is the advantages for the multinational company to control the whole value chain of its production rather than entering the market as third party or joint venture.

In summary, the theory of Dunning supposes that a firm should first build comparative advantage on the local market before internalization. As a next step, the firm should assess whether to make investment, based on the transaction costs. Lastly, companies decide where to invest, in which country, based on macroeconomic and business environment. Among the main limitation and critics to the theory is its complexity and insertion of numerous variables, which make it impractical (Nayak & Choudhury, 2014). However, Dunning paradigm is widely employed as the theory acknowledges the role of host country economic, political and social characteristics for decision of multinational companies.

Pioneering work of Dunning, which is used until very recently, has opened the discussion for further theoretical and empirical studies of determinants of foreign direct investment. There are various approaches, perspectives and frameworks to study foreign direct investment drivers and respectively there is no consensus among researchers. One of the ongoing academic debates in FDI literature is horizontal and vertical considerations for FDI, (also known as market-seeking and efficiency-seeking). Market-seeking investment is horizontal if foreign companies’ motivation for investment is determined by proximity of the trade partners. Efficiency-seeking (vertical) investment, on the other hand, is motivated by the difference of factor prices. In reality, foreign investment is a combination of both horizontal and vertical motives, where part of the production is designated for the local market and other for export.

Recent studies explore the economic determinants of foreign direct investment, but political determinants are disregarded. With respect to the economic determinants,

there is a consensus that market size has significant impact over the level of FDI. Chakrabarti (2001) associates larger market of the host economies for FDI with efficient use of the economies of scale and also with utilization of resources. Other drivers of FDI such as the stage of economic development and economic growth are also well researched (e.g. Buthe&Milner, 2008). There are extensive studies which examine economic factors and the impact of domestic politics on FDI. Knah & Akbar (2013) found significant relationship between political risk and inward foreign direct investment. Busse (2007) explanation for Multinational companies choices where to invest is the political institutions. According to Feng (2001) and Jenson (2003; 2006) democracy as regime type have a positive impact for attracting more FDI. In the case of Central and East Europe, Bevan and Estrin (2000) find that FDI is driven by four factors which are competitive labor, market size, credit rating and distance. For transition economies international political factors as preferential trade agreement are less explored.

2.2.5 Foreign Direct Investment and theories of global value chains

Theories of foreign direct investment (which are predominantly qualitatively designed) and global value chains (which are predominantly theoretically grounded), are usually studied separately. However, several recent studies examine the links between FDI and GVCs focused on trade in parts and components and intra-firm trade. Recent study of Buelens and Tirpák (2017) which combines GVC-related metrics and bilateral FDI stock suggest that foreign investment increase trade in parts and components. Buelens and Tirpák (2017) employed bilateral FDI stock and the foreign content of exports which is one of the indicators for the GVCs participation. However, the primary focus of the study is to explore the role of the gravity factors as geographical links for

production network as well as effect of FDI on trade in parts and components. However, GVCs concept goes beyond trade in parts and components including more sophisticated GVCs metrics. Taglioni & Winkler, (2016) also identify FDI – GVCs linkages especially for developing countries through increased intra-firm trade of multinational corporations. Damijan et al. (2013) revealed that FDI has affected export composition as well as factor productivity but emphasizing more on the spillover effect of investment on the domestic economies. Amador and Cabral (2014) highlight the importance of FDI for establishment of GVCs operated by the multinational corporations with qualitative data. Without empirical analysis, Amador and Cabral (2014) describe the main driving factors of global production network and explore different measurement of the involvement.

Chapter 3. Foreign Direct Investment in CEE Countries

3.1 Introduction

For offshoring, multinational enterprises (MNEs), relocating their production facilities abroad and building wholly or jointly owned subsidiaries in foreign countries, are effective approach to establishing their own GVCs and integrating foreign firms into those GVCs. After the fall of the Berlin Wall, and the collapse of the Soviet Union, CEE countries were transformed from planned economies to market economies and gradually became major hosts of foreign direct investment by Western European countries and economies from other regions, such as Japan and the US. The inflows of FDI have allowed GVCs to extend into CEE countries and have integrated various industries of those countries into value chains led by MNEs from developed nations. This chapter gives an overview of the major FDI trends in CEE countries since 1995, based on the data taken from UNCTAD.

At the initial stage of the transition period in the 1990's, characterized by an unfavorable investment and business environment for most of the Central and East European countries, the level of foreign direct investment was negligible. For example, in Bulgaria FDI inflows amounted to \$90 million in 1995, compared to \$14 billion in 2007. Macroeconomic instability, regime crises and currency crises were some of the major adverse effects of the post-communist regimes. However, privatization of state-owned enterprises increased the interest of multinationals, European companies in particular. In many aspects Central European bloc (Hungary, Poland and Czech Republic), where countries are closer to the Western Europe, have had experienced higher level of

economic and social development, more favorable conditions for transition to and for FDI attraction. In order to facilitate regional convergence, pre-accession programs (1995-2007) conducted broad economic and financial reforms which encouraged domestic investment, export and regional cooperation with various sectors including manufacturing, tourism and agricultural processing. The main instruments of economic and social transformation of transition economies had been European Union cohesion funds (European pre-accession funds). European cohesion funds (Phare) focused on two main objectives: 1) institutional development and 2) economic and social convergence. The funds covered various sectors for development, technical support, training and environmental policy.

European pre-accession funds allocate financial grants toward domestic private sector development. Currency boards, strict financial discipline and economic and social cohesion policy increased macroeconomic stability in the region. The European stability pact facilitated trade and regional integration between new European candidate countries and actual European Union members.

In the pre-accession stage (since 2000), in order to comply with the high standard set by EU accession regulations, candidate members had to conduct broad administrative and institutional reforms. From the perspective of foreign investors, broad judicial system reforms, including strategies for combatting corruption, law amendments, and public discussions had provided a more transparent investment and business environment for both domestic and foreign companies. For instance, in Slovakia, FDI inflow surged from \$236 million in 1995 to \$2 billion in 2000. As mentioned until the beginning of the 21st century, FDI was driven by the privatization process. With the use of structural funds, investment encouragement law enforcement provided direct subsidies for infrastructure

development and training of personnel in order to facilitate foreign investment. Financial support, predictability and access to the European Union market increased Greenfield foreign investment in the CEE countries. The sectors, receiving the highest levels of foreign direct investment were the real estate, services and manufacturing sectors. As a result of 1) European regional integration, 2) structural reforms and 3) enforcement of investment encouragement laws, MNCs interest in FDI for manufacturing sectors increased. Offshoring in medium and high technology industries such as automobile, electrical machinery, and information technology sectors would not be possible without free markets and movement of people and capital.

3.1 Foreign Direct Investment inflows to CEE countries

Over the last two decades (1995-2019), EU accession increased the comparative advantage of CEE countries for investment to the extent that even global financial crises (2008) have not had any long term negative effect on FDI, export and economic growth. Currently, European post accession funds (Cohesion funds) continue to support economic and social cohesion through projects such as infrastructure development, environmental policy, capacity building, and research and development. In 2007-2015 from European funds domestic and foreign companies, executive and local authorities and NGOs (Non-Government Organizations) in transition economies received more than EU180 billion. In terms of economic and social cohesion, the absorption of European funds encouraged private sector development and increased competition between domestic companies and economies of scale.

Classical theory and numerous empirical studies have shown that foreign investment is one of the major sources of economic growth in the host countries (UNCTAD, 2009). Many studies have shown that foreign investment contributes more to

growth than domestic investment, given direct effect of accumulation of foreign capital and transfer of technology (Moosa, 2002). One reason for that is the fact that foreign firm productivity is higher than that of domestic firms. United Nations (1999) defines FDI “*as an investment involving a long term relationship and reflecting a lasting interest and control of a resident entity in one economy (foreign direct investor or parent enterprise) in a enterprise resident in an economy other than that of the foreign direct investor (FDI enterprise, affiliate enterprise or foreign affiliate).*” Since the mid-1990s Central and East European countries have restructured their economies and striven to become part of the multilateral system. In those transition economies, foreign direct investment was crucial to the successful restructuring of the economy, in terms of both growth and technological progress. Today Central and East European countries are competing to attract foreign direct investment. The significant increase in FDI is driven by the political stability steaming from the integration of these countries into the European Union (the accession process started in 2002), and the subsequent reduction of trade barriers to FDI. Today the EU operates as a single market where trade barriers between member states such as tariffs, custom duties and quantitative restrictions, are removed. For instance, non-technical barriers to FDI are also removed due to changes in the FDI administrative regimes, entry and exit barriers license transparency and intellectual property rights protection (United Nations, 2008).

From domestic perspective, the main instruments for investment promotion are national economic and investment policies and regional trade agreements. Former planned economies have been implementing similar investment encouragement measures which are synchronized with European legislation. Shorter terms of administrative support, financial support for infrastructure development and support of training

employee are main provisions in the encouragement laws. On a bilateral and regional level, CEE countries have taken efforts to improve not only international trade system but also framework which refer to foreign investment. Prior to the EU enlargement (in 2004 and 2007) CEE countries enforced free trade agreements with European members which gradually eliminated tariffs between trade partners. In addition since 1995 transition economies had concluded various Bilateral Trade Agreements for Mutual Promotion and Protection of Investment, including avoidance of double taxation.

According to the theory side of the literature, horizontal investment is observed when multinational corporations replicate activities in multiple plants in several countries (Horstmann & Markusen, 1992 and Brainard, 1993). What usually determines the existence of horizontal FDI is large host country market size and significant trade costs. Horizontal FDI arises between developed countries with similar market size and factor endowments. In vertical FDI, on the other hand, multinationals locate some of the stages of production abroad, taking advantage of various factor endowments. Vertical FDI often occurs when the source country is developed and its affiliate host country is developing. In vertical FDI, production is divided into several steps which are dispersed geographically through multi-plant production, and the firm engages in export (Helpman, 1984). In horizontal FDI, all production activities are performed in a single plant which usually serves the host market (abroad).

During the 1990s and 2000s western European multinational corporations have been relocating their production activities, mainly in the manufacturing sector, to Central and Eastern European markets through vertical investment. Today, due to the comparative advantage of Central and East Europe, the region is regarded as the second best location for investment after Western Europe (Allen & Overy, 2006). Further expansion of West

European investment in East Europe is important for successful industrial integration of the CEE countries into the European Union.

Table 3-1 shows the substantial increase of FDI inflows to Central and East Europe as a % of GDP during the period 1996-2015. As mentioned earlier, one of the important reasons for the higher level of investment is increased financial and political stability. After the first wave of European Union accessions (2004 accessions included Estonia, Latvia, Lithuania, Czech, Slovakia, Poland, Hungary, Slovenia and Slovakia), in 2006 average FDI reached a record level, 8.2% of GDP. In 2009, due to the financial crisis in 2008, on average FDI decreased to 1.7% of GDP in 2009 and 1.8% in 2010. However, in 2015 foreign direct investment increased to 2.9%.

Table 3-1 FDI inflows to CEE countries (% of GDP)

Country	1996	2000	2006	2009	2010	2012	2015	1996-2015
Bulgaria	1.1	7.6	23	7.5	2.5	3.3	3.5	48.5
Estonia	3.2	6.8	1.3	9.5	13.3	7.7	5.9	47.7
Czech Republic	2.1	8.1	3.6	2.6	4.9	4.6	2.4	28.3
Hungary	7.1	5.9	16.3	-2.3	-16.1	8.3	9	28.2
Latvia	6.4	5.2	8	-0.1	1.8	3.8	2.8	27.9
Poland	2.9	5.4	6.3	3.2	3.8	1.5	3.2	26.3
Romania	0.7	2.8	9.3	2.9	1.9	1.5	1.9	21
Slovakia	1.3	7	5.8	1.8	2.4	1.6	0.1	20
Lithuania	1.8	3.3	6.8	0	2.3	3.5	0.7	18.4
Slovenia	0.8	0.7	1.7	-0.1	0.7	0.1	2.1	6

Note. Source: author's calculations, based on World Development Indicators (2015)

Table 3-2 provides an overview of the volume of foreign direct investment inflows for the period 1995 - 2017. From 1995 till 2008 CEE countries increased their level of foreign direct investment significantly. However, the volume of foreign investment among countries was heterogeneous. The largest economies, group of Visegrad 4 (Czech Republic, Hungary, Poland and Slovakia), received the highest amount of FDI, whereas

Bulgaria and Romania attracted significantly lower levels of FDI. In year 2007 FDI reached the highest level for all CEE countries. Czech Republic, Hungary and Poland had high GDP, which gave to foreign investors' better access to domestic market. Also, Central European countries' proximity to Western European countries gives them better access to foreign investors in the European markets. In 2012 countries the average GDP growth rate of CEE was about 1.3%, with the highest growth in Estonia and Latvia, and lowest in Romania.

Table 3-2 FDI inflows, \$ millions, (1995-2017)

Country	1995	2000	2003	2004	2006	2007	2008	2009	2013	2015	2016	2017
Bulgaria	90	1,001	2,096	3,072	7,874	13,875	10,296	3,896	1,989	2,609	1,562	2,182
Estonia	201	416	1,037	1,086	2,212	3,429	1,873	1,8655	1,098	-714	939	1,555
Czech Republic	2,567	4,987	20,211	6,423	7,132	13,815	8,815	52,716	7,357	1,699	10,850	9,210
Hungary	4,804	2,747	4,157	4,538	18,678	70,631	75,013	2,967	3,772	5,517	69	1,348
Latvia	179	324	316	591	1,704	2,713	1,432	-32	989	838	2,435	1,137
Poland	3,659	9,335	5,371	13,868	21,473	25,031	14,574	14,025	795	150,650	18,321	10,673
Romania	419	1,037	1,844	6,443	11,006	10,103	13,600	4,637	3,854	4,317	6,252	5,952
Slovakia	236	2,183	969	4,060	5,696	5,059	4,641	1,519	1,003	1,519	4,741	5,921
Lithuania	72	380	217	7,961	20,676	2,293	1,907	1,798	708	970	9,624	1,190
Slovenia	150	135	535	763	691	1,884	1,081	3,462	103	1,729	1,446	1,081

Note. Source: author's calculations, based on World Bank (2017)

3.2 Sectorial distribution of Foreign Direct Investment in Central and East European countries

3.2.1 Sectorial distribution of FDI in CEE countries

The figures below report the distribution of foreign investment by economic activity for the period 2003-2012 for Czech Republic, Estonia, Hungary, Poland, Slovak Republic and Slovenia (industry level data for Bulgaria and Romania are not available).

Industry level analyses are important for examining export potential, employment and value added.

The sectors which received the majority of investment inflows are services, finance, real estate, manufacturing, trade and electricity. Foreign inflows in services sector accounts from about 40% of the total investment. Other sector which received high inflows of foreign direct investment is financial sector, where Estonia and Slovenia have the highest level (24% and 23%, respectively), Hungary and Poland the lowest level of investment (13% and 12%, respectively). After the 2008 global financial downturn, there were outflows from investment in the manufacturing sector, which resulted in lower levels of overall FDI in the manufacturing sector for reported period 2003-2012. Since then, Poland has been leading destination for foreign investment as the Government provides additional packages for encouragement of investment from manufacturing sector.

Figure 3.2 presents Czech Republic foreign investment inflows by economic activity over the period 2003-2012. FDI in service sector accounts for 41% of total foreign investment. FDI in financial and real estate sectors were 15% and 12%, respectively of total FDI in Central and East European countries. On average, since 2012 the manufacturing sector has account for 11% of FDI in CEE countries.

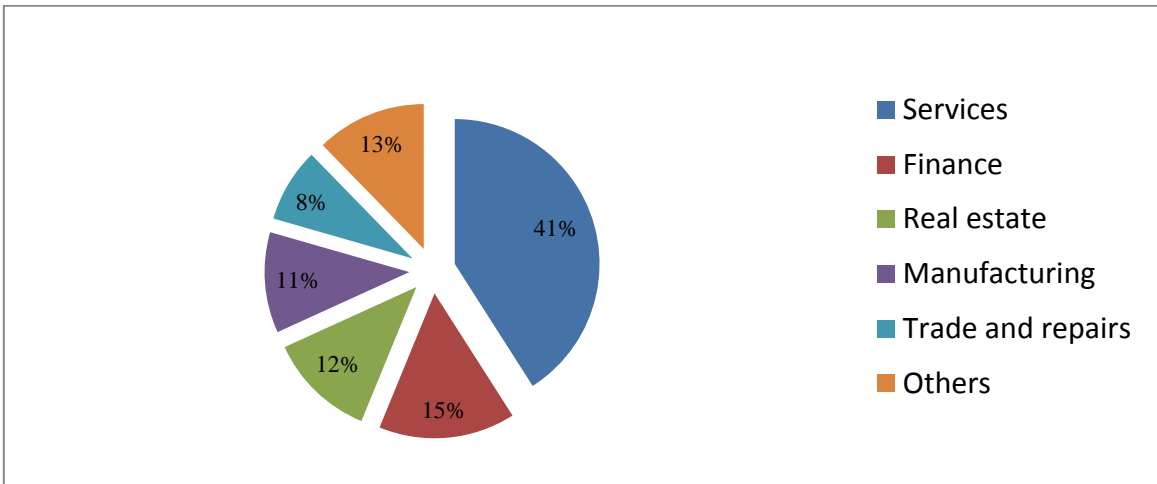


Figure 3-2 Czech Republic, FDI inflows by economic activity, 2003-2012

Note: Authors calculations with data taken from OECD statistics (2018)

Figure 3-3 presents foreign direct investment in Estonia by economic activity for 2003-2012. Similarly to the Czech Republic, Estonian's foreign investment in service sector accounts for 41% of total FDI. Finance and real estate sectors had second and third position in terms of FDI with 24% and 7%, respectively. On average, both manufacturing and trade sector had received 6% of the total foreign direct investment inflows in the Central and Eastern European countries.

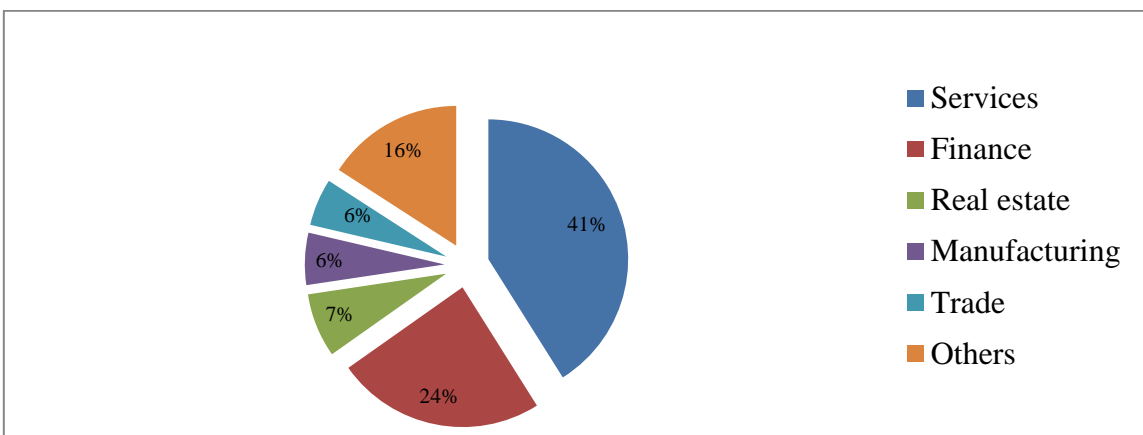


Figure 3-3 Estonia, FDI inflows by economic activity, 2003-2012

Note: Authors calculations with data taken from OECD statistics (2018)

Figure 3-4 presents Hungarian foreign direct investment by economic activity for 2003-2012. On average, service sector in Hungary received 44% of total FDI. The second largest recipient of FDI is real estate sector. Trade and repairs and electricity received 2% of total FDI in Hungary.

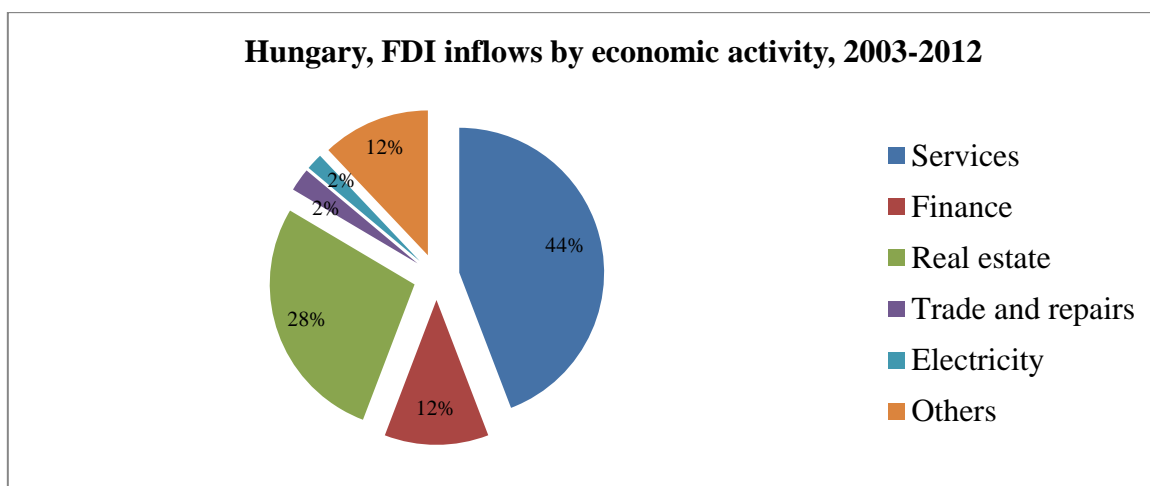


Figure 3-4 Hungary, FDI inflows by economic activity, 2003-2012

Note: Authors calculations with data taken from OECD statistics (2018)

Figure 3-5 presents Poland sectorial distribution of foreign direct investment for 2003-2012. Similarly to Czech Republic, Estonia and Hungary, Poland had highest share of total FDI in service sector. In comparison to other CEE countries, Poland had higher share of FDI in manufacturing sector which is 18% of total FDI in the country.

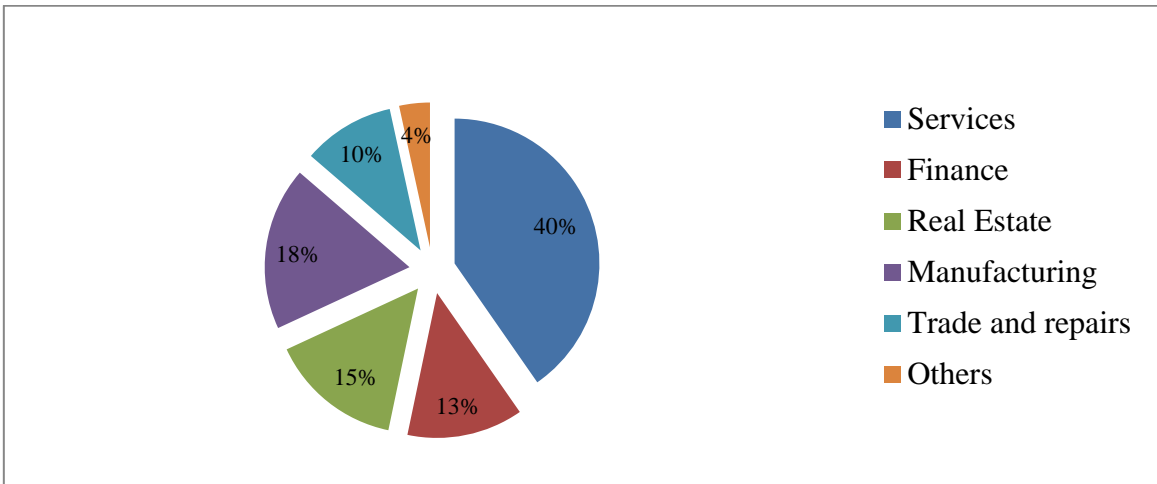


Figure 3-5 Poland, FDI inflows by economic activity, 2003-2012

Note: Authors calculations with data taken from OECD statistics (2018)

Figure 3-6 presents Slovak Republic sectorial distribution of foreign direct investment for 2003-2012. On average, service sector had received 34% of total FDI. Manufacturing sector and financial sector had received 16% and 14% of the total FDI.

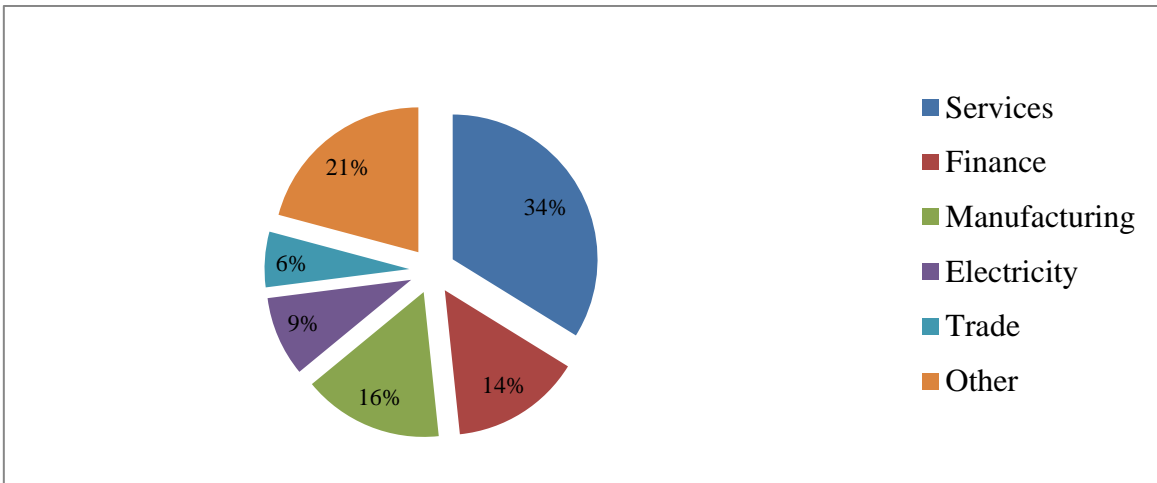


Figure 3-6 Slovak Republic, FDI inflows by economic activity, 2003-2012

Note: Authors calculations with data taken from OECD statistics (2018)

Figure 3-7 presents Slovenia sectorial distribution of foreign direct investment for 2003-2012. Similarly to other CEE countries, Poland had highest share of total FDI in service

sector which is 50% of all FDI in the country. Other important sectors for Poland are finance and real estate with 23% and 18% respectively.

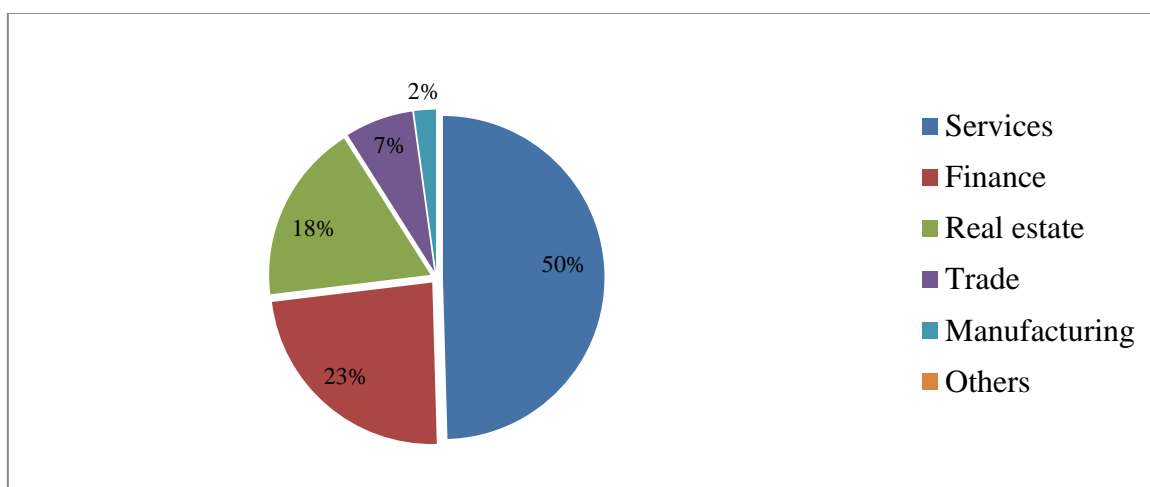


Figure 3-7 Slovenia, FDI inflows by economic activity, 2003-2012

Note: Authors calculations with data taken from OECD statistics (2018)

3.2.2 Source of the foreign direct investment

The main source of investment in the Central and East European countries are developed European countries and United States. Traditionally, foreign direct investment inflows in Bulgaria and Romania are attracted from the closest neighboring countries such as Germany, Italy and Greece, which is 60% respectively. Also, 50% of Latvia, Lithuania and Estonia (Baltic States) FDI inflows come from neighboring countries, such as Sweden and Norway (Deloitte, 2015). Low transportation cost, intensive intra-firm trade and increased fragmentation of production are main explanations of this trend.

The data below provide evidence that most of the Central and East European countries FDI inflows come from developed European members. For instance, in 1999 and 2003 Bulgaria received 52% and 61% of the overall FDI from EU15. Among other CEE countries Czech Republic and Poland had highest level of FDI inflows from EU with 83% and 74%, respectively.

Table 4-3 FDI stock by partner country as a %, 1999 and 2003.

FDI stock	Bulgaria		Romania		Czech		Hungary		Poland	
	1999	2003	1999	2003	1999	2003	1999	2003	1999	2003
EU15	52	61	56	60	44	83	71	73	56	74
USA	12	7	25	18	39	5	12	9	18	12
Japan	0.4	1.5	0.1	0.6	0	2	2.4	5.4	0.7	0.4
Russia	7	3	-	-	-	0.1	0	0.1	3.5	2
Other	24	15	28	26	15	4	12	5	14	9

Source: Adapted from Deloitte (2015)

In 2017, FDI stock of Bulgaria had reached 41362 million euro (figure 3.7). Except of Russia, largest top 10 investors in Bulgaria come from the European Union countries. Netherland, Austria and Germany are largest investors' in 2017 with FDI stock 7166, 3966 and 2799 million euro, respectively. After EU member countries, traditionally, large portion of FDI come also from United States while Japan and China had lower FDI in CEE countries. The data clearly shows that FDI in the Central and East European countries are driven mainly by the investment from Western European member countries. European membership which leads to decreasing of trade cost and improvement of macroeconomic environment is among main explanation for the high share of the Central and East European countries foreign direct investment.

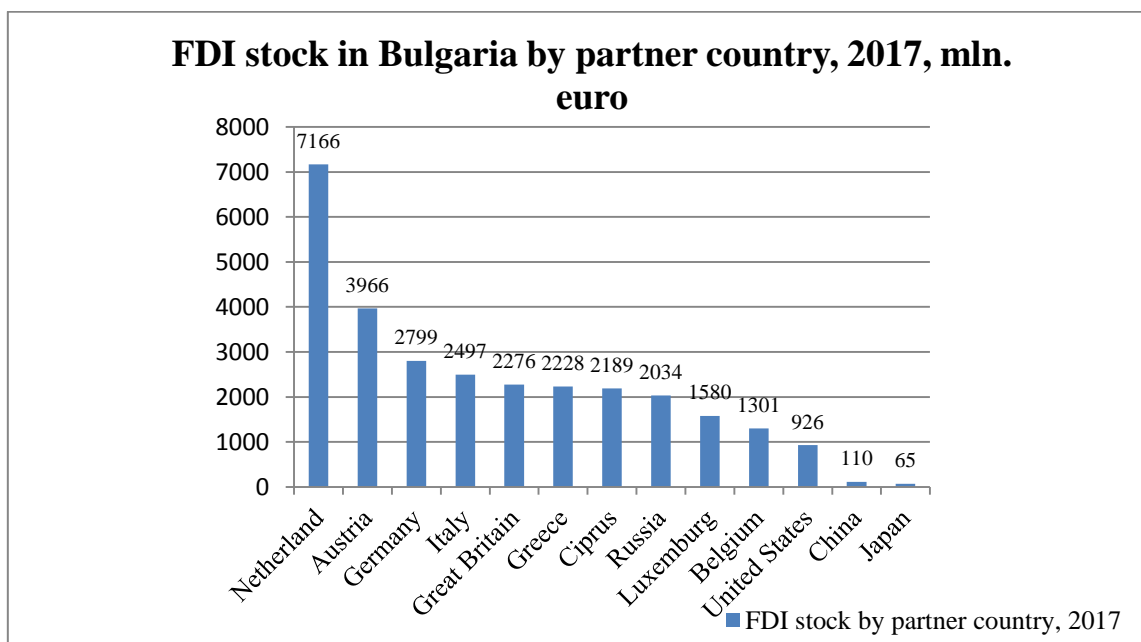


Figure 3-7 FDI stock in Bulgaria by partner country, 2017

Source: National Statistics, Bulgaria

3.3 Conclusion

European memberships have multiplied the level of FDI inflows in Central and Eastern European countries. Single market and improved macroeconomic stability from the EU membership support both efficiency and market seeking foreign investors from European Union and outside European Union. Starting from low base of Greenfield and privatization led FDI, today global value chain and increased competitiveness allow old European members to continue to expand production activities in CEE countries in higher value added sectors.

Chapter 4. Foreign Direct Investment Determinants and European Union

4.1 Introduction

The most distinctive features of the contemporary world economy are expansion of foreign direct investment, globalization of production and intra-firm trade. As production has become internationalized and firms have become multinational, the investigation of drivers and effect of globalization have become central topics for researchers, economists, policy makers and international organizations. Over the last two decades, there has been an unprecedented increase of foreign direct investment, determined by structural, institutional and other factors of business and the investment climate. Regional trade agreements and technological advancement allows multinational companies to fragment, relocate and disperse production in different parts of the world at a faster pace. Equally important, technological advancement facilitates unbundling of production as allows for synchronization of different stages of production instantaneously.

Based on various motives (including achieving more efficient production), international companies offshore and outsource parts of their production. For instance, over the last four decades, in automobile sector, western multinational companies (such as BMW, Mercedes, Fiat, etc.) through foreign direct investment offshore vast parts of their production facilities overseas (especially in lower cost production bases as Central and East European countries). Outsourcing is another strategy where multinational companies use independent suppliers for production process. For instance, for manufacturing sector in computers and electronic equipment sector (part of manufacturing sector), United States Apple Inc. outsources assembling activities for iPhones, iPods, cameras, laptops, etc. in China.

However, the service sector is also highly impacted by globalization and foreign direct investment. Both in the United States and European countries multinational companies have offshored or outsourced large part of information technology sector to India.

Along with globalization of production process, growth of international trade and FDI, there is also an increased protectionism waves. British decision for exit from the European Union, as well as Trump restrictive trade policy toward China has become new trend which would have impact not only on international trade system but also both on foreign direct investment and global value chains.

Based on the increased importance of the intra-firm trade, foreign investment and GVCs as well as recent uncertainties in international trade relations, empirical analysis in this chapter investigates the relationship between foreign direct investment and European Union membership. What are the major factors which have driven foreign investment into CEE countries? What is the role of European Union membership for foreign direct investment? What is the role of regional trade agreement (RTA), which were signed between CEE countries and European Union countries before the European accession?

As given in the Chapter 3, the trend of FDI in CEE countries' suggests that significant surge of foreign investment is due to the EU accession of the former communist countries. It is not a coincidence that since 1990 for CEE transition economies inward FDI stock increased sixfold from \$103 billion to \$637 billion in 2015 (UNCTAD, 2017). For Central and East European (CEE) countries, FDI became main source for employment, transfer of capital and economic growth. European developed countries have created thousands of jobs in the new members countries and billions of euro profits through multinationals. Also, foreign investment has fostered the process of economic convergence between new and old members. Initially, for CEE economies, income per capita in 1990 was

30% from the European member countries level. However, after EU membership, CEE countries income per capita had increased to about 50% in 2013 from the EU15 level (Roaf, J. et al., 2014).

FDI plays a critical role in promoting GVCs participation for CEE countries. Encouraging FDI flows into CEE countries would enhance the participation of CEE into value chains led by multinational firms of developed nations, so firms of CEE involving in GVCs could grow together with MNEs. As presented in chapter two, Ricardian model, which dominates international trade in the 19th century, where two factors of production and two countries exist on the international market has been already outdated model.

Besides economic benefits, foreign investment has social, financial and political impact. What is the causal relationship between European membership and foreign direct investment inflows in Central and East European countries? So far, there has been extensive literature on determinants and benefits of foreign direct investment (FDI) on transition economies. Geographical proximity, competitive labor and level of economic development are some of the well-known drivers of FDI (Bevan & Estrin, 2009). However, for CEE countries, the empirical literature has not been conclusive for the role of the European Union accession for increasing of FDI inflows.

The structure of a chapter is as follows. Next section 4.2 examines Central and East European countries accession in the European Union and its impact of foreign direct investment flows. Section 4.3 explores channels by which European membership impact on inward foreign direct investment inflows. Then, it describes variables, empirical model, data used and estimation technique. Finally, it presents the econometrics estimations and final section concludes and gives policy implications.

4.2. Central and East European countries accession in the EU and FDI

The latest two waves of the European Union (EU) integration (2004 and 2007), were largest in the history of the EU in terms of newly accessed members and size of the population. With the latest waves of accessions, European Union became the largest economy in the world. European accession of Central and East European countries was a phenomenon in the history of the EU, because of the difference in the size of the countries and significantly lower level of development in comparison of Western European countries.

Appendix A (table A1-1) shows in more details the process of European integration of all 28 member countries in the European Union. The primary goal of the European Union, which was initially founded in 1957 by Belgium, France, Italy, Luxemburg, Germany and Netherland, was to provide peace, integration and economic recovery for the countries from the World War II. Since than, the focus of the Union had shifted from security and recovery to more ambitious agenda, from trade and investment liberalization to integration and sincronization of EU policies and monetary policy. Today, every European country which fullfil membership requirement in three areas, economic, political and judicial, can become a candidate member. During pre-accession period (1990-2004), Central and East European countries have conducted large scale reforms and transformation toward establishing free market economy (economic transformation), building of stable political institutions and democracy (political transformations), and encouragement of transition economies judicial compitablility with European practices (Barysch, 2007).

In return, more than a decade before actual EU agreement, European countries have started to lower and remove bilateral barriers to trade. Since 2000, Poland, Hungary and Czech Republic export to the EU has reached 70% of their total export. Together with

expansion of export, as a result of EU membership, Eastern European countries have achieved remarkable trade and financial integration and also attracted significant amount of FDI. In 1995 FDI inflows in transition economies have reached \$10 billion (table 4-1). For year 2000, CEE transition economies inward FDI stock amounted to \$103 billion, which increased sixfold to \$637 billion in 2015 (UNCTAD, 2017). Poland, Hungary, Slovakia and Slovenia (Central European countries) have made substantial progress in their transition from a planned to market economy, and thus attracted about 80% of regional FDI. (Suder & Sohn, 2016). Other countries, such as Bulgaria and Romania (Eastern European countries) have made much slower progress toward economic transition and attraction of foreign direct investment.

Table 4-1 Foreign direct investment inflows before EU membership and after joining EU, \$, million

Country	Year	FDI inflows prior EU membership (\$, million)	Year of EU accession	FDI inflows as EU member (\$, million)
Bulgaria	1995	90	2007	12,389
Czech	1995	2,562	2004	4,974
Estonia	1995	193	2004	957
Slovenia	1995	117	2004	765
Slovakia	1995	2,587	2004	4,029
Poland	1995	3,658	2004	12,140
Lithuania	1995	31	2004	774
Latvia	1995	178	2004	608
Romania	1995	419	2007	6,436
Hungary	1995	5,103	2004	4,266

Source: Eurostat statistics (2019)

European FDI inflows support Eastern economies for the development of production base in manufacturing sector, primary in automobile industry, electronics and pharmaceutical industry. Germany is the largest source of FDI for the ten CEE countries which take advantage of the lower production and lower labor costs in CEE countries to transfer part of lower value added activities.

I examine the role of joining European Union as an important factor which attracts foreign investment in Central and East European countries in general. The results of the previous studies for the impact of the European membership on FDI are not conclusive. Efstathiou (2011) found that European integration has positive impact on FDI inflows. Other study which use gravity model, found that for the CEE regional integration does not lead to increase of foreign investment (Brenton et al., 1998). Contradictory results are also given in CEE countries case studies for the effect of the EU membership on investment. Despite the fact that there are many studies which explore EU integration and FDI in CEE countries, this thesis differs in the choice of variables and data selection. I include bilateral free trade agreements which as an additional dummy variable to capture the effect of bilateral free trade agreement of CEE countries with EU before accession.

4.2.1 Foreign Direct Investment and European integration

What are the main channels by which European membership impact on inward foreign direct investment inflows in the Central and East European countries?

First of all, from economic perspective, accession to the European Union lead to liberalization of trade, services and people between member states. Through investing in CEE countries, foreign companies have free access to market of 500 million customers which can potentially increase both European investment and external investment (from

third countries). Larger market size is regarded by scholars as the main determinant for investors which relate to increase scale of production and efficiency (Chakrabarti, 2001).

With respect to the type of investment (horizontal or vertical) there are two main channels through which European membership may impact on new members' countries foreign direct investment inflows. As a result, EU membership can lead to increasing or decreasing of inward FDI in the new member countries. The particular impact depends on the motivation of foreign investor as horizontal and vertical investment is driven by different factors. Vertical type of investment is driven by differences of factor cost of production between host and source country. As part of the single open market in the European Union, foreign investment in the source country is a platform for foreign companies to export production to other European member countries, while taking advantage of the lower production cost. Thus, both EU member investment and third countries investment export production is tariff free within European Union. As a consequence, vertical investment will increase inward FDI in the new member countries.

The second type of foreign investment is horizontal. Horizontal investment is driven by increased trade cost where firms prefer to establish production in the host country rather than exporting, to avoid these trade costs (Chen, 2014). European Union single market provides for foreign investors (originated both from EU countries and other countries) increased market access without trade costs, as border controls and tariff between member states. As a consequence, in the case of horizontal FDI, European membership may lead to decreasing of inward investment because horizontal investment represents the trade off between trade cost and investment cost.

Regardless type of investment, there are many other channels by which European membership may impact to the inflows of FDI. From institutional perspective, European

membership had fostered investment by increasing member states political and economic stability, gained by European membership (Hunya, 2000). Increasing political stability is widely accepted as main benefit which accession countries will gain from European membership. Establishment of the European Union (1957) is considered as political act which lead to institutional transformations. Initially, established from six European countries, now European Union members increased to 28 members countries. European member countries are part of the custom union which allows free movement of goods, services and people. Nineteen out of twenty eight countries from European Union are also in the Monetary union, (Eurozone), using euro as their main currency. Also, twenty two EU countries are part of the Schengen zone where there is no border controls. In order new member countries (these are almost all Central and East Europe) to integrate in largest custom, trade and currency union, they have to comply their national legislation with the EU *acquis communautaire*. The process of compliance had fostered broad institutional reforms and laws amendments, which increased overall economic and political stability for foreign investors. With that respect many studies have found positive impact of EU accession on political and economic stability and reducing the investment risk (Narula & Bellak (2009) and Jones (2014). However, few studies found that institutional transformation can have also negative impact on foreign direct investment. For instance, Kalotay (2006) suggests that new European regulation and standards will pose higher standards for multinational corporations. In order to meet the new imposed laws and regulations the cost for doing business will also increase. However, it is very difficult to measure the direct impact of the new regulations on business and foreign investors. Labor cost will also increase which will have impact on comparative advantage of the the new member countries.

Mann (2015) provides empirical evidence which suggests that European Union integration had increased economic growth of the new Member States. According to his study, the effect of European Union membership on individual country economic growth for one country is small but the accumulative effect of CEE countries is significant. New member states have to join European Monetary Union which introduces common currency among member states. European Union participation increased monetary stability and decreased exchange rate volatility.

4.3 Foreign Direct Investment and Regional Trade Agreements

Regional Trade Agreement (RTA) is an agreement between two or more partners. RTA includes Free Trade Agreement (FTA), Custom Union (CU), Economic Union (EU) and other forms of reciprocal agreements (WTO, 2019). RTA enhances GVCs flourishing as regionalism not only facilitates exchange of goods, services and people, but also encourages and facilitates foreign direct investment. On a global scale, the rate of increase of RTA is impressive, starting from 50 agreements in 1990's, and today reaching about 300 agreements (OECD, 2017). Through trade liberalization, it is less costly for companies to outsource and allocate part of the production process toward their more efficient regional partner. Of course, the welfare effect of regionalism is ambiguous, just as the debate about trade diversion and trade creation from RTA (Baldwin & Freund, 2011). With certainty, multilateralism has superiority to regionalism, but also after latest Doha rounds of trade negotiations within WTO it does not seem feasible, at least for the near future.

Most dispersed form of regionalism is Free Trade Agreements. Interestingly, to great extent, Free Trade Agreements are not for free. Instead, it is a trade union between two or more countries to reduce, but not necessarily to eliminate trade barriers as tariffs

and quotas. However, the degree of integration and cooperation between trade countries depends on the number of countries in the union (bilateral, regional and multilateral) and type of agreement (shallow or deeper trade liberalization). Custom Union, Common Market and Economic Union are agreements which have highest level of trade integration. Existing theoretical and empirical literature on RTA mainly focuses on the trade creation and trade diversion effect from trade agreement. A main dispute in the literature is whether trade agreement serves as building block or stumbling blocks for further liberalization (Ahearn, 2011). Answers are controversial due to patterns of trade, and magnitude of the barriers being reduced due the particular agreement.

If multiplication of the RTA continues, there are two foreseeable tendencies regarding the outlook of international fragmentation of production development. One foreseeable scenario is that regional treaties can foster global value chains development. Indeed, trade agreements have been seen from policy makers, researchers and economists as a tool for integration in the international supply chains. There are plethora's of studies which classify and assess comprehensively content and policy areas of RTA which provide evidence that trade agreements are becoming deeper (Hofmann, Osnago & Ruta, 2018). Increasing number of the agreements settle areas that go beyond tariff arrangements of WTO. Some of these areas are provisions related to competition policy, investment protection or various other regulatory regimes. Osnago, Rocha & Ruta (2016) estimate empirically that deeper provisions in RTA increase trade in parts and components between multinationals with 22%. RTA facilitates and deepens multiple cross border trade of parts and components through synchronizing member states regulatory, legal and investment regimes.

This chapter focuses on exploration of European membership impact on the inflows of FDI. It includes RTA, which was signed between CEE countries and European Union countries before accession. After 1990, for the Central and East European countries, the number of these agreements increased significantly. The bilateral agreements were terminated after the accession of CEE countries in the European Union in 2004 and 2007 (Vicard, 2009). Initially, the primary goal for both regional and global RTA was to increase the bilateral trade between its member states, which is supported by many empirical researches. However, in the 21st century beside international trade, the primary focus of most of the RTA is deep provisions arrangement including investment promotion and protection. According to Adams et al. (2003) proliferation of RTA has created new third waves of globalization where the accent of the trade agreement is no longer trade itself, but the deep integration provisions in the RTA as investment, trade in services, dispute settlement mechanism, and intellectual property rights. Empirical evidence supports the new focus of regionalism, which is designed to attract foreign investment. For example, many of the agreements that are signed are taking place between countries that are located in large geographical distance from each other and it is not much likely to trade. Due to the rule of origin, Medvedev (2006) revealed empirically that preferential trade between member countries is less than 50%. An alternative explanation about proliferation of RTA is that primary focus of membership is facilitation of foreign direct investment.

Several studies have investigated the impact of international agreements on inflows of FDI using gravity model. Büge (2014) found that for both developing and developed countries, RTA has a significant positive effect on FDI. Another research of Buthe & Milner (2008) which focused on developing countries found significant impact

of international institutions as WTO and RTA on the level of foreign investment. Bae & Jang (2013) have found positive impact of RTA on outward FDI and ambiguous result for inward investment. In addition to positive impact of free trade agreements on inward FDI, Cardamonne & Scoppola (2011) have found positive impact of the outward investment, through using knowledge-capital theory.

The data for the regional trade agreement is taken from the World Bank Global Preferential trade agreements database (2016) and World Trade Organization, preferential trade agreements database (2016).

Table 4-2 European Union Agreements with countries from Central and East Europe

Name of the Agreement	Type of the Agreement	Data in force
EC-Bulgaria	Free Trade Agreement	31 Dec 1993
EC – Croatia	Free Trade Agreement	01 Mar 2002
EC - Czech Republic	Free Trade Agreement	01 Mar 1992
EC – Estonia	Free Trade Agreement	01 Jan 1995
EC – Hungary	Free Trade Agreement	01 Mar 1992
EC – Latvia	Free Trade Agreement	01 Jan 1995
EC – Lithuania	Free Trade Agreement	01 Jan 1995
EC – Poland	Free Trade Agreement	01 Mar 1992
EC – Romania	Free Trade Agreement	01 Jun 1993
EC - Slovak Republic	Free Trade Agreement	01 Mar 1992
EC – Slovenia	Free Trade Agreement	01 Jan 1997

Source: Data is taken from Global Preferential Trade database, (2016)

<http://wits.worldbank.org/gptad/library.aspx>

4.3 Variables, Data and Methodology

4.3.1 Variables

The main dependant variable of interest is foreign direct investment in Central and East European countries. The main independent variable, EU membership indicates entering the European Union and it is given in two categories. European membership

takes value of 1 if the country joins the EU, and 0 otherwise. Regional Trade Agreement participation – include Regional Trade Agreements which are signed between CEE country and other European member country. RTA takes value of 1 when CEE country enter in Bilateral Free Trade Agreement, and 0 otherwise.

The choice of the dependent variable gives several important advantages. FDI stock is available since 1995 for all Central and East European countries. Due to bilateral data limitations this study considers FDI position from all partners and thus RTA effect may be due to increased FDI from countries not only inside, but also outside European Union.

As for independent variables, this thesis consider four of the traditional foreign direct investment determinants, which are suggested by the theoretical and empirical literature – GDP (market size), GDP growth, unit labor cost, inflation and BFTA. The main variables, follow the choice for variables of Borrmann, Jungnickel & Keller (2005) - which are divided into three main categories, market size, cost efficiency and political factors. All variables of interests are given in the table 4-3.

The variables GDP (market size) and annual GDP growth measure the size of host country *i* and the country's potential for growth. In the literature, these are classical determinants of FDI, which gives locational advantage to the host country. Market size is the mostly employed determinant of foreign direct investment. The empirical literature demonstrates that, under *ceteris paribus* condition, there is a positive relationship between host country size and the amount of inward foreign direct investment (Charkrabarti, (2001); Kolstad&Tondel, (2002).

According to the theoretical and empirical literature unit labor cost (which measures labor productivity) affects foreign direct investment, but the effect is ambiguous.

For CEE countries, Hunya (2004) discovers that unit labor cost shows positively vertical FDI. Other studies show that higher unit labor cost has a negative impact on FDI. Kinoshita & Campos (2009) find that for efficiency seeking investors, lower labor is expected to be negative. Here I will employ the OECD definition of unit labor which is the ratio of the cost of one unit of labor to produced output per hour.

The third distance variables capture for the effect for host country political risk or inflation. Busse (2005) shows that insitutions and political risk are among most important determinants of FDI. Higher political stability is provides predictability for foreign investors and favorable business enviroment. Inflation on the other hand may constitute to a decrease in macroeconomic stability and thus the flow of foreign investment.

Table 4-3 Econometric variables and source of the data

Variable	Specification	Name of the source	Data retrieved from
Inward FDI stock	Inward foreign direct investment stock (annual)	UNCTAD	http://unctad.org/en/Pages/DIAE/FDI%20Statistics/FDI-Statistics-Bilateral.aspx
		OECD stat	https://stats.oecd.org/Index.aspx?DataSetCode=FDI_FLOW_PARTNER#
GDP	Gross Domestic Product	World Bank World Development Indicators	http://data.worldbank.org/indicator/NY.GDP.MKTP.CD
GDP growth	Gross Domestic Product growth (annual data, %)	World Bank World Development Indicators	http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG
Unit labor cost	The Ratio of total labor compensation per hour worked to output per hour worked (labor productivity)	OECD	https://data.oecd.org/lprdy/unit-labour-costs.htm#indicator-chart
Inflation	DGP deflator,% change, yearly	World Bank data	http://data.worldbank.org/indicator/NY.GDP.DEFL.KD.ZG/
Political stability	Political stability indicator (rank from 0-100)	Worldwide Governance Indicators	http://info.worldbank.org/governance/wgi/#reports
European Union membership	Date of accession in the European Union	European Commission	https://ec.europa.eu/neighbourhood-enlargement/policy/from-6-to-28-members_en
BRTA	Global Preferential Trade Agreement Database	dummy variable	http://wits.worldbank.org/gptad/library.aspx

4.3.2 Data

This study uses panel data for 10 Central and East European countries for the period 1995-2015. The panel is unbalanced, as data availability vary within country and years. Data for FDI stock are obtained from UNCTAD and Eurostat statistics. There are two reasons for choosing FDI stock in the analysis. First, availability of investment stock, greater than inflows, and second, FDI stocks are less volatile than FDI inflows. Data for the control variables are taken mainly from World Bank and OECD databases. In order

to avoid large deviations and for ease report results , GDP and FDI are given in natural logarithms.

4.4 Empirical Model

Random and fixed effect OLS (Ordinary Least Square) are used to estimate the impact of European membership on FDI inflows of ten new members Central and East European countries. The equation takes the following form:

$$\text{Log}FDI_{it} = \alpha + \beta_1 EU_{it} + \beta_2 BRTA_{it} + \beta_3 \text{Log}GDP_{it} + \beta_4 GDPgrowth_{it} + \beta_6 ULC_{it} + \beta_7 INFL_{it} + \beta_8 BRTA_{it} + \lambda_{it} + \varepsilon_{it}$$

1)

where FDI_{it} measures inward foreign direct investment stock in country i at time t , Central and East European country ($i=1, \dots, 10$) at time t , in year (1995-2015), λ_{it} is fixed effect or individual effect, EU_{it} is European Union membership, with value 1 if Central and East European country i join EU and 0 otherwise, GDP_{it} measures annual *gross domestic product* of the host country, $GDP\ growth_{it}$ is *gross domestic product growth* of the host country, ULC_{it} is the ratio of total labor compensation per hour worked to output per hour worked (labor productivity), $INFL_{it}$ is inflation, $BRTA_{it}$ is Bilateral Regional Trade Agreement, which takes value 1 if Central and East European country i is a member of RTA and 0 otherwise, and ε is the error term. The expected signs of the empirical estimations are given in detail in the table below.

Table 4-4 Foreign Direct Investment Inflows (stock) expected sign

Variable	Specification	Horizontal investment (market seeking)	Vertical (efficiency seeking)
GDP_j^t	Gross Domestic Product	+	+
$GDPgrowth_j^t$	Gross Domestic Product growth	+	+
ulc_j^t	Unit Labor Cost	+	-
$INFL_j^t$	Inflation	-	-
EU_j^t	European Union	+	+
$BRTA_j^t$	Bilateral Regional Trade Agreement	+	+

For panel data, random and fixed estimations are the preferred econometric technique. For this dataset, fixed-effect model will be able to control for heterogenous time-invariant country characteristics such as race, location and religion. One disadvantage is that the effect of factors which do not vary within the group will be absorbed by λ_{it} . Any time-invariant regressors cannot be included as a variables due to multicollinearity. In the case where no omitted heterogenous variables are correlated with the main independent variables, random effect is the appropriate method of estimation.

Intuitively, fixed effect estimations are more appropriate for our model as there are a variety of FDI determinants that might be correlated with our independent variables. In order to choose between fixed and random effect Hausman test is conducted. The null hypothesis is that the coefficients from both estimations are not different. Hausman test showed small p-value, i.e. less than 0.05, cannot reject null hypothesis and therefore we chose fixed effect for the estimations.

4.5 Results

The results of the estimations are reported in the table 4-5. The panel dataset is unbalanced, as observations vary by county. Column 1) presents random effect

estimations, column 2) fixed effect estimations without controlling for year fixed effect and column 3) fixed effect estimations with year fixed effect.

As expected, when a CEE country joins the European Union, the amount of inward foreign direct investment increases. Fixed effect estimations suggest that European Union membership increases FDI by 5.71% points at 10% significance level (column 2). With year effect, (column 3), estimations of the EU membership coefficient slightly increase to 5.74 at 5% significance level. For fixed effect estimations, explanatory BFTA dummy variable affect positively foreign investment but the effect is indeed insignificant at 10% level. According to the random effect estimations for Central and East European countries, RTA impacts positively on FDI (results in column 1). The insignificant result of RTA dummy variable (with fixed effect estimations) might be result of the insufficient number of the Central and East European countries RTA that are included in the sample and large-scale study demand.

The coefficient of GDP is positive and significant for both random and fixed effect estimations. Our result is consistent with economic theory, which argues that larger market size encourages investment as it provides greater opportunities for investment return. As expected in the random effect the impact of GDP is higher than that for fixed effect. However, the random effect result may not be precise, as this estimation does not control for time-invariant factors. With country fixed effect, a 1% increase of GDP lead to 5.32% increase in inward FDI stock for CEE countries. Results with country fixed effect and year fixed effect suggest a one % increase in host country GDP leads to a 6.22% increase in foreign direct investment.

The rate of GDP growth is also significant at 1% level for fixed effect estimations while the coefficient is insignificant for the random effect estimations. Fixed effect results

suggest that one % increase in the GDP growth leads to 0.027 increase of foreign direct investment. In other words, countries which have higher rate of growth attract higher FDI.

Results from the model suggest that host country unit labor cost has positive impact on inward foreign direct investment. One unit increase in the unit labor cost implies 0.022 increase in the foreign direct investment, when controlling for the country and year-fixed effect. One explanation for the positive effect of that variable is that unit labor cost embodies not only wage, but also labor quality and productivity (Donaubauer & Dreger, 2016). For the case of China, Donaubaue & Dreger (2016) found that for some provinces higher wages encourage FDI. Accordingly, for the case of transition economies in my study foreign investors seek for skilled labor instead of cheap labor.

For random effect estimations, inflation has negative impact over FDI. Usually low inflation rate reflects macroeconomic stability which is of main interest for foreign investors. Also, for this study inflation is a proxy for the financial crisis, which leads to significant drop in the foreign direct investment in 2007 and 2008. The motivation to include this variable in the estimation is to control for the financial crisis. Inflation has a negative impact for the fixed effect also, but it is not statistically significant.

Table 4-5 The impact of the EU membership on Foreign Direct Investment inflows

Variables	Dependent variable InFDI stock		
Estimation method	1) Random effect	2) - Fixed effect	3) - Fixed effect
InGDP	1.016*** (0.068)	0.532** (0.256)	0.622** (0.433)
GDP growth	0.021 (0.017)	0.028* (0.014)	0.027* (0.015)
Unit labor cost	0.033*** (0.011)	0.023* (0.009)	0.022** (0.010)
Inflation	-0.021** (0.09)	-0.002 (0.008)	-0.003 (0.008)
EU membership (dummy)	0.608** (0.290)	0.571* (0.282)	0.574** (0.284)
BRTA (dummy)	0.487*** (0.204)	0.314 (0.197)	0.324 (0.202)
Constant	92.497 (56.354)	-6.409 (6.166)	11.518 (73.298)
<i>F</i> -Statistic (<i>P</i> -value):	0.000	0.000	0.000
Observations	210	210	210
Country Fixed-Effect	No	Yes	Yes
Year Fixed-Effect	Yes	No	Yes
<i>R</i> -squared	0.694	0.638	0.666
Number of countries	10	10	10

Note. ***, **, and * indicate coefficients at the 1%, 5%, and 10% level of significance.

Due to data limitation and time constraint, this study does not cover the RTAs which were signed between CEE countries and countries outside EU, which can also be included in the estimations.

4.6 Multicollinearity checks

In general, for panel data and fixed effect models in particular, multicollinearity is not considered as an issue. However, for the random effect regression model, I use the variance inflation factor (VIF). The calculation of the VIF shows that variables of interest are over 1 which shows no multicollinearity problems.

Variable	VIF
Unit labor cost	1.32
Inflation	1.28
GDP growth	1.07
GDP	1.05

Source: own calculations with Stata

Results over 5 of VIF show existence of multicollineary problems

4.7 Conclusion and Implication

The results of this empirical study show that FDI increased significantly since Central and East European countries joining of the European Union. To a great extent, economic factors do play an important role for Central and East Europe increasing of foreign investment. Since 1990, transition economies have reached remarkable progress in their economic development and attraction of FDI. It is not surprising that market size and level of economic development determine the amount of foreign direct investment that transition economies have received. However, those factors are usually pre-determined and very difficult for the national governments to intervene.

There are other, political and institutional factors as European Union membership which also plays as much important role for FDI inflows. European Union not only removes trade barriers between acceded countries. but also reduce various investment associated costs. Foreign companies set-up costs and information costs are substantially reduced. Within European Union parties foreign companies are equally treated as domestic investment. Moreover, for Central and East European countries, EU

membership has fostered substantial transformation of institutions. In order to comply with Maastricht criteria, the CEE countries' governments conducted variety of reforms which improved overall business environment and political stability. Main efforts were directed towards liberalization of trade and administrative reform.

Main implication of the estimations is that among various benefits of European integration as economic, financial and social, European membership has significant explanatory power for foreign direct investment.

Chapter 5. Foreign Direct Investment and Participation in Global Value Chains

5.1 Introduction

Since 1995, developing and transition economies have increased their participation in global value chains, engaging in different activities along various chains (UNCTAD, 2009). In order to properly measure individual country participation in GVCs, OECD (2013) proposed GVCs participation indices which consist of backward and forward participation indexes. A backward participation index, which is the share of foreign inputs in overall export, is above 30% on average for the countries in the sample. In small and developing countries the share of backward participation index is even higher. Central and East European countries have increased backward share of GVCs participation from 25% in 1995 to 35% in 2011, respectively, while in the United States and Japan the shares in 2011 were 11% and 15%, respectively. A forward participation index is the share of intermediate inputs which will be further re-exported by the foreign partners (Koopman, 2010). For Central and East European countries, the share of forward participation indexes was 13% in 1995 and 18% in 2011, respectively. In comparison, developed and large countries usually have higher share as their domestic export is embodied in others country export as US and Japan forward participation share was 33% and 28% in 2011.

With sophistication of export and multilayered production process, the impact of GVCs on individuals, firms, sectors, local economies and welfare has intensified. Over the last four decades China has transformed global economy. Today, Chinese manufacturing industry export about 25% of the global manufacturing output, of which 70% on mobile phones, and 60% on shoes production (Economist, 2015). To great extent,

FDI and GVCs enable China to become factory of the world and to engage in production of iPhones for which does not have comparative advantages. Likewise, GVCs support India to engage and develop IT industry without having comparative advantage for that sector. Over the last 20 years, Central and East European countries also have increased participation in the global supply chains and have gained access to technology and knowledge which allow them to engage in productions without having revealed comparative advantage.

GVCs participation is beneficial to the economic development of the host countries' since MNCs pass on benefits including knowledge and technology transfer and job creation to their foreign affiliates. The extent and scope of knowledge transfers from MNCs to their foreign affiliates depends heavily on the position of the foreign affiliates in the MNCs' international production network (Birkinshaw and Hood, 1998). For the CEE countries, foreign direct investment has been playing a major role in knowledge and technology transfer and integration and in global value chain.

On the other hand, many studies have confirmed that participation in production networks does not automatically lead to positive spillovers if the countries engage in low-technology activities. Baldwin (2011) argued that the 'vertical specialization' pattern, which is typical of the offshoring of labor intensive production stages from headquarters to factory economies, should not be referred to as technology transfer, but rather as technology lending. On the other hand, the higher the technology intensity of the industries integrated into a chain, the higher are the potential benefits for the host economies (Damijan, Rojec and Kostevc, 2013). Banga (2014) also suggests that global value chains engagement itself is not sufficient for boosting competitiveness and enhancing economic growth. For example when the participation in the international

production is concentrated at the end of the chain, engaged in the assembling activities, the effect on wages and growth is controversial. On the other hand, when participation in the GVC is concentrated at the beginning of the GVCs engaged in activities as R&D and design which create high value added, the effect on growth is substantial. For majority of Asian countries, the effect of participation in fragmentation of production is ambiguous as the measurement on generated income distribution is also very limited. On the other hand industries which are more labor intensive and less technology intensive (as apparel and agriculture) do not have high level of engagement in fragmentation of production in comparison to medium (transport equipment, electrical machinery) and high technology industries (electronics, optical products). Interestingly enough, empirical studies suggest that GVCs engagement leads to change in the factor intensity in the respective industries.

Why do some countries participate more and others participate less in the global value chains? What is the level of Central and Eastern European countries participation in the global value chains? What factors determine the participation of a country in a global value chain? The relationship between participation in the global value chains and the amount of foreign direct investment remains unclear. Chapter 5 focuses on empirical investigation of the relationship between global value chain participation and foreign direct investment, in the context of ten comparable countries.

Despite the fact that proliferation of global value chains comes at time of unprecedented levels of FDI, the relationship between investment and global value chain participation is not thoroughly examined. So called-buyer driven chains are usually owned by local firms, and built without direct foreign investment (usually in labor-intensive industries such as apparel and footwear). Producer-driven value chains are centered on multinational corporations with multilayered production systems involving

parent companies, subsidiaries, and subcontractors (Broadman, 2005). Examples of producer-driven value chains are: automobile, computer, semiconductor, and heavy machinery industries.

This chapter examines the importance of foreign direct investment as a driver of the rise of global value chains as well as other important factors of global value chain engagement. Next, it will determine the rate of Central and East Europe individual country participation in the global value chains, paying attention to the importance of forward and backward participation. Finally, with panel data and fixed-effect regression technique it will test whether the flow of foreign direct investment is related to global value chain participation.

5.2. Foreign Direct Investment and Global Value Chains participation

The four main features of globalization are: upsurge of international trade flows, transportation and communication facilitation, free movement of people and foreign direct investment flows (Penalver, 2002). These components have been drivers of the first (1850) and second wave of globalization (1980) and have been examined ever since. In particular, the first wave of globalization (Baldwin, 1996) was fostered by fall of the transportation costs, expansion of international trade and the concentration of manufacturing agglomerations at the sector and firm level. This concept is supported by the well-known Ricardian and Heckscher-Ohlin theories of trade. The second wave of globalization (Baldwin, 2006), observed from the mid-1980s to the present, was caused by the fall in communication costs and it is often called fragmentation, offshoring or outsourcing where foreign investment are taking place. According to Baldwin (2006), the second wave of globalization revealed the new pattern of international trade where multinationals through FDI started to unbundle the production. The rapid advancement

of information technologies gradually shifts the focus of international trade from export and import of goods, to trade in intermediate products. Empirical research shows that Multinational corporations have transformed the trade structure of the host economies in various ways. With European countries dataset, Damijan et al. (2013) suggest that inward FDI has changed CEE countries export structure and increased productivity. Amendolagine (2017) estimates that intensive participation in the GVCs relate to higher intermediate inputs, sourced locally by foreign investors.

What are the main channels of impact of FDI to GVCs participation? Before discussion of FDI and GVCs linkages, we have to start the discussion for types of organization of production. Gereffi et al. (2013) describe four mechanisms for organization of production. In the first one, in-house production, the company operates only inside the firm and domestically. When the firm uses only domestic suppliers and export only final products, this form of trade is not affecting global value chain. In the others types of production, the product is fragmented into intermediates which are traded internationally within a global value chain, through outsourcing and offshoring. In offshoring the company still operates mainly domestically, but some activities are performed abroad through foreign direct investment. Special form of outsourcing is arms-length trade mechanism when a foreign company outsources some of activities to an independent contractor supplier. For both foreign outsourcing and offshoring the result is increased intra-firm trade (Gereffi et al. 2013).

In addition to the types of GVCs governance, it is important to examine what part of export production is included in the GVCs trade? Firstly, GVC participation is determined by trade, including export of intermediate inputs, from country A to country B. The second condition of GVC trade is the fact that these intermediate inputs are

sourced from elsewhere, i.e. from country C. The intermediate inputs are 1) either imported from abroad and then exported (backward participation) or 2) intermediate inputs that are produced domestically, but are used in other partner's countries export (forward participation). In these two possible cases, it is important to stress that final product export from country A to country B (bilateral) is not considered as a global value chain export trade. Also, bilateral intermediate products export that are produced in country A and exported to country B are also not trade along GVC. Thus global value chain trade can be easily understood as defined by multilateral trade, in which one segment of production (intermediate product) crosses more than two borders before being consumed.

Given this main condition for GVC participation definition, domestic firms which are usually exporting final products from country A to country B are not contributing to the global value chain trade. In this sense, horizontal investment (headquarters and foreign affiliate) which offshores their production and use a host country as a platform for final export, is not part of international value chains trade.

In light of this important clarification, there are various channels in which FDI might increase international trade: through vertical investment by multinational companies; horizontal investment. Horizontal and vertical FDI are determined by motives of the Multinationals, for instance market seeking or efficiency seeking. The integration of global value chains provides access to foreign markets, giving countries opportunities to specialize in particular segments of production, even countries which have no comparative advantage in that product/industry group. In the case of vertical FDI, the host market is a platform for export of multinational companies which increased intra-firm trade between foreign affiliates. Foreign direct investment can impact directly on global

value chains forward and backward participation share through increased intra-firm trade from FDI – through vertical investment or (vertical joint-ventures. Outsourcing increase GVCs participation indirectly.

How vertical investments promote GVCs participation? In vertical FDI a multinational company locates each stage of production in a different country taking advantage of the lower cost of production. In many cases multinational companies export intermediate products (instead of final goods) which will be further exported, which leads to an increase in forward share of participation in the global value chain (forward participation). Vertical specialization is the main explanation of GVCs participation. A number of studies have attempted to measure vertical trade specialization in parts and components (Ng & Yeats, 2001, 2003; Yeats, 2001; Kaminski & Ng, 2001; Athukorala, 2006; Zeddies, 2010). Horizontal FDI can also promote GVCs participation. Horizontal FDI is usually observed between developed countries including either whole production offshoring or high value added production. For example engine production of US Boeing and European Airbus is outsourced to German's BMW because of their high specialization (Azarhauzand, 2015).

China's processing trade operated by Multinationals and state-owned companies is an example of backward increase of GVCs. Processing trade, operated by foreign direct investment, refers to imports of raw materials and intermediated parts which has been manufactured or assembled, and further export for consumption. According to Xing (2011), processing exports provide a direct measure of exports, given the participation of the global value chains. As 'processing trade' use imported parts and components for export, they tend to increase the share of backward participation in global value chain. However, it is important to mention that higher backward participation in global value

chain may not necessarily be related to foreign direct investment as Multinational corporations often locate part of the production process abroad through joint ventures or contractors, and not FDI.

Theoretically, a global value chain can function without FDI participation since there are domestic small and SME firms which can operate in the international production (Ivanova & Ivanov, 2017). However, because of the close linkage between trade and investment and prevailing technological advantages of multinationals, FDI is the most important channel through which global value chains operate (though not the only one). UNCTAD (2013), estimates that 80% of international trade is trade in intermediates within multinational corporations. Also, around 50% of global imports are in intermediate inputs (Yi, 2003). GVCs enforced high standard of both efficiency and quality. With this respect Kaplinsky and Readman (2001) explains that domestic enterprises have to cover high fixed costs for standardization in order to engage in the global production. Also, foreign companies operate in the most advanced sectors which provide higher value added. Very often, domestic companies do not have the complexity of resources for that production, (as capital, technological and managerial resources).

5.3 Central Eastern European countries participation in the Global Value Chains

By definition, participation rate in global value chain in country is a sum of 1) foreign value added content of export in country *i* and 2) domestic value added content of export in country *i*, used in another countries exports. Domestic value added represents the part of exports which is created in-country the share of the country's exports that contributes to GDP (domestic value added trade share) (UNCTAD, 2013). Foreign value added (foreign value added as a share of exports) indicates what part of a country's gross

exports consists of inputs that have been produced in other countries. It is the share of the country's exports that is not adding to its GDP (UNCTAD, 2013).

Backward participation is the import of foreign inputs for processing and further export (Hummel et al., 2001) and forward participation is exporting inputs that are incorporated in the export of other countries (Koopman, 2010) (see equation 2). Timmer et al. (2012), OECD (2013), de Backer and Miroudot (2013) and UNCTAD (2013) used this metric for calculation of backward and forward participation. In 2013, OECD released trade in value added indicators which calculated of backward and forward participation, based on decomposition of gross flows into foreign and domestic content of export.

Participation rate P of a country is equal to the sum backward participation share and forward participation share. It is defined as below:

$$P_i = VS_i + VS1_i$$

where VS is backward participation and $VS1$ is forward participation in country i .

VS is defined as

$$VS_i = \frac{FVA_i}{E_i}$$

where FVA is foreign content in country i export E (Hummel et al., 2001), and $VS1$ is defined as

$$VS1_i = \frac{DVA_i}{E_i}$$

where DVA is domestic input content embedded in other countries' exports (Koopman, 2010).

Countries do not always participate equally in or benefit equally from global value chains (OECD, 2015). However, both of these measurements express share of individual country export in global value chains but show very different global value chain engagement. Usually greater global value chain participation provides scope for increased domestic value added of export by producing more intermediate inputs (increasing forward participation) and/or engaging in more production activities, like assembly, as a result of trading with more intermediates (increasing backward participation). Participation indices were obtained from the OECD global value chains indicators (May 2013).

Since 1995 all Central and East European countries have increased their level of participation in global value chains. The level of participation in the global value chains for 2009 is shown by country (Figure 5-1). Although countries engage in the global value chains, CEE countries participation in the global value chains shows that there is great heterogeneity among countries in terms of participation rate. Central European countries, Czech Republic, Slovakia and Hungary had highest level of participation in GVCs with 62, 62 and 61%, respectively. East European countries, Romania and Bulgaria, had the lowest level of participation with 46 and 47% respectively in comparison to the reference group.

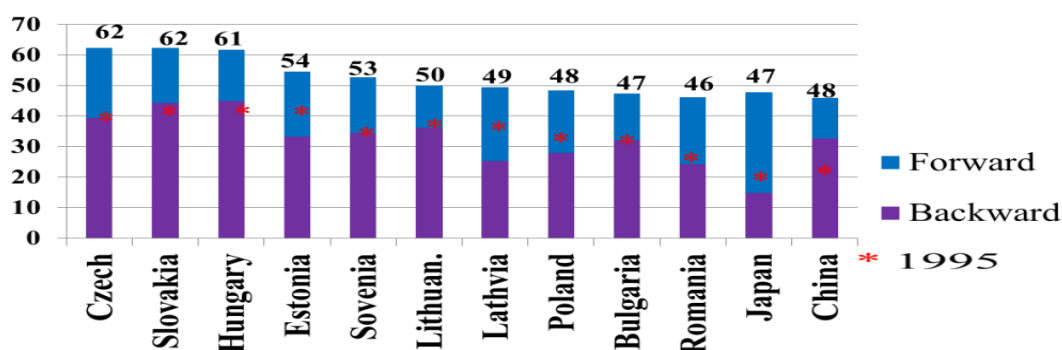


Figure 5-1 GVC participation index, 2009

Source: author's calculations based on OECD TiVA database, June 2013. Backward participation is foreign value of countries exports (Hummels et al., 2001); forward participation is the use of exports by other countries (Koopman et al. (2011))

Kowalski (2015) suggests that both sourcing foreign inputs for export production (backward participation) or providing foreign inputs to foreign countries for export (forward participation) bring economic benefits for a country, as a result of increased productivity, sophistication and export diversification.

The main purpose of the empirical analysis is to investigate whether individual country GVC participation is related to FDI.

5.4 Variables

5.4.1 Participation Index

GVCs participation rate measure how much one country is engaged in global production. Decomposition of export allow for global production chains to divide by business functions, which are specific tasks along chains. Countries no longer specialize at the industry level, since every production process is divided into stages and includes activities such as R&D, operations, marketing, services and assembling. Those specific tasks are spread over multiple locations and involve inputs from other industries. Raw materials and extractive industries appear to be source for transforming materials to

finished products for almost all manufacturing industries value chains (OECD, 2012). Multinational corporations organize their value chains through (offshore) and/or outsource of production with foreign direct investment. Therefore, degree of participation in the global value chain is related to the level of foreign direct investment. Greater value chain participation should imply higher FDI and vice versa. So far, many studies on GVC participation have focused on South East Asian countries, regardless of the fact that East European countries show comparable levels of participation.

In order to test the hypothesis that higher global value chain participation is related to increase of the foreign direct investment, this study applies fixed-effect estimations with several independent variables. The main variable of interest is GVC participation rate in transition economies. Foreign direct investment is the main independent variable variable of interest. FDI stock data is preferred based on the following considerations. FDI stock data are used as an alternative of FDI flows data, which are much more volatile. FDI flows are more volatile due to the economic shocks, and also very dependent on individual large-scale investment decisions. On the other hand the interest of the thesis is long term investment and how much FDI in total CEE countries have attracted

Other explanatory variables included in the empirical model, suggested by the theoretical and empirical literature, are: market size, index to final demand, economic openness, and tariffs. The dataset are retrieved from the OECD investment statistics, OECD trade in value added, Trade Analysis Information System (TRAINS) and other sources for the period 1995-2011.

Larger market size tends to increase rate of forward participation in global value chains, as it increases the country's capacity to produce intermediate inputs and export

them to foreign markets. Also, larger market size tends to lead to lower backward participation, as the country tends to source less from abroad (Marel, 2015).

Change of the share of manufacturing sector (industrial structure) is also often associated with change in the rate of global value chain participation. For instance, Stöllinger (2013) states that a negative effect of increased manufacturing rate on global value chains participation may indicate that international production sharing may involve offshoring of activities that previously were done domestically (decreased forward participation). Positive change in increased manufacturing share of global value chain may indicate that activities that lead to creation of higher value added are compensated by negative structural effect (increased backward participation).

As FDI is the main vehicle for development of GVCs, openness to investment is another factor of GVCs participation rate. The level of entry barriers to trade and investment is another classical factor for integration to GVCs (Marel, 2015). Oppositely, any barrier to trade as tariff has a negative impact on participation in global value chains. In general, liberalization of trade contributes to countries, especially developing countries, in terms of entry into foreign markets, diversification of exports, and transfer of new skills, knowledge and technology, all of which are considered as key factors for productivity enhancement and growth (UNIDO, 2004). In particular, Johnson & Noguera (2012) provide first evidence of the impact of liberal trade on global value chains through their gravity equation studies of free trade agreement formation.

Higher GDP per capita is related to higher forward and backward participation. Usually developed countries tend to source more from abroad and as a result to have higher share intermediate products of their exports (Kowalski *et al.* 2015).

5.4.2 Market Size (GDP as a proxy)

The economics literature generally regards market size to be fundamental determinant of engagement in international trade, attraction of foreign direct investment and participation in global value chains.

Integrating in the global value chain reveals that a country trades either in intermediate inputs that are imported from abroad (backward participation share) or in intermediate inputs that are produced domestically and exported to third countries (forward participation share). Backward and forward participation constitute an index of position in a value chain. In the case of backward participation, the index shows the level of imports (which are used in other countries' exports) whereas in the case of forward participation, the index show the level of exports that are domestically produced and shipped to third countries. Participation in global value chains involves both sides of production – imports and exports. According to Marel (2015), sourced inputs from abroad are equally important as they reveal both the type of GVC that the country can join and the sources of technological transfer which can potentially create higher value added growth.

The larger the domestic economy, the less backward engagement in vertical integration, as the country has its own resources and trades less in the global value chain context. As for the forward participation index, large economies have higher forward participation in the global value chains. Usually small economies (Slovenia, Latvia and Estonia) have greater participation in global value chains, as they rely on imports of intermediate inputs. Poland is the largest economy among CEE countries, with a GDP of 389 billion euros in 2012 whereas Estonia had the smallest economy with a GDP of 18 billion euros.

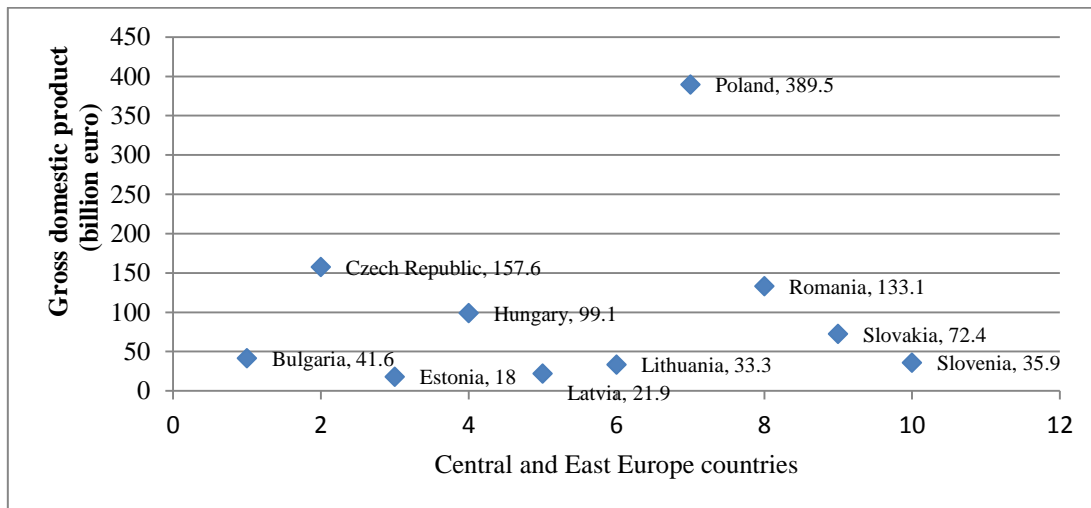


Figure 5-2 Real gross domestic product, 2012 (billion euros)

Note: Data from Eurostat statistics (2016)

5.4.3 Index Distance to Final Demand

Fally (2013) and Antras et al. (2012) introduce the upstreamness indicator, which represents the distance from final demand. This indicator shows how many stages certain industries and products have to the final consumption stage. In the case that there is one single stage of production the indicator will be 1. The further a product is from final consumption, the more upstream the classification of that particular sector. This means that the more stages of production the highest engagement in the GVCs. Over the last decade many production stages were outsourced, which increased the upstreamness of industries and the participation rate in the GVC. Baker and Miroudot (2014) explained what every outsourcing of production inputs, move backward and divide the production stage which increase the index distance to final demand. For example China has one of the highest stages of production because of processing trade and engagement in the assembly stages.

In essence, since 2000, CEE countries increased their distance to final demand which imply deepening the fragmentation in the GVCs. Czech Republic which has high economic size and natural resources had highest rate of the index, which can be interpreted as integration in the beginning stages of GVCs and production of inputs. Poland and Lithuania had lowest rate the indicator, suggesting that those countries are less specialized in the initial stages of production.

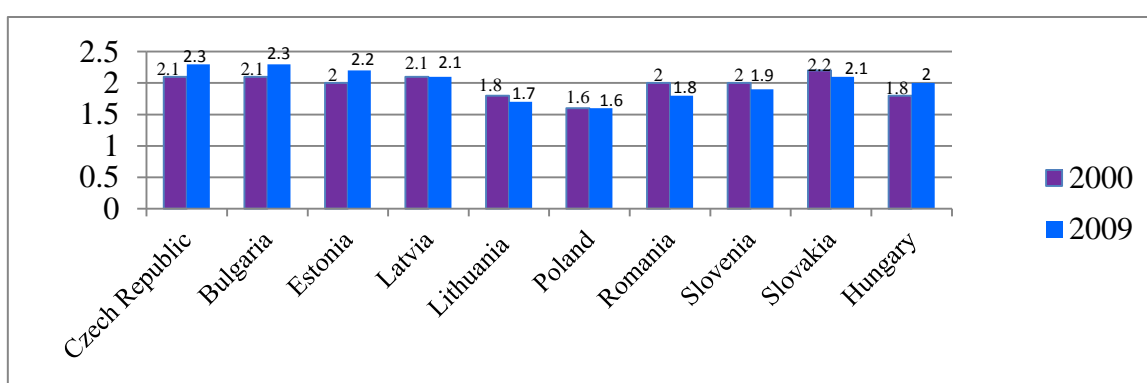


Figure 5-3 Index of distance to final demand

Note: Data retrieved from Trade in Value Added indicators, OECD on November 16, 2016

5.4.4 Economic Openness

Another factor that has a positive impact on global value chain integration is country's economic openness, measured as the ratio of the sum of country exports and imports to country GDP.

$$TGDP = (\text{exports} + \text{imports})/\text{GDP}$$

Greater openness should be positively linked with backward and forward participation, as more intermediates can cross borders. The data for exports, imports and GDP is taken from the World Bank development indicators (2016). Economic openness promotes foreign direct investment to export-oriented sectors and thus may increase a country's participation rate in a global value chain. Since 1990, all Central and East

Europe countries have democratic political systems and have successfully transitioned to open economies, though there are still differences in the degree of openness. Table 5-1 shows the extreme values of the trade to GDP ratio in CEE countries. Romania had lowest trade to GDP ratio in 2009, 80%, whereas Slovakia and Czech Republic had the highest trade to GDP ratio, 180% and 150% of GDP, respectively.

Table 5-1 Economic openness in 2009

Country	(X+M)/GDP (1995)	(X+M)/GDP (2009)
Romania	0.6	0.8
Poland	0.5	0.9
Slovakia	1.1	1.8
Czech Republic	1.0	1.5

Note. Own calculations based on World Bank Development indicators, retrieved on October 17, 2017

5.4.5 Tariff

For CEE countries, applied tariffs under the WTO's most favored nation's principle are about 5-10% range (TRIANS, WTO, 2016). Since 1995, there is gradual decrease of the tariffs and other trade restrictions for CEE countries.

In general, tariffs are used on one hand to protect primary sector and on the other to promote downstream industry. Restricting export is broader economic development strategy often used from developing or transition economies, known as "import substitution industrialization". This theory suggests replacing the imports with only domestic production which is considered to decrease foreign dependency of foods and primary industries. With respect to the trade in the global value chain tariffs has a direct negative impact on the import of intermediate products. In addition and more important, protection measures that restrict imports will have a negative impact also on the exports and participation in the global value chain.

5.4.6 Other variables

The level of industrialization is considered as another important indicator of global value chain participation (Kowalski, 2011, Stöllinger, 2013). Kowalski, (2011) and Stöllinger, (2013) use the share in GDP of manufacturing sector domestic value added to compare industrial structure across countries.

The size of manufacturing sector is positively related to backward participation, and negatively related to forward participation. Backward linkages can refer to engagement of an individual country in simple assembly activities. On the other hand backward participation can refer to more sophisticated service activities. Developing countries tend to have higher forward participation in global value chains as they specialize in primary products (natural resources and extractive industries) which are used as inputs of foreign production.

Figure 5-4 shows the change in manufacturing share in GDP (on the vertical axis) for the period 1995-2011 (on the horizontal axis). The share of manufacturing sector is straightforward. It is the share of domestic value added in manufacturing sector in nominal GDP. Data show that there is a positive trend in manufacturing share since 1995 with a variation for individual country. Hungary, Lithuania, Latvia and Slovakia gradually increased the share of manufacturing. Although in Czech Republic and Slovenia the share of manufacturing decline, it still remain one of highest in CEE countries (22% and 23%).

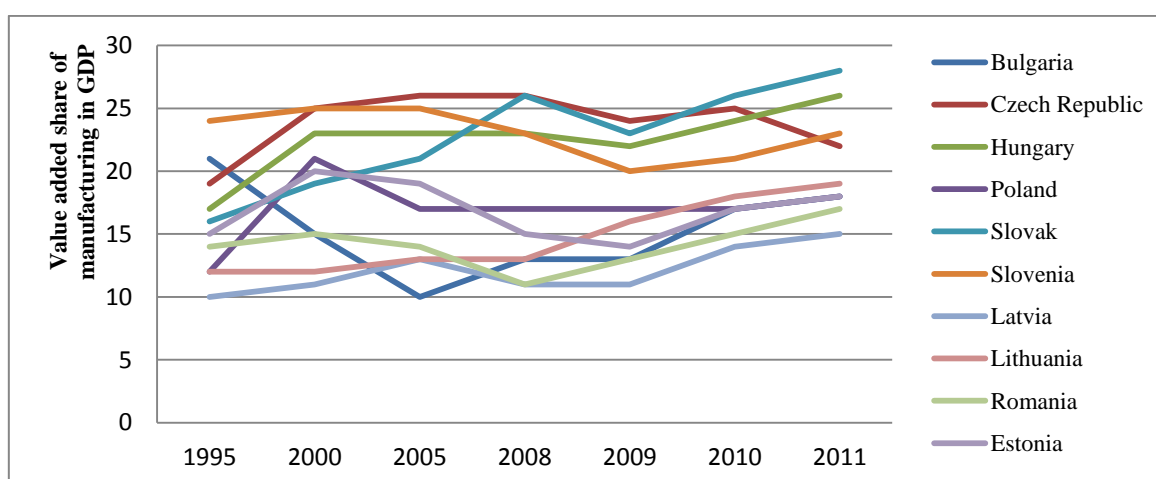


Figure 5-4 Value added share of manufacturing in GDP, 1995-2011

Note. Own calculations based on OECD Trade in value added, October 2015 release and World Bank GDP (million euros), retrieved on November 16, 2016

5.5 Empirical Model and results

Following theoretical literature predictions, I will first test whether global value chain participation depends on foreign direct investment with fixed-effect estimations.

Global value chain participation may be affected by other unobservable variables which are country-invariant or time-invariant, and are correlated with FDI inflows. Fixed-effect approach controls for the unobservable omitted variables in the regression model. Panel data analysis allows controlling for the time-invariant variables. Panel data examines the heterogeneity of individual cross-section units, which give more variability, less collinearity among the variables, more degrees of freedom and more efficiency (Baltagi, 2001). Random effect approach is not appropriate in this study as it omits time invariant unobserved variables, and treats all individual countries as having same characteristics.

The main source of the data is obtained from OECD, trade in value added indicators. The database covers 5 years 1995, 2000, 2008, 2009 and 2011. OECD derived those indicators from the input-output tables which describe inter-country, inter-industry flows of intermediate goods and services and origin of goods and services. Inter-country input-output tables are mainly based on data of national official statistics institutes as international bilateral trade statistics and also data from international organization. However, OECD made considerable reconciliation to correct for differences in National Accounts Statistics, national input-output tables and supply and use tables.

Data for the independent variable foreign direct investment stock is taken from the interactive database of UNCTAD. Tariff average weighted data is retrieved from the United Nations Conference on Trade and Development's Trade Analysis and Information

System (TRAINS) database and the World Trade Organization (WTO) integrated database. Information for the other control variables is given in the Appendix A.

First regression: In the first regression, the country and year fixed effect is captured by λ_{it} . y_{it} denotes participation in the global value chain participation rate, FDI denotes *foreign direct investment stocks, in time t and industry i*. The fixed model allows including omitted variables in the regression results. For instance, geographical characteristics, or other structural factors may cause an omitted bias in the model.

$$y_{it} = \beta_0 + \beta_1 FDI_{it} + \lambda_{it} + \varepsilon_{it}$$

1)

Second regression: In this model, fixed effect is used and control variables are added (1), T denotes *average weighted tariffs*, D denotes *distance to final demand, in time t and industry i*.

To control for the year and country effects differences, year and country fixed effect control variables are used. For instance, since 2002 gradual CEE countries accession to the European Union affect the attraction of more foreign investment, and also to increase of the participation of the global value chain. Since 2008 due to the financial crisis and economic downturn year, the participation in global value chain decreased.

$$y_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 T_{it} + \beta_3 D_{it} + \lambda_{it} + \varepsilon_{it}$$

(2)

Third regression: This regression estimated fixed effect with control variables, but without controlling for the year effect

$$y_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 T_{it} + \beta_3 D_{it} + \lambda_{it} + \varepsilon_{it} \quad (3)$$

For the estimation results, I expect positive coefficient for the foreign direct investment and all other control variables. Negative coefficient is expected only for the tariffs.

Regression analysis results are given below. Regression 1) is fixed effect model. Regression 2) is fixed effect model with control variables, tariff and index to final demand and regression 3) is fixed effect model with control variables but without year effect. The results project that FDI increase global value chain participation index. Imposed tariffs have a negative impact on the global value chain participation rate, at 10% significance level.

Regression 1 suggested that when there is one % increase in the level of the FDI stock, the participation rate in the global value chain in Central and East economies would increase with 0.013% points. The result is statistically significant at 1% level and the adjusted R² suggest that 0.568% of the variance of the global value chains rate is explained by this model. Results are comparable to finding of recent paper of World Economy Journal Galan and Fortuna (2019) where GVCs participation coefficient is 0.000312 . According to the new trade theory, multinationals separate production process into many production blocks and locate them in different places with lower factor prices. Given the lower labor and operational cost in CEE countries, multinationals from West Europe have

strong incentive to locate part of their activities in Central and East European countries. With vertical foreign direct investment, intermediate products cross border in order to be organized and combined to generate final outputs. Thus vertical investment increase the foreign content of domestic export through adding value added along the value chain and take advantage from the difference in the production costs as they can obtain some of intermediate products. In a way FDI increase trade between countries and increase participation in global value chain.

When adding tariff and index to final demand as control variables 2), the FDI stock coefficient increased slightly to 1.140. Tariff average weighted showed a negative impact on the participation in the global value chain, at 10% significance level (see table below). When there is one % increase in the imposed tariff, the participation rate in the global value chain in Central and East economies decreases with 0.899 points (2). The tariff coefficient is larger if year effect is dropped from the regression (3). One % increase of the tariff leads to 1.509 decrease of the participation rate in the global value chain.

Policy factors also plays important role for multiple border crossing. High tariffs tend to decrease participation rate in the global value chain because firms have high trading cost in order to import the intermediate product. For European countries tariffs are relative low, but in the context of the value chain their effect is magnified. Tariff which are applied on imports make foreign content of export more costly. Thus, the final product is less competitive on the international markets because of the higher price. Tariffs and the other non-tariff barriers impact of the investment decision for the firms involved in the global value chain whether to invest or whether to maintain the investment.

Table 5-2 Regression Coefficients results for the impact of FDI on the Participation in Global Value Chain

Dependent variable – Global Value chain Participation Index			
Fixed effect			
CEE countries	Eq. 1)	Eq. 2)	Eq.3)
Log (FDI stocks)	1.138*** (0.608)	1.140*** (0.583)	1.398*** (0.499)
Tariff		-0.899*** (0.439)	-1.509*** (0.360)
Index distance to Final demand		0.488 (9.991)	5.888 (9.991)
R-squared	0.568	0.568	0.437
Number of observations	50	50	50
Robust standard errors	Y	Y	Y
Controls		Log (GDP), Openness	Log (GDP), Openness
Fixed effects	Year effect, Country effect	Year, Country effect	Country effect

Note: Standard Errors are given in Parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Some of the control variables in the regression estimations as GDP, share of manufacturing and openness to foreign direct investment do not have a significant effect on the participation of the global value chain.

It should be noted that the dataset in this research, is taken from OECD-WTO January 2013 database, with a further release on May 2013 which is preliminary and is subject to further updates every year.

OECD conciliates trade statistics with national accounts across different countries using strong assumptions. One of the main assumptions for creating the matrix is that the share of a given import consumed by an industry is the same for all industries in the country.

5.4.1 Robustness checks:

I tested the main variables in the regression model for multicollinearity with Stata. For the random effect regression model, I use the variance inflation factor (VIF). The calculation of the VIF shows that variables of interest are over 1 which is an indicator for no multicollinearity.

Variable	VIF
GDP	1.21
Tariff average rated	1.20
FDI stock	1.05
Index to final demand	1.03

Source: own calculations, Stata

*Results over 5 are considered as having multicollinearity problem

Conclusion

Foreign direct investment has changed the structure of international trade and increases fragmentation of production and participation rate in the GVC over the period 1995-2009. A growing number of scholars' theorized global value chain concept but few researches give quantitative analysis of the interconnectedness between trade and investment. This study, through quantitative approach, is one of the few studies for CEE Europe which study the relationship between foreign direct investment and participation in global value chain. In other words foreign direct investment is important channel for creating domestic and foreign value added and fragmentation of production inclusion. The causal relationship between GVCs and FDI open important questions about domestic trade policies and emphasize on the importance of FDI policies for development. Any protectionism measures as tariffs which concerns importing intermediate goods easy and efficiently, will have negative impact not only on the level of FDI inflows but also will affect trade nations global value chain participation.

Chapter 6. Measuring Revealed Comparative Advantage with Trade in Value

Added

6.1 Introduction

Michael Spence, a Nobel Laureate in Economics noted that no country has a comparative advantage for producing iPhones, but many countries can specialize in making parts and components, or assembling them (World Bank, 2013). Fragmentation of production extend beyond electronic appliances to other industries from manufacturing sector where countries specialize in a particular task and export intermediate products as part of global value chains.

Many economists and researchers noticed that in the presence of GVCs trade statistics are less effective for measuring the actual contribution of exports and imports for individual countries, as the total value added of a single product is usually created by firms located in various countries. Until now calculations of comparative advantage and patterns of trade specialization have been based on gross export data, which mistakenly assumes that all the value added of exports is produced by the exporting country. As a result, traditional analysis leads to exaggeration of individual country exports by adding foreign content to domestic export, which can distort overall trade results. For instance, in terms of gross exports, China has a comparative advantage in computer, but in value added this is no longer the case. Value added in trade indicates that China instead has a comparative advantage in assembling computers (Johnson, 2014). By using the definition of revealed comparative advantage, Koopman et al. (2014) give examples which show how comparative advantage can reverse its patter by applying trade in value added. In the

age of GVCs, trade in value added gives a clearer picture for comparative advantage of the countries (WTO, 2013).

Central and East European countries export specialization has been thoroughly examined with gross trade data. Carraresi & Banterle (2008) measure EU competitiveness with RCA gross trade indices. Halilbašić & Snježana (2017) estimate RCA index of South East European countries with respect to their EU export. Ferto (2017) investigates the changing pattern RCA of CEE countries.

In order to resolve the inconsistencies with distorted trade data, this thesis adopts a new approach to compute revealed comparative advantage based on trade in value added data. This chapter explores comparative advantage in ten Central and East European countries, for 42 industry groups, and attempts to answer two questions: How does revealed comparative advantage differ when measured in gross exports and value added in exports? How do individual sectors RCAs differ in gross and value added measurement and how do those measures change over time?

6.2 Rise of Global Value Chains

GVC's analysis, developed from the global commodity chain concept, was introduced in Gereffi (1994), a study of the United States large retailers and brand name firms which shape overseas production networks. Gereffi's case study of the apparel industry emphasizes the commodity chain as an organizational feature, a buyer driven commodity chain rather than a producer driven one. Porter (1985) proposed global value chains analysis and described how value is created along goods and services in the production chains. In U.S. international production network amplifies after 1985's with textiles and apparel industry, whereas in Central East Europe the process of vertical

integration began after 1995 with the end of Soviet Union dominance. European integration and accession has created single market which reduced the cost of trade and accelerates CEE countries integration in West Europe global supply chains.

The rise of GVC's is not a new phenomenon. Merchandized from Turkey (Assyriau at that time) four thousand years ago imported fabrics from Iraq (Assur) in order to produce apparel which was traded in that region (World Bank, 2019). Today the impact of GVCs on the world trade has increased (Ravenhill, 2011). Between 1990 and 2008 the world trade to GDP ratio increased from 16 to 27%, respectively. Sturgeon & Gereffi, (2009) found that increased intermediate trade within global production networks contributed to this rapid world growth in trade. Trade in intermediate goods and services is considered to be positive for economic growth, as it contributes to the transfer of technology across borders and allows countries to specialize in producing goods and services in which those countries have a comparative advantage (Haltimaier, 2015). Since 1990, a significant decrease in trade barriers and transportation costs, along with development of information and communication technologies (ICT), has been moving forward global value chain.

Instead of countries, companies have played a central role for GVCs. Multinational companies decide where to source production, which suppliers to use and what to produce themselves (Sydor, 2011). MNCs and their affiliates organize and coordinate the production process regionally or globally, taking advantage of the possibilities of specialization which GVCs provide. Given the increasing importance of intermediate inputs in international trade and increased intra-firm trade, countries no longer rely entirely on domestic resources to produce goods and services and export them to the rest of world. Today, for a given product, many countries can be involved in

production activities such as design, component production, assembly or marketing. This allows countries and firms to enhance their competitiveness by specializing in particular tasks or activities, even though they have no comparative advantage in production of the product.

There are multiple approaches, which aim to present international production network (Cingolani, Iapadre & Tajoli, 2018). Hummels et al. (2001) & Koopman (2003) first suggested a theoretical approach for calculation of trade in value added, which main advantage is overcoming double-counting. Initially, the approach is based on the availability of input-output tables, combined with trade data. With new country data sets and refine methodology, Koopman et al. (2014) and Timmer et al (2014) further elaborate the approach. Several empirical studies showed the implications of value added measurement for trade analyses and comparative advantage. (Linden et al., 2007; Xing & Detert, 2010; & Kraemer et al., 2011). The results of these studies show that conventional measures of gross value may give biased estimations of exports and imports of international trade and also of country comparative advantage.

Another strand in the literature which pursues representation of the impact of international production network on the export is case studies with firm-level micro data. Popular iPhone example illustrates the significant impact of global value chains spread for trade imbalance (Xing & Detert, 2010). Despite great analytical and measurement presentation of the structure of production of particular product, replication of the study on a broader scale is not possible.

In order to estimate international competitiveness with trade in value added, I employ classical indicator of revealed comparative advantage (RCA), elaborated by Balassa, (1965). As mentioned, the main strands of the literature which use trade in value

added focus on case study on a product level. However, broader regional analyses on the comparative advantage on the industry level with trade in value added approach are scarce. Therefore, on a systemic level, this study attempts to show the importance of trade in value added for revealing international competitiveness. Employing an empirical approach, this study investigates the gap between trade statistics and trade in value added with respect to determining of export capabilities of the target countries.

Central & East European countries are highly engaged into production networks mostly in manufacturing and services GVCs sectors. In the last 25 years those countries have experienced a profound transition to a market economy, and have undertaken reforms towards reintegration into the global economy, enterprise restructuring and trade liberalization (Timer et al., 2013). Collapse of the communism and European Union accession redirect CEE countries trade from Soviet Union toward Western European countries. Driven from decreasing production cost, Western foreign companies relocate part or whole production to the new EU member countries. Initially, FDI is characterized with horizontal investment in low value added activities as real estate and service sector. Eventually, diversification of the types and increase of the flows of FDI toward CEE countries lead to gradual engagement in the global production network. Today the region of CEE is the one of the most fragmented trade center due to geographical proximity as well as free of movement of capital and goods.

6.3 Importance of Measurement with Trade in Value Added of RCA

Efforts to explore comparative advantage have led to the establishment of the revealed comparative advantage index, which is widely used for determining competitive sectors of economies (Balaasa, 1964). As we emphasized at the introduction, empirical

studies of comparative advantage mostly use gross export data for measurement, regardless of the fact that this exaggerates the export capacities of countries due to the double counting of intermediate goods.

In the context of European Union countries, there are several studies that have explored the RCA, based on conventional trade statistics. For instance, Khatiba (2008) examined Kazakhstan's competitiveness vis-à-vis world exports to the EU-27 and intra-exports between the EU-27 member countries. The results revealed that although Kazakhstan had comparative advantage in a number of sectors, competitiveness decrease in almost all sectors (Khatibi, 2008). Ferto and Hubbard (2008) investigated the advantage of Hungarian agriculture in relation to European Union countries. The results suggest that there is a weakening of the level of comparative advantage in Hungarian agriculture in comparison to other European countries. According to the study, government intervention and competitiveness tend to be inversely related, which suggest that comparative advantage could become even more competitive if markets were less distorted.

In the last two decades with the expansion of GVCs foreign content of export increased which has made traditional approaches to interpretation of export competitiveness misleading. According to De Backer and Yamano (2011) trade data seem to show the increasing importance of GVCs only in an indirect way but the existing trade data on gross export doesn't show the actual contribution or value added of the countries.

There has been extensive theoretical discussion of GVCs aimed at explaining this inconsistency, although empirical studies are few. One of exception is studies of the iPod (Dedrick et al., 2010) and iPhone (Xing & Detert, 2010) which illustrate on the product level the pervasive effects GVCs have on interpreting export.

This chapter analyses and compares CEE countries revealed comparative advantage using gross trade data (RCA1) and domestic value added content of gross export (RCA2). There are two reasons why gross-based data are an inappropriate indicator of the position of countries within international production networks. First, a country's competitiveness, measured in gross values, reflects not only domestic but also other countries' production capabilities, which makes export data an inappropriate indicator for country competitiveness (Baldwin, 2008). For example in 2011, on average, foreign share of EU country gross export was between 30 and 50% (OECD, 2013). This inflates export statistics, as the foreign share of export is not subtracted from the country export data. As a result of this measurement, trade statistics capture only the flows of the final products, while the role of foreign intermediates is disregarded. This creates significant bias, especially in comparisons of international position and competitiveness of countries. The second reason is that companies specialize in specific tasks, rather than in whole industries. For instance, in automobile industry, the production of a car requires more than 20,000 parts with the use of other support industries (as steel industry, electrical machinery), which further distort the picture of comparative advantage.

6.4. Components of gross export and Index of Production stages

6.4.1 Components of gross export

Koopman et al. (2013) decompose gross exports into domestic and foreign value added components. Domestic value added has four sub-components: 1) value added as final goods; 2) value added as exports in intermediate goods which are not processed for further exports; 3) value added exports as intermediates, processed for re-export in third countries; and 4) value added goods in exported intermediate goods that return home.

Foreign value added consists of other countries' domestic value in intermediates and is not included in domestic value added.

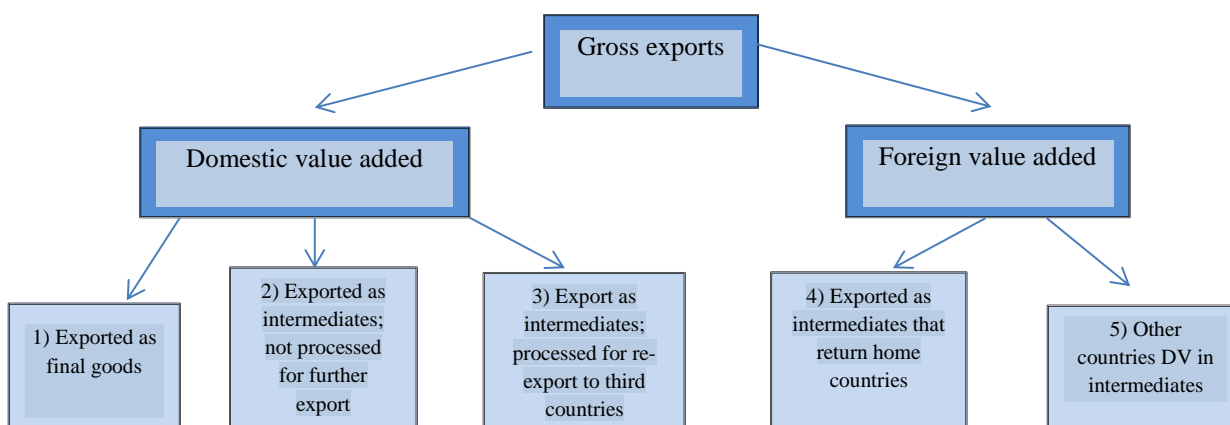


Figure 6-1 Gross export broken into value added

Source: Koopman et al. (2013)

Components 1 to 4 are given the value of exports created domestically, and component 5 includes value imported from another country. The participation index in the GVCs which is defined further is based on countries export decomposition in multi-stage production.

Figure 6-2 reports the CEE countries' share of domestic value added content of gross export for the period 1995-2011. On average, for all countries studied here, the share of domestic value added content of gross exports decreased from 83% to 71%. The world average of domestic value added exports also decreased.

As domestic and foreign value added of exports must be equal to one, any decrease in domestic value added means that foreign content of exports will increase.

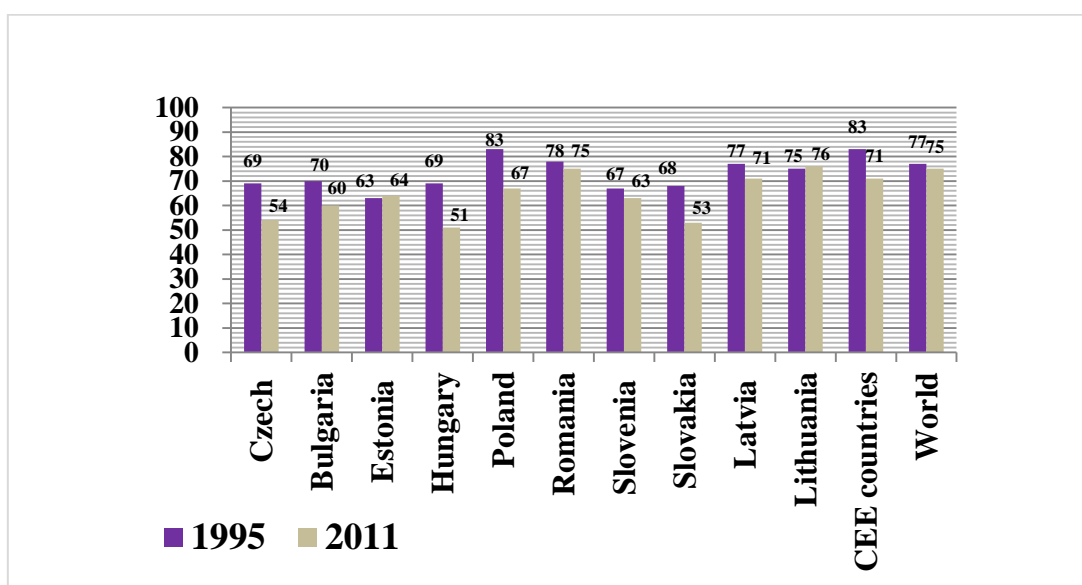


Figure 6-2 Domestic content of exports, CEE countries, 1995 and 2011

Source: OECD TiVA database, June 2013, author's calculations

The evolution of GVC and the increased importance of intermediate inputs led to the development of new approaches to measuring value added. Initially, Feenstra & Hanson (1996) used imported inputs shares of gross output and total inputs or exports to characterize GVC. However, this approach did not incorporate the values of imported inputs in countries' exports.

More recent research, such as Hummels, Ishii and Yi (2001) and Chen et al. (2005), introduced the concept of vertical specialization. Vertical specialization (or Participation rate) is an indicator which recognizes that goods are produced in stages and value is added by several countries. This indicator assesses the share of imported intermediates used in a country's export. What distinguishes vertical specialization from simple outsourcing is that vertical specialization requires imported inputs to be exported to third countries or country of origin.

By definition higher forward participation means relatively higher value added, as it shows the production of advanced parts and components which are sent abroad for assembling. Backward participation, seen in countries engaged in less skill-intensive activities, generates smaller value added for those countries. On average, the participation rate of CEE countries in GVC (OECD, WTO indicators) increased from 46 in 1995 to 54 in 2009. In contrast, for all European Union countries, this index was only 30 in 2009. Backward participation, (foreign value content of gross exports), is 12% for European countries and higher for Central and East European countries. This may indicate that CEE countries usually import higher-value added components from the euro zone and either assemble them or add additional components for subsequent export.

6.4.2 Production stages index

Another GVCs indicator is index of production stages. If GVC participation rate provide information about the country engagement in production sharing, the production stage index measure the level of engagement of particular industry (as automobile, transport equipment, electrical machinery industry) in the global value chains. The length of the value chain is the number of production stages involved in the entire production process. The minimum value of production stage index could be 1, when there is a single production stage. This number increases when inputs either from the same industry or from another are used (thus increasing the weighted average of the number of production stages). The product groups with the shortest production stage length are more difficult to integrate in international value chains as they use fewer intermediate inputs. Sectors with the lowest index of fragmentation include mining and quarrying, wholesale and retail trade, financial intermediation and business services. Usually, in extractive and service

industries, there is less fragmentation of production than in those which have sophisticated value chains.

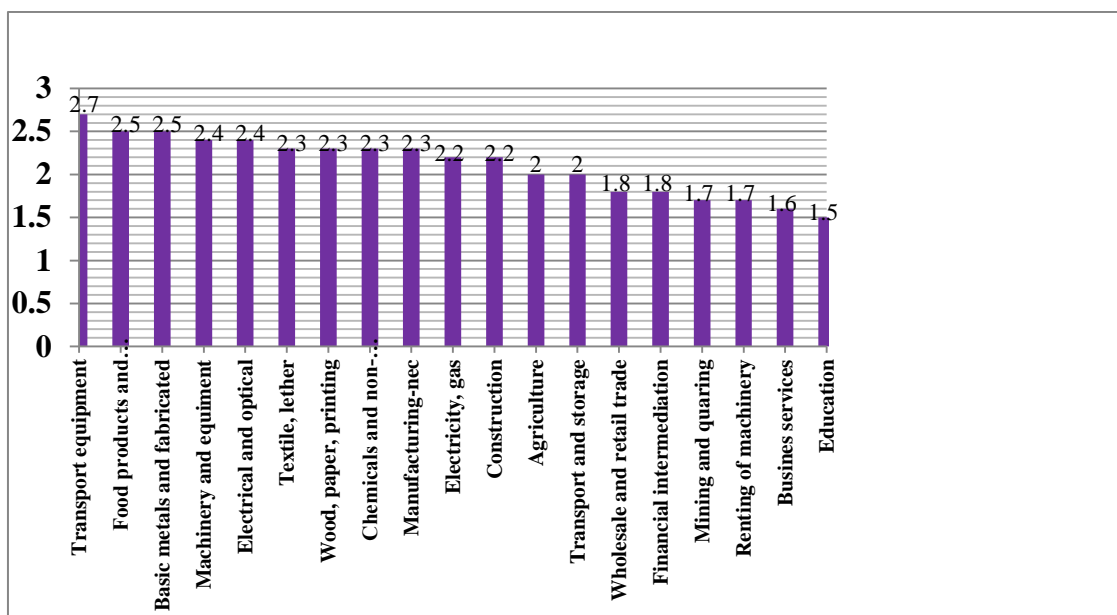


Figure 6-3 Index of number of production stages, selected industries 2009, EU

Note: 1 is the minimum value, i.e. when no intermediate inputs are used for goods/services
Source: OECD Indicators, May 2011

The sectors which have the longest production stages are transportation, food products and machinery and equipment. In those sectors, part of the production process could be situated abroad. Traditionally, the transport equipment sector uses the highest level of intermediate inputs (average of 2.7 production stages). For example, automobile production uses parts and components from many countries as intermediate inputs. The main intuition is that with other factors *ceretis paribus*, categories of economic activity which have longest production stages have also higher trade regionalization (Cingolani, Iapadre and Tajoli (2018) and participation in the global supply chains. Those sectors which are characterized with higher integration in the production network, on its hand also can reverse the pattern of their revealed comparative advantage.

6.5 Methodology

I will calculate RCA with both gross trade value added and trade in value added. The calculations refer to 42 industries, including 16 manufacturing and 14 services sectors for 7 years - 1995, 2000, 2005, 2008 2009, 2010, 2011 and 2015. Then, I will compare whether the two approaches lead to significant difference.

Computing Index of *Revealed Comparative Advantage* (RCA), using gross export

1) RCA gross export

$$RCA1 = \frac{x_{ij}/x_i}{x_{wj}/X_w}$$

where x_{ij} is exports of product j from country i , x_i is exports from country i , x_{wj} is total world exports of product j , X_w is total world exports. The numerator is equal to the proportion of country export in particular sector and the denominator is the proportion of the world export in particular sector

In general, when $RCA > 1$, it means that country has a revealed comparative advantage in the sector.

If $RCA < 1$, it means that country has a revealed comparative disadvantage in the sector.

Next, I will calculate RCA, but using domestic value added content of export

2) RCA Domestic Value added content of export

$$RCA2 = \frac{XV_{ij}/XV_i}{XV_{wj}/XV_w}$$

where, XV_{ij} is domestic value added export of sector j from country i , XV_i is domestic value added export from country i , XV_{wj} is total world domestic value added export of sector j , XV_w is total world exports in terms of domestic value added exports.

In general, when $RCA > 1$, it means that country has a revealed comparative advantage in the sector in terms of trade in value added.

If $RCA < 1$, it means that country has a revealed comparative disadvantage in the sector in terms of value added.

6.6 Results

6.6.1 Comparison of RCA index in terms of gross value added and domestic value added for all CEE countries.

As the Balassa index of revealed comparative advantage is calculated in terms of gross export data (RCA1) and value added data (RCA2), the results are expected to be different. A difference between computations of the Balassa index of RCA1 and RCA2 indicate that the traditional statistical measurement inflates the results of comparative advantage due to double counting and highly integration of CEE countries into value chains. The results confirm the importance of trade in intermediate inputs (foreign content of export) for measurement of revealed comparative advantage as suggested by the OECD (2013).

I have selected representative results which show index RCA1 calculated with gross export and RCA2, calculated with value added export for nine manufacturing industries in the CEE countries in 2011. In total, calculations of RCA1 and RCA2 are

estimated for 42 sectors and 10 countries for the period 1995-2015, which are given at the Appendix. The selected results, given below, are classified in three groups.

Group 1 consists of three industrial sectors: transport equipment, electrical machinery and motor vehicles. For group 1 the results of the index of RCA2 are of most significance given their consistency of changed pattern (compared to RCA1) for countries in the sample, for the time period. Two of these sectors== transport equipment and electrical machinery and apparatus, n.e.c.--also had high shares of foreign content of exports (see Appendix). For the transport equipment sector, CEE countries have revealed comparative advantage when measured in gross trade but have no revealed comparative advantage when measured in value added trade.

For Poland (table 6-1), the index of RCA1 for transport equipment in 2011 is 3.05, suggesting that the country has revealed comparative advantage in that sector. However the index of RCA2 (based on value added data) does not suggest revealed comparative advantage. The index for RCA2 for Poland is 0.92, which is < 1 , a result that projects that the country does not have comparative advantage in that transport equipment sector.

For Hungary, the Balassa index for electrical machinery does not show revealed comparative advantage as the RCA1 index is 0.59, which is < 1 . On the other hand for Hungary in 2011 Balassa index for RCA2 shows revealed comparative advantage. The index of RCA2 is 2.09 for 2011 which shows competitive position of electrical machinery on the international markets.

For Slovenia, Balassa index of RCA1 is 0.76 which suggests no revealed comparative advantage of motor vehicles on the international markets. For the same year Slovenia shows high competitive position in electrical machinery (RCA2 index is 1.15).

For Czech Republic, the findings for electrical machinery sector in 2015 suggest that is highly competitive as corresponding index of RCA1 is 1.06. However for 2015 the result is not confirmed by value added computations as RCA2 index is 0.66.

Group 2 consists of: pulp and paper, rubber and plastic bags, machinery and equipment, total manufacturing, paper products and basic metals. For group two, (table 6-1) in 2011 the index of revealed comparative advantage for these four sectors also shows different results between RCA1 and RCA2. However in these finding (group 2 in 2011) the difference between the index of RCA1 and RCA2 is not consistent over all countries and years. Pulp and paper industry is resource and energy intensive and is a very significant component of Central and East European countries economies.

Lithuania is highly competitive in the pulp and paper sector export because the RCA1 index is 4.80. In reality, revealed comparative advantage measured with export trade data, show less competitive RCA1 (index is 1.91).

Lithuania index of RCA1 for rubber and plastic bags does not show revealed comparative advantage in 2011 as index of RCA1 is 0.80. However, the index of RCA2 shows revealed comparative advantage as corresponding index of RCA2 is 1.63 which indicates competitive position of the sector on the international market. For machinery and equipment sector, Lithuania index of RCA1 is greater than 1. However the index of RCA2 is less smaller than one (RCA2 is 0.97).

Slovakian index of RCA1 for total manufacturing, shows revealed comparative advantage in 2011 (the index of RCA1 is 1.10). Contrary, the Balassa index of RCA2 does not show revealed comparative advantages (the index of RCA2 is 0.29). In 2015, index of RCA1 for paper products does not show comparative advantage but the index of RCA1 shows revealed comparative advantage (RCA1 is 1.38).

Group three consists of the following sectors: other non-metallic mineral products and manufacturing and n.e.c. For group three, (table 6-1) in 2011 other non-metallic mineral products and manufacturing, nec, have difference more than > 1 in the index of RCA1, compared to the index of RCA2.

Lithuanian's RCA1 index is 4.87 which is significantly higher than RCA2 index which is 1.87 in value added. In the manufacturing sector, n.e.c. Slovenia RCA1 index reached to 1.81 in gross export and RCA2 index in value added is 2.60. For 2015, Poland had revealed comparative advantage of woods and paper which is 1.18 in gross exports, compared to 1.09 in value added calculations.

Calculations based on gross exports and domestic value added of export produced contradictory comparative advantage patterns. According to the OECD, (2013) small countries usually have a high foreign share of export as they source more inputs from abroad (in comparison to large countries). Smallest European economies Lithuania and Slovenia are highly engaged in global value chains with the use of intermediate products which determines their comparative advantage.

Table 6-1 RCA2 indexes of CEE countries in selected industries (2011 and 2015)

Group	Industries	RCA1 Gross export	RCA2 Value added export	Difference of computation RC1 – RCA2
1.	Transport equipment (2011)	3.05 (POL)	0.92 (POL)	-2.13
	Electrical machinery (2011)	0.59 (HUN)	2.09 (HUN)	+1.5
	Motor vehicles (2011)	0.76 (SLV)	1.15 (SLV)	< 1
	Transport equipment (2015)	0.97 (HUN)	2.46 (HUN)	1.5
	Electrical machinery (2015)	1.06 (CZ)	0.66 (CZ)	0.40
2.	Pulp, paper (2011)	4.80 (LIT)	1.91 (LIT)	-2.90
	Rubber and plastic bags (2011)	0.80 (LIT)	1.63 (LIT)	+0.80
	Machinery and equipment (2011)	1.00 (LIT)	0.97 (LIT)	< 1
	Total manufacturing (2011)	1.10 (SLK)	0.29 (SLK)	< 1
	Paper products (2015)	0.53 (CZ)	1.43 (CZ)	< 1
	Basic metals (2015)	1.38 (CZ)	0.42 (CZ)	< 1
3.	Other non-metallic mineral products (2011)	4.87 (LIT)	1.87 (LIT)	- 3.00
	Manufacturing, n.e.c. (2011)	1.81 (SLOV)	2.60 (SLOV)	+ 0.80
	Woods and paper (2015)	1.18 (POL)	1.09 (POL)	< 1

Source: The author own calculations using OECD TiVA database, (2013)

In the case of Central and East European countries sectors which shows highest incompatibility of traditional measurement of revealed comparative advantage (RCA1) and revealed comparative advantage based on trade in value added (RCA2) are: transport equipment, electrical machinery and motor vehicles. Gross export includes foreign content which distort the results of revealed comparative advantage. As European countries became a production hub for transport equipment and electrical machinery products, these sectors are greatly affected by that distortion. Further analysis and results for these sectors are elaborated below.

6.6.2 Transport Equipment, Motor Vehicles and Electrical Machinery

Tables 6-2, 6-3 and 6-4 list estimations of revealed comparative advantages indicators for four years, 2000, 2008, 2011 and 2015. The transport equipment, motor vehicles and electrical machinery sectors results show consistent shift of the index of RCA2 in value added calculations when compared to the traditional export competitiveness index RCA1.

Transport equipment sector estimations are given in the table 6-2. For this industry group, ten countries from CEE (except Czech Republic) have revealed comparative advantage in gross export estimations. For instance in 2000, RCA1 index for Bulgaria is 2.65, Estonia is 2.31, Hungary is 2.74 and Lithuania is 3.44. Surprisingly, re-calculations of RCA2, using domestic value added of exports shows the opposite trend, which suggests that these countries does not have export competitiveness in transport equipment. Value added calculations for 2000 and 2011 followed the same reverse pattern for all countries in the sample (except Slovakia and Slovenia in 2000, and Czech Republic and Slovakia in 2011). In value added computations for 2000, RCA2 index suggests that Bulgaria, Estonia, Hungary and Lithuania do not have revealed comparative advantages in transport equipment. The corresponding index of RCA2 is 0.69, 0.63, 0.72 and 0.94, respectively. In 2008 RCA2 index in value added estimations for Lithuania, Poland, Romania and Slovakia is significantly lower compared to RCA1. In 2015, RCA1 index in transport equipment for Hungary, Poland and Romania does not suggest revealed comparative advantages. However, the index of RCA2 suggests that for the same year these countries have strong competitive position in export of transport equipment. In 2015 Slovakia had the highest RCA2 index (2.47) and Poland had lowest index of RCA2 in value added calculations (0.11).

The results for transport equipment confirm the hypothesis that high content of export can distort the RCA1 estimations. In fact, transport equipment is having high and sophisticated value chain where there is high share of foreign content of export as production of some parts and components has been offshored. Notably, for CEE countries, transport equipment had 51% foreign content of export compared to 40% world average. Producers can take advantage of differences in costs, skills and technologies across countries (OECD/WTO, 2013). There is a consistent pattern in the 2000 and 2008 results: the transport equipment sector is highly dependent on imports of intermediate goods, which inflate the results for RCA. CEE countries import parts and components from Western Europe, a sector highly engaged in the value chains using intermediate inputs.

Table 6-2 Gross export (RCA1) and Value Added (RCA2) indicator for Transport Equipment

Country	2000		2008		2011		2015	
	RCA1 and RCA2		RCA1 and RCA2		RCA1 and RCA2		RCA1 and RCA2	
	Gross export	Value added	Gross export	Value added	Gross export	Value added	Gross export	Value added
Bulgaria	2.65	0.69	2.25	0.64	1.53	0.43	0.09	0.24
Czech	0.19	0.42	0.98	0.96	1.04	1.02	0.97	2.46
Estonia	2.31	0.63	2.09	0.67	2.68	0.82	0.08	0.22
Hungary	2.74	0.72	2.13	0.65	1.75	0.55	0.90	2.46
Lithuania	3.44	0.94	3.67	1.05	2.67	0.79	0.03	0.11
Latvia	2.62	0.67	3.12	0.89	1.01	0.29	0.04	0.11
Poland	3.64	0.91	4.31	1.30	3.05	0.92	0.39	1.06
Romania	1.56	0.40	3.71	1.04	2.42	0.73	0.04	1.85
Slovakia	4.08	1.06	5.43	1.62	4.49	1.39	1.02	2.47
Slovenia	4.19	1.01	2.92	0.88	2.56	0.79	0.33	0.87

Note. Author calculations

Motor vehicles estimations of RCA for 10 countries for four years, 2000, 2008, 2011 and 2015 are given in the table 6-3. In motor vehicles products, the index RCA2 increase or reverse (compared to the RCA1 index calculations). RCA1 index in 2000 does not show revealed comparative advantage for 10 CEE countries. In 2000, the index of RCA2 for Hungary, Lithuania, Poland, Slovakia and Slovenia is higher than one which indicates strong competitive position for motor vehicles. In the years 2000, 2008 and 2011, motor vehicles index of RCA2 showed higher estimations in comparison to gross export RCA1. This tendency of increase or reverse of RCA2 continues also in 2008. For example in 2008, RCA1 for Lithuania and Latvia increased from 0.86 and 0.84 to 1.17 and 1.15 for the index of RCA2, respectively. In year 2015, the results of revealed comparative advantages are lower in the value added estimations. Only for year 2015, motor vehicles RCA1 index in value added are similar to the RCA2 in gross export data calculations.

Poland, Slovakia and Slovenia had consistent reversal of the index of revealed comparative advantage for the value added calculation for three years of estimations: 2000, 2008 and 2011. The results of the RCA1 in gross exports for 2000, 2008 and 2011 suggest opposite trend, revealed comparative advantage smaller than one. For 2011 the index of RCA1 for, Lithuania, Poland and Romania suggest revealed comparative advantage. The index of the revealed comparative advantage for Lithuania, Poland and Romania in value added is 1.0, 1.16 and 1.01 respectively. However, revealed comparative advantage index in gross trade is 0.66, 0.76 and 0.66.

Stronger position of the index of RCA2 in the value added in the motor industry than official data again suggest high level of foreign direct investment in that sector and high participation in the global value chains. In the last 20 years Western and Asian

automotive companies invested in CEE countries, creating automobile clusters in the region (Labay et al., 2013). For instance, FIAT invest in Poland (1992), Volkswagen in Czech Republic (1991), Audi, Opel and Suzuki in Hungary. The results of RCA2 index with trade in value added confirm empirically motor vehicle sector competitiveness and export potential of CEE countries.

Table 6-3 Gross export (RCA1) and Value Added (RCA2) indicator for Motor Vehicles

Country	2000		2008		2011		2015	
	RCA1 and RCA 2		RCA1 and RCA2		RCA1 and RCA2		RCA1 and RCA2	
	Gross export	Value added export	Gross export	Value added	Gross export	Value added	Gross export	Value added
Bulgaria	0.62	0.88	0.56	0.76	0.39	0.54	0.28	0.25
Czech	0.51	0.52	1.25	1.24	1.46	1.45	3.84	3.44
Estonia	0.53	0.82	0.58	0.83	0.64	0.94	0.29	0.28
Hungary	0.68	1.00	0.59	0.85	0.51	0.79	3.70	3.48
Lithuania	0.62	1.05	0.86	1.17	0.66	1.00	0.09	0.10
Latvia	0.61	0.87	0.84	1.15	0.18	0.27	0.11	0.10
Poland	0.78	1.12	1.06	1.55	0.76	1.16	1.34	1.28
Romania	0.29	0.41	0.96	1.29	0.66	1.01	1.35	1.28
Slovakia	0.96	1.56	1.38	2.26	1.32	2.01	4.17	3.50
Slovenia	0.99	1.43	0.77	1.10	0.76	1.15	1.35	1.23

Note. Author calculations

Electrical machinery gross and value added revealed comparative advantages in selected years 2000, 2008, 2011 and 2015 are given in the table 6-4. The findings does not suggest strong competitive position in export of electrical machinery as RCA1 indexes are < 1 . In all years, 2000, 2008 and 2011 RCAs, based on gross export are less than 1, except Czech Republic for 2000 and 2008. This implies that none of the CEE

countries have international competitiveness in electrical machinery sector. However, for my surprise, the index of comparative advantages with domestic value added results show strong competitive position for electrical machinery sector for the 10 CEE countries for years 2000, 2008 and 2011 (Bulgaria, Latvia and Poland are exception in the year 2000).

Hungary and Slovakia have major specialization in electrical machinery. For year 2011, Hungary and Slovakia RCA2 in value added amounted to 2.09 and 1.95 which demonstrate competitive position on the international markets. RCA1 index shows no comparative position as revealed comparative advantages is 0.59 and 0.57 respectively. Results for 2000 and 2008 are similar – reversed pattern of revealed comparative advantages RCA2 in comparison to the RCA1. For year 2015, CEE countries had lower index of revealed comparative advantages in value added estimations.

It is also very surprising to observe that for years 2008 and 2011, for electrical machinery sector all countries had revealed comparative advantages in the value added calculations (RCA2). Electrical machinery sector appears to be one of the most competitive sectors in the CEE countries.

According to Eurostat (2015) for CEE countries electrical machinery sector was the third largest industrial activity in 2006 in terms of its value added generated. The first and the second largest sectors are only manufacture of basic metals, fuel processing and manufacture of chemicals, respectively. Electrical machinery had 50% foreign value added of export compared to 40% world average.

Table 6-4 Gross export (RCA1) and Value Added (RCA2) indicator for Electrical Machinery

Country	2000		2008		2011		2015	
	RCA1 and RCA2		RCA1 and RCA2		RCA1 and RCA2		RCA1 and RCA2	
	Gross export	Value added	Gross export	Value added	Gross export	Value added	Gross export	Value added
Bulgaria	0.12	0.63	0.31	1.03	0.30	1.00	1.00	0.66
Czech	1.12	1.23	1.24	1.40	0.16	1.77	1.78	0.66
Estonia	0.58	2.83	0.40	1.37	0.43	1.42	1.19	0.34
Hungary	0.24	1.23	0.61	2.16	0.59	2.09	1.15	1.14
Lithuania	0.31	1.57	0.34	1.13	0.31	1.00	0.38	0.27
Latvia	0.19	0.93	0.42	1.39	0.46	1.56	0.39	0.22
Poland	0.13	0.69	0.37	1.30	0.40	1.36	0.31	0.71
Romania	0.39	1.98	0.47	1.63	0.46	1.66	1.92	0.83
Slovakia	0.35	1.80	0.43	1.51	0.57	1.95	1.32	0.70
Slovenia	0.31	1.67	0.29	1.08	0.48	1.73	0.83	0.78

Note. Author calculations

6.7 Evolution of the Revealed Comparative advantage index in value added (RCA2)

To examine the dynamic changes of comparative advantage of CEE countries, this section presents findings for only RCA2 indices of CEE countries, for four years: 1995, 2008, 2011 and 2015. Table 6-5 shows estimations of RCA2 with trade in value added. I examine international competitiveness in eight main manufacturing sectors: food, beverage and tobacco, textile and textile products, basic metals, fabricated metals, chemicals and non-chemical products, manufacturing - nec, recycling, motor vehicles and electrical machinery.

In 1996, CEE countries have increased their specialization in a resource and labor-intensive industries. Industrial activities follow STAN classification by OECD which is based on the International Standard Industrial Classification (OECD, 2012). Food and beverage sector include rice and flour milling, oil and sugars refining, dairy products, alcoholic beverage and soft drinks (STAN classification). Lithuania and Bulgaria had highest revealed comparative advantages which are 2.3 and 1.88, respectively in 1995. In the same year for food and beverage sector, Hungary and Czech Republic had lowest level of specialization with RCA2 smaller than one, 0.71 and 0.84, respectively. In 2011, food and beverage sector has revealed comparative advantage. For CEE countries, food production is traditional sector which attract significant amount of foreign investment: Lithuania increased RCA2 index in value added calculations in food and beverage from 1995 to 2015.

Textile industry is one of the most globalized labor-intensive sectors which provide developing countries access to GVCs engagements (Gereffi, 2002) According to STAN classification textile and textile products include: yarn, cloth production and leather. After the breakout of the Soviet Union, textile and textile products have taken large share of export production in CEE economies. From 1995 to 2011, RCA2 index suggests revealed comparative advantage for the group of CEE countries (except Slovenia and Hungary). In 2011, Romania had the highest level of the index of RCA2 which is 2.10, and Hungary has the lowest RCA2, which is 0.37. In 2015 CEE countries decreased their specialization in the textile industry (except for Bulgaria and Romania).

Basic metals sector is classified as a sector with medium technological intensity. According to the estimations CEE countries have competitive position on the international markets (except Estonia which has RCA2 is < 1). For fabricated metal

products, Slovenia followed by Poland has 2.39 RCA2, the highest index in 2011. In fabricated metal product, Bulgaria has the lowest comparative advantage RCA2 index in 2011 which is 0.96. In basic metals sector Latvia shifted the pattern of RCA2. In 1995 RCA2 index for basic metals does not show revealed comparative advantage and competitive position on the international market. In 2011 the index of RCA2 shows opposite trend of revealed comparative advantages. The index of RCA2 for basic metals decreased in 2015 (except for Bulgaria, Slovakia and Slovenia).

For the period 1995-2011 the estimations suggest that CEE countries kept their specialization in traditional labor-intensive products (as food, beverage and tobacco and textile and textile products) and resource-based industries (as basic metals and fabricated metals). In principle agricultural sector and other primary sectors have lowest level of GVCs participation rate – only 2% (World Bank, 2019).

Next, chemical and chemical products division is considered as high technology and high skill industry which encompass various products: pharmaceutical products, plastics, rubber, etc. Over 33% of total chemical products are further processed domestically/exported for the same production or to other sectors (Hanzl, 2001). Czech Republic, Poland and Latvia had highest level in revealed comparative advantage for the sector in 1995, 2008 and 2011. On the other hand, export specialization in Lithuania and Bulgaria were lowest with 0.91 and 0.58, respectively in 1995. Czech Republic, Poland and Latvia had revealed comparative advantages > 1 for 1995, 2008 and 2011. Lithuania and Slovakia had RCA2 in chemical and chemical products for 2015.

Motor vehicles sector belongs to medium and high-technology industry. The products range from motor vehicles to trailers and semi-trailers. In 1995, only Bulgaria, Czech, Hungary and Slovakia had comparative advantages in that sector. However value

added estimations in 2008 suggest that CEE countries increased export specialization in motor vehicles with Slovenia and Poland having the highest RCA2 of 2.26 and 1.55, respectively. In 2011, RCA2 again have reduced specialization (except Czech Republic and Slovakia).

Electrical machinery sector belongs to high-technology industry, manufacturing of electric motors, transformers, electrical lights and batteries. The sector is of central importance for European industrial development and productivity as to large extend all other industries depend on that sector. Calculations of RCA2 in value added show strong comparative advantage and increased specialization for the region. Hungary, Poland and Czech Republic have the strongest position in electrical machinery which increased from 1.32, 1.18 and 1.41, respectively to 2.39, 1.36 and 1.77, respectively from 1995 to 2011. The rest of CEE countries showed similar pattern of strong specialization in that sector.

The sector that shows clear increased specialization and improved comparative advantage, compared to the year base 1995, is electrical machinery and apparatus, n.e.c. Increased specialization – occurs when revealed comparative advantages at the industry level become more pronounced (Freudenberg M. and F. Lemoine, 1999). CEE countries' have received substantial foreign direct investment inflows mainly to manufacturing industry which explains increasing specialization and comparative advantage. However, in 2015 RCA in electrical machinery and apparatus, n.e.c. decreased (except for Hungary). Other sectors which show increased specialization are fabricated metals, manufacturing - n.e.c. and recycling.

These estimations of RCA2 with trade in value added show that in the year 2008, most of the countries reached the highest average index of RCA2. Since then, in 2011 and 2015 most of the sectors experienced decreased of export specialization. It is interesting

to note that strong position on international market in almost all of the industries reported for Poland, Latvia and Slovakia. Poland, as largest economy in the region increased its competitiveness and has RCA in all industries shown in the table (except in the base year for food, manufacturing, n.e.c and motor vehicles). In addition to the traditional industries, Poland increased specialization¹ in chemicals, manufacturing - nec, motor vehicles and electrical machinery. On the other hand, Bulgaria had specialization in a limited number of industries (as textile, basic metals and electrical machinery). A similarity in their specialization profile can be found between Latvia and Slovakia (high RCA in food, textile, fabricated metals, and electrical machinery).

Table 6-5 Selected sectors, RCA2 index in Value added estimations (1995, 2008, 2011 and 2015)

	<i>Year</i>	<i>BG</i>	<i>CZ</i>	<i>HU</i>	<i>EST</i>	<i>POL</i>	<i>LTN</i>	<i>LAT</i>	<i>ROM</i>	<i>SLV</i>	<i>SLK</i>
1. Food, beverage and tobacco	1995	1.88	0.84	0.71	1.76	0.99	2.28	1.50	1.28	0.95	1.12
	2008	0.90	0.98	0.89	1.68	1.05	2.31	1.52	1.09	1.16	1.16
	2011	1.44	0.98	0.95	1.80	1.19	2.62	1.77	1.10	1.20	1.13
	2015	1.45	0.92	1.06	1.17	1.65	2.03	1.25	0.51	0.47	0.53
2. Textile and textile products	1995	2.08	1.09	1.07	1.30	1.38	1.40	1.25	1.94	0.58	1.47
	2008	1.43	1.08	0.74	1.49	1.21	1.64	1.04	1.16	0.87	1.29
	2011	1.59	1.08	0.37	1.38	1.31	1.38	1.28	2.10	0.81	1.33
	2015	1.36	0.39	0.28	0.69	0.41	0.68	0.38	1.20	0.43	0.49
3. Basic metals	1995	0.70	1.21	1.03	0.94	1.00	0.82	0.53	0.78	0.99	1.45
	2008	1.09	1.56	1.04	0.89	1.40	1.12	1.07	1.58	1.49	1.50
	2011	1.26	1.51	1.04	0.93	1.43	0.90	1.17	1.49	1.37	1.55
	2015	1.75	0.73	0.44	0.07	0.66	0.03	0.28	0.60	1.19	1.39
4. Fabricated metal products	1995	0.93	1.60	1.46	0.88	1.47	1.32	1.32	0.79	1.02	1.77
	2008	1.47	2.30	1.65	1.82	1.83	1.74	1.26	1.78	2.06	2.05
	2011	0.96	2.46	1.67	2.06	1.95	1.39	2.13	1.91	2.39	2.15
	2015	0.90	2.57	1.12	1.90	1.13	0.75	0.66	0.67	2.71	2.36
5. Chemicals and chemical products	1995	0.91	1.05	1.18	1.01	1.49	0.58	1.41	1.06	1.05	1.22
	2008	0.69	1.15	0.91	0.88	1.13	0.08	1.39	0.91	0.85	0.91
	2011	0.90	1.02	0.82	1.01	1.37	0.09	1.31	1.17	0.93	0.84
	2015	0.71	0.29	0.95	0.29	0.69	0.93	1.00	0.33	1.47	0.40
6. Manufacturing, nec, recycling	1995	0.55	0.97	0.78	1.88	0.67	0.77	0.87	0.68	0.64	0.86
	2008	0.70	1.85	1.61	1.82	1.48	0.98	0.74	0.62	0.76	2.83
	2011	0.54	1.93	1.72	2.06	1.54	0.84	1.01	0.56	1.84	2.60
	2015	-	-	-	-	-	-	-	-	-	-
7. Motor vehicles	1995	1.12	1.70	1.27	0.74	0.71	0.78	0.60	0.30	0.93	1.63
	2008	0.76	1.24	0.85	0.83	1.55	1.16	1.14	1.29	2.26	1.10
	2011	0.54	1.45	0.79	0.96	1.16	0.94	0.27	0.96	2.01	1.15
	2015	1.39	3.34	3.45	0.28	1.28	0.10	0.10	1.28	1.23	1.23
8. Electrical machinery	1995	0.77	1.41	1.32	0.96	1.18	1.09	1.06	1.01	0.80	1.43
	2008	1.03	1.40	2.16	1.37	1.30	1.13	1.39	1.63	1.51	1.08
	2011	1.00	1.77	2.09	1.42	1.36	1.00	1.56	1.66	1.95	1.73
	2015	0.66	0.66	1.14	0.34	0.71	0.27	0.22	0.83	0.78	0.70

Note **1** Sectors with Revealed Comparative advantage (1995, 2008, 2011 and 2015)

6.8 Conclusion

Globalization has led to increased interconnectedness of economies and sophisticated production process divided into several stages across countries. GVCs proliferation posed various implications over developing nations, which cannot be ignored (Baldwin, 2018). Because of vertical integration of products, intermediate goods move across borders several times before final assembling. This phenomenon has made

traditional measurement of trade and competitiveness outdated. Trade data in value added availability allows us to analyze participation in global value chain and to identify the international competitive sectors from value added perspective. With this respect several conclusions can be made:

➤ Trade in value added analyses showed that from 1995 to 2009, all countries in CEE has increased significantly their foreign share of export, which is direct indicator for GVC participation.

On average foreign share of gross exports increased from 28% in 1995 to 36% in 2011, which is 8% increase. The world average foreign value added of export increased with lower rate, from 22% in 1995 to 28% in 2011, respectively. Hungary, Slovakia and Czech Republic had the highest foreign share of the gross exports, 50%, in 2011. For CEE countries in 2011, on average, foreign share of export reached about 50 per cent. High foreign content of export inflates the export capabilities of countries. As a result trade data inflate the result of the revealed comparative advantages.

➤ Consistently reversed pattern of RCA2 with trade in value added for 1995-2015 and Electrical machinery sector & Transport equipment sector & Motor vehicles sector

The results suggest consistent reversed pattern of RCA2 with trade in value added. These sectors are: electrical machinery sector & transport equipment sector & motor vehicles sector. Estimations of RCA2 in value added for electrical machinery sector suggests strong competitiveness on the international market (except 2015). In contrast, RCA1 with conventional export data suggest opposite trend, which does not show strong position on the international markets for electrical machinery. For transport equipment sector, majority of CEE countries does not have strong competitiveness in export (RCA2). Reversely, gross trade data calculation suggests comparative advantage for the countries

in the sample. For motor vehicle, trade in value added reversed the pattern of revealed comparative advantage with countries variation of RCA2 over the period 1995-2015.

➤ Other sectors changes in the pattern of RCA2 index with trade in value added calculations

Beside consistent reverse in the pattern of RCA2, other sectors demonstrate lower or higher estimations for RCA2 with trade in value added calculations. In 2011, pulp and paper sector & rubber and plastic bags sector & total manufacturing sector revealed comparative advantage shift when measured with TiVA. In 2011, for pulp and paper sector, Czech Republic had 1.46 RCA2 in value added, but RCA1 in gross export suggest lower index 0.14. For rubber and plastic bags, Lithuania RCA2 index in value added is 1.63 while RCA1 in gross export is 0.80 (2011). For total manufacturing, Slovakia RCA1 index is 1.1 in gross exports but RCA2 in value added is 0.29 which shows that the country does not have advantage on the international market. For 2015, paper products RCA1 index shift from 0.53 in gross export to 1.43 in value added computations.

Sophistication of export and fragmentation on production provide new opportunities for countries to engage in the global value chain. Based on the evidence from the analysis this study suggests that value added estimations lead to very different result in the assessment of the export capabilities of the countries. From policy perspective, trade and investment policy have to be re-evaluated with respect to the comparative advantage of the industries.

Further in-depth analysis is necessary.

Chapter 7. Conclusion

Over the last four decades, globalization has transformed international trade. Enhancement of intra-firms and inter-country links, blurring national borders, overcoming the distances are some of the dominant features of the economy. Fast and efficient shipment allows for international fragmentation of production into several stages. Multinational companies became main agents for technology and knowledge transfer. For transition economies from CEE countries regional integration as European Union membership facilitates increase of foreign direct investment. Foreign capital allow for developing countries to overcome technological differences, liberalizing their investment policies, changing their position in the GVCs and industry specialization.

Because countries specialize in only certain stage of production, denationalization of comparative advantage become prominent feature of modern economies. However, sophistication of production has complicated interpretation of trade data. With 20th century perspective of trade and comparative advantage, interpretation of 21st century export and competitiveness is misleading. It is clear that public governance needs to acknowledge various impacts of GVCs on trade and comparative advantage, but also to adapt and reshape frameworks which properly reflect the new realities. To great extent, the quality of public policies depends on the quality of data analysis.

The conclusions include results of the three analyses: (1) Foreign direct investment determination (2) FDI impact on GVCs participation; and (3) RCA measured with trade in value added (TiVA)

Three main research questions of this thesis are:

1. What is the impact of EU membership and BFTA for foreign direct investment inflows in Central and East European countries over the period 1995-2015?

2. What is the causal relationship between the foreign direct investment inflows and global value chain participation in Central and East European countries over the period 1995-2011?

3. How does revealed comparative advantage in Central and East European countries differ when measured with traditional gross trade data and with trade in value added data (TiVA)? How do individual sectors RCAs differ in gross and value added measurement over the period 1995-2015?

7.2.1 Implication of European membership on FDI inflows

➤ European membership is one of the important channels for increasing FDI inflows for Central and East European countries

Over the last 20 years CEE countries integrate in the global production network and in the last fourteen years transition economies became European members. Foreign direct investment rose sharply even before accession in the European Union.

- Hungary, Czech Republic and Poland, the largest economies from Central Europe, are leaders in terms of FDI inflows which report \$8.668 million, \$1.394 million and \$577 million respectively in 2012. Before EU membership in the period 2003-2004 FDI inflows increased from \$4.869 million to \$12.755 million for Poland, from \$ 2.108 million to \$4.975 million for Czech Republic and \$2.137 million to \$4.508 million.

- After the collapse of the communism in 1990, European integration and membership of CEE countries attract attention of multinational companies to locate their production facilities in the region. For manufacturing industry from high and medium

technology as automobile industry or machinery industry foreign investment are especially important as they increase both foreign and domestic content of export and participation in the global supply chains.

Empirical literature on FDI does not explain the role of political factors, as European membership, in particular, for foreign direct investment inflows in Central and East European countries. Contrary, empirical studies explore extensively the role of economic determinants as market size, economics growth, stage of economic development for foreign direct investment (Chakrabarti, 2001, Buthe&Milner, 2008). This thesis confirm hypothesis that European membership impact on the level of FDI through various channels, depending on the type of investment. Trade facilitation and EU integration will increase vertical investment, which are efficiency seeking, driven by differences of factor cost of production between host and source country. However in certain cases trade facilitation and integration from EU membership can decrease foreign investment. For instance market seeking horizontal investment is driven by increased trade cost where firms prefer to establish production in host country rather than exporting, to avoid these trade costs (Chen, 2014).

It is important to mention that government reports project that in the next 15 years, it is expected about 90% of the world growth to be generated in countries outside European Union (European commission, 2011). Therefore, trade agreements are important tools for European companies to import intermediate products and to participate in the global production.

7.2.2 Increase of Central and East European countries GVCs participation indices

➤ Three of the Central European countries, Hungary, Slovakia and Czech have higher global value chains engagement, compared to East European countries as Bulgaria and Romania and world average in 1995-2011.

Participation rate in global value chains determines the depth of GVCs which comprise of backward participation and forward participation. The analysis confirms the conclusions of previous studies that trade integration has led to significant increase of CEE countries participation in the global value chains over the period 1995-2011. Industry analysis suggests that three high and medium technology sectors, transport equipment, electrical machinery and motor vehicles are highly integrated into GVCs. For CEE countries transport equipment is having high and sophisticated value chain with 51% foreign content of export, compared to 40% world average. Electrical machinery and motor vehicles also have sophisticated value chains with high content of export.

➤ Through foreign investment, GVCs provide a platform for entry in multitasking production in sectors for which does not have specialization and capacity to produce.

As highlighted, headquarters of multinational corporations in developed countries transfer knowledge and know how to branch factories in developing countries. Thus, participation in global value chains provides opportunities for countries to engage in manufacturing process on more refined level. Data show that for CEE countries sectorial specialization is very high in medium technology sectors as Electrical machinery & Motor vehicle & other transport equipment with highest integration in the production network and longest production stages which is over 2 stages. For European Union, electrical

machinery, n.e.c. which includes electrical motors, lighting, batteries, and transformers is a core industry group driver of EU jobs and growth. Electrical machinery production varies from electric plants to parts and components for computers. Cost efficiency differences, driven FDI from West European countries to allocate part of the electrical machinery & transport equipment production process in the CEE countries and then re-export products back to final demand. Czech Republic and Hungary have main contribution for export of electrical machinery intermediate inputs to EU countries. For Central and East European countries increasing of foreign content of export is a premise for future upgrading to the value chains and also for creation of domestic value added.

For motor vehicles industry, GVCs also have long production stages over 2.5, which present the high vertical integration of the industry and importance of intermediate inputs. Visegrad group (Czech Republic, Poland, Slovakia and Hungary) participate in both productions of parts and component, as well as assembling activities for automobile companies which are further exported to Germany, France and Italy.

7.2.3 Implications of FDI inflows on the level of Central and East European countries GVCs participation

➤ The results provide evidence that FDI are driving force of the global value chains participation

The GVCs implications are multi-layered. For CEE countries, which are less developed, but one of the highly integrated in the GVCs regions, it is an opportunity to access new foreign technologies and access foreign markets.

Since 1990, gradual transition in CEE countries from planned to market economy has been facilitated through FDI. Multinational companies had played a prime role in

privatization and restructuring of state owned firms, increased exports, technology and know-how. On the other hand, multinationals integrated production in global supply chains. UNCTAD (2013) calculates that 80% of the world trade is within global value chains and is operated by multinational corporations, though empirically links between FDI and GVCs participation are not well established. However companies which engage in the global supply chain are 15% of all firms (World Bank, 2019). According to the theoretical and empirical literature the relationship between foreign investment and global value chains are ambiguous. For instance in the labor intensive sector, global supply chains are operated by local firms, without participation of foreign companies (buyer-driven chains). On the other hand, other sectors as automobile, computer, semiconductor, and heavy machinery industries (producer-driven value chains) global supply chains are operated from multinational corporations with multilayered production systems involving parent companies, subsidiaries, and subcontractors (Broadman, 2005).

Literature explains the variation of GVCs participation as a result of structural factors, such as economic size, share of manufacturing, or policy factors such as tariffs, trade liberalization, IPR (OECD, 2015, Anderson&Van Wincoop, 2003, Mirodot, Spinelli&Rouzet, 2013). Institutional factors as openness to investment or trade openness have been widely examined as global production network driver, which is indirectly linked to FDI. This study employs the results of vertical specialization to examine the direct impact of foreign direct investment on the level of individual country GVC participation. Key metrics for participation in GVCs are taken from Timmer et al. (2012), OECD (2013), de Backer and Miroudot (2013) and UNCTAD (2013b).

- Estimations suggested that when there is one % increase in the FDI stock, the participation rate in the global value chain in Central and East economies increases with 0.0138 % points.

- In the period 1995-2011, Central and East European countries have increased both backward and forward participation rate

- Czech Republic, Slovakia and Hungary have highest GVCs participation rate - 60%

- Regression estimations for CEE countries suggests that traditional FDI variables as market size, trade openness and tariffs have significant impact on GVCs participation rate

- Policies instruments, which encouraged FDI, also increase global value chains participation

Foreign investment has multiple implications on host economies as transfer of knowledge, capital, job creation, increasing competitiveness and upgrading GVCs. Even though this thesis investigates one particular aspect of foreign investment, it is also a new avenue for research, which can be conducted concentrating over single country or group of countries and regions. With that respect policies which are focused on encouragement of FDI, also have effect on the GVCs participation. Also, according to the estimations, protectionism measures as tariffs which concerns importing intermediate goods have negative impact on the FDI and on the global value chain participation.

7.2.4 Implications of measurement of Central and East European economies

revealed comparative advantages with trade in value added

GVCs proliferation and trade revolution posed various implications over developing nations, which cannot be ignored (Baldwin, 2018). Sophistications of the structure of

trade over the last 20 years results in changes of RCA, when measured with trade in value added. Data show that since 1995, CEE countries increased foreign content of export and number of production stages in the manufacturing sector. Thus, in various sectors, a trade country does not need to rely on domestic inputs only or technology in order to export products. Instead, engagement in the international value chains provides nations access to foreign technology and foreign factors of production. Following the main research hypothesis, the estimations of RCA in value added provide different information for strong and weak sectors of CEE countries.

➤ Increase of foreign content of export and index of production stages in CEE countries in 1995-2011

For Eastern economies countries, the average foreign share of gross exports increased from 28% in 1995 to 36% in 2011, which is 28% increase. The world average foreign value added of export increased with lower rate, from 22% in 1995 to 28% in 2011, respectively. Hungary, Slovakia and Czech Republic had the highest foreign share of the gross exports, 50%, in 2011, respectively. On average, CEE countries foreign content of export of 2011 was 30% in 2011 which implies high GVCs engagement (in comparison to the average). If GVCs participation measures the depth of engagement, index of production stages measure the length in one particular industry in the value chain (Fally, 2012). In the case of a single stage of production where materials are produced domestically, the value of the indicator is 1. The results showed that manufacturing sector length varied from one to other industry. Electrical machinery & Transport equipment & Food products sectors had longest production stages with 2.5 production stages in 2011, which imply higher sourcing of intermediate inputs from foreign countries. Sectors with the lower index of fragmentation include Mining and quarrying & Wholesale and retail

trade& financial intermediation & Business services with 1.7 production stages, which imply mainly domestic use of intermediate products

➤ Consistent reversed pattern of RCA2 with trade in value added for 1995-2015 and each country for Electrical machinery sector & Transport equipment sector & Motor vehicles sector

Three sectors show consistent reverse pattern of RCA2 with trade in value added. These sectors are: electrical machinery sector & motor vehicles sector & transport equipment sector. Table 7-1 shows RCA1 and RCA2 index for these three sectors over three years: 2000, 2011 and 2015. The estimations of RCA2 for electrical machinery sector suggest strong competitiveness on the international market over the period 1995-2015. In contrast, the export performance calculated with conventional export data suggest opposite trend, revealed comparative advantages <1. For motor vehicle, the actual export performance based on value added show lower or higher level of revealed comparative advantage. However the result is more nuanced and varies within particular country. For transport equipment sector, majority of CEE countries have shifted their revealed comparative advantages when actual export performance (RCA2) is measured.

Table 7-1 Gross and Value Added RCA indicator for RCA in Transport Equipment, Motor Vehicles and Electrical machinery, 2011

Country	2000		2011		2015	
	Electrical Machinery		Motor vehicles		Transport equipment	
	RCA1	RCA2	RCA1	RCA2	RCA1	RCA2
Bulgaria	0.12	0.63	0.39	0.54	0.09	0.24
Czech	1.12	1.23	1.46	1.45	0.97	2.46
Estonia	0.58	2.83	0.64	0.94	0.08	0.22
Hungary	0.24	1.23	0.51	0.79	0.90	2.46
Lithuania	0.31	1.57	0.66	1.00	0.03	0.11
Latvia	0.19	0.93	0.18	0.27	0.04	0.11
Poland	0.13	0.69	0.76	1.16	0.39	1.06
Romania	0.39	1.98	0.66	1.01	0.04	1.85
Slovakia	0.35	1.80	1.32	2.01	1.02	2.47
Slovenia	0.31	1.67	0.76	1.15	0.33	0.87

Note. Author calculations

➤ Other sectors changes in the pattern of RCA with trade in value added calculations for the period 1995-2015

Along with three sectors electrical machinery sector & transport equipment sector & motor vehicles other sectors demonstrate change in the pattern of trade performance when measured with trade in value added. For example, total manufacturing, pulp and paper and rubber and plastic bags sectors show difference in the result of RCA2 with trade in value added. However the difference between the index of RCA1 and RCA2 are less consistent (as it varies over countries) in comparison to the electrical machinery sector & transport equipment sector & motor vehicles.

The main highlights from the estimations suggest that trade statistics overestimate the export capabilities of the countries, but industry estimations results vary from country to country and years. Difference of the results of RCA2 with value added approach in comparison to gross export implies increasing importance of TiVA analysis and a need for revision of traditional measures of comparative advantages.

7.2.5 Implications of GVCs on trade and industrial policy

➤ Policies on trade and investment need to be re-evaluated and adjusted with respect to global fragmentation of production reality

With the new GVCs reality trade and investment policies require main adjustments. Trade statistics require a new data in value added which reflect the new reality of products which are done in a several sequential stages. Measuring RCA with new dataset with trade in value added will give the policy makers, investors, suppliers accurate information about the country's comparative advantages.

Sophistication of export gives access for countries to engage in the global value chains. With vertical integration liberalization of trade and FTA agreement are essential. With that respect trade nations have to adjust its trade policy and focus on sectors which have export competitiveness and also potential for growth. For sectors which have high integration in the global value chains the revealed comparative advantages with value added estimations leads to different results. Trade policy and investment policy have to be re-evaluated with respect to comparative advantages of the industries. Even though these calculations are conducted for ten CEE countries over 42 sectors, they can be replicated over other countries or regions. For trade and investment policy it is essential to access both index of RCA1 based on trade data as well as index of RCA2 based on value added export data. Policies which restrict free movement of intermediate inputs and increasing import costs would lead to higher costs of final products while decreasing competitiveness. Any policies which promote further opening of the EU markets to intermediate inputs are beneficial for increasing competitiveness of European domestic and foreign companies both in the European Union and abroad.

The European market must be open to the intermediate inputs as restricting their movement or increasing import costs or other restriction would lead to increased costs of final products while decreasing competitiveness of European companies both in the European Union and abroad.

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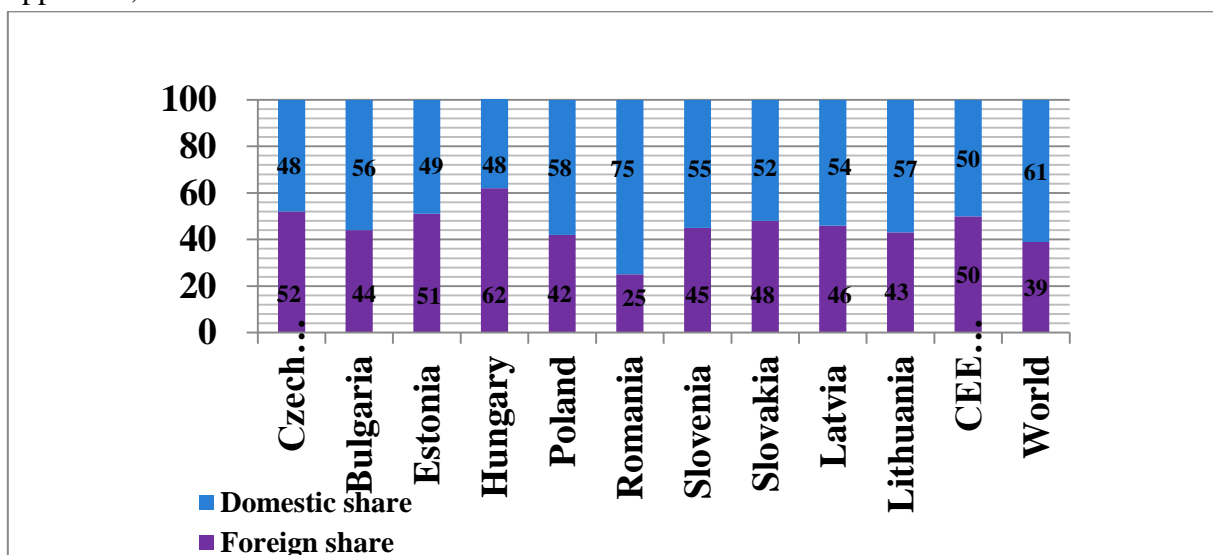
Appendix 1 to Chapter 3

Table A1-1 Sector classification, Trade in value added, OECD

	Code	Description
1.	CO1TO5	Agriculture, hunting, forestry and fishing
2.	C10T14	Mining and quarrying
3.	C15T37	Total manufactures
4.	C15T16	Food products, beverages and tobacco
5.	C17T19	Textile, textile products, leather and footwear
6.	C20T22	Wood, paper products, printing and publishing
7.	C20	Woods and products from wood and cork
8.	C21T22	Pulp, paper, paper products, printing and publishing
9.	C23T26	Chemicals and non-metallic mineral products
10.	C23	Coke, refined petroleum products and nuclear fuel
11.	C24	Chemicals and chemical products
12.	C25	Rubber and plastic bags
13.	C26	Other non-metallic mineral products
14.	C27T28	Basic metals and fabricated metal products
15.	C27	Basic metals
16.	C28	Fabricated metal products
17.	C29	Machinery and equipment
18.	C30T33	Electrical and optical equipment
19.	C30T33X	Computer, electronic and optical equipment
20.	C31	Electrical machinery and apparatus, nec
21.	C34T35	Transport equipment
22.	C34	Motor vehicles, trailers and semi-trailers
23.	C35	Other transport equipment
24.	C36T37	Manufacturing nec, recycling
25.	C40T41	Electricity, gas and water supply
26.	C45	Construction
27.	C50T74	Total business and sector services
28.	C50T55	Wholesale and retail trade: Hotels and restaurants
29.	C50T52	Wholesale and retail trade, repairs
30.	C55	Hotels and restaurants
31.	C60T64	Transport and storage; post and telecommunication
32.	C60T63	Transport and storage
33.	C64	Post and telecommunication
34.	C65T67	Financial intermediation
35.	C70T74	Real estate, renting and business activities
36.	C70	Real estate activities
37.	C71	Renting and other business activities
38.	C72	Computer and related activities
39.	C73T74	R&D and other business activities

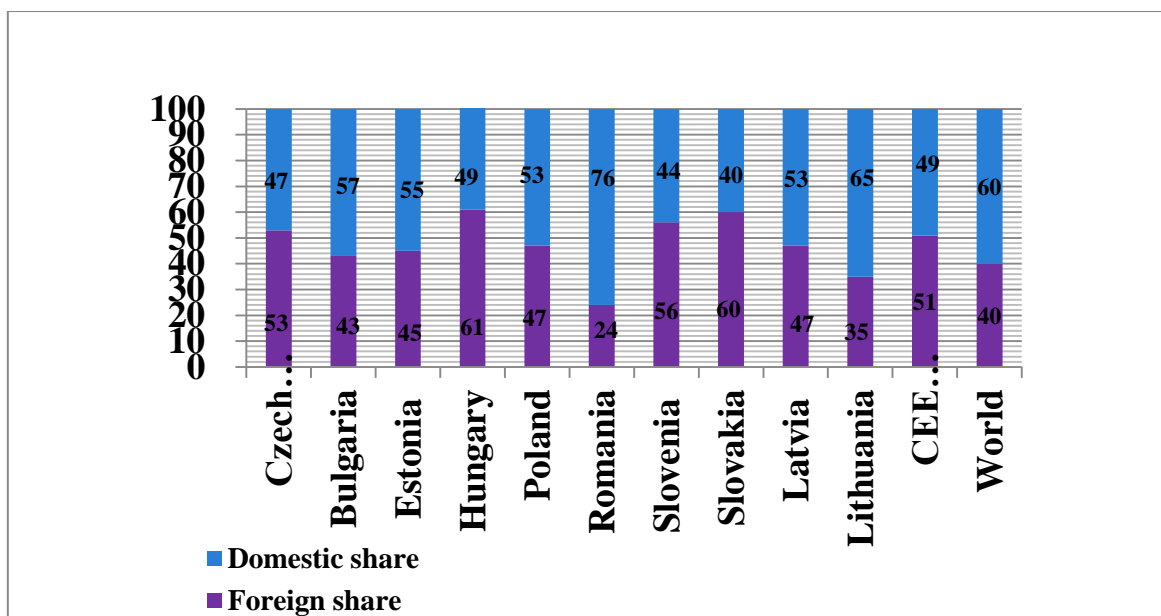
- 40. C75T95 Communication
- 41. C75 Public administration
- 42. C80 Education Health

Figure A1-1. Foreign and Domestic content share of export, electrical machinery and apparatus, n.e.c.



Sources: OECD, Trade in value added (2016)

Figure A1-2. Foreign and Domestic content of export, Transport equipment



Source: OECD, Trade in value added, (2016)

Table A1-3. RCA1 Bulgaria, Gross export computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture and hunting	0.757896	0.530509	0.599836	0.63243	0.748144	0.979142	0.837551
Mining and quarrying	1.040919	1.924091	1.602262	1.688671	2.203429	1.654641	1.858305
Total manufacturing	1.018068	0.868728	0.996178	0.931201	0.858134	0.96993	0.925314
Food products and beverages	1.822823	0.898219	0.953293	0.942411	1.337584	1.565531	1.490217
Textile, textile products	1.989928	2.070192	2.20298	1.46502	1.231324	1.766828	1.653862
Wood, paper products	0.809083	0.726279	0.927009	0.872038	0.902726	1.066955	0.795274
Wood and pr. from wood	0.474789	0.324089	0.86066	1.066701	0.834385	1.082072	0.810581
Pulp, paper, printing	0.809083	0.726279	0.927009	0.872038	0.902726	1.066955	0.795274
Chemicals and non-metallic pr.	0.937165	0.988007	0.905127	0.721196	0.854709	1.027864	0.946894
Coke, refined petroleum products	0.252154	1.326222	1.112992	0.746714	0.840564	1.335152	1.277466
Chemicals and chemical products	0.86674	1.071714	1.114867	0.850406	0.917881	1.175581	1.079427
Rubber and plastic bags	0.914063	1.033493	1.427082	1.182903	1.103246	1.220115	1.113962
Other non-metallic mineral pr.	1.427374	0.999165	2.09464	1.801775	1.417634	1.645787	1.169668
Basic metals and fabricated	0.722334	0.684975	0.978586	1.469356	1.096598	1.227492	1.231348
Basic metals	0.622402	0.63981	0.884304	1.448236	1.154917	1.176039	1.318101
Fabricated metal products	0.936552	0.769952	1.200338	1.525656	0.969681	1.36116	0.988728
Machinery and equipment	1.642602	1.435756	1.279189	1.229128	1.11012	1.018365	0.951543
Electrical and optical equip.	0.548002	0.425573	0.525214	0.592677	0.552619	0.597281	0.540427
Computer electronics	0.489509	0.386449	0.482693	0.458617	0.411533	0.435546	0.406399
Electrical machinery	0.207463	0.129694	0.173669	0.314465	0.307627	0.338507	0.300941
Transport equipment	3.158093	2.657664	3.669088	2.252405	1.481977	1.293278	1.533639
Motor vehicles	0.812261	0.614648	0.882539	0.564236	0.346446	0.327506	0.397064
Other transport equipment	0.105976	0.126452	0.127137	0.164836	0.227667	0.126832	0.117462
Manufacturing – nec	0.40641	0.292467	0.466038	0.59035	0.448429	0.454067	0.411246
Electricity gas	0.06614	0.202815	0.090554	0.074242	0.164584	0.151164	0.108345
Construction	3.231542	0.724287	1.065624	1.913837	3.058143	0.854162	0.501765
Total business	0.966132	1.088364	0.878268	0.909667	0.942186	0.886304	0.874806
Wholesales and retailed tr.,hotels	0.984848	0.902733	0.987031	1.200684	1.121765	1.155295	1.211795
Wholesales, repairs	0.903174	0.966098	1.07343	1.191105	1.130014	1.118388	1.161391
Hotels and restaurants	0.471772	1.313684	1.591365	1.128642	1.179309	0.882805	0.827188
Transportation and storage, post	1.48573	1.85651	0.790468	0.747555	0.85536	0.856077	0.860064
Transportation and storage	1.435899	1.771224	0.773209	0.756832	0.848588	0.828865	0.833817
Post and telecommunication	0.645067	0.685335	0.573386	0.862175	0.784041	0.547341	0.559775
Financial intermediation	0.30204	0.732171	0.657102	0.559146	0.963162	0.409515	0.261794

Sectors	1995	2000	2005	2008	2009	2010	2011
Real estate, renting	0.431528	0.368514	0.713751	0.704958	0.680829	0.723976	0.629233
Real estate activities	0.559772	1.032511	0.892085	0.600433	0.707086	0.475568	0.436889
Renting and other business	0.899666	0.697704	1.165737	1.318392	1.231636	1.139478	1.069892
Computer and other activities	0.196853	0.158452	0.41813	0.103533	0.507743	0.470187	0.382325
R & D	0.377238	0.278694	0.68917	0.770627	0.627964	0.739849	0.636486
Communication	0.539574	0.873071	0.971684	1.289443	1.058281	1.090522	1.337756
Public administration	0.487661	0.585576	0.521195	0.458026	0.423745	0.465022	0.450432
Education	1.64372	2.650397	2.877131	1.641151	1.320957	1.994298	1.801509

Table A1-4. RCA2 Bulgaria, Value added Computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture and hunting	0.752947	0.530617	0.603286	0.623382	0.737375	0.946099	0.80017144
Mining and quarrying	1.021759	1.806699	1.51778	1.616316	2.105971	1.60776	1.75917436
Total manufacturing	1.036195	0.870903	1.00503	0.923763	0.846018	0.979302	0.9307146
Food products and beverages	1.880152	0.89583	0.967546	0.906259	1.287304	1.533518	1.4447063
Textile, textile products	2.087359	2.128039	2.268029	1.439847	1.203226	1.741153	1.59809187
Wood, paper products	0.792959	0.689624	0.889396	0.828165	0.852409	1.021346	0.75755118
Wood and pr. from wood	0.469441	0.319409	0.831386	1.026017	0.805854	1.062338	0.79050219
Pulp, paper, printing	0.909689	0.813416	0.911007	0.765608	0.865716	1.009225	0.74794534
Chemicals and non-metallic pr.	0.86451	1.013511	1.064858	0.819597	0.878647	1.154424	1.07218922
Coke, refined petroleum products	0.280351	1.260042	0.962816	0.657151	0.760668	1.389004	1.41644137
Chemicals and chemical products	0.913991	0.939904	0.882195	0.69442	0.823061	0.987952	0.90172604
Rubber and plastic bags	0.902493	0.990739	1.391709	1.153089	1.062989	1.16004	1.04796817
Other non-metallic mineral pr.	1.437949	0.960337	2.073717	1.822422	1.393398	1.634779	1.16615576
Basic metals and fabricated	0.708691	0.667175	0.984792	1.505722	1.09071	1.247288	1.26431768
Basic metals	0.602148	0.616491	0.893914	1.516765	1.162637	1.210881	1.37348089
Fabricated metal products	0.931857	0.757496	1.193811	1.477375	0.93821	1.34042	0.96571408
Machinery and equipment	1.616653	1.349435	1.24071	1.183778	1.062659	0.991686	0.91969209
Electrical and optical equipment	0.55913	0.453276	0.54427	0.595168	0.550052	0.614383	0.55445814
Computer electronics	0.497656	0.411219	0.493925	0.445538	0.391634	0.428739	0.40630016
Electrical machinery	0.775361	0.636473	0.722858	1.03711	1.017954	1.181818	0.99945603
Transport equipment	0.881887	0.699519	0.967194	0.640265	0.446293	0.380998	0.43563867
Motor vehicles	1.120807	0.885185	1.217209	0.767597	0.536886	0.462155	0.54672894
Other transport equipment	0.273622	0.293149	0.326442	0.35725	0.30904	0.23041	0.22123375
Manufacturing – nec	0.553427	0.417513	0.573492	0.704769	0.603843	0.598425	0.54370915
Electricity gas	0.425092	1.556772	0.476378	0.283806	0.68433	0.513701	0.37733529
Construction	3.243772	0.721827	1.053401	1.937032	2.999869	0.827454	0.49054297
Total business	0.948627	1.051209	0.874342	0.899349	0.919976	0.862846	0.84850763
Wholesales and retailed tr.,hotels	0.972055	0.878495	0.971712	1.173843	1.085124	1.118548	1.16835855
Wholesales, repairs	0.894344	0.941871	1.057263	1.165374	1.09585	1.086725	1.12367373
Hotels and restaurants	0.468187	1.300373	1.588024	1.107882	1.162115	0.876026	0.81437498
Transportation and storage, post	1.477368	1.834658	0.800011	0.738064	0.842554	0.842137	0.84312822
Transportation and storage	1.425618	1.743971	0.781221	0.749252	0.836054	0.814625	0.81689837

Sectors	1995	2000	2005	2008	2009	2010	2011
Post and telecommunication	0.64938	0.661088	0.579074	0.86545	0.778332	0.547998	0.56177876
Financial intermediation	0.291343	0.707349	0.653512	0.548715	0.940272	0.35438	0.21544635
Real estate, renting	0.553517	1.023349	0.890104	0.589219	0.684893	0.468518	0.42869722
Real estate activities	0.41404	0.360875	0.696538	0.682503	0.652245	0.695812	0.59409516
Renting and other business	0.852798	0.676556	1.094344	1.314054	1.181342	1.045137	0.88702557
Computer and other activities	0.186674	0.151501	0.426768	0.100332	0.528342	0.422457	0.349421
R & D	0.357896	0.264381	0.668663	0.732747	0.588616	0.723778	0.62089043
Communication	0.537333	0.870619	0.98373	1.236096	1.012653	1.055156	1.27101721
Public administration	0.481301	0.575259	0.517397	0.444711	0.408166	0.463835	0.44801084
Education	1.618504	2.61151	2.852594	1.596333	1.264265	1.944684	1.74770134

Table A1-5. RCA2 Czech Republic, Value Added computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture and hunting	0.957528	0.734816	0.821974	0.743222	0.715081	0.756518	2.17574431
Mining and quarrying	0.997663	1.833359	0.814428	0.749577	0.798629	0.872177	0.61270497
Total manufacturing	1.069964	1.019123	1.18435	1.165076	1.138757	1.074086	1.11678926
Food products and beverages	0.842141	0.827795	0.824839	0.980693	1.077301	0.913606	0.9832717
Textile, textile products	1.092697	0.84086	0.955973	1.086882	1.028344	0.989383	1.08265378
Wood, paper products	1.263459	0.983912	1.170651	1.389887	1.393616	1.351591	1.53846663
Wood and pr. from wood	0.604674	0.847919	0.80931	1.236884	1.330971	1.173492	1.23294687
Pulp, paper, printing	1.037628	1.260291	1.44657	1.659935	1.62348	1.577564	1.48548431
Chemicals and non-metallic pr.	1.053226	2.025275	1.214014	1.156338	1.166837	0.967539	1.02849545
Coke, refined petroleum products	0.944154	5.752298	0.979331	0.96438	1.076376	0.348034	0.37355086
Chemicals and chemical products	0.938535	0.704297	0.936727	0.960117	0.959034	0.94261	1.00121867
Rubber and plastic bags	1.486046	2.259486	2.403039	2.11341	1.988716	1.971545	2.08079555
Other non-metallic mineral pr.	1.178603	1.493762	1.58526	1.657603	1.567273	1.554138	1.8006951
Basic metals and fabricated	1.216275	1.367993	1.640668	1.56098	1.425973	1.563471	1.51182063
Basic metals	1.029669	1.065888	1.383386	1.270438	1.108678	1.292152	1.16291963
Fabricated metal products	1.606774	1.906326	2.232136	2.309048	2.098462	2.256896	2.465432
Machinery and equipment	1.248375	0.853474	1.391865	0.828029	0.759554	0.680019	0.75955575
Electrical and optical equipment	0.852381	0.604123	1.191279	1.102686	1.164498	1.131459	1.06761493
Computer electronics	0.69173	0.459427	0.996545	1.001983	1.09562	1.01106	0.8316883
Electrical machinery	1.418212	1.235523	1.882226	1.400076	1.367995	1.499431	1.77617041
Transport equipment	1.326329	0.428277	1.002684	0.968069	0.930274	1.129444	1.0296922
Motor vehicles	1.704122	0.524253	1.203784	1.24327	1.374491	1.612445	1.45905551
Other transport equipment	0.363774	0.217964	0.487248	0.356499	0.257356	0.232984	0.20075787
Manufacturing - nec	0.978398	0.748252	0.761825	1.856442	1.565618	0.81328	1.93343053
Electricity gas	3.465637	2.104298	1.765337	1.665812	4.867305	10.53188	3.71886306
Construction	0.896701	1.144842	0.913532	1.199904	0.859022	1.202064	1.25785698
Total business	0.87763	0.797396	0.807618	0.862168	0.840236	0.797216	0.85332787
Wholesales and retailed tr.,hotels	0.876263	0.844058	0.89609	1.049635	0.994446	0.932891	1.00243171
Wholesales, repairs	0.884887	0.924389	0.99881	1.145087	1.090301	1.013582	1.09193894
Hotels and restaurants	0.82895	0.390075	0.258511	0.402154	0.403239	0.398507	0.38289736
Transportation and storage, post	0.778574	0.5348	0.597284	0.471956	0.54241	0.494008	0.53767269

Sectors	1995	2000	2005	2008	2009	2010	2011
Transportation and storage	0.742569	0.55122	0.564221	0.423207	0.477011	0.431143	0.46100783
Post and telecommunication	1.318688	0.339142	0.952971	0.977932	1.123176	1.102835	1.28246374
Financial intermediation	0.504504	0.273176	0.510372	0.457361	0.334788	0.330984	0.40110158
Real estate, renting	1.27336	1.365822	1.061818	1.208689	1.17199	1.129945	1.1493925
Real estate activities	1.040685	0.285334	0.29705	0.425708	0.286508	0.491929	0.50447654
Renting and other business	0.899915	0.266424	0.777004	1.219362	1.126916	2.543603	2.58612772
Computer and other activities	0.542929	0.498841	1.037162	1.338233	1.433821	1.341946	1.31861907
R & D	1.467694	1.868505	1.201464	1.253037	1.200374	0.88281	0.90855717
Communication	0.775179	0.65387	0.433047	0.748346	0.679027	0.677012	0.70594062
Public administration	0.78967	0.818189	0.514168	0.525276	0.551067	0.409722	0.44814785
Education	0.99439	1.035396	0.677283	0.723346	0.735809	0.595674	0.59541744

Table A1-6. RCA1 Estonia, Gross value added computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	1.188589	1.402878	1.295033	1.046782	1.064271	1.030134	0.896707
Mining	0.360499	0.722735	0.872543	0.400526	0.572638	0.618862	0.368863
Total manufactures	1.108306	1.051343	0.992413	0.995443	0.932519	0.960809	0.996545
Food products and beverages	1.74022	1.353682	1.400563	1.783341	2.154836	1.982644	1.903857
Textile, textile products	1.284858	0.665616	1.199631	1.512707	1.478429	1.368583	1.404964
Wood, paper	1.080713	1.318842	1.437154	1.956483	2.244606	2.369543	2.143633
Woods and products from wood	1.366748	1.406113	2.389385	3.441245	3.867076	4.529081	4.474299
Pulp, paper, printing	0.976373	1.289248	1.069071	1.470635	1.758759	1.711708	1.440289
Chemicals and non-metallic pr.	1.306262	0.948818	0.892934	0.952135	0.904136	0.87705	0.871685
Coke, refined petroleum pr.	1.83893	1.001653	0.593683	0.616093	0.181118	0.212211	0.152229
Chemicals and chemical pr.	1.006848	0.638918	0.745188	0.876067	1.014972	0.942081	0.980825
Rubber and plastic bags	1.675713	1.68867	1.588491	1.446377	1.522429	1.568941	1.572595
Other non-metallic mineral	1.631358	1.412028	1.698733	2.302174	1.733851	1.987104	2.14632
Basic metals and fabricated	0.920231	0.61799	1.123353	0.888562	1.101972	1.008059	0.948739
Basic metals	0.506745	0.188594	0.995747	0.540696	0.677552	0.587844	0.551353
Fabricated metal products	1.806785	1.427054	1.423394	1.814442	2.024761	2.099237	2.060169
Machinery and equipment	1.04429	1.252304	1.090923	0.915173	0.625382	0.608006	0.553237
Electrical and optical equipment	1.165657	1.526563	1.093705	0.694442	0.586005	0.826829	0.934196
Computer	1.221513	1.271106	0.903189	0.497774	0.383251	0.690161	0.786039
Electrical machinery	0.261042	0.580624	0.463662	0.408047	0.379291	0.381281	0.436706
Transport equipment	2.175983	2.312505	2.095828	2.296011	1.217647	1.756391	2.682558
Motor vehicles	0.517795	0.537363	0.478092	0.589402	0.297361	0.416032	0.64136
Other transport equipment	0.130379	0.106322	0.108155	0.147744	0.166457	0.215632	0.284228
Manufacturing-nec	0.70134	0.486177	0.525659	1.322333	0.572178	0.577395	0.619912
Electricity gas	0.093837	0.108443	0.116275	0.487631	0.40529	0.4837	0.540237
Construction	1.752594	0.799139	3.487072	1.613567	1.779119	1.824869	3.415468
Total business	0.875333	0.971482	1.023495	1.170792	1.194524	1.150464	1.15907
Wholesales and retailed tr.,hotels	0.88077	0.977086	1.010773	1.065264	1.07402	1.034039	0.99286
Wholesales, repairs	0.937949	1.018195	1.049853	1.043456	1.019594	0.985232	0.939478
Hotels and restaurants	0.578951	0.751171	0.776401	1.207337	1.398714	1.345683	1.346826
Transportation and storage, post	0.788858	1.157032	1.206919	1.404092	1.404831	1.357239	1.498743
Transportation and storage	0.813915	1.190427	1.156621	1.26622	1.258168	1.190015	1.328229
Post and telecommunication	0.389608	0.733394	1.789614	2.969227	2.79975	3.085782	3.27787

Sectors	1995	2000	2005	2008	2009	2010	2011
Financial intermediation	0.794663	0.108067	0.074306	0.066343	0.052901	0.067165	0.067405
Real estate, renting	1.090882	1.056962	1.249858	1.688091	1.768896	1.658486	1.600624
Real estate activities	0.402953	0.610884	0.712967	1.127982	1.285366	1.079658	1.033091
Renting and other business	3.766057	5.8288	4.247798	4.891704	4.711642	4.201782	3.943589
Computer and other activities	0.851012	0.657209	0.771751	1.226317	1.256417	1.268583	1.212027
R & D	0.82047	0.466979	0.904486	1.356463	1.436422	1.35794	1.340706
Communication	0.45192	0.431547	0.502054	0.990331	0.847437	0.922038	1.005002
Public administration	0.933075	0.718955	0.7761	0.809662	0.638593	0.557747	0.466838
Education Health	0.438687	0.490029	0.485557	0.573283	0.691265	0.514317	0.434034

Table A1-7. RCA2 Estonia, Value added computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	1.212136151	1.464703	1.278853	1.014373	1.048517	1.009481	0.882302
Mining and quarrying	0.365748272	0.688294	0.84275	0.391165	0.554998	0.609691	0.368276
Total manufactures	1.118467647	0.101368	0.156898	0.09402	0.100944	0.122869	0.088958
Food products and beverages	1.768037183	1.380875	1.341421	1.68371	2.058853	1.869072	1.808003
Textile, textile products	1.304805063	0.673291	1.181937	1.497049	1.457942	1.349713	1.384651
Wood, paper	1.109826124	1.272003	1.383062	1.884127	2.146948	2.283048	2.109332
Woods and products from wood	1.420271829	1.448993	2.362544	3.433158	3.884293	4.5721	4.627261
Pulp, paper, printing	0.997523144	1.212549	1.015496	1.393903	1.647379	1.612404	1.379011
Chemicals and non-metallic pr.	1.329218171	0.977797	0.943127	1.042146	0.923915	0.915607	0.933126
Coke, refined petroleum pr.	1.980755123	1.193201	0.786451	0.860216	0.210353	0.244278	0.178339
Chemicals and chemical pr.	1.014336661	0.632342	0.746656	0.888492	1.003226	0.956315	1.01621
Rubber and plastic bags	1.687126468	1.645362	1.570205	1.44541	1.49298	1.543206	1.549962
Other non-metallic mineral pr.	1.643726192	1.456652	1.61584	2.215315	1.667027	1.930831	2.098043
Basic metals and fabricated	0.940565463	0.651998	1.104844	0.899576	1.066143	0.991819	0.933866
Basic metals	0.490718706	0.199849	0.970534	0.540629	0.629218	0.565113	0.520475
Fabricated metal products	1.882243352	1.457758	1.413621	1.82373	1.991863	2.08251	2.063501
Machinery and equipment	1.001527738	1.036618	1.045264	0.886746	0.596096	0.586854	0.540324
Electrical and optical equipment	1.1221324	1.673003	1.170987	0.739536	0.616939	0.850275	0.944323
Computer	1.167222674	1.407849	0.980455	0.525066	0.39799	0.704169	0.78342
Electrical machinery	0.963707852	2.830411	1.846768	1.37302	1.264002	1.296626	1.427758
Transport equipment	0.634061319	0.634956	0.566838	0.679542	0.389611	0.536993	0.825225
Motor vehicles	0.747343988	0.820007	0.677554	0.83633	0.481599	0.623067	0.96465
Other transport equipment	0.346092411	0.229386	0.282805	0.331263	0.250318	0.377027	0.556009
Manufacturing-nec	0.981328211	0.716833	0.653964	1.645355	0.786005	0.768481	0.858428
Electricity gas	0.599902991	0.840005	0.620673	2.182203	1.746997	1.722896	2.041881
Construction	1.731634455	0.791621	3.467935	1.544068	1.695361	1.754932	3.305365
Total business	0.893680805	0.974419	1.00837	1.136701	1.159269	1.129018	1.152173
Wholesales and retailed tr.,hotels	0.90162945	0.992772	0.999869	1.056357	1.055572	1.023049	0.995673
Wholesales, repairs	0.955259881	1.031568	1.03463	1.031671	0.998958	0.973545	0.940002
Hotels and restaurants	0.607218821	0.773541	0.784071	1.223854	1.405118	1.350422	1.380855
Transportation and storage, post	0.80718468	1.155761	1.212337	1.384179	1.379278	1.353242	1.520908
Transportation and storage	0.834810535	1.191719	1.16715	1.241431	1.223272	1.176106	1.342537
Post and telecommunication	0.392213873	0.725269	1.698707	2.865789	2.763902	3.06833	3.253596

Sectors	1995	2000	2005	2008	2009	2010	2011
Financial intermediation	0.825612199	0.116559	0.073847	0.066147	0.051601	0.069208	0.071151
Real estate, renting	1.085910149	1.040724	1.190856	1.56889	1.679521	1.595194	1.561681
Real estate activities	0.41477378	0.621955	0.704171	1.094902	1.253379	1.060861	1.034028
Renting and other business	3.816562686	5.626569	3.889499	4.139698	4.322289	3.860261	3.558545
Computer and other activities	0.87058301	0.654957	0.76126	1.195059	1.22926	1.257625	1.218591
R & D	0.79652515	0.452979	0.873659	1.306757	1.376728	1.327675	1.345668
Communication	0.466164848	0.44235	0.504125	0.976607	0.839571	0.905875	1.029729
Public administration	0.942315093	0.713135	0.751937	0.784001	0.617312	0.540381	0.461705
Education	0.446662638	0.500739	0.487631	0.570988	0.68594	0.513443	0.441684

Table A1-8 RCA1 Hungary, Gross export computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	0.674755	0.42411	0.508598	0.5034	0.585455	0.554638	0.627453
Mining and quarrying	0.555102	1.928332	0.763849	0.617673	0.870328	0.909554	0.736613
Total manufacturing	1.061406	0.994697	1.149437	1.131492	1.089587	1.099202	1.086649
Food products and beverages	0.708748	0.540067	0.707835	0.913487	0.890927	0.895117	0.983616
Textile, textile products	1.055461	1.050488	0.768413	0.754472	0.658435	0.622931	0.585208
Wood, paper	1.082064	1.080052	1.091103	1.154224	1.142558	0.963462	1.146396
Wood and product	0.707484	0.864937	0.917286	1.126477	1.098285	1.040889	1.092349
Pulp, paper, printing	1.217781	1.153476	1.158238	1.163294	1.155819	0.939884	1.162629
Chemicals and non-metallic pr.	1.158494	0.781375	0.926899	1.109476	1.25543	0.938427	0.937285
Coke, refined petroleum pr.	0.691013	0.507362	0.693901	1.268103	1.717795	0.750654	0.833186
Chemicals and chemical pr.	1.199826	0.553753	0.796139	0.895764	0.907255	0.880401	0.819496
Rubber and plastic bags	1.343015	1.689338	1.598154	1.494191	1.703585	1.393657	1.473747
Other non	1.370663	1.271097	1.391982	1.334287	1.366732	1.363655	1.364934
Basic metals and fabricated	1.027982	1.410817	1.123121	1.041502	1.098797	1.175883	1.056936
Basic metals	0.84016	1.383237	0.904376	0.845327	0.930754	1.043277	0.874011
Fabricated metal products	1.43065	1.462768	1.637464	1.563664	1.464253	1.520243	1.568552
Machinery and equipment	1.398925	0.762689	1.095319	1.527415	1.301957	1.292438	1.295365
Electrical and optical equipment	1.062157	1.405579	1.668926	1.454339	1.523125	1.90044	1.648661
Computer electronics	1.011288	1.456909	1.58868	1.279862	1.368618	1.66401	1.563173
Electrical machinery	0.339727	0.248036	0.497008	0.617159	0.613617	0.798882	0.594722
Transport equipment	3.375817	2.741132	3.776456	2.137638	1.346951	1.524383	1.752077
Motor vehicles	0.901554	0.681047	0.954972	0.590174	0.361612	0.427095	0.517094
Other transport equipment	0.067878	0.063262	0.067201	0.078666	0.131133	0.087726	0.040257
Manufacturing - nec	0.577975	0.433432	1.455937	1.302161	0.401299	0.407932	1.269023
Electricity gas	0.203986	0.150127	0.337129	0.605969	0.722191	0.680716	1.089137
Construction	0.724417	0.688426	0.616835	0.806247	0.748547	0.801623	0.781139
Total business	0.982943	0.865428	0.821889	0.887307	0.880763	0.86163	0.910374
Wholesales and retailed tr.,hotels	0.86844	1.05825	0.978837	0.968521	0.914979	0.950699	0.994295
Wholesales, repairs	0.869358	1.148555	1.069074	1.049656	0.995482	1.041379	1.089157
Hotels and restaurants	0.863459	0.562173	0.437796	0.439927	0.434919	0.372229	0.365189
Transportation and storage, post	0.388757	0.454599	0.548453	0.562191	0.556704	0.522321	0.540237
Transportation and storage	0.373989	0.439488	0.51488	0.536474	0.529727	0.4983	0.5155
Post and telecommunication	0.622891	0.646844	0.936443	0.854268	0.813141	0.770683	0.798432
Financial intermediation	0.433465	0.452557	0.35763	0.348663	0.391112	0.262502	0.326792

Sectors	1995	2000	2005	2008	2009	2010	2011
Real estate, renting	2.956773	1.288615	1.139048	1.528164	1.523691	1.453464	1.538868
Real estate activities	1.495495	0.724429	0.62231	0.542074	0.536223	0.539477	0.575059
Renting and other business	2.212154	1.153885	0.858643	5.288344	4.58824	3.961425	4.148945
Computer and other activities	1.086677	0.709743	0.86868	1.208514	1.093873	1.154773	1.233785
R & D	3.545242	1.505407	1.305858	1.112396	1.193008	1.162044	1.240248
Communication	0.714993	0.535942	0.537394	0.90741	0.860645	0.72126	0.762942
Public administration	1.661182	0.900162	0.841044	0.723718	0.78639	0.599511	0.65721
Education	1.657927	0.936462	0.9513	0.87011	0.876769	0.812522	0.796422

Table A1-9 RCA2 Hungary, Value added computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	0.676297	0.42906	0.50015	0.491915	0.563808	0.531928	0.59995626
Mining and quarrying	0.543754	1.728737	0.767483	0.609522	0.863265	0.917308	0.74154862
Total manufactures	1.06926	1.001583	1.168849	1.156447	1.097219	1.105381	1.10317754
Food products and beverages	0.710525	0.543775	0.706224	0.897345	0.870903	0.886094	0.95402097
Textile, textile products	1.071086	1.085091	0.788833	0.749896	0.648862	0.627261	0.57351783
Wood, paper	1.072415	1.064956	1.08794	1.136856	1.126479	0.960365	1.13717495
Woods and products from wood	0.702831	0.87573	0.910584	1.15888	1.132486	1.08666	1.13447053
Pulp, paper, printing	1.205426	1.128145	1.154491	1.129845	1.124752	0.923399	1.1378793
Chemicals and non-metallic pr.	1.144415	0.799693	0.949079	1.144848	1.253473	0.951569	0.95269868
Coke, refined petroleum pr.	0.600304	0.570279	0.672237	1.362152	1.743651	0.727969	0.85337112
Chemicals and chemical pr.	1.188543	0.54476	0.811374	0.914403	0.910042	0.890248	0.82283302
Rubber and plastic bags	1.350624	1.714795	1.651328	1.543103	1.744616	1.424655	1.4853526
Other non-metallic mineral	1.371269	1.262221	1.426249	1.354027	1.373288	1.3806	1.38086729
Basic metals and fabricated	1.03646	1.435856	1.14905	1.042128	1.096463	1.150397	1.04679739
Basic metals	0.831249	1.387852	0.892387	0.804995	0.881066	0.963529	0.81740746
Fabricated metal products	1.465822	1.521341	1.739166	1.652626	1.552983	1.627976	1.67369894
Machinery and equipment	1.393724	0.768423	1.143628	1.570858	1.338113	1.335198	1.32801565
Electrical and optical equipment	1.098134	1.470639	1.791434	1.563212	1.636544	2.039365	1.77778112
Computer	1.032875	1.524112	1.685419	1.359359	1.462107	1.738139	1.67122085
Electrical machinery	1.327814	1.237258	2.1676	2.165275	2.151935	2.960029	2.0978983
Transport equipment	0.961588	0.72654	1.010674	0.645489	0.441973	0.493219	0.55278267
Motor vehicles	1.270091	0.992476	1.333265	0.854501	0.598657	0.66639	0.79574926
Other transport equipment	0.175419	0.143984	0.183904	0.181019	0.204611	0.171842	0.08371872
Manufacturing-nec	0.783953	0.634565	1.853387	1.61052	0.556459	0.555506	1.72211608
Electricity gas	<i>1.315241</i>	<i>1.101028</i>	<i>1.834075</i>	<i>2.774005</i>	<i>3.198652</i>	<i>2.538125</i>	<i>4.2024404</i>
Construction	0.726739	0.689728	0.640749	0.838161	0.768402	0.820626	0.79838206
Total business	0.991001	0.889293	0.856787	0.92018	0.905523	0.892197	0.93421736
Wholesalers and retailers	0.86429	1.069971	1.002167	0.988095	0.930841	0.97494	1.00852494
Wholesales and	0.864351	1.15917	1.091176	1.066648	1.00922	1.063688	1.10003513
Hotels and restaurants	0.863908	0.565921	0.449725	0.455247	0.447474	0.387232	0.3751039
Transport	0.398136	0.463399	0.572111	0.583431	0.580459	0.544509	0.55853236
Transport and	0.381774	0.447481	0.535266	0.553725	0.551018	0.517308	0.53003232
Post	0.643283	0.653112	0.968556	0.891739	0.841829	0.807933	0.83550664
Financial intermediation	0.453257	0.47011	0.351787	0.355164	0.388253	0.2616	0.28976033
Real estate, renting	2.93657	1.309632	1.192241	1.562365	1.546096	1.478725	1.56661807

Sectors	1995	2000	2005	2008	2009	2010	2011
Real estate activities	1.471368	0.72005	0.63694	0.551553	0.543619	0.55304	0.58395976
Renting and other business	2.226003	1.179815	0.923735	5.408253	4.490955	3.808563	4.08246253
Computer and other activities	1.129544	0.726567	0.914583	1.220157	1.15644	1.17632	1.21575639
R & D	3.516665	1.532622	1.364962	1.148343	1.231389	1.226025	1.30101106
Communication	0.729775	0.53667	0.55511	0.926633	0.880204	0.743299	0.78738778
Public administration	1.669869	0.914287	0.86788	0.740818	0.801553	0.619323	0.67714968
Education Health	1.669728	0.953487	0.985038	0.898046	0.904019	0.847312	0.82549584

Table A1-10 RCA1 Latvia, Gross export computation1 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	1.193077	0.977488	1.232141	1.201102	1.062381	3.596447	1.089603
Mining and quarrying	0.658996	0.324272	0.943052	0.377705	0.401264	0.141653	0.352715
Total manufacturing	1.097382	1.084462	1.027436	1.10869	1.031895	1.038531	1.121513
Food products and beverages	1.506708	1.877287	1.613393	1.63491	1.575422	2.043437	1.907397
Textile, textile products	1.275749	1.117533	0.967374	1.06738	0.776471	0.912063	1.319045
Wood, paper	1.281135	1.218198	1.513911	1.51493	1.596274	2.039819	1.92859
Wood and product	0.47492	0.585147	2.596789	2.850665	3.192983	4.034722	3.957449
Pulp, paper, printing	1.573495	1.434185	1.095508	1.077975	1.118402	1.432312	1.31633
Chemicals and non-metallic pr.	2.102554	1.701581	1.316489	1.512801	1.200468	1.347947	1.40393
Coke, refined petroleum pr.	5.607064	2.95268	0.835184	1.47357	0.732568	0.360513	1.015451
Chemicals and chemical pr.	1.460506	1.252684	1.384002	1.422387	1.241702	1.549411	1.305501
Rubber and plastic bags	1.298116	1.321902	1.455837	1.578613	1.325833	1.893997	1.939677
Other non-metallic mineral	1.622505	1.973324	2.359102	2.35344	2.606851	3.127809	3.227888
Basic metals and fabricated	0.512841	1.058297	0.934685	1.000322	0.992165	1.088864	1.119522
Basic metals	0.153107	0.89341	0.748955	0.899428	0.730901	0.777762	0.748282
Fabricated metal products	1.283002	1.368607	1.37157	1.268929	1.56017	1.896507	2.157676
Machinery and equipment	1.027935	1.24708	1.244268	1.133786	1.158403	1.300602	1.655854
Electrical and optical equipment	0.712324	0.600215	0.528048	0.62711	0.495604	0.653395	0.630597
Computer electronics	0.623422	0.530936	0.307277	0.396758	0.320811	0.417673	0.356169
Electrical machinery	0.282449	0.197113	0.352679	0.421257	0.324203	0.429024	0.46922
Transport equipment	1.812349	2.62746	3.33565	3.123251	2.41751	0.660176	0.981283
Motor vehicles	0.436794	0.618646	0.808234	0.841049	0.680824	0.072625	0.188452
Other transport equipment	0.10088	0.109108	0.107566	0.145179	0.183633	0.207017	0.17228
Manufacturing - nec	0.650447	0.635708	0.827475	0.606294	1.607396	0.69993	0.743627
Electricity gas	1.176321	0.592374	0.4303	0.290998	0.323821	0.550213	0.407864
Construction	0.588056	1.534779	0.753407	2.450836	1.577711	1.265798	1.273583
Total business	0.804765	0.964904	0.951957	0.963768	1.067188	0.981557	0.974454
Wholesales and retailed trade	1.024114	0.939928	1.099302	1.037786	1.120167	0.997925	1.021281
Wholesales, repairs	1.039754	0.924378	1.111119	1.010671	1.075054	0.972368	1.017889
Hotels and restaurants	0.93969	1.02562	1.028637	1.214504	1.389085	1.160799	1.043685
Transportation, post	0.670487	1.049666	0.708463	0.809912	0.939773	0.810111	0.838586
Transportation and storage	0.699938	1.040645	0.694553	0.747879	0.878634	0.747487	0.768256
Post and telecommunication	0.201853	1.164021	0.87033	1.514506	1.521216	1.457161	1.571974
Financial intermediation	0.299474	1.769759	0.278809	0.377269	0.250479	0.22199	0.24564
Real estate, renting	0.636617	0.472785	1.350992	1.377703	1.579718	1.573448	1.43248
Real estate activities	0.701157	0.848941	0.892658	0.716472	0.996707	0.964696	0.792614

Sectors	1995	2000	2005	2008	2009	2010	2011
Renting and other business	2.73875	0.516981	1.619321	1.430455	1.683394	1.490322	1.376767
Computer and other activities	0.162996	0.450676	0.771884	0.826486	0.859691	0.831246	0.775959
R & D	0.380075	0.422248	1.492083	1.568525	1.793557	1.842781	1.6803
Community	0.559774	0.633561	0.742204	0.785731	0.935346	0.794958	0.726204
Public administration	0.636585	0.670512	0.878229	0.711561	0.858605	0.775815	0.718828
Education	0.899212	1.153929	0.755426	0.663446	0.732057	0.657939	0.557935

Table A1-11 RCA2 Latvia, Value added computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	1.170297	0.950608	1.179168	1.125695	0.980401	3.29703	0.99045168
Mining and quarrying	0.661043	0.291138	0.928376	0.372248	0.397119	0.141832	0.35551919
Total manufactures	1.115593	1.121207	1.043719	1.154993	1.058465	1.076567	1.1703019
Food products and beverages	1.503632	1.827922	1.524245	1.52072	1.481387	1.914147	1.77101196
Textile, textile products	1.255815	1.108214	0.943876	1.043758	0.758511	0.899181	1.28789455
Wood, paper	1.280425	1.176572	1.463565	1.465747	1.538467	1.967357	1.86614263
Woods and products from wood	0.462586	0.578493	2.574171	2.829426	3.181604	4.028139	3.96101772
Pulp, paper, printing	1.575248	1.375229	1.046342	1.034182	1.065988	1.364034	1.25876231
Chemicals and non-metallic pr.	2.121068	1.807271	1.339297	1.66885	1.247832	1.40401	1.50102654
Coke, refined petroleum pr.	6.171646	3.854253	1.10199	2.126617	0.961198	0.425258	1.29125371
Chemicals and chemical pr.	1.415157	1.212935	1.320366	1.396547	1.210698	1.546634	1.31057614
Rubber and plastic bags	1.305506	1.281778	1.370894	1.532014	1.278127	1.866764	1.9241441
Other non-metallic mineral	1.559345	1.887002	2.187712	2.269729	2.522943	3.111988	3.18600591
Basic metals and fabricated	0.53163	1.062791	0.964592	1.071981	1.030954	1.153862	1.17702295
Basic metals	0.154498	0.886406	0.812335	0.997231	0.779988	0.862345	0.82518526
Fabricated metal products	1.320553	1.377751	1.314882	1.264605	1.562511	1.899042	2.13844531
Machinery and equipment	1.013795	1.18374	1.187747	1.105899	1.141421	1.278502	1.64321053
Electrical and optical equipment	0.710642	0.625769	0.580079	0.664988	0.532111	0.672544	0.65777557
Computer	0.610483	0.555828	0.343707	0.416211	0.336811	0.411306	0.35545058
Electrical machinery	1.063466	0.931302	1.418675	1.399702	1.109279	1.470604	1.56592357
Transport equipment	0.509557	0.673408	0.809231	0.895727	0.723239	0.196294	0.29362658
Motor vehicles	0.605834	0.872086	1.01607	1.149846	1.035558	0.10311	0.27338788
Other transport equipment	0.26508	0.238488	0.279069	0.331158	0.25012	0.369342	0.33262002
Manufacturing-nec	0.872678	0.925713	1.018934	0.743033	2.246129	0.944861	1.01511554
Electricity gas	7.990421	4.792159	2.373493	1.278259	1.380675	2.14309	1.78298268
Construction	0.553056	1.536455	0.730838	2.482693	1.526278	1.22314	1.26457921
Total business	0.806306	0.958394	0.947458	0.970336	1.060471	0.979995	0.97835002
Wholesales and retailed tr.,hotels	1.032867	0.940077	1.081517	1.030223	1.109018	0.993834	1.02258113
Wholesales, repairs	1.045312	0.918956	1.088202	0.998704	1.059797	0.964454	1.01431252
Hotels and restaurants	0.962816	1.059588	1.039747	1.244064	1.412294	1.188407	1.08001266
Transportation and storage, post	0.658832	1.03689	0.721524	0.846104	0.972987	0.824631	0.86948763
Transportation and storage	0.689585	1.024804	0.709214	0.778767	0.914737	0.760877	0.7977805
Post and telecommunication	0.197723	1.18156	0.853851	1.545109	1.48967	1.44179	1.56568363
Financial intermediation	0.304088	1.77555	0.264879	0.341058	0.180337	0.182961	0.18289051

Sectors	1995	2000	2005	2008	2009	2010	2011
Real estate, renting	0.624959	0.475812	1.310475	1.360261	1.539683	1.548798	1.41189033
Real estate activities	0.717166	0.858645	0.883716	0.720643	0.997529	0.966477	0.79733153
Renting and other business	2.638237	0.53377	1.473603	1.405585	1.421489	1.217662	1.10403544
Computer and other activities	0.162515	0.452328	0.759513	0.837496	0.882179	0.824966	0.74956329
R & D	0.367515	0.41919	1.457345	1.540695	1.764398	1.843469	1.69319699
Communication	0.570511	0.647609	0.741649	0.785481	0.941195	0.801363	0.73182118
Public administration	0.631303	0.67199	0.861269	0.708413	0.857855	0.784405	0.73368178
Education Health	0.911844	1.177851	0.757703	0.66759	0.735891	0.668899	0.5695265

Table A1-12 RCA1 Lithuania, Gross export computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	1.787381	1.785404	1.556539	1.805605	1.930994	3.032532	2.784467
Mining and quarrying	0.476412	0.343948	0.245746	0.855074	1.324062	0.896319	0.902101
Total manufacturing	1.040388	1.114874	1.163607	1.019042	0.94076	0.961187	0.956611
Food products and beverages	2.286513	2.400887	2.07614	2.425208	2.782445	2.748417	2.75711
Textile, textile products	1.426062	2.288237	1.767907	1.674254	1.439197	1.811026	1.442343
Wood, paper	1.256694	1.777004	1.994278	1.87353	1.752672	2.419491	2.330924
Wood and product	0.859318	1.915031	3.350153	3.00808	2.914996	3.729026	3.255717
Pulp, paper, printing	4.062999	2.920934	6.346659	3.808252	5.659231	4.359148	4.800739
Chemicals and non-metallic pr.	0.167895	0.011317	0.32948	0.052287	0.245566	0.119041	0.144768
Coke, refined petroleum pr.	2.239149	0.184544	0.288216	0.148673	0.606836	0.131709	0.160206
Chemicals and chemical pr.	0.394537	0.646022	0.669149	0.428876	0.415131	0.449134	0.438414
Rubber and plastic bags	0.836677	1.148404	1.162222	1.146544	0.738671	0.923445	0.800208
Other non	2.571442	2.296754	3.84951	5.836855	4.283605	4.780883	4.871867
Other non-metallic mineral	0.802734	0.943744	1.045511	1.103494	0.938491	1.033496	0.892326
Basic metals and fabricated	0.576006	0.59017	0.728212	0.85136	0.789305	0.760899	0.7017
Basic metals	1.288755	1.610018	1.791405	1.774504	1.262804	1.741216	1.425563
Fabricated metal products	1.221813	1.635953	1.564393	1.199898	1.010932	0.974193	1.001845
Machinery and equipment	0.747828	0.787746	0.800716	0.671343	0.61367	0.654057	0.626379
Computer electronics	0.653559	0.638848	0.69006	0.535478	0.557399	0.579311	0.507472
Electrical machinery	0.297549	0.316615	0.310609	0.340195	0.241236	0.268273	0.31236
Transport equipment	2.868532	3.449322	3.956068	3.671087	1.197045	1.904258	2.672115
Motor vehicles	0.574616	0.672227	0.862092	0.86552	0.2549	0.464989	0.667263
Other transport equipment	0.319281	0.342556	0.259132	0.345509	0.22436	0.212722	0.241023
Manufacturing - nec	0.575991	0.584996	0.710309	0.814477	0.572919	0.554351	0.630598
Electricity gas	0.100769	0.183446	0.172928	0.162495	0.122396	1.116329	0.988415
Construction	0.571838	0.720088	0.832994	1.196502	2.346711	0.871384	0.681601
Total business	0.973325	0.901573	0.884646	0.953849	0.961641	0.909674	0.93721
Wholesales and retailed trade	0.928558	1.004957	1.016691	1.131897	1.139617	1.083474	1.072514
Wholesales, repairs	1.041701	1.105868	1.073267	1.191383	1.198677	1.1709	1.168418
Hotels and restaurants	0.330984	0.451004	0.677409	0.744297	0.787378	0.525501	0.436576
Transportation and post	1.38757	1.135137	0.948172	1.065359	1.24519	1.104989	1.216887
Transportation and storage	1.418184	1.133878	0.888888	1.030976	1.193225	1.029714	1.143383
Post and telecommunication	0.903496	1.14937	1.632752	1.455549	1.739101	1.883724	1.983655
Financial intermediation	0.09882	0.265933	0.447244	0.606696	0.268975	0.394771	0.445698
Real estate, renting	0.605749	0.517228	0.706877	0.567499	0.589488	0.536598	0.510705

Sectors	1995	2000	2005	2008	2009	2010	2011
Real estate activities	0.360482	0.364603	0.556945	0.590683	0.613746	0.478886	0.426835
Renting and other business	1.629452	1.572978	1.88403	0.945873	0.405553	0.398619	0.400911
Computer and other activities	0.615661	0.446799	0.422506	0.523646	0.612271	0.589121	0.550235
R & D	0.483961	0.389398	0.588552	0.517426	0.613043	0.551596	0.525768
Communication	0.352759	0.462375	0.509421	1.186327	0.800421	1.09201	1.154581
Public administration	0.601656	0.500244	0.676869	0.329998	0.382628	0.305536	0.358199
Education	0.288419	0.351288	0.266207	0.192748	0.189457	0.139884	0.128621

Table A1-13 RCA2 Lithuania, Value added computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	1.793605	1.799561	1.528505	1.703086	1.799089	2.825846	2.580259
Mining and quarrying	0.472545	0.310123	0.246129	0.844098	1.282821	0.887984	0.8962809
Total manufactures	1.056024	1.153368	1.211148	1.039717	0.955149	0.981303	0.9771187
Food products and beverages	2.28761	2.390197	2.02402	2.312858	2.641477	2.624283	2.6272376
Textile, textile products	1.405112	2.295204	1.787924	1.634871	1.369785	1.76199	1.3816250
Wood, paper	1.247374	1.740082	1.944368	1.797317	1.650953	2.289769	2.2206635
Woods and products from wood	0.859651	1.941608	3.356488	2.968223	2.881949	3.683087	3.2696977
Pulp, paper, printing	1.386913	1.671525	1.414332	1.426875	1.296658	1.881597	1.9166425
Chemicals and non-metallic pr.	0.909211	0.588728	0.998128	0.484399	0.749904	0.528716	0.5305732
Coke, refined petroleum pr.	1.23772	0.050627	1.618077	0.219501	1.127005	0.514231	0.568499
Chemicals and chemical pr.	0.589445	0.075947	0.145183	0.088727	0.283518	0.07055	0.0921637
Rubber and plastic bags	1.335709	2.153423	2.328522	1.700557	1.597661	1.696307	1.6361737
Other non-metallic mineral	1.662423	2.206787	2.538626	2.362234	1.58164	2.075732	1.8761090
Other non-metallic mineral	0.828255	0.964501	1.041986	1.123416	0.927864	1.030913	0.9017982
Basic metals and fabricated	0.591387	0.586002	0.72103	0.883215	0.787538	0.769028	0.7218180
Basic metals	1.324442	1.638505	1.779696	1.741773	1.225282	1.700116	1.3937769
Fabricated metal products	1.195916	1.573796	1.523473	1.156878	0.961333	0.944869	0.9768398
Machinery and equipment	0.754147	0.83652	0.875742	0.706642	0.635359	0.67289	0.6456630
Computer	0.656825	0.668478	0.754949	0.560354	0.578354	0.593556	0.5247077
Electrical machinery	1.097173	1.570736	1.304531	1.138672	0.803774	0.91516	1.0088931
Transport equipment	0.81438	0.948378	1.036997	1.050511	0.365219	0.569214	0.7904660
Motor vehicles	0.788314	1.02532	1.167786	1.177629	0.391344	0.666946	0.9447187
Other transport equipment	0.880783	0.779499	0.701486	0.768201	0.325539	0.387791	0.492637
Manufacturing-nec	0.775237	0.854924	0.885279	0.984642	0.766995	0.724019	0.8421549
Electricity gas	0.661436	1.470705	0.955565	0.710142	0.506459	3.582074	3.5389888
Construction	0.55006	0.720151	0.789831	1.170783	2.358983	0.843128	0.6457189
Total business	0.962335	0.899303	0.896948	0.949006	0.93795	0.896334	0.9173747
Wholesales and retailed tr.,hotels	0.925268	1.005985	1.017657	1.118539	1.104041	1.063494	1.0530345
Wholesales, repairs	1.032347	1.101951	1.069522	1.173382	1.157163	1.144277	1.1415091
Hotels and restaurants	0.336906	0.462674	0.695493	0.746368	0.776082	0.528364	0.4405596
Transportation and storage, post	1.378548	1.142923	0.979339	1.063472	1.23868	1.109244	1.2184469
Transportation and storage	1.411419	1.143379	0.913085	1.023835	1.186782	1.023399	1.1424260
Post and telecommunication	0.886379	1.135431	1.69264	1.474551	1.699019	1.940656	1.9573614
Financial intermediation	0.103233	0.262293	0.4461	0.640061	0.265074	0.372944	0.3919067
Real estate, renting	0.598336	0.508803	0.717944	0.554947	0.563733	0.520505	0.4941528

Sectors	1995	2000	2005	2008	2009	2010	2011
Real estate activities	0.361199	0.365455	0.553497	0.570818	0.585893	0.466263	0.4101672
Renting and other business	1.599714	1.517124	1.991152	0.97457	0.383524	0.38365	0.3705683
Computer and other activities	0.626056	0.443099	0.427237	0.535443	0.629271	0.59007	0.5540678
R & D	0.476602	0.38296	0.581528	0.49315	0.576627	0.531773	0.5077221
Communication	0.352419	0.474396	0.50778	1.136645	0.767499	1.060808	1.1240774
Public administration	0.594132	0.50635	0.684145	0.323164	0.369104	0.301233	0.3544414
Education Health	0.286452	0.360296	0.272261	0.192419	0.185753	0.139151	0.1290602

Table A1-14 RCA1 Poland, Gross export computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	1.387703	1.016908	1.01348	1.401057	0.955303	0.962602	0.976889
Mining and quarrying	1.570288	1.599961	0.744143	0.554885	0.604536	0.683168	0.651072
Total manufacturing	1.062517	0.981222	1.135767	1.156972	1.157484	1.127108	1.137965
Food products and beverages	1.000296	0.869191	0.94888	1.058298	1.538584	1.121835	1.162273
Textile, textile products	1.369136	1.109299	0.948076	1.183711	1.688389	1.102693	1.291738
Wood, paper	1.21001	1.29081	1.283596	1.338836	1.36802	1.463552	1.518026
Wood and product	0.487173	0.863644	0.9876	1.309645	1.217725	1.214134	1.319783
Pulp, paper, printing	1.472134	1.436686	1.397986	1.348393	1.413012	1.539517	1.577865
Chemicals and non-metallic pr.	1.474151	1.155777	1.398787	1.107691	1.197819	1.259902	1.203777
Coke, refined petroleum pr.	0.944377	0.615322	1.51611	0.712886	1.230955	1.212786	0.60732
Chemicals and chemical pr.	1.512809	1.122489	1.215783	1.094957	1.064231	1.131166	1.339968
Rubber and plastic bags	1.676458	1.739471	1.878887	1.934336	1.576775	1.827192	1.921001
Other non-metallic mineral	1.783744	1.725957	1.327165	1.527643	1.421757	1.385884	1.495245
Basic metals and fabricated	1.017574	1.495631	1.49575	1.393599	1.211216	1.232104	1.484335
Basic metals	0.824237	1.365596	1.322705	1.263047	1.015751	1.054534	1.35375
Fabricated metal products	1.432068	1.740713	1.902677	1.741101	1.636272	1.693208	1.849578
Machinery and equipment	1.498225	0.840933	1.26403	1.194093	1.129724	1.04876	1.020775
Electrical and optical equip.	0.762847	0.675389	0.812273	0.855723	0.883604	0.918821	0.859233
Computer electronics	0.664328	0.681064	0.742358	0.741408	0.759649	0.833686	0.720161
Electrical machinery	0.305953	0.138162	0.272757	0.374787	0.390292	0.357062	0.404468
Transport equipment	2.051	3.649	4.092	4.315	2.955	3.194	3.005
Motor vehicles	0.519882	0.783745	0.882757	1.066516	0.76422	0.841117	0.765658
Other transport equipment	0.079266	0.259064	0.280474	0.336214	0.33488	0.264946	0.248303
Manufacturing - nec	0.500724	0.545257	0.536148	1.171804	0.894194	1.065053	1.093944
Electricity gas	0.075643	0.046472	0.089157	0.142799	0.155707	0.173811	0.174248
Construction	4.40619	1.035013	1.121254	1.1149	0.999514	0.784413	0.775297
Total business	0.745931	0.933363	0.834408	0.840029	0.842639	0.871809	0.870041
Wholesales and retailed trade	0.878877	1.144527	1.063607	1.097891	1.124327	1.096172	1.089745
Wholesales, repairs	0.987937	1.078739	1.002123	1.054501	1.097733	1.052263	1.066811
Hotels and restaurants	0.302557	1.505904	1.432229	1.380566	1.282939	1.37626	1.241841
Transportation and post	0.488686	0.863724	0.606561	0.6425	0.650751	0.598668	0.576161
Transportation and storage	0.480315	0.849301	0.595395	0.6321	0.627734	0.593061	0.574345
Post and telecommunication	0.620734	1.047241	0.735551	0.760636	0.86952	0.656618	0.595082
Financial intermediation	1.736378	0.689196	0.490329	0.320498	0.304351	0.220031	0.438313
Real estate, renting	0.418018	0.603718	0.851442	0.859057	0.831296	1.11534	1.025106
Real estate activities	0.34568	1.001684	1.193916	1.224808	1.212872	1.580346	1.496866

Sectors	1995	2000	2005	2008	2009	2010	2011
Renting and other business	0.548904	1.074281	0.509665	0.547051	0.53938	0.352281	0.244141
Computer and other activities	0.578269	0.752251	1.457049	1.532703	1.458586	2.129565	1.929551
R & D	0.385086	0.448995	0.72832	0.704491	0.690317	0.934589	0.869281
Communication	0.255555	0.513369	0.560561	0.733772	0.73266	0.846935	0.87361
Public administration	0.459461	0.534254	0.563694	0.576533	0.539549	0.743879	0.703436
Education	0.646591	0.725278	0.665882	0.685395	0.735352	0.823806	0.782958

Table A1-15 RCA2 Poland, Value added computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	1.400674	1.019537	1.015937	1.398495	0.949281	0.95253	0.95955666
Mining and quarrying	1.550078	1.460118	0.748203	0.560716	0.60799	0.689255	0.65866751
Total manufactures	1.073191	0.990819	1.163404	1.189408	1.1835	1.149207	1.16613292
Food products and beverages	0.992786	0.848793	0.950638	1.057348	1.534938	1.118253	1.14820587
Textile, textile products	1.383873	1.12276	0.957202	1.213172	1.725215	1.12556	1.31773262
Wood, paper	1.211472	1.276047	1.287231	1.361009	1.378905	1.473668	1.52805645
Woods and products from wood	0.489949	0.867693	0.978017	1.349398	1.249995	1.244237	1.35216477
Pulp, paper, printing	1.471229	1.412303	1.403285	1.364691	1.415963	1.540863	1.57910486
Chemicals and non-metallic pr.	1.465468	1.152897	1.44861	1.152756	1.225406	1.312158	1.26418829
Coke, refined petroleum pr.	0.921195	0.575352	1.656752	0.679102	1.28417	1.340351	0.62999032
Chemicals and chemical pr.	1.493404	1.101021	1.240889	1.134984	1.081796	1.15681	1.37331375
Rubber and plastic bags	1.677824	1.754144	1.919213	2.001614	1.609277	1.856909	1.9542852
Other non-metallic mineral	1.787815	1.696594	1.337437	1.562041	1.439118	1.395017	1.51675718
Basic metals and fabricated	1.005998	1.483783	1.485886	1.402286	1.201203	1.197143	1.43665364
Basic metals	0.782459	1.323908	1.269294	1.233721	0.956741	0.968385	1.2469432
Fabricated metal products	1.473765	1.768664	1.983836	1.836258	1.719346	1.781772	1.95512756
Machinery and equipment	1.499534	0.82652	1.288016	1.229333	1.160286	1.072977	1.0436309
Electrical and optical equipment	0.781975	0.693169	0.836741	0.890109	0.897901	0.935253	0.88548103
Computer	0.667076	0.693568	0.745563	0.750128	0.744585	0.828069	0.72417755
Electrical machinery	1.186745	0.691417	1.160216	1.30352	1.350873	1.262844	1.36992169
Transport equipment	0.569	0.971	1.092	1.304	0.938	0.998	0.9282
Motor vehicles	0.710881	1.127009	1.228341	1.557629	1.259629	1.29001	1.16427144
Other transport equipment	0.206287	0.628421	0.743493	0.740267	0.451492	0.456543	0.47247744
Manufacturing-nec	0.675771	0.79167	0.666923	1.489395	1.272297	1.47435	1.54009509
Electricity gas	0.492853	0.348322	0.48361	0.650206	0.677561	0.627706	0.65905437
Construction	4.356844	1.026661	1.146091	1.190719	1.055145	0.821876	0.82064874
Total business	0.754903	0.937179	0.851514	0.868463	0.866427	0.894438	0.89485809
Wholesales and retailed tr., hotels	0.879814	1.147298	1.071044	1.120615	1.143137	1.11211	1.10827148
Wholesales, repairs	0.985091	1.083448	1.011195	1.079397	1.117651	1.069209	1.08582686
Hotels and restaurants	0.302346	1.508117	1.442475	1.400188	1.300309	1.396223	1.2636314
Transportation and storage, post	0.490612	0.845345	0.617573	0.664286	0.672363	0.614188	0.59002628
Transportation and storage	0.480454	0.829396	0.604625	0.652016	0.647316	0.606385	0.58689622
Post and telecommunication	0.642986	1.035608	0.756856	0.79161	0.894841	0.689747	0.62043588
Financial intermediation	1.771898	0.70385	0.47177	0.309655	0.283795	0.200297	0.41557296

Sectors	1995	2000	2005	2008	2009	2010	2011
Real estate, renting	0.429623	0.625118	0.876664	0.879201	0.851405	1.134122	1.04860535
Real estate activities	0.342461	1.008712	1.215758	1.264128	1.247348	1.62873	1.54421784
Renting and other business	0.572425	1.104398	0.547655	0.587792	0.529863	0.334472	0.25706739
Computer and other activities	0.614407	0.754722	1.510094	1.546011	1.532834	2.171764	1.97209801
R & D	0.394608	0.469902	0.749054	0.727517	0.709147	0.967429	0.90335622
Communication	0.261064	0.514949	0.569993	0.746764	0.740171	0.85315	0.88040327
Public administration	0.462414	0.539286	0.573836	0.593864	0.551295	0.763626	0.72221377
Education Health	0.653249	0.73274	0.680299	0.708122	0.752046	0.842542	0.80378493

Table A1-16 RCA1 Romania, Gross export computation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	0.42529	0.695771	0.700198	0.83175	0.929911	1.164733	1.080975
Mining and quarrying	3.354119	1.111435	1.592618	1.186974	1.198546	0.830896	0.591789
Total manufacturing	0.910978	1.047043	0.999281	1.052392	1.028492	1.135261	1.182025
Food products and beverages	1.285943	1.251318	1.017694	1.129123	1.379572	1.154407	1.10532
Textile, textile products	1.888835	1.920107	1.54725	1.154791	1.889349	1.978587	2.041995
Wood, paper	0.573057	0.798883	0.990282	1.024061	1.193523	1.127444	1.027598
Wood and product	0.397158	0.664854	1.071574	1.83353	1.585418	1.357476	1.190168
Pulp, paper, printing	0.6367	0.844527	0.958892	0.75927	1.07625	1.057359	0.978576
Chemicals and non-metallic pr.	1.104532	1.167374	1.020436	0.870584	1.081029	1.523917	1.577631
Coke, refined petroleum pr.	1.490356	0.711034	0.570102	0.457448	0.455433	1.96147	2.008129
Chemicals and chemical pr.	1.105126	1.282536	0.949559	0.91572	1.091072	1.094112	1.155392
Rubber and plastic bags	0.865535	1.364247	1.686852	1.231636	1.900592	2.150604	2.148646
Other non-metallic mineral	0.865352	1.275662	1.873602	1.851815	1.947188	1.891913	1.876958
Basic metals and fabricated	0.806364	1.333738	1.555462	1.610075	1.441006	1.531365	1.513676
Basic metals	0.806681	1.425551	1.446963	1.554097	1.185804	1.434053	1.425583
Fabricated metal products	0.805507	1.160739	1.810632	1.759026	1.995955	1.784021	1.760075
Machinery and equipment	1.338877	1.288581	1.272038	1.060195	1.398983	1.202247	1.209474
Electrical and optical equipment	0.630716	0.992474	0.681112	0.861207	0.431237	0.693899	0.695707
Computer electronics	0.533712	0.811138	0.545641	0.646701	0.370287	0.562857	0.443304
Electrical machinery	0.268552	0.392728	0.305545	0.47665	0.190929	0.336399	0.467285
Transport equipment	1.162188	1.565381	2.669872	3.71687	2.364612	1.861689	2.427804
Motor vehicles	0.222703	0.291662	0.58882	0.968113	0.69562	0.503199	0.662313
Other transport equipment	0.143259	0.174584	0.16536	0.219346	0.131567	0.134839	0.136026
Manufacturing - nec	0.51238	0.446942	0.53865	0.517561	0.370076	0.368097	0.399561
Electricity gas	0.255797	0.200517	0.214056	0.267134	0.097956	0.099281	0.093111
Construction	0.790353	1.099779	1.343204	1.256753	1.24694	1.494653	1.091742
Total business	0.899537	0.894829	0.880313	0.872603	0.922724	0.75463	0.752613
Wholesales and retailed tr.,hotels	1.0354	0.968039	1.006928	0.947098	0.934245	0.91166	0.901052
Wholesales, repairs	1.027092	1.017931	1.082914	0.99159	0.989848	0.945761	0.930631
Hotels and restaurants	1.079348	0.693991	0.551384	0.657248	0.602677	0.694226	0.704898
Transportation and storage, post	1.04815	0.958305	0.520452	0.657179	0.919334	0.455059	0.469374
Transportation and storage	1.05207	0.872758	0.389537	0.543568	0.721883	0.373071	0.376402
Post and telecommunication	0.985519	2.047232	2.033485	1.947502	2.796409	1.30258	1.439372
Financial intermediation	0.716063	0.88045	0.540893	0.379669	0.402466	0.435242	0.6128

Sectors	1995	2000	2005	2008	2009	2010	2011
Real estate, renting	0.210905	0.586462	1.340386	1.328562	1.18705	1.006302	0.897222
Real estate activities	1.275865	0.88349	1.050048	1.260501	1.056166	1.041148	1.035226
Renting and other business	0.073678	0.306563	0.679466	0.597401	0.819531	0.740486	0.602143
Computer and other activities	0.14453	0.635123	1.747014	1.824848	1.789888	1.994125	1.750016
R & D	0.091608	0.581229	1.385292	1.323387	1.109376	0.779361	0.696911
Communication	1.018074	0.96268	0.528527	0.438439	0.826937	1.586826	1.689881
Public administration	0.780006	0.58295	0.643126	0.75289	0.739221	0.875066	0.781965
Education	0.286428	0.315978	0.385968	0.489909	0.533247	0.424515	0.4242

Table A1-17 RCA2 Romania, Value added calculations, 1995-2011

Romania	1995	2000	2005	2008	2009	2010	2011
Agriculture	0.422305	0.697507	0.689859	0.799662	0.872005	1.117146	1.067611
Mining and quarrying	3.276774	1.054694	1.560998	1.196803	1.208228	0.876458	0.633622
Total manufactures	0.910073	1.065853	0.998121	1.048007	1.026237	1.129382	1.189580
Food products and beverages	1.286193	1.24638	1.004833	1.092208	1.321113	1.144256	1.108584
Textile, textile products	1.947067	2.037773	1.571263	1.162359	1.875268	2.044369	2.104980
Wood, paper	0.550796	0.763928	0.938373	0.989144	1.143514	1.120263	1.028057
Woods and products from wood	0.388582	0.645608	1.009104	1.789226	1.538382	1.36674	1.215025
Pulp, paper, printing	0.609176	0.803281	0.91182	0.736003	1.029971	1.0481	0.973819
Chemicals and non-metallic pr.	1.064415	1.130302	0.995485	0.885313	1.053164	1.406247	1.498038
Coke, refined petroleum pr.	1.458919	0.658046	0.523419	0.42561	0.349764	1.501044	1.711877
Chemicals and chemical pr.	1.063589	1.234828	0.919115	0.913365	1.062961	1.112624	1.175657
Rubber and plastic bags	0.832345	1.30584	1.629976	1.216284	1.839668	2.176321	2.194359
Other non-metallic mineral	0.848697	1.218419	1.79515	1.857318	1.904073	1.93868	1.940725
Basic metals and fabricated	0.786516	1.307512	1.518137	1.583628	1.393324	1.509822	1.496875
Basic metals	0.780246	1.386847	1.398256	1.505125	1.091727	1.351893	1.34525
Fabricated metal products	0.799866	1.166131	1.793803	1.785753	2.032501	1.91337	1.911335
Machinery and equipment	1.303113	1.25815	1.244007	1.061014	1.394504	1.244803	1.26115
Electrical and optical equipment	0.643018	1.084712	0.70502	0.900276	0.431618	0.711639	0.7504
Computer	0.536953	0.87851	0.548323	0.651978	0.356775	0.540463	0.445107
Electrical machinery	1.016698	1.984382	1.260912	1.63355	0.652791	1.234747	1.667512
Transport equipment	0.319057	0.402759	0.675118	1.048084	0.717374	0.57146	0.737381
Motor vehicles	0.301568	0.419347	0.770601	1.298392	1.058893	0.738169	0.96698
Other transport equipment	0.363656	0.366342	0.430334	0.491839	0.199977	0.262062	0.294093
Manufacturing-nec	0.680368	0.652661	0.654942	0.626872	0.514867	0.50941	0.563462
Electricity gas	1.609066	1.444552	1.128912	1.202228	0.380484	0.351842	0.347944
Construction	0.767329	1.072314	1.31829	1.279686	1.272886	1.630456	1.189241
Total business	0.877272	0.897764	0.882358	0.894301	0.933889	0.80346	0.809674
Wholesales and retailed tr.,hotels	1.010076	0.965607	0.985254	0.948826	0.924912	0.941875	0.938092
Wholesales, repairs	1.002008	1.01258	1.056739	0.991157	0.977506	0.973809	0.965193
Hotels and restaurants	1.054206	0.699983	0.541533	0.661712	0.600516	0.730435	0.750495
Transportation and storage, post	1.021717	0.968631	0.53008	0.687108	0.953771	0.497223	0.519320
Transportation and storage	1.02607	0.879124	0.390686	0.560535	0.743903	0.403302	0.411401
Post and telecommunication	0.95662	2.036683	2.030664	2.000751	2.817364	1.406938	1.567689
Financial intermediation	0.711429	0.912447	0.552133	0.37116	0.396007	0.44081	0.641217
Real estate, renting	0.212474	0.584239	1.329995	1.35753	1.212598	1.082584	0.979106
Real estate activities	1.259547	0.894826	1.028079	1.257729	1.048418	1.099233	1.105494

Romania	1995	2000	2005	2008	2009	2010	2011
Renting and other business	0.072068	0.31108	0.707371	0.635015	0.854088	0.800045	0.64079
Computer and other activities	0.142909	0.653161	1.799181	1.953949	1.933371	2.257539	1.997791
R & D	0.088137	0.57067	1.362499	1.336891	1.119356	0.832137	0.761571
Communication	0.973686	0.953102	0.511263	0.439914	0.817358	1.652763	1.770944
Public administration	0.757013	0.584537	0.633358	0.763027	0.737787	0.919012	0.835707
Education Health	0.284574	0.320918	0.382305	0.500818	0.538449	0.449495	0.455873

Table A1-18 RCA1 Slovakia, Gross export calculation, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	1.087467	0.779219	0.732271	0.650765	0.61293	0.686457	0.733002
Mining and quarrying	2.307103	1.390764	1.355683	0.972899	1.221694	1.374482	1.21684
Total manufacturing	0.937	1.092	1.112	1.132	1.105	1.104	1.109
Food products and beverages	1.010075	1.213558	1.176096	1.159317	1.141085	1.156776	1.22679
Textile, textile products	0.600119	1.008634	0.914838	0.852404	0.849742	0.725058	0.798916
Wood, paper	0.940595	1.053414	1.080878	1.115875	1.183327	1.135772	1.068652
Wood and product	0.536384	0.817621	0.94764	1.351725	1.512308	1.392785	1.08234
Pulp, paper, printing	1.087175	1.134	1.132345	1.038722	1.084787	1.057472	1.064444
Chemicals and non-metallic pr.	1.100076	1.172777	1.049926	0.832779	0.880484	0.924949	0.919524
Coke, refined petroleum pr.	0.824249	0.444278	0.770708	0.555502	0.459504	0.626447	0.647753
Chemicals and chemical pr.	1.086764	1.25785	0.860199	0.727833	0.790093	0.740135	0.805574
Rubber and plastic bags	1.240904	1.787659	1.987583	1.543627	1.6482	1.985955	1.647265
Other non-metallic mineral	1.417766	1.414576	1.574463	1.681652	1.86104	1.685149	1.785164
Basic metals and fabricated	1.02985	1.44946	1.589276	1.434049	1.282371	1.412644	1.337448
Basic metals	1.029456	1.381205	1.35127	1.227751	1.006013	1.165053	0.996686
Fabricated metal products	1.030695	1.577885	2.148972	1.983145	1.883365	2.055621	2.290471
Machinery and equipment	1.316261	1.629204	1.18338	0.987925	1.022684	1.018142	0.91706
Electrical and optical equipment	0.69753	0.740984	1.024269	1.111931	1.09801	1.110976	1.010847
Computer electronics	0.673255	0.547097	0.92036	1.013875	0.978705	0.9675	0.748062
Electrical machinery	0.213987	0.351652	0.359675	0.436507	0.450275	0.472276	0.575009
Transport equipment	3.170462	4.086936	4.12313	5.43203	3.676657	4.401942	4.494378
Motor vehicles	0.716732	0.965753	1.018759	1.568004	1.13249	1.340129	1.324089
Other transport equipment	0.241539	0.165103	0.105967	0.102827	0.121995	0.092613	0.106738
Manufacturing - nec	0.484348	0.497972	0.533597	0.611516	1.447962	0.506628	1.346509
Electricity gas	0.915	0.155	0.232	0.142	0.214	0.224	0.228
Construction	1.04851	1.265838	0.952539	1.525491	1.022349	1.236027	1.354175
Total business	0.895428	0.755131	0.731943	0.768296	0.798147	0.726742	0.740773
Wholesales and retailed tr.,hotels	0.858235	1.004882	1.015285	1.021279	1.184372	1.061476	1.107194
Wholesales, repairs	0.864816	1.071784	1.073787	1.056764	1.228997	1.098919	1.156117
Hotels and restaurants	0.823271	0.637204	0.664604	0.790116	0.918261	0.822642	0.78278
Transportation and storage, post	0.956859	0.462376	0.557071	0.539921	0.516424	0.393249	0.400735
Transportation and storage	0.831819	0.475718	0.576116	0.509246	0.497624	0.389899	0.394709
Post and telecommunication	2.939587	0.292676	0.336804	0.888318	0.695075	0.428055	0.463595
Financial intermediation	0.253637	0.173496	0.274623	0.333098	0.294389	0.488149	0.514818

Sectors	1995	2000	2005	2008	2009	2010	2011
Real estate, renting	1.185643	0.893962	0.599	0.798394	0.680844	0.612749	0.540719
Real estate activities	0.875553	0.663293	0.59408	0.754417	0.872454	0.830677	0.763799
Renting and other business	1.150988	0.557654	0.255418	0.501694	0.863967	0.814618	0.63522
Computer and other activities	0.547289	0.538784	0.832087	1.188381	0.865267	0.710447	0.624383
R & D	1.32721	1.051197	0.602111	0.750153	0.586553	0.53166	0.4821
Communication	0.922267	0.663578	0.513859	1.16938	0.886999	0.984938	0.946815
Public administration	0.811221	0.505734	0.329412	0.461088	0.364569	0.308626	0.282993
Education	0.891794	0.781239	1.242141	1.396162	0.915132	0.912822	0.837084

Table A1-19 RCA2 Slovakia, Value added calculation. 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	1.099568	0.787547	0.734889	0.654879	0.6195	0.682088	0.7162
Mining and quarrying	2.292629	1.282976	1.374822	0.987233	1.229205	1.387707	1.218079
Total manufactures	0.19278	0.18998	0.25658	0.23787	0.224	0.28989	0.2942
Food products and beverages	0.959399	1.143342	1.174376	1.165187	1.154958	1.160216	1.2007552
Textile, textile products	0.589036	1.025386	0.933321	0.875678	0.860587	0.750376	0.8160323
Wood, paper, printing	0.906425	1.018623	1.047782	1.099113	1.147352	1.096431	1.0272473
Woods and products from wood	0.537927	0.830597	0.951164	1.403946	1.576702	1.451629	1.0954626
Pulp, paper	1.039147	1.081342	1.084219	1.002527	1.023822	0.992373	1.007363
Chemicals and non-metallic pr.	1.057092	1.161875	1.049414	0.85321	0.909698	0.926888	0.9387338
Coke, refined petroleum pr.	0.797444	0.433265	0.670007	0.444999	0.38894	0.462945	0.549330
Chemicals and chemical pr.	1.052489	1.214681	0.871975	0.756593	0.810059	0.758567	0.8264524
Rubber and plastic bags	1.130979	1.785884	2.02163	1.59875	1.701974	2.068558	1.7153956
Other non-metallic mineral	1.379069	1.338643	1.600146	1.823001	2.008106	1.835088	1.9276522
Basic metals and fabricated	0.99392	1.424671	1.610457	1.490887	1.323184	1.460075	1.37720114
Basic metals	0.977953	1.327008	1.356365	1.268385	1.027833	1.189951	1.0065218
Fabricated metal products	1.027335	1.598612	2.19459	2.063757	1.949163	2.150474	2.3902639
Machinery and equipment	1.315611	1.664384	1.097443	0.955241	0.930405	0.953629	0.875775
Electrical and optical equipment	0.726265	0.825106	1.111997	1.148965	1.125063	1.148227	1.0500111
Computer	0.705216	0.600671	0.994959	1.026524	0.982611	0.975022	0.7494296
Electrical machinery	0.800303	1.804269	1.527207	1.510578	1.545965	1.677589	1.9527438
Transport equipment	0.844463	1.062628	1.057976	1.628906	1.171315	1.384292	1.3960176
Motor vehicles	0.934238	1.384389	1.367355	2.263236	1.836129	2.046491	2.018936
Other transport equipment	0.615752	0.357783	0.265051	0.219267	0.164187	0.155296	0.1933978
Manufacturing-nec	0.641728	0.724339	0.646641	0.768993	2.049533	0.690584	1.8418206
Electricity gas	5.946	1.1	1.267	0.64	0.934	0.807	0.8548
Construction	1.01669	1.255053	0.942498	1.590428	1.017282	1.238021	1.3565650
Total business	0.8998	0.777767	0.75811	0.802742	0.822499	0.756919	0.7663976
Wholesales and retailed tr.,hotels	0.861733	1.034087	1.047997	1.061929	1.212992	1.094433	1.128838
Wholesales, repairs	0.864621	1.100437	1.106752	1.099992	1.259926	1.133019	1.178413
Hotels and restaurants	0.845729	0.658964	0.68335	0.803779	0.923526	0.838864	0.7857644
Transportation and storage, post	0.978483	0.475346	0.575619	0.565345	0.532449	0.410062	0.4185494
Transportation and storage	0.851499	0.490345	0.596612	0.529739	0.511688	0.406855	0.4119225
Post and telecommunication	2.881679	0.296075	0.349569	0.934788	0.716774	0.44117	0.4829560
Financial intermediation	0.265437	0.180316	0.266912	0.300096	0.250853	0.472403	0.4925085

Sectors	1995	2000	2005	2008	2009	2010	2011
Real estate, renting	1.157732	0.869716	0.598597	0.813343	0.689094	0.620179	0.544676
Real estate activities	0.870165	0.669439	0.594671	0.736864	0.848662	0.807401	0.7341055
Renting and other business	1.175049	0.578294	0.257122	0.492047	0.889885	0.825513	0.6445891
Computer and other activities	0.57234	0.557219	0.846679	1.267272	0.915069	0.75626	0.65801
R & D	1.27982	1.008346	0.600734	0.762346	0.587146	0.532453	0.4807471
Communication	0.906666	0.656307	0.524674	1.190074	0.883919	0.967229	0.9205341
Public administration	0.831833	0.519878	0.342375	0.480542	0.375502	0.321053	0.2927625
Education Health	0.908558	0.8067	1.273422	1.450897	0.934475	0.93761	0.8539921

Table A1-20 RCA1 Slovenia, Gross export calculations, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	0.951633	1.074138	6.10753	0.87364	0.886624	0.994054	0.985648
Mining and quarrying	0.418142	0.231409	0.161589	0.430154	0.558395	0.747224	0.427745
Total manufacturing	1.157126	1.22164	1.079511	1.151581	1.107172	1.070745	1.104977
Food products and beverages	1.1105	0.992528	0.946299	1.13057	1.315476	1.231434	1.290191
Textile, textile products	1.408652	1.423463	1.297212	1.212142	1.217006	1.21175	1.279234
Wood, paper	1.116659	1.40019	1.326679	1.391089	1.675055	1.73333	1.643139
Wood and product	1.041024	1.352073	1.494368	2.011223	2.909251	2.650878	2.178817
Pulp, paper, printing	1.144013	1.416616	1.261842	1.188226	1.305371	1.453883	1.481448
Chemicals and non-metallic pr.	1.442293	1.671702	1.433367	1.365672	1.258288	1.27004	1.288106
Coke, refined petroleum pr.	2.225968	2.296111	1.845963	2.006104	1.538423	1.585524	1.920287
Chemicals and chemical pr.	1.232522	1.413287	1.109238	0.876393	0.891434	0.916524	0.813848
Rubber and plastic bags	1.297361	1.549422	1.65025	1.42482	1.761098	1.653768	1.424873
Other non-metallic mineral	1.717132	1.904107	1.905557	2.16074	2.215419	2.092183	2.004807
Basic metals and fabricated	1.466051	1.870513	1.609798	1.459089	1.609948	1.745736	1.541893
Basic metals	1.363016	1.875972	1.510171	1.285813	1.502102	1.688658	1.386663
Fabricated metal products	1.686785	1.860224	1.844026	1.920143	1.844386	1.893882	1.975877
Machinery and equipment	1.064926	1.356782	1.138454	1.138505	1.074122	0.916193	0.619842
Electrical and optical equipment	0.698671	0.680368	0.555701	0.547083	0.545567	0.482344	0.615537
Computer electronics	0.526041	0.51199	0.402873	0.413927	0.475376	0.389984	0.323196
Electrical machinery	0.3626	0.313305	0.291577	0.299691	0.234642	0.235131	0.482469
Transport equipment	4.43889	4.191177	3.228769	2.92579	3.107942	2.753763	2.561882
Motor vehicles	1.162988	0.990939	0.79156	0.771846	0.917695	0.816544	0.762637
Other transport equipment	0.120023	0.168477	0.091436	0.158789	0.167405	0.090759	0.049187
Manufacturing - nec	0.625696	0.524269	0.649307	2.194045	0.678931	0.656232	1.816428
Electricity gas	0.132786	0.084625	0.658637	0.440672	0.62048	1.184377	1.756356
Construction	0.933053	1.657525	1.067372	1.293536	0.915361	0.815038	0.871085
Total business	0.783142	0.727406	0.793233	0.857303	0.876566	0.837056	0.852669
Wholesales and retailed tr.,hotels	0.986676	0.907313	0.889302	0.95177	0.920861	0.893059	0.945684
Wholesales, repairs	1.056976	0.96705	0.967532	1.030467	0.976194	0.947875	1.011325
Hotels and restaurants	0.615047	0.57919	0.420167	0.438968	0.590853	0.543446	0.510285
Transportation and storage, post	0.339648	0.391035	0.677372	0.767232	0.791628	0.689264	0.693111
Transportation and storage	0.335904	0.321931	0.629342	0.701824	0.689583	0.591777	0.572665
Post and telecommunication	0.398524	1.270285	1.232162	1.510155	1.761806	1.697275	1.949718
Financial intermediation	0.23628	0.197197	0.191939	0.445415	0.387325	0.403478	0.431783

Sectors	1995	2000	2005	2008	2009	2010	2011
Real estate, renting	1.381985	1.110584	1.068912	1.021266	1.170043	1.146878	1.087921
Real estate activities	0.541456	0.688149	0.561095	0.641792	0.740763	0.692767	0.669007
Renting and other business	2.229132	0.856308	1.177772	2.311539	2.883529	3.025998	2.844349
Computer and other activities	1.015847	1.324832	1.03307	0.805583	1.100153	0.962121	0.926456
R & D	1.425901	1.157036	1.110848	0.909049	0.931607	0.898665	0.855899
Communication	0.814072	0.842456	0.614778	1.543873	1.436722	1.765369	1.701242
Public administration	0.627812	0.401851	0.469023	0.648499	0.501495	0.439856	0.456262
Education	0.505423	0.657975	0.612323	0.474435	0.626783	0.566441	0.50796

Table A1-21 RCA2, Slovenia, Value added calculations, 1995-2011

Sectors	1995	2000	2005	2008	2009	2010	2011
Agriculture	0.949698	1.094982	6.190246	0.886925	0.879052	0.991993	1.0070614
Mining and quarrying	0.420429	0.2334	0.157966	0.41613	0.552823	0.739469	0.4309005
Total manufactures	1.179714	1.258506	1.097333	1.17799	1.125446	1.082705	1.12780608
Food products and beverages	1.123591	1.024025	0.966631	1.166362	1.329129	1.240662	1.31315447
Textile, textile products	1.475959	1.508063	1.355391	1.266073	1.251529	1.250118	1.33701245
Wood, paper	1.123518	1.42637	1.317041	1.422178	1.659261	1.719554	1.65848693
Woods and products from wood	1.075505	1.429495	1.514962	2.124811	2.972954	2.725226	2.28512397
Pulp, paper, printing	1.140617	1.425275	1.242709	1.199709	1.281274	1.425089	1.47652598
Chemicals and non-metallic pr.	1.417948	1.584005	1.361166	1.27023	1.233611	1.216239	1.19007551
Coke, refined petroleum pr.	2.108548	1.829887	1.440055	1.620421	1.372311	1.316336	1.54874468
Chemicals and chemical pr.	1.221179	1.430311	1.152372	0.91493	0.911401	0.943464	0.84720048
Rubber and plastic bags	1.322227	1.615626	1.690234	1.504121	1.81238	1.701331	1.48169751
Other non-metallic mineral	1.742749	1.945472	1.968978	2.252175	2.258451	2.142269	2.07469372
Basic metals and fabricated	1.452641	1.874391	1.621851	1.501037	1.623307	1.736471	1.55624399
Basic metals	1.300536	1.798824	1.479613	1.28541	1.46974	1.625392	1.33615971
Fabricated metal products	1.77114	2.009385	1.948892	2.056221	1.948759	2.020325	2.1577462
Machinery and equipment	1.087323	1.409436	1.114734	1.134219	1.021402	0.877413	0.62503627
Electrical and optical equipment	0.757009	0.777292	0.631642	0.614055	0.588844	0.528772	0.70279858
Computer	0.565726	0.570729	0.44835	0.452981	0.502359	0.416786	0.35760615
Electrical machinery	1.430933	1.678526	1.281917	1.089713	0.844166	0.871077	1.73958199
Transport equipment	1.268766	1.104367	0.831397	0.88017	0.989172	0.852511	0.79224386
Motor vehicles	1.639841	1.432965	1.06053	1.107945	1.487247	1.221355	1.15106184
Other transport equipment	0.323121	0.384623	0.244164	0.373946	0.23466	0.167834	0.09955405
Manufacturing-nec	0.866836	0.79896	0.831364	2.837742	0.972147	0.907147	2.60294927
Electricity gas	0.877501	0.666837	3.671716	2.037171	2.771112	4.410864	6.89412161
Construction	0.941477	1.735486	1.0645	1.347708	0.910186	0.832033	0.89383883
Total business	0.795858	0.761977	0.814727	0.900822	0.897166	0.855303	0.88145547
Wholesales and retailed tr.,hotels	0.993266	0.93184	0.903644	0.986283	0.932375	0.906329	0.97195014
Wholesales, repairs	1.060496	0.99142	0.980253	1.063923	0.985804	0.958648	1.03523134
Hotels and restaurants	0.624406	0.594961	0.428008	0.45958	0.602977	0.559922	0.53398383
Transportation and storage, post	0.34974	0.417816	0.709224	0.817884	0.831669	0.720345	0.74377951
Transportation and storage	0.345584	0.341388	0.657473	0.741412	0.719162	0.610662	0.60502687
Post and telecommunication	0.410998	1.328954	1.266016	1.611378	1.830809	1.782758	2.09187304
Financial intermediation	0.24721	0.211851	0.206464	0.450984	0.361669	0.371359	0.37327105

Real estate, renting	1.373378	1.139548	1.067207	1.070203	1.192744	1.161368	1.10776826
Real estate activities	0.548504	0.712218	0.57416	0.67093	0.756627	0.710449	0.69389634
Renting and other business	2.284853	0.902939	1.177745	2.53715	2.878444	2.884722	2.68960421
Computer and other activities	1.05518	1.418427	0.966987	0.859073	1.18605	1.022564	0.97074207
R & D	1.400954	1.176664	1.125494	0.932765	0.948972	0.931896	0.90100931
Communication	0.821318	0.847894	0.619964	1.581458	1.443086	1.779861	1.74183355
Public administration	0.639451	0.422326	0.486119	0.681746	0.51325	0.454328	0.47828507
Education Health	0.516241	0.694537	0.626687	0.496799	0.641655	0.582666	0.52873952

Table A1–22 RCA1 and RCA2, Bulgaria, 2015

Sectors	Value added RCA12	Gross export RCA2
Mining and quarrying	0.354999134	0.341283054
Mining and extraction of energy products	0.019400123	0.157123399
Mining and quarrying of non-energy products	1.003777973	1.840814843
Mining and support service activities	0.286694768	0.452839784
Manufacturing	0.829267936	0.940781826
Food products, beverages and tobacco	1.456602551	1.387162355
Textiles, wearing apparel, leather and related products	1.362013193	1.259481699
Woods and paper products, printing	1.204621037	1.14836492
Wood and products of wood and cork	1.469201205	4.158874506
Paper products and printing	0.93553806	0.356669016
Chemicals and non-metal mineral products	0.877583829	1.088584995
Coke and refined petroleum products	0.625614778	1.375789754
Chemicals and pharmaceutical products	0.712481621	0.778866954
Rubber and plastic products	1.037544494	1.25065156
Other non-metallic mineral products	2.235676818	2.244516521
Basic metals and fabricated metal products	1.455923278	0.712935848
Basic metals	1.753851779	2.750691245
Fabricated metal products	0.90995168	1.003893103
Computer, electronic and electrical equipment	0.397208312	0.42919802
Computer, electronic and optical products	0.204887132	0.188080638
Electrical equipment	0.818707051	1.001115359
Machinery and equipment, n.e.c.	0.191706587	0.666138181
Transport equipment	0.241446361	0.094540889
Motor vehicles, trailers and semi-trailers	0.252749765	0.282357108
Other transport equipment	0.21603633	0.262294807
Other manufacturing: repair	0.8112923	0.805564593
Construction	6.513527436	6.988931239
Total business sector services	1.180511894	1.034474777
Distributive trade, transport	1.290127363	1.166480015
Wholesales and repair trade	1.152030389	1.02305783
Transportation and storage	1.507547035	1.329481727
Accommodation and food services	1.455837581	1.257685725
Information and communication	1.548832731	1.258798118
Publishing audiovisual	0.447460885	0.40337174
Telecommunications	2.405417783	2.009198633
IT and other information services	1.601863939	1.263522246
Financial and insurance activities	0.600206712	0.421725515
Real estate activities	1.685095732	1.415288084
Other business services sectors	0.913033092	0.815767041
Education	0.503588505	0.397651577
Human health	1.987908806	1.690871068

Sectors	Value added RCA12	Gross export RCA2
Other social and personal services	2.240003412	2.027364449
Arts, entertainment	2.240003412	2.027364449
Industry (mining)	0.795586726	0.897945731
Total services	1.189319431	1.042792637
Information, finance	1.029462526	0.853528581
Total services, including construction	1.203471582	1.060215505
Information services	0.704398066	0.61423065

Table A1-23 RCA1 and RCA2, Czech Republic, 2015

Sectors	Value added RCA2	Gross export RCA1
Mining and quarrying		0.063263038
Mining and extraction of energy products	0.065411496	0.569111678
Mining and quarrying of non-energy products	0.092270435	0.087069198
Mining and support service activities	0.234279104	0.216070066
Manufacturing	1.259579373	1.304066635
Food products, beverages and tobacco	0.925186264	0.843451278
Textiles, wearing apparel, leather and related products	0.393459412	0.398041936
Woods and paper products, printing	1.606691188	1.519839721
Wood and products of wood and cork	1.649846857	1.667131886
Paper products and printing	1.437580469	0.536766432
Chemicals and non-metal mineral products	0.893678298	0.839706337
Coke and refined petroleum products	0.101017591	0.213864904
Chemicals and pharmaceutical products	0.471047127	0.430230711
Rubber and plastic products	2.596024086	2.617699636
Other non-metallic mineral products	2.324467442	2.092937371
Basic metals and fabricated metal products	1.385028216	0.421094962
Basic metals	0.736142583	0.693173173
Fabricated metal products	2.57751264	2.387129939
Computer, electronic and electrical equipment	1.072458378	1.15515853
Computer, electronic and optical products	0.800373969	0.908788719
Electrical equipment	1.668729483	1.782513856
Machinery and equipment, n.e.c.	0.385256883	0.661645891
Transport equipment	2.463800378	0.970970612
Motor vehicles, trailers and semi-trailers	3.344021431	3.849669913
Other transport equipment	0.485020105	0.42217006
Other manufacturing: repair	1.051637746	0.940835914
Construction	2.664591802	2.175353895
Total business sector services	0.832411857	0.686670998
Distributive trade, transport	0.947796502	0.786962841
Wholesales and repair trade	0.791027255	0.673868095
Transportation and storage	1.20604198	0.950684226
Accommodation and food services	0.873509537	0.740679614
Information and communication	1.01551361	0.805187821
Publishing audiovisual	2.046047316	1.781162521
Telecommunications	0.965191272	0.825489471
IT and other information services	0.723322211	0.533532639
Financial and insurance activities	0.2983421	0.216982244
Real estate activities	0.621366312	0.527558639
Other business services sectors	0.045832166	0.584912445
Education	0.808937876	0.616760376
Other social and personal services	0.969575258	0.789074027
Arts, entertainment	0.969575258	0.789074027

Sectors	Value added RCA2	Gross export RCA1
Industry (mining)	1.100068117	1.166696076
Total services	0.83733569	0.690260927
Information, finance	0.670978688	0.549000763
Total services, including construction	0.842589551	0.694537233
Information services	0.880353692	0.875779925

Table A1-24 RCA1 and RCA2 Estonia, 2015

Sectors	Value added RCA2	Gross export RCA
Mining and quarrying	0.100753444	0.09727988
Mining and extraction of energy products	0.07092039	0.700236364
Mining and quarrying of non-energy products	0.234667076	0.213096092
Mining and support service activities	0.406220533	0.372734569
Manufacturing	0.807402421	0.894248229
Food products, beverages and tobacco	1.170540094	1.201140166
Textiles, wearing apparel, leather and related products	0.631487696	0.692328228
Woods and paper products, printing	5.71236639	5.717672472
Wood and products of wood and cork	11.85711505	13.3615206
Paper products and printing	1.098245616	0.428201485
Chemicals and non-metallic mineral products	0.462583591	0.480280365
Coke and refined petroleum products	0.379009617	0.268132548
Chemicals and pharmaceutical products	0.293955912	0.348780785
Rubber and plastic products	0.79061605	0.878567155
Other non-metallic mineral products	1.180528569	1.164208726
Basic metals and fabricated metal products	0.72104123	0.264775629
Basic metals	0.076056002	0.080133841
Fabricated metal products	1.905173123	2.191812391
Computer, electronic and electrical equipment	0.852750762	1.267481557
Computer, electronic and optical products	0.859146073	1.381072594
Electrical equipment	0.836923272	1.198064404
Machinery and equipment, n.e.c.	0.099006308	1.148433782
Transport equipment	0.224783496	0.080853322
Motor vehicles, trailers and semi-trailers	0.283945178	0.298361916
Other transport equipment	0.08719602	0.088259884
Other manufacturing: repair	1.525293104	1.530828502
Construction	3.425855385	3.26315082
Total business sector services	1.327338687	1.223776772
Distributive trade, transport	1.473451291	1.399413787
Wholesales and repair trade	0.84397417	0.744057401
Transportation and storage	2.356700284	2.210184116
Accommodation and food services	1.590392617	6.38859656
Information and communication	1.837119848	0.938161392
Publishing audiovisual	1.100687563	1.058778465
Telecommunications	2.548145852	2.443929125
IT and other information services	1.833998426	1.511462007
Financial and insurance activities	0.358486411	0.276611356
Real estate activities	2.1192318	1.832568421
Other business services sectors	1.049815635	1.056195823
Education	0.885920662	0.791368339
Human health	1.927055596	1.695421574
Other social and personal services	1.505916515	1.377904618
Arts, entertainment	1.505916515	1.377904618
Industry (mining)	0.715327194	0.807394609

Sectors	Value added RCA2	Gross export RCA
Total services	1.327772452	1.223295433
Information, finance	1.125996517	0.98327404
Total services, including construction	1.333220734	1.228728827
Information services	1.22265082	1.454794842

Table A1-25 RCA1 and RCA2, Hungary, 2015

Sectors	Gross export RCA1	Value added RCA2
Mining and quarrying	0.014877731	0.022802241
Mining and extraction of energy products	0.046313328	0.00704522
Mining and quarrying of non-energy products	0.030658251	0.049363451
Mining and support service activities	0.872707064	0.818385784
Manufacturing	1.200234589	1.137969797
Food products, beverages and tobacco	0.940049214	1.061302746
Textiles, wearing apparel, leather and related products	0.27774353	0.28405096
Woods and paper products, printing	0.891958443	0.909237599
Wood and products of wood and cork	0.786075853	0.732354224
Paper products and printing	0.357921862	0.962178817
Chemicals and non-metal mineral products	0.977113871	1.03830539
Coke and refined petroleum products	0.412951638	0.322467314
Chemicals and pharmaceutical products	0.868642057	0.951533867
Rubber and plastic products	2.034143356	2.061453544
Other non-metallic mineral products	1.215535648	1.278358168
Basic metals and fabricated metal products	0.231099411	0.684282548
Basic metals	0.488391526	0.442616733
Fabricated metal products	1.102104688	1.126968766
Computer, electronic and electrical equipment	1.189327426	0.934633061
Computer, electronic and optical products	1.205405599	0.921808933
Electrical equipment	1.151517522	0.962667952
Machinery and equipment, n.e.c.	1.068006631	0.330627523
Transport equipment	0.909576839	2.460852201
Motor vehicles, trailers and semi-trailers	3.700334751	3.485063864
Other transport equipment	0.170456911	0.158372828
Other manufacturing: repair	0.691869525	0.753688082
Construction	1.590288519	1.784678385
Total business sector services	0.78413459	0.98791978
Distributive trade, transport	0.837615508	1.027291821
Wholesales and repair trade	0.674570562	0.814954615
Transportation and storage	1.018509158	1.305097801
Accommodation and food services	0.956478557	1.131414477
Information and communication	0.704901755	0.94770713
Publishing audiovisual	0.736859451	0.858857181
Telecommunications	0.442850166	0.571317976
IT and other information services	0.775708495	1.092859205
Financial and insurance activities	0.119794324	0.171408447
Real estate activities	1.061573328	1.221191664
Other business services sectors	1.018366604	1.279015577
Education	0.273810007	0.385174126
Human health	0.710442588	0.910243164
Other social and personal services	0.778020559	0.976053579

Sectors	Gross export RCA1	Value added RCA2
Arts, entertainment	0.778020559	0.976053579
Industry (mining)	1.058753418	0.97428036
Total services	0.776393506	0.977488816
Information, finance	0.710752037	0.93354158
Total services, including construction	0.778679652	0.979638847
Information services	1.045522041	0.931455815

Table A1-26 RCA1 and RCA2, Latvia, 2015

Sectors	Value added RCA1	Gross added RCA2
Mining and quarrying	0.013920221	0.015950352
Mining and extraction of energy products	0.004453153	0.054032757
Mining and quarrying of non-energy products	0.051108285	0.055321131
Mining and support service activities	0.252151011	0.271687221
Manufacturing	0.768115569	0.87307305
Food products, beverages and tobacco	2.03078459	2.014316132
Textiles, wearing apparel, leather and related products	0.680569815	0.658384492
Woods and paper products, printing	2.056817279	1.966829641
Wood and products of wood and cork	3.972274933	4.299744474
Paper products and printing	0.601270381	0.216700158
Chemicals and non-metal mineral products	1.086879829	1.733286497
Coke and refined petroleum products	1.569421982	3.956669297
Chemicals and pharmaceutical products	0.935976591	1.120691815
Rubber and plastic products	1.284823072	1.358554514
Other non-metallic mineral products	0.714679517	0.768196756
Basic metals and fabricated metal products	0.260757359	0.697661141
Basic metals	0.03866198	0.041021765
Fabricated metal products	0.756546732	0.798215141
Computer, electronic and electrical equipment	0.221625141	0.211625418
Computer, electronic and optical products	0.159946739	0.137562079
Electrical equipment	0.350571449	0.385974056
Machinery and equipment, n.e.c.	0.077468034	0.274970608
Transport equipment	0.111556445	0.03550429
Motor vehicles, trailers and semi-trailers	0.102227912	0.099947576
Other transport equipment	0.131535107	0.113069884
Other manufacturing: repair	2.602690702	2.487687255
Electricity, gas, water supply	0.000821834	1.428949428
Construction	3.724667821	3.322569271
Total business sector services	1.260481331	1.169442074
Distributive trade, transport	1.868744164	1.750182583
Wholesale and retail trade	1.210618481	1.075326518
Transportation and storage	3.21093146	2.97534115
Accommodation and food services	0.694643085	0.641121357
Information and communication	0.540815241	0.462628456
Publishing audiovisual	0.649559538	0.608997195
Telecommunications	0.888286932	0.77656718
IT and other information services	0.395542701	0.251911736
Financial and insurance activities	0.136965162	0.114352558
Real estate activities	1.748602902	1.651352833
Other business services sectors	0.403098717	0.37290549
Education	0.463296332	0.403651865
Human health	0.698981744	0.636622854

Sectors	Value added RCA1	Gross added RCA2
Other social and personal services	0.694733532	0.641903959
Arts, entertainment	0.694733532	0.641903959
Industry (mining)	0.654387995	0.768269643
Total services	1.236009065	1.148216667
Information, finance	0.422299303	0.372592987
Total services, including construction	1.242571374	1.154419337
Information services	0.30329245	0.241342159

Table A1-27 RCA1 and RCA2, Poland, 2015

Sectors	Gross export RCA1	Value added RCA 2
Mining and quarrying		0.129935046
Mining and extraction of energy products	0.548267955	0.055466001
Mining and quarrying of non-energy products	0.462605012	0.465893129
Mining and support service activities	0.825905491	0.896888816
Manufacturing	1.048614535	1.024754966
Food products, beverages and tobacco	1.535887147	1.625786798
Textiles, wearing apparel, leather and related products	0.430767311	0.410479227
Woods and paper products, printing	1.90259466	2.181919355
Wood and products of wood and cork	2.711336905	2.51507187
Paper products and printing	0.684001958	1.794366144
Chemicals and non-metal mineral products	0.108427926	0.985707987
Coke and refined petroleum products	0.659868374	0.54670089
Chemicals and pharmaceutical products	0.714250797	0.692977407
Rubber and plastic products	2.285627082	2.22438518
Other non-metallic mineral products	1.590045168	1.635551115
Basic metals and fabricated metal products	0.378386167	0.135829318
Basic metals	0.653905173	0.662877836
Fabricated metal products	2.085242148	2.080111703
Computer, electronic and electrical equipment	0.163085188	0.678820704
Computer, electronic and optical products	0.452564529	0.392905335
Electrical equipment	0.312088964	1.305437286
Machinery and equipment, n.e.c.	0.776633968	0.716366083
Transport equipment	0.391461132	1.066748756
Motor vehicles, trailers and semi-trailers	1.341121812	1.284352541
Other transport equipment	0.674720774	0.577565993
Other manufacturing: repair	1.835401446	1.881360687
Electricity, gas, water supply	1.575989463	0.001175165
Construction	0.522469079	4.465244555
Total business sector services	1.024565452	0.101878844
Distributive trade, transport	1.251957137	1.347224384
Wholesales and repair trade	1.382310409	1.477899935
Transportation and storage	1.256146241	1.367829427
Accommodation and food services	0.657246092	0.689651612
Information and communication	0.976899692	1.072992581
Publishing audiovisual	1.461510933	1.464756595
Telecommunications	0.434095292	0.458840925
IT and other information services	1.010825747	1.150881863
Financial and insurance activities	0.097302635	0.295449316
Real estate activities	1.800280607	1.834738226
Other business services sectors	0.739161633	0.783630577
Education	0.648658665	0.72293279
Human health	1.676585405	1.754113773
Other social and personal services	0.561575235	0.845618813

Sectors	Gross export RCA1	Value added RCA 2
Arts, entertainment	0.784422551	0.845618813
Industry (mining)		0.50900935
Total services	0.64498737	1.108616537
Information, finance	0.712590542	0.778782456
Total services, including construction	1.012842077	1.105663171
Information services	0.620004527	0.64568341

Table A1-28 RCA1 and RCA1 Lithuania, 2015

Sectors	Gross export RCA	VA export RCA
Mining and quarrying	0.028846407	0.024486522
Mining and extraction of energy products	0.055404057	0.004988966
Mining and quarrying of non-energy products	0.06716841	0.060889762
Mining and support service activities	1.897666606	1.610194983
Manufacturing	0.872027444	0.848630053
Food products, beverages and tobacco	0.50060648	0.517581089
Textiles, wearing apparel, leather and related products	1.275011734	1.200419079
Woods and paper products, printing	1.653766283	1.630331002
Wood and products of wood and cork	3.721505863	3.807654463
Paper products and printing	0.158524537	0.396883177
Chemicals and non-metal mineral products	0.623752284	0.600605888
Coke and refined petroleum products	0.584238832	0.706780398
Chemicals and pharmaceutical products	0.338366439	0.3311736
Rubber and plastic products	1.792948097	1.554969822
Other non-metallic mineral products	0.461982626	0.452414068
Basic metals and fabricated metal products	0.215538419	0.621204281
Basic metals	0.619168867	0.60041319
Fabricated metal products	0.670280632	0.667896654
Computer, electronic and electrical equipment	0.791594385	0.799975685
Computer, electronic and optical products	0.314696446	0.314879338
Electrical equipment	1.92276983	1.863147898
Machinery and equipment, n.e.c.	0.910790458	0.271326791
Transport equipment	0.040831473	1.858290149
Motor vehicles, trailers and semi-trailers	1.35255995	1.287644378
Other transport equipment	0.774993373	0.763889613
Other manufacturing: repair	1.337625467	1.340581704
Total business sector services	1.161413774	1.163220928
Distributive trade, transport	1.235711613	1.225423496
Wholesales and repair trade	0.918727032	0.863067446
Transportation and storage	1.883807382	1.990925892
Accommodation and food services	0.471963364	0.481656768
Information and communication	1.304388832	1.38704265
Publishing audiovisual	0.203686385	0.19910307
Telecommunications	1.473057401	1.498776993
IT and other information services	1.551283855	1.705375505
Financial and insurance activities	0.155963805	0.180463087
Real estate activities	0.359818299	0.362149985
Other business services sectors	1.467994485	1.422244794
Education	0.123166193	0.129435878
Human health	0.331989692	0.312450791
Other social and personal services	0.338277118	0.342652977
Arts, entertainment	0.338277118	0.342652977
Industry (mining)	0.772730101	0.728642102

Sectors	Gross export RCA	VA export RCA
Total services	1.129722791	0.113207164
Information, finance	1.059467786	1.080144898
Total services, including construction	1.126230944	1.126229152
Information services	0.630529035	0.713379093

Table A1-29 RCA1 and RCA2, Romania, Gross and Value added calculations, 2015

Sectors	Gross export RCA1	VA export RCA2
Mining and quarrying	0.028846407	0.024486522
Mining and extraction of energy products	0.055404057	0.004988966
Mining and quarrying of non-energy products	0.06716841	0.060889762
Mining and support service activities	1.897666606	1.610194983
Manufacturing	0.872027444	0.848630053
Food products, beverages and tobacco	0.50060648	0.517581089
Textiles, wearing apparel, leather and related products	1.275011734	1.200419079
Woods and paper products, printing	1.653766283	1.630331002
Wood and products of wood and cork	3.721505863	3.807654463
Paper products and printing	0.158524537	0.396883177
Chemicals and non-metal mineral products	0.623752284	0.600605888
Coke and refined petroleum products	0.584238832	0.706780398
Chemicals and pharmaceutical products	0.338366439	0.3311736
Rubber and plastic products	1.792948097	1.554969822
Other non-metallic mineral products	0.461982626	0.452414068
Basic metals and fabricated metal products	0.215538419	0.621204281
Basic metals	0.619168867	0.60041319
Fabricated metal products	0.670280632	0.667896654
Computer, electronic and electrical equipment	0.791594385	0.799975685
Computer, electronic and optical products	0.314696446	0.314879338
Electrical equipment	1.92276983	1.863147898
Machinery and equipment, n.e.c.	0.910790458	0.831326791
Transport equipment	0.040831473	1.858290149
Motor vehicles, trailers and semi-trailers	1.35255995	1.287644378
Other transport equipment	0.774993373	0.763889613
Other manufacturing: repair	1.337625467	1.340581704
Total business sector services	1.161413774	1.163220928
Distributive trade, transport	1.235711613	1.225423496
Wholesales and repair trade	0.918727032	0.863067446
Transportation and storage	1.883807382	1.990925892
Accommodation and food services	0.471963364	0.481656768
Information and communication	1.304388832	1.38704265
Publishing audiovisual	0.203686385	0.19910307
Telecommunications	1.473057401	1.498776993
IT and other information services	1.551283855	1.705375505
Financial and insurance activities	0.155963805	0.180463087
Real estate activities	0.359818299	0.362149985
Other business services sectors	1.467994485	1.422244794
Education	0.123166193	0.129435878
Human health	0.331989692	0.312450791
Other social and personal services	0.338277118	0.342652977
Arts, entertainment	0.338277118	0.342652977
Industry (mining)	0.772730101	0.728642102
Total services	1.129722791	0.113207164

Sectors	Gross export RCA1	VA export RCA2
Information, finance	1.059467786	1.080144898
Total services, including construction	1.126230944	1.126229152
Information services	0.630529035	0.713379093

Table A1-30 RCA1 and RCA2, Slovakia, 2015

Sectors	Gross export RCA1	Value added RCA2
Mining and quarrying	0.036725633	0.046415062
Mining and extraction of energy products	0.185411261	0.023092534
Mining and quarrying of non-energy products	0.117127267	0.154020558
Mining and support service activities	0.13476065	0.192452073
Manufacturing	1.283236609	1.197661695
Food products, beverages and tobacco	0.455000045	0.531931723
Textiles, wearing apparel, leather and related products	0.459360882	0.493473408
Woods and paper products, printing	1.413879617	1.791902099
Wood and products of wood and cork	1.372024672	1.756185067
Paper products and printing	0.539250498	1.684825612
Chemicals and non-metal mineral products	0.833816475	0.85609018
Coke and refined petroleum products	0.899103181	0.653371483
Chemicals and pharmaceutical products	0.367672811	0.402303469
Rubber and plastic products	2.382789049	2.59215501
Other non-metallic mineral products	1.000053171	1.184948341
Basic metals and fabricated metal products	0.521311752	1.734693297
Basic metals	1.299883742	1.390377456
Fabricated metal products	2.078550362	2.365341421
Computer, electronic and electrical equipment	1.065077949	0.853659059
Computer, electronic and optical products	0.955224646	0.703310905
Electrical equipment	1.325652665	1.204715482
Machinery and equipment, n.e.c.	0.985839317	0.703739336
Transport equipment	1.022291823	2.472901344
Motor vehicles, trailers and semi-trailers	4.17397995	3.509496944
Other transport equipment	0.141716859	0.14258221
Other manufacturing: repair	0.850562282	0.990394594
Construction	3.392847059	4.411723149
Total business sector services	0.602128006	0.793354254
Distributive trade, transport	0.741396911	0.983464812
Wholesales and repair trade	0.799224672	1.032932095
Transportation and storage	0.700347434	0.971678485
Accommodation and food services	0.621679906	0.795270468
Information and communication	0.411023646	0.544886403
Publishing audiovisual	0.360219787	0.443489413
Telecommunications	0.708195925	0.939781711
IT and other information services	0.33356518	0.449882055
Financial and insurance activities	0.132464097	0.197767093
Real estate activities	0.729487116	0.949308201
Other business services sectors	0.543967561	0.662081399
Education	0.313455937	0.438794027
Human health	1.152388664	1.241580812
Other social and personal services	0.855151374	1.208639305
Arts, entertainment	0.855151374	1.208639305

Sectors	Gross export RCA1	Value added RCA2
Industry (mining)	1.125193995	1.019002066
Total services	0.60540283	0.798694755
Information, finance	0.411033535	0.531211178
Total services, including construction	0.613570854	0.808319082
Information services	0.781356621	0.644445263

Table A1-31 RCA1 and RCA2 Slovenia, 2015

Sectors	Gross export RCA1	Value added RCA2
Mining and quarrying	0.027538906	0.02595208
Mining and extraction of energy products	0.116082343	0.010942958
Mining and quarrying of non-energy products	0.100841236	0.100168165
Mining and support service activities	0.041944436	0.045987672
Manufacturing	1.050665006	1.012601405
Food products, beverages and tobacco	0.472064612	0.458086502
Textiles, wearing apparel, leather and related products	0.200831669	0.433865353
Woods and paper products, printing	2.599799116	2.335745595
Wood and products of wood and cork	3.97398289	2.890446916
Paper products and printing	0.770757657	1.786623847
Chemicals and non-metal mineral products	1.230632425	1.292833644
Coke and refined petroleum products	0.001350353	0.001281642
Chemicals and pharmaceutical products	1.404007138	1.47360026
Rubber and plastic products	2.133549185	2.049654515
Other non-metallic mineral products	1.571597788	1.539649553
Basic metals and fabricated metal products	0.630734739	1.745139774
Basic metals	1.402223439	1.186766822
Fabricated metal products	2.872817548	2.717823268
Computer, electronic and electrical equipment	0.708759293	0.6969838
Computer, electronic and optical products	0.214145031	0.241103561
Electrical equipment	1.881955756	1.696128164
Machinery and equipment, n.e.c.	0.83647036	0.787102906
Transport equipment	0.336460656	0.879608692
Motor vehicles, trailers and semi-trailers	1.359022756	1.232226768
Other transport equipment	0.086408664	0.084732958
Other manufacturing; repair	0.989471768	1.033692674
Construction	3.697577966	3.787670073
Total business sector services	0.856341225	0.923356706
Distributive trade, transport	1.028680462	1.09361289
Wholesales and repair trade	0.804747288	0.855541799
Transportation and storage	1.198532674	1.308507428
Accommodation and food services	1.455719517	1.508934951
Information and communication	0.800838483	0.85724625
Publishing audiovisual	0.940200412	4.640139877
Telecommunications	2.203222799	2.240156569
IT and other information services	0.333624336	0.39832408
Financial and insurance activities	0.327574962	0.405243665
Real estate activities	1.038974128	1.199801549
Other business services sectors	0.64635081	0.701909384
Education	0.876796943	1.024099595
Human health	2.353059222	2.610817395
Other social and personal services	1.203656363	1.305386228

Sectors	Gross export RCA1	Value added RCA2
Arts, entertainment	1.203656363	1.305386228
Industry (mining)	0.944701064	0.887163696
Total services	0.870053113	0.939821278
Information, finance	0.619601753	0.689106583
Total services, including construction	0.878259038	0.947407275
Information services	0.401451759	0.470111768

Appendix 2 to Chapter 5

Table A2-1 List of Variables

	Variable	Description	Unit	Source
1.	PI	Participation index	Index (%age)	Trade in value added, OECD
2.	FDI stocks	Foreign direct investment stocks	Million current US\$	World Development Indicators, World Bank
3.	GDP	Gross domestic product	Million current US\$	Eurostat statistics http://appsso.eurostat.ec.europa.eu
4.	Industrial characteristic	Level of industrialization, share of manufacturing	%	Trade in value added, OECD
5.	Index Distance to Final Demand		Number of the production stages in GVC's	Trade in value added, OECD
6.	Tariff	Tariff average weighted, average mean	%	Trade and Development's Trade Analysis and Information System (TRAINS) database
7.	Export	World Trade Organization	Million current US\$	http://stat.wto.org/StatisticalProgram

Table. A2-2 European Union integration, 1958-2013

Country	Year of accession	Country	Year of accession	Country	Year of accession
1. Belgium	1957 (EU-12)	11. Portugal	1986 (EU-12)	21. Lithuania	2004 (EU-25)
2. France		12. Spain		22. Malta	
3. Italy		13. Austria	23. Poland		
4. Luxembourg		14. Finland	24. Slovakia		
5. Netherlands		15. Sweden	25. Slovenia		
6. Germany		16. Cyprus	26. Bulgaria		
7. Denmark	1973 (EU-12)	17. Czech Republic	2004 (EU-25)	27. Romania	2007 (EU-27)
8. Ireland		18. Estonia		28. Croatia	2013 (EU-28)
9. United Kingdom		19. Hungary			
10. Greece	1981 (EU-12)	20. Latvia			

Note. Data is obtained from European Commission (2017).

https://ec.europa.eu/neighbourhood-enlargement/policy/from-6-to-28-members_en

Appendix 3 to Empirical estimations results

Table A3-1 Stata results

```
. xi:xtreg BackwardPartIndex logStock Indexofdistancetofinaldeman Tarriffaverageweighted i.Year , fe i(country) vce(robust)
i.Year      _IYear_1995-2009      (naturally coded; _IYear_1995 omitted)
note: _IYear_2009 omitted because of collinearity
```

```
Fixed-effects (within) regression      Number of obs   =      50
Group variable: country                Number of groups =      10

R-sq:  within = 0.5689                  Obs per group:  min =      5
      between = 0.0923                      avg =      5.0
      overall = 0.1648                      max =      5
```

```
corr(u_i, Xb) = -0.0366                  F(6,9)          =      76.07
                                          Prob > F         =      0.0000
```

(Std. Err. adjusted for 10 clusters in country)

BackwardPartIndex	Coeff.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
logStock	1.144077	.5831761	1.96	0.081	-.1751589	2.463313
Indexofdistancetofinaldeman	.4888514	9.991959	0.05	0.962	-22.11453	23.09223
Tarriffaverageweighted	-.8995008	.4396615	-2.05	0.071	-1.894084	.0950827
_IYear_2000	3.204029	1.971231	1.63	0.139	-1.255206	7.663264
_IYear_2005	4.646084	1.489547	3.12	0.012	1.276494	8.015674
_IYear_2008	4.533893	.8897822	5.10	0.001	2.521065	6.54672
_IYear_2009	0	(omitted)				
_cons	30.77429	18.86861	1.63	0.137	-11.90946	73.45804
sigma_u	7.1670538					
sigma_e	3.7424312					
rho	.78575392	(fraction of variance due to u_i)				


```
. xi:xreg BackwardPartIndex logStock Tarriffaverageweighted Indexofdistancetofinaldeman , fe i(country) vce(robust)
```

```
Fixed-effects (within) regression      Number of obs   =    50
Group variable: country                Number of groups =    10

R-sq:  within = 0.4374                  Obs per group:  min =    5
      between = 0.0073                    avg =    5.0
      overall = 0.1489                    max =    5

F(3,9) = 12.44
corr(u_i, Xb) = -0.0098                  Prob > F = 0.0015
```

(Std. Err. adjusted for 10 clusters in country)

BackwardPartIndex	Robust					
	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
logStock	1.39892	.4994902	2.80	0.021	.2689943	2.528845
Tarriffaverageweighted	-1.509322	.3602905	-4.19	0.002	-2.324356	-.6942885
Indexofdistancetofinaldeman	5.888241	10.02993	0.59	0.572	-16.80105	28.57753
_cons	23.42527	19.48772	1.20	0.260	-20.65902	67.50956
sigma_u	7.0183258					
sigma_e	4.0979431					
rho	.74575127	(fraction of variance due to u_i)				

```
. xi:xtreg BackwardPartIndex logStock Tarriffaverageweighted , fe i(country) vce(robust)
```

```
Fixed-effects (within) regression      Number of obs   =    50
Group variable: country                Number of groups =    10
```

```
R-sq:  within = 0.4294                Obs per group: min =    5
      between = 0.1147                    avg =    5.0
      overall = 0.1104                    max =    5
```

```
corr(u_i, Xb) = -0.0586                F(2,9)          =   14.65
                                          Prob > F         =    0.0015
```

(Std. Err. adjusted for 10 clusters in country)

BackwardPartIndex	Robust					
	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
logStock	1.351894	.5009224	2.70	0.024	.2187288	2.485059
Tarriffaverageweighted	-1.507966	.3426276	-4.40	0.002	-2.283043	-.7328887
_cons	35.247	1.828058	19.28	0.000	31.11164	39.38235
sigma_u	7.2172356					
sigma_e	4.072325					
rho	.75850778	(fraction of variance due to u_i)				

```
. reg BackwardPartIndex logStock
```

Source	SS	df	MS	Number of obs = 50	
Model	11.970605	1	11.970605	F(1, 48) =	0.17
Residual	3322.0944	48	69.2102999	Prob > F =	0.6793
Total	3334.065	49	68.0421429	R-squared =	0.0036
				Adj R-squared =	-0.0172
				Root MSE =	8.3193

BackwardPa-x	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
logStock	.555871	1.3366	0.42	0.679	-2.131543	3.243285
_cons	33.53932	4.139797	8.10	0.000	25.2157	41.86294