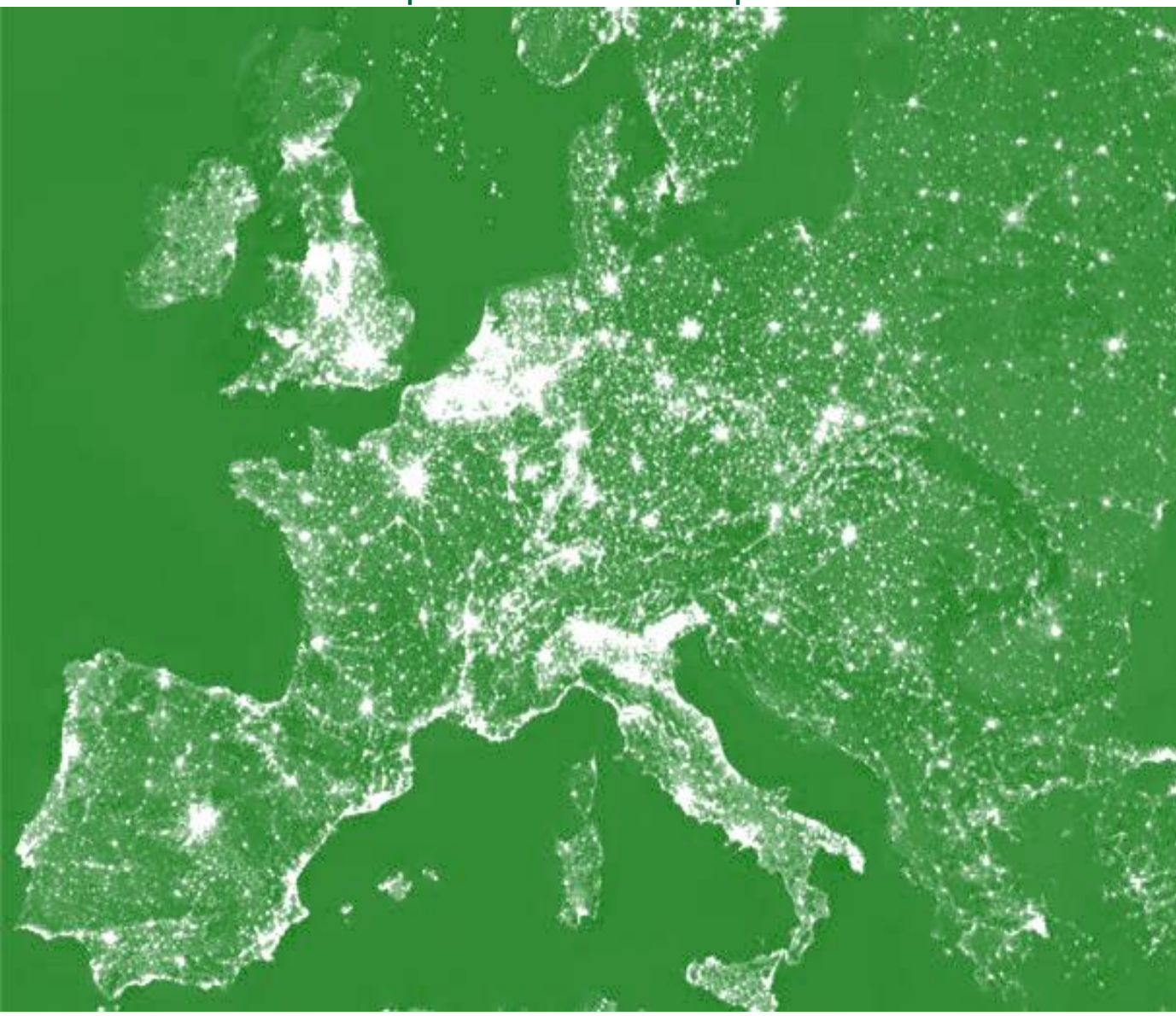
Oeconomica

Rajmund Mirdala

Global Value Chains, International Fragmentation of Production and Implications for European Union



ASERS Publishing

Editor
Rajmund Mirdala

Global Value Chains, International Fragmentation of Production and Implications for European Union

ASERS Publishing

Global Value Chains, International Fragmentation of Production and Implications for European Union

ASERS Publishing
http://www.asers.eu/asers-publishing
ISBN-L: 978-606-8689-38-8
Print ISBN: 978-606-8689-39-5

DOI: http://dx.doi.org/10.14505/gvcifpieu.2018

Descrierea CIP a Bibliotecii Naționale a României
Global Value Chains, International Fragmentation of Production and Implications for European Union / Rajmund Mirdala
Craiova : ASERS Publishing, 2018
Bibliogr.
ISBN 978-606-8689-38-8

Printed and bound by Grafi Print – Printing House,
M. Kogălniceanu Street, 20, Craiova, Romania

How to order: E-mail for orders and customer service enquiries: apg@aserspublishing.eu

ASERS Publishing Books Collections' are the initiative of Association of Sustainable Education, Research and Science to publish a series of books in many fields of knowledge with a special focus on emerging and frontier areas of scientific research. The books in these collections are based on relevant, authoritative and thought-provoking chapters written by experts to meet the requirements of executives, research scholars, academicians and students of master programs.

ASERS Publishing

Global Value Chains, International Fragmentation of Production and Implications for European Union

Chapters Contributions

Oľga Nosáľová
Faculty of Economics
Technical University of Košice
Slovak republic

Júlia Ďurčová
Faculty of Economics
Technical University of Košice
Slovak republic

Dominika Oravcová
Faculty of Economics
Technical University of Košice
Slovak republic

Ľudmila Bartóková
Faculty of Economics
Technical University of Košice
Slovak republic

Anna Ruščáková
Faculty of Economics
Technical University of Košice
Slovak republic

Jozefína Semančíková
Faculty of Economics
Technical University of Košice
Slovak republic

Rajmund Mirdala
Faculty of Economics
Technical University of Košice
Slovak republic

ASERS Publishing
http://www.asers.eu/asers-publishing
ISBN-L: 978-606-8689-38-8
Print ISBN: 978-606-8689-39-5

DOI: http://dx.doi.org/10.14505/gvcifpieu.2018

Table of Contents

From the Editor
By Rajmund Mirdala ... 6

Chapter 1. Development of global value chains
by Oľga Nosáľová ... 11

Chapter 2. Slovak republic and global value chains
by Oľga Nosáľová ... 26

Chapter 3. Balance of trade of the Slovak Republic according to the traditional measurement and value added
by Oľga Nosáľová ... 85

Chapter 4. Structural changes of the Slovak economy
by Júlia Ďurčová and Dominika Oravcová ... 96

Chapter 5. Offshoring and labor demand changes in the Slovak Republic
by Júlia Ďurčová ... 121

Chapter 6. Input-output analysis of agriculture and food sectors in the selected European countries
by Ľudmila Bartóková ... 142

Chapter 7. International fragmentation of production and export-import determination in the EU member countries
by Rajmund Mirdala, Anna Ruščáková, Jozefína Semančíková ... 171

ASERS Publishing

Global Value Chains, International Fragmentation of Production and Implications for European Union

List of tables ... 200

List of figures ... 203

ASERS Publishing
http://www.asers.eu/asers-publishing
ISBN-L: 978-606-8689-38-8
Print ISBN: 978-606-8689-39-5

DOI: http://dx.doi.org/10.14505/gvcifpieu.2018

From the Editor

International fragmentation of production draws increasing attention in both theoretical literature in the area of foreign trade. Due to international fragmentation of production in world economy we may observe changes in understanding of international competitiveness. Traditional measures of export performance provide biased information for policy decisions. As a result, many authors focus on estimations of domestic value added shares in unit of exports that is used as a measure of vertical specialization in foreign trade.

We may observe high dynamics of fragmentation of value chains on global level than on regional level. Territorial proximity or common trade areas are still considered as key determinants of distribution of value added within production chains though with reduced importance that 15-20 years ago. Intention of countries to participate in new international division of labor based on participation of country in the global value chains reveals lot of opened questions for industrial policy framework.

Examination of relative importance of individual sectors of the economy in the international production chains naturally corresponds to a requirement to use appropriate methodology. In order to examine structural and intra-industrial linkages, empirical literature tend to implement input-output analysis that is based on the use of multiregional input-output tables that provide crucial information not only on value added within individual segments of production chains but also on quantitative and qualitative features of inputs (labor and capital).

Empirical literature on input-output analysis concentrates on examination of equilibrium in the individual country. Such studies are based on the use of input-output tables due to their precise ability to monitor not only value added in export industries but also on the individual levels of a production chain. Most of the production for exports in developed countries consist of industrial products while the key portion of value added may be concentrated in non-industrial sectors providing materials and services for upper segments of a production process. Such information reveals a relative importance of intra-industrial linkages.

Input-output analysis enables us to examine intra-industrial linkages while it improves the quality of analysis due to its focus on relative importance of international trade in the whole production process. For evaluation of such linkages the empirical literature suggests to use a coefficient of industrial interdependence or coefficient of leakages from foreign trade. Employment of above mention methods on long-term time series enables us to identify and analyze important structural changes in economy or to do some estimations about future changes. Some papers confirm that a variety of countries experienced a reduced importance of production industries while the role of service industries clearly increased during last two decades. Authors also highlight reduced mutual intra-industrial linkages in the analyzed countries while the relative importance of imports for domestic production increased.

Considering narrow trade linkages among Eurozone member countries and their high external trade openness, the analysis of mutual flows of production among countries represent another interesting area for a research. Mutual linkages among national productions can be also examined according to their contribution to external imbalances. Some authors analyze flows of goods and intermediate goods within the global supply chains, volumes of cross-country flows of production employed in domestic production that is subsequently exported abroad.
Analysis of interdependence of countries due to fragmentation of production is also crucial for examination of effects on business cycle of countries and its synchronization. Fragmentation of production obviously triggers and further strengthen positive effects on correlation of cyclical development among countries.

This book was written in connection with scientific project VEGA no. 1/0961/16 “Economic Implications and Perspectives of the Participation of the Slovak Republic in the Process of Production”. It contributes to the recent empirical literature that deals with origins, effects and implications of the international fragmentation of production and participation of countries in the global value chains in the following areas:
1. International fragmentation of production is recognized as one of the key implications of the internationalization of the production. We start with analysis of the key features, theoretical concepts and empirical knowledge of incentives, conditions, utterances as well as key and side effects resulting from the participation of the countries in the process of international division of labor. It enables us to explain the key factors, conditions and implications that cause the deviation of small economies from the participation on traditional international division of labor towards the participation that is based on new international division of labor and consider the participation of the country on international production chains.
2. Explanation of theoretical and empirical literature, patterns, relationships and implications considering the forms and intensity of participation on global value chains. Particular attention is given to evaluation of afore mentioned features in the Slovak Republic regarding its participation in global value chains with the member and non-member EU counties. Our results outline the influence of regionalism and trade policy on the participation of the Slovak Republic in global value chains.
3. Explanation of the important methodological aspects of input-output (I-O) analysis enables us to determine the contribution of this approach by identifying of the key implications resulting from participation of the Slovak Republic in global value chains.
4. I-O analysis using multi-regional I-O tables to capture the value added formation in the country (with a dominant focus on the Slovak Republic) enables us to identify the flows of intermediate products and final goods by industries. Interactions with EU countries (without trade barriers) and with third countries (with trade barriers) resulting from the common trade policy (on imports) or trade policies of third countries (for exports) will be considered as well.
5. Clarification of long-term trends in formation of branch structure of the Slovak economy based on identification of cross-branch linkages (linkages forwards/backwards. Benefits will be based on the identification of key implications of the structural changes in the Slovak economy in the context of long-term participation of the SR in the process of international division of labor resulting from the Slovak Republic involvement in the international production chains.

6. Participation of the Slovak Republic in the fragmentation of production activities within the global value chains is identified and the key implications critically discussed. Particular attention was payed on effects of internal and external competitiveness (at both the industry and country levels), employment (at both the industry and country levels), factor productivity, the key characteristics of the production chains (including the creation of value added at different levels of the production chain), essential characteristics of the inter-branch relations, and dynamic development of the individual sectors.
7. In-depth analysis of the inter-branch relations and key aspects of value added within Slovak industries (particular attention was focused on the participating of industries in the international fragmentation of production activities) enable to identify the potential to increase the Slovak benefits from involvement in the process of international production fragmentation. We have focused on domestic production chains and domestic segments of international production chains especially in three following areas: 1. The growth potential of the Slovak economy (production chains a) with high growth potential, b) with a significant impact on employment, c) with high value added creation, d) with high competitiveness in the domestic and foreign markets). 2. Export-oriented (production chains: a) with significant size/growth of export performance, b) with the potential to new markets entry). 3. Regional development (production chains: a) with a significant impact on regional development (especially undeveloped), b) with the potential development of cross-border cooperation).
8. Critical discussion of the policy recommendations aiming to support the three areas identified in the previous paragraph regarding the business environment, regional development, labor and education based on alternative scenarios and perspectives of Slovak participation in the production activities fragmentation within the GVCs.

Long-term structural changes in the world economy, as a natural consequence of globalization and internationalization of economic events represent one of the key factors of international fragmentation of production activities. Considering the shortcomings of the traditional approaches to the evaluation of countries` participation on the process of the international labor division, the book is focused on the analysis of the substantial features of the value added creation process. Analysis is based on the sector levels in the Slovak Republic and selected EU member countries considering international fragmentation of production activities via employing input-output tables.
The key results confirms that the Slovak Republic is intensively participating in the global value chain. Based on the key findings we suggest the economic and political recommendations that intensify structural changes that increase positive macroeconomic and microeconomic effects derived from the active participation of the Slovak Republic in the global value chains.

Thus, the goal of this book - **Global Value Chains, International Fragmentation of Production and Implications for European Union** - is to encourage the exchange of new ideas about challenges that arises from emergence and existence of global value chains, international fragmentation of production and, as a result, new insights into the international division of the labor. The book consists of seven chapters. Contributing authors discuss crucial aspects of the recent problems that are related to: emergence and development of the global value chains (chapter 1), position of the Slovak Republic in the process of international division of labor, value added creation and global value chains (chapter

2), balance of trade evaluation in the Slovak Republic according to the traditional measures and value added approach (chapter 3), structural changes of the Slovak economy (chapter 4), offshoring and labor demand changes in the Slovak Republic (chapter 5), input-output analysis of agriculture and food sectors in the selected European countries (chapter 6) and International fragmentation of production and export-import determination in the EU member countries (chapter 7).

The editor would like to thank all authors that have contributed to the volume with their enthusiasm and high scientific professionalism.

Rajmund Mirdala
Faculty of Economics, Technical University of Košice, Slovak Republic

Chapter 1

Development of global value chains

*by **Oľga Nosáľová***
Faculty of Economics, Technical University of Košice, **Slovak republic**
olga.nosalova@tuke.sk

1.1 Introduction
1.2 Global value chains - an important feature of economic globalization
1.3 Commodity and value chains
References

http://dx.doi.org/10.14505/gvcifpieu.2018.ch1

Development of global value chains

Oľga Nosáľová
Faculty of Economics, Technical University of Košice, **Slovak republic**
olga.nosalova@tuke.sk

Abstract:
The main objective of the chapter is to present the basis and development of global value chain and the reflection of this issue in publications in the literature from the time when commodity chains began to change the nature of relations between suppliers and buyers from different countries till present. It explains how and why the fragmentation of production has contributed to the strong interconnectedness of the countries and how different authors and institutions responded to this development. Their approaches and characteristics are summed up according to stages and commodity chain (CC), global commodity chain (GCC) and global value chain (GVC) theories.

Keywords: vertical division of labor, fragmentation of production, commodity chains, global value chains, networks, added value in exports

JEL Classifications: F00, F10, F19, F60

1.1 Global value chains - an important feature of economic globalization

The topic of global value chains (GVC) resonates very intensively today in literature focusing on the evolution of the world economy in a period of globalization and in the publications where the authors seek to define the location of companies, countries, regions and consumers in it. The complexity of the topic and the interest in it have also come to the phase that it is impossible to summarize all aspects and partial problems of fragmentation of production in details. The topic of the GVC is in fact the theme of the development of the international division of labor in all its forms and its consequences the current functioning of the world economy.

De Backer, K., Miroudot, S (2013) conclude that outsourcing of activities and fragmentation of production are not new. The economist Bertil Ohlin already noted in 1933 that “As a matter of fact, production is in many cases divided not into two stages - materials and finished goods - but into many.”

1.2 Global value chains - an important feature of economic globalization

The overall understanding of the development of international trade and of the countries' participation in it is changing substantially due to the fundamental changes causing that the medium of international

trade has become a product that is produced not just by one country. According to Lama (2011), and emphasized by Johnson, RC (2014), there is a mercantilist view of international trade (where on the one side there are "WE", on the other side "THEM") that is changing to the international trade in which "WE" are all interconnected through the so-called "shared production" of several countries. Companies are currently distributing their activities around the world - from product design and component manufacturing to assembly and marketing. Companies can coordinate their production needs in real time regardless of their geographic location. Stephenson, S. (2013) notes that this has changed the functioning of the world trade and production models. The result is that more and more products are "made in the world" rather than "made in a particular country".

Hernández, Martinez-Piva and Mulder (2014, p. 21) report two significant changes over the past decades, which have significantly affected international trade and production. The first is the ever-increasing interdependence of world markets, and the second is the emergence and growth of global value chains. Exports and imports in shared production have gained a qualitatively new meaning, manifested in the fact that:

- the significant share of trade among countries was represented by the growth of export and import of intermediate products,
- the export and import value (both final products and intermediate products) does not involve the country exporting the product only,
- even the country importing the product can even participate in the value of imported production.

International fragmentation of production based on vertical division of labor has gradually become the subject of many studies that have empirically analyzed this phenomenon both globally and from the specific regions point of view. Vertical specialization is, according to Hummels, D., Rapoport, D., Kei-Mu Yi (1998), a country involved using imported intermediate goods to produce goods later exported, making countries dependent on each other for producing the final goods. Later, Hummels, D., Ishii, J., Yi, K.M. (2001) define three conditions when we can consider the trade as a result of vertical specialization:

1. the goods (or service) is manufactured in two or more successive stages,
2. two (or more) countries are involved in the production of the product with their value added during the manufacturing process,
3. at least one country uses imported inputs in the production process and part of the output is exported.

Leamer (2007), in connection with the development of globalization of the world economy, draws attention to new features that are not only related to intensification of international trade, but mainly to the fragmentation of production among countries within global value chains. Amador and Cabral (2014, p. 4) consider global value chains to be the most important aspect of globalization nowadays, the Organization for Economic Co-operation and Development (OECD) (2010, p. 85) considers them as the dominant feature of today's global economy.

The ability of companies to organize production by dividing it into specific parts has changed the nature of the trade and the space for companies to engage in global production networks. This opens new opportunities for companies and not only for multinational companies in advanced, developing and emerging economies. Companies are able to use economically more advantageous conditions and enter global value chains (GVC) by taking advantage of such conditions that are considered as their

advantage. GVC connect companies, their employees and consumers around the world. The GVC are often also a starting point for inclusion of less developed countries in the world economy, and their involvement in the GVC is a prerequisite for their further development.

1.3 Commodity and value chains

Global value chains theory focuses on production fragmentation problems in several countries, at the end of the chain being the final product, its final use, and consumption. This process increased its intensity in the 1990s, which was reflected in a great deal of literature in this field, with an enormous interest in bringing together GVC findings from international institutions and organizations, such as World Bank (WB), World Trade Organization (WTO), United Nations Conference on Trade and Development UNCTAD, OECD. The main reason - the GVC significantly changes the world economy, changing the position of countries and entire regions in it, compared to the era when international trade prevailed in the form of exchanging of the final products or the goods that were produced by one country only.

The development of international trade itself has already represented a significant shift towards the interdependence of the world, while the development of a vertical international division of labor has shifted this phenomenon to a brand new level, i.e. in the effort of companies, countries and international organizations to make trade flows smooth, predictable and free. Examining how vertically specialized production forms interdependence among involved entities in a given supply chain, and how production sharing affects shocks transmission in the trade can be found in the publications by Kose and Yi (2001, 2006), Burstein, Kurz and Tesar (2008), and Bergin, Feenstra and Hanson (2009), Baldwin, R., Venables, A. (2010). One of the conclusions of the analysis of international trade in the context of the great collapse of 2008-2009 in the publications of Levchenko, Lewis and Tesar (2010) - "The Collapse of international trade during the 2008-09 crisis: In search of the smoking gun" - is that vertical links played important role for international trade. Moreover, authors conclude that the decline in international trade was much higher than during the previous crises (except for 2001), with a stronger decline in industries that are intensively buying intermediate products.

We see that the chain links among trading partners through the purchases and sales of products for production has gained global proportions. How has such a phenomenon occurred and how emergence and raise of GVC is explained and evaluated by individual authors? It seems that views, explanations, discussions and theories of the GVC are formed by participants from different countries and - considering implications of the GVC in various areas (e.g. trade, production, sectoral structure, employment, development, geopolitics, impact on developed and developing countries) - various disciplines as well (except economics even sociology, geography, regional planning, political science, management, development studies, etc.). The recent concept of the value chain is quite different from the first concept of so-called commodity chain from the 1960s. The conceptual change in this view originates in 2005. The evolution of these concepts represents a successive transition from the commodity chain (CC) and the global commodity chain (GCC) to the global value chain (GVC), and proceeded as follows:

- 1960s. The French concept of "filière" (steps, chain) - according to Faße (2009), the concept was mentioned in 1960 at the Instituto Nacional de Recherche Agronomique (INRA) and the Center Internationale en Recherche Agronomique pour Développement (CIRAD) as the

analytical tool for empirical research in agriculture. The concept has been used to better understand economic processes within production and distribution systems and creation of domestic commodity chains.

- 1970s. Wallerstein concept of commodity chain (CC). The term "commodity chain" originates to 1977 article by Terrence Hopkins and Immanuel Wallerstein published in Review, a journal issues by the Fernand Braudel Center for the Study of Economies, Historical Systems, and Civilizations at the State University of New York-Binghamton Bair, J. (2005). The main idea was to trace all inputs, activities and processes resulting in final goods. They specifically claim „Let us conceive of something we shall call, for want of a better conventional term, "commodity chains." What we mean by such chains is the following: take an ultimate consumable item and trace back the set of inputs that culminated in this item – the prior transformations, the raw materials, the transportation mechanisms, the labor input into each of the material processes, the food inputs into the labor. This linked set of processes we call a commodity chain. If the ultimate consumable were, say, clothing, the chain would include the manufacture of the cloth, the yarn, etc., the cultivation of the cotton, as well as the reproduction of the labor forces involved in these productive activities" (Hopkins and Wallerstein 1977, p. 128).
  Hopkins, T. and Wallerstein, I. (1986, p. 159) offered a more succinct definition in a 1986 review article analyzing trade and capital flows in the global economy before 1800: a commodity chain refers to "a network of labor and production processes whose final result is a finished commodity" (p. 159).
  In the early stages of the development of the world economy, countries played an important role in the coordination of commodity chains. During the 19th century and especially in the 20th century, an increasing proportion of production is provided by trading companies. The CC concept allows to unravel the essence of economic change and to examine in more detail the role of individual actors in the global economy.
- 1980s. Porter (1985) introduced the concept of the value chain. In his work "Competitive Advantage: Creating and sustaining superior performance", he focused on activities whereby the company generates value added. It shares the primary and supportive activities. The primary activities are:
  1. Inbound Logistics - involve relationships with suppliers and include all the activities required to receive, store, and disseminate inputs.
  2. Operations - are all the activities required to transform inputs into outputs (products and services).
  3. Outbound Logistics - include all the activities required to collect, store, and distribute the output.
  4. Marketing and Sales - activities inform buyers about products and services, induce buyers to purchase them, and facilitate their purchase.
  5. Service - includes all the activities required to keep the product or service working effectively for the buyer after it is sold and delivered.

  Secondary activities are:
  1. Procurement - is the acquisition of inputs, or resources, for the firm.

2. Human Resource management - consists of all activities involved in recruiting, hiring, training, developing, compensating and (if necessary) dismissing or laying off personnel.
3. Technological Development - pertains to the equipment, hardware, software, procedures and technical knowledge brought to bear in the firm's transformation of inputs into outputs.
4. Infrastructure - serves the company's needs and ties its various parts together, it consists of functions or departments such as accounting, legal, finance, planning, public affairs, government relations, quality assurance and general management.

Portera's shortcoming is an enterprise-only constraint and does not deal with the analysis of related non-business activities.

During the 80s of the 20th century, the research of commodity chains (CC) is gradually becoming independent and shaping itself as a new, independent area of the analysis of the world economy - but it took another decade before the original concept created a separate theoretical framework as we know it today.

- 1990s. The global commodity chain theory (GCC) - an outstanding publication by Gereffi and Korzeniewicz became the article of “Commodity chains and global capitalism” (1994). It was the first modification of commodity chains in which Gary Gereffi and Miguel Korzeniewicz focused a number of papers presented at the 16th Annual conference on the political economy of the world system, held at Duke University in April 1992. Thus, the period when the topic of commodity chains in the 1980s appeared rarely in the literature was over. However, the topic did not remain unnoticed, the accumulated knowledge was presented at the conference. Since then the intensity of the research increased. The most cited and influential was Gary Gereffi, who defined the framework for studying of what he called global commodity chains (GCC). Gereffi et al. (1994) questioned whether the observed global changes are historically new phenomena and a signal announcing the emergence of a new international division of labor, or these changes are just another stage in the development of the world economy. It was primarily about phenomena such as the flexibility and specialization of production, the industrialization of peripheral countries, new dynamic forms of production characterized by developed product differentiation, a shortening of the production cycle and, above all, an increasing density of inter-companies relations. Searching for answers to these questions formed the theory of global commodity chains (GCC).

  The basis of the change in GCC theory over the CC approach lies in the following:

  - Special attention is paid to companies - commodity chains become networks of inter-companies relationships that are needed to produce certain goods and they also interconnect households, firms and states. Particular attention is paid to the strongest or major industrial firms that have an impact on other actors in the chain and are becoming the carriers of modernization in the GCC - the GCC theory highlights the strategy of a gradual learning process for other companies from leading companies in the chain Gereffi, G. (2001).
  - GCC analysis seeks to capture and explain how production, distribution and consumption of goods is influenced by social relationships.

- Increased attention is paid to new opportunities for companies from the developing world to join commodity chains and the impact of their involvement is influenced by modernization of their economies.

Authors Faße, A., Grote, U., Winter, E., (2009) report that the GCC studies have contributed theoretically to understanding how the global economy works and, in particular, how it is applied in the global industry. Gereffi identified four dimensions in relation to which each commodity chain can be analyzed from the following perspective:

1. input-output structure (the process of transformation of raw materials into final products);
2. territorial (or geographical scope),
3. structure of management,
4. institutional context.

Papers (Henderson et al 2002; Raikes et al., 2000) on existing GCCs focused primarily on the management dimension, i.e. to find out which companies in the chain are the able to control various aspects of the manufacturing process the best and how they appropriately distribute the value that is created. Knowing the nature and structure of chain management intendeds to enlighten the nature of the influential relationships that exist together in the chain. The concept of governance, as understood by the GCC, recognizes that in the current international economy the dynamics of power (influence) and control do not necessarily correlate with ownership. The best-known difference with CC in GCC papers is that it combines management with the position and location of commodity chain actors.

Gereffi (1994, 1996) introduced a division of GCC to producer-driven GCC (PDCC) and purchaser-driven (BDCC) commodity chains.

- The first type of chain (PDCC) is typical in technology and know-how demanding sectors (automotive, aerospace, etc.). The chain is organized in such a way that the administrative center of the company is at the top, grouping together to control other parts of production owned by the company as well as the system of subcontractors. Leading companies are protecting their know-how and supply companies have to go through a thorough entry selection. Suppliers often do not provide finished products, but only necessary components, intermediate products. Large companies themselves usually do the final assembly.
- BDCCs are based on decentralized chain organization and not on decentralized work organization. There are primarily labor-intensive industries such as the clothing industry, consumer electronics, etc. At the top of the chain are large retailers (e.g. Wal-Mart) or brand companies (e.g. Nike) outsourcing production to suppliers who are able to offer the best ratio between quality and price.

The main difference among the types of chains is based on the different concepts of outsourcing and the control that the leading companies in the chain perform. Bair. J. (2005) notes that while the garment industry is the most pervasive case of a commodity-driven by purchaser (Bair and Gereffi 2002, Gereffi 1999), a similar management structure was identified in the commodity chain of some agricultural producers where supermarkets as “big buyers” control individual farmers (Dolan and Humphrey 2000).

The GCC framework has evolved as a networking, organizational approach to study the dynamics of global industry (Raikes et al., 2000). The GCC framework contains clear research questions and partial problems and provides information on the functioning of global industries and their diversity and functioning in Asia, Africa and Latin America as well as North America and Europe.

- 2000 until present. The emergence and development of the global value chain theory (GVC). The development, diversity and discovery of new dimensions of the topic brought a new problem to the GCC concept - the different terminology used by the authors - international production networks (Borrus et al., 2000, global production (Ernst 1999, Henderson et al., 2002), global production systems (Milberg 2003) and the French filière concept (Raikes et al., 2000). Given this diversity of approaches, it has become apparent that it would be useful to agree on common terminology.

Considering that a large group of researchers, politicians, international organizations, entrepreneurs and students from different regions of the world, research community or research network "Global Value Chain" was established at a workshop in Bellagio (Italy) in 2000. The network keeps operating till today on the Duke University, Durham, USA, with the title "The Global Value Chains Initiative" (Duke GVCC 2018b) and comprehensive information, analysis, studies, manuals about GVC can be found on its website (https://globalvaluechains.org/). Currently, Duke University Global Center Chains Center (Duke GVCC 2018a; https://gvcc.duke.edu/) is formerly known as the Duke University Center for Globalization, Governance & Competitiveness, which deals with research sponsored by its clients and deals with research problems associated with economic and social development for governments, foundations, and international organizations. A director of GVCC is Gary Gereffi.

In the 1990s, Gereffi and Korzeniewicz (1994), Gereffi Gereffi, G., Humphrey, J. and Sturgeon, T (2005) combined value-added concepts - introduced the term value chain. The concepts of commodity and value chain are very similar, but the value chain is more ambitious as it is focused on description of the organization of production in more details (Slušná, Balog et al., 2015, p. 61). The "value chain" is preferred over the "commodity chain" because, as Sturgeon explains, TJ (2008) focuses on value - to create and capture values across a range of possible chain activities and products (goods and services). They also chose to replace the term "commodity" by "value". The reason is that the use of the word "commodity" with undifferentiated products, especially primary sources such as oil and agricultural products, and the term "value" also captures the term "value added" good chain product creation, and the concept of "value" at the same time draws attention to the main source of economic development. The word "global" in global value chains simply signals interest in value chains that contains a long distance element.

Regional, national and local value chains are firmly embedded in the global value chains as we perceive them and the GVC management theory works fine as well, as all these spatial scales.

Based on this new understanding of globalized production, the value chain describes the full range of activities that firms and workers do to bring a product/good or service from its conception to its final use and beyond. This includes activities such as design, production, marketing, distribution and support to the final consumer (Duke GVCC 2018b). Activities that contain a value chain can be conducted in one company or divided among different companies. The World Bank (World Bank, 2017) defines a global value chain as the production of a final product through production and assembly in

several countries while each step in the process creates value added to the final product. According to the Cambridge Dictionary Cambridge Dictionary (2016), the global value chain is a summary of different processes in different parts of the world, each process adding value to the produced goods or services.

Consequently, the concept of global value chains (GVC) captures these current characteristic features of the global economy (De Backer, Miroudot, 2012):

- increasing fragmentation of production across countries,
- countries specialize in tasks and functions to a greater extent than to specific products,
- buyers and suppliers in the global economy have a decisive role in global networks.

In the context of global value chains, individual inter-production processes can work in different relationships among themselves. Papers on GVC (Humphrey, J., Schmitz, H. 2017) distinguish four types of relationships in which buyers and suppliers enter global value chains:

1. "Shoulder length" relationship. Buyer and supplier do not develop close relationships. This means that the supplier produces the product that the buyer requests and also that the buyer only requires what it could get from many other companies (including quality, reliability, etc.) The product should be standardized or easily customizable and the customer should not have any specific requirements. Basically, these are two independent units, where neither the customer nor the supplier determines any reciprocal rules.
2. Relationship of "networking". Companies collaborate, exchange information, and often distribute the competencies among themselves. Relationship characterizes interdependence. In this case, the customer may set certain standards of the manufacturing process or product itself that has to be achieved but must be convinced that the supplier can meet them.
3. The relationship of "quasi hierarchy". One firm performs a high degree of control over other firms in the chain. It often specifies the properties of the product and sometimes determines the processes to be followed in production, as well as the control mechanisms to be performed. This level of control can arise not only from the role of the lead supplier who defines the product, but also from the risk of loss of buyers for inappropriate products. The lead firm can control not only its direct suppliers but also other suppliers along the chain.
4. The "hierarchy" relationship. The lead company takes direct ownership over some operations in the chain.

The following workshops included NGO policy makers and NGO activists from the UN, OECD, UNCTADT, WTO and WTC. The participation of these organizations underlines the importance of the GVA for the world economy. Discussions resulted in focusing on the problem of network management at the company level and culminated in 2005 in paper elaborated by Gereffi, G., Humphrey, J. and Sturgeon, T (2005), published in the Review of International Political in 2005. By identifying the various types of linkages within the GVC, it has become necessary to complement the global management of the "chain-linked" and "manufactured" commodity chain with a new concept that also takes into account other independent forces from suppliers and buyers, which affect GVC participants.

In particular, we see four new elements in managing the global economy Sturgeon, T.J. (2008):

1. Improvements in IT and sector-level standards make it easier for organizations to access their network in technology demanding sectors.

2. Flexible capital equipment enables to accumulate a capital-intensive technology as well as workforce; production can be merged and redistributed, and free up the way for networking organizations in technologically demanding industries.
3. Sophisticated supply chain management tools that push for the workforce.
4. Growth of outsourcing by manufacturing companies and increased participation of small and medium-sized enterprises in the production of a well-defined (branded) product.

These facts have discarded any clear distinction between buyers and manufacturers. GCC typology based on buyers and manufacturers was based on a static view of technology deployment and barriers to entry into the chain. At the moment, however, they are both dynamic - so management should also be more dynamic and the management of the production network should be independent of the manufacturer and the buyer. The new GVC governance framework responds to all new facts and its specification is rigorous and extensive - it is based on the principle of Sturgeon, T.J. (2008): "If chains consist of multiple links, they can also contain multiple forms of management."

In determining the factors undermining the expansion of global value chains, it is difficult to separate those that have determined the growth of international trade from those that have a specific impact on the fragmentation of production. Many authors consider that most significant drivers of GVC in recent decades are the technological advancement, activities of transnational corporations, declining transport costs, a drop in information and communication costs, or lower political and economic barriers for movements of goods, services and capital. Railways and steamers allowed to spatially separate production from consumption, achieve effects of economies of scale, and benefit from comparative advantages. Baldwin calls this phenomenon "first unbundling". From the 1980s onwards, the increase in the trade intermediate products, further reduction of transport costs, fall in tariffs, communication and coordination costs have enabled the worldwide fragmentation of production, so-called "second unbundling". Baldwin (2006) points that at the first globalization stage (prior to 1980), international competition took place at sector level (e.g. Japanese cars versus Thai), second (after 1985) already at the level of production stages (Japanese cars may contain components from Japan and vice versa). The spatial division of the production stage according to Baldwin, R., Venables, A. (2010) may have a complicated form, indicating two ways of interacting between production actors - he called them "snakes" and "spiders" (Figure 1.1).

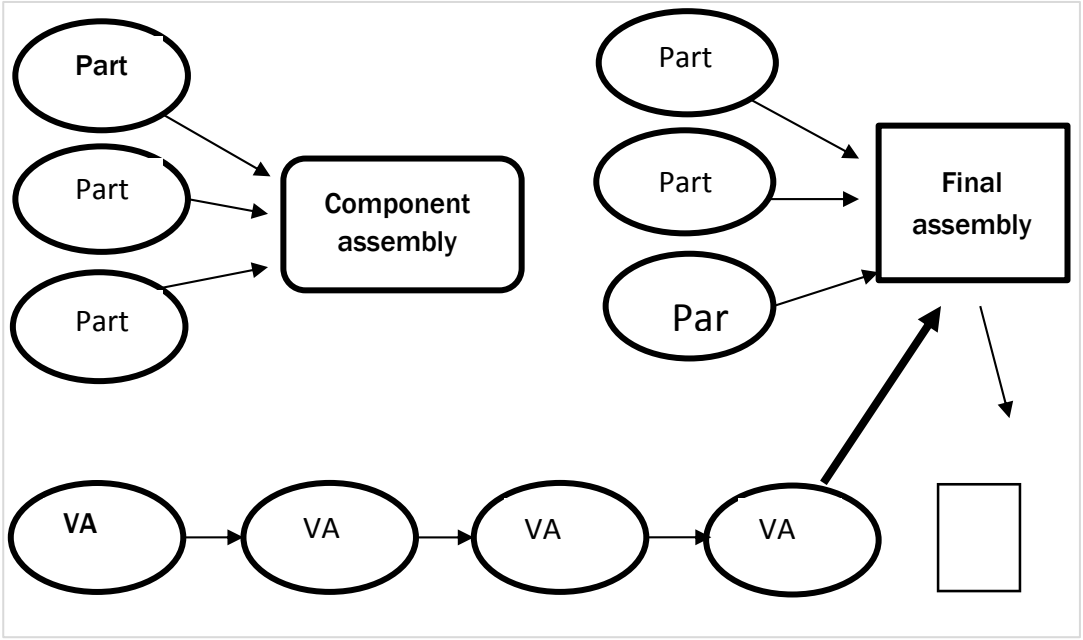


Figure 1.1 Spiders and snakes
Source: Compiled by the author based on Baldwin, R., Venables, A. (2010)

Each cell is the stage in which the value is added to the product and the result is a product designed for consumption, each arrow is the physical movement of the part, the components or the product itself. These may be movements within the country (perhaps within the enterprise), or they may be separate movements between actors in different countries. There are two completely different configurations. One is referred to as a spider with multiple limbs that are combined to form a body, which can be the final product itself, or another component, an intermediate product. The second is the snake - it draws the next stages of production, producing at each stage its value added - the last one in the chain produces the final product. Production processes can be composed from several combinations of "spiders" and "snakes". Dixit and Grossman (1982) analyze multi-stage production - "spiders", and point out that the order of shipments is not significant, Levine (2010) and Costinot et al. (2011) investigate the implications of a snake in which the sequence is important for finalizing production. A bad organization is dragging time and causing losses to other companies in the chain. The final product consists of elements in "snake" and "spiders" and the values added that are created in the chain. In this simple example of production of final goods there is a concentrated number of problems that are contained in the theory of global value chains. In UNCTAD (2013) some are formulated as follows:

- how to measure the economic impacts of participation in GVC at the company, industrial and country levels;
- how to identify and measure value added, exports, the number of business entities in the chain, tax revenues, barriers to trade, and other statistical issues to best reflect the participation of companies in the GVC;

- how GVC create new jobs, as participation in GVC affects overall employment, employment patterns, wages;
- how GVC work in line with sustainable development requirements such as social impact, environmental impact and development impacts;
- many others.

Hiroyuki Taguchi (2014) investigated the dynamics of GVC by examining value added in the trade structure focusing on Asian developing countries, and concluded that in the initial phase of GVC participation the contribution of domestic value added to EXP was reduced, but was restored in a later phase of GVC engagement following the upgrading of domestic production capacities.

Even the competitiveness of companies, regions, countries is gaining another dimension - Grodzicki, M.J. (2014) e.g. presents a comprehensive description of the involvement of V4 economies in GVC and their competitiveness; noting that the value added results are different from traditional competitiveness analyzes based on gross trade data.

Johnson, R.C. (2014) and Johnson, R.C., Noguera, G. (2012) address the issue of multiple accounting of intermediate products in gross exports and the size of value added in exports. Their main finding was that the product, if it finishes its final form, would cross the border more often, and the share of domestic value added in exports is decreasing. In one of the most successful work in this area, Johnson and Noguer (2014) report that this trend occurs only after 1990.

The World Economic Forum (WEF, 2013) reports findings on GVC country engagement:

- the bigger the domestic market, the lower the involvement of the country "backward" and higher "upward" - the large enough market means for the country to draw from a larger number of domestic intermediate goods;
- the higher the per capita income, the "upward" involvement is higher, while the "backward" engagement is negligible. Developed countries tend to sell a higher proportion of their gross exports in the form of intermediate products;
- the higher the proportion of the manufacturing sector in GDP, the higher the "backward" involvement;
- the greater the distance from the main production nodes in Europe, North America and Asia, the lower the engagement "backward" and the "forward" involvement is negligible. It is a premium for the company to settle near world or region leading economies.

Nowadays, there is a large number of such analyzes (i.e. see https://globalvaluechains.org/ with more than 300 of them), which means that the issues of opportunity, assessment, benefits of companies, workers, organization of production, trade, in the context of involving countries in vertical division of labor, have become priorities.

References

AMADOR, J. – CABRAL, S. 2014. Global Value Chains: Surveying Drivers and Measures. In ECB Working paper series. 2014, no. 1739. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1739.en.pdf?13f6d86f40a3c60325f27cbc08a18742 . ISSN 1725-2806

BAIR. J. 2005 Global Capitalism and Commodity Chains: Looking Back, Going Forward, Competition and Change, Vol. 9, No. 2, 2005, pp. 153-180.

https://www.researchgate.net/publication/228339509_Global_Capitalism_and_Commodity_Chains_Looking_Back_Going_Forward

BALDWIN, R. (2006). Globalisation: the great unbundling(s). Office of the Prime Minister of Finland, Helsinki.

BALDWIN, R., VENABLES, A. 2010 Spiders and snakes: offshoring and agglomeration in the global economy. NBER Working Paper No. 16611, Issued in December 2010, Revised in December 2012. https://www.nber.org/papers/w16611

BURSTEIN, Ariel & KURZ, Christopher & TESAR, Linda, 2008. Trade, production sharing, and the international transmission of business cycles. Journal of Monetary Economics, Elsevier, vol. 55(4), pages 775-795, https://www.nber.org/papers/w13731

Cambridge Dictionary 2016 Global value chain Meaning in the Cambridge English. 2016. https://dictionary.cambridge.org/dictionary/english/global-value-chain

DE BACKER, K., Miroudot, S (2013) Mapping Global Value Chains, OECD Trade Policy Papers, No. 159, OECD Publishing, Paris, https://doi.org/10.1787/5k3v1trgnbr4-en.

Duke GVCC 2018a The Duke University Global Value Chains Center. Durham 2018. https://gvcc.duke.edu/

Duke GVCC 2018b CONCEPT & TOOLS. Global Value Chains Initiative. Durham 2018. https://globalvaluechains.org/

ELMS, K. – LOW, P. 2013. Global value chains in a changing world. Geneva: WTO Secretariat, 2013, 436 p. ISBN: 978-92-870-3882-1 https://www.wto.org/english/res_e/booksp_e/aid4tradeglobalvalue13_e.pdf .

FAßE, A., GROTE, U., WINTER, E., 2009. Value chain analysis Methodologies in the context of environment and trade research, Hannover Economic Papers (HEP) dp-429, Leibniz Universität Hannover, Wirtschaftswissenschaftliche Fakultät. https://ideas.repec.org/p/han/dpaper/dp-429.html

GEREFFI, G., KORZENIEWITZ, M. (eds.). 1994. Commodity Chains and Global Capitalism. Westport,Connecticut, London: Praeger.

GEREFFI, G. 1994. „The Organization of Buyer-Driven Global Commodity Chains: How U.S. Retailers Shape Overse as Production Networks.“ Pp. 95-122 in Gereffi, G., Korzeniewitz, M. (eds.). Commodity Chains and Global Capitalism. Westport, Connecticut, London: Praeger.

GEREFFI, G., KORZENIEWICZ, M.,KORZENIEWICZ, R.P. 1994. „Introduction: Global Commodity Chains.“ Pp. 1-14 in GEREFFI, G., KORZENIEWITZ, M. (eds.). Commodity Chains and Global Capitalism. Westport, Connecticut, London: Praeger.

GEREFFI, G. (2001). Shifting Governance Structures in Global Commodity Chains, with Special Reference to the Internet. American Behavioral Scientist, Vol. 44, No. 10, pp. 1616-1637

GEREFFI, G. (2005). The Global Economy: Organization, Governance, and Development. In: N.J. SMELSER & R. SWEDBERG (eds),The Handbook of Economic Sociology, Princeton: Princeton University Press, pp. 160–182.

GEREFFI, G., Humphrey, J. and Sturgeon, T (2005) The governance of global value chains. Review of International Political Economy, Vol. 12, No. 1, pp. 78-104.

GEREFFI, G., Fernandez-Stark, K. 2016. Global Value Chain Analysis: A Primer, Second Edition, The Duke Center on Globalization, Governance & Competitiveness, July 2016.

https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/12488/2016-07-28_GVC%20Primer%202016_2nd%20edition.pdf?sequence=1

GRODZICKI, M.J. (2014). Global Value Chain and Competitiveness of V4 Countries http://www.visegrad.uek.krakow.pl/publications_graz01.html

HERNÁNDEZ, E.A. – Martinez-Piva, J. M. – Mulder, N. 2014. Global value chains and world trade. Prospects and challenges for Latin America. Santiago: United Nations, 2014. 282 p. , http://repositorio.cepal.org/bitstream/handle/11362/37041/1/S2014061_en.pdf .

HIROYUKI Taguchi 2014 Dynamic Impacts of Global Value Chains Participation on Asian Developing Economies. Foreign Trade Review 49(4) 313–326, Indian Institute of Foreign Trade. SAGE Publications Los Angeles, London, New Delhi, Singapore, Washington DC. http://ftr.sagepub.com

HOPKINS, T., WALLERSTEIN, I. (1977) Patterns of development of the modern world-system, Review 1(2), pp. 11–145.

HOPKINS, T. and WALLERSTEIN, I. (1986) Commodity chains in the world economy prior to 1800, Review, 10(1), pp. 157–170.

HUMMELS, D., RAPOPORT, D., Kei-Mu Yi 1998. Vertical Specialization and the Changing Nature of World Trade. . Economic Policy Review Economic Policy Review, 1998, issue Jun, 79-99. https://econpapers.repec.org/article/fipfednep/y_3a1998_3ai_3ajun_3ap_3a79-99_3an_3av.4no.2.htm

HUMMELS,D., ISHII,J., YI, K.M. 2001 The nature and growth of vertical specialization in world trade, 2001. Journal of international economics 54 (1): 75-96. https://www.sciencedirect.com/science/article/pii/S0022199600000933

HUMPHREY, J., SCHMITZ, H. 2017 How does insertion in global value chains affect upgrading in industrial clusters? In: Institute of Development Studies. https://www.ids.ac.uk/ids/global/pdfs/JHHSRegStudies25jun02.pdf

JOHNSON, R. C. 2014. "Five Facts about Value-Added Exports and Implications for Macroeconomics and Trade Research." Journal of Economic Perspectives, 28(2): 119-42. https://www.aeaweb.org/issues/336

JOHNSON, R. C. Noguera, G. 2012, Accounting for Intermediates: Production Sharing and Trade in Value Added, Journal of International Economics, vol. 86, no. 2, pp. 224–236.

JOHNSON, R. C. 2014. Five facts about value-added exports and implications for macroeconomics and trade research. In Journal of Economic Perspectives. 2014, vol. 28, no. 2. pp. 119-142. http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.28.2.119 ; https://www.dropbox.com/s/slm5ssvjn9kdv0t/Johnson_JEP_2014.pdf?dl=0

KOSE, M.A. and K. YI, 2006. Can the standard international business cycle model explain the relation between trade and comovement? Journal of International Economics, Volume 68, Issue 2, Pages 267-295, http://dept.ku.edu/~empirics/Courses/Econ850/Papers/Can%20standard%20international%20business%20cycle%20model%20explain%20the%20relationship%20between%20trade%20and%20comovement.pdf

LAMY, P. 2011. 'Made in China' tells us little about global trade. In Financial Times. https://www.ft.com/content/4d37374c-27fd-11e0-8abc-00144feab49a

LEAMER, E. E. 2007. A flat world, a level playing field, a small world after all, or none of the above? A review of Thomas L. Friedman's the world is flat. In Journal of Economic Literature. 2007, vol. 45, no. 1, p. 83-126. http://www.anderson.ucla.edu/faculty/edward.leamer/pdf_files/mar07_leamer.pdf

LEVCHENKO, A. A , LEWIS, L. T. & TESAR, L. L, 2010. The Collapse of International Trade during the 2008–09 Crisis: In Search of the Smoking Gun. 2010. NBER Working Paper No. 16006. https://www.nber.org/papers/w16006

MAESSO CORRAL, M., FERNÁNDEZ NÚÑEZ, M.T. https://old.reunionesdeestudiosregionales.org/Santiago2016/htdocs/pdf/p1734.pdf

OECD. 2010. OECD Economic Globalisation Indicators. Version 1.1, March 2017 https://www.mtholyoke.edu/acad/intrel/ipe/oecd.pdf ISBN 978-92-64-08436-0

PORTER, M. E., "Competitive Advantage". 1985, Ch. 1, pp 11-15. The Free Press. New York.

SLUŠNÁ, Ľ. – BALOG, M. a kol. 2015. Automobilový priemysel na Slovensku a globálne hodnotové reťazce. Bratislava: Slovenská inovačná a energetická agentúra, 2015, 96 s., ISBN 978-80-88823-60-5 https://www.siea.sk/materials/files/inovacie/publikacie/studia_Automobilovy_priemysel_na_Slovensku_a_globalne_hodnotove_retazce_SIEA_web.pdf.

STEPHENSON, S. 2013. Global Value Chains: The New Reality of International Trade. The E15 Initiative. Geneva: International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum,2013. 18 s. http://e15initiative.org/wp-content/uploads/2015/09/E15-GVC-Stephenson-Final.pdf

STURGEON, T. J. (2008) From Commodity Chains to Value Chains: Interdisciplinary Theory Building in an Age of Globalization. .Industry Studies Working Paper:2008-02. http://isapapers.pitt.edu/84/

STURGEON, T. J. 2013. Global Value Chains and Economic Globalization - Towards a New Measurement Framework. http://ec.europa.eu/eurostat/documents/54610/4463793/Sturgeon-report-Eurostat

UNCTAD. 2013. Global Value Chains and Development: Investment and Value Added Trade in the Global Economy. A Preliminary Analysis. New York & Geneva: United Nations, 2013, 40 p. http://unctad.org/en/PublicationsLibrary/diae2013d1_en.pdf

WANG,Z., WEI,S., YU, X., ZHU, K. 2017. Measures of participation in global value chain and global business cycles, 2017. Cambridge, MA: NBER working paper No. 23222. https://www.researchgate.net/publication/315770618_Measures_of_Participation_in_Global_Value_Chains_and_Global_Business_Cycles

WEF 2013. Enabling trade: Valuing growth opportunities, 2013. Geneva: Published by World economic forum. https://www.weforum.org/reports/enabling-trade-valuing-growth-opportunities

WTO. 2016. What is Trade in Value Added (TiVA)? Trade in Value Added data day - 24 November 2016. https://www.wto.org/english/res_e/reser_e/xreser_e/tivaicio_e.pdf .

WTO, IBRD/WB, IDE-JETRO , OECD 2017 GLOBAL VALUE CHAIN DEVELOPMENT REPORT 2017, MEASURING AND ANALYZING THE IMPACT OF GVC ON ECONOMIC DEVELOPMENT ISBN 978-92-870-4125-8 https://www.wto.org/english/res_e/publications_e/gvcd_report_17_e.htm

https://wiiw.ac.at/value-added-and-factors-in-trade-a-comprehensive-approach-p-2591.html

https://www.brookings.edu/opinions/value-added-trade-and-its-implications-for-international-trade-policy/

World Bank 2017 Global Value Chains http://www.worldbank.org/en/topic/global-value-chains

Chapter 2

Slovak Republic and global value chains

*by **Oľga Nosáľová***
Faculty of Economics, Technical University of Košice, **Slovak republic**
olga.nosalova@tuke.sk

2.1 Introduction
2.2 Slovakia's position in the world economy by gross production, GDP, value added and gross exports
2.3 Decomposition of foreign trade by the value added
2.4 Decomposition of foreign trade of the Slovak Republic
2.4.1 Export and import structure of the Slovak Republic in gross terms and value added
2.4.2 Export structure of the Slovak Republic by sector and industry according to the measures based on gross expression and value added
2.4.3 Export and import of intermediate goods and final products in the Slovak Republic based on gross measures and value added
References

http://dx.doi.org/10.14505/gvcifpieu.2018.ch2

Slovak Republic and global value chains

Oľga Nosáľová
Faculty of Economics, Technical University of Košice, **Slovak republic**
olga.nosalova@tuke.sk

Abstract:
The main objective of the chapter is to determine the position of the Slovak Republic in the world economy, to compare the export and import development in the of the Slovak Republic according to the gross (traditional) measures and the relatively new approach - value added in exports and imports, using the OECD trade in value added (TiVA) database. On the basis of the decomposition of gross exports and gross imports of the Slovak Republic for the period 1995-2011 to items according to the movement of domestic and foreign value added in total exports and import and export of intermediate products and final products. The chapter identifies participation of the Slovak Republic in global value chains, by sector and branches. The observed increasing differences in the bilateral foreign trade relations of the Slovak Republic in terms of value added, compared to the traditional results, point to the fact that the Slovak Republic is increasingly becoming part of simple and complex global value chains..

Keywords: the Slovak Republic, export, import, domestic value added in exports, foreign added value in exports, intermediate, final product, global value chains, industry.

JEL Classifications: F00, F10, F14. F19, F60, F62

2.1 Introduction

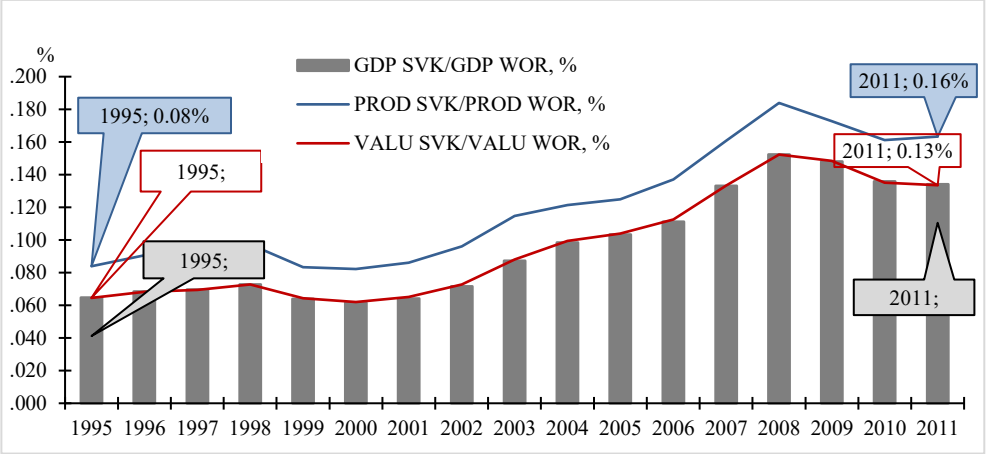
The economy of Slovak Republic has changed since its establishment in 1993 - the transformation of the centrally planned economy into a market economy has created the possibility of engaging more intensely in the world economy, in which significant changes related to processes of globalization have also been made during this period. The Slovak Republic is a small economy whose development is dependent on foreign markets, so engaging in a modern, "new" international labor division is an essential way of existence, growth and development.

The aim of the chapter is to find and compare the development of foreign trade of the Slovak Republic according to traditional measurement and value added approach. It seems that we cannot ignore the parallel changes in the international division of labor, which are reflected in the deepening of the vertical division of labor among countries and the associated global value chains (GVC) phenomenon, when assessing the export and import of the Slovak Republic. The GVC concept changes the view of export and import measurement. Traditional indicators need

to be confronted with value-added indicators that provide a more realistic view of the country's participation in the international division of labor.

2.2 Slovakia's position in the world economy by gross production, GDP, value added and gross exports

The gradual opening of the economy since the establishment of the Slovak Republic in 1993 has created market conditions for engaging in international trade and changing the position of the Slovak Republic in the world economy. The share of gross production of the Slovak Republic in world gross output (Figure 2.1) increased from 0.0869% in 1995 to 0.1633% in 2011 (+0.0794 percentage points) and the share of value added created in the Slovak Republic (+0.0689 percent) - the intermediate production (the difference between gross production and added value) of the Slovak Republic follows increasing trend - the share of the Slovak Republic in gross production of the world is raising thanks to an increase of the share of intermediate production in gross production of the Slovak Republic.



Note: SVK = Slovak Republic; WOR = the world; GDP = GDP; PROD = production (gross production) at fixed prices; VALUE = value added at fixed prices;

Figure 2.1 Position of the Slovak Republic in the world economy by gross production, GDP and value added, 1995-2011 (%)

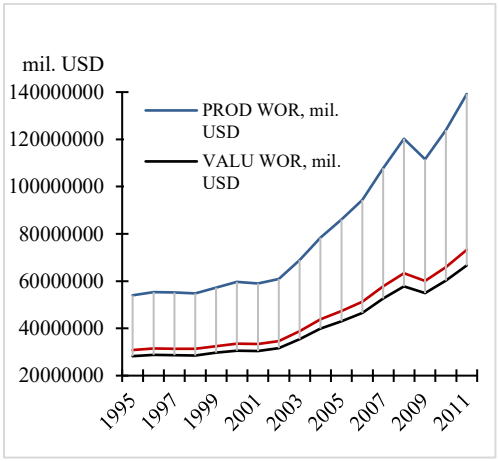
Source: Compiled by the author (OECD.Stat. 2018)

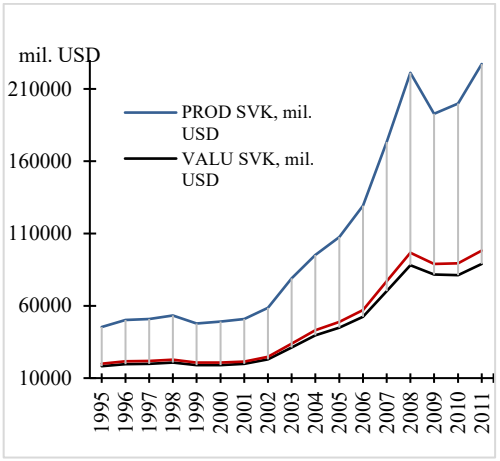
The development of gross output, value added and GDP in the Slovak Republic are compared with their development in the world economy (Figure 2.2). Nayak G. (2017) states that despite the fact that the performance of the economy is mostly interpreted via GDP, the importance of the gross value added (GVA) indicator is also important. GVA provides an idea of the state of economic activity from the perspective of producers or suppliers. According to Merwin, R. (2017), it is important to monitor GVA, not just GDP, as it more accurately captures economic activity - GDP changes by collecting taxes can distort the real situation. If the tax increases dramatically (or decreases) GDP is different from GVA. GVA usually representsmore than 90%

of GDP (Košťáková, 2016). Development (Figure 2.2) shows that the difference between GVA (VALU) and GDP (GDP) is generally increasing in the world economy and in the economy of the Slovak Republic.

$$PROD = VALU + INT \tag{2.1}$$

where
PROD - Production (Gross Production)
VALUE - value added
INT – Intermediate production





Note: SVK = the Slovak Republic; WOR = the world; GDP = GDP; PROD = production (gross production) at fixed prices; VALUE = value added at fixed prices; INT = Intermediate production - Connector between PROD and VALU

Figure 2.2 Gross production, GDP, value added in the world and the Slovak Republic, 1995-2011 (mil. USD)

Source: Compiled by the author (OECD.Stat. 2018)

For the period 1995-2011 world gross production multiplied 2.58 times, the development of Slovakia's gross production was more dynamic - in 2011 it represented 5 times the production in 1995 (Figure 2.2). Development of value added and GDP also experienced similar trend (Table 2.1):

a) the world value added increased 2.36 times, the value added in the Slovak Republic almost 5 times (4.88 times),
b) the volume of world GDP has more than doubled (2.37 times), Slovak GDP has multiplied by 4.92 times
c) world gross production has increased 2.58 times, Slovakian 5-fold.

The dynamics of changes in Slovakia's value added is lower than the dynamics of gross output and GDP, but we are also seeing this situation in the dynamics of the world GVA. In the case of GDP and GDP development, both in the world and the Slovak Republic, the gap between them is increasing in the examined period in favor of higher GDP, suggesting that net taxes are a more significant component of GDP than in the early 1990s. At the same time, we see that scissors between the volume of gross production (PROD) and added value (VALU) are opened both in the world and the Slovak Republic (Figure 2.2), which means that growth of gross output induces faster increases in the volume of intermediate production than value added.

Table 2.1 Dynamics of changes in the gross production, total value added and GDP in the world and the Slovak Republic for the period 1995-2011 (multiple since 1995)

	change 1995-2011 (multiple)		
	PROD	GDP	VALU
WOR	2.58	2.37	2.36
SVK	5.01	4.92	4.88

Note: SVK = the Slovak Republic; WOR = the world; GDP = GDP; PROD = production (gross production) at fixed prices; VALUE = value added at fixed prices

Source: Compiled by the author (OECD.Stat. 2018)

The data on the share of value added on gross output (VALU/PROD,%) (Figure 2.3) also show that in the Slovak Republic and the world the share of value added on gross output is decreasing over the examined period. Higher fluctuations are evident in the Slovak Republic, with a peak in the pre-crisis period in 2005, but in 2011, after the crisis, it was lower than at the beginning of the examined period. Obviously, there is a worldwide trend to reduce the share of value added to gross output. Why is it so? The difference between gross production and value added is intermediate production. Is it actually increasing its share? Or, the increase in the share of intermediate production is the result of multiplying the share of intermediate production in the gross production, the production of which is increasingly being made by producers from several countries? We will find answers to these questions in a further examination of the trade in intermediate products and in examining the contribution of the country to their production and trade.

The share of value added in GDP (VALU/GDP,%) also drops (Figure 2.3). This decline was halted by the 2008 crisis. During the crisis, there was an increase in the share of value in GDP. Decreased foreign demand was influenced by foreign trade, exports (Figure 2.4, Figure 2.5), output and GDP decreased, while trade in intermediate products for export production decreased (see Section 2.3.2 Export and import of intermediate products and final products by gross expressions and value added).

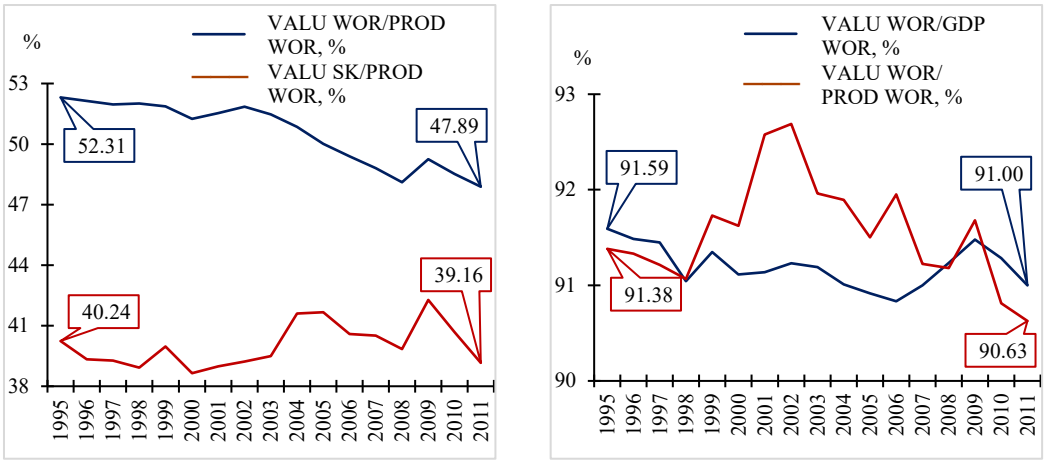


Figure 2.3 Share of value added in the gross production and GDP in the world and the Slovak Republic, 1995-2011, %
Source: Compiled by the author (OECD.Stat. 2018)

In the examined period (except for the year 2009) in the world and the Slovak Republic, foreign trade grew, with an increasing growth observed since 2003 compared to the previous period.

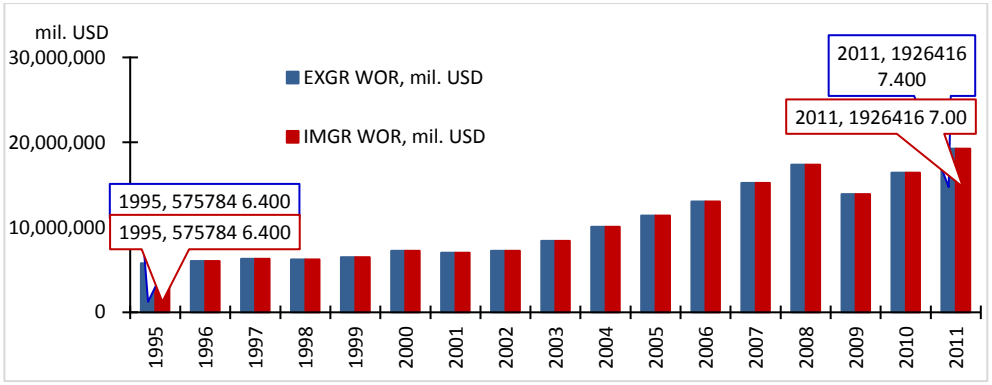


Figure 2.4 Evolution of gross EXP and gross IMP in the world, 1995-2011 (mil. USD)
Source: Compiled by the author (OECD.Stat. 2018)

In the world and Slovak economies, exports and imports were becoming more and more important, increasing the dependence between the growth of gross production and GDP on the possibility of realizing production abroad, while increasing the dependence of production and consumption on imports (Table 2.2). In the world, the share of gross exports (and imports) in world production increased by 3.18 percentage points, the share of gross exports (and imports) to GDP by 7.63 percentage points (EXGR WOR/GDP WOR; IMGR WOR/GDP WOR;%).

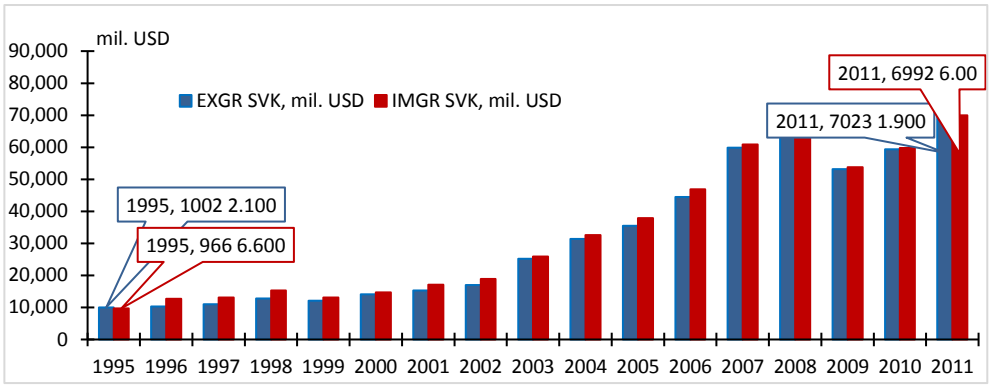


Figure 2.5 Development of gross EXP and gross IMP in the Slovak Republic, 1995-2011 (mil. USD)
Source: Compiled by the author (OECD.Stat. 2018)

We are experiencing dynamic changes in the Slovak Republic - in 2011, the gross export to gross production reached 30.91% (EXGR SVK/PROD SVK,%), which is 8.80 percent more than in 1995. In terms of GDP, the share of gross exports increased to 71.53% (21.32 percentage points higher than in 1995). Changes in the share of gross imports on gross output was higher than of exports (+9.45 percentage point IMGR SVK/PROD SVK,%) and GDP (+22.79 percentage point IMGR SVK/GDP SVK,%). The share of IMGR SVK in gross production was 30.77% in 2011 and 71.22% in GDP. (Table 2.2)

Table 2.2 Share of gross EXP and gross IMP of the world and the Slovak Republic in gross production and GDP, 1995-2011, %

	EXGR WOR / PROD WOR %	IMGR WOR / PROD WOR %	**EXGR SVK / PROD SVK %**	**IMGR SVK / PROD SVK %**	EXGR WOR / GDP WOR %	IMGR WOR / GDP WOR %	**EXGR SVK / GDP SVK %**	**IMGR SVK / GDP SVK %**
1995	10.66	10.66	**22.11**	**21.33**	18.67	18.67	**50.21**	**48.43**
1996	10.94	10.94	**20.53**	**25.30**	19.20	19.20	**47.69**	**58.75**
1997	11.37	11.37	**21.57**	**25.80**	20.00	20.00	**50.09**	**59.92**
1998	11.38	11.38	**23.96**	**28.70**	19.92	19.92	**56.07**	**67.17**
1999	11.36	11.36	**25.41**	**27.49**	20.01	20.01	**58.30**	**63.08**
2000	12.12	12.12	**28.80**	**30.00**	21.54	21.54	**68.28**	**71.12**
2001	11.87	11.87	**30.10**	**33.60**	20.99	20.99	**71.49**	**79.79**
2002	11.90	11.90	**29.05**	**32.23**	20.95	20.95	**68.65**	**76.17**
2003	12.21	12.21	**31.85**	**32.75**	21.63	21.63	**74.18**	**76.27**
2004	12.84	12.84	**32.98**	**34.30**	22.98	22.98	**72.84**	**75.75**
2005	13.22	13.22	**33.05**	**35.26**	24.03	24.03	**72.56**	**77.43**
2006	13.82	13.82	**34.40**	**36.22**	25.41	25.41	**77.93**	**82.07**
2007	14.11	14.11	**34.55**	**35.14**	26.32	26.32	**77.82**	**79.15**
2008	14.46	14.46	**31.80**	**33.04**	27.42	27.42	**72.78**	**75.61**
2009	***12.45***	***12.45***	***27.55***	***27.86***	***23.13***	***23.13***	***59.75***	***60.42***

2010	13.26	13.26	**29.69**	**29.90**	24.94	24.94	**66.28**	**66.74**
2011	13.84	13.84	**30.91**	**30.77**	26.30	26.30	**71.53**	**71.22**
change 1995-2011	3.18	3.18	**8.80**	**9.45**	7.63	7.63	**21.32**	**22.79**

Source: Compiled by the author (OECD.Stat. 2018)

The comparison of the development of gross export and import shares in gross output and GDP is shown in Figure 2.6.

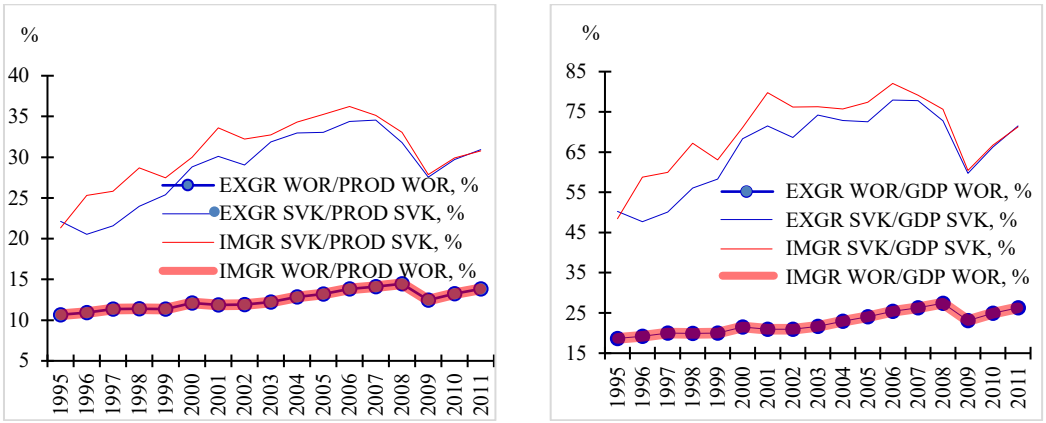


Figure 2.6 Share of gross EXP and gross IMP in the world and the Slovak Republic in gross production and GDP, 1995-2011, %

Source: Compiled by the author (OECD.Stat. 2018)

Growth in export performance during periods of intense development of trade relationship within the GVA also requires a more intense increase in imports of intermediate goods. Import growth is significant in production for domestic use but mainly for export.

Slovakia's growing participation in world trade is also reflected in the growth of the number of countries where the Slovak Republic exports and where the Slovak Republic imports from (Table 2.3, Figure 2.7). The number of countries exporting to the Slovak Republic since 1995 has increased from 162 to 190 in 2011. The number of countries importing to the Slovak Republic is higher than the number of countries exporting to the Slovak Republic (excluding 1998 and 1999 - Table 2.3 in italics).

The number of countries importing to the Slovak Republic increased more dynamically than the countries of export - the number of countries from which the Slovak Republic imports from increased from 172 in 1995 to 2019 in 2011. However, if we monitor the number of products that are the subject of foreign trade in the Slovak Republic, we find that the number of exported products has increased more markedly than the imported products but the number of products exported is less than the number of imported products (Table 2.3, Figure 2.8).

Table 2.3 Trade partners of the Slovak Republic, number of products in the foreign trade of the Slovak Republic, 1995-2011, number

	Number of export target countries	Number of import origin countries	Number of exported products	Number of imported products
1995	162	172	2986	4178
1996	156	169	2842	4096
1997	157	162	4164	4743
1998	*164*	*156*	4111	4726
1999	*159*	*156*	4073	4711
2000	181	186	4092	4700
2001	182	190	4140	4726
2002	182	200	4127	4662
2003	186	191	4114	4684
2004	187	214	4031	4713
2005	182	215	3093	4363
2006	189	219	3006	4347
2007	188	212	2980	4183
2008	190	223	2945	4157
2009	186	215	3876	4450
2010	191	216	3854	4449
2011	190	219	3871	4469
change 1995-2011	28	47	885	291

Source: Compiled by the author (WITS Database; World Bank 2018)

On the basis of the overview of Slovakia's position in the world economy and the development of foreign trade, we can say that the Slovak Republic has intensified its position in the world economy, with growth and development intensively connected with penetration into foreign markets. The growth of the number of trade partners and the number of exported and imported products at the same time reveals an increase in the dependence of the Slovak economy on foreign countries. Dependence is manifested by:

a) increasing the number of countries where the Slovak Republic's exports - increasing foreign demand from several countries,
b) the growth of the number of countries from which the Slovak Republic imports - the imports are geographically diversified and allow a more complex composition of imports. The country's participation in the GVC (UNCTAD 2013) is linked to the increase in the number of countries from which the country imports, in particular intermediate products - the involvement of the Slovak Republic in the GVC can also have an impact on the growth of the number of suppliers,
c) the number of exported products, which reflects the structure of the economy – it has experienced a significant changes in the examined period and has been stabilized during the recent years.

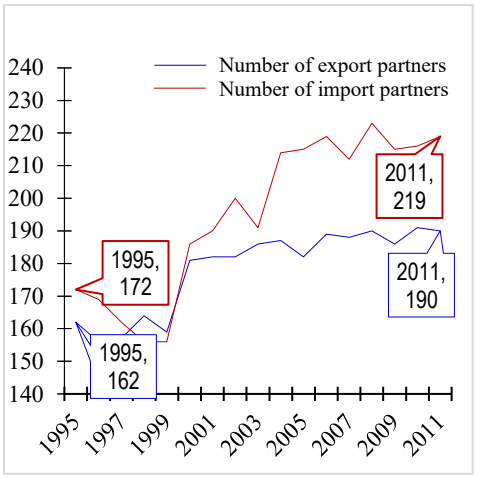


Figure 2.7 Number of trade partners in the Slovak Republic, 1995-2011, number
Source: Compiled by the author (WITS Database; World Bank 2018)

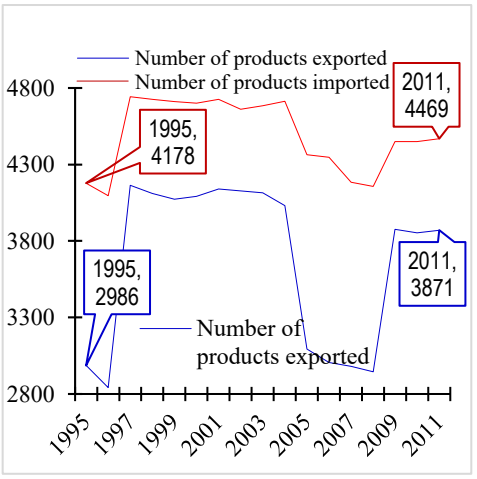


Figure 2.8 Number of exported products from the Slovak Republic and number of imported products to the Slovak Republic, 1995-2011, number
Source: Compiled by the author (WITS Database; World Bank 2018)

Significant changes occurred in the world economy, especially in the production and the international division of labor (reflected in the development of global value chains, characterized by the fact that production in individual countries is becoming more dependent on other countries, which also changes the view on the foreign trade) during the examined period. How the economy of the Slovak Republic was involved in this process, we find via a more sophisticated view of the foreign trade, its composition in terms of the participation of domestic producers in exported production.

2.3 Decomposition of foreign trade by the value added

International trade is traditionally measured through the so called gross values - the total market value of imports is attributed to only one country of origin. Lamy (2011), however, points out that this approach was appropriate at the time of Ricardo 200 years ago; nowadays, the concept of the country of origin is outdated because products are produced under the GVC and several countries are involved in the production process and individual production phases, with the country of origin being the country which allocates the final product on the market. Traditional trade statistics are often misleading. In relation to the assessment of Slovakia's engagement in the vertical international division of labor (GVC), it is important to evaluate how foreign trade is evolving, above all, measured by added value.

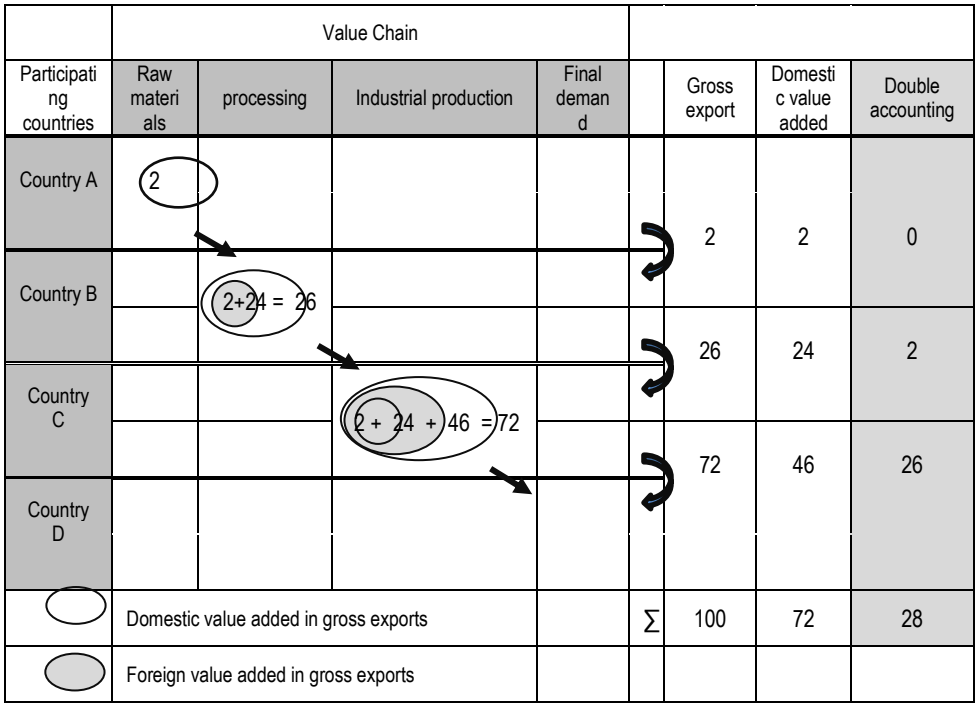


Figure 2.9 Scheme of the TiVA concept
Source: Compiled by the author (UNCTAD, 2013)

The Trade in Value Added concept (TiVA) was introduced for the needs of a new approach to international trade measurement that considers a participation of countries in the vertical division of labor. Its role is to identify where the added value in global production chains is generated. Only the value added generated by the country in the manufacture of goods and services for export is recorded as exports (Javorsek, Camacho, 2015). The TiVA concept illustrates Figure 2.9. - raw materials harvested in one country may be exported to the other country for further processing, then to the third country – manufacturing producer and subsequently exported to the fourth country for final consumption.

According to the traditional gross measurement, total exports among countries are worth 100 units, but using the TiVA concept the value added flows represent only 72 units and total exports are overestimated to 28 units (UNCTAD, 2013, p. 1). This means that in addition to the decomposition of gross exports for the export of intermediate and final goods (more in section 2.3.2 of this chapter), it is necessary to monitor the contribution of each country to their value. This is only possible by monitoring the value added of the country in the export, with domestic value added being present both in intermediate products and in final goods. If several countries participate in the production of intermediate goods, then the intermediate production contains the contributions (value added) of several countries that are subsequently contained in the final output. The intermediate product may pass cross one or more countries. Wang, Z., Wei, S.,

Yu, X., Zhu, K. (2017) illustrate the source and decomposition of the value added of production of final goods in the scheme (Figure 2.10), characterizing four types of production:

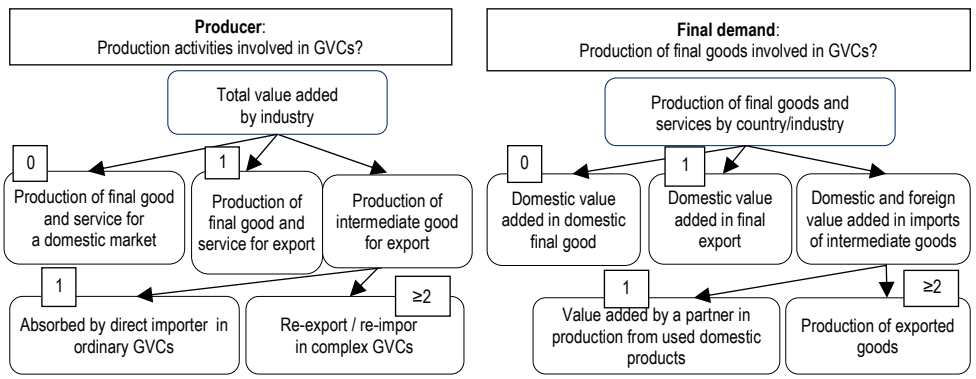
a) Type 1: value added originates at home country, no cross-border production activity is carried out and the created value added satisfies domestic demand.

b) Type 2: the value added crosses the border, no cross-border production activity takes place, all intermediate products are produced from domestic sources and meet foreign demand. value added is only exported once, for consumption.

c) Type 3: Cross-border production activity takes place; Type 3 is linked to the trading of intermediate goods and is divided into two types:

- Value added that is embedded in an intermediate goods absorbed by a direct importer, with cross-border manufacturing activities being carried out only within a country of direct import (without further border crossing) - simple GVCs.
- Value added that crosses the boundary at least twice to meet domestic and foreign final demand - cross-border manufacturing activities are carried out in a number of countries - composite or complex GVCs.

The first two types are fully implemented within the country, so we can see them as pure domestic manufacturing activities. The last type shows the involvement of the country in GVC by production activities - production is divided between among (Wang, Z., WEI, S., Yu, X., Zhu, K. 2017).



Note: "0" - VA that does not cross the border - does not belong to the GVC; "1" VA that crosses borders only once - belongs to a simple GVC; ≥2 - VA crosses the border at least 2 times - belongs to complex GVC

Figure 2.10 Decomposition of GDP and output of final goods within countries or sectors
Source: WANG,Z., WEI,S., Yu, X., Zhu, K. 2017

Koopman, Wang and Wei (2014) report a detailed breakdown of the country's gross exports as a sum of the various components and quantify the different types of double counting of items - gross exports were first decomposed into four categories:

1. domestic value added absorbed by foreign countries;
2. domestic value added for the first time exported and then returned home;
3. foreign value added;
4. net double counting.

This decomposition of gross exports is presented in the diagram (Figure 2.11). It contains domestic value added, which is consumed abroad (as a final product or as an intermediate product) and is not returned (item 1 + 2 + 3) - its part remains in the country of the first recipient and part can be exported to third countries. Considering item 3 there is already a situation where a portion of the gross export in the global chain is counted multiple times. The foreign value added in the gross export "C" exceeds the boundary at least twice - it is also the source of double counting in official trade statistics (Koopman, Wang, Wei, 2014, p. 25). Double counting occurs in two cases:

a) item 6 - in the export of intermediate products which are produced at home and subsequently consumed by one or more importers;
b) and item 7 - accounting of value added in imported intermediate products produced abroad - in one or more countries.

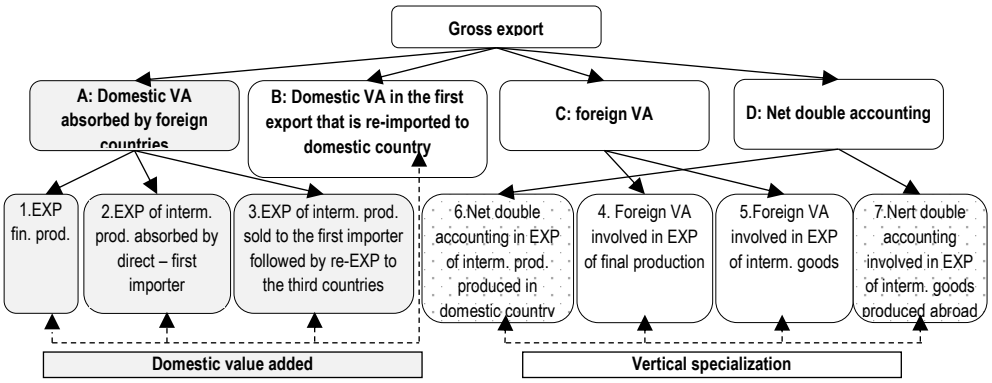


Figure 2.11 Decomposition of gross exports
Source: Compiled by the author based on Koopman, Wang, Wei (2014) and WTO Amendments, IBRD/WB, IDE-JETRO, OECD (2017)

All official trade statistics are based on gross trade measurements and double counts the value of intermediate products that cross the borders of the country more than once. For the need of the new approach to measure international trade activities that evaluates a presence in the vertical division of the labor, the OECD's (2018a) Trade in Value Added (TiVA) concept was introduced. Its role is to identify where the value added in global value chains originates and identifies the actual export and import of the country. Javorsek and Camacho (2015) specify that only the value added generated by the country in the manufacturing of goods and services for export is recorded as exports. At the same time, using the TiVA concept, we find out how

total exports are overestimated, as it also contains value added, the source of which is outside the domestic economy. (UNCTAD, 2013, p. 1)
The framework presented in Figure 2.11 describes a precisely defined relationship between the TiVA concept and official trade statistics. Identification of the different, double counted (recorded) items in the country's gross export helps to estimate the depth and the way the country is involved in global value chains. Countries may have a similar volume of domestic components in the gross exports of some industries, but the composition of duplicate items may be quite different. Double counting in the country may be reflected mainly in the use of foreign components in the final products exported by the country, while in the second country duplicate counting occurs in the form of domestic value added re-imported and consumed at home. The authors therefore emphasize that not only the amount of duplicate items but also their structure provides information on the positions of countries in the GVC.

If we analyze the foreign trade considering a decomposition of the origin of the value added, then the export and import of the country can be expressed as follows:

$$EXGR = EXGR\ DVA + EXGR\ FVA \tag{2.2}$$

where
EXGR - gross export of a country;
EXC DVA - domestic value added in the gross export of the country;
EXGR FVA - foreign value added in the gross export of the country.

AS a result, the analysis of the country's involvement in the GVC generally starts with evaluation of the following key indicators:

1. GVC participation share indicator: EXGR_FVASH - Foreign value added share of gross exports - is defined as foreign value added embodied in gross exports. It is a „FVA intensity measure“ often referred to as „import content of exports“ and considered as a measure of „backward linkages“ in analyses of GVCs. (OECD 2017).

$$EXGR\ FVASH = \frac{EXGR\ FVA}{EXGR}\ x\ 100\ (\%) \tag{2.3}$$

2. Indicator of the contribution of domestic value added to exports: EXGR_DVASH - Domestic value added share of gross exports - is defined as domestic value added in gross exports. It is a "DVA intensity measure" and reflects how much value added, generated in the domestic economy, is embodied per unit of total gross exports (OECD 2017). VAX ratio (WTO, 2014, p. 123) and was proposed by Johnson and Noguer (2012).

$$EXGR\ DVASH\ = \frac{EXGR\ DVA}{EXGR}\ x\ 100\ (\%) \tag{2.4}$$

We will use these indicators to identify participation of the Slovak Republic in global value chains.

2.4 Decomposition of foreign trade of the Slovak Republic

2.4.1 Export and import structure of the Slovak Republic in gross terms and value added

In absolute values, gross exports and exports of value added increased between 1995 and 2011 in the world. The exception is stagnation at the beginning of the millennium (the year 2001 and the bubble burst of dot.com) and the downfall during the economic crisis (2009). While at the beginning of the examined period, the share of domestic GDP in gross exports (VAX ratio, indicator 3) was over 82%, gradually falling to 75.6% in 2011. The share of domestic value added in exports is declining with an increase in the size of foreign trade and it is associated with a vertical division of labor and involvement of countries in the GVC. Johnson (2014, pp. 123-124) states that in the 1970s and 1980s the VAX ratio was around 85%. After 1990, however, it began to decline rapidly as a result of major changes in the global economy, such as international trade liberalization, EU enlargement, the birth of major regional trade agreements, and the expansion of information technology. These events contributed to a reduction in international trade costs, which led to a substitution of domestic foreign inputs and a decline in the share of domestic value added in gross exports.

In Figure 2.12, countries are ranked according to the VAX ratio. Bubble size is directly proportional to the size of exported value added (EXGR DVA), and the horizontal line represents a median of values - 74% (average is 72%). The lowest VAX ratio has Luxembourg, only 41%, the VAX share in the second country in order - Hungary - is by 11 percentage points higher. Followed by the Slovak Republic with VAX at 53%. The highest export share of value added export to gross exports is reached by Saudi Arabia (97%), Russia (86%) and Japan (85%).

There are significant differences among countries in the share of domestic value added in exports (VAX). Which factors affect the share of domestic or of foreign value added in gross exports of countries? While it is generally assumed that the high share of foreign inputs in exports is mainly present in small countries with open and liberal international trade regimes and a high degree of foreign investment, there are a number of other determinants affecting the rate of integration of economies into the GVC. These are in particular the following:

a) the geographical location,
b) the size of the economy (bigger economy = more domestic suppliers),
c) natural wealth,
d) large economies, countries with rich mineral sources, and countries relatively distant from foreign markets tend to use domestic inputs higher (higher VAX ratio),
e) country specialization - if countries specializing in production activities at the beginning of the value chain (agriculture, extractive industries) and those specializing in services typically have a higher share of domestic value added in exports while countries at the end

of value chains have a generally low share of domestic value added in exports (OECD, 2013). E.g. Vietnam, as a country specializing in "assembly", is the last string of the chain, and in its exports the value added of foreign inputs from previous production stages is accumulating. The level of industrialization is also important. Low industrialized countries show a higher share of foreign value added in their exports. For high industrialized countries (e.g. Japan), the high VAX ratio (WTO, 2016) is typical.

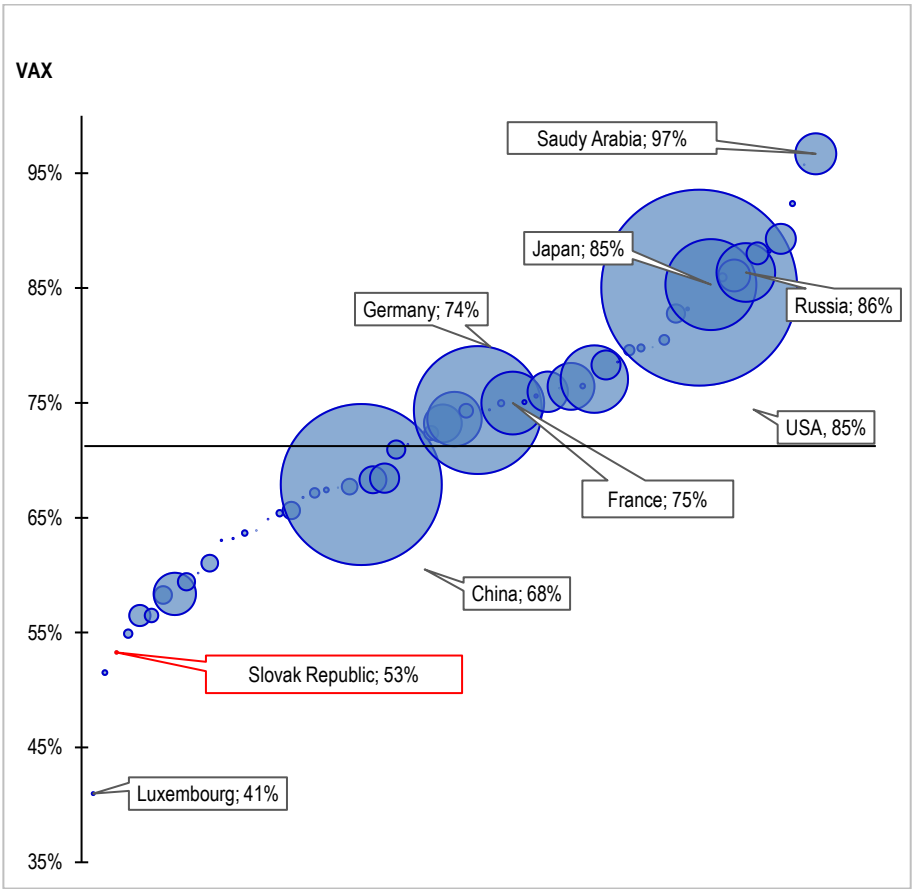


Figure 2.12 VAX Ratio in Selected Countries, 2011, %
Source: Compiled by the author (OECD.Stat. 2018)

In this section we show how foreign trade is being measured by the value added and compare these results with foreign trade indicators of the Slovak Republic according to gross weight, based on the presented theoretical starting points on the importance of foreign trade monitoring in terms of added value. We will use the data and indicators of the TiVA database, which was last updated in 2016 and available data for 1995-2011 and we will identify the actual export and import of the Slovak Republic by value added for all industries.

Table 2.4 Gap between gross exports and exports of domestic value added, gross imports and imports of foreign value added, the Slovak Republic, 1995-2011, mil. USD

	EXGR SVK, mil. USD	EXGR DVA SVK, mil. USD	*EXGR FVA = gap between EXGR a EXGR DVA SVK, mil. USD*	IMGR SVK, mil. USD	DFD FVA SVK, mil. USD	*gap between IMGR a DFD FVA SVK, mil. USD*
1995	10 022.1	6 836.1	*3 186.0*	9 666.6	6 420.7	*3 245.9*
1996	10 287.6	6 510.7	*3 776.9*	12 674.5	8 845.2	*3 829.3*
1997	10 959.8	6 779.1	*4 180.7*	13 110.8	8 879.3	*4 231.5*
1998	12 783.9	7 635.3	*5 148.7*	15 313.1	10 102.5	*5 210.6*
1999	12 122.7	7 316.2	*4 806.6*	13 115.7	8 264.0	*4 851.7*
2000	14 120.5	7 892.8	*6 227.7*	14 707.1	8 432.9	*6 274.2*
2001	15 280.8	8 078.9	*7 201.9*	17 055.2	9 803.7	*7 251.5*
2002	17 009.8	9 196.0	*7 813.9*	18 872.5	11 010.4	*7 862.1*
2003	25 162.9	13 007.6	*12 155.3*	25 870.5	13 633.0	*12 237.5*
2004	31 360.1	16 663.0	*14 697.1*	32 613.8	17 800.0	*14 813.8*
2005	35 527.9	18 807.3	*16 720.6*	37 911.1	21 060.5	*16 850.6*
2006	44 489.2	22 512.2	*21 977.0*	46 847.3	24 722.7	*22 124.6*
2007	59 865.0	31 021.9	*28 843.1*	60 887.8	31 839.1	*29 048.7*
2008	70 301.9	37 836.8	*32 465.1*	73 037.6	40 291.9	*32 745.7*
2009	53 138.4	30 096.1	*23 042.3*	53 741.5	30 533.0	*23 208.5*
2010	59 318.9	32 190.9	*27 128.0*	59 731.0	32 419.6	*27 311.4*
2011	70 231.9	37 414.9	*32 817.1*	69 926.0	36 883.2	*33 042.8*
change 1995-2011	60 209.8 appr. 7x	30 578.8 appr. 6x	*29 631.0 appr. 10x*	60 259.40 appr. 7x	30 462.50 appr. 6x	*29 796.90 appr. 10x*

Legend: DFD_FVA = foreign value added contained in domestic final demand = foreign value added remaining in the Slovak Republic = import of foreign value added

Source: Compiled by the author (OECD.Stat. 2018)

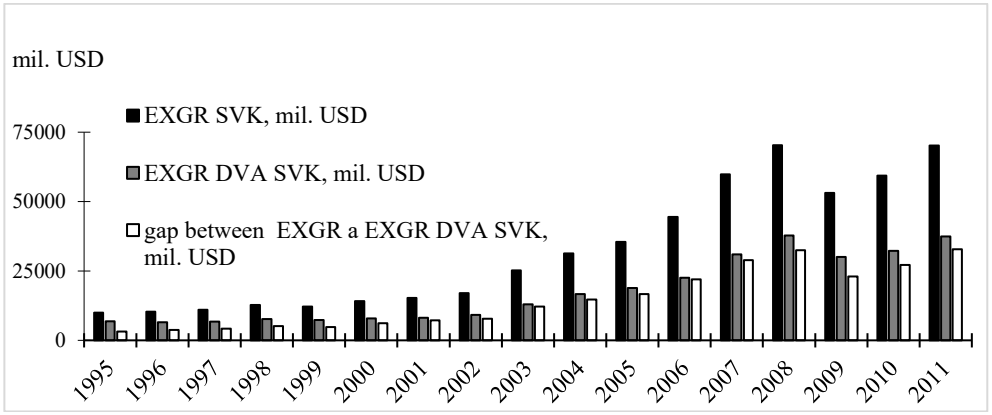


Figure 2.13 Gap between gross exports and exports of domestic value added, the Slovak Republic, 1995-2018, mil. USD

Source: Compiled by the author (OECD.Stat. 2018)

The volume of foreign trade (exports) of the Slovak Republic increased over the examined period by both gross and value added. Gross exports of the Slovak Republic (EXGR SVK) increased 7-fold and the value added about 6-fold (Table 2.3), thanks to the fact that the liberalization of Slovakia's foreign trade allowed for more intensive entry into the vertical international division of labor.

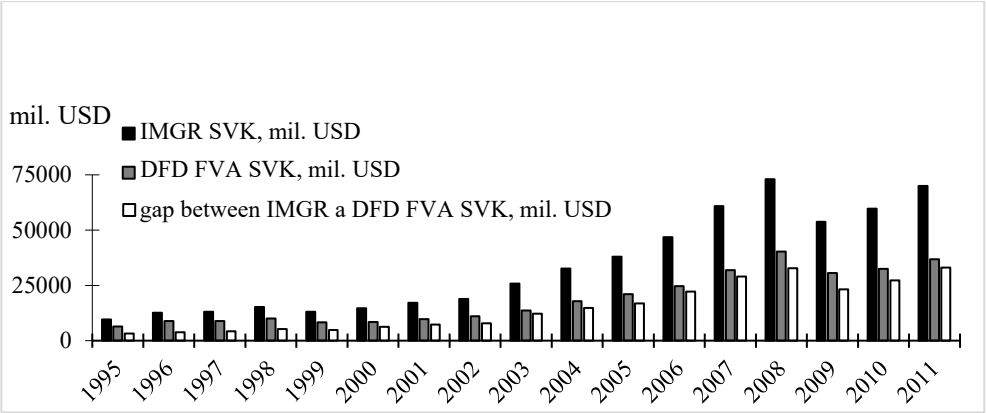


Figure 2.14 Gap between gross imports and imports of foreign value added, the Slovak Republic, 1995-2018, mil. USD
Source: Compiled by the author (OECD.Stat. 2018)

The Slovak Republic has more intensive use of foreign inputs, which is also used for export of goods and services, which suggests that gross exports include, besides domestic value added, foreign value added as well (Table 2.5 and Figure 2.15 and Figure 2.16). In 1995, 68% of the gross exports of the Slovak Republic accounted for 21% of the domestic value added (EXGR_DVA) and 31.79% of the foreign value added (EXGR_FVA).

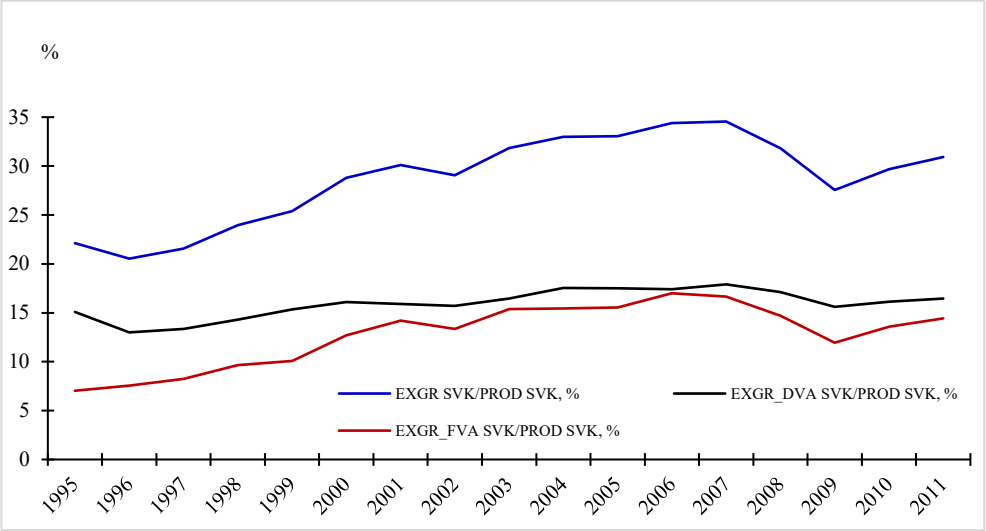
Table 2.5 Domestic and foreign value added in gross EXP, 1995 and 2011, mil. USD, %

	EXGR SVK, mil. USD	EXGR_DVA SVK/EXGR SVK = VAX, %	EXGR_FVA SVK/EXGR SVK, %
1995	10 022.10	68.21	31.79
1996	10 287.60	63.29	36.71
1997	10 959.80	61.85	38.15
1998	12 783.90	59.73	40.27
1999	12 122.70	60.35	39.65
2000	14 120.50	55.90	44.10
2001	15 280.80	52.87	47.13
2002	17 009.80	54.06	45.94
2003	25 162.90	51.69	48.31
2004	31 360.10	53.13	46.87
2005	35 527.90	52.94	47.06
2006	44 489.20	50.60	49.40
2007	59 865.00	51.82	48.18
2008	70 301.90	53.82	46.18
2009	53 138.40	56.64	43.36
2010	59 318.90	54.27	45.73
2011	70 231.90	53.27	46.73
change 1995-2011, mil. USD; percentage points	60 209.80	-14.94	14.94

Source: Compiled by the author (OECD.Stat. 2018)

With the growth of EXGR SVK, the ratio of values added changed in favor of foreign value added. Over the entire period the domestic value added prevails in gross exports, but its drop

by 14.94 percentage points for the period 1995-2011 also means an increase in foreign value added in exports (+14.94 percent). The rise in domestic value added occurred in 2009 during the crisis, after 2009 is again decreasing and the foreign value added in exports is increasing, suggesting the resumption of trade relations within the GVC.



Legend: EXGR = GROSS EXPORT = gross export; PROD = gross production

Figure 2.15 Share of gross EXP, domestic and foreign value added in EXP on gross production in the Slovak Republic, 1995-2011, %

Source: Compiled by the author (OECD.Stat. 2018)

According to Johnson R.C. (2014), the trend of the decline in domestic value added in exports worldwide occurs only after 1990 and suggests that more intermediate goods are more often counted until the final product is made. These data are the result of an increasing rate of double counting of intermediate goods in official statistics and the increasing importance of GVC. E.g. in the world exports of domestic value added in the 1970, 1980 was about 85%, in 2004, 2008 this represented only about 70-75%. Johnson and Noguera (2012) report that the median of the ratio of domestic value added to gross exports of 94 countries was 0.73 (73%) in 2004. There are large differences between countries of the world, according to Johnson and Noguera (2014) 50-90% and declines were higher in fast-growing developing countries. The decline in domestic value added in exports of the Slovak Republic indicates an increasing integration into the GVC. The indicator EXGR_FVA (OECD 2017), which is interpreted as an indicator of the country's participation in the GVC multiplied almost 10 times during the period 1995-2011.

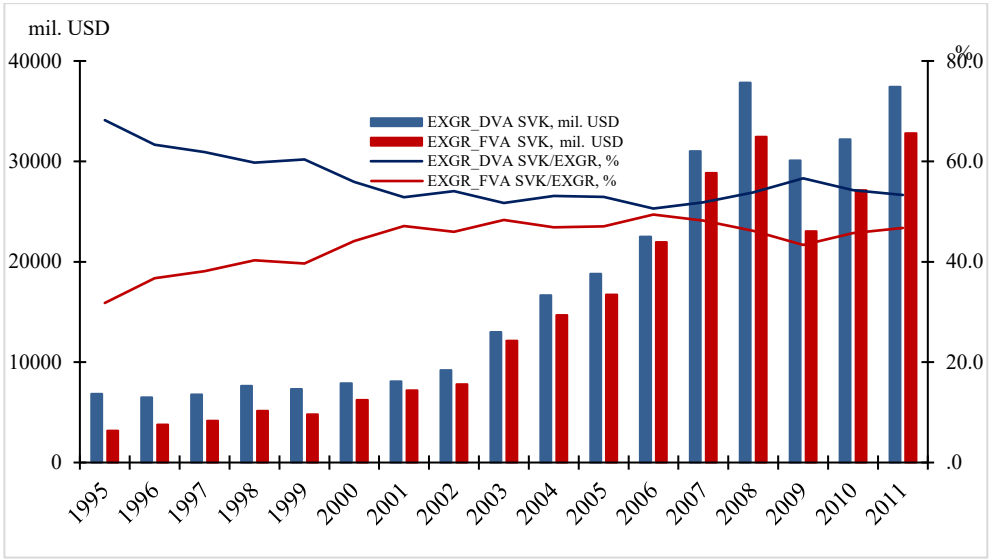


Figure 2.16 Domestic and foreign value added in gross EXP (mil. USD) and share of domestic and foreign value added to gross EXP, 1995-2011, %
Source: Compiled by the author (OECD.Stat. 2018)

On the basis of detailed export and import decomposition (see Figure 2.10 and Figure 2.11 in the previous section 2.2), we need to adjust the export and import data for those values that are returned via exports or imports to the countries of origin - this is to prevent double counting of the portion of values added in the export and determine how the country participates in the vertical international division of labor. The country, according to Hummels, Ishii and Yi (2001), is involved in vertical specialization in two ways:

(a) the country uses imported intermediate goods as inputs for production for export;
(b) the country exports intermediate products which are used as inputs in other countries for the production of export goods.

Portion of the domestic value added in export therefore remains definitively abroad and another portion returns to the country of origin in the imported production. Therefore, the actual export of domestic value added can be considered as the part that satisfies the final demand abroad (FFD DVA). This is a value added that a country exports directly through exports of final goods or services and indirectly through the export of intermediate products that are being imported to other countries through foreign final consumers (households, governments and investments). This portion of domestic value added in exports reflects how domestic industries in the value chain are linked to consumers in other countries. The indicator shows the full impact of final demand on foreign markets on domestic production. It can be seen as a definitive "export of value added". (OECD 2017)

Similarly, the import of foreign value added can be divided into two parts - one part is definitively left in the country of import, the other part can be exported in the exported production. Foreign value added contained in domestic final demand reveals the amount of foreign value added

present in the final goods or services purchased by households, government, non-profit institutions serving households or as investments. It is equivalent to the "import" of the DFD DVA and shows how households, consumers are connecting with foreign countries in the value chain. It can be interpreted as "import of value added". (OECD 2017)

In Table 2.6, we compare export performance according to traditional expression with export performance according to value added, which we also interpret as the share of domestic value added in exports to GDP - the amount of GDP of the Slovak Republic, which is satisfied with final foreign demand. It also reveals the import intensity of the Slovak Republic according to the traditional expression and the imports of foreign value added, which definitely remain in the Slovak Republic. Similarly, we compare openness by gross foreign trade indicators and value added in exports and imports. Table 2.6 provides data for the Slovak Republic according to the following indicators:

1. Export performance:
   a) according to the traditional measurement:

$$exp/GDP_T = \frac{EXGR}{GDP} x\ 100\ (\%) \quad (2.5)$$

   b) according to value added:

$$exp/GDP_{VA} = \frac{FFD\ DVA}{GDP} x\ 100\ (\%) \quad (2.6)$$

2. import intensity:
   a) according to the traditional measurement:

$$imp/GDP_T = \frac{IMGR}{GDP} x\ 100\ (\%) \quad (2.7)$$

   b) according to 2. import intensity:

$$imp/GDP_{VA} = \frac{DFD\ DVA}{GDP} x\ 100\ (\%) \quad (2.8)$$

3. import intensity:
   a) according to the traditional measurement:

$$exp + imp/GDP_T = \frac{EXGR+IMGR}{GDP} = x\ 100\ (\%) \quad (2.9)$$

   b) according to value added:

$$exp + imp/GDP_{VA} = \frac{FFD\ DVA+DFD\ DVA}{GDP} x\ 100\ (\%) \quad (2.10)$$

where
exp/GDP_T - export performance based on traditional gross exports
EXGR - gross export
GDP - gross domestic product

exp/GDP_{VA} – export performance based on value added
IMGR - gross import
imp/GDP_{T} – import intensity based on value added
imp/GDP_{VA} - import intensity based traditional gross import measurement
FFD DVA - domestic value added in foreign final demand = export of value added
DFD DVA - foreign added value contained in domestic final demand = import of value added
exp+imp/GDP_{T} - openness based on traditional gross export and gross import
exp+imp/GDP_{VA} – openness based on value added

In the Slovak Republic, the dynamic growth in export performance, in gross terms, was accompanied by an increase in export performance based on value added. In addition to 1995 and 2011, import demand was higher than export performance – based on both gross measures (+21.32 percentage point) and value added (+3.93 percentage points). Import intensity of the Slovak Republic by gross measurement increased by 22.79 percentage point while based on value added by 5.40 percentage points.

Table 2.6 Export performance and import intensity, openness of the Slovak Republic: world - by gross measurement and by value added, % of GDP

	exp/GDP_{T} SVK, %	imp/GDP_{T} SVK, %	exp/GDP_{VA} SVK, %	imp/GDP_{VA} SVK, %	*exp+imp/GDP_{T} SVK, %*	*exp+imp/GDP_{VA} SVK, %*
1995	*50.21*	*min 48.43*	*33.95*	*min 32.17*	*min 98.65*	*min 66.12*
1996	min 47.69	58.75	min 29.94	41.00	*106.44*	*70.94*
1997	50.09	59.92	30.75	40.58	*110.01*	*71.33*
1998	56.07	67.17	33.22	44.31	*123.24*	*77.53*
1999	58.30	63.08	34.97	39.75	*121.38*	*74.72*
2000	68.28	71.12	37.94	40.78	*139.40*	*78.72*
2001	71.49	79.79	37.56	max 45.86	*151.27*	*max 83.42*
2002	68.65	76.17	36.92	44.44	*144.82*	*81.36*
2003	max 74.18	76.27	38.11	40.19	*150.45*	*78.30*
2004	72.84	75.75	38.43	41.34	*148.58*	*79.77*
2005	72.56	77.43	38.14	43.01	*149.98*	*81.16*
2006	77.93	max 82.07	39.18	43.31	*max 160.00*	*82.49*
2007	77.82	79.15	max 40.06	41.39	*156.98*	*81.45*
2008	72.78	75.61	38.88	41.71	*148.39*	*80.59*
2009	59.75	60.42	33.65	34.33	*120.17*	*67.98*
2010	66.28	66.74	35.76	36.22	*133.02*	*71.98*
2011	*71.53*	*71.22*	*37.88*	*37.57*	*142.75*	*75.44*
change 1995-2011 percentage points	+ 21.32	+ 22.79	+ 3.93	+ 5.40	*+ 44.11*	*+ 9.32*

Source: Compiled by the author (OECD.Stat. 2018)

The larger difference between the increase in export performance and import intensity was recorded in values based on value added (exp. performance +3.93 percentage point and import intensity +5.40 percentage points); in values based on gross measurement this difference is

smaller (exp. Performance +21.32 percentage points and import intensity +22.79 percentage points). It means that imports of foreign value added that remains in the Slovak Republic during the examined period have become a major factor for production, the results of which remain in the Slovak Republic or final consumption. The development of export performance and import intensity of the Slovak Republic against the world according to gross expression for the whole period is compared with the development according to value added (Figure 2.18 and Figure 2.19).

Comparing the development of export performance and import intensity in gross terms and according to value added for the period 1995-2011 (Table 2.6, Figure 2.17, Figure 2.18), we find:

a) with export performance growth, export performance also increases according to value added, although according to value added, growth is lower,
b) export performance by gross measurement records more fluctuations than export performance based on value added,
c) the difference between export performance based on gross measures and by value added is increased from the beginning of the examined period,
d) the import intensity has increased since 1995, both in gross terms and in terms of value added,
e) the import intensity according to the value added also responds with minor changes, rather than in gross terms,
f) the difference between the import intensity by gross measurement and value added increases,
g) export performance and import intensity in gross terms and also according to value added are getting closer to each other, in 2011 the differences are the lowest since 1995.

These findings require further investigation. In the view of Slovakia's involvement in the GVC, it is necessary to identify how the participation of the Slovak Republic in the vertical division of labor contributes to the given development, which sectors contribute the most to the given development and what impact on the situation has the change in the trade in intermediate products and the final production.

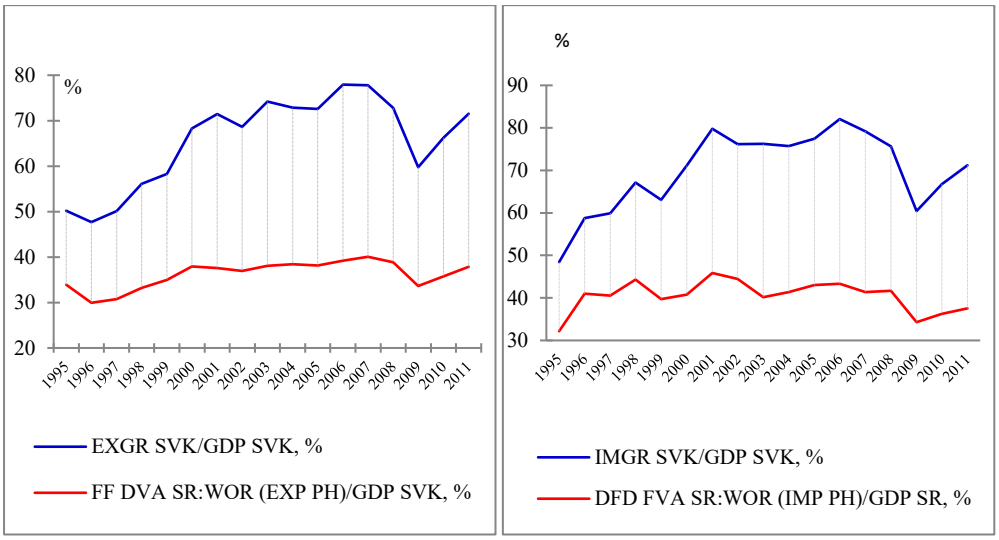


Figure 2.17 Export performance and import intensity of the Slovak Republic by gross EXP and by domestic value added in EXP, % of GDP
Source: Compiled by the author (OECD.Stat. 2018)

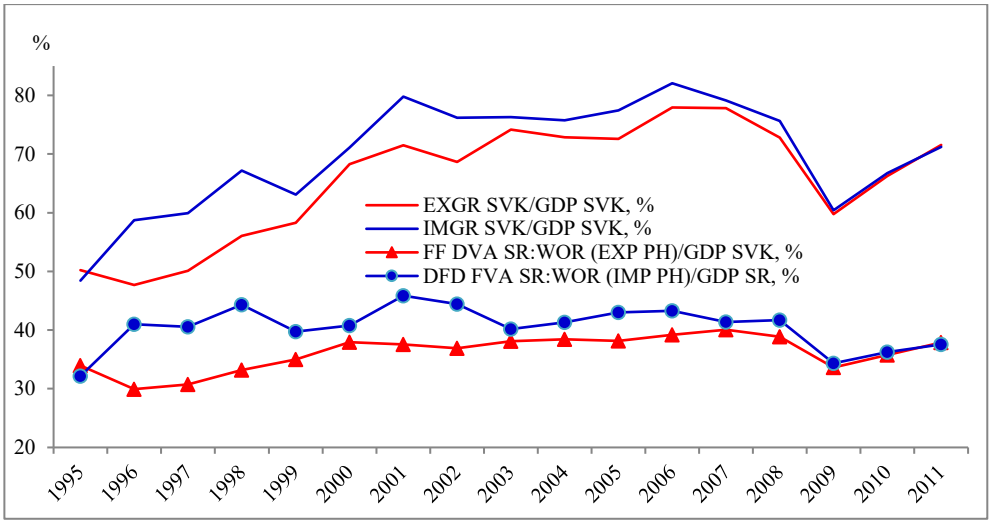


Figure 2.18 Export performance and import intensity of the Slovak Republic and the world - comparison by gross measurement and by value added, 1995-2011, % of GDP
Source: Compiled by the author (OECD.Stat. 2018)

A characteristic feature of the development of the world economy is the tendency towards increasing openness of national economies. An inseparable part of a market open economy is its external economic relations, which have important impacts on the economy (businesses, consumers and the state). The issue of openness of the economy includes questions about creating opportunities for movements of goods, services, capital, labor, technology, information, economic and cultural activities at all. External economic relations are a sphere in which specific

economic movements and related operations with foreign countries are realized. An open economy is an economy characterized by low barriers to trade, open financial markets and the private markets. Individual national economies, for objective and subjective reasons, are not equally involved in world markets. The predominant tendency to liberalism since the end of World War 2 intensified the processes of internationalization and, as a result, the degree of openness of the countries has increased. The world economy has thus become a system consisting of economically independent state units with varying relative openness. Despite the crisis in 2009, the tendency for protectionism to reduce the level of openness of the countries has hindered the involvement of subjects within the national economy in the process of the international division of labor, but there are still factors contributing to the openness of countries:

a) countries are differently equipped with production factors and, therefore, in the case of their absence, they obtain them on foreign markets or, in the case of their surplus, they allocate them abroad. The need to use material, financial and other (knowledge, information ...) resources of other countries is determined in all economies on the one hand, due to the gradual depletion of internal development resources and also due to the need for specialization and orientation towards the use of their comparative advantages and capabilities and efficiency in the use of production factors.
b) the absorption capacity of the internal market of individual countries is limited, so the countries are oriented towards realizing their production abroad.
c) due to stronger competition, individual economies are forced to become increasingly open and take advantage of the positive effects of international division of labor.

The deepening of the economic openness of the country to external environment becomes an crucial precondition for preserving dynamic intensive development (especially in small economies). The openness of the country is, to some extent, determined by economic policy of the government. The policy of openness creates opportunities for cross border allocation of goods, services, capital, labor, technology, information ... and the movement of economic and cultural activities at all. Barriers that hinder any movement may affect negative effect on the country.

After 1989, the economy of the Slovak Republic experienced many opportunities that contributed to its openness. On the basis of market relations, the Slovak Republic became involved in world trade at a time when internationalization processes increasingly moved from the sphere of circulation and distribution (i.e. international trade) to the sphere of production and research cooperation of individual entities. At the same time, this cooperation led to a more intensive development of the vertical division of labor, which subsequently altered the relationship between intermediate goods and final product trade and raised the question of how the countries contribute (with their domestic value added) to world production, the significant part of which is the result of the global value chain mechanism. According to Bøegh Nielsen, P. (2017), the degree of openness can be considered as an indicator of integration into global value chains.

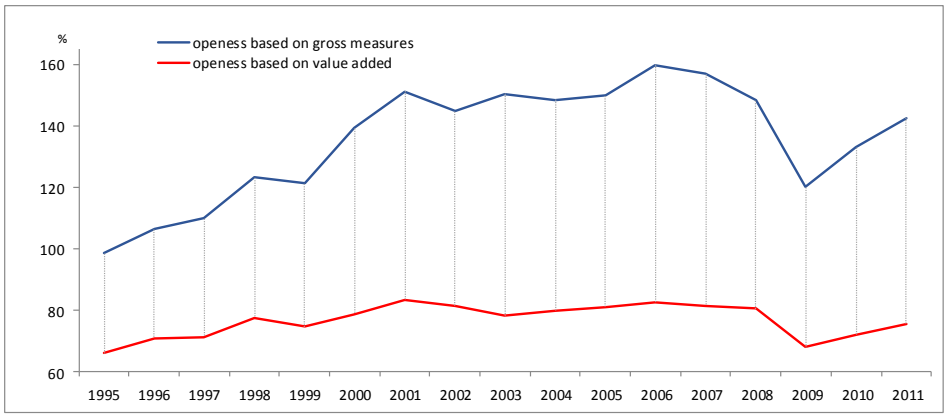


Figure 2.19 Openness of the economy of the Slovak Republic and the world - by gross measurement and by value added, % of GDP
Source: Compiled by the author (OECD.Stat. 2018)

During the examined period, the Slovak Republic has become a highly open country, a substantial part of foreign trade is being realized with the neighboring countries and in 2004 became an EU member, which represents trading on the internal market with far fewer barriers than with non-EU and geographically distant countries. The openness of the Slovak Republic (Figure 2.19) has been increasing since 1995, but a significant fall in openness based on gross measurement and value added has been caused by the crisis since 2008. However, after 2009 the openness increased again, but did not reach its maximum since 2011 (according to gross measurement reached its maximum in 2006: 160% and by value added in 2001: 83.42%). By comparing the development over the whole examined period, we find:

a) the difference between openness according to gross expression and according to value added is increasing in the Slovak Republic,
b) if changes were made, the openness was changed more intensively according to gross expression than by value added.

The reasons for these differences and the development of openness in the examined period in the Slovak Republic can be found in the internal development of the economy (transformation of the economy, use of the possibilities to engage in the world economy, reduction of trade barriers, sectoral restructuring of the economy due to foreign direct investments and many others). However, it is positive that the removal of trade barriers has allowed the Slovak Republic to become part of the global trend of GVC development.

2.4.2 Export structure of the Slovak Republic by sector and industry according to the measures based on gross expression and value added

Dependence processes were intensified at different stages of world economic development and globalization, with the consequence that the phenomena, inherent for advanced economies, gradually became the typical of less developed and even least developed countries. This also applies to changes in the structure of economies that represent the impact

of the involvement of the economies in the processes of globalization. Looking at the development of the sectoral structure in the countries of the world shows that the trend of the gradual direction of economies to the modern structure is undeniable.

The history of the social division of labor is a history of creating an increasingly complex structure of the economy. In economics and economic theory, people and their economic activities are integrated into certain groups, which become an element of the structure of the economy.

The concept of the economic structure is used in economic theory to characterize the internal division of a certain economic variable. Attention is drawn to the internal composition of a given economic variable that is subject to change over time (Urban, 1994 p. 81). Every economic development, especially in the longer term, is linked to structural changes, resulting in the shift of the center of gravity from one sector to another. By structural changes we call changes in the structure of the economy, respectively, changes in its individual components. Structural changes occur when economic growth is accompanied by uneven changes in production inputs and outputs, as a result of which the percentage share of individual sectors and branches changes over time. Major or minor changes occur in the sectoral structure of total production and corresponding shifts in total employment, new job qualification requirements are emerging and a territorial distribution of production is changing as well. Structural changes are becoming an important factor in economic growth and are a prerequisite for satisfying a changing demand structure in a changing availability of factors of production (Spěváček, 1994).

Sectors are different clusters of economic activities. With the deepening of the social division of labor and the development of economic science, we can also see the emergence of different criteria to the decomposition of the economy. One model of the sectoral structure of the economy, whereby economies are currently observed and compared according to their development, is a model comprised of three sectors (Holub, 2000, p. 27): agriculture “A” (Agriculture), industry “I” (Industry) and service sector “S” (Services) - “AIS” model. Such an approach is currently widely used as part of analyzes and assessments of economic reality in different contexts at national level and at the level of the globalized world economy. It is, for example, monitoring and assessing the development of the world economy and its parts, analyzing and comparing economic development, and thus incorporating countries into groups according to advancement, structure, etc. Knowledge of the sectoral structure of the economy and the patterns of its development is of importance for at least the following reasons:

a) based on the knowledge that a certain type of structure is historically conditioned, we can determine, according to the characteristics of the structure, the degree of historical development in which the economy is located,
b) gives the opportunity to compare countries or groups of countries,
c) provide information needed to process forecasts for further economic development,
d) assist in formulating the objectives of the economic policy of the country and in selecting ways, means and instruments of economic policy for structural change,

e) in a globalizing and integrating world economy to evaluate these processes, their impact on different parts of the world, groups of countries.

Analyzes based on traditional measurements give a good picture of the state and development of economies, but since the 1990s, since the vertical division of labor has contributed to the change in economic structure, gross indicators are no longer sufficient. They do not give an opportunity to see how the sectors of the economy are involved in the vertical division of labor and the involvement of countries in global value chains.

We will use the model of the "AIS" sectoral structure to determine the structure of Slovakia's export by value added. We have compiled the data by aggregating the sectors into the trade in value added (TiVA) data (OECD.Stat. 2018). We have included branches into the sectors as follows:

a) sector "A" : C01T05: Agriculture, hunting, forestry and fishing;
b) sector "I" : C15T37: Total Manufactures;
c) sector "S" : C50T95: Total Services;

Indicators in Table 2.7:

a) exp_G^S = ratio of gross exports from the sector to total gross exports:

$$exp_G^S = \frac{EXGR^S}{EXGR} \; x \; 100 \; (\%) \tag{2.11}$$

where
EXGR - gross export,
SVK - the Slovak Republic,
s - sector "A", "I" or "S",
G - by gross measurement.

b) exp_{VA}^S = the share of domestic value added from the sector on domestic exports of value added:

$$exp_{VA}^S = \frac{EXGR\ DVA^S}{EXGR\ DVA} \; x \; 100 \; (\%) \tag{2.12}$$

where
EXGR DVA - export of domestic value added,
SVK - the Slovak Republic,
s - sector "A", "I" or "S",
VA - by value added.

The share of gross exports from sectors to total gross exports and the share of exports of domestic value added from sectors to exports of total domestic value added may be ranked as "ISA" structure over the whole period (Table 2.7, Figure 2.20). It does not, therefore, copy the structure according to the share of sectors in GDP, which is "AIS" in the Slovak Republic. Also, according to the share of export of domestic value added from the sectors to exports of the total domestic value added, the structure of Slovak exports is structured by "ISA". This means that

foreign demand is mainly directed towards the "I" industrial sector, which has also recorded the highest increase (in gross terms) since the year 1995 according to the value added in exports.

Table 2.7 Share of exports from AIS sectors to gross exports and share of export of domestic value added from domestic AIS on export of domestic value added, the Slovak Republic, 1995-2011, %

	A: $\exp SVK\ {}^{A}_{G}$, %	I: $\exp SVK^{I}_{G}$, %	S: $\exp SVK^{S}_{G}$, %	*A:* $\exp SVK^{A}_{VA}$, %	*I:* $\exp SVK^{I}_{VA}$, %	*S:* $\exp SVK^{S}_{VA}$, %
1995	1.8	min 63.1	max 35.2	*2.1*	*min 57.0*	*max 40.9*
1996	1.7	66.0	32.3	*2.1*	*59.1*	*38.8*
1997	1.6	67.8	30.6	*2.0*	*60.9*	*37.1*
1998	1.5	70.3	28.2	*1.9*	*61.7*	*36.4*
1999	1.4	70.7	27.8	*1.8*	*63.0*	*35.2*
2000	1.2	72.7	26.0	*1.7*	*64.2*	*34.2*
2001	1.2	72.9	25.9	*1.7*	*63.9*	*34.4*
2002	1.1	72.7	26.2	*1.6*	*64.8*	*33.6*
2003	min 1.0	75.4	23.7	*min 1.4*	*65.4*	*33.2*
2004	1.2	75.6	23.2	*1.7*	*64.3*	*34.0*
2005	1.5	75.4	23.1	*2.1*	*64.1*	*33.8*
2006	1.5	77.1	21.4	*2.2*	*64.5*	*33.3*
2007	1.4	77.0	21.5	*2.2*	*64.6*	*33.3*
2008	1.7	75.1	23.2	*2.5*	*63.5*	*34.1*
2009	2.0	75.1	22.9	*2.9*	*62.7*	*34.4*
2010	1.8	max 77.4	20.8	*2.5*	*66.0*	*31.5*
2011	max 2.2	77.3	min 20.5	*max 3.1*	*max 66.1*	*min 30.8*
change 1995-2011, percentage points	0.4	14.3	-14.7	*1.0*	*9.1*	*-10.1*

Source: Compiled by the author (OECD.Stat. 2018)

Also by gross measurement and by domestic added value in exports:

a) the share of "A" exports to gross exports increased, the share of exports from the S-sector to gross exports decreased and the share of exports from the 'I' industry to gross exports increased significantly,
b) in the "A" sector, there was a break in 2003 when it had a minimum share in the monitored period according to both measurements, then the share of the sector was increasing, while larger increase since 1995 in the share of exports was captured according to the value added in exports (+1.0 percentage points). By gross measurement, the increase was +0.4 percentage points.
c) exports from the "I" sector in the Slovak Republic ranged from 1995 to 2011 - according to both gross exports and exports of domestic value added the minimum was reached in 1995 and the maximum in 2011, the increase was higher by gross measurement than considering domestic value added.

d) the export of the Slovak Republic from the "S" sector decreases according to both measurements, a smaller decrease is recorded in the share of export of domestic value added in the export of the total domestic value added in exports (-10.1 percentage points). According to gross exports, the decline is -14.7 percentage points.

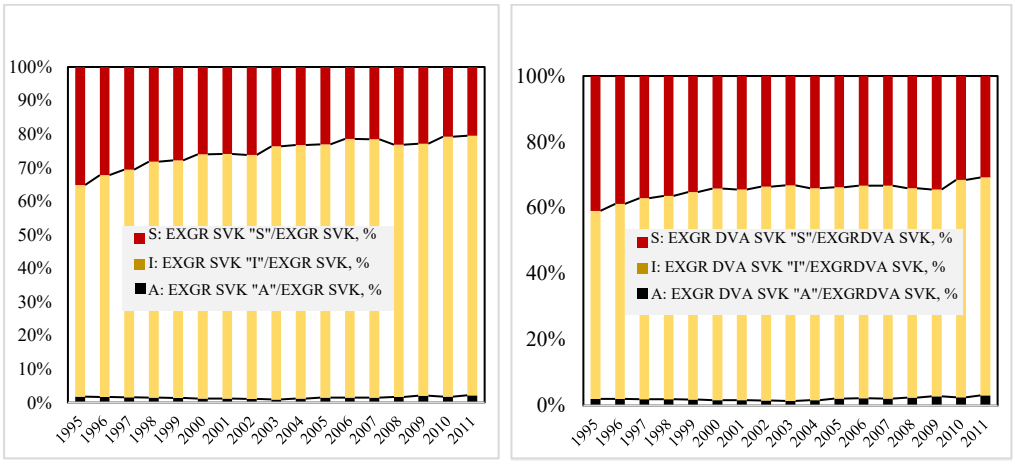


Figure 2.20 Sector structure of gross exports and value added in exports, the Slovak Republic, 1995-2011, %
Source: Compiled by the author (OECD.Stat. 2018)

The Slovak Republic at the beginning of the 21st century can be characterized as a country with a highly industrialized economy, which is also reflected in the sectoral structure of exports by gross measurement, also according to the export of domestic value added.
Table 2.8., 2.9. and 2.10. Figure 2.21 shows more detailed industrial data by industry sector "I". We have observed the following:

a) All industries increased gross export volume (EXGR) - Mining and quarrying (+495.0 mil. USD) recorded the lowest increase in volume. This is also the sector of the Slovak economy whose volume of EXGR is the lowest, which results from the lack of own raw materials.

b) In the gross exports of the Slovak Republic 5 groups of industrial branches are growing in importance - we identify those sectors which in the last monitored year 2011 have reached the gross export volume (EXGR) over 3,000 mil. USD (ranking by 2011 from the largest volume of EXGR):
   1. C34T35: Transport equipment;
   2. C30T33: Electrical and optical equipment;
   3. C23T26: Chemicals and non-metallic mineral products;
   4. C27T28: Basic metals and fabricated metal products;
   5. C29: Machinery and equipment, nec.

(c) the ranking of the sectors according to the increase in gross export volume (in mil. USD) from 1995 to 2011 is the same as in (b).

(d) one of the indicators of the country's participation in the GVC is the indicator of domestic gross value added (EXGR DVA). According to the data in Table 2.9, the volume of EXGR DVA in industrial production in the reference period, similar to gross export (EXGR), increased in all sectors. Also, according to the volume of EXGR DVA, the ranking of the most important export sectors of the Slovak industry is the same as in point b).

(e) The share of domestic sales of exports of selected 5 significant groups of Slovakian domestic sales in the "I" sector exports was different:

- industries increased their share (C34T35: Transport equipment (+12.7 percentage point), C30T33: Electrical and optical equipment (+6.3 percentage points) and C29: Machinery and equipment, nec (+0,5 percentage points),
- 2 sectors decreased their share: C23T26: Chemicals and non-metallic mineral products (-2.8 percentage points) and C27T28: Basic metals and fabricated metal products (-2.6 percentage points).

f) In the GVC, we measure the participation of the individual sectors of the “I” sector in the GVC through the indicator EXGR DVAC/EXGR DVA (% where C is the industry) - the share of exports of the domestic value added on exports of the total domestic value added in exports. For the Slovak Republic, data is shown in Table 2.10 and Figure 2.21. The development of this indicator is in the following five sectors of the “I” sector:

- increase:
  - C34T35: Transport equipment: 1995 (3,9%), 2011 (16,5%),
  - C30T33: Electrical and optical equipment: 1995 (5,6%), 2011 (11,9%),
  - C29: Machinery and equipment, nec.: 1995 (5,1%), 2011 (5,6%).
- decrease:
  - C23T26: Chemicals and non-metallic mineral products: 1995 (13,3%), 2011 (10,5%),
  - C27T28: Basic metals and fabricated metal products: 1995 (12,3%), 2011 (9,7%).

These are industries whose production for export significantly affects the economy of the Slovak Republic. These industries are increasingly becoming part of the GVC, whether domestic or foreign. Growth of EXGR DVAC/EXGR DVA in the sectors means that production and its export depends on the domestic economy, the domestic value added in exports of the respective sectors with increasing trend. The decrease means that producers from other countries are increasingly involved in the production and export of the given domestic sectors (foreign value added in export).

The importance of the service sector “S” in the Slovak economy is increasing, the volume of gross exports increased during the period 1995-2011, but the share in total gross exports of the country decreased - in 1995 the share of EXGR from sector “S” to the total gross exports of the Slovak Republic (EXGR) was 35.2%, but only 20.5% in 2011. Table 2.11. 2.12 and 2.13.

and Figure 2.22 gives more detailed data by industry sector "S". We have observed the following:

a) all sectors increased gross export volume (EXGR) - the lowest increase in volume was reported by C80: Education; (+25.9 mil. USD). This is not the case for the service sector of the Slovak Republic, whose volume of EXGR is the lowest, an even lower volume of EXGR is recorded from C75: Public admin. and defense; compulsory social security where the increase was 34.2 mil. USD.

b) In the development of the EXGR from the sector of services in the Slovak Republic we record in some years a one-time larger or smaller volume than before and for the given year - i.e., in the sector 60T63: Transport and storage in 2008, or C90T93: Other community, social and personal services in 2007 and 2009. Such leaps are more frequent, and we believe that the service sector is more sensitive to shocks. Exports from these sectors are more sensitive to one-off effects than the industrial sectors in the "I" industry.

c) In the gross export of the Slovak Republic, four groups of service sectors are growing in importance - we identify the sectors which in the last monitored year 2011 reached the gross export volume (EXGR) above 800 mil. USD (ranking by 2011 from the largest volume of EXGR):
   1. C50T52: Wholesale and retail trade; repairs,
   2. C60T63: Transport and storage,
   3. C90T93: Other community, social and personal services,
   4. C73T74: R & D and other business activities.

(d) The ranking of the sectors according to the increase in gross export volume (in mil. USD) from 1995 to 2011 is the same as in (b).

(e) According to the data in Table 2.12, the volume of EXGR DVA in the branches of service sector in the reference period, similar to Gross Export (EXGR), increased in all sectors. Even according to EXGR DVA, the order of the most important export services of the Slovak Republic is the same as in point b).

g) the industry's participation in the GVC sector is estimated by the EXGR DVAC/EXGR DVA (% where C is the industry) - the share of export of the domestic value added on exports of the exports of total domestic value added. For the Slovak Republic, data is shown in Table 2.12 and Figure 2.22. The development of this indicator is in the following four sectors of the S sector:

- increase:
  - C50T52: Wholesale and retail trade; repairs: 1995 (12,79%), 2011 (13,54%),
  - C90T93: Other community, social and personal services; 1995 (2,48%), 2011 (2,66%),
- decrease:
  - C60T63: Transport and storage: 1995 (12,97%), 2011 (6,02%),
  - C73T74: R&D and other business activities; 1995 (3,05%), 2011 (2,49%).

According to the data in Table 2.7, the gross exports of the services sector decreased between 1995 and 2011, and the share of domestic exports of value added to gross exports decreased as well. Nevertheless, the branches of this sector are gradually joining the GVC. This is documented by the above-mentioned developments in domestic exports in the services sector which have the greatest contribution to Slovakia's joining the GVC.

Table 2.8 Gross exports from the industrial sector (I), the Slovak Republic, 1995-2011, mil. USD

	EXGR SVK, mil. USD	C10T14: Mining and quarrying	C15T16: Food products, beverages and tobacco	C17T19: Textiles, textile products, leather and footwear	C20T22: Wood, paper, paper products, printing and publishing	C23T26: Chemicals and non-metallic mineral products	C27T28: Basic metals and fabricated metal products	C29: Machinery and equipment, nec	C30T33: Electrical and optical equipment	C34T35: Transport equipment	C36T37: Manufacturing nec; recycling
1995	10 022.1	44.9	284.6	534.9	499.8	1 437.3	1 477.9	546.1	694.5	594.0	205.1
1996	10 287.6	50.3	298.3	525.9	488.6	1 502.9	1 421.5	609.7	891.0	811.0	192.3
1997	10 959.8	57.6	332.2	569.1	557.1	1 602.1	1 610.3	653.5	920.4	888.4	245.1
1998	12 783.9	61.2	357.5	686.4	629.6	1 685.2	1 756.4	703.1	1 065.7	1 741.4	306.7
1999	12 122.7	58.4	343.4	652.2	609.2	1 675.8	1 598.1	675.6	937.4	1 753.9	272.0
2000	14 120.5	61.1	395.2	641.6	683.3	2 319.9	1 759.4	760.4	1 194.0	2 138.6	316.9
2001	15 280.8	70.4	482.9	953.6	767.3	2 375.0	1 744.3	860.2	1 277.5	2 236.9	373.8
2002	17 009.8	68.1	547.0	1 061.7	832.6	2 651.1	1 853.8	906.3	1 388.3	2 540.7	508.4
2003	25 162.9	72.0	603.9	1 254.8	1 011.5	3 090.1	2 721.6	1 361.0	2 199.0	5 785.8	871.4
2004	31 360.1	97.4	725.3	1 346.8	1 325.1	4 251.9	3 869.6	1 736.2	3 313.5	6 193.2	849.7
2005	35 527.9	170.5	1 019.1	1 212.1	1 519.6	5 289.7	4 476.5	2 045.4	4 523.4	5 729.8	811.0
2006	44 489.2	180.7	1 135.3	1 424.7	1 807.7	5 933.8	5 706.7	2 700.9	6 494.6	8 020.5	880.8
2007	59 865.0	169.2	1 535.4	1 723.6	2 077.9	7 220.6	7 109.9	3 723.6	9 150.4	12 156.0	1 258.1
2008	70 301.9	313.1	1 923.3	1 772.1	2 344.2	7 016.1	8 216.0	4 021.3	10 748.0	15 139.8	1 304.7
2009	53 138.4	235.4	1 245.9	1 261.5	1 712.6	6 082.5	5 410.1	2 530.1	9 569.6	10 763.9	1 093.5
2010	59 318.9	421.1	1 340.2	1 211.3	1 819.7	7 036.0	7 221.8	3 272.6	9 946.6	12 670.2	960.9
2011	70 231.9	539.9	1 702.5	1 479.0	2 025.8	9 859.9	7 918.3	3 898.4	10 266.5	15 651.8	970.3
change 1995-2011, mil. USD	60 209.8	495.0	1 417.9	944.1	1 526.0	8 422.6	6 440.4	3 352.3	9 572.0	15 057.8	765.2

Note: green shade - lowest volume from 0 to 999, yellow shade - medium volume from 1000 to 2999, red shade - high volume from 3000 or more.
Source: Compiled by the author (OECD.Stat. 2018)

Table 2.9 Domestic value added in exports of industry sector (I), the Slovak Republic, 1995-2011, mil. USD

	C10T14: Mining and quarrying	C15T16: Food products, beverages and tobacco	C17T19: Textiles, textile products, leather and footwear	C20T22: Wood, paper, paper products, printing and publishing;	C23T26: Chemicals and non-metallic mineral products;	C27T28: Basic metals and fabricated metal products;	C29: Machinery and equipment, nec	C30T33: Electrical and optical equipment;	C34T35: Transport equipment;	C36T37: Manufacturing nec; recycling;
1995	34.2	215.9	386.2	369.0	908.2	839.6	350.0	385.5	263.2	145.8
1996	36.3	218.8	363.8	349.1	829.4	707.1	341.0	522.2	343.4	136.8
1997	39.3	233.4	376.4	384.7	830.6	760.9	399.5	515.5	427.7	162.8
1998	43.6	253.8	394.3	425.5	922.2	874.7	399.8	561.6	634.7	198.8
1999	42.1	263.9	400.7	422.5	933.4	773.7	370.0	478.2	751.3	171.0
2000	44.0	277.6	414.2	454.5	1 073.4	937.3	408.8	595.0	676.6	182.6
2001	48.0	334.6	423.6	485.2	1 017.1	875.2	461.9	620.7	702.3	197.1
2002	44.6	363.1	482.2	507.8	1 133.7	837.3	479.1	729.0	1 121.9	262.9
2003	54.5	411.8	630.8	655.6	1 404.6	1 366.5	723.5	1 068.5	1 761.6	429.8
2004	73.6	499.0	721.7	841.8	1 900.5	1 957.9	899.6	1 436.7	1 930.3	457.7
2005	129.9	673.3	678.7	977.1	2 230.1	2 264.3	1 004.7	1 737.1	1 913.0	451.9
2006	129.1	762.7	748.5	1 157.3	2 239.5	2 810.3	1 234.4	2 516.3	2 428.2	495.0
2007	135.1	1 040.8	948.2	1 405.1	2 965.1	3 839.8	1 714.6	3 393.1	3 910.2	677.7
2008	246.5	1 294.0	983.4	1 687.2	3 270.9	4 054.9	2 073.5	4 694.8	4 994.5	713.6
2009	178.1	883.1	777.7	1 240.8	2 819.2	2 833.0	1 365.1	3 819.3	4 327.6	629.0
2010	322.0	924.7	876.1	1 279.0	3 051.9	3 386.9	1 824.1	4 030.0	4 935.4	609.4
2011	412.9	1 123.7	930.3	1 377.4	3 925.5	3 626.9	2 112.3	4 460.6	6 191.5	579.1
change 1995-2011, mil. USD	378.7	907.8	544.1	1 008.3	3 017.2	2 787.3	1 762.4	4 075.2	5 928.3	433.2

Note: green shade - lowest volume from 0 to 499, yellow shade - medium volume from 500 to 999, red shade - high volume from 1000 or more.
Source: Compiled by the author (OECD.Stat. 2018)

Table 2.10 Share of domestic value added in exports of the industrial sector (I) in the total domestic value added in exports, the Slovak Republic, 1995-2011, %

	C10T14: Mining and quarrying	C15T16: Food products, beverages and tobacco	C17T19: Textiles, textile products, leather and footwear	C20T22: Wood, paper, paper products, printing and publishing;	C23T26: Chemicals and non-metallic mineral products;	C27T28: Basic metals and fabricated metal products;	C29: Machinery and equipment, nec;	C30T33: Electrical and optical equipment;	C34T35: Transport equipment;	C36T37: Manufacturing nec; recycling;
1995	0.5	3.2	5.6	5.4	13.3	12.3	5.1	5.6	3.9	2.1
1996	0.6	3.4	5.6	5.4	12.7	10.9	5.2	8.0	5.3	2.1
1997	0.6	3.4	5.6	5.7	12.3	11.2	5.9	7.6	6.3	2.4
1998	0.6	3.3	5.2	5.6	12.1	11.5	5.2	7.4	8.3	2.6
1999	0.6	3.6	5.5	5.8	12.8	10.6	5.1	6.5	10.3	2.3
2000	0.6	3.5	5.2	5.8	13.6	11.9	5.2	7.5	8.6	2.3
2001	0.6	4.1	5.2	6.0	12.6	10.8	5.7	7.7	8.7	2.4
2002	0.5	3.9	5.2	5.5	12.3	9.1	5.2	7.9	12.2	2.9
2003	0.4	3.2	4.8	5.0	10.8	10.5	5.6	8.2	13.5	3.3
2004	0.4	3.0	4.3	5.1	11.4	11.8	5.4	8.6	11.6	2.7
2005	0.7	3.6	3.6	5.2	11.9	12.0	5.3	9.2	10.2	2.4
2006	0.6	3.4	3.3	5.1	9.9	12.5	5.5	11.2	10.8	2.2
2007	0.4	3.4	3.1	4.5	9.6	12.4	5.5	10.9	12.6	2.2
2008	0.7	3.4	2.6	4.5	8.6	10.7	5.5	12.4	13.2	1.9
2009	0.6	2.9	2.6	4.1	9.4	9.4	4.5	12.7	14.4	2.1
2010	1.0	2.9	2.7	4.0	9.5	10.5	5.7	12.5	15.3	1.9
2011	1.1	3.0	2.5	3.7	10.5	9.7	5.6	11.9	16.5	1.5
change 1995-2011, percentage points	0.6	-0.2	-3.2	-1.7	-2.8	-2.6	0.5	6.3	12.7	-0.6

Note: green shade - lowest volume from 0 to 3.9, yellow shade - medium volume from 4.0 to 6.9, red shade - high volume from 7 or more.
Source: Compiled by the author (OECD.Stat. 2018)

Table 2.11 Gross exports from the service sector (S), the Slovak Republic, 1995-2011, mil. USD

	EXGR SVK mil. USD	C40T41 Electricity, gas and water supply;	C45: Construction	C50T52: Wholesale and retail trade; repairs;	C55: Hotels and restaurants	60T63: Transport and storage;	C64: Post and telecommunications;	C65T67 Financial intermediation;	C70: Real estate activities;	C71: Renting of machinery and equipment	C72: Computer and related activities;	C73T74: R&D and other business activities;	C75: Public admin. and defence; compulsory social security;	C80: Education;	C85: Health and social work;	C90T93: Other community, social and personal services;
1995	10 022.1	47.3	125.0	1 078.8	267.7	1 171.7	98.6	50.6	113.2	17.8	44.6	285.6	0.4	11.9	7.4	204.7
1996	10 287.6	56.1	92.3	991.1	297.3	1 047.9	88.3	35.6	89.7	14.4	52.3	302.6	8.1	17.9	14.5	210.9
1997	10 959.8	46.1	118.0	1 267.7	205.2	920.9	84.9	44.6	46.0	9.0	50.9	292.2	0.2	9.3	42.0	211.6
1998	12 783.9	50.6	123.5	1 410.3	194.9	977.1	90.9	45.9	46.3	9.2	47.6	340.6	0.4	9.6	24.0	229.3
1999	12 122.7	48.4	104.5	1 319.6	187.4	903.4	85.4	38.9	42.7	7.4	44.2	352.9	0.0	10.0	22.7	206.2
2000	14 120.5	69.4	144.1	1 443.6	182.0	1 012.0	70.4	37.4	35.9	7.3	48.2	359.8	7.6	13.2	44.3	200.6
2001	15 280.8	72.9	127.0	1 461.3	212.1	1 136.6	64.8	40.5	64.9	13.3	55.5	342.0	7.0	14.5	52.8	295.5
2002	17 009.8	124.5	138.5	1 586.9	233.3	1 248.2	71.9	78.1	73.3	13.8	60.4	405.7	6.7	16.0	65.4	333.6
2003	25 162.9	184.7	166.2	2 433.8	245.4	1 698.5	102.1	53.9	44.3	23.7	86.4	481.3	18.5	22.4	74.0	316.1
2004	31 360.1	341.6	246.9	3 134.5	249.2	1 712.7	152.2	87.6	66.5	35.3	116.8	645.9	16.6	16.1	80.8	383.6
2005	35 527.9	219.1	362.9	3 343.4	358.1	1 946.0	142.4	183.0	123.2	39.1	136.9	728.9	14.4	26.7	94.5	472.9
2006	44 489.2	377.6	303.7	3 652.3	406.8	2 451.1	196.6	246.0	162.1	51.0	237.9	763.9	24.3	24.7	90.2	543.4
2007	59 865.0	197.0	290.5	5 396.7	565.0	2 877.7	252.1	310.1	166.7	67.2	240.4	1 454.1	27.4	33.8	73.9	921.1
2008	70 301.9	440.4	759.5	6 741.0	613.5	3 761.3	361.5	555.7	106.5	49.9	417.0	1 080.7	40.7	31.4	99.6	1 246.6
2009	53 138.4	143.1	335.3	5 111.8	714.5	2 810.1	249.7	323.5	98.8	173.0	404.4	851.2	61.2	38.8	86.9	746.4
2010	59 318.9	144.5	476.5	5 288.3	722.5	2 537.5	188.3	272.2	130.1	134.3	322.7	1 000.7	34.3	35.1	61.8	991.1
2011	70 231.9	167.5	540.1	6 372.7	760.7	2 942.5	214.7	325.6	144.9	118.9	398.6	1 112.7	34.6	37.8	66.4	1 145.3
change 1995-2011, mil. USD	60 209.8	120.2	415.1	5 293.9	493.0	1 770.8	116.1	275.0	31.7	101.1	354.0	827.1	34.2	25.9	59.0	940.6

Note: green shade - lowest volume from 0 to 109, yellow shade - medium volume from 110.0 to 799.0 red shades - high volume from 800.0 or more.
Source: Compiled by the author (OECD.Stat. 2018)

Table 2.12 Domestic value added in exports of the services sector (S), the Slovak Republic, 1995-2011, mil. USD

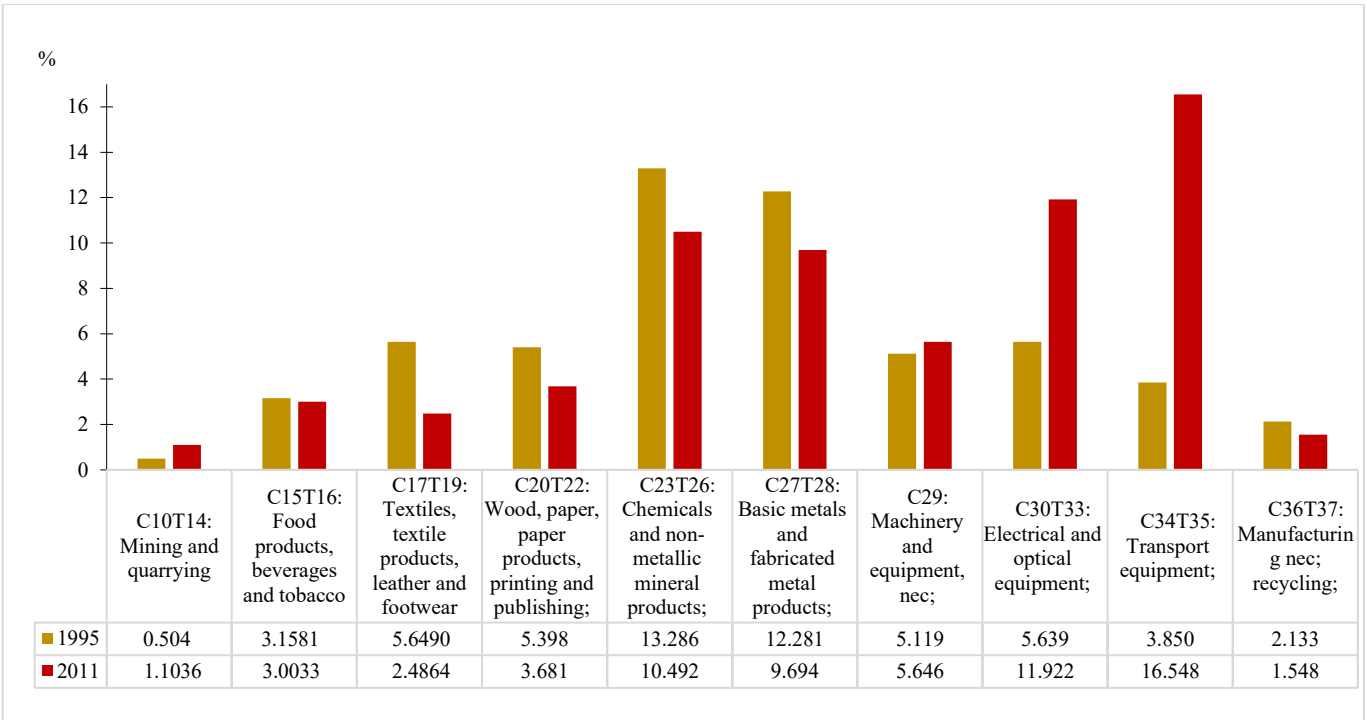
	C40T41: Electricity, gas and water supply	C45: Construction	C50T52: Wholesale and retail trade; repairs	C55: Hotels and restaurants	C60T63: Transport and storage	C64: Post and telecommunications	C65T67: Financial intermediation	C70: Real estate activities	C71: Renting of machinery and equipment	C72: Computer and related activities	C73T74: R&D and other business activities	C75: Public admin. and defence; compulsory social security	C80: Education	C85: Health and social work	C90T93: Other community, social and personal services
1995	37.8	93.6	874.5	216.2	886.6	85.2	47.7	106.4	17.1	35.7	208.2	0.3	11.1	6.3	169.7
1996	42.8	68.2	784.5	232.7	726.7	79.1	32.0	84.2	13.0	43.3	211.1	6.9	16.5	12.0	174.1
1997	32.7	84.0	1 011.0	160.8	576.4	76.1	39.8	43.2	8.2	42.0	217.6	0.2	8.5	36.1	178.2
1998	38.7	89.7	1 107.9	154.0	700.5	80.2	40.7	43.3	7.6	35.9	260.2	0.4	8.9	20.5	191.7
1999	37.6	74.6	1 043.8	153.9	612.6	73.6	32.7	40.4	6.1	34.7	262.7	0.0	9.4	19.6	173.2
2000	51.3	105.2	1 108.8	141.5	627.9	60.8	31.9	33.8	6.1	37.9	273.4	6.6	12.3	36.0	162.9
2001	44.0	85.9	1 099.9	168.2	615.2	55.6	34.9	60.8	10.2	45.4	254.5	6.0	13.6	42.6	241.8
2002	76.1	97.6	1 200.4	183.0	627.1	63.2	68.2	69.0	11.3	48.7	300.5	5.8	14.6	52.5	269.8
2003	117.8	112.4	1 943.5	203.2	926.1	90.4	47.5	41.5	19.8	69.3	378.5	16.3	20.5	61.4	265.6
2004	180.5	169.0	2 561.6	205.1	1 227.9	133.4	79.0	60.2	27.9	95.5	521.1	14.8	14.7	63.3	313.4
2005	123.3	250.7	2 699.3	294.1	1 352.0	126.6	165.2	109.9	31.8	110.2	576.1	12.8	24.5	73.7	399.4
2006	205.9	204.3	2 999.8	333.7	1 786.9	172.9	218.2	143.8	43.5	196.2	612.0	21.1	22.1	70.2	466.3
2007	113.9	211.2	4 300.8	461.2	2 249.7	218.2	273.1	149.1	56.7	203.6	1 191.4	24.3	30.7	60.3	780.0
2008	226.2	573.0	5 452.1	494.0	2 841.8	310.8	477.2	96.7	40.1	343.1	888.8	36.5	28.9	81.1	1 003.3
2009	87.2	271.2	4 418.2	589.8	2 336.7	216.3	297.2	89.6	150.2	349.1	730.5	55.4	35.9	71.0	664.8
2010	74.8	366.2	4 379.0	592.1	1 975.9	168.3	242.6	117.5	113.3	286.3	844.3	30.8	31.8	51.7	867.9
2011	84.3	406.6	5 065.4	599.9	2 252.6	189.4	289.5	131.0	96.0	354.3	931.0	30.8	34.1	53.6	994.2
change 1995-2011, mil. USD	46.5	313.0	4 190.8	383.7	1 366.0	104.2	241.8	24.5	78.9	318.6	722.8	30.5	23.1	47.3	824.5

Note: green shade - lowest volume from 0 to 199, yellow shade - medium volume from 200 to 999, red shade - high volume from 1000 or more.
Source: Compiled by the author (OECD.Stat. 2018)

Table 2.13 Domestic value added in the exports of the services sector (S) to the total domestic value added in the exports, the Slovak Republic, 1995-2011, %

	C40T41: Electricity, gas and water supply	C45: Construction	C50T52: Wholesale and retail trade; repairs	C55: Hotels and restaurants	C60T63: Transport and storage	C64: Post and telecommunications	C65T67: Financial intermediation	C70: Real estate activities	C71: Renting of machinery and equipment	C72: Computer and related activities	C73T74: R&D and other business activities	C75: Public admin. and defence; compulsory social security	C80: Education	C85: Health and social work	C90T93: Other community, social and personal services
1995	0.6	1.4	12.8	3.2	13.0	1.2	0.7	1.6	0.2	0.5	3.0	0.0	0.2	0.1	2.5
1996	0.7	1.0	12.0	3.6	11.2	1.2	0.5	1.3	0.2	0.7	3.2	0.1	0.3	0.2	2.7
1997	0.5	1.2	14.9	2.4	8.5	1.1	0.6	0.6	0.1	0.6	3.2	0.0	0.1	0.5	2.6
1998	0.5	1.2	14.5	2.0	9.2	1.1	0.5	0.6	0.1	0.5	3.4	0.0	0.1	0.3	2.5
1999	0.5	1.0	14.3	2.1	8.4	1.0	0.4	0.6	0.1	0.5	3.6	0.0	0.1	0.3	2.4
2000	0.7	1.3	14.0	1.8	8.0	0.8	0.4	0.4	0.1	0.5	3.5	0.1	0.2	0.5	2.1
2001	0.5	1.1	13.6	2.1	7.6	0.7	0.4	0.8	0.1	0.6	3.1	0.1	0.2	0.5	3.0
2002	0.8	1.1	13.1	2.0	6.8	0.7	0.7	0.8	0.1	0.5	3.3	0.1	0.2	0.6	2.9
2003	0.9	0.9	14.9	1.6	7.1	0.7	0.4	0.3	0.2	0.5	2.9	0.1	0.2	0.5	2.0
2004	1.1	1.0	15.4	1.2	7.4	0.8	0.5	0.4	0.2	0.6	3.1	0.1	0.1	0.4	1.9
2005	0.7	1.3	14.4	1.6	7.2	0.7	0.9	0.6	0.2	0.6	3.1	0.1	0.1	0.4	2.1
2006	0.9	0.9	13.3	1.5	7.9	0.8	1.0	0.6	0.2	0.9	2.7	0.1	0.1	0.3	2.1
2007	0.4	0.7	13.9	1.5	7.3	0.7	0.9	0.5	0.2	0.7	3.8	0.1	0.1	0.2	2.5
2008	0.6	1.5	14.4	1.3	7.5	0.8	1.3	0.3	0.1	0.9	2.3	0.1	0.1	0.2	2.7
2009	0.3	0.9	14.7	2.0	7.8	0.7	1.0	0.3	0.5	1.2	2.4	0.2	0.1	0.2	2.2
2010	0.2	1.1	13.6	1.8	6.1	0.5	0.8	0.4	0.4	0.9	2.6	0.1	0.1	0.2	2.7
2011	0.2	1.1	13.5	1.6	6.0	0.5	0.8	0.4	0.3	0.9	2.5	0.1	0.1	0.1	2.7
change 1995-2011, percentage points	-0.4	-0.3	0.7	-1.6	-7.0	-0.7	0.1	-1.2	0.1	0.4	0.5	0.1	-0.1	0.0	0.2

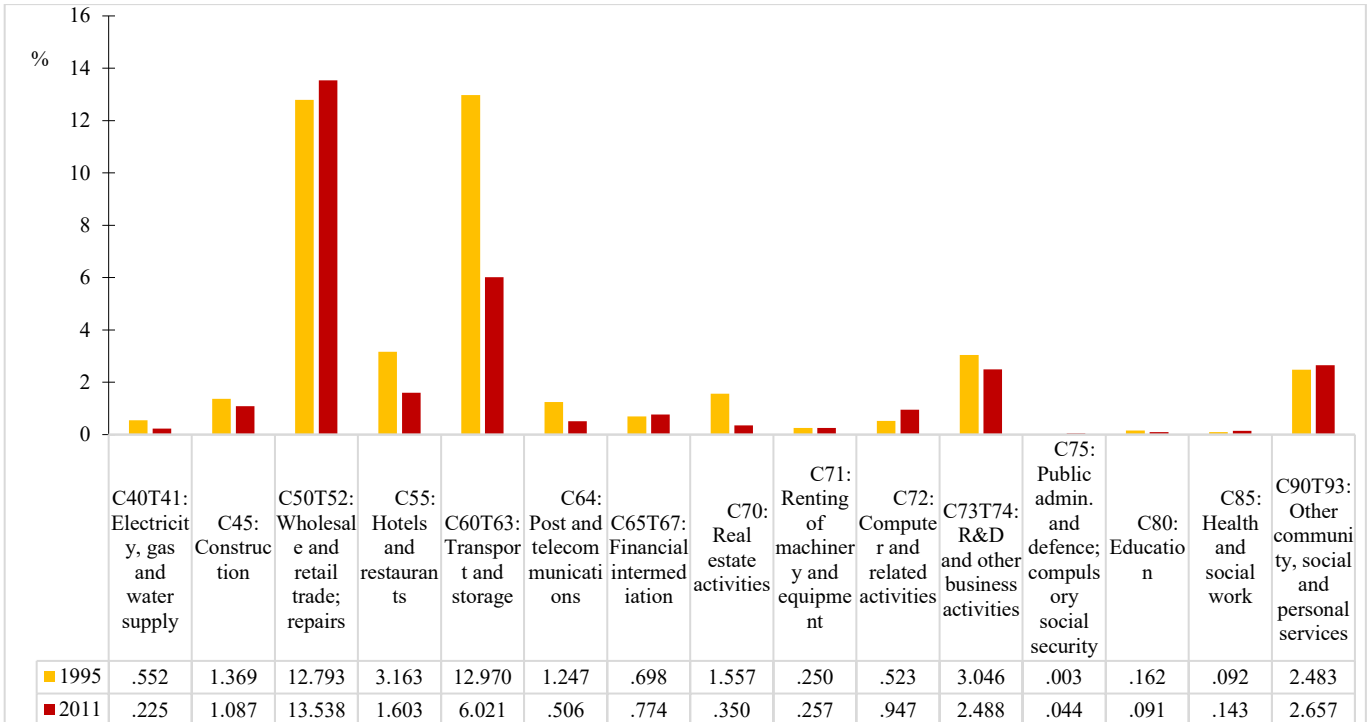
Note: green shade - lowest share from 0 to 0.9, yellow shade - medium share from 1.0 to 4.9, red shade - high share of 5.0 or more.
Source: Compiled by the author (OECD.Stat. 2018)



	C10T14: Mining and quarrying	C15T16: Food products, beverages and tobacco	C17T19: Textiles, textile products, leather and footwear	C20T22: Wood, paper, paper products, printing and publishing;	C23T26: Chemicals and non-metallic mineral products;	C27T28: Basic metals and fabricated metal products;	C29: Machinery and equipment, nec;	C30T33: Electrical and optical equipment;	C34T35: Transport equipment;	C36T37: Manufacturing nec; recycling;
1995	0.504	3.1581	5.6490	5.398	13.286	12.281	5.119	5.639	3.850	2.133
2011	1.1036	3.0033	2.4864	3.681	10.492	9.694	5.646	11.922	16.548	1.548

Figure 2.21 Domestic value added in the export of the industrial sector (I) to the total domestic value added in the exports, the Slovak Republic, 1995-2011, %

Source: Compiled by the author (OECD.Stat. 2018)



	C40T41: Electricity, gas and water supply	C45: Construction	C50T52: Wholesale and retail trade; repairs	C55: Hotels and restaurants	C60T63: Transport and storage	C64: Post and telecommunications	C65T67: Financial intermediation	C70: Real estate activities	C71: Renting of machinery and equipment	C72: Computer and related activities	C73T74: R&D and other business activities	C75: Public admin. and defence; compulsory social security	C80: Education	C85: Health and social work	C90T93: Other community, social and personal services
1995	.552	1.369	12.793	3.163	12.970	1.247	.698	1.557	.250	.523	3.046	.003	.162	.092	2.483
2011	.225	1.087	13.538	1.603	6.021	.506	.774	.350	.257	.947	2.488	.044	.091	.143	2.657

Figure 2.22 Domestic value added in the exports of the services sector (S) to the total domestic PH in the exports, the Slovak Republic, 1995-2011,%

Source: Compiled by the author (OECD.Stat. 2018)

2.4.3 Export and import of intermediate goods and final products in the Slovak Republic based on gross measures and value added

Gross recordings of trade flows and the fact that exports increasingly form inter-company inputs from abroad make it more difficult to identify the real export of the country. It also does not allow for the fact that the growth of trade with intermediate goods makes it more difficult to identify the real contribution of the country to the production of the final output and does not allow us to evaluate the country's share of the created and exported value added that comes to foreign countries in intermediate products and final goods.

Intermediate export is understood as the monetary value of all intermediate products produced within all industries in the domestic country sold abroad. Exports of final products is understood as the monetary value of all produced final products within all domestic sectors sold abroad. Total gross export/import of goods and services is the sum of exports/imports of intermediate products and final products.

$$EXGR = EXGR\ INT + EXGR\ FNL \tag{2.13}$$

$$IMGR = IMGR\ INT + IMGR + FNL \tag{2.14}$$

where
EXGR - gross export,
IMGR - gross import,
EXGR INT - gross intermediate export,
EXGR FNL - gross export of final production,
IMGR INT - gross imports of intermediate products,
IMGE FNL - gross imports of final production.

According to Gereffi (2005, p. 166), an increasing share of trade with intermediate goods in the overall trade is characteristic for the current phase of globalization. The reason, according to Baldwin (2006, 2009), is to bring about a drastic reduction in transport costs and the ability to coordinate production in different countries in order to allow the use of savings from specialization.

World trade has become today's dimension in particular due to development of vertical specialization. By exporting and importing of intermediate products, global value chains have become dynamic. By identifying the different uses of intermediate goods, we can tell whether the country is involved in global value chains:

- the producer in the country can produce the intermediate products and use them for further processing - in this case and at this stage of production the country does not join the GVC;
- the manufacturer can produce and then sell the intermediate products in his country - if the buyer uses these intermediate goods for production that is not the subject of export - he does not join the GVC. If the buyer of intermediate goods produces another intermediate product and export it, it is the involvement of the country in the GVC;

- the manufacturer can obtain intermediate goods in the production of another intermediate good or in the production of the final product, from a supplier from the same country (does not join the GVC) or from a foreign supplier (engages in the GVC).

The development of GVC causes a faster increase in intermediate goods trade. On gross world exports (Figure 2.23), over the whole of the examined period, the export share of exports of intermediate goods on gross exports already outweighed the share of exports of final product, with increasing share of intermediate goods trade in gross world trade. In 1995, the share of intermediate goods in world trade was 56.62%, in 2011 it was already 63.76% (Figure 2.23).

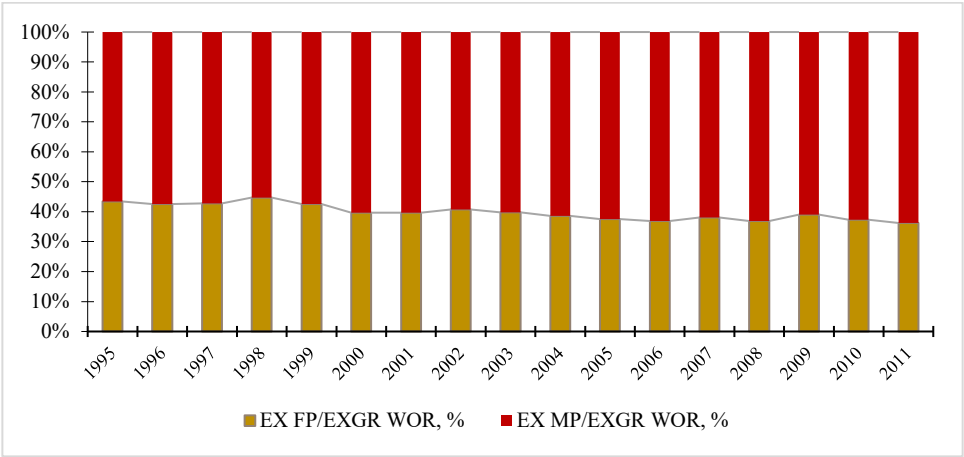


Figure 2.23 Share of intermediate and final goods in gross world exports, 1995-2011, %
Source: Compiled by the author (OECD.Stat. 2018)

Developed countries (OECD countries) record higher share of exports of intermediate goods on gross exports than non-OECD countries (Table 2.16, Figure 2.24).

However, the growing share of intermediate goods trade in comparison with final production trade is reflected in both groups of countries over the examined period. At the beginning of the reporting period, the difference between the share of export of final goods and intermediate products in overall gross exports in OECD was low (1995: EXGR INT/EXGR = 52.33%; EXGR FNL/EXGR = 47.67%) though even in this period export of intermediate goods prevails over the export of final goods. By 2011, this difference has increased by about 10% in favor of the share of intermediate goods in the OECD gross trade.

In non-OECD countries at the beginning of the examined period, there is a larger difference between INT and FNL in gross exports (1995: EXGR INT/EXGR = 61.67%, EXGR FNL/EXGR = 38.33%). Till 2011 the share of INT in comparison with FIN in gross exports increased even more (2011: EXGR INT/EXGR = 65.43%), but the change was smaller than in the OECD countries.

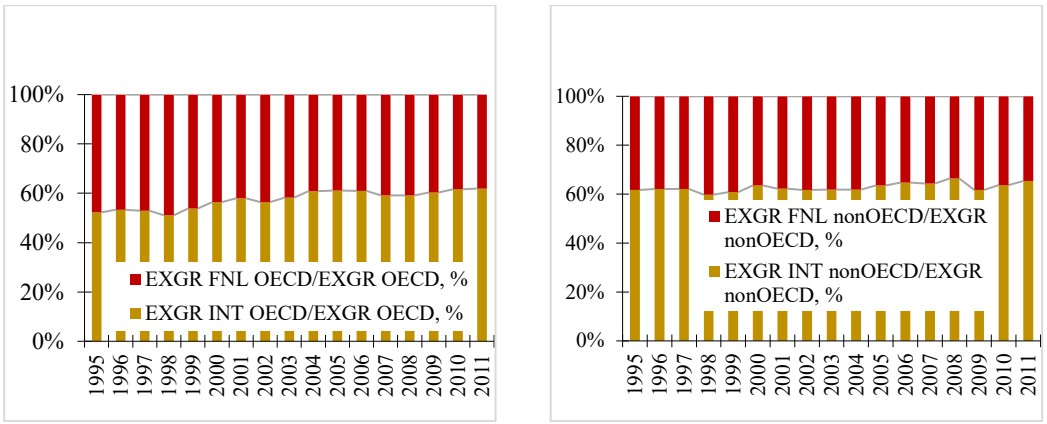


Figure 2.24 Share of gross exports of intermediate and final products to gross exports and imports of OECD and non-OECD countries, 1995-2011, %
Source: Compiled by the author (OECD.Stat. 2018)

The trend of gross exports of intermediate and final products of the Slovak Republic in the examined period follows a global trend. Based on OECD data in Table 2.13, we focus on volume and share of trade in intermediate and final production of the Slovak Republic.

Table 2.14 Gross exports and imports of intermediate products and final products and their share in total exports and imports, the Slovak Republic, 1995-2011, mil. USD, %

	EXGR FNL SVK, mil. USD	EXGR INT SVK, mil. USD	IMGR FNL SVK, mil. USD	IMGR INT SVK, mil. USD	*EXGR FNL SVK / EXGR SVK, %*	*EXGR INT SVK / EXGR SVK, %*	*IMGR FNL SVK / IMGR SVK, %*	*IMGR INT SVK / IMGR SVK, %*
1995	4 040.8	5 981.3	3 581.4	6 085.3	*40.3*	*59.7*	*37.0*	*63.0*
1996	4 314.9	5 972.7	4 855.5	7 819.0	*41.9*	*58.1*	*38.3*	*61.7*
1997	4 316.5	6 643.3	4 816.5	8 294.3	*39.4*	*60.6*	*36.7*	*63.3*
1998	5 264.5	7 519.4	6 216.5	9 096.6	*41.2*	*58.8*	*40.6*	*59.4*
1999	5 031.3	7 091.5	5 015.2	8 100.5	*41.5*	*58.5*	*38.2*	*61.8*
2000	5 590.0	8 530.5	5 184.6	9 522.4	*39.6*	*60.4*	*35.3*	*64.7*
2001	6 143.9	9 136.9	5 751.8	11 303.3	*40.2*	*59.8*	*33.7*	*66.3*
2002	6 809.2	10 200.6	6 206.6	12 665.8	*40.0*	*60.0*	*32.9*	*67.1*
2003	10 406.9	14 756.0	7 905.6	17 964.9	*41.4*	*58.6*	*30.6*	*69.4*
2004	12 135.8	19 224.3	10 455.6	22 158.1	*38.7*	*61.3*	*32.1*	*67.9*
2005	13 548.7	21 979.2	12 672.7	25 238.4	*38.1*	*61.9*	*33.4*	*66.6*
2006	17 029.7	27 459.5	14 397.6	32 449.7	*38.3*	*61.7*	*30.7*	*69.3*
2007	23 953.3	35 911.7	19 311.5	41 576.3	*40.0*	*60.0*	*31.7*	*68.3*
2008	28 789.7	41 512.2	24 854.0	48 183.5	*41.0*	*59.0*	*34.0*	*66.0*
2009	22 224.9	30 913.5	18 359.5	35 382.0	*41.8*	*58.2*	*34.2*	*65.8*
2010	23 742.8	35 576.0	18 578.5	41 152.5	*40.0*	*60.0*	*31.1*	*68.9*
2011	27 273.0	42 958.9	20 907.7	49 018.4	*38.8*	*61.2*	*29.9*	*70.1*
change 1995-2011, mil. USD	23 232.2	36 977.6	17 326.3	42 933.1	*-1.5*	*1.5*	*-7.1*	*7.1*

Source: Compiled by the author (OECD.Stat. 2018)

At the end of the examined period, the gross export of final products in the Slovak Republic was worth 27,273 mil. USD and exports of intermediate products 42,958.9 mil. USD. It is clear from the data in Table 2.14 and Figure 2.25 that the Slovak Republic exported more intermediate products than the final products during the examined period while this gap is even increasing and increasing is also the share of INT exports in gross exports of the Slovak Republic (Figure 2.26).

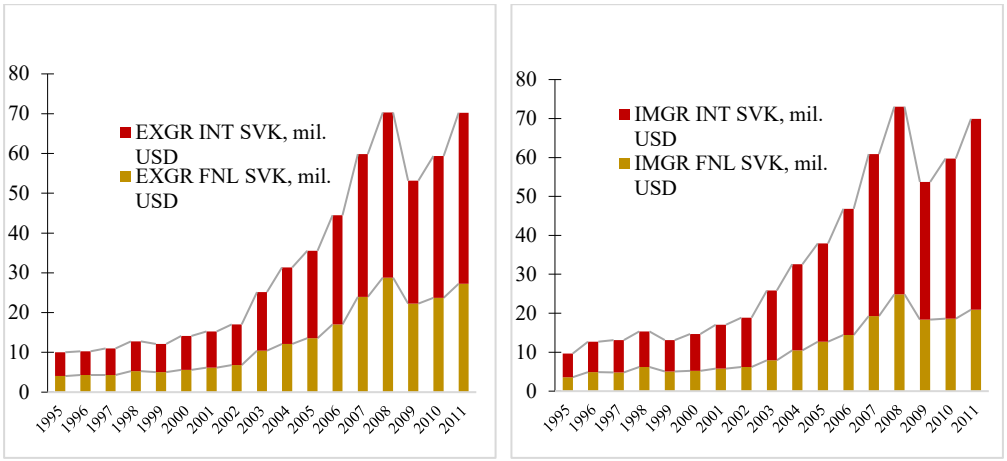


Figure 2.25 Gross exports and gross imports of intermediate and final products, the Slovak Republic, 1995-2011, bil. USD
Source: Compiled by the author (OECD.Stat. 2018)

At the same time, production in the Slovak Republic is increasingly dependent on imports of intermediate products (Table 2.14 and Figure 2.25). Gross imports of intermediate products outweigh the import of final production, reaching 49,018.4 mil. USD, which accounts for up to 70.1% of total gross imports of the Slovak Republic (Figure 2.26). This figure documents the high dependence of Slovak production on foreign suppliers.

Considering the high volume of gross exports of the Slovak Republic and its share of GDP (see Section 2.1, Table 2.2), it is clear that some of the imported intermediate products are becoming part of the export. These data show that the Slovak Republic, especially after 2002, has been strongly integrated into the GVC. Conventional trade statistics are not able to reveal the extent of this participation. We cannot identify the contribution of exported and imported intermediate products and final products to the volume of production in the Slovak Republic. This will allow us to analyze domestic value added in the export of intermediate products and final products. We will therefore use the data on domestic value added in exports (TiVA) from the OECD database and have fond out the following:

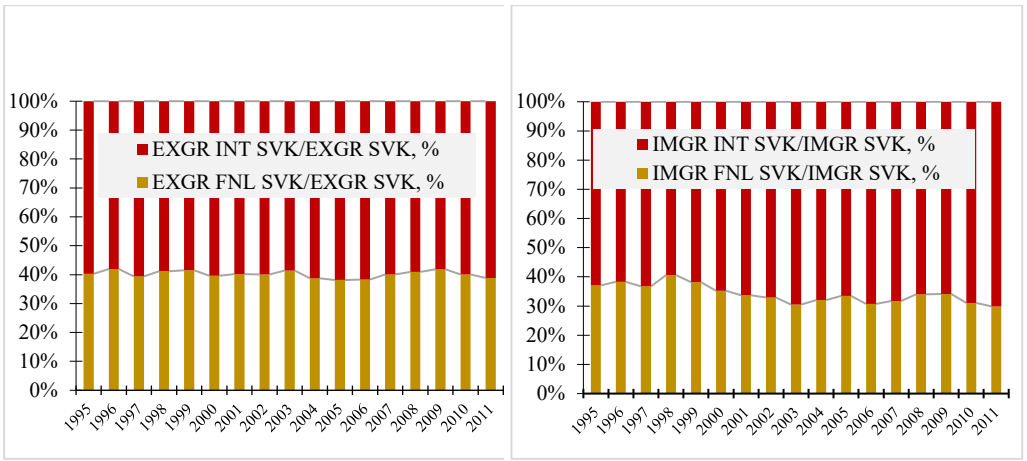


Figure 2.26 Share of gross exports and imports of intermediate and final products in gross exports and imports, the Slovak Republic, 1995-2011, %
Source: Compiled by the author (OECD.Stat. 2018)

1. the size of the domestic value added in exports of intermediate and final products:

$$EXGR\ DVA = EXGR\ INTDVA + EXGR\ FNLFVA \quad (2.15)$$

2. EXGR INTDVASH - the share of domestic value added in export of intermediate products (EXGR INTDVA) on the total domestic value added in export (EXGR DVA):

$$EXGR\ INTDVASH = \frac{EXGR\ INTDVA}{EXGR\ DVA}\ x\ 100\ (\%) \quad (2.16)$$

3. EXGR FNLDVASH - the share of domestic value added in export of final products (EXGR FNLDVA) on total domestic value added in exports (EXGR DVA):

$$EXGR\ FNLDVASH = \frac{EXGR\ FNLDVA}{EXGR\ DVA}\ x\ 100\ (\%) \quad (2.17)$$

In order to examine the significance of changes in the trade with INT and FNL of the Slovak Republic when the Slovak Republic is involved in the GVC, we recall the following:

- the volume of domestic value added in exports (EXGR DVA) in the Slovak Republic is increasing (Table 2.14), which is related to the growth of Slovakia's gross production,
- the share of EXGR DVA on gross production (PROD) ranges from 15.08% to 16.46% between 1995 and 2011 (see Section 2.3.1, Figure 2.15),
- the share of EXGR DVA on gross exports of the Slovak Republic - VAX (EXGR_DVA SVK/EXGR SVK,%) is decreasing (explained in section 2.3.1, Table 2.5, Figure 2.16),

- the share of EXGR INT SVK/EXGR SVK is increases while EXGR FNL SVK/EXGR SVK is decreases (Table 2.13).

Consequently, on the basis of the indicators (2.15), (2.16) and (2.17), we find out how the domestic export of the domestic value added contained in exports of INT and FN (Table 2.15, Figure 2.27) is being developed within EXGR DVA. We have observed the following:

- EXGR DVA SVK, mil. USD - domestic added value in gross exports of the Slovak Republic increased by about 5.5 times over the examined period, with a higher share of domestic value added in exports of intermediate products (EXGR INTDVA SVK - 5.6-fold increase) than domestic value added in the export of final products (EXGR FNLDVA SVK - 5.2-fold increase) - it indicates that Slovak producers are more involved in the production abroad (where they export intermediate products) than in the production of final products for final use abroad.
- EXGR INTDVASH SVK, % - the share of domestic value added in the export of Slovakian intermediate production to total domestic exports in the Slovak Republic (EXGR DVA) increased from 58.3% in 1995 to 60.4% in 2011 (2.1 percentage points) at the expense of the decrease in the share of domestic value added in exports of final products (EXGR FNLDVASH SVK, % - by 2.1 percentage points).
- After 2002, the Slovak Republic recorded a more intensive growth of total domestic value added in exports (EXGR DVA SVK) - the first largest growth recorded in 2003 - up to 3,811.2 mil. USD (Table 2.14), with export of domestic value added in exports of intermediate products which mainly contributed to this increase (EXR INTDVA SVK - by 2,283.2 mil. USD), an increase in domestic value added in exports of final product was lower (EXGR FNLDVA SVK - by 1,528.0 mil. USD). Such a development after 2002 indicates that the Slovak Republic is increasingly engaged in vertical division of labor.
- The crisis, in times of high interconnectedness of economies in global value chains, is reflected in reduced foreign demand, which was also examined in the Slovak economy. Specifically, in relation to the examined indicators, we have found that in 2009, export of domestic value added (EXGR DVA SVK) decreased by 7,744.2 mil. USD, with export of domestic value added in exports of intermediate products which mainly contributed to this decrease (EXGR INTDVA SVK a decrease of 5,096.7 mil. USD), a decline in export of domestic value added in exports of final products (EXGR FNLDVA SVK) was 2,647.5 mil. USD. External shocks in countries intensively integrated into the vertical division of labor show a stronger impact on trade in intermediate goods and the reduced possibility of realizing domestic value added in their exports.

Table 2.15 Domestic value added in exports of intermediate products and final products, the Slovak Republic, 1995-2011, mil. USD, %

	EXGR FNLDVA SVK, mil. USD	EXGR INTDVA SVK, mil. USD	EXGR DVA SVK, mil. USD	EXGR FNLDVASH SVK, %	EXGR INTDVASH SVK, %
1995	2 850.3	3 985.8	6 836.1	41.7	58.3
1996	2 840.4	3 670.6	6 511.0	43.6	56.4
1997	2 803.5	3 976.2	6 779.7	41.4	58.7
1998	3 184.5	4 451.4	7 635.8	41.7	58.3
1999	3 093.7	4 222.3	7 316.0	42.3	57.7
2000	3 116.4	4 777.0	7 893.4	39.5	60.5
2001	3 250.2	4 828.7	8 079.0	40.2	59.8
2002	3 786.4	5 409.1	9 195.5	41.2	58.8
2003	5 314.4	7 692.3	13 006.7	40.9	59.1
2004	6 363.0	10 298.7	16 661.6	38.2	61.8
2005	7 219.3	11 589.2	18 808.5	38.4	61.6
2006	8 559.7	13 956.3	22 516.0	38.0	62.0
2007	12 200.5	18 821.6	31 022.0	39.3	60.7
2008	15 262.5	22 573.9	37 836.5	40.3	59.7
2009	12 615.1	17 477.2	30 092.3	41.9	58.1
2010	13 162.9	19 029.5	32 192.4	40.9	59.1
2011	14 826.0	22 586.6	37 412.5	39.6	60.4
change 1995-2011	11 975.7 appr. 5.2x	18 600.8 appr. 5.6x	30 576.5 appr. 5.5x	-2.1	2.1

Note: gray lines highlight extraordinary phenomena: 2003 - intensification of trade with value added, the Slovak Republic; 2009 - response to the global crisis.

Source: Compiled by the author (OECD.Stat. 2018)

For comparison, Table 2.16 and Table 2.17 also show OECD and non-OECD group data. The Slovak Republic is a member of the OECD, in a group of more advanced countries than the non-OECD group. In the Slovak Republic, the OECD group as well as in the non-OECD group, the volume of exports of domestic value added (EXGR DVA) is increasing. The non-OECD group exports a larger volume of EXGR DVA.

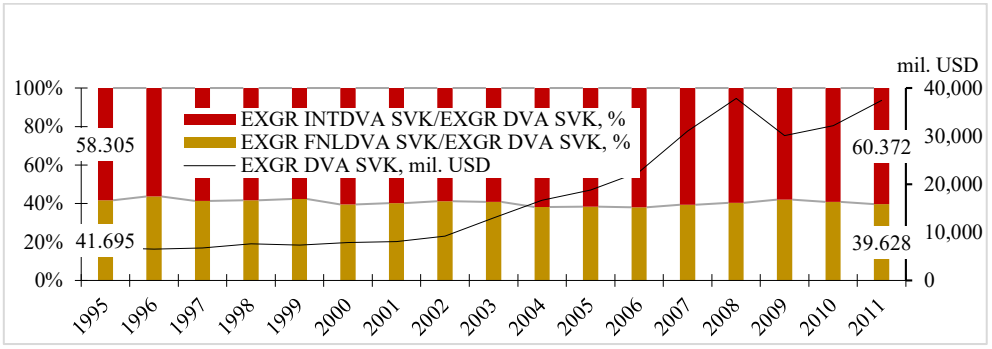


Figure 2.27 Domestic value added in gross exports of the Slovak Republic and share of domestic value added in exports of intermediate and final goods of the Slovak Republic to total domestic value added in gross exports, the Slovak Republic, 1995-2011, mil. USD, %

Source: compiled by data author (OECD State 2018)

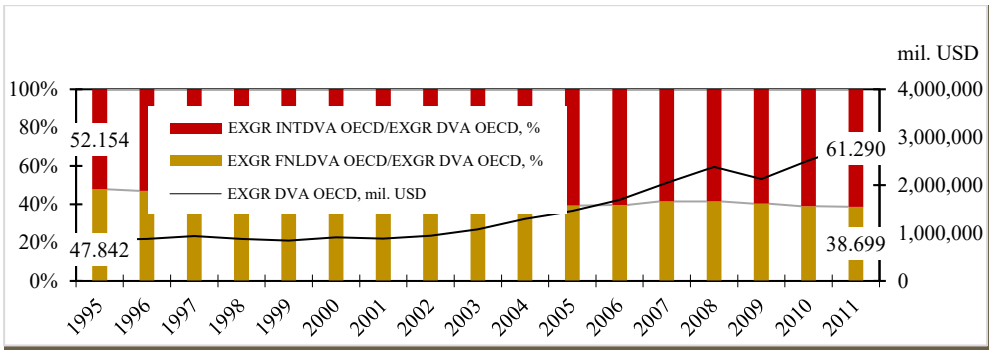


Figure 2.28 Domestic value added in OECD gross exports and the share of domestic value added in exports OECD intermediate and final goods to total domestic value added in OECD gross exports 1995-2011, mil. USD, %
Source: Compiled by the author (OECD.Stat. 2018)

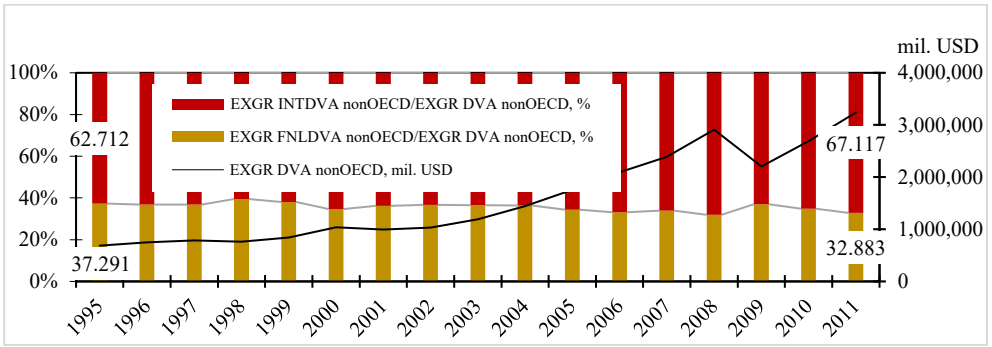


Figure 2.29 Domestic value added in non-OECD gross exports and share of domestic value added in exports of intermediate and final non-OECD products to total domestic value added in non-OECD gross exports 1995-2011, mil. USD, %
Source: Compiled by the author (OECD.Stat. 2018)

Table 2.16 Domestic value added in gross OECD and non-OECD exports and the share of domestic value added in exports of intermediate and final goods on the total domestic value added in gross OECD and non-OECD exports 1995-2011, USD,%

	EXGR FNLDVA OECD, mil. USD	EXGR INTDVA OECD, mil. USD	EXGR DVA OECD, mil. USD	EXGR OECD, mil. USD	VAX EXGR FNLDVA OECD / EXGR OECD, %	VAX EXGR INTDVA OECD / EXGR OECD, %	EXGR FNLDVA non-OECD, mil. USD	EXGR INTDVA non-OECD, mil. USD	EXGR DVA non-OECD, mil. USD	EXGR non-OECD, mil. USD	VAX EXGR FNLDVA non-OECD / EXGR non-OECD, %	VAX EXGR INTDVA non-OECD / EXGR non-OECD, %
1995	411 302.87	448 372.65	859 715.65	1 010 075.80	40.72	44.39	255 774.64	430 127.40	858 880.60	858 880.60	29.78	50.08
1996	411 613.91	464 557.94	876 151.86	1 038 118.30	39.65	44.75	275 686.75	472 070.21	937 391.20	937 391.20	29.41	50.36
1997	442 873.95	490 930.01	933 740.36	1 114 989.80	39.72	44.03	289 043.88	497 008.42	993 619.40	993 619.40	29.09	50.02
1998	432 100.90	444 455.62	876 551.77	1 047 009.70	41.27	42.45	301 776.64	462 495.94	978 206.30	978 206.30	30.85	47.28
1999	391 795.63	449 798.33	841 571.15	1 008 742.60	38.84	44.59	320 541.78	521 610.86	1 082 180.20	1 082 180.20	29.62	48.20
2000	401 059.47	511 877.06	912 983.93	1 113 744.70	36.01	45.96	360 774.67	678 574.31	1 347 179.50	1 347 179.50	26.78	50.37
2001	375 965.76	509 774.89	885 743.80	1 083 474.80	34.70	47.05	359 970.06	634 276.03	1 292 067.70	1 292 067.70	27.86	49.09
2002	413 017.33	527 865.24	940 931.20	1 145 043.90	36.07	46.10	378 270.17	654 019.76	1 336 643.70	1 336 643.70	28.30	48.93
2003	453 514.57	623 152.81	1 076 688.28	1 322 199.90	34.30	47.13	436 027.11	755 769.89	1 565 065.00	1 565 065.00	27.86	48.29
2004	511 912.14	783 170.81	1 295 110.98	1 610 799.70	31.78	48.62	524 824.83	917 443.33	1 904 990.30	1 904 990.30	27.55	48.16
2005	571 314.62	884 977.54	1 456 384.13	1 836 434.00	31.11	48.19	604 039.68	1 154 632.68	2 303 736.40	2 303 736.40	26.22	50.12
2006	670 472.11	1 022 824.28	1 693 112.25	2 180 397.10	30.75	46.91	693 674.99	1 398 569.18	2 736 390.50	2 736 390.50	25.35	51.11
2007	847 069.50	1 198 422.89	2 045 451.00	2 653 726.50	31.92	45.16	809 427.01	1 581 227.94	3 109 592.80	3 109 592.80	26.03	50.85
2008	987 922.86	1 391 972.92	2 379 894.86	3 149 260.00	31.37	44.20	929 338.79	1 982 218.43	3 709 935.30	3 709 935.30	25.05	53.43
2009	856 448.29	1 272 260.14	2 128 627.57	2 698 324.80	31.74	47.15	816 039.36	1 390 738.82	2 822 688.90	2 822 688.90	28.91	49.27
2010	979 349.16	1 535 827.02	2 515 273.73	3 242 878.00	30.20	47.36	937 256.02	1 752 487.97	3 476 468.90	3 476 468.90	26.96	50.41
2011	1 103 118.22	1 747 074.31	2 850 497.72	3 763 624.10	29.31	46.42	1 064 902.67	2 173 568.45	4 167 916.50	4 167 916.50	25.55	52.15
change 1995-2011	691 815.36	1 298 701.66	1 990 782.07	2 753 548.30	-11.41	2.03	809 128.02	1 743 441.05	3 309 035.90	3 309 035.90	-4.23	2.07

Source: Compiled by the author (OECD.Stat. 2018)

Table 2.17 Domestic value added in exports of intermediate and final goods, OECD and non-OECD countries, 1995-2011, mil. USD, %

	EXGR DVA OECD, mil. USD	EXGR FNLDVASH OECD, %	EXGR INTDVASH OECD, %	EXGR DVA non-OECD, mil. USD	EXGR FNLDVASH OECD non-OECD, %	EXGR INTDVASH non-OECD, %
1995	859 715.65	47.84	52.15	685 881.02	37.29	62.71
1996	876 151.86	46.98	53.02	747 770.92	36.87	63.13
1997	933 740.36	47.43	52.58	786 051.80	36.77	63.23
1998	876 551.77	49.30	50.71	764 284.25	39.48	60.51
1999	841 571.15	46.56	53.45	842 111.97	38.06	61.94
2000	912 983.93	43.93	56.07	1 039 381.99	34.71	65.29
2001	885 743.80	42.45	57.55	994 319.60	36.20	63.79
2002	940 931.20	43.89	56.10	1 032 300.88	36.64	63.36
2003	1 076 688.28	42.12	57.88	1 191 903.15	36.58	63.41
2004	1 295 110.98	39.53	60.47	1 442 268.15	36.39	63.61
2005	1 456 384.13	39.23	60.77	1 758 762.11	34.34	65.65
2006	1 693 112.25	39.60	60.41	2 092 292.59	33.15	66.84
2007	2 045 451.00	41.41	58.59	2 390 699.55	33.86	66.14
2008	2 379 894.86	41.51	58.49	2 911 214.75	31.92	68.09
2009	2 128 627.57	40.23	59.77	2 206 840.38	36.98	63.02
2010	2 515 273.73	38.94	61.06	2 689 645.57	34.85	65.16
2011	2 850 497.72	38.70	61.29	3 238 470.29	32.88	67.12
change 1995-2011	1 990 782.07	-9.14	9.14	2 552 589.27	-4.41	4.41

Source: Compiled by the author (OECD.Stat. 2018)

Analysis of the export of domestic value added contained in gross exports (EXGR), especially for intermediate products and final products (Table 2.17, Figure 2.27 and Figure 2.28) reveals the following:

- VAX for intermediate products (VAX INT): OECD countries achieve lower share of domestic value added in export of intermediate products on total exports (EXGR FNLDVA OECD/EXGR OECD, %) than non-OECD countries (EXGR INTDVA non-OECD/EXGR non-OECD). It means that non-OECD countries contribute to the GVC with higher share of their domestic value added in intermediate goods than the OECD countries. As we have already mentioned - VAX, the share of domestic value added in exports is an indicator of participation in the GVC. In both groups of countries, VAX INT decreased and in 2011 non-OECD reached VAX INT 52.15% and OECD 46.42%.
- VAX for final products (VAX FNL): At the beginning of the examined period (1995), this indicator was significantly higher in the OECD than in the non-OECD countries, which means that the OECD countries exported a higher share of domestic value added in exports in final products (VAX FNL = 40.72%) than non-OECD countries (VAX FNL = 29.78%). In both groups, the VAX FNL declined in 2011 and these indicators got closer - VAX FNL in the OECD reached 29.31% and non-OECD 25.55%.

VAX development in the Slovak Republic, OECD and non-OECD countries confirms the boom in vertical division of labor. The decrease in the share of total value added in exports (VAX) is accompanied by VAX growth in exports of intermediate goods and by a drop in export of final products. Final products are increasingly made up from intermediate goods from different countries through networks of global value chains. This evidenced is further confirmed by the increase in the share of domestic value added in the export of intermediate products to exports of domestic value added (EXGR INTDVASH) of the Slovak Republic, OECD and non-OECD countries (Table 2.15 and Table 2.17). We see this development in Figures 2.27, 2.28 and 2.29 - in the Slovak Republic in 2011, this indicator for intermediate products reached 60.4%, in OECD 61.3% and in non-OECD 67.1% - all groups export from their domestic value added more than 60% in intermediate products (EXGR DVA).

We have analyzed a development of domestic value added in total gross exports (EXGR DVA SVK), gross exports of intermediate products (EXGR INTDVA SVK) and in gross exports of final products (EXGR FNLDVA SVK) in the Slovak Republic. We have found that intermediate products and their exports play a significant role in global value chains, so we are further exploring how the export of domestic value added contained in the export of intermediate products of selected "I" and "S" services contributes to EXGR DVA SVK.

The share of domestic value added in the intermediate and final products of the particular branch in given sector in exports of total domestic value added is calculated as follows:

$$exp\ DVA_c^s = \frac{EXGR\ INTDVA_c}{EXGR\ DVA}\ x\ 100\ (\%) \qquad (2.18)$$

where

EXP DVA - export of domestic value added, s - sector; c - the industry

The data are shown in Table 2.18 and Table 2.19 and shown in Figure 2.30 and Figure 2.31.

In the industrial sector "I", we analyze the situation in sectors that we identified as the sectors with the largest share on exports of the Slovak Republic.

1. C34T35: Transport equipment,
2. C30T33: Electrical and optical equipment,
3. C23T26: Chemicals and non-metallic mineral products,
4. C27T28: Basic metals and fabricated metal products,
5. C29: Machinery and equipment, nec.

The ranking of these sectors, according to the indicator (2.18), does not match the order according to the share in the total export of the Slovak Republic. Considering the share of exported domestic value added in intermediate products on the total export of domestic value added in export, the industrial sectors are listed but the ranking of these industrial sectors is changing - in the last reference year 2011 the order was as follows:

1. C27T28: Basic metals and manufactured metal products: 8.7%,
2. C23T26: Chemicals and non-metallic mineral products: 8.2%,

3. C34T35: Transport equipment: 8.1%,
4. C30T33: Electrical and optical equipment: 7.0%,
5. C29: Machinery and equipment, nec: 3.2%.

Compared to 1995, however, development shows that in the sector C27T28: Basic metals and fabricated metal products and sector C23T26: Chemicals and non-metallic mineral products, the share of domestic value added in the export of intermediate products to the total EXGR DVA decreased. In Sector C34T35: Transport equipment, sector C30T33: Electrical and optical equipment and sector C29: Machinery and equipment, nec. this share increased, while Transport Equipment, C30T33, recorded the most significant increase of up to 6.6 percentage point. Domestic value added of the Slovak Republic is more and more widely used in the export of intermediate products.

In the service sector "S", we have identified sectors with the largest share of Slovakia's exports:

1. C50T52: Wholesale and retail trade; repairs,
2. C60T63: Transport and storage,
3. C90T93: Other community, social and personal services,
4. C73T74: R & D and other business activities.

Even in the service sector, the ranking of these sectors is not in line with the share of total exports of the Slovak Republic according to the indicator used (2.18). According to the share of exported domestic value added in the intermediate exports on the total domestic value added in exports, there are five industries, but the ranking of these industries is changing - in the last reference year 2011, the order was as follows:

1. C50T52: Wholesale and retail trade; repairs: 8.0% and compared with 1995, this share increased, while the service sector is also extremely high in relation to other service sectors
2. C73T74: R&D and other business activities: 2.0% and since 1995 there has been a decrease of 0.3 percentage points.
3. C90T93: Other community, social and personal services: 1.0% and since 1995 there has been an increase of 0.2 percentage point.
4. C60T63: Transport and storage: almost zero, compared to 1995 (0.1%), the share decreased.

Domestic value added in the export of intermediate products is generally low. It will be interesting to examine such an important sector of services for a further development of the country such as C72: Computer and related activities. This industry increases its share of domestic value added in the intermediate exports to EXGR DVA and reached 0.6% in 2011.

Table 2.18 Share of domestic value added in exports of intermediate products in the industrial sector (I) on total domestic value added in exports, Slovak Republic, 1995-2011; %

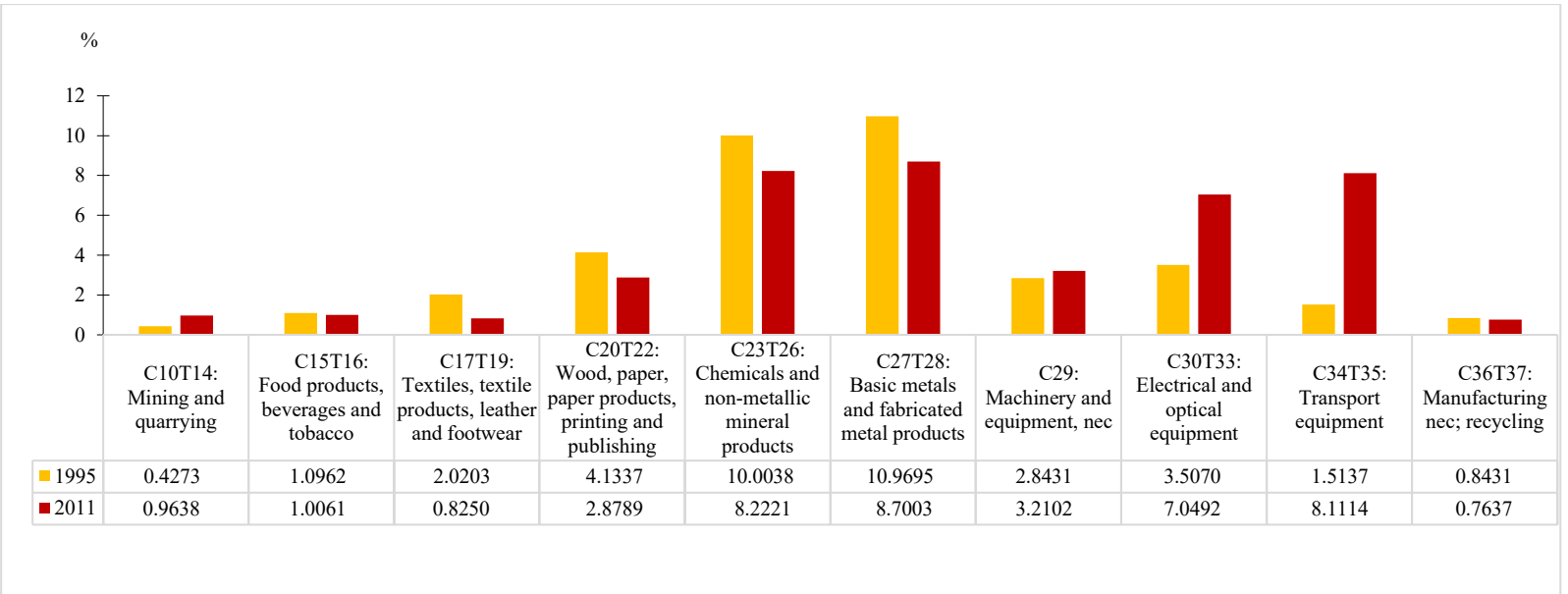
	C10T14: Mining and quarrying	C15T16: Food products, beverages and tobacco	C17T19: Textiles, textile products, leather and footwear	C20T22: Wood, paper, paper products, printing and publishing	C23T26: Chemicals and non-metallic mineral products	C27T28: Basic metals and fabricated metal products	C29: Machinery and equipment, nec	C30T33: Electrical and optical equipment	C34T35: Transport equipment	C36T37: Manufacturing nec; recycling
1995	0.4	1.1	2.0	4.1	10.0	11.0	2.8	3.5	1.5	0.8
1996	0.5	1.1	1.8	4.2	9.2	9.7	2.8	4.9	1.9	0.8
1997	0.5	1.2	1.8	4.5	9.2	10.0	3.1	4.7	2.6	1.0
1998	0.5	1.1	1.6	4.5	9.1	10.3	2.6	4.6	3.2	0.9
1999	0.5	1.2	1.7	4.6	9.5	9.5	2.5	4.2	3.9	0.9
2000	0.5	1.2	1.6	4.6	10.4	10.4	2.5	4.7	3.5	0.7
2001	0.5	1.4	1.6	4.8	9.6	9.7	3.0	5.0	3.7	0.7
2002	0.4	1.4	1.7	4.5	9.4	8.2	2.7	5.1	5.6	0.9
2003	0.4	1.1	1.5	4.1	8.4	9.4	2.9	5.3	6.2	0.9
2004	0.4	1.1	1.4	4.0	8.8	10.6	2.9	5.6	5.3	0.9
2005	0.6	1.3	1.2	4.1	9.2	10.9	2.8	5.9	4.7	0.8
2006	0.5	1.2	1.2	4.1	7.8	11.3	3.0	7.0	4.9	0.8
2007	0.4	1.1	1.0	3.7	7.4	11.2	2.9	6.6	5.8	0.8
2008	0.6	1.2	0.8	3.6	6.7	9.7	2.9	7.1	5.9	0.9
2009	0.5	1.0	0.8	3.3	7.2	8.4	2.5	7.2	6.4	0.9
2010	0.9	1.0	0.9	3.1	7.4	9.5	3.1	7.1	7.4	0.9
2011	1.0	1.0	0.8	2.9	8.2	8.7	3.2	7.0	8.1	0.8
change 1995-2011, percentage points	0.5	-0.1	-1.2	-1.3	-1.8	-2.3	0.4	3.5	6.6	-0.1

Note: green shade - lowest share from 0 to 2.5, yellow shade - medium share from 2.6 to 4.0, red shade - high share of 4.1 or more.
Source: Compiled by the author (OECD.Stat. 2018)

Table 2.19 Domestic value added in the exports of intermediate goods in the sector of services (S) to total domestic value added in exports, the Slovak Republic, 1995-2011; %

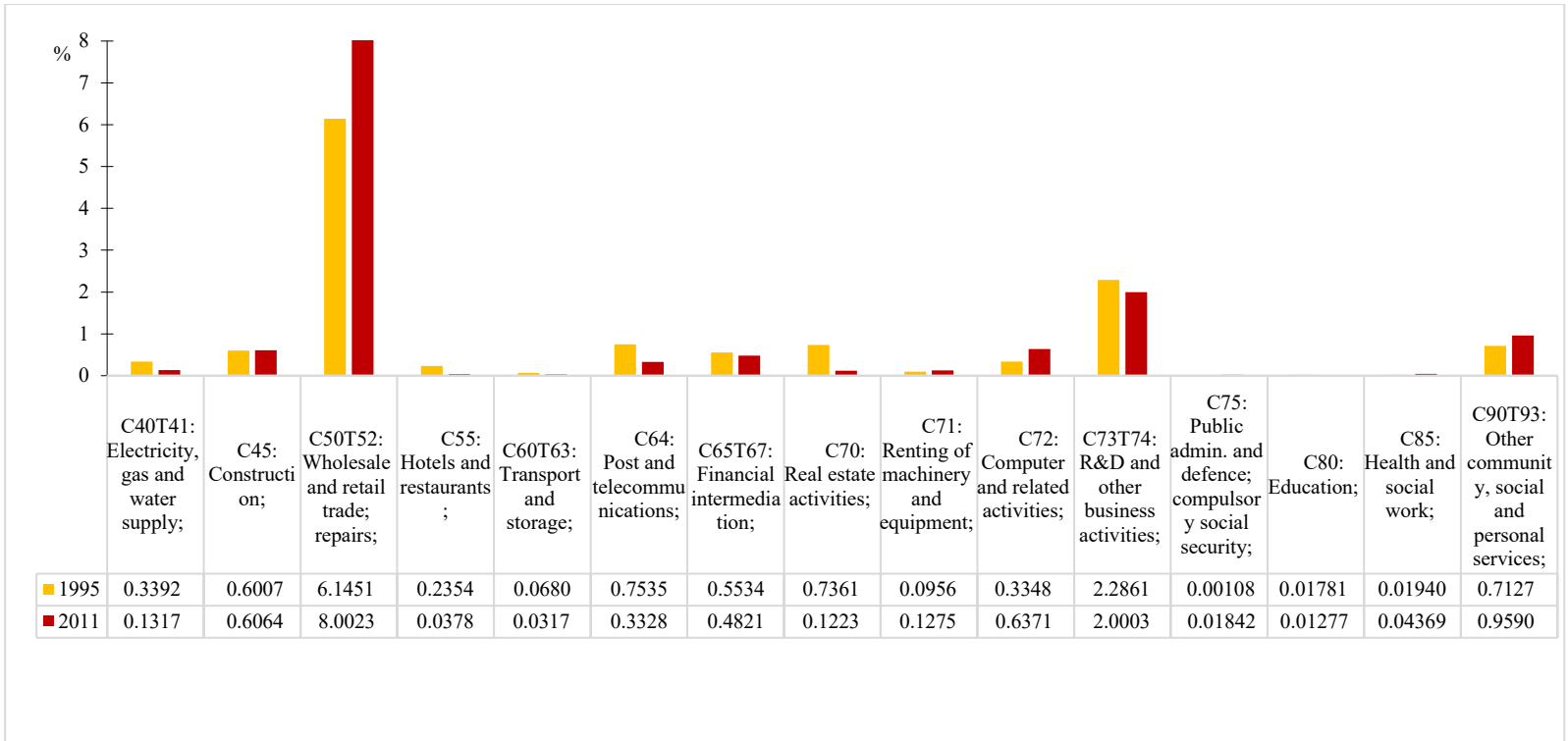
	C40T41: Electricity, gas and water supply;	C45: Construction;	C50T52: Wholesale and retail trade; repairs;	C55: Hotels and restaurants;	C60T63: Transport and storage;	C64: Post and telecommunications;	C65T67: Financial intermediation;	C70: Real estate activities;	C71: Renting of machinery and equipment;	C72: Computer and related activities;	C73T74: R&D and other business activities;	C75: Public admin. and defence; compulsory social security;	C80: Education;	C85: Health and social work;	C90T93: Other community, social and personal services;
1995	0.3	0.6	6.1	0.2	0.1	0.8	0.6	0.7	0.1	0.3	2.3	0.00	0.02	0.02	0.7
1996	0.4	0.5	6.0	0.2	0.1	0.7	0.4	0.4	0.1	0.4	2.4	0.02	0.04	0.02	0.7
1997	0.3	0.6	7.9	0.0	0.0	0.6	0.4	0.2	0.0	0.4	2.7	0.00	0.01	0.01	0.8
1998	0.3	0.6	7.5	0.1	0.0	0.7	0.4	0.2	0.0	0.3	2.8	0.00	0.01	0.01	0.8
1999	0.4	0.5	7.4	0.1	0.0	0.6	0.3	0.2	0.0	0.3	2.9	..	0.02	0.01	0.8
2000	0.4	0.7	7.9	0.1	0.1	0.4	0.3	0.1	0.0	0.2	3.0	0.05	0.02	0.02	0.8
2001	0.3	0.5	7.9	0.1	0.0	0.4	0.3	0.2	0.0	0.3	2.5	0.04	0.02	0.01	1.1
2002	0.5	0.5	7.6	0.0	0.0	0.5	0.4	0.2	0.0	0.3	2.6	0.03	0.01	0.03	1.0
2003	0.6	0.5	8.4	0.0	0.0	0.5	0.3	0.0	0.1	0.3	2.3	0.05	0.01	0.01	0.7
2004	0.7	0.6	9.1	0.0	0.0	0.5	0.3	0.1	0.1	0.3	2.7	0.04	0.01	0.02	0.7
2005	0.4	0.7	8.4	0.1	0.0	0.5	0.5	0.2	0.1	0.4	2.5	0.03	0.01	0.03	0.7
2006	0.5	0.5	8.3	0.1	0.0	0.5	0.5	0.3	0.1	0.5	2.3	0.04	0.01	0.03	0.7
2007	0.2	0.4	8.4	0.1	0.0	0.4	0.4	0.1	0.1	0.4	3.3	0.03	0.02	0.04	0.9
2008	0.3	0.7	9.2	0.1	0.0	0.4	0.6	0.0	0.0	0.6	1.8	0.06	0.01	0.05	0.8
2009	0.2	0.5	9.1	0.0	0.0	0.4	0.6	0.0	0.3	0.8	1.9	0.10	0.02	0.04	0.6
2010	0.1	0.6	7.8	0.0	0.0	0.3	0.4	0.1	0.2	0.6	2.1	0.02	0.01	0.04	0.9
2011	0.1	0.6	8.0	0.0	0.0	0.3	0.5	0.1	0.1	0.6	2.0	0.02	0.01	0.04	1.0
change 1995-2011	-0.2	0.0	1.9	-0.2	0.0	-0.4	-0.1	-0.6	0.0	0.3	-0.3	0.0	0.0	0.0	0.2

Note: green shade - lowest share from 0 to 0.2; yellow shade - medium share of 0.3 to 1.0, red shade - high share of 1.1 or more.
Source: Compiled by the author (OECD.Stat. 2018)



	C10T14: Mining and quarrying	C15T16: Food products, beverages and tobacco	C17T19: Textiles, textile products, leather and footwear	C20T22: Wood, paper, paper products, printing and publishing	C23T26: Chemicals and non-metallic mineral products	C27T28: Basic metals and fabricated metal products	C29: Machinery and equipment, nec	C30T33: Electrical and optical equipment	C34T35: Transport equipment	C36T37: Manufacturing nec; recycling
1995	0.4273	1.0962	2.0203	4.1337	10.0038	10.9695	2.8431	3.5070	1.5137	0.8431
2011	0.9638	1.0061	0.8250	2.8789	8.2221	8.7003	3.2102	7.0492	8.1114	0.7637

Figure 2.30 Share of domestic sales of intermediate products in the industrial sectors (I) in total domestic sales, the Slovak Republic, 1995-2011; %
Source: Compiled by the author (OECD.Stat. 2018)



	C40T41: Electricity, gas and water supply;	C45: Construction;	C50T52: Wholesale and retail trade; repairs;	C55: Hotels and restaurants;	C60T63: Transport and storage;	C64: Post and telecommunications;	C65T67: Financial intermediation;	C70: Real estate activities;	C71: Renting of machinery and equipment;	C72: Computer and related activities;	C73T74: R&D and other business activities;	C75: Public admin. and defence; compulsory social security;	C80: Education;	C85: Health and social work;	C90T93: Other community, social and personal services;
1995	0.3392	0.6007	6.1451	0.2354	0.0680	0.7535	0.5534	0.7361	0.0956	0.3348	2.2861	0.00108	0.01781	0.01940	0.7127
2011	0.1317	0.6064	8.0023	0.0378	0.0317	0.3328	0.4821	0.1223	0.1275	0.6371	2.0003	0.01842	0.01277	0.04369	0.9590

Figure 2.31 Domestic value added share in exports of intermediate goods in service sectors (S) to total domestic value added in exports, the Slovak Republic, 1995-2011; %
Source: Compiled by the author (OECD.Stat. 2018)

References

BALDWIN, R. (2006). Globalisation: the great unbundling(s). Office of the Prime Minister of Finland, Helsinki. http://appli8.hec.fr/map/files/globalisationthegreatunbundling(s).pdf

BØEGH NIELSEN, P. 2017. The puzzle of measuring global value chains – The business statistics perspective. CEPII (Centre d'Etudes Prospectives et d'Informations Internationales), a center for research and expertise on the world economy. Published by Elsevier B.V. All rights reserved. 2017. https://www.sciencedirect.com/science/article/pii/S2110701716300464#fn8

GEREFFI, G. (2005). The Global Economy: Organization, Governance, and Development. In: N.J. Smelser & R. Swedberg (eds),The Handbook of Economic Sociology, Princeton: Princeton University Press, pp. 160–182. http://www.soc.duke.edu/~ggere/web/Global_Economy_chapter_Handbook_2005.pdf

HOLUB, A. 2000. Změny ve vývoji odvětvové makrostruktury HDP a zaměstnanosti. Acta oeconomica pragensis. 8, 2000, 7, s. 27-59. ISSN: 0572-3043

HUMMELS,D., ISHII,J., YI,K.M. 2001 The nature and growth of vertical specialization in world trade, 2001. Journal of international economics 54 (1): 75-96. https://www.sciencedirect.com/science/article/pii/S0022199600000933

JAVORSEK, M. – CAMACHO, I. 2015. Trade in Value Added: Concepts, Estimation and Analysis. In ARTNeT Working Paper Series 2015, no. 150. http://www.unescap.org/sites/default/files/AWP150Trade%20in%20Value%20Added.pdf

JOHNSON, ROBERT C., and GUILLERMO NOGUERA, 2012, Accounting for Intermediates: Production Sharing and Trade in Value Added, Journal of International Economics, vol. 86, no. 2, pp. 224–236. https://econpapers.repec.org/article/eeeinecon/v_3a86_3ay_3a2012_3ai_3a2_3ap_3a224-236.htm

JOHNSON, R. C. 2014. Five facts about value-added exports and implications for macroeconomics and trade research. In Journal of Economic Perspectives. 2014, vol. 28, no. 2. pp. 119-142. http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.28.2.119 ; https://www.dropbox.com/s/slm5ssvjn9kdv0t/Johnson_JEP_2014.pdf?dl=0

KOOPMAN, R., WANG, Z., WEI, S. J. (2014). Tracing value-added and double counting in gross exports. American Economic Review, 104(2), 459-94.

LAMY, P. 2011. 'Made in China' tells us little about global trade. In Financial Times. https://www.ft.com/content/4d37374c-27fd-11e0-8abc-00144feab49a

OECD, 2013. OECD/WTO Trade in Valie Added (TIVA) indicators: guide to country notes. http://www.oecd.org/sti/ind/TiVA_Guide_to_Country_Notes.pdf .

OECD 2017 TiVA 2016 indicators – definitions. http://www.oecd.org/sti/ind/tiva/TIVA_2016_Definitions.pdf

OECD.Stat. 2018 Trade in Value Added - TiVA. December 2016. http://www.oecd.org/sti/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm

SPĚVÁČEK, V. 1994. Makroekonomická analýza a mezinárodní komparace. Praha : VŠE, 1994. ISBN 80-7079-844-0.

World Bank 2018. The World Integrated Trade Solution (WITS) software https://wits.worldbank.org/Default.aspx?lang=en

URBAN, L. a kol. 1994. Hospodářská politika. Praha : VICTORIA PUBLISHING, 1994. ISBN 80_85_865_01_7.

UNCTAD. 2013. Global Value Chains and Development: Investment and Value Added Trade in the Global Economy. A Preliminary Analysis. New York & Geneva: United Nations, 2013, 40 p. http://unctad.org/en/PublicationsLibrary/diae2013d1_en.pdf

WTO. 2016. What is Trade in Value Added (TiVA)? Trade in Value Added data day - 24 November 2016. https://www.wto.org/english/res_e/reser_e/xreser_e/tivaicio_e.pdf .

WANG,Z., WEI,S., Yu, X., Zhu, K. 2017. Measures of participation in global value chain and global business cycles, 2017. Cambridge, MA: NBER working paper No. 23222. https://www.researchgate.net/publication/315770618_Measures_of_Participation_in_Global_Value_Chains_and_Global_Business_Cycles

WTO. 2014. World trade report 2014. https://www.wto.org/english/res_e/booksp_e/world_trade_report14_e.pdf

WTO, IBRD/WB, IDE-JETRO , OECD. (2017). Global Value CHain Development Report. 2017 ISBN 978-92-870-4125-8

https://www.wto.org/english/res_e/publications_e/gvcd_report_17_e.htm

Chapter 3

Balance of trade of the Slovak Republic according to the traditional measurement and value added

*by **Oľga Nosáľová***
Faculty of Economics, Technical University of Košice, **Slovak republic**
olga.nosalova@tuke.sk

3.1 Introduction
3.2 Approach to balance of trade according to value added
3.3 Export, import and balance of trade of the Slovak Republic according to traditional measurement and value added
3.4 Conclusion
References

http://dx.doi.org/10.14505/gvcifpieu.2018.ch 3

Balance of trade of the Slovak Republic according to the traditional measurement and value added

Oľga Nosáľová
Faculty of Economics, Technical University of Košice, **Slovak republic**
olga.nosalova@tuke.sk

Abstract:
Examination of foreign trade according to the value added allows the compilation of the balance of trade according to exports of domestic value added in exports and foreign value added in imports. In this chapter, according to this approach, the development of balance of trade of the Slovak Republic is compared to the world, OECD and non-OECD countries with traditional approach according to gross indicators of export and import for the period 1995-2018..

Keywords: the Slovak Republic, gross trade balance, balance of trade according to the trade value added, OECD countries, non-OECD countries.

JEL Classifications: F00, F10, F14. F19, F60, F62

3.1 Introduction

In the previous chapter, we have explained the decomposition of foreign trade in order to identify and analyze the participation of countries in vertical international division of labor and in global value chains. We have compared the development of foreign trade of the Slovak Republic according to the gross (traditional) measures and according to a relatively new approach - by added value. At the same time, this approach makes it possible to ascertain the differences in the bilateral foreign trade relations of the Slovak Republic in terms of value added, as compared to values in gross terms. In this chapter we analyze a balance of trade of the Slovak Republic with the world, OECD countries and OECD countries.

3.2 Approach to balance of trade according to value added

The country's balance of trade is based on the gross commercial value of goods and services leaving and entering the country, which do not adequately capture the fact that some goods and services cross the borders of several countries until a final product is created and subsequently exported. Balancing the value added trade (BOT - Balance of Trade) is the logical consequence of changing a country's export and import perspective when there is multiple export or import of the same value contained in intermediate or final output. Real export and import of a given country do not include

items that are counted multiple times for export and import. Nagengast and Stehrer (2015) state that just vertical specialisation is the factor responsible for the difference between BOT by gross measurement and BOT by value added. Johnson and Noguera (2012) emphasize that bilateral balance of trade in gross terms may differ materially from bilateral balance of trade according to value added:

Aggregate BOTs (country: the world) are the same in both cases (according to gross measurement also according to value added);

Bilateral BOTs (country: country, or country: grouping of several countries) varies according to gross measures and value added.

In the absence of intermediate trade, bilateral and aggregate balances of trade would be the same. Derviş Kemal, Meltzer, J. P., and Foda K. (2013) explain the case where the total balance of trade of a country (country: world) is the same according to gross reporting and also according to value added, when calculating exports and imports of domestic and foreign goods by value added, imports and exports cancel each other. They rely on the Benedetto table (2012) explaining which components enter the value added export and import and which and why they cancel each other (Table 1):

- The country's gross export consists of three components:
  1a) domestic value added remaining abroad;
  1b) domestic value added, which returns home via imports;
  1c) foreign value added incorporated in exports.
- Similarly, the reported gross country import includes:
  2a) foreign value added remaining in the country of import;
  2b) domestic value added of the country included in its imports (it returns);
  2c) imported foreign value added, which is later exported.

Items 1b), 1c) are cancelled out by items 2b). 2c).

Table 3.1 Equivalence of gross balance of trade and balance of trade with value added on the World Trade Level according to Benedetta

item	(1) export = (1a)+(1b)+(1c)	(2) import = (2a)+(2b)+(2c)	balance
Gross balance of trade with the world (1)-(2)	(1a) Domestic value added that stays overseas	(2a) Foreign value added that stays home	Domestic value added that stays overseas minus Foreign value added that stays home
	+	+	
	(1b) Domestic value added that will return home in imports	**(2b) Domestic added value that is embedded in imports**	
	+	**+**	
	(1c) Foreign added value that is embedded in exports	**(2c) Foreign value added that will be embedded in exports**	
Value-added balance of trade with the world (1a)-(2a)	(1a) Domestic value added that stays overseas	(2a) Foreign value added that stays home	Domestic value added that stays overseas minus Foreign value added that stays home

Note: gray fields and words in bold = items that are cancelled by export and import.

Source: Compiled by the author according to Benedetto, John B. (2012)

Export by value added includes: 1a) only domestic added value remaining abroad. Import by value added includes: (2a) only foreign added value remaining in the country of import. Balance of Trade by value added - is the difference between exports of domestic value added that remain abroad 1a) and the import of foreign added value remaining in the country of import 2a).
The sum of countries' bilateral balances of trade according to value added (= the sum of bilateral BOTs of one country with all the countries) equals the country's total balance of trade with the world. As a result, the bilateral trade deficit by value added with one country must be offset by changes in other value added bilateral balances of trade. When looking at bilateral balances of trade in gross terms, the surplus of exporters of final products, and the deficits of importers of these products, are found to be exaggerated and overstated, as they also include the added value of foreign inputs. The TiVA concept does not change the country's overall balance of trade but can significantly change bilateral balances of trade - reallocate surpluses and deficits across partner countries.

3.3 Export, import and balance of trade of the Slovak Republic according to traditional measurement and value added

The subject of this part of the thesis is based on the presented theoretical backgrounds on the importance of foreign trade monitoring in terms of value added, to show how foreign trade is being measured by the value added and comparing these results with the foreign trade indicators of the Slovak Republic according to gross measurement. At this stage of the analysis, we want to show involvement of the Slovak Republic in simple and complex GVCs by means of a detailed decomposition of gross exports and gross imports into value added components according to Benedetto (2012), whose structure we described in Section 2.2. of this book. We will use the data and indicators of the TiVA database, which was last updated in 2016 and available data for 1995-2011, and we will identify the actual export and import of the SR by value added for all industries. We compare balance of trade of the Slovak Republic:

- total (with the world) by gross measurement with total BOT by value added,
- the balance of trade of the Slovak Republic with a group of OECD member countries (34 countries in total) by gross measurement and by value added,
- the balance of trade of the Slovak Republic with a group of non-OECD countries (27 specific countries + 1 group = rest of the world) by gross measurement and by value added.

Gross exports of the Slovak Republic (EXGR SVK) increased 7 times (see chapter 2) thanks to the fact that the liberalization of the foreign trade of the Slovak Republic (especially after EU accession) allowed for more intensive entry into the vertical international division of labor. The Slovak Republic is more intensely using foreign inputs, which are also used for export goods and services, which suggests that gross exports include, besides domestic value added, also foreign value added. In 1995, 68% of the gross exports of the Slovak Republic accounted for 21% of the domestic value added (EXGR_DVA - Domestic Value Added as a Share of Gross Exports) and 31.79% of the foreign value added (EXGR_FVA - Foreign Value Added as a Share of Gross Exports). With the growth of EXGR SVK, the ratio of values added changed in favor of foreign value added. Over the entire period in gross exports, the domestic value added prevails, but its drops by 14.94 percent for the period 1995-2011 also means an increase in foreign value added in exports (+14.94 percent). A rise in domestic value added occurred in 2009 during the financial crisis, but is again decreasing after 2009 and the foreign

value added in exports is growing, suggesting the resumption of trade relations within the GVC.
The knowledge of EXGR_DVA SVK and EXGR_FVA SVK is not sufficient to fully understand how the Slovak Republic joins the GVC as these indicators do not indicate, for example, whether or not the exported value added remained abroad.
Intermediate trade can cause the exported value added to return back to the Slovak Republic either in the form of an intermediate product, which will get processed and exported, for example, in the form of a final product. In Table 3.2 we describe - according to Benedetto, John B. (2012) - the decomposition of EXGR SVK and IMGR SVK that also allows us to use this data to ascertain balance of trade of the Slovak Republic by gross measurement and by value added. We can see how much of the domestic value added returns to the Slovak Republic, what part of imported foreign value added definitely stays in the Slovak Republic and what part will become part of the export.

Table 3.2 Domestic and foreign value added in gross exports of the Slovak Republic, 1995 and 2011, mil. USD, %

	1. Gross EXP SR, out of which:	1a) domestic VA remeining abroad	*1b) domestic VA returning to the SR as part of IMP*	*1c) foreign value added incorporated into EXP SR*	2. Gross IMP SR, out of which:	2a) IMP foreign value added remaining in the SR	*2b) domestic value added incorporated into IMP SR*	*2c) IMP of foreign VA, which the SR later exports*
1995	10 022.1	6 776.2	*59.9*	*3 186.0*	9 666.6	6 420.7	*59.9*	*3 186.0*
1996	10 287.6	6 458.2	*52.5*	*3 776.9*	12 674.5	8 845.2	*52.5*	*3 776.9*
1997	10 959.8	6 728.3	*50.8*	*4 180.7*	13 110.8	8 879.3	*50.8*	*4 180.7*
1998	12 783.9	7 573.3	*61.9*	*5 148.7*	15 313.1	10 102.5	*61.9*	*5 148.7*
1999	12 122.7	7 271.0	*45.2*	*4 806.6*	13 115.7	8 264.0	*45.2*	*4 806.6*
2000	14 120.5	7 846.4	*46.5*	*6 227.7*	14 707.1	8 432.9	*46.5*	*6 227.7*
2001	15 280.8	8 029.3	*49.6*	*7 201.9*	17 055.2	9 803.7	*49.6*	*7 201.9*
2002	17 009.8	9 147.7	*48.3*	*7 813.8*	18 872.5	11 010.4	*48.3*	*7 813.8*
2003	25 162.9	12 925.4	*82.2*	*12 155.3*	25 870.5	13 633.0	*82.2*	*12 155.3*
2004	31 360.1	16 546.4	*116.6*	*14 697.1*	32 613.8	17 800.0	*116.6*	*14 697.1*
2005	35 527.9	18 677.3	*130.0*	*16 720.6*	37 911.1	21 060.5	*130.0*	*16 720.6*
2006	44 489.2	22 364.6	*147.6*	*21 977.0*	46 847.3	24 722.7	*147.6*	*21 977.0*
2007	59 865.0	30 816.3	*205.6*	*28 843.1*	60 887.8	31 839.1	*205.6*	*28 843.1*
2008	70 301.9	37 556.3	*280.5*	*32 465.1*	73 037.6	40 291.9	*280.5*	*32 465.1*
2009	53 138.4	29 929.9	*166.3*	*23 042.3*	53 741.5	30 533.0	*166.3*	*23 042.3*
2010	59 318.9	32 007.4	*183.5*	*27 127.9*	59 731.0	32 419.6	*183.5*	*27 127.9*
2011	70 231.9	37 189.0	*225.8*	*32 817.0*	69 926.0	36 883.2	*225.8*	*32 817.0*
Change 1995-2011	60 209.8 about 7x	30 412.8 about 5x	*165.9 about 3x*	*29 631.0 about 10x*	60 259.4 about 7x	30 462.5 about 9x	*165.9 about 3x*	*29 631.0 about 10x*

Source: Compiled by the author using the TiVA database (OECD b, 2018)

Table 3.2 shows data that measure the foreign trade of the Slovak Republic with the world. According to Table 1, there are therefore items in Table 2 that cancel each other. Real exports of the Slovak Republic by value added include item 1a) - that is, only domestic value added remaining abroad. The real import of the Slovak Republic by value added includes item 2a) - only the foreign value added that remains in the Slovak Republic. However, the export of domestic value added (EXGR_DVA SVK) is divided into two parts: 1a) Domestic value added, which remains abroad + 1b) domestic value added, which returns to the Slovak Republic - export and import of this value added cancel each other out.

In 1995, the Slovak Republic exported domestic value added (EXGR_DVA SVK) worth 6,836.1 mil. USD, some of which returned to the country (59.9 mil. USD) in the form of intermediate or final goods. The actual export of Slovak value added, which definitely stays abroad, is 6,776.2 mil. USD. Over the period 1995-2011, the EXGR increased 7-fold, the export by value added, which definitely stays abroad, increased 5-fold. The exported and imported domestic and foreign values added exceeded the gross exports of the Slovak Republic into the rest of the world multiple times, with an increase of items 1b), 1c), 2b) and 2c) showing that, apart from the Slovak Republic's involvement in simple GVCs, the country is also becoming a part of complex GVCs. An almost 10-fold increase in foreign value added in the export of the Slovak Republic (1c and its counterpart 2c) shows the growing importance of business networks in the GVC of the world for the Slovak Republic.

Table 3.3 Balance of trade of the Slovak Republic and the world, Slovak Republic and the OECD and Slovak Republic and non-OECD countries according to the gross measurement and value added, 1995 and 2011, mil. USD

	(1) BALVAFD: SVK:WOR mil. USD	(2) BALVAFD: SVK:OECD mil. USD	(3) BALVAFD: SVK: non-OECD mil. USD	(4) BALGR: SVK: WOR mil. USD	(5) BALGR: SVK: OECD mil. USD	(6) BALGR: SVK: non-OECD mil. USD	(5) – (2) BALGR - BALVAFD SVK:OECD mil. USD	(6) – (3) BALGR - BALVAFD SVK: non-OECD mil. USD
1995	355.5	173.9	181.5	355.5	513.9	-158.4	340.0	-339.9
1996	-2 387.0	-1 977.0	-410.0	-2 387.0	-1 508.0	-879.0	469.0	-469.0
1997	-2 151.0	-1 554.8	-596.2	-2 151.0	-592.9	-1 558.1	961.9	-961.9
1998	-2 529.2	-2 290.3	-238.9	-2 529.2	-1 786.9	-742.3	503.4	-503.4
1999	-993.0	-580.5	-412.5	-993.0	224.4	-1 217.4	804.9	-804.9
2000	-586.6	55.2	-641.8	-586.6	1 014.5	-1 601.1	959.3	-959.3
2001	-1 774.4	-426.3	-1 348.1	-1 774.4	1 436.3	-3 210.7	1 862.6	-1 862.6
2002	-1 862.7	-168.5	-1 694.2	-1 862.7	2 252.5	-4 115.2	2 421.0	-2 421.0
2003	-707.6	686.4	-1 394.0	-707.6	3 084.9	-3 792.5	2 398.5	-2 398.5
2004	-1 253.6	1 193.3	-2 446.9	-1 253.6	4 683.6	-5 937.2	3 490.3	-3 490.3
2005	-2 383.2	804.2	-3 187.5	-2 383.2	5 626.4	-8 009.7	4 822.2	-4 822.2
2006	-2 358.2	1 934.0	-4 292.2	-2 358.2	8 377.1	-10 735.3	6 443.1	-6 443.1
2007	-1 022.8	3 926.3	-4 949.1	-1 022.8	12 627.2	-13 650.0	8 700.9	-8 700.9
2008	-2 735.7	2 055.3	-4 791.0	-2 735.7	8 009.0	-10 744.6	5 953.7	-5 953.6
2009	-603.1	4 300.8	-4 904.0	-603.1	11 396.7	-11 999.8	7 095.9	-7 095.8
2010	-412.1	4 918.9	-5 331.1	-412.1	12 250.9	-12 663.0	7 332.0	-7 331.9
2011	305.8	5 914.5	-5 608.6	305.8	14 582.5	-14 276.7	8 668.0	-8 668.1
Change 1995-2011	-49.7	5 740.6	-5 790.1	-49.7	14 068.6	-14 118.3	8 328.0	-8 328.2

Key: BALGR = gross balance of trade; BALVAFD = value added balance of trade; is the difference between domestic value added in foreign final demand (FFD DVA) and foreign value added in domestic final demand (DFD FVA).

Source: Compiled by the author using data from the TiVA database (OECD b, 2018)

Decomposition of the country's EXGR and IMGR in relation to one country or a group of countries revealed that items 1b, 1c, 2b and 2c would not mutually cancel each other as was the case in the decomposition of EXGR and IMGR in relation to the world, as not every domestic exported value added has to return from the country (group of countries) - they can export it to a third country and return it to the country of origin. In bilateral relationships, consideration should be given to the movement of values across the GVS. Therefore, the balance of trade of the SR with the world by gross

measurement is equal to the balance of trade according to value added, but already in bilateral balance of trade this is not the same (Table 3.3).
Table 3.3 shows the decomposition of gross exports and gross imports according to the template by Benedetto, John B. (2012), which we listed in Table 3.1. We report the Slovak Republic's balance of trade with the world by gross measurement and value added and we compare them for the period of years between 1995 and 2011.

Table 3.4 Balance of trade of the Slovak Republic and the world by gross measurement and by value added and their components, 1995 and 2011, mil. USD

Gross balance of trade with the world BALGR = (1) - (2)		(1) export = (1a)+(1b)+(1c)			(2) import = (2a)+(2b)+(2c)			Balance of trade with value added with the world BALVAFD = (1a) - (2a)	
1995	2011	Components of gross export	1995	2011	Components of gross import	1995	2011	1995	2011
355.5	305.8	(1a) Domestic value added that stays overseas	6 776.2	37 189.0	(2a) Foreign value added that stays home	6 420.7	36 883.2	355.5	305.8
		+			+				
		(1b) Domestic value added that will return home in imports	59.9	225.8	(2b) Domestic value added that is embedded in import	59.9	225.8		
		+			+				
		(1c) Foreign value added that is embedded in exports	3 186.0	32 817.0	(2c) Foreign value added that will be embedded in exports	3 186.0	32 817.0		
		(1) gross export = (1a)+(1b)+(1c)	10 022.1	70 231.8	(2) gross import = (2a)+(2b)+(2c)	9 666.6	69 926.0		
Foreign value added that will be included in the Balance of Trade Export with value added with the world BALVAFD= (1a) - (2a)		(1a) Domestic value added that stays overseas	6 776.2	37 189.0	(2a) Foreign value added that stays home	6 420.7	36 883.2	Balance of trade with value added with the world BALVAFD = (1a) - (2a)	
355.5	305.8							355.5	305.8

Source: Compiled by the author according to the Benedetto, John B. (2012) scheme listed in Table 3.1 and data contained in the TiVA database (OECD b, 2018)

Net exports by value added are equal to net exports by gross measurement - in 1995, these net exports amounted to 355.5 mil. USD (1.78% of GDP). In 2011, net exports remained positive, but lower - 305.8 mil. USD (0.31% of GDP). What we know about the development of foreign trade during the period between those years is that for a long period imports were higher than exports (Table 3.5). Using the decomposition of gross exports and imports of the Slovak Republic, we have identified which added value moves between the Slovak Republic and the world at least twice, and for the purpose of calculation of net export based on value added we do not take these values added into account as they cancel each other out in the process of export and import.

In Table 3.3 and in the graphs (Figure 3.1 and Figure 3.2), we compare bilateral balance of trade of the Slovak Republic with OECD countries and non-OECD countries by value added and by gross measurement. We found that over the period 1995-2011 six different situations occurred, as summarized in Table 3.7.

Table 3.5 Balance of trade of the Slovak Republic with the world, with OECD countries and non-OECD countries according to value added and gross measurement, 1995-2011

No.	BALVAFD SVK : OECD	BALVAFD SVK: non-OECD	BALGR SVK : OECD	BALGR SVK: non-OECD	BALGR ≡ BALVAFD SVK : WOR	Years
1.	+	+	+	-	+	1995
2.	+	-	+	-	+	2011
3.	-	-	-	-	-	1996, 1997, 1998,
4.	+	-	+	-	-	1999, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010
5.	+	-	+	-	-	2000
6.	-	-	+	-	-	2001, 2002

Key: BALVAFD = BOT by VA; BALGR = BOT gross; + positive BOT, - negative BOT;
Source: Compiled by the author using data in Table 5

The most common is situation No. 4 (Table 3.5). In the above mentioned years, the total balance of trade of the Slovak Republic with the world was negative (gross and also according to value added), with OECD countries positive (gross, also according to value added), with non-OECD countries negative (gross, also according to value added). This means that a group of countries outside of the OECD was involved in the negative balance of trade of the Slovak Republic with the world. In the last year, 2011, the situation changed considerably - the Slovak Republic, after a long period of time, achieved a positive gross BOT as well as a positive BOT by value added with the world, with the OECD also positive and negative with a group of countries outside the OECD.

Bilateral balance of trade of the Slovak Republic according to both approaches show that the Slovak Republic had a negative balance of trade for the whole period (with the exception of 1995) with countries outside the OECD, a negative BOT by value added with OECD countries (excluding 1995 and 2000), but since 2003 the BOT by value added has only ever been positive with OECD countries. However, according to the gross measurement, OECD countries have started to achieve a positive BOT since 1999. The different BOT results according to gross measurement and according to value added point to the need for a deeper analysis of foreign trade relations of the Slovak Republic. By decomposing the gross exports and gross imports into individual components, it is possible to identify the causes of the observed results on the bilateral balances of trade of the Slovak Republic.

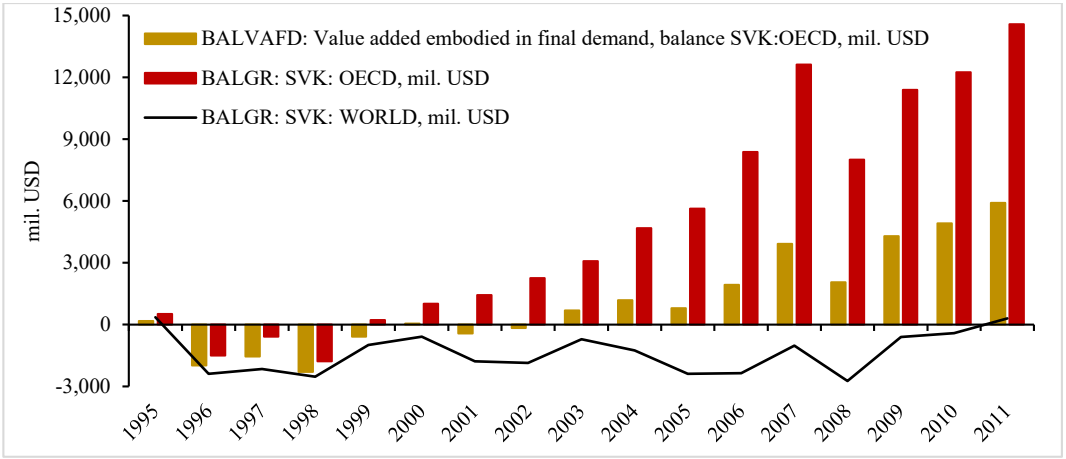


Figure 3.1 Trade of balance of the Slovak Republic and the world, Slovak Republic and the OECD by gross measurement and according to value added, 1995 and 2011, mil. USD
Source: Compiled by the author according to data from the TiVA database (OECD b, 2018)

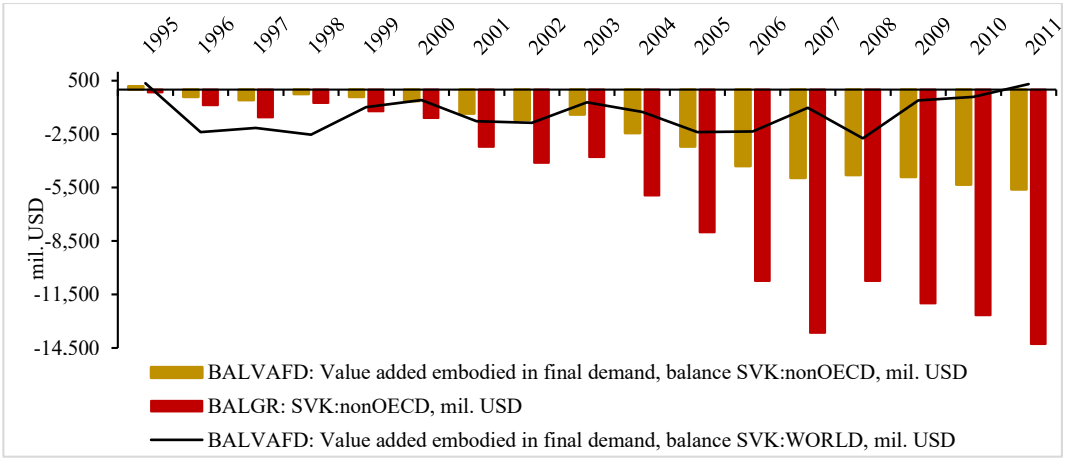


Figure 3.2 Balance of trade of the Slovak Republic and the world, Slovak Republic and the non-OECD by gross measurement and according to value added, 1995 and 2011, mil. USD
Source: Compiled by the author according to data from the TiVA database (OECD b, 2018)

However, attention should be drawn to the fact that since 1995 we have seen a sharp increase in the difference between the gross balances of trade and balances of trade according to the value added of the Slovak Republic - with the OECD countries in favor of the growth of the positive balance of the BOT and with the non-OECD countries towards a negative BOT, and we consider these to be mirror differences (Table 3.4, Figure 3.1 and Figure 3.2). With an increase of the positive balance of trade of the Slovak Republic with the OECD countries, the negative balance with the non-OECD countries increased (Table 3.5).

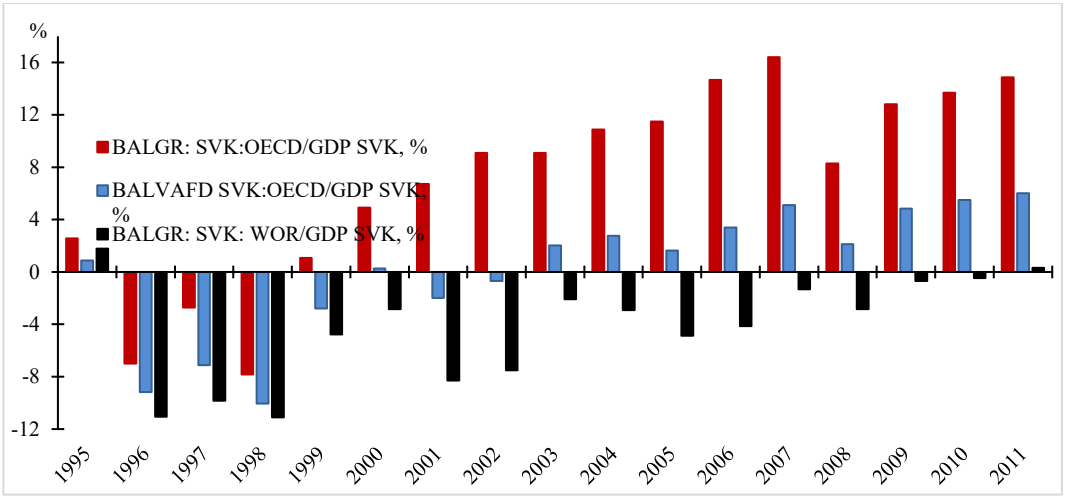


Figure 3.3 Share of the balance of trade of the Slovak Republic with the world and with OECD countries on GDP, 1995-2011, gross measurements and value added, %
Source: Compiled by the author according to data from the TiVA database (OECD b, 2018)

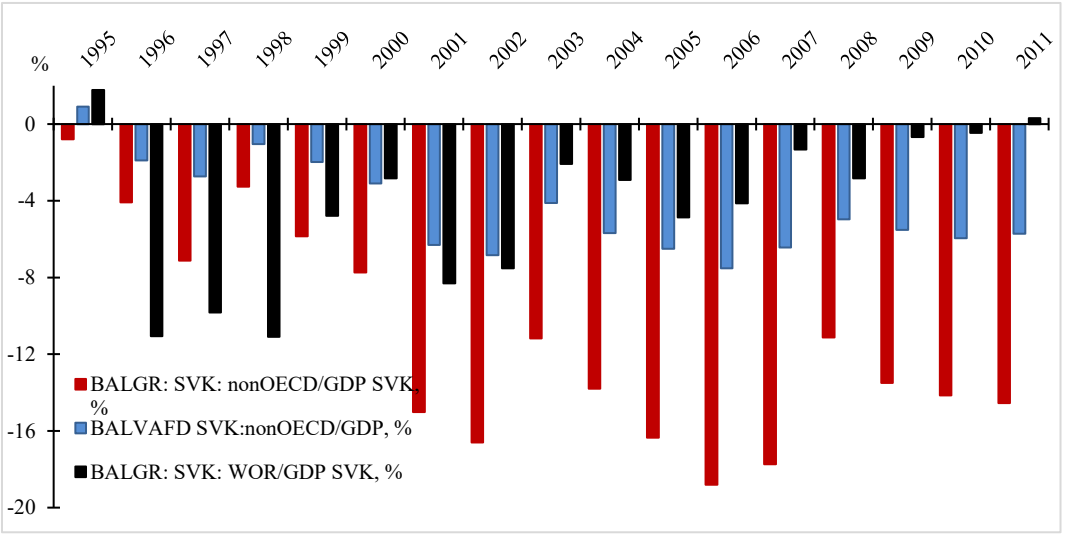


Figure 3.4 Share of the balance of trade of the Slovak Republic with the world and with non-OECD countries on GDP, gross measurements and value added, %
Source: Compiled by the author according to data from the TiVA database (OECD b, 2018)

The trade surplus with OECD countries and the deficit with non-OECD countries in absolute terms (mil. USD) increased over the reference period. The comparison of the share of the Slovak Republic's balance of trade on GDP with the world, the OECD and the non-OECD by gross weight and value added is shown in the graphs Figure 3.3. and Figure 3.4.
The differences between the BOT/GDP ratio by gross - traditional measurement are large. Such a finding raises the need to review the associated macroeconomic problems.

3.4 Conclusion

The rise in global value chains fundamentally changes the structure of trade flows and makes the analysis of international trade more difficult. It is no longer true that the value of exported goods and services of the country is generated "at home". Traditional gross trade statistics do not reflect the true degree of interconnectedness and interdependence of economies. They do not reflect the actual share of domestic producers and producers from other countries in the final production but also in intermediate products that are subject to export and import.

By decomposing the gross exports and gross imports we found that during the period under review, the Slovak Republic, in addition to the growth of foreign trade itself, reduced the share of domestic value added in exports and proportionally increased the share of foreign value added in exports. This fact indicates that the economy of the Slovak Republic is increasingly involved in the vertical division of labor, and in the fragmentation of production between countries.

Within the framework of the export and import of value added there is a repeated shift of the same value added between the Slovak Republic and the world, between the Slovak Republic and the OECD countries and non-OECD countries, which means that the Slovak economy has become part of simple and complex global value chains.

The observed increasing divergences between bilateral gross balance of trade of the Slovak Republic with OECD and non-OECD countries with value-added balances of trade point to the fact that net export earnings should be reassessed because, according to the value added, they are smaller than according to traditional reporting.

References

BENEDETTO, J. B. (2012). Implications and interpretations of value-added trade balances. J. Int'l Com. & Econ., 4, 39. www.usitc.gov/journals/Added_Trade_Balance_final_7_12.pdf

DERVIŞ, K., MELTZER, J. P., FODA, K. (2013). Value-Added Trade and Its Implications for International Trade Policy. The Brookings Institution, April 2, 2013 https://www.brookings.edu/opinions/value-added-trade-and-its-implications-for-international-trade-policy/

JOHNSON, R. C., NOGUERA, G. (2012). Accounting for Intermediates: Production Sharing and Trade in Value Added. Journal of International Economics, vol. 86, no. 2, pp. 224–236. https://econpapers.repec.org/article/eeeinecon/v_3a86_3ay_3a2012_3ai_3a2_3ap_3a224-236.htm

NAGENGAST, A.J., STEHRER, R. (2015). On the interpretation of trade imbalances. In: J. Amador and F. di Mauro (eds.), The age of global value chains: Maps and policy issues, CEPR e-book. https://voxeu.org/content/age-global-value-chains-maps-and-policy-issues

OECD. (2018a). Trade in Value Added. http://www.oecd.org/sti/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm

OECD. (2018b). OECD. Stat Trade in Value Added (TiVA): December 2016 https://stats.oecd.org/

Chapter 4

Structural changes of the Slovak economy

by Júlia Ďurčová
Faculty of Economics, Technical University of Košice, **Slovak republic**
julia.durcova@tuke.sk

and Dominika Oravcová
Faculty of Economics, Technical University of Košice, **Slovak republic**
dominika.oravcova@tuke.sk

4.1 Introduction
4.2 Literature review
4.3 Stylized facts
4.4 Methods and model specification – Input-output approach
4.5 Results
4.6 Conclusion
References

http://dx.doi.org/10.14505/gvcifpieu.2018.ch 4

Structural changes of the Slovak economy

Júlia Ďurčová
Faculty of Economics, Technical University of Košice, **Slovak republic**
julia.durcova@tuke.sk

Dominika Oravcová
Faculty of Economics, Technical University of Košice, **Slovak republic**
dominika.oravcova@tuke.sk

Abstract:
Due to international fragmentation of production in world economy we observe changes in international competitiveness. Intention of countries to participate in new international division of labor based on participation of country in the global value chains reveals lot of opened questions. Understanding effects of exports for domestic production as well as value added creation and employment can provide important development policy insights. Since the differences between gross exports and value added in exports are already considerable and growing, assessing the competitiveness of economies through traditional indicators based on gross export statistics is becoming increasingly less relevant. In order to examine structural and intra-industrial linkages we implement input-output analysis that is based on the use of input-output tables that provide crucial information on value added within individual segments. The results indicate that Slovak industries are strongly linking to foreign demand. Almost all value added of top Slovak exporting sectors is generated by foreign demand. This confirms the high risk of vulnerability to external shocks. The results prove that production multiplier over analysed period decreases, the most in exporting sectors. As expected, the exporting sectors generated lower product multiplication effect for Slovak economy. The sectors with dominant services share multiply more value added by unit of production compared to manufacturing exporting sectors. Moreover, the multiplier of value added for example for construction sector rises. However, the exporting sectors still lagged and their effect on domestic value added is even weakening.

Keywords: global value chains, export, input-output analysis, multipliers, value added

JEL Classification: F14, F62, C67

4.1 Introduction

Recent decades have seen the emergence of global supply chains in which production stages are divided and distributed across countries. The flows of value added across countries rather than goods have become an increasingly debated topic due to the rapid international integration of production processes. The questions ranking from how global supply chains influence income distribution to how

they transmit shocks across borders, how fragments of value added are combined via the global supply chain to form final goods (Foster-McGregor, Stehler, 2013, Johnson, Noguera, 2012).
The process of fragmentation is often analyzed in literature under the names such as vertical specialization, outsourcing, offshoring or trade in task. Due to international fragmentation of production in world economy we may observe changes in understanding of international competitiveness. Intention of countries to participate in new international division of labor based on participation of country in the global value chains reveals lot of opened questions for industrial policy framework. Traditional measures of export performance provide biased information for policy decisions (Lábaj 2014; Habrman, 2013). As a result, many authors focus on estimations of domestic value added shares in unit of exports that is used as a measure of vertical specialization in foreign trade. Examination of relative importance of individual sectors of the economy in the international production chains naturally corresponds with a requirement to use appropriate methodology (Lábaj, 2013). In order to examine structural and intra-industrial linkages, empirical literature tend to implement input-output analysis that is based on the use of multiregional input-output tables that provide crucial information not only on value added within individual segments of production chains but also on quantitative and qualitative features of inputs (labor and capital) (Backer and Miroudot, 2014).

4.2 Literature review

Increasing global production fragmentation has allowed exporting more to rely less on domestic inputs for production. The domestic content in exports has been declining in most countries. Understanding effects of exports for domestic production as well as value added creation and employment can provide important development policy insights. Since the differences between gross exports and value added in exports are already considerable and growing, assessing the competitiveness of economies through traditional indicators based on gross export statistics is becoming increasingly less relevant. For example, the firms in China import materials or parts to be further assembled, processed and exported. Domestic value added in Chinese exports may be far less than actual gross exports. Input-output tables at the sector level enable to assess foreign content in exports, which simply equals the ratio of net exports to gross exports at the firm level. Domestic value added in Chinese processing exports was around 50 percent in 2000, and it gradually increases to 62 percent in 2006. Such increase is wide spread across industries as well as across destination countries. Export processing firms substitute imported materials with domestic materials which explains the rising domestic value added. This result suggests that China may be moving up the global production chain and is no longer only responsible for the final stage of productions. However, foreign content remains high. Chinese exports policy analysis based on gross trade allows will grossly overestimate the impact of Chinese exports (Kee and Tang, 2016).
Empirical literature on input-output analysis concentrates on examination of equilibrium in the individual country. Such studies are based on the use of input-output tables due to their precise ability to monitor not only value added in export industries but also on the individual levels of a production chain. The recent studies using input-output approach concluded that there are large differences between EU countries (Johnson, 2014). EU countries from Central and Eastern Europe (CEE) generate about 5% lower domestic value added compared to old EU (EU15) countries. Foreign value added represents a larger share of CEE exports than the EU-15. Although the CEE countries have

become major suppliers of intermediates and components, semi-final products and final products, they are shown to have an increasing share of imports included in their exports. In the CEE, the share in global value chains (GVCs) is higher than the EU-15 average, so they can improve their positions in the long run and increase domestic value added in exports (Vrh, 2015).

The small and open countries such as Ireland, Estonia, Malta, the Czech Republic and the Slovak Republic indicated the lowest importance of domestic demand for their output creation. The collapse in international trade due to the economic recession in 2009 led to a substantial increase in domestic demand, particularly in India, Canada, Russia, China, Brazil and the rest of the world. Among the smaller economies, the Slovak Republic was affected significantly, as decline in demand for domestic products in foreign markets led to an increase of output generated by domestic demand for more than 2 percent (Lábaj, 2013, 2014). The absolute number of jobs reduced in the majority of developed countries as well as the share of labor in value added creation decrease. However, the significant changes appeared in the internal structure of the workers. For example, in Germany and France during the period of 1995-2009 the share of high skilled labor in value added creation increased and opposite the share of low-skilled labor decreased. Thus, the loss of jobs occurred mainly in case of low-skilled work positions. In the Slovak Republic, the share of capital and labor in value added creation has unusual unbalanced ratio (capital has unusual high share and labor low share). High share of capital is typical for the electronics industry. This development is related to the massive inflow of foreign capital. In Germany and France, the share of capital in the value added creation declined in favor of work. The high share of high skilled labor on the value added creation is due to the high contribution of the service sector in production of vehicles in France and Germany and conversely, with low share of input from services in the Slovak Republic and other CEE countries. The share of high skilled labor in value added creation in the industry of vehicles production in the Slovak Republic was one of the lowest in the EU. Therefore, the Slovak Republic competed mainly with large stock of (foreign) capital and average high proportion of medium skilled labor. Further development of the automotive industry in the Slovak Republic will have significant effects for the whole economy only if its participation in global value chains will increase. (Slušná, Balog et al., 2015)

The export of the Slovak Republic in the period 1995 -2009 generates directly and indirectly approximately 40% of value added and employment in the Slovak Republic. Despite the very high openness of the Slovak economy and regular high growth of exports, GDP and employment is not growing as the economists, politicians and the public would expect. The reason is that the Slovak exports create low value added, which is a serious problem of the Slovak economy. Despite the rising importance of export in the Slovak Republic, most of jobs are created by domestic demand. Employment generated per unit of value added in sectors producing for export correspond with the sectors producing for the domestic demand. The extremely small proportion of manufacturers of modules and systems compared to the production of finished automobiles is the reason why the share of export on value added is low. The greater part of the value added is generally generated by manufacturers of modules and systems, including their development (Habrman, Kočišová, Lábaj, 2013). A deeper look at the sectorial structure of the economy shows that the Slovak three most exporting sectors - Automotive, Electrical and Optical Equipment and basic metal and fabricated metal account for up to 50% of the economy's exports, but only 40% of the effects of all exporting sectors on value added and employment. This is mainly caused by the automotive industry, whose production

is highly fragmented, and therefore domestic value added of the export generated in the Slovak Republic represents only 26% Habrman (2013).

Although one job in car manufacturing bring six additional jobs in the rest of the Slovak economy. In 2012, 9% of total employment in the Slovak economy, direct and indirect depends on the automotive industry. The share of value added generated by the automotive industry in national value added is over 11%. The value added generated directly by automotive industry is 4%. The automobile industry generates directly and indirectly 17% of the Slovak economy gross production and create more than 200,000 jobs (9% of total employment). (Luptáčik et al., 2013) For comparison, the economic growth sources of Ireland are based on biotechnology, pharmaceuticals, financial services and IT sectors with high and inelastic wages. Even during the crisis the salaries and labor costs in Ireland grew (the decline occurred in the public sector). Ireland economy beneficed from economic structural changes - traditional industries such as the manufacture of computers has been moved to cheaper countries. However, the loss of these jobs was offset by growth in the service sector. (Brejčák, 2016).

The OECD also states that Slovak Republic needs to reconsideration its position in GVCs. The involvement of the Slovak Republic in GVCs is highly concentrated, with strong involvement in a limited number of industries. With a relatively high share of intermediate inputs used for exports abroad, combined with a relatively low level of the share of domestically produced inputs in third countries' exports, the Slovak Republic is mainly positioned in the downstream activities of GVCs, often involving the assembly or manufacturing of components and parts. This contributes to the relatively limited domestic value added created by exports. Half of the value of exports is value added from abroad embodied in intermediates, compared to one quarter on average in the OECD. There is a great potential for diversification of the economy, which, however, needs an appropriate supply response, driven by skills and innovation. The Slovak economy can make more out of its privileged position in by upgrading and diversifying its supply capacity. This could contribute to increasing the domestic value added created by exports. Competitiveness in GVCs requires strengthening factors of production that are unlikely to cross national borders. This implies mainly investment in human capital and skills (OECD 2013).

4.3 Stylized facts

The type of competitiveness selected by the Slovak Republic was based on low taxes and salaries instead of investments in research and development and quality factors (e.g. quality of institutions, education system or national innovation system). The growth of labor productivity has been achieved mainly by transfers of technologies and organizational innovations in the framework of multinational companies. The Slovak economy achieves a strong position, both in comparison with the Central European economies and with the innovation leaders, only in the area of foreign direct investments and transfer of technologies. Increased arrival of foreign investments into the economy is demonstrated by the high level of a production process. In the 1997-2011, a clear trend towards specialization in certain product types could be seen in the Slovak export of goods. In 2011, more than a half of the Slovak export was provided by only three sectors (MHSR, 2013).

The next figures illustrate the development of the sectors with the higher share on Slovak output creation (such as Construction, Electricity, gas stream and air conditioning supply, Wholesale trade, Retail trade and Real estate activities) and the sectors with the higher export share (Manufacture of

motor vehicle, Manufacture of computer product, Manufacture of basic metal and Manufacture of machinery n.e.c.) see Figure 4.1 and 4.2.

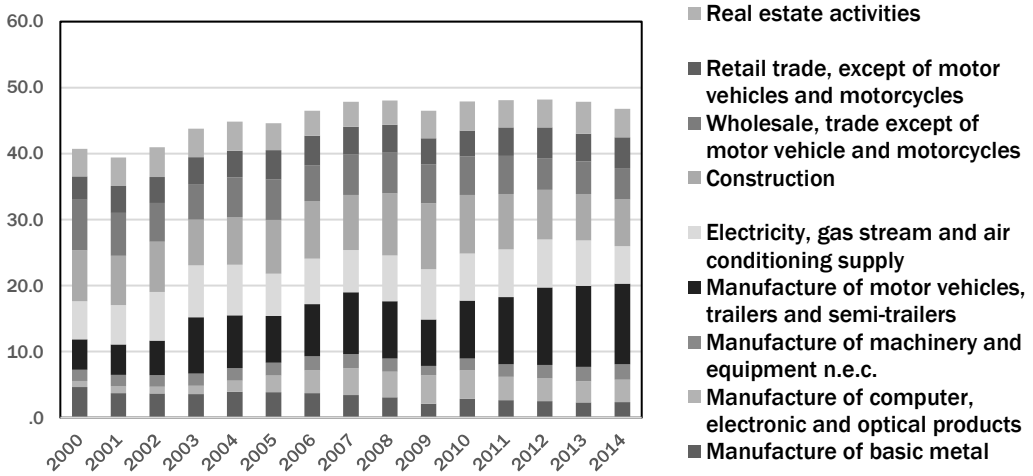


Figure 4.1 Slovak sectors with the higher share on output creation, 2000-2014, %
Source: Compiled by the author (WIOD data)

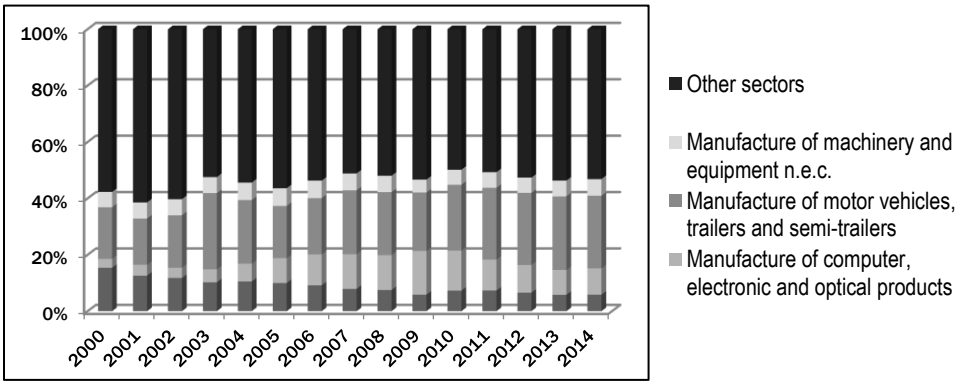


Figure 4.2. Sectors with the higher share on Slovak export, 2000-2014, %
Source: Compiled by the author (WIOD data)

The next tables focused on the main characteristic of the most important industries in terms of production, export and value added creation in the Slovak Republic such as automotive industry - manufacture of motor vehicles, trailers and semi-trailers (that includes the manufacture of motor vehicles for transporting passengers or freight) as well as construction (including general construction and specialized construction activities for buildings and civil engineering works). The construction sector is analyzed mainly for the purpose of comparison of typically domestic sector with high level of domestic value added and employment creation. The source of data is WIOD database that provides

annual time-series of world input-output tables from 2000 to 2014 and provides data on the factor inputs used in production, low, medium and high-skilled workers and capital (for period 1995-2011).
From the data in Table 4.1 a slight change in the share of value added in total output, but in particular a significant increase in export, can be noticed. This growth of exports, as already mentioned, can be associated with the production of the automotive sector, whose share in the total production of the Slovak Republic increased from 4.6% to 12.2% (in connection with the current foreign direct investment of new car manufacturer in the Slovak Republic it can be expected that this share will increase). This is also supported by the growing share of automotive exports in total export, which in 2014 accounted for up to 25.7% of whole export.

Table 4.1 Main characteristics of selected Slovak sectors

	2000	2008	2009	2011	2014
GO (millions of USD)	47,953.6	22,2650.9	19,3954.5	22,8356.7	22,9289.1
VA / GO (%) total	38.4	39.5	41.8	38.9	39.7
EXP / GO (%) total	15.7	31.1	27.6	31.9	35.8
GO automotive / GO (%)	4.6	8.7	7.0	10.2	12.2
GO construction / GO (%)	7.7	9.4	10.0	8.4	7.1
VA automotive / VA (%)	1.9	3.2	2.3	3.6	3.8
VA construction / VA (%)	7.2	9.5	9.7	8.9	8.4
EXP automotive / EXP (%)	18.3	22.4	20.7	25.5	25.7
EXP construction / EXP (%)	0.6	0.8	1.0	0.7	0.7

Note: Automotive = manufacture of motor vehicles, trailers and semi-trailers. GO = gross output, VA = gross value added, EXP=export

Source: Calculated by the author (WIOD data)

On the other hand, the share of construction in the total output is almost unchanged (growth was mainly in the pre-crisis period). Similarly, the share of exports is small, but the significant difference can be observed for the share of value added that is more than 8% in construction, but less than 4% in automotive industry. Construction belongs among the sectors that produce the largest share of value added in the Slovak economy.
In the Slovak Republic, the share of capital and labor in value added creation has unusual unbalanced ratio (capital has unusual high share and labor low share). This development is related to the massive inflow of foreign capital. Contrary, in Germany and France, the share of capital in the value added creation declined in favor of labor. The high share of high skilled labor in the value added creation is due to the high contribution of the service sector in production of vehicles in France and Germany and conversely, with low share of input from services in the Slovak Republic and other CEE countries.

Table 4.2 Share of labor and capital in value added creation for individual industries in the Slovak Republic, 1995 and 2011, %

		1995	2011
automotive	LAB/VA	42	30
	CAP/VA	58	70

construction	LAB/VA	55	33
	CAP/VA	45	67
total industries	LAB/VA	37	39
	CAP/VA	63	61

Note: LAB/VA = share of labor in value added creation, CAP/VA = share of capital in value added creation

Source: Calculated by the author (WIOD data)

The share of high skilled labor in value added creation in the industry of automotive in the Slovak Republic was one of the lowest in the EU. Therefore, the Slovak Republic competed mainly with large stock of (foreign) capital and average high proportion of medium skilled labor. Slušná, Balog et al. (2015). Table 4.2 supports these conclusions and points to a significant change in favor for capital share in the construction sector.

In the EU27 approximately 4.5 % of labor force works in the industrial production whereas in the Slovak Republic this share is 8.1 %. The Slovak Republic is the third most specialized economy in this area in the EU. In the Slovak Republic almost 65 % of production is created by production of motor vehicles and spare parts thereof. Such a high share in the production can be seen in no other EU27 country. Similar situation is in the case of industrial production with medium lower technology where in the EU27 the share in the total employment is on the level of 4.4 % and in the Slovak Republic 7.5 %, which makes 176 thousand workers MHSR (2013).

From the point of view of job creation (see Table 4.3), the construction belongs to the sectors with the highest labor demand. Automotive industry does not directly generate such employment as construction, but its indirect effects are significant. Luptáčik et al. (2013) stated that in 2012, 9% of total employment in the Slovak economy, direct and indirect depends on the automotive industry. The growth rate of employees during period of 1995-2011 was 24%.

The Slovak Republic, like other European countries, experienced considerable skill upgrading of employment. The growth of jobs requiring the medium and high skilled workers increased the demand for high skilled labor and thus it is in contrast with the image of the Slovak Republic as a low-skilled production factory. In addition, the strategy for future industry clearly indicates that new innovative manufacturing systems will need flexible labor force with innovative knowledge level and IT experiences.

The aim of the next investigation is to discuss and compare the position of sectors in term of domestic product and value added creation as well as share of domestic value created by export. Such analysis enables to estimate how the rising export affects the domestic value added creation. Understanding the development of domestic value added of export can provide important development policy insights. Whereby firms in the Slovak Republic import materials or parts to be further assembled, processed and exported, domestic value added in Slovak exports may be far less than actual gross exports.

Table 4.3 Share of persons engaged in total number for individual industries in the Slovak Republic, 1995 and 2011, %

	1995	2011	Growth rate (%)
total industries	100	100	6.83

agriculture, hunting, forestry, fishing	9	4	-57
basic metals and fabricated metal	4	3	-7
manufacturing (total)	27	20	-21
electrical and optical equipment	3	3	4
automotive (transport equipment)	1	1	24
electricity, gas and water supply	2	2	-15
construction	7	9	34
wholesale trade and commission trade	5	7	61
retail trade	5	11	112
other inland transport	5	4	-15
financial intermediation	1	2	46
real estate activities	1	1	15
renting of m&eq and other business activities	5	9	107
public admin and defense	6	6	8
education	9	7	-16
health and social work	6	6	4

Source: Calculated by the author (WIOD data)

4.4 Methods and model specification – Input-output approach

Identification of the individual sectors performance and effects in the economy require structural models and input-output analysis, taking into account the complex links between sectors in the national economy. Backward linkages are the most advanced analyses built on the Leontief inverse matrix and intermediate input matrix. Forward linkages are a slightly less used model. According to Cardanet and Sancho (2006), no general consensus about optimal model has been adopted so far, because each of the methods has its advantages and disadvantages, although models based on the Leontief inverse matrix can be clearly interpreted and are well supported by the theory of production. The Leontief model is based on a symmetrical input-output table, presented for the first time in the 1930s by the so called Nobel Prize winner, Wassily Leontief. The model is based on the equilibrium of resources (supply) and use (demand). Leontief's input-output model allows analysis of cross-sector and interregional structural links in the world economy therefore represented an advantage compared to other macroeconomic models. While aggregated models consider total output in the economy as one product, the Leontief model assumes that outputs from the production process are different goods and services. The interest is focused on the volume of total output as well as on the structure of production. Standard input-output analysis is typically made for one country or region where foreign countries are represented by import and export. By deriving it is possible to obtain an input-output model for two regions or more regions of the world economy.

Leontief's input-output model for one region assumes the division of the economy into the n sectors, with the output of each sector being used to satisfy final demand (households, public administration, investment or exports) or used as an intermediate product for the manufacture of other products (in the same or other sectors). Country's gross output can be expressed as column vector:

$$x = \begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix} \tag{4.1}$$

Final use as the ultimate goal of production serves to satisfy the needs of various economic subjects. Under this notion, we understand the purchase and use of various goods and services by households, investment by firms, final government consumption and export, indicating the final consumption of products and services abroad (foreign demand for products and services). Final demand vector can be written as follows:

$$y = \begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix} \tag{4.2}$$

The matrix Z representing the *n x n* input-output (I-O) matrix of coefficients that stand for intermediate use (specifying units of intermediate goods in the production of one unit of gross output). The matrix Z can be written as:

$$Z = \{z_{ij}\} = \begin{bmatrix} z_{11} & \cdots & z_{1n} \\ \vdots & \ddots & \vdots \\ z_{n1} & \cdots & z_{nn} \end{bmatrix} \tag{4.3}$$

So country ´s gross output has to satisfy the following accounting relationship (Koopman et al., 2014):

$$\begin{gathered} x_1 = z_{11} + z_{12} + \cdots + z_{1n} + y_i \\ \vdots \\ \vdots \\ x_n = z_{n1} + z_{n2} + \cdots + z_{nn} + y_n \end{gathered}$$

The country production system can be written as input-output model as follows:

$$\begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix} = \begin{bmatrix} z_{11} & \cdots & z_{1n} \\ \vdots & \ddots & \vdots \\ z_{n1} & \cdots & z_{nn} \end{bmatrix} \times \begin{bmatrix} 1 \\ \vdots \\ 1 \end{bmatrix} + \begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix} \tag{4.4}$$

By reorganizing the equation (4.4), the gross output vector X can be expresses as (Vrh, 2015):

$$x = Zi + y \tag{4.5}$$

where *i* represents a unit column vector. From the intermediate input matrix *Z* it is possible to calculate the matrix of technical coefficients noted as *A*. From the matrix *A* we can read the structure and volume of direct inputs of different commodities to produce one unit of production in the sector *j*. For example, we can find an answer to the question as how many agricultural products and minerals is used to produce one unit of production in manufacturing. The individual elements of the matrix *A* are noted as a_{ij} and are calculated as follows (Lábaj, 2014):

$$a_{ij} = \frac{z_{ij}}{x_j} \tag{4.6}$$

Therefore the enrolment of the technical coefficient matrix calculation is as follows:

$$A = \mathrm{Z(x)} \tag{4.7}$$

Using equivalent adjustments, we calculate Leontief's inverse matrix L:

$$x = Ax + y \tag{4.8}$$

$$x = (I - A)^{-1}y = Ly \tag{4.9}$$

where I stands for unit matrix (n x n) and (I-A)-1=L represents Leontief inverse matrix. Leontief's inverse matrix links final demand and production. It represents the overall direct and indirect effects for each sector's production when the final demand increase. If the inverse matrix L is multiply by individual component of final consumption (for example export), the getting result will capture the part of the output generated by this component (export). The horizontal sum of the L matrix elements represents the production multiplier, which characterizes the need for both direct and indirect inputs if the final demand for one commodity increased by one. The vertical sum of the Leontief matrix captures the direct and indirect demand of the domestic sector inputs, thus how much domestic output will grow if demand for the sector is increased by an additional unit.
For measuring the domestic and foreign contents, the value-added coefficient vector *v* is defined as:

$$v' = [v'_1 \ \cdots v'_n] \tag{4.10}$$

where v'$_1$ represents the total value added of industry 1 for whole economy. Dividing the elements of the value added vector v' by the elements of the total production vector *x*, we obtain the vector of the direct value added coefficients *v* that give us the value added generated in a given sector per unit of production of the sector.
To find the matrix of value added cumulative coefficients it is necessary to multiply unit vector of direct value added coefficients V (n x n) with Leontief inverse matrix that can be written as:

$$VL = \begin{bmatrix} v_1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & v_n \end{bmatrix} \times \begin{bmatrix} l_{11} & \cdots & l_{n1} \\ \vdots & \ddots & \vdots \\ l_{1n} & \cdots & l_{nn} \end{bmatrix} \tag{4.11}$$

The individual elements of the VL matrix represent directly and indirectly generated value added in a particular sector caused by one final-use unit of the commodity. The multiplier of the value added of the j-commodity is then calculated as the corresponding column sum of the matrix elements. The value added multiplier reflects the value added that generates one final consumption unit of the j-th commodity. Multiplying the matrix VL by final demand y, we obtain the direct and indirect value added generated by one sector of economy.

$$VA = VLy \tag{4.12}$$

To determine value added generated by export or domestic demand, the value in the VA expression is replaced by its part, i.e. by export e (n x 1), or domestic demand d (n x 1) (Habrman, 2013).

$$va = VLe; va = VLd. \tag{4.13}$$

4.5 Results

Multiplier of production express the production of all commodities in the economy necessary to satisfy one unit of final demand for one commodity. It can be calculate as the sum of individual column in the Leontief inverse matrix. It should be noted that the multipliers of production are bigger when the links with domestic production are stronger and weaker with foreign countries (import).

Table 4.4 Results of production multiplier

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Manufacture of motor vehicles, trailers and semi-trailers														
1.72	1.67	1.72	1.83	1.66	1.58	1.55	1.49	1.48	1.47	1.54	1.48	1.55	1.55	1.55
Manufacture of computer, electronic and optical products														
1.33	1.29	1.29	1.27	1.19	1.18	1.17	1.19	1.19	1.22	1.20	1.19	1.12	1.11	1.11
Manufacture of basic metals														
1.96	1.73	1.79	1.74	1.55	1.50	1.46	1.46	1.52	1.59	1.54	1.49	1.46	1.43	1.41
Manufacture of machinery and equipment n.e.c.														
1.68	1.59	1.62	1.62	1.49	1.46	1.46	1.47	1.47	1.47	1.44	1.44	1.49	1.47	1.46
Wholesale, trade except of motor vehicle and motorcycles														
1.98	1.93	1.96	1.84	1.68	1.65	1.63	1.66	1.65	1.57	1.60	1.71	1.76	1.63	1.69
Retail trade, except of motor vehicles and motorcycles														
1.82	1.77	1.68	1.62	1.57	1.55	1.51	1.55	1.56	1.56	1.58	1.68	1.54	1.56	1.53
Construction														
1.98	1.95	1.88	1.91	1.85	1.86	1.82	1.77	1.79	1.80	1.75	1.78	1.70	1.69	1.64
Electricity, gas stream and air conditioning supply														
2.09	2.16	2.23	2.12	1.90	1.81	1.70	1.74	1.87	1.89	1.93	2.03	2.04	2.03	1.87
Real estate activities														
1.43	1.39	1.45	1.45	1.42	1.47	1.42	1.40	1.40	1.45	1.54	1.54	1.52	1.37	1.51

Source: Calculated by the author (WIOD data)

These multipliers are greater than one, since increasing the final consumption of the commodity by one unit causes an increase in production at least by this unit. Based on the results in Table 4.4, it can be stated that the multiplication effect of all sectors decline, the most in Manufacture of computer, electronic and optical product and manufacture of basic metal sectors. The highest multiplication effect for Slovak economy generated the sectors as Electricity, gas stream and air conditioning supply, Construction, Retail and Wholesale trade. As expected, the exporting sectors generated lower multiplication effect. The fall of the multiplier may be due to an increasing dependence on imports.

Table 4.5 Results of value added multiplier

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Manufacture of motor vehicles, trailers and semi-trailers														
0.37	0.35	0.34	0.35	0.32	0.30	0.28	0.29	0.30	0.29	0.31	0.28	0.27	0.26	0.27
Manufacture of computer, electronic and optical products														
0.42	0.33	0.34	0.28	0.23	0.20	0.20	0.18	0.20	0.17	0.19	0.20	0.15	0.15	0.15
Manufacture of basic metals														
0.50	0.51	0.48	0.51	0.51	0.50	0.49	0.49	0.46	0.43	0.43	0.37	0.36	0.36	0.35
Manufacture of machinery and equipment n.e.c.														
0.59	0.56	0.54	0.54	0.53	0.51	0.47	0.47	0.49	0.50	0.50	0.46	0.46	0.45	0.47

Wholesale, trade except of motor vehicle and motorcycles														
0.80	0.79	0.78	0.81	0.82	0.81	0.80	0.80	0.81	0.84	0.83	0.82	0.77	0.79	0.78
Retail trade, except of motor vehicles and motorcycles														
0.83	0.83	0.85	0.86	0.86	0.85	0.85	0.85	0.86	0.87	0.86	0.84	0.85	0.83	0.84
Construction														
0.71	0.67	0.71	0.69	0.67	0.65	0.66	0.69	0.72	0.73	0.72	0.75	0.79	0.75	0.76
Electricity, gas stream and air conditioning supply														
0.53	0.43	0.46	0.54	0.57	0.55	0.62	0.59	0.56	0.57	0.52	0.50	0.50	0.46	0.47
Real estate activities														
0.91	0.91	0.90	0.90	0.90	0.88	0.89	0.90	0.91	0.91	0.89	0.88	0.89	0.91	0.88

Source: Calculated by the author (WIOD data)

The value added multiplier examines the relationship between value added and final demand. This multiplier indicates the value added created by final demand one unit increase. The low values indicate that intermediate consumption is the dominant production input and thus the real value added creation diminish. Otherwise, as the value of multiplier grows, the effect for domestic value added increases. As expected, the sectors with dominant services share as Real estate activities, Retail and wholesale trade, and Construction multiply more value added by unit of production than manufacture exporting sectors (see Table 4.5). Moreover, the multiplier of value added for construction sector rise. However, the exporting sectors still lagged and their effect on domestic value added is even weakening. The results confirm the decreasing multiplication effects of automotive industry as well as others exporting sectors for value added creation in the Slovak Republic during observed period.

The conclusions made above, are even confirmed by comparing the indicator of value added creation across industries (see Table 4.6). Value added indicator specify the share of value added per unit of production. The sectors such as Real estate activities as well as Retail and Wholesale trade noted higher share of value added per unit of production. The lowest value added across exporting sectors generate automotive industry and computer, electronic and optical products manufacturing. Unfortunately, the indicator even decrease during observed period. The automotive sector reduced the share of value added per unit of production during the period, although its total production significantly increased. The reason of this low value added may consist in the limited share of module and system manufacturers compared to the production of finished cars. Then the production of finished cars in the Slovak Republic consists of assembly individual modules together.

The experiences from the world leader in export such as China confirmed the similar conclusions. Chen et. al. (2012) stated that the production of processing exports sectors, which are highly dependent on imported inputs, would similarly generate less domestic value and employment than non-processing export sectors. Traditional manufacturing exports such as textile and garment products generated higher total domestic value added and employment than “high-technology” manufacturing exports such as electric equipment and machinery or telecommunication equipment, computer and other electronic products. Thus, promoting the high-technology industries at the expense of the traditional labor intensive industries may not necessarily lead to greater growth in domestic value added and employment, unless there is much greater room for export growth in the former than in the latter.

Table 4.6 Value added creation across industries

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Manufacture of motor vehicles, trailers and semi-trailers														
0.16	0.15	0.14	0.12	0.13	0.13	0.12	0.13	0.15	0.14	0.15	0.14	0.12	0.11	0.12
Manufacture of computer, electronic and optical products														
0.31	0.24	0.24	0.19	0.16	0.13	0.14	0.10	0.13	0.08	0.10	0.12	0.11	0.11	0.11
Manufacture of basic metals														
0.19	0.26	0.22	0.26	0.30	0.30	0.31	0.31	0.25	0.20	0.23	0.18	0.20	0.21	0.20
Manufacture of machinery and equipment n.e.c.														
0.36	0.35	0.33	0.32	0.33	0.32	0.28	0.27	0.30	0.31	0.32	0.29	0.27	0.27	0.29
Wholesale, trade except of motor vehicle and motorcycles														
0.41	0.41	0.39	0.44	0.49	0.50	0.50	0.49	0.51	0.56	0.54	0.49	0.42	0.50	0.46
Retail trade, except of motor vehicles and motorcycles														
0.49	0.50	0.56	0.59	0.59	0.59	0.60	0.58	0.59	0.59	0.58	0.52	0.60	0.56	0.59
Construction														
0.36	0.33	0.38	0.35	0.34	0.33	0.35	0.38	0.40	0.40	0.41	0.42	0.47	0.44	0.47
Electricity, gas stream and air conditioning supply														
0.21	0.13	0.15	0.21	0.27	0.28	0.35	0.32	0.27	0.27	0.23	0.22	0.21	0.19	0.22
Real estate activities														
0.74	0.75	0.71	0.71	0.71	0.68	0.70	0.71	0.73	0.70	0.63	0.64	0.62	0.72	0.62

Source: Calculated by the author (WIOD data)

The next indicators of domestic value added generated by export can better clarify the position of individual sectors on export strength for the Slovak Republic. The results in Table 4.7 present the share of individual sectors on total domestic value added created by exports. The automotive industry as the top Slovak exporter, generated in 2014 the most value added created by export among all other sectors and its value even increase over time.

Interestingly, the other traditional Slovak exporting sectors are outclassed by the sector Wholesale trade. However the share of this sector in total value added decline significantly after crisis period. Comparing the situation with China, Kee and Tang (2016) empirically showed that an increase in foreign direct investment raises firm domestic value added ratio by stimulating an increased supply of local input variety. The positive result suggests that China may be moving up the global production chain and is no longer only responsible for the final stage of productions. Unfortunately the situation in the Slovak Republic is rather different with growing share of imported intermediate inputs in manufacturing.

Table 4.7 Share of individual sectors on total value added generated by export, %

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Manufacture of motor vehicles, trailers and semi-trailers														
6.30	5.68	5.97	7.98	7.06	5.92	6.08	7.37	7.97	6.78	8.76	9.59	8.14	7.95	8.62
Manufacture of computer, electronic and optical products														
2.04	1.82	1.77	1.78	1.95	2.28	3.22	2.64	3.30	2.67	3.17	3.09	2.38	2.06	2.27
Manufacture of basic metals														
7.41	7.68	6.30	6.70	7.55	7.22	7.07	6.17	4.56	2.98	4.09	3.27	3.14	2.91	2.75
Manufacture of machinery and equipment n.e.c..														
3.91	4.00	3.84	3.84	4.27	4.22	3.93	3.68	3.86	3.05	3.83	3.85	3.37	3.39	3.85

Wholesale, trade except of motor vehicle and motorcycles														
11.38	9.78	8.82	8.87	10.97	11.42	10.54	11.14	12.17	14.28	12.92	11.25	7.21	8.40	7.44
Retail trade, except of motor vehicles and motorcycles														
2.51	3.23	3.85	4.50	4.01	4.45	4.89	4.57	4.55	3.50	3.53	3.49	4.43	3.51	4.28
Construction														
2.03	1.63	1.97	1.70	1.63	1.66	2.09	2.10	2.91	3.54	2.98	3.41	3.61	2.99	3.32
Electricity, gas stream and air conditioning supply														
2.03	1.20	1.77	2.77	3.10	2.57	3.70	3.15	2.90	2.79	2.38	2.33	2.42	1.92	1.76
Real estate activities														
3.33	3.53	3.72	3.56	3.07	2.62	2.75	2.88	2.93	2.87	2.83	2.45	7.71	10.67	8.46

Source: Calculated by the author (WIOD data)

Nevertheless, the study of Amador, Cappariello and Stehrer (2015) conclude that in the period 2000-2011, the export share of foreign value added sourced within the euro area was more stable than that sourced from other blocks, representing around 11 per cent of total exports for the average euro area country. In other words, the growing relevance of external suppliers does not reflect a weakening of the production links within the euro area, being instead a substitution of domestic value added by extra euro area sourcing. They find evidence of an increasing trend in the share of foreign value added in exports for the euro area as a whole over the 11-year period, with a cyclical pattern evident during the trade collapse. The analysis also shows that the euro area is the main source of foreign value added in exports for most member countries and its share is more stable than that of other trade blocks. In other words, the growing relevance of external suppliers does not reflect a weakening of the production links within the euro area, being instead a substitution of domestic value added by extra euro area sourcing.

The value added indicator can be split in two categories - the domestic value added generated by domestic demand and value added generated by export. The weaknesses of Slovak exporting industries is their strong linking to foreign demand. Almost all value added of top Slovak export sectors is generated by export (see Table 4.8). This confirms the high risk of vulnerability for Slovak export sectors to external shocks. Moreover, there is an important network of domestic subcontractors connected to the production of cars. It is necessary for domestic intermediate suppliers to focus not only to subcontracting Slovak companies but to increase their importance as intermediary suppliers abroad. Furthermore, the traditionally domestic sectors producing mainly for domestic demand such as construction sector, retail trade etc. observed the considerable growing share of value added created for export. This indicator for whole Slovak sectors indicates the influence of foreign demand for Slovak value added creation is growing mainly after crisis period and compared to initial situation in 2000 the value is almost double. It can be dangerous as the sensitivity of Slovak economy to external shocks increases.

Table 4.8 Share of domestic value added generated by export on value added of individual sector, %

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Manufacture of motor vehicles, trailers and semi-trailers														
77.4	78.5	82.7	93.1	95.4	92.9	97.7	93.6	93.7	94.3	97.6	95.3	95.4	95.5	95.2
Manufacture of computer, electronic and optical products														
61.7	73.8	74.0	87.4	98.8	98.9	99.1	99.2	99.3	99.2	99.3	100	100	100	100
Manufacture of basic metals														

74.8	77.0	77.8	84.9	86.9	87.5	90.4	90.4	88.0	92.2	90.2	97.0	100.4	99.6	99.5
Manufacture of machinery and equipment n.e.c.														
57.2	65.1	68.8	77.1	92.1	94.6	95.4	95.7	95.8	95.6	95.7	97.0	97.6	97.5	97.3
Wholesale, trade except of motor vehicle and motorcycles														
32.2	36.3	39.4	44.2	50.2	52.9	57.0	57.5	57.8	57.1	58.4	56.1	57.4	57.4	57.5
Retail trade, except of motor vehicles and motorcycles														
12.7	15.6	17.7	21.9	23.1	23.9	26.7	28.6	27.5	20.0	22.2	21.8	25.8	25.3	26.5
Construction														
6.5	6.5	6.9	8.2	8.9	8.8	10.1	10.3	11.5	11.6	11.8	13.8	16.4	16.3	16.9
Electricity, gas stream and air conditioning supply														
15.0	15.4	16.6	19.6	20.1	20.4	22.2	23.5	22.9	17.9	20.5	20.6	24.9	24.4	23.9
Real estate activities														
9.8	10.7	11.7	13.7	13.1	13.5	15.0	16.4	16.2	13.0	14.4	13.1	46.6	51.57	53.36
All sectors														
23.1	25.1	25.9	30.0	33.4	34.9	36.8	38.5	37.5	31.7	35.0	36.1	41.1	42.6	42.4

Source: Calculated by the author (WIOD data)

Firms substitute domestic materials with imported materials which explains the decreasing domestic value added. Our results suggests that the Slovak Republic may not be moving up the global production chain and is still responsible for the final stage of productions. Slovak export policy analysis based on gross trade can grossly overestimate the impact of Slovak export for national economy. Moreover, as Lábaj (2017) concluded, the growth of trade with intermediate has been dominated in world trade development, indicating an increasing fragmentation of production chains across the world. Significant increases in value added have been recorded in particular by countries which have increased their participation in trade with intermediate products. Profits from intermediate trade more than offset losses in market shares in the final products trade. Countries that do not significantly engage in intermediate trade and achieve low labor productivity growth rates, have seen lower growth rates of value added. This development has negatively affected the economic growth of these countries in the next period.

Hence, the next investigation is focused on the involvement of the Slovak Republic in intermediate trade. The volume of intermediate trade remarkably grown moreover the dynamic of its change overcome the growth of gross output as well as value added (Figure 4.3 and 4.4). Gross output and value added volumes have grown approximately 2.4 times over the period 2000-2014, compared to 4.6 increase in intermediate production. Among the sectors, the highest gross output growth was recorded for the manufacture of motor vehicles (automotive industry 524%), manufacture of computers, electronic and optical products (753%) or manufacture of machinery and equipment (224%), but also computer programming, consultancy and related activities (532%). Growth in value added was also significant, but slower in these sectors compared to growth in gross production (manufacture of motor vehicles 398%, manufacture of computers 270%, manufacture of machinery and equipment 158%, computer programming 590%). The growth of intermediate consumption between 2000 and 2014 increased by 1000% in the manufacture of computer, by 547% in the manufacture of motor vehicles and by 474% in the computer programming sector.

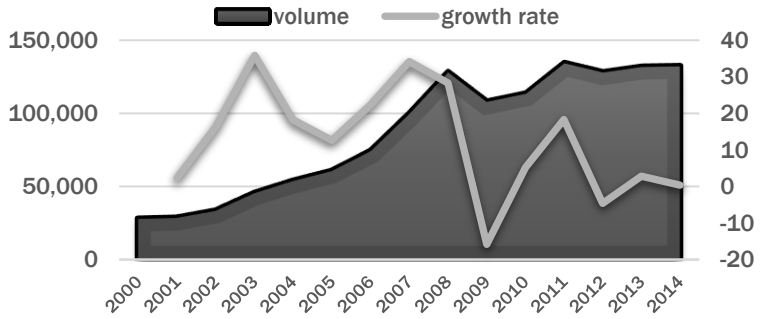


Figure 4.3 Development of intermediate consumption in the Slovak Republic
Source: Compiled by the author (WIOD data), mil. USD

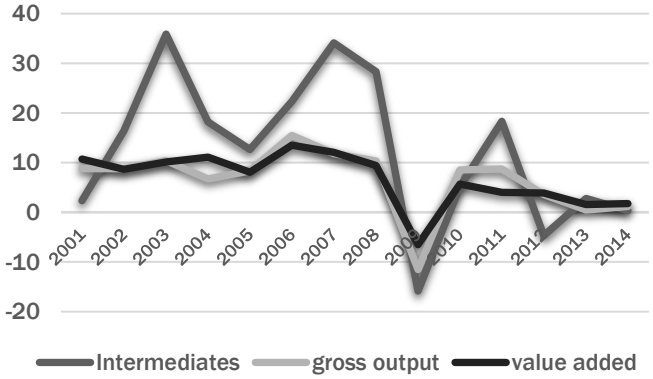


Figure 4.4 Average intermediate inputs, gross product and value added annual rates of growth, %
Source: Compiled by the author (WIOD data)

The growing participation in the GVCs move the structure of intermediate consumption in the Slovak Republic as well. While in 2000 almost 76% inputs had domestic origins, in 2014 it was 10% less. Consequently the volume of imported intermediate consumption significantly increased (the share of imported intermediate in total intermediate consumption raised from 24% in 2000 to 40% in 2014) (Figure 4.5).

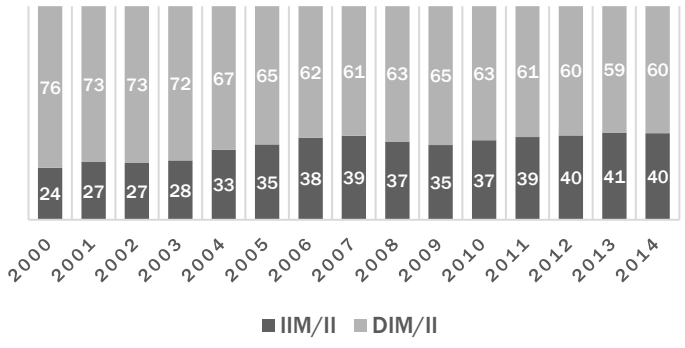


Figure 4.5 Share of domestic (DIM) and imported (IIM) intermediates in total Slovak intermediate consumption (II), %
Source: Compiled by the author (WIOD data)

Durable goods (for investment or consumer use) are mostly produced in large international production networks, while services have usually domestic origin. Hence the import of intermediates is more apparent in manufacturing services (Figure 4.6). If the national economy is more oriented on durable goods production rather than services it may increase sensitivity to external shocks with more pronounced manifestations.

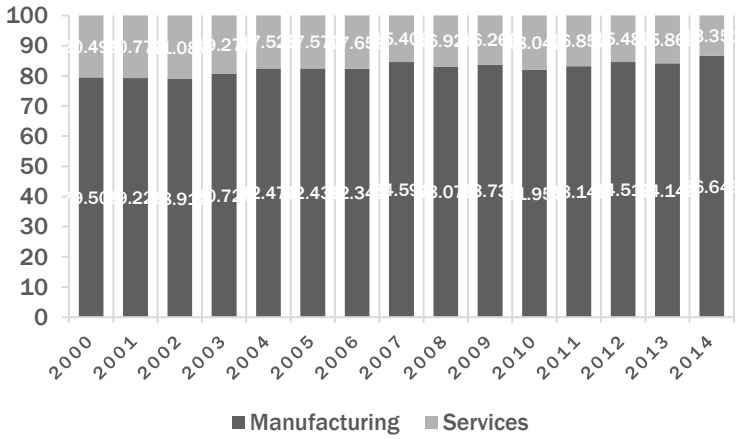


Figure 4.6 Share of imported intermediates in the manufacturing and services, %
Source: Compiled by the author (WIOD data)

Up to 2008 the rates of annual import and export growth reached more than 20% (Figure 4.7). In 2009 the slowdown of world economy influenced the development in the Slovak Republic as well. Moreover, the difference between imported and exported intermediates grew. Furthermore the share of manufacturing sectors in export of intermediates decreased (81% in 2000 and 72% in 2014) and contrary the share of services grew (19% in 2000 and 28% in 2014).
The changes are clearly visible in consumption of intermediates as well. While in 2000 more than 80% of domestic intermediates were used in Slovak production and 17% were exported, in 2014 the share of export represented already 37% (Figure 4.8). It also manifest the growing involvement of the Slovak Republic in GVCs as well as the risk of growing external fluctuations influence.

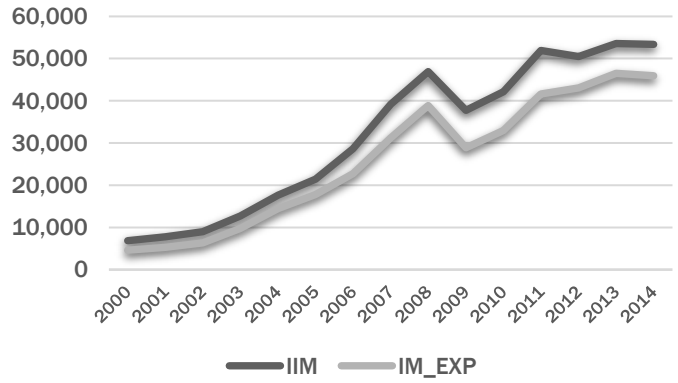


Figure 4.7 Volume of imported (IIM) and exported (IM_EXP) intermediates, mil. USD
Source: Calculated by the author (WIOD data)

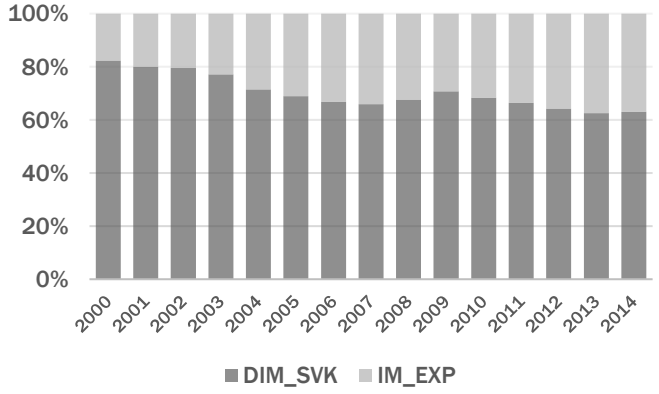


Figure 4.8 Share of domestic intermediate consumed in the Slovak Republic (DIM) and exported from the Slovak Republic (IM_EXP), %
Source: Compiled by the author (WIOD data)

The manufacturing sectors exported the intermediates more intensively (Table 4.9). Although the involvement of individual manufacturing sectors in export of intermediates during 14 years changed. Up to 2000, Manufacture of basic metal held the dominant exporting position (25%), while in 2014 it was automotive industry (18%). The export of intermediates in 2000 was concentrated to less number of countries. The main destination of Slovak intermediate export was Germany and neighbor countries (54%). In 2014 the share of counties is more disperse, the export widen to other countries like Russia, Great Britain, France as well as Rest of world. However, almost 72% of Slovak intermediate is exported to the EU markets (38% to Eurozone countries).

In the period 2000-2014 the import of intermediates to the Slovak Republic grew by 7.8%. More than half of imported intermediate (59%) was demanded only by the six industrial sectors, moreover just automotive industry required 26%. The automotive industry in the Slovak Republic is highly depended on import of intermediates that clearly reveal the lower position of the Slovak Republic on its global value chain. Moreover, the sector Manufacture of computer with lower share on the total Slovak output creation (3.4% while automotive industry 12.23%) engaged on import of intermediates by more than

11%. However the share of this sector on Slovak value added creation is no more than 0.96% (the automotive industry 3.84%) witch raise the question whether this sector is beneficial for Slovak economy.

Table 4.9 Intermediate export from the Slovak Republic by industrial sectors and country of destination, %

Export by industrial sectors	**2000**		**2014**
Manufacture of basic metals	25%	Manufacture of motor vehicles, trailers and semi-trailers	18%
Manufacture of motor vehicles, trailers and semi-trailers	9%	Manufacture of basic metals	10%
Land transport and transport via pipelines	5%	Manufacture of rubber and plastic products	6%
Manufacture of paper and paper products	5%	Real estate activities 6%	6%
Wholesale trade, except of motor vehicles and motorcycles	5%	Manufacture of machinery and equipment n.e.c.	6%
Manufacture of machinery and equipment n.e.c.	5%	Manufacture of electrical equipment	5%
Others	46%	Others	48%
Export by country of destination	**2 000**		**2 014**
Germany	23%	Rest of world	12%
Czech republic	15%	Germany	11%
Rest of world	11%	Czech republic	10%
Austria	8%	Hungary	7%
Poland	8%	Austria	7%
Italia	6%	Poland	6%
Others	30%	Others	48%

Source: Calculated by the author (WIOD data)

Furthermore the significant change appears in territorial structure of intermediate import (Table 4.10). While the German market rest the dominant source of Slovak intermediate import, the demand from the counties as Austria or Russia decreased (the share of intermediate import from these countries on total intermediate import). Generally, the main partners are EU countries although the intertemporal comparison showed that the share from these counties decreased (68% of imported intermediate from EU in 2000 while 66% in 2014). The Slovak manufacturing sectors increased the import of intermediates from the Rest of World as South Korea. Moreover, the share of import from the countries of Eurozone decreased (from 47% in 2000 to 37% in 2014). That's the reason why it can´t be generally stated that the growing relevance of external suppliers does not reflect a weakening of the production links within the euro area, as argue (Amador, Cappariello, Stehrer, 2015).

Table 4.10 Intermediate inputs import by industrial sectors and countries, %

Import by industrial sectors	***2000***		***2014***
Manufacture of motor vehicles, trailers and semi-trailers	13%	Manufacture of motor vehicles, trailers and semi-trailers	26%

Manufacture of coke and refined petroleum products	10%	Manufacture of computer, electronic and optical products	11%
Manufacture of basic metals	9%	Manufacture of coke and refined petroleum products	7%
Electricity, gas, steam and air conditioning supply	7%	Electricity, gas, steam and air conditioning supply	6%
Construction	6%	Manufacture of basic metals	5%
Manufacture of electrical equipment	5%	Manufacture of rubber and plastic products	4%
Others	50%	Others	41%
Import by countries	**2 000**		**2 014**
Germany	26%	Germany	20%
Russia	19%	Rest of world	17%
Czech republic	12%	Czech republic	14%
Austria	8%	Poland	7%
Rest of world	6%	South Korea	6%
Poland	4%	Hungary	5%
Others	25%	Others	31%

Source: Calculated by the author (WIOD data)

The Slovak Republic has experienced a significant change in trade in intermediates over last 14 years. The volume of intermediate trade remarkably grown moreover the dynamic of its change overcome the growth of gross output as well as value added. Up to 2008, many investments were coming to the Slovak Republic, mainly to industrial sectors e.g. automotive industry. The manufacturing sectors have stronger intermediate inputs demand as well as capital use and lower demand for labor.

4.6 Conclusion

The weaknesses of Slovak industries is their strong linking to foreign demand. Almost all value added of top Slovak exporting sectors is generated by foreign demand. This confirms the high risk of vulnerability to external shocks. Moreover, there is an important network of domestic subcontractors connected to the production of cars. It is necessary for domestic intermediate suppliers to focus not only to subcontracting Slovak companies but to increase their importance as intermediary suppliers abroad. Furthermore, as the growth of trade with intermediate has been dominated in world trade development, significant increases in value added have been recorded in particular by countries which have increased their participation in trade with intermediate products. Countries that do not significantly engage in intermediate trade and achieve low labor productivity growth rates, have seen lower growth rates of value added and in the next period lower economic growth.

The results confirmed that production multiplier over analyzed period decreases, the most in exporting sectors. As expected, the exporting sectors generated lower product multiplication effect for Slovak economy. The sectors with dominant services share multiply more value added by unit of production compared to manufacturing exporting sectors. Moreover, the multiplier of value added for example for construction sector rises. However, the exporting sectors still lagged and their effect on domestic value added is even weakening. The lowest value added across exporting sectors generated automotive industry and computer, electronic and optical products manufacturing. The automotive sector reduced the share of value added per unit of production during the period although its total production significantly increased. The reason of this low value added is the limited share of module and system

manufacturers compared to the production of finished cars. Then the production of finished cars in the Slovak Republic consists of individual modules assembly hence the final stage of production process characterized by low value added. However, the indicator of value added generated by export showed that in absolute value, the automotive industry generated in 2014 the most value added among all other sectors and its value even increased over time.

References

AMADOR, J. CAPPARIELLO, R. and STEHRER, R. 2015. Global Value Chains: A View From The Euro Area. *Asian Economic Journal,* Vol.: 29 Iss. 2I Pages: 99-120. DOI: https://doi.org/10.1111/asej.12050

BACKER, K. D. - MIROUDOT, S. 2014. Mapping Global Value Chains. In: *ECB Working Paper* 1677. Available at: https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1677.pdf

BREJČÁK, P. (2016). Zo stoky hore: Ako sa Írsko opäť stalo ekonomickým tigrom Európy, Trend 05.04.2016, http://www.etrend.sk/ekonomika/zo-stoky-hore-ako-sa-irsko-opat-stalo-ekonomickym-tigrom-europy.html

CARDENETE, M. Alejandro - SANCHO, Ferran: Missing Links in Key Sector Anaysis. [online]. Economic Systems Research, 2006. [cit 2017-03-19]. Dostupné na internete: <https://www.iioa.org/conferences/15th/pdf/cardenete_sancho.pdf>.

CHEN X., CHENG, L. K. and FUNG, K. C. et al. 2012. Domestic value added and employment generated by Chinese exports: A quantitative estimation, *China Economic Review,* Vol. 23 Iss. 4 Pages: 850-864. DOI: 10.1186/s40008-017-0079-6

FOSTER-MCGREGOR N., STEHRER R. (2013). Value added content of trade: A comprehensive approach. Economics Letters 120 (2013) 354–357. http://dx.doi.org/10.1016/j.econlet.2013.05.003

HABRMAN M. (2013). Vplyv export na pridanú hodnotu a zamestananosť v slovenskej ekonomike, Ekonomický ústav SAV working paper, ISSN 1337-5598 http://www.ekonom.sav.sk/uploads/journals/239_wp_53_habrman.pdf

HABRMAN, M., KOČIŠOVÁ, M., LÁBAJ, M. 2013. *Štruktúrne súvislosti slovenskej ekonomiky v roku 2008. New Economy* (Nová ekonomika), 6(2): 40 - 51

JOHNSON R.C., NOGUERA G. (2012). Fragmentation and trade in value added over four decades, NBER working paper series 18186, http://www.nber.org/papers/w18186

JOHNSON, R. C. (2014) Five Facts about Value-Added Exports and Implications for Macroeconomics and Trade Research. *Journal of Economic Perspectives*, 28(2): 119–142

Kee, H. L. and Tang, H. 2016. Domestic Value Added in Exports: Theory and Firm Evidence from China, *American Economic Review,* Vol.:106 Iss.: 6 Pages 1402-1436

KOOPMAN, R., WANG, Z., WEI, S. J. (2014) Tracing Value-Added and Double Counting. *American Economic Review*, 104(2): 459-494 DOI: 10.1257/aer.104.2.459

LÁBAJ, M. (2014) Štrukturálne aspekty ekonomického rozvoja. Slovenská ekonomika v globálnych súvislostiach. Vydavateľstvo Ekonóm, Bratislava 2014 ISBN 978-80-7144-2233, http://www.ekonom.sav.sk/uploads/journals/255_labaj-monografia-2.pdf

LÁBAJ, M. (2013). Zmeny vo význame domáceho dopytu pre generovanú produkciu vo svetovej ekonomike v období rokov 1995 – 2009, Finančné trhy, august 2013 ISSN 1336-5711. http://www.derivat.sk/index.php?PageID=2113

LÁBAJ, M. 2017. Structural Decomposition of Global Value Chains: Slovak Economy in an International Context, *politicka Ekonomie,* Vol.: 65 Iss.: 5 Pages: 562-582

Luptáčik M., et al. (2013). Národohospodársky význam automobilového priemyslu na Slovensku, Katedra hospodárskej politiky, Bratislava DOI: 10.13140/2.1.2476.4167

MHSR. (2013) Research and Innovation Strategy for Smart Specialisation of the Slovak Republic. Available at: http://www.eu2020.gov.sk/data/files/4664_ris3_1311_en.doc

OECD. (2013) Slovak Republic Fostering an Inclusive Job-Rich Recovery. In Series: Better Policy Series. April 2013. Available at: http://www.oecd.org/publications/slovak-republic-fostering-an-inclusive-job-rich-recovery-9789264201637-en.htm

SLUŠNÁ Ľ., BALOG M., et al. (2015). Automobilový priemysel na Slovensku a globálne hodnotové reťazce, Slovenská inovačná a energetická agentúra, Bratislava 2015, ISBN 978-80-88823-60-5, https://www.siea.sk/materials/files/inovacie/publikacie/studia_Automobilovy_priemysel_na_Slovensku_a_globalne_hodnotove_retazce_SIEA_web.pdf

VRH, N. (2015) Pay-off to Participation in Global Value Chains: How Much are New EU Member States Lagging behind the Rest of EU Countries in Terms of Domestic Value Added in Exports? *Economic and Social Development: Book of Proceedings*, Varazdin, Faculty of Economics. University of Ljubljana, p. 592-601

Appendix

Appendix 4.1 Industry classification in WIOD according to ISIC Rev.4, 2000-2014

INDUSTRY NAME	ISIC Code
Crop and animal production, hunting and related service activities	A01
Forestry and logging	A02
Fishing and aquaculture	A03
Mining and quarrying	B
Manufacture of food products, beverages and tobacco products	C10-C12
Manufacture of textiles, wearing apparel and leather products	C13-C15
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	C16
Manufacture of paper and paper products	C17
Printing and reproduction of recorded media	C18
Manufacture of coke and refined petroleum products	C19
Manufacture of chemicals and chemical products	C20
Manufacture of basic pharmaceutical products and pharmaceutical preparations	C21
Manufacture of rubber and plastic products	C22
Manufacture of other non-metallic mineral products	C23
Manufacture of basic metals	C24
Manufacture of fabricated metal products, except machinery and equipment	C25
Manufacture of computer, electronic and optical products	C26
Manufacture of electrical equipment	C27
Manufacture of machinery and equipment n.e.c.	C28
Manufacture of motor vehicles, trailers and semi-trailers	C29
Manufacture of other transport equipment	C30
Manufacture of furniture; other manufacturing	C31_C32
Repair and installation of machinery and equipment	C33
Electricity, gas, steam and air conditioning supply	D35
Water collection, treatment and supply	E36
Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	E37-E39
Construction	F
Wholesale and retail trade and repair of motor vehicles and motorcycles	G45
Wholesale trade, except of motor vehicles and motorcycles	G46
Retail trade, except of motor vehicles and motorcycles	G47
Land transport and transport via pipelines	H49
Water transport	H50
Air transport	H51
Warehousing and support activities for transportation	H52
Postal and courier activities	H53
Accommodation and food service activities	I
Publishing activities	J58
Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities	J59_J60
Telecommunications	J61
Computer programming, consultancy and related activities; information service activities	J62_J63
Financial service activities, except insurance and pension funding	K64
Insurance, reinsurance and pension funding, except compulsory social security	K65
Activities auxiliary to financial services and insurance activities	K66
Real estate activities	L68
Legal and accounting activities; activities of head offices; management consultancy activities	M69_M70

Architectural and engineering activities; technical testing and analysis	M71
Scientific research and development	M72
Advertising and market research	M73
Other professional, scientific and technical activities; veterinary activities	M74_M75
Administrative and support service activities	N
Public administration and defense; compulsory social security	O84
Education	P85
Human health and social work activities	Q
Other service activities	R_S
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	T
Activities of extraterritorial organizations and bodies	U

Chapter 5

Offshoring and labor demand changes in the Slovak Republic

by Júlia Ďurčová
Faculty of Economics, Technical University of Košice, **Slovak republic**
julia.durcova@tuke.sk

5.1 Introduction
5.2 Literature review
5.3 Stylized facts
5.4 Model based on translog cost function
5.5 Impact of offshoring on labor demand
5.6 Conclusion
References

http://dx.doi.org/10.14505/gvcifpieu.2018.ch 5

Offshoring and labor demand changes in case of the Slovak Republic

Júlia Ďurčová
Faculty of Economics, Technical University of Košice, **Slovak republic**
julia.durcova@tuke.sk

Abstract:
Offshoring represents one of the main characteristics of the current stage of globalization. It is often felt that whilst offshoring leads to important gains to producers and consumers, the costs appear to fall disproportionately on workers, especially those with low levels of skills. The research for OECD countries shows that the demand for skilled workers relative to unskilled workers as well as the relative wages of skilled workers have risen in OECD countries. The question is whether increased participation in GVCs is a cause of the rising demand for skilled workers or whether outsourcing and offshoring is a large enough activity to have an adverse effect on labor market. The effect of offshoring on labor demand is estimated using the system of cost share equations derived from translog cost function. The data come from World Input-Output Database (WIOD). The results for the Slovak Republic indicate that the rising participation of Slovak industry on global value chains did not lead to dramatically changes in labor structure during last 17 years. However, the disproportionate share of industrial sectors as well as capital and labor share in value added creation still remain and raise. Moreover, the results clearly reveal the differences between domestic and foreign orientated industry.

Keywords: labor demand, global value chains, employment, offshoring, translog cost function

JEL Classification: J31, F14, F16

5.1 Introduction

Rising participation in global value chains (GVCs) caused not only changes in sectorial performance but also an important socio-economic impacts. The recent empirical studies supposed that the demand for skilled workers relative to unskilled workers as well as the relative wages of skilled workers have risen in OECD countries. The question is whether increased participation in GVCs is a cause of the rising demand for skilled workers or whether outsourcing and offshoring is a large enough activity to have an adverse effect on labor market. Foster-McGregor, Stehrer, De Vries (2013) suggest that the demand for skilled workers was closely related to various measures of technology such as R&D but not with measures of trade. The changes of skill demand away from medium skilled workers toward high-skilled workers are explained by changes in ICT capital inputs. Michaels et al. (2014) concluded that ICT polarized labor market by increasing demand for the highly educated at the expense of the medium educated workers. Although OECD suggests that trade openness is not systematically related

to aggregate employment and that increased offshoring may not only represent a shock to which labor markets need to adjust, but may also have an impact on the way that labor markets work. Labor demand has become increasingly elastic across a number of countries and the growing practice of offshoring may have contributed to this trend Hijzen and Swaim (2007).

5.2 Literature review

International fragmentation of production draws increasing attention in both theoretical literature in the area of foreign trade (i.e. Grossman and Rossi-Hansberg, 2008; Costinot, Vogel, and Wang, 2013) and empirical literature (i.e. Feenstra and Hong 2007; Johnson and Noguera, 2012; Baldwin and Lopez-Gonzalez, 2013; Los, Timmer and De Vries, 2015). The process of fragmentation is often analysed in literature under the names such as vertical specialization, outsourcing, offshoring or trade in task. Due to international fragmentation of production in world economy we may observe changes in understanding of international competitiveness. Intention of countries to participate in new international division of labor based on participation of country in the global value chains reveals lot of opened questions for industrial policy framework.

Offshoring represents one of the main characteristics of the current stage of globalisation. It is often felt that whilst offshoring leads to important gains to producers and consumers, the costs appear to fall disproportionately on workers, especially those with low levels of skills. The current situation in advanced countries give an impression that firms shifts low-skilled intensive stage of production to low-skilled abundant countries and that offshoring is a cause of rising demand for skilled workers. This could tent to conclusion that offshoring will contribute to reduction of the demand for relative unskilled workers resulting in falling wages of unskilled labor in developed countries Foster- McGregor, Stehrer and de Vries (2013). The studies on the impact of offshoring for individual old EU member states (e.g. Belgium, Sweden) confirm that the shift away from low-skilled workers is driven by offshoring to Central and Eastern Europe countries Ekholm and Hakkala (2005) and Hertveld and Michel (2013). Therefore the conclusion resulting for CEE countries assumed rising demand for low-skilled labor. However the position of CEE countries as low-skilled and cheap abundant countries dynamically change.

Hijzen and Swaim (2007) looks at the implications of offshoring for industry employment. The effects of offshoring on employment are analysed using industry-level data for 17 high income OECD countries. Their findings indicate that offshoring has no effect or a slight positive effect on sectorial employment. Offshoring within the same industry ("intra-industry offshoring") reduces the labor-intensity of production, but does not affect overall industry employment. Inter-industry offshoring does not affect labor-intensity, but may have a positive effect on overall industrial employment. These findings of Timmer et. al (2015) suggest that the productivity gains from offshoring are sufficiently large that the jobs created by higher sales completely offset the jobs lost by relocating certain production stages to foreign production sites. Similarly the offshoring effects was examine by Foster- McGregor, Stehrer and de Vries (2013). They studied the link between offshoring and the skill structure of labor demand for 40 countries and 35 industries over period 1995-2009 using data from WIOD. Their results indicate that offshoring has impacted negatively all skill-levels, the largest impacts was observed for medium-skilled workers. An evidence of offshoring impact on the skill structure across industries of one country was examined by Hertveld and Michel (2013). They focused mainly on the contribution of offshoring on the fall of the low-skilled workers. The amount of this fall count approximately between

24-32 % during period 1999-2004. Their estimations shows that it is mostly offshoring to Central and Eastern European countries that entails a fall in the low-skilled employment share.

Ekholm and Hakkala (2005) searching the evidence for Sweden found that overall offshoring as well as offshoring to low-wage economies tend to shift demand away for workers with upper secondary education. This effect is robust to controlling for offshoring of final goods production. It contrasts with the estimated effect of R&D investments, which tend to shift demand away from workers with lower secondary education and towards workers with tertiary education. On the other hand, they do not found any statistically significant effect of offshoring to high-income countries. They interpret this as evidence of offshoring to high-income countries constituting the main part of measured offshoring from Sweden and being related to a more general fragmentation of production, rather than as a tendency for labor intensive activities to be re-located in response to labor cost differentials. A decomposition of offshoring to different geographical regions yields results suggesting that the negative effect on workers with upper secondary education is mainly driven by offshoring to Central and Eastern Europe.

Los, Timmer and de Vries (2015) analysed the impact of foreign demand on Chinese employment creation by extending the global input–output methodology. They found that between 1995 and 2001, fast growth in foreign demand was offset by strong increases in labor productivity and the net effect on employment was nil. Between 2001 and 2006, booming foreign demand added about 70 million jobs. These jobs were overriding for workers with only primary education. Since 2006 growth in domestic demand for non-tradable has become more important for job creation than foreign demand, signaling a rebalancing of the Chinese economy.

Timmer et al. 2015 studied the German automotive industry and the effects of offshoring on labor demand. Their findings showed that the decline in domestic value added appears to reflect declining contributions from less-skilled domestic labor, in particularly medium-skilled workers. The value added by domestic capital and high-skilled workers in contrast held up well as their shares did not, or only slightly, decline. The change in the factorial distribution of foreign value added did not mirror these domestic changes. Value added by less-skilled foreign workers increased somewhat but by much less than the decrease in Germany. Obviously, this is due to lower foreign wages, which is an important driver for international production fragmentation. In addition, it might also indicate that activities carried out by these workers are increasingly automated as they are typically routine-based. This hypothesis is buttressed by the finding that the income share of capital abroad rapidly increased, by more than seven percentage points.

5.3 Stylized facts

As mentioned below, the vast inflow of foreign direct investments during early 2000s helped to transform economy of the Slovak Republic, as well as created new jobs. These positives effects were unfortunately balanced by increasing demand for medium and low skilled labor and high share of capital in value added creation. (Slušná, Balog et al. 2015, Habrman, 2013). The labor and capital share in value added creation for all sectors in the Slovak Republic during the period of 1995-2011 shown in Table 5.1, confirm this assumption. However it is important to note, that this share did not significantly change during monitored 17 years.

Table 5.1 Share of labor and capital in value added creation for whole industries in the Slovak Republic, 1995-2011, %

	1995	1996	1997	1998	1999	2000	2001	2002	2003
LAB/VA	37	38	41	41	40	40	38	38	38
CAP/VA	63	62	59	59	60	60	62	62	62
	2004	2005	2006	2007	2008	2009	2010	2011	
LAB/VA	38	39	38	38	38	40	39	39	
CAP/VA	62	61	62	62	62	60	61	61	

Note: LAB/VA = share of labor in value added creation, CAP/VA = share of capital in value added creation

Source: Calculated by the author (WIOD data)

The deeper look at the individual industries reveal various information. The analysis is made for whole economic sectors according to ISIC classification Rev. 3.1 available in WIOD. The sectorial data cover 35 industries (The WIOD database provide data for 11 sections and 32 divisions see Appendix 5.1). The development in individual sectors differ from general industry values Table 5.2 present cumulated data for 16 basic industrial sectors.

The worst balance for labor share can be observed for construction sector where during 17 years the decline in labor share is more than 20%. The similar conclusions can be made for the agriculture, hunting, forestry and fishing sector and electrical, optical and transport equipment as well. The capital and labor ratio change significantly more than 12% in favour for capital. However the data for manufacturing sectors as whole brings positive information and correspond to the general industrial trend in the Slovak Republic. The decline of labor share in value added creation can be seen also in sectors such as Education (-18%) and Renting of m&eq and other business activities (-13%). Contrariwise, the positive development of labor share can be noticed for retail and wholesale trade and financial intermediation. The important thing is whether there have been significant change in the internal labor structure.

The participation in global value chains gives rise the question whether the employment and created jobs are sustainable. The declining importance of manufacturing in developed OECD countries is often associated with a transfer of low-skilled jobs to CEE countries. The data of employment share for individual industries confirm the dominant position of manufacturing for job creation in the Slovak Republic. However the intertemporal comparison reveal the decreasing share in total industries employment. Although this is not true for division of transport equipment (the key sector of FDI inflow in the Slovak Republic). The growth rates between 1995 and 2011 show that the most jobs are created in sectors: Renting of m&eq and other business activities (such as computer and relative activities, software publishing consultancy and supply, research and development and other business activities) and retail trade. This information is very positive because these sectors create considerable demand for high skilled labor.

Table 5.2 Share of labor and capital in value added creation for individual sectors in the Slovak Republic, 1995 and 2011, %

		1995	2011			1995	2011
agriculture, hunting, forestry and fishing	LAB/VA	44	28	retail trade,	LAB/VA	38	48
	CAP/VA	56	72		CAP/VA	62	52
basic metals and fabricated metal	LAB/VA	42	41	other inland transport	LAB/VA	34	46
	CAP/VA	58	59		CAP/VA	66	54
manufacturing (total)	LAB/VA	37	41	financial intermediation	LAB/VA	16	31
	CAP/VA	63	59		CAP/VA	84	69
electrical and optical equipment	LAB/VA	59	34	real estate activities	LAB/VA	4	6
	CAP/VA	41	66		CAP/VA	96	94
transport equipment	LAB/VA	42	30	renting of m&eq, other business activities	LAB/VA	61	48
	CAP/VA	58	70		CAP/VA	39	52
electricity, gas and water supply	LAB/VA	20	18	public admin and defense	LAB/VA	50	52
	CAP/VA	80	82		CAP/VA	50	48
construction	LAB/VA	55	33	education	LAB/VA	83	65
	CAP/VA	45	67		CAP/VA	17	35
wholesale trade and commission trade	LAB/VA	34	41	health and social work	LAB/VA	57	62
	CAP/VA	66	59		CAP/VA	43	38

Note: LAB/VA = share of labor in value added creation, CAP/VA = share of capital in value added creation

Source: Calculated by the author (WIOD data)

Although the leading employment sector – manufacturing loss force of the new job creation, the share of labor in value added formation increase (Table 5.2). There has been also significant transformation of internal structure of labor force. For example, the share of high-skilled labor in total labor has increased in manufacturing (1.8%) as well as in total sector result (5.4% see Table 5.3 - the data are available only until 2009). The highest expansion of high-skilled labor experienced sectors such as Education (14.5%), Public administration (14.9%), Renting of m&eq and other business activities (10.7%) and Real Estate activities (10.7%). The sectors with domination of services. Overall, the share of high-skilled labor in manufacturing is only 8.3% compared to Renting of m&eq and other business activities with 42.2%. This can indicate the low share of services in manufacturing. Slušná, Balog et al. (2015) state that the share of high-skilled labor in value added creation in manufacturing sector was one of the lowest in the EU. Thus the Slovak manufacturing sector competitive advantage was the high reserve of (foreign) capital and average share of medium-skilled labor.

The qualification structure of selected sectors reported in Table 5.3 revealed the reduction of hours worked by low skilled workers (-5.6% change for total sectors). The largest decline of this indicator can be seen in the agriculture sector (-8.2%). Agriculture sector experienced negative tendency concerning general labor demand however the internal structure of labor show that the ratio for high and medium skilled labor demand tend to grow. Consequently it is possible to deduce that the loss of jobs appear mainly in low-skilled profession.

Table 5.3 Share of hours worked by high, medium and low skilled labor for individual industries in the Slovak Republic, 1995 and 2009, % share in total hours

		1995	2009	Δ			1995	2009	Δ
total industries	H_HS	13.4%	18.8%	5.4%	retail trade,	H_HS	7.9%	10.5%	2.6%
	H_MS	77.1%	77.3%	0.2%		H_MS	87.6%	87.5%	-0.1%
	H_LS	9.5%	3.8%	-5.6%		H_LS	4.5%	2.0%	-2.5%
agriculture, hunting, forestry, fishing	H_HS	8.4%	9.5%	1.1%	other inland transport	H_HS	5.1%	10.3%	5.2%
	H_MS	70.4%	77.5%	7.1%		H_MS	84.3%	87.5%	3.2%
	H_LS	21.3%	13.0%	-8.2%		H_LS	10.6%	2.2%	-8.4%
basic metals and fabricated metal	H_HS	6.4%	8.3%	1.9%	financial intermediation	H_HS	32.9%	37.1%	4.2%
	H_MS	83.5%	87.9%	4.4%		H_MS	66.6%	62.1%	-4.5%
	H_LS	10.1%	3.8%	-6.3%		H_LS	0.5%	0.8%	0.3%
manufacturing (total)	H_HS	6.6%	8.3%	1.8%	real estate activities	H_HS	31.5%	42.2%	10.7%
	H_MS	83.0%	87.9%	4.8%		H_MS	65.7%	56.3%	-9.4%
	H_LS	10.4%	3.8%	-6.6%		H_LS	2.8%	1.4%	-1.4%
electrical and optical equipment	H_HS	5.2%	8.3%	3.1%	renting of m&eq, other business activities	H_HS	31.5%	42.2%	10.7%
	H_MS	84.5%	87.9%	3.4%		H_MS	65.7%	56.3%	-9.4%
	H_LS	10.3%	3.8%	-6.5%		H_LS	2.8%	1.4%	-1.4%
transport equipment	H_HS	5.2%	8.3%	3.1%	public admin, defense	H_HS	20.3%	35.2%	14.9%
	H_MS	84.5%	87.9%	3.4%		H_MS	72.8%	60.7%	-12.1%
	H_LS	10.3%	3.8%	-6.5%		H_LS	6.8%	4.1%	-2.7%
electricity, gas, water supply	H_HS	10.8%	17.3%	6.4%	education	H_HS	39.1%	53.6%	14.5%
	H_MS	83.4%	80.7%	-2.7%		H_MS	52.5%	42.7%	-9.8%
	H_LS	5.7%	2.0%	-3.8%		H_LS	8.4%	3.7%	-4.7%
construction	H_HS	5.2%	6.4%	1.2%	health and social work	H_HS	17.5%	24.0%	6.5%
	H_MS	85.1%	89.3%	4.2%		H_MS	75.2%	70.6%	-4.5%
	H_LS	9.7%	4.3%	-5.4%		H_LS	7.3%	5.4%	-1.9%
wholesale trade and commission trade	H_HS	7.9%	10.5%	2.6%					
	H_MS	87.6%	87.5%	-0.1%					
	H_LS	4.5%	2.0%	-2.5%					

Note: H_HS = share of hours worked by high-skilled labor, H_MS = share of hours worked by medium-skilled labor, H_LS = share of hours worked by low-skilled labor. The data are available only for period 1995-2009.

Source: Calculated by the author (WIOD data)

5.4 Model based on translog cost function

To analyses the effect of GVCs represented by offshoring on the skill structure of labor demand we follow the approach that considers the relative demand for labor. Model will be based on translog cost function (see Berndt, Wood 1975) that is frequently used in empirical studies. Instead of estimating the translog cost function directly, we estimate a system of cost share equations derived from it. The translog cost function, so-called flexible functional forms, allows substitution elasticities to be unrestricted and they should not even be constant. Cost minimizing relative input demands may depend on the level of output.

Denoting C as total variable costs, w_i represents wages for different skill types and prices of material that are optimally selected for $i = 1,...,M$, x_k represents fixed inputs and outputs (fixed input capital

K and gross output Y), z represents proxies for technological change, O represents offshoring and DO represents domestic outsourcing (quasi-fixed) (notation of variables see in Appendix 5.2 and 5.3). The general formulation of the translog cost function is as follows (Foster-McGregor et al 2013):

$$\ln C = \alpha_0 + \frac{1}{2}\sum_{i=1}^{M}\alpha_i \ln w_i + \sum_{k=1}^{K}\beta_i \ln x_k + \sum_{y=1}^{Y} y_y z_y + \frac{1}{2}\sum_{i=1}^{M}\sum_{j=1}^{M}\gamma_{ij}\ln w_i \ln w_j + \frac{1}{2}\sum_{k=1}^{K}\sum_{l=1}^{K}\delta_{kl}\ln x_k \ln x_l + \frac{1}{2}\sum_{y=1}^{Y}\sum_{p=1}^{R} y_{yp} z_y z_p + \frac{1}{2}\sum_{i=1}^{M}\sum_{k=1}^{K}\theta_{ik}\ln w_i \ln x_k + \frac{1}{2}\sum_{i=1}^{M}\sum_{y=1}^{Y}\delta_{iy}\ln w_i z_y + \frac{1}{2}\sum_{k=1}^{K}\sum_{y=1}^{Y}\delta_{iy}\ln x_k z_y \quad (5.1)$$

Taking first derivatives of the cost function with respect to wages and material we obtain $\frac{\delta \ln C}{\delta \ln w_i} = \left(\frac{\delta C}{\delta w_i}\right)\left(\frac{w_i}{C}\right)$ where $\left(\frac{\delta C}{\delta w_i}\right)$ represents the demand for input i. Differentiating the translog cost function (5.1) with respect to input prices we obtain a set of N cost share equations of the form:

$$s_i = \alpha_i + \frac{1}{2}\sum_{j=1}^{M}\gamma_{ij}\ln w_j + \frac{1}{2}\sum_{k=1}^{K}\theta_{ik}\ln x_k + \frac{1}{2}\sum_{y=1}^{Y}\delta_{iy}\ln z_y, \quad i = 1,...,M \quad (5.2)$$

Taking differences between two periods the equations for wage shares of different labor skill and material in industries $n = 1,...,N$ become:

$$\Delta s_i = \alpha_0 + \sum_{j=1}^{M}\gamma_{ij}\ln w_j + \theta_K \Delta \ln K + \theta_Y \Delta \ln Y + \delta_O \Delta \ln O + \delta_{DO}\Delta \ln DO + \varepsilon_i \quad (5.3)$$

Instead of estimating the translog cost function directly, most authors estimate the system of cost share equations because the number of parameters to be estimated is lower (Hertveldt, Michel 2013). Specification of our model follows approach employed by Foster-McGregor et al (2013) and Hertveldt, Michel (2013) that considers labor and material inputs to be flexible and other inputs to be quasi-fixed. Dependent variables in the model are represented by the shares of each labor type on total variable costs. Total variable costs are calculated as the sum of total labor compensation plus the value of intermediate input purchases.

The source of data is the WIOD database consisting of a complete dataset for industries over the period of 1995-2009. When examining effects of offshoring and domestic outsourcing the WIOD data enables us to measure the intermediate input purchases by each industry from each industry. Foster-McGregor et al. (2013) distinguish between narrow and broad offshoring considering imported intermediates in a given industry from the same industry and imported intermediates from all industries. In our analysis we consider a broad measure of inter-industry offshoring O calculated as:

$$O_n = \frac{\sum IIM_n}{V_n} \quad (5.4)$$

where IIM refers to imported intermediate purchases from industry, n is the industry index and V refers to value added. Measures of domestic intermediate use DO are constructed in a same manner:

$$DO_n = \frac{\sum DIM_n}{V_n} \tag{5.5}$$

where DIM stands for domestic intermediate purchases, n is the industry index and V refers to value added. Domestic intermediate use or domestic outsourcing can capture efficiency gains due to a reallocation of production within industries in a country while international offshoring capture efficiency gains due to fragmentation and includes industry specialization across borders.

Data for labor is split into three different skill categories (low, medium and high skilled) according to ISCED classification. The average wages by education level are calculated as the ratio of labor compensation for each labor skill type to the total hours worked of each labor skill type (according to Foster-McGregor et al 2013). The values for gross output and capital stock are available directly from the WIOD.

The cost functions are estimated as a system of demand equations for all variables. The complete system of equations is estimated using seemingly unrelated regression (SUR) method.

5.5 Impact of offshoring on labor demand

Measuring offshoring typically focused on trade in intermediates in one way or another. The main drawback of focusing on trade in intermediates is that one necessarily excludes the offshoring of assembly activities. In line with most previous work Hijzen and Swaim (2007), Foster-Mc Gregor et al 2013 we will also focus on trade in intermediates. We measure offshoring by focusing on the foreign content of production using the ratio of imported intermediates (using the import-use matrix) to value-added.

In order to investigate the impact of offshoring and domestic outsourcing on skill structure of Slovak industry we start our analysis with aggregate data for all sectors. Table 5.4 reports initial and final levels (i.e. 1995 and 2009) of offshoring as well as cost shares. As expected, the value of domestic intermediate use is larger than imported intermediate use. The study of the evolution between 1995 and 2009 shows the increased trend of offshoring and vice versa decreasing trend of domestic outsourcing on value added creation. According to Foster-Mc Gregor et al (2013) the offshoring ratios tend to be larger in smaller and open economies. This is confirmed for Slovak republic with average offshoring rate of 0.52 (for example the offshoring ratio for all sectors in USA is around 0.05 and in Germany 0.09 (Foster-Mc Gregor et al 2013)). The cost shares Si reflect the payment to factor i relative to total costs representing wage share of different labor skill types and materials in total variable costs. The sum of shares is equal to 1 (100%).

The results in Table 5.4 reveals that the cost shares of low-skilled labor and materials have declined over the period with those of high and medium-skilled labor increasing. The high percentage of material costs (average 80%) confirm the largest portion of intermediates in total variable costs due to the dominance of capital in value added creation (for example the share of material in total variable costs was in 1995 62% in Germany, 66.4% in France, 64% in USA and 71% in Poland (Foster-Mc Gregor et al 2013)).

Table 5.4 Levels of offshoring, outsourcing and cost shares

	O	DO	S_{LS}	S_{MS}	S_{HS}	S_{II}
1995	0.38	1.57	1.27%	13.94%	3.91%	80.89%
1996	0.43	1.13	1.23%	13.89%	3.94%	80.95%
1997	0.42	1.14	1.27%	14.57%	4.10%	80.07%
1998	0.45	1.14	1.23%	14.33%	4.07%	80.37%
1999	0.42	1.10	1.04%	14.73%	4.18%	80.04%
2000	0.52	1.09	0.81%	14.12%	4.18%	80.89%
2001	0.56	1.03	0.75%	13.99%	4.06%	81.20%
2002	0.55	1.03	0.66%	14.15%	4.03%	81.17%
2003	0.57	1.00	1.02%	13.79%	4.01%	81.18%
2004	0.56	0.88	0.62%	14.30%	4.91%	80.17%
2005	0.57	0.86	0.55%	14.11%	5.50%	79.85%
2006	0.63	0.85	0.53%	13.38%	5.43%	80.66%
2007	0.62	0.49	0.53%	13.82%	5.09%	80.56%
2008	0.59	0.90	0.63%	13.52%	5.22%	80.63%
2009	0.46	0.90	0.64%	14.96%	6.16%	78.24%

Note: O = offshoring (constant), DO= domestic outsourcing (constant), s=cost share (wage shares of different labor skill types and materials)

Source: Calculated by the author (WIOD data)

In Table 5.5 the summary statistics on average growth rates of all variables included in the analysis are reported. The cost shares of low skilled labor have declined while for medium and high-skilled labor cost share we observe positive growth rates. The positive growth in the labor compensation per hour tend to be higher for all labor types than for materials. The similar results are found when we consider the quantity of fixed inputs that increased significantly. The average growth rate of offshoring and domestic outsourcing differ. The growth rate of domestic outsourcing have slowly declined while offshoring gradually rise.

Table 5.5 Descriptive statistics - average growth rates of variables, 1995-2009

Sample: 1995-2009					
Cost shares	Mean	Maximum	Minimum	Std. Dev.	Observations
ΔS_{LS}	-0.02695	0.55721	-0.39805	0.21534	15
ΔS_{MS}	0.00583	0.10609	-0.05110	0.04159	15
ΔS_{HS}	0.03590	0.22556	-0.06317	0.08239	15
Flexible factor prices					
Δw_{LS}	0.13097	0.81440	-0.35606	0.24327	15
Δw_{MS}	0.09397	0.18317	-0.00601	0.04450	15
Δw_{HS}	0.09655	0.25528	-0.02790	0.07454	15
Δw_{II}	0.08495	0.17092	-0.13947	0.07758	15
Fixed input and output quantities					
ΔK	0.08721	0.15123	-0.08965	0.05547	15
ΔY	0.08685	0.15353	-0.10751	0.06357	15
Offshoring and domestic outsourcing					
ΔO	0.02011	0.21324	-0.22157	0.10419	15
ΔDO	-0.00860	0.85837	-0.43124	0.28049	15

Source: Calculated by the author (WIOD data)

According to equation (5.3) the whole industry results will be discussed. A priori, offshoring should have a negative effect on the labor-intensity in an industry (the technology effect), but a positive effect on the level of output, due to the productivity gains from offshoring (the scale effect), so that the overall effect is ambiguous (Hijzen, Swaim 2007). The respective estimation results using SUR technique for each of the labor cost shares are shown in the next table. The estimation results for equation (5.3) are discussed. To save the space the descriptive statistics for the variables are not reported here, they are available upon request. We estimate the system of variable factor demands rather than single equation estimation. The variable factors are individual skilled types of labor (shares of high, medium and low-skilled labor in total variable costs) and material. In our analysis we drop the equation for the share of material in total variable costs as the sum of shares adds up to one.

The results in Table 5.6 give mixed set of coefficients. Starting with the own-wage coefficients that are found to be positive and significant for low and medium-skilled labor but insignificant for high-skilled labor. The medium-skilled wage impacts negatively upon the cost shares of high-skilled labor. The other coefficients tend to be insignificant. The price of intermediates has a strong and negative impact on the cost share of high-skilled labor and negative but insignificant effect on low-skilled labor cost share, suggesting that materials are substitutes for these type of labor but has the negative impact on high-skilled labor. Such results for high-skilled labor are close to Foster-Mc Gregor et al (2013). This set of results indicate the strongest effect of material price change upon the labor cost shares.

Table 5.6 SUR results - the full sample of industries

	ΔS_{LS}	ΔS_{MS}	ΔS_{HS}
Δw_{LS}	0.716760***	-0.014639	-0.045926
	(0.228946)	(0.033121)	(0.074639)
Δw_{MS}	-1.199389	0.429321***	-1.127491***
	(0.977984)	(0.141480)	(0.318835)
Δw_{HS}	-0.768684	0.038945	0.216149
	(0.688674)	(0.099627)	(0.224516)
Δw_{II}	-6.144889	0.136174	-14.08250***
	(5.740619)	(0.830467)	(1.871515)
ΔK	-3.673386*	-0.154096	-3.453205***
	(1.893873)	(0.273977)	(0.617427)
ΔGO	10.35747	-0.393331	18.51767***
	(7.913642)	(1.144827)	(2.579948)
ΔO	-0.117688	-0.255077***	0.676072***
	(0.533673)	(0.077204)	(0.173984)
ΔDO	-0.059728	-0.047849**	0.122468***
	(0.133451)	(0.019306)	(0.043507)
Constant	8.718654	5.810370	0.801124
R-squared	0.969625	0.918925	0.983749

Note: The set of equations are estimated by SUR, standard errors are reported in parentheses. ***, **, *, Significant at 1, 5 and 10 percent respectively.

Source: Calculated by the author

The cost share of all three types of labor are decreasing in capital. This association is consistent with Foster-Mc Gregor et al (2013) that between the output and labor share is not. The impact of output growth is positive upon the low and high-skilled labor and negative upon the medium-skilled labor. The

coefficient of output effect reveal the most significant and strongest impact on the change of high-skilled labor cost share.

The results suggest that offshoring has reduced demand for low and medium-skilled labor contrary to high-skilled labor. Domestic outsourcing has also negative effect on low and medium-skilled labor demand and positive effect on high-skilled labor. Interestingly, the offshoring impact coefficient is largest in absolute value for high-skilled labor as well as domestic impact coefficient. This would tend to suggest that the high-skilled labor have been the most affected by international offshoring and domestic outsourcing. The coefficient for low-skilled labor in both case offshoring and domestic outsourcing we find insignificant.

Overall findings indicate that the low-skilled labor share was mostly influenced by changes in material prices and capital (negatively) and gross output (positively). The medium-skilled labor share affected mostly the changes in own wages (positively) and offshoring (negatively). Finally, the main influence on high skilled labor share was observed in case of output (positive) and material prices (negative) change. Interestingly all significant coefficient for high and low-skilled labor shares in absolute value are largest than for medium-skilled labor. It is also interesting to note the difference between the output influence upon the low and high-skilled labor share. It indicate that the output growth had the bigger effect on high-skilled labor demand.

The global overview of our results reveal the importance of offshoring on labor demand with stronger impact than domestic outsourcing. It is interesting to note that the impact of offshoring differ, is positive upon the high-skilled labor demand and negative upon the medium-skilled labor. We have stated that the share of high as well as medium skilled labor in total labor force has risen. However, the change of high-skilled labor share was more significant (5.4%) than the medium-skilled labor change of share (0.2%). Offshoring could have play important role on this process. The positive influence of offshoring on high-skilled labor demand runs counter to the findings of Foster-Mc Gregor et al (2013). Their results confirmed negative influence of offshoring as well as domestic outsourcing on all types of labor demand. To settle the issue, this should be checked with a long time dataset. When consider the regression coefficients the results showed that the medium-skilled labor was hit hardest by offshoring. Such result is consistent with Foster-McGregor et al (2013).

The analysis is extended on individual sectors level as well in order to compare and specify the differences among industries. First, the results for manufacturing and services sectors is discussed (The classification of manufacturing and services sectors see in Appendix 5.1). Considering different industry types could overcome an aggregate problem when considering all industries together.

Next tables (Table 5.7, 5.8) presents the mix set of coefficients describing the effects of one-unit increase in a specific factor on the change of shares of high, medium and low-skilled labor. The factors that influenced the demand for low and medium labor in manufacturing the most negatively were prices of intermediates, gross output and offshoring (Table 5.7). Regarding differences of results for only manufacturing industries, it can be monitored significantly strongest effect of offshoring that influence negatively the labor demand mainly for low and medium skilled labor. The results also revealed that international offshoring have squeezed labor demand in much greater extent than domestic outsourcing. The coefficients for offshoring differ upon the individual skilled types. The low and medium skilled labor seem to be more negatively affected than high skilled labor demand. This may be

explained by the fact that offshoring is more likely to replace low-skilled employment, as the cost competitiveness matter a lot more in low-tech than in high-tech industries (Herverth, Michel, 2013).

Table 5.7 SUR results for manufacturing

	ΔLS	ΔMS	ΔHS
Δw_LS	0.985995***	-0.010477	-0.149875
	(0.072712)	(0.038068)	(0.101826)
Δw_MS	-0.030507	0.732681***	-0.071788
	(0.356287)	(0.186530)	(0.498943)
Δw_HS	0.101594	0.056059	0.190894
	(0.260887)	(0.136585)	(0.365346)
Δw_II	-0.683406***	-0.755415***	-0.619388***
	0.091217	(0.047756)	(0.127741)
ΔK	-0.052130	0.105642*	-0.000280
	(0.106297)	(0.055651)	(0.148858)
ΔGO	-0.527575***	-0.736270***	-0.557711***
	(0.069872)	(0.036581)	(0.097848)
ΔO	-0.231969***	-0.226446***	-0.164097***
	(0.040378)	(0.021139)	(0.056545)
ΔDO	-0.033901*	-0.028682***	-0.014104
	(0.018057)	(0.009454)	(0.025288)
Constant	-0.109714	-0.013239	0.065773
R-squared	0.744458	0.817273	0.289108
Observations	220	220	220

Note: The set of equations are estimated by SUR, standard errors are reported in parentheses. ***, **, *, Significant at 1, 5 and 10 percent respectively. Notation of variables see in Appendix 5.1.

Source: Calculated by the author (WIOD data)

When considering the services (Table 5.8), we observe that the labor demand for all skilled types is mostly determined by labor wages. Compared with manufacturing, the coefficients for material prices are much smaller. It can be explained by the higher involvement of labor in services sectors than in manufacturing. The differences can be also noticed in the case of coefficients for offshoring. They are much smaller than for manufacturing. Interestingly, the coefficient related to offshoring is lower for low-skilled labor than for high-skilled labor, which means that the high-skilled labor is influenced more negatively by offshoring than low-skilled labor. It goes counter to results for manufacturing. As mentioned above, the services sectors witnesses the decrease of demand for low and medium-skilled labor. The factors influencing these negative changes were mainly wages of medium skilled labor in the case of low-skilled labor demand and prices of material inputs for medium skill-labor.

It can be noted that the factors the most influencing the skill upgrading in the Slovak Republic was the wages and prices of intermediate inputs as well as growing influence of offshoring activities. As expected, the offshoring tends to reduce the labor demand of all skill types but mainly the demand for low skilled labor in manufacturing. This finding highlight the possible risk from close relationship between labor market and situation on external markets with intermediate inputs. As expected, the prices of intermediates inputs are most pronounced in manufacturing with the greatest influence upon the medium skilled labor. As the observed period finish in 2009, it will be important to update this study

and compare the results with the recent evolution, the more the situation in the Slovak labor marker fortunately improve.

Table 5.8 SUR results for services

	ΔLS	ΔMS	ΔHS
ΔwLS	1.073942***	0.033810	0.084716*
	(0.085401)	(0.037225)	(0.051070)
ΔwMS	-0.652566*	0.649934***	-0.939340***
	(0.358576)	(0.156299)	(0.214430)
ΔwHS	0.108266	-0.057799	1.258488***
	(0.285097)	(0.124271)	(0.170490)
ΔwII	-0.307069**	-0.559706***	-0.468040***
	(0.144000)	(0.062768)	(0.086113)
ΔK	-0.050149	-0.106751***	-0.111286***
	(0.054647)	(0.023820)	(0.032679)
ΔGO	-0.280329***	-0.463185***	-0.475700***
	(0.098365)	(0.042876)	(0.058823)
ΔO	-0.088857*	-0.109909***	-0.132731***
	(0.046229)	(0.020151)	(0.027645)
ΔDO	-0.080131*	-0.059472***	-0.037454
	(0.046363)	(0.020209)	(0.027725)
Constant	-0.071148	0.000305	0.041536
R-squared	0.541864	0.652913	0.551684
Observations	250	250	250

Note: The set of equations are estimated by SUR, standard errors are reported in parentheses. ***, **, *, Significant at 1, 5 and 10 percent respectively. Notation of variables see in Appendix 5.1.

Source: Calculated by the author (WIOD data)

Next the results for agriculture, hunting, forestry, fishing, automotive and construction sectors are reviewed. In order to investigate the impact of offshoring and domestic outsourcing on skill structure of agriculture, hunting, forestry and fishing sector labor demand we will limit our analysis only in one sector. As expected, the value of domestic intermediate use is larger than imported intermediate use. Between 1995 and 2009 both variables considerable increased. The offshoring ratios tend to be larger in smaller open economies. This is confirmed even in one particular sector of small and open economy such as Slovak republic (for example the offshoring ratio for all sectors in USA is around 0.05 and in Germany 0.09 (Foster-McGregor et al., 2013) and for the Slovak Republic 0.24 see Table 5.9).
According to equation (5.3) the results for one selected industry – agriculture, hunting, foresting and fishing (AtB) will be discussed. The respective estimation results using SUR technique for each of the labor cost shares for agriculture, hunting, foresting and fishing sector are shown in the next table (Table 5.10).

Table 5.9 Levels of offshoring and cost shares for agriculture, hunting, forestry and fishing sector

AtB sector	1995	2009	Growth rate	Index of growth 1995=100

IIM	253.00	645.00	0.07	-
DIM	1 411.79	2 199.02	0.03	-
O	0.24	0.21	-0.03	84.20
DO	1.36	0.70	-0.05	51.39

Note: IIM - imported intermediate purchases (million USD), DIM - domestic intermediate purchases (million USD), O - offshoring (constant), DO - domestic outsourcing (constant).

Source: Calculated by the author (WIOD data)

The results in Table 5.10 give mixed set of coefficients. The own-wage coefficients are found to be positive and significant for medium and high skilled labor but insignificant for low-skilled labor. The medium-skilled wage impacts negatively upon the cost shares of high-skilled labor while the high skilled wage impact negatively upon the low and medium-skilled cost shares. The positive impact of medium-skilled wage can be observed upon the cost shares of low and medium-skilled labor

Table 5.10 SUR results for agriculture, hunting, foresting and fishing sector

	ΔS_{LS}	ΔS_{MS}	ΔS_{HS}
ΔwLS	-0.10107	-0.40641***	0.742171*
	(-0.16028)	(-0.08311)	(-0.5244)
ΔwMS	3.805164***	0.997804***	-3.78753*
	(-0.59397)	(-0.308)	(-1.94336)
ΔwHS	-3.44417***	-0.36108*	3.201428**
	(-0.41195)	(-0.21361)	(-1.34783)
ΔwII	1.687013***	-0.19203	-2.9922***
	(-0.30953)	(-0.1605)	(-1.01272)
ΔK	-1.22432***	-0.05774	-2.93001***
	(-0.20639)	(-0.10702)	(-0.67526)
ΔY	0.523064*	-0.29467*	5.253268***
	(-0.31306)	(-0.16234)	(-1.02429)
ΔO	-1.09539***	-0.24902	-0.6428*
	(-0.13659)	(-0.07083)	(-0.44691)
ΔDO	0.494468***	-0.04114	-1.10653**
	(-0.14327)	(-0.07429)	(-0.46875)
Constant	1.683118	7.395813	14.93778
R-squared	0.980471	0.93289	-0.7758

Note: w - wages, LS - low skilled workers, MS - medium skilled workers, HS - high skilled workers, II - intermediate input, K - capital, Y - gross output, O - offshoring, DO - domestic outsourcing.

The set of equations are estimated by SUR, standard errors are reported in parentheses.

***, **, * - results are significant at the 1%, 5% and 10% level, respectively.

Source: Calculated by the author (WIOD data)

. The price of intermediates has a positive impact on the cost share of low-skilled labor suggesting that materials are substitutes for this type of labor but has the negative impact on high-skilled labor. Such results are close to Foster-McGregor et al. (Foster-McGregor et al., 2013). The cost shares of all three types of labor are decreasing in capital. The impact of output growth is positive upon the law and high-

skilled labor and negative upon the medium-skilled labor. The results suggest that offshoring has reduced demand for all types of labor contrary to domestic outsourcing with positive effect on low-skilled labor demand and negative effect on high-skilled labor. Interestingly, the offshoring impact coefficient is largest in absolute value for low-skilled labor while domestic impact coefficient for high-skilled labor. This would tend to suggest that the low-skilled labor of agriculture sector have been the most negatively affected by international offshoring and high-skilled labor by domestic outsourcing. The coefficient for medium skilled-labor for both offshoring and domestic outsourcing we find insignificant. For future research it will be interesting also to study the regional (countries) contributions to offshoring intensities.

Table 5.11 SUR results for automotive sector

	ΔLS	ΔMS	ΔHS
ΔwLS	0.885645**	-0.284341**	-0.695522**
	(0.347663)	(0.123200)	(0.329953)
ΔwMS	-2.024672*	1.363281***	0.645269
	(1.141585)	(0.404540)	(1.083434)
ΔwHS	0.793834	-0.699650**	-0.139118
	(0.798795)	(0.283066)	(0.758105)
ΔwII	-0.116344	0.059008	0.060607
	(0.336492)	(0.119242)	(0.319352)
ΔK	-0.296899	-1.107201***	-2.538717***
	(0.797206)	(0.282503)	(0.756598)
ΔGO	-0.201047	0.831622*	2.805503**
	(1.159916)	(0.411035)	(1.100831)
ΔO	-0.087817	-1.053631***	-1.861268***
	(0.639532)	(0.226629)	(0.606955)
ΔDO	-0.269534	-0.492583***	-0.882438**
	(0.350252)	(0.124118)	(0.332411)
Constant	10.71186	11.00018	16.64463
R-squared	0.977814	0.989346	0.921883

Note: The set of equations are estimated by SUR, standard errors are reported in parentheses. ***, **, *, Significant at 1, 5 and 10 percent respectively. For notation of variables see in Appendix 5.1.

Source: Calculated by the author (WIOD data)

The results for each of the labor cost shares for automotive industry (see Table 5.11) and then for construction industry (see Table 5.12) will be discussed.

The results for Slovak automotive industry indicate that offshoring influenced negatively the cost share of medium and high skilled labor demand. The coefficient for low skilled level we found insignificant. The offshoring impact coefficient is larger in absolute value as domestic outsourcing coefficient that underline the international fragmentation of this industry. The significant negative effect of capital influence is reported for medium and high skilled level. This could be explained by increasing capital intensity. The low-skilled labor demand is influenced mainly by changes in own wages and wages of medium-skilled labor. The coefficient for price of domestic intermediates tend to be insignificant for all skilled labor highlighting the facts about high level of imported intermediate in automotive industry and low influence of domestic intermediate suppliers.

Table 5.12 SUR results for construction sector

	ΔLS	ΔMS	ΔHS
Δw_LS	0.442306	-0.031265	0.444685
	(0.543893)	(0.106465)	(0.307094)
Δw_MS	2.588125*	0.317181	-1.952589**
	(1.458584)	(0.285513)	(0.823547)
Δw_HS	-3.133852*	-0.022819	2.087059**
	(1.493018)	(0.292253)	(0.842990)
Δw_II	-0.795494	0.055456	0.029207
	(1.013381)	(0.198366)	(0.572176)
ΔK	-1.438398***	-0.439334***	-0.291970
	(0.366900)	(0.071819)	(0.207159)
ΔGO	2.222195***	0.262727**	-0.041393
	(0.540821)	(0.105864)	(0.305359)
ΔO	-0.477714	-0.265398***	-0.250183
	(0.340754)	(0.066701)	(0.192397)
ΔDO	-0.295215	-0.299069***	-0.213066
	(0.397178)	(0.077746)	(0.224255)
Constant	8.846314	6.543458	5.431079
R-squared	0.929083	0.846271	0.905428

Note: The set of equations are estimated by SUR, standard errors are reported in parentheses. ***, **, *, Significant at 1, 5 and 10 percent respectively. For notation of variables see in Appendix 5.1.
Source: Calculated by the author (WIOD data)

It is possible to conclude that the most significant factor influencing different skill level of labor demand differs. The strongest effect on the cost share of low-skilled is found in the case of wages (negative), on the medium-skilled labor in the case of own wage (positive) and on the high-skilled labor in the case of gross output (positive). The decreasing demand for low-skilled labor could be so attributed to wages contrary to medium skilled labor. The rising demand for high skilled labor in automotive industry is driven by growth of gross output.

The negative influence of offshoring can be observed in construction industry as well. The comparison of results for these two industries revealed as expected significantly stronger impact of offshoring on the labor demand in case of automotive industry. The coefficient for offshoring in construction industry is quite low and insignificant in the case of low and high skilled labor. The significant factors for labor demand in construction industry are mainly the wages, capital and gross output changes. The capital substitution decrease demand for low-skilled labor in construction industry contrary to results for automotive industry. The results clearly revealed the differences between domestic and foreign orientated industry. The main driver of changes in labor demand for domestic industry such as construction industry was level of wages, output growth and capital substitution.

5.6 Conclusion

Accelerating participations of countries in global value chains and industrial progress caused that the absolute number of jobs reduced in the majority of developed countries as well as the share of labor in value added creation decrease. However, the significant changes appeared in the internal structure

of the workers. The vast inflow of foreign direct investments during early 2000s helped to transform economy of the Slovak Republic, as well as created new jobs. These positives effects were unfortunately balanced by decreasing labor and increasing share of capital in value added creation. Therefore it is possible to state that the rising participation of Slovak industry on global value chains did not lead to dramatically changes in labor structure during last 17 years. However the disproportionate share of industrial sectors as well as capital and labor share in value added creation still remain and raise. The characteristic sign of Slovak industry is its main orientation on one sector. The share of manufacturing in gross output creation is more than 30% and the share in value added creation is around 20%. The capital and labor ratio in this sector did not change significantly between 1995 and 2011. The analysis of internal labor structure show better results, the proportion of high-skilled labor increased by 3% and medium-skilled labor by 9%, while the share of low-skilled labor decreased by 2%. Regarding the approaching new industrial revolution the growing tendency of high and medium skilled labor demand is positive, but the future will require more dynamics.

References

BALDWIN, R., LOPEZ- GONZALES, J. (2013). Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses, [NBER Working Paper, no. 18957], Cambridge, National Bureau of Economic Research, 39 p. Available at: http://www.nber.org/papers/w18957.pdf

BERNDT, E. and WOOD, D. (1975) Technology, Prices and the derived demand for energy. *The Review of Economics and Statistics*, Vol. 57, No. 3 (Aug., 1975), pp. 259-268 http://www.aae.wisc.edu/aae705/References/Berndt.pdf (accessed September, 2016).

COSTINOT, A., VOGEL, J., WANG, S. (2013) An Elementary Theory of Global Supply Chains. Review of Economic Studies (2013) 80, pp. 109–144

EKHOLM K. and HAKKALA K. (2005) The effect of offshoring on labor demand: Evidence from Sweden. Working paper, no.654, 2005. The research institute of industrial economics

FEENSTRA, R. C., HONG, Ch. (2007). China's exports and employment. NBER Working Paper 13552 http://www.nber.org/papers/w13552

GROSSMAN, G. ,ROSSI-HANSBERG E. (2008) Trading Tasks: A Simple Theory of Offshoring American. Economic Review, 98(5) (Dec.2008), pp.1978-1997.

FOSTER-MCGREGOR N., STEHRER R., DE VRIES G.J. (2013) Offshoring and the Skill Structure of Labor Demand, Review of World Economics, 149(4): 631-662. Available at: http://dx.doi.org/10.1007/s10290-013-0163-4

HERTVELDT, B., MICHEL, B. (2013) Offshoring and the Skill Structure of Labor Demand in Belgium, *De Economist* (2013) 161:399-420. DOI 10.1007/s10645-013-9218-0

Available at: https://link.springer.com/content/pdf/10.1007%2Fs10645-013-9218-0.pdf

HIJZEN, A., SWAIM, P. (2007) Does Offshoring Reduce Industry Employment? National Institute Economic Review, 201: 86-96. Available at: http://www.jstor.org/stable/23879219

JOHNSON R.C., NOGUERA G. (2012). Fragmentation and trade in value added over four decades, NBER working paper series 18186, http://www.nber.org/papers/w18186

LOS B., TIMMER M., DE VRIES G.J. (2015). How important are exports for job growth in China? A demand side analysis, Journal of Comparative Economics 43 (2015) 19–32 doi:10.1016/j.jce.2014.11.007

MICHAELS, G., NATRAJ, A., VAN REENEN, J. (2014) Has ICT polarized skill demand? Evidence from eleven countries over 25 years. *Review of Economics and Statistics*, 96(1): 60-77

SLUŠNÁ Ľ., BALOG M., et al. (2015). Automobilový priemysel na Slovensku a globálne hodnotové reťazce, Slovenská inovačná a energetická agentúra, Bratislava 2015, ISBN 978-80-88823-60-5, https://www.siea.sk/materials/files/inovacie/publikacie/studia_Automobilovy_priemysel_na_Slovensku_a_globalne_hodnotove_retazce_SIEA_web.pdf

TIMMER M.P., DIETZENBACHER E., LOS B., STEHRER R., De VRIES G.J. (2015). An Illustrated User Guide to the World Input–Output Database: the Case of Global Automotive Production, Review of International Economics Volume 23, Issue 3, pages 575–605, DOI: 10.1111/roie.12178

Appendix

Appendix 5.1 Industry classification in WIOD according to ISIC Rev. 4 (2000-2014)

INDUSTRY NAME	ISIC Code	Industry Type
TOTAL INDUSTRIES	TOT	
AGRICULTURE, HUNTING, FORESTRY AND FISHING	AtB	Manufacturing
MINING AND QUARRYING	C	Manufacturing
FOOD , BEVERAGES AND TOBACCO	15t16	Manufacturing
Textiles and textile	17t18	Manufacturing
Leather, leather and footwear	19	Manufacturing
WOOD AND OF WOOD AND CORK	20	Manufacturing
PULP, PAPER, PAPER , PRINTING AND PUBLISHING	21t22	Manufacturing
Coke, refined petroleum and nuclear fuel	23	Manufacturing
Chemicals and chemical	24	Manufacturing
Rubber and plastics	25	Manufacturing
OTHER NON-METALLIC MINERAL	26	Manufacturing
BASIC METALS AND FABRICATED METAL	27t28	Manufacturing
MACHINERY, NEC	29	Manufacturing
ELECTRICAL AND OPTICAL EQUIPMENT	30t33	Manufacturing
TRANSPORT EQUIPMENT	34t35	Manufacturing
MANUFACTURING NEC; RECYCLING	36t37	Manufacturing
ELECTRICITY, GAS AND WATER SUPPLY	E	Services
CONSTRUCTION	F	Services
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	50	Services
Wholesale trade and commission trade, except of motor vehicles and motorcycles	51	Services
Retail trade, except of motor vehicles and motorcycles; repair of household goods	52	Services
HOTELS AND RESTAURANTS	H	Services
Other Inland transport	60	Services
Other Water transport	61	Services
Other Air transport	62	Services
Other Supporting and auxiliary transport activities; activities of travel agencies	63	Services
POST AND TELECOMMUNICATIONS	64	Services
FINANCIAL INTERMEDIATION	J	Services
Real estate activities	70	Services
Renting of m&eq and other business activities	71t74	Services
PUBLIC ADMIN AND DEFENCE; COMPULSORY SOCIAL SECURITY	L	Services
EDUCATION	M	Services
HEALTH AND SOCIAL WORK	N	Services
OTHER COMMUNITY, SOCIAL AND PERSONAL SERVICES	O	Services
PRIVATE HOUSEHOLDS WITH EMPLOYED PERSONS	P	Services

Source: WIOD

Appendix 5.2 Notation of variables for translog cost function

cost shares	
S_{LS}	cost share of low skilled labor
S_{MS}	cost share of medium skilled labor
S_{HS}	cost share of high skilled labor
S_{II}	cost share of intermediate inputs
input quantities	
LS	number of hours worked by low skilled labor
MS	number of hours worked by medium skilled labor
HS	number of hours worked by high skilled labor
II	intermediate inputs
flexible factor prices	
w_{LS}	wage of low skilled labor
w_{MS}	wage of medium skilled labor
w_{HS}	wage of high skilled labor
w_{II}	prices of intermediate inputs
fixed input and output quantities	
K	capital
Y	gross output
offshoring and domestic outsourcing	
O	offshoring
DO	domestic outsourcing

Appendix 5.3 Notation of variables

Cost shares	
S_{LS}	Cost share of low skilled labor
S_{MS}	Cost share of medium skilled labor
S_{HS}	Cost share of high skilled labor
S_{II}	Cost share of intermediate inputs
Input quantities	
LS	Number of hours worked by low skilled labor
MS	Number of hours worked by medium skilled labor
HS	Number of hours worked by high skilled labor
II	Intermediate inputs
Flexible factor prices	
w_{LS}	Wage of low skilled labor
w_{MS}	Wage of medium skilled labor
w_{HS}	Wage of high skilled labor
w_{II}	Prices of intermediate inputs
Fixed input and output quantities	
K	Capital
Y	Gross output
Offshoring and domestic outsourcing	
O	Offshoring
DO	Domestic outsourcing

Chapter 6

Input-output analysis of agriculture and food sectors in the selected European countries

*by **Ľudmila Bartóková***
Faculty of Economics, Technical University of Košice, **Slovak republic**
ludmila.bartokova@tuke.sk

6.1 Introduction
6.2 Literature review and methodology
6.3 Results and discussion
    6.3.1 V4 countries
    6.3.2 “Old” EU members and the Slovak Republic
    6.3.3 Baltic countries and the Slovak Republic
6.4 Conclusions
References

http://dx.doi.org/10.14505/gvcifpieu.2018.ch 6

Input-output analysis of agriculture and food sectors in selected European countries

Ľudmila Bartóková
Faculty of Economics, Technical University of Košice, **Slovak republic**
ludmila.bartokova@tuke.sk

Abstract:
Input-output tables can be considered as a relatively simple, but rather useful tool, used for analyzing the structure of economies, direct and indirect linkages between their sectors, or for studying sectors' demand and supply relationships in order to determine their positions.
The aim of this chapter is to present and compare the main characteristics of two selected sectors in V4 countries, Baltic countries and in three selected so-called "old EU members". The focus is on the agriculture and food sectors and their characteristics. The analysis is based on the use of principal input output coefficients and multipliers. The objective is to verify the similarities in the position and the development of these sectors in observed countries, to examine backward and forward linkages and their strength in order to identify countries' key sectors and to measure possible concentrations of their impacts. With accordance to the previous research as well as general trends, we expected certain decline of importance over the analyzed period, namely in the terms of production, employment but also in overall effects on the whole economy.

Keywords: input-output analysis, multipliers, backward and forward linkages, agriculture sector, food sector, demand, supply, impact

JEL Classification: C67, F62, L66, E23, Q15

6.1 Introduction

Input-output tables (IOT) and input output analysis are based on the model presented by Leontief (1953). This type of analysis is not new; however, it still represents a very useful and rather simple way for assessing various structural changes in economies. This way we can easily see and study sectorial interdependencies or existing linkages between sectors or their strength. As a result, the calculations help to see how the whole economy and all its sectors can be impacted in case of a change in one particular sector.
This paper focuses on the agriculture and food sectors, the two sectors that were getting more attention mainly due to their general decreasing trend over previous decades. The aim of the analysis is to compare and evaluate the position and the development of these sectors in selected European countries over the period of 2000-2014. The countries were chosen so as to represent "older" and "newer" EU member countries: V4 countries (the Slovak Republic – SK, the Czech Republic – CZ, Hungary – HU, Poland - PL), Baltic countries (Estonia – EST, Lithuania- LIT, Latvia – LAT) and selected "old" EU member countries (Austria - AT, Germany – DE, France - FR). Their analysis and

comparisons should permit to study whether the possible similarities exist and in what domains. We expect that there would be many similarities among the countries within each group but the group would not present many similar traits.
We tried to compare the positions of these sectors from the point of view of the production, employment, foreign trade and value added. We also tried to verify the strength of the sectors' demand and supply linkages, the importance of their positions in national economies (especially from the point of view of key sectors). This analysis should permit to study whether the possible similarities exist and in what domain. Other objectives are the verification of the strength of sectors' demand and supply linkages, the importance of their positions in national economies (especially from the point of view of key sectors) and measuring the possible concentration of their effects on the whole economy. In accordance with general trends and the previous research, it can be expected that these sectors would have experienced fairly stable, but decreasing trend over the observed period. Due to the limited extent, this paper presents only selected results of the analysis. More detailed results can be provided upon request.

6.2 Literature review and methodology

The agricultural and food sectors represent essential sectors to each national economy. Nevertheless, their economic importance has been declining over the last decades. According to the European Environment Agency, Europe is still one of the most intensively exploited continents in the world. The total area of agricultural land in the EU decreases in time in favor of construction and other areas, and partly even forest. (Gebeltová 2017) This can be seen as a sign or a lessening importance in this domain. This author points out to similar trend also on the national level in various EU countries, e.g. in the Czech Republic, Poland but also in Germany or United Kingdom.
This general trend, observed in many European countries, has been even more pronounced in countries that shifted from centrally planned economy to market systems such as Central European, Baltic or Balkan countries. This transformation can be linked to the growth of innovations and the use of new technologies that have led to the increase of productivity as well as effectiveness in the agricultural sector as a whole. (Benešová et al. 2016) The transition from one system to other significantly impacted various area of economic life of these countries, the agriculture and food sectors included. (Záhorský and Pokrivčák 2017) In case of these two sectors, the transformation process brought many changes in the institutional structure, transfers of property rights, competition of cheap imported products or need of machinery renovation. These changes were also necessary in order to "modernize" both sectors and to assure a higher similarity of economic structures of so-called "old" and "new" European Union (EU) member countries. (Bednaříková, 2012)
With transition, these countries also lost many of their traditional market. On the other hand, the EU accession in 2004 opened for them new markets of other EU countries. (Lauri, 2012) (Néméthová, Civáň, 2017) The EU accession equally impacted national agricultural policies that needed to be revisited to assure their compliance with the EU policies. However, it also allowed new member countries to draw yearly financial resources in order to support their agriculture sectors and to help increase their efficiencies in general. (Věznik, Král, 2017)
When studying sectors of agriculture and food production, one should also take into account other important factors, such as declining or less favorable terms of agricultural trade or extreme weather. (Pokrivčák, 2003) Deteriorating climate conditions related mainly to global warming will manifest more and more often and will be impacting these sectors with greater force. It can be expected that they will require further restructuring in order to adapt to these conditions. Thanks to their environmental implications, these two sectors are slowly starting to gain attention. As a result, there is e.g. an obligation for farmers (according to European Common Agricultural Policy) to respect the requirements

of maintaining the land in good agricultural and environmental condition and to obey the relevant European environment legislation. (Turčeková et al. 2015)

In general, positions and importance of any sector can be described by various basic indicators. One of the simplest are for example the sector's share on overall output, employment, overall value added, imports or exports. More detailed analyses, such as input output (IO) analysis, represents another approach for studying the particular sector, its place in the national economy or its linkages with other sectors. Thanks to the IO analysis we can verify to what extent the positions and impacts of agriculture as well as food sector on the whole economy correspond to their shares on the whole territory.

As mentioned before, IO models are based on the input output theory by W. Leontief. (Leontief, 1953) Models can be constructed as basic model that take into account only data drawn from national economies (national input output tables, NIOT) or as more detailed models that cover also the country's relationships with other countries of the world (World input output tables, WIOT). In general, input output tables (or transaction tables) supply information about activities of all sectors in each economy, from the point of view of producers (suppliers) of inputs, as well as from the point of view of buyers (consumers) of inputs, within the whole production process of the economy. (Dujava, Lábaj, Workie, 2011) These transactions are recorded in monetary terms, as both intra and intersectorial flows. They usually cover a period of 1 year. (Miller, Blair, 2009) Availability of this type of data can be thus viewed as very useful when evaluating overall linkages between sectors as well as overall macroeconomic impacts of the changing demand in various sectors. (D'Hernoncourt, Cordier, Hadley, 2011). IOT analyses are therefore often referred to as impact analyses. (Pissarenko, 2003) According to Miller and Blair (2009), the use of the IO framework for impact analysis, due to changing final demands, using multipliers, constitutes one of the most frequent uses of the model.

This very same approach can be equally applied for the analysis on the regional level. Originally proposed as intraregional analysis by W. Isard, it evolved later to multiregional level. (Dupuis and Chesnais 1976) In this case the analysis allows tracing the effects of economic changes in a particular region on the total production in another region. This approach is noticeable due to interregional spillovers and feedback effects, especially when regions have strong economic interactions or links with each other. (Abootalebi et al. 2017) (Vaishar, Zapletalová, 2009).

The data contained in input output tables can be read either as columns or as rows. The columns describe the composition of inputs required by a particular industry to produce its output, i.e. the demand point of view. The rows show the distribution of a producer's output throughout the economy that corresponds to a supply side of production. (Miller, Blair 2009) The intersectorial flows of products and services are registered simultaneously by origin and by destination. (D'Hernoncourt, Cordier, Hadley 2011) The exchanges of goods between sectors are, ultimately, sales and purchases of physical goods. In accounting for transactions between and among all sectors, it is possible in principle to record all exchanges either in physical or monetary terms. However, in most cases, these "accounts" are recorded and held in monetary terms. (Wixted, 2006)

Based on these linkages, it is possible to evaluate the structure of the economy or impacts of changing demand in various sectors in national economy. IOT framework evaluates two kinds of economic linkages between sectors, i.e. backward linkages, representing demand side, and forward linkages, representing supply side. (Lábaj 2014) Input-output tables enable to calculate various types of multipliers. The general methodology permits to generate several kinds of input-output multipliers: output multipliers, input multipliers, income multipliers, employment multipliers, import multipliers and value added multipliers. (Miller and Blair, 2009) (Lábaj, 2017) One of the advantages of IO multipliers is that they can be viewed as summary measures allowing to estimate the likely effects of economic changes or possible impacts of changes in the demand for one particular sector on all industries in the whole national economy.

IO Multipliers can be calculated either as simple (also partial) or total multipliers. (Pissarenko 2003) (McLennan 1995) The calculation of simple multipliers is based on the assumption that there is no feedback between the household sector and the other sectors. In other words, the spending of households takes place outside the model (open model). On the other hand, when the households are included, i.e. the assumption of some existing feedback between households and other sectors (in the form of households' spending expenditures), the model becomes total or respectively closed with respect to households. (Pissarenko 2003) The formulation of a "closed" model means that various income-consumption-output impacts can be isolated. (Miller and Blair, 2009)
Assume that each national economy can be divided into "n" sectors. These sectors are interlinked by various intersectoral flows what can be described as demand and supply relationships or linkages. Thus the overall structure of each economy can be in general described by a following set of equations (Miller, Blair, 2009):

$$\begin{aligned} X_1 &= Z_{11} + Z_{12} + \cdots + Z_{1j} + \cdots + Z_{1n} + Y_1 \\ X_2 &= Z_{21} + Z_{22} + \cdots + Z_{2j} + \cdots + Z_{2n} + Y_2 \\ &\cdots \\ X_i &= Z_{i1} + Z_{i2} + \cdots + Z_{ij} + \cdots + Z_{in} + Y_i \\ &\cdots \\ X_n &= Z_{n1} + Z_{n2} + \cdots + Z_{nj} + \cdots + Z_{nn} + Y_n \end{aligned} \tag{6.1}$$

where X_i stands for total sector output for sector i, Y_i the final demand for this sector's production and Z_{ij} the intersectorial flows in this economy. The production of each sector can further serve as the intermediate consumption (inputs for other productions) or can be used directly in various sectors, i.e. consumption of households, investment of firms, government expenditures or export. All of these consumptions represent the final use of produced goods. (Habrman, 2013) (Duvajová, 2014). When the flows of inputs from sector i to the sector j (or from one sector to the other in general) are divided by total outputs X_i, we can obtain technical coefficients (ratios of input to output) that reflect the cost structure of each industry. (Lábaj, 2014) (Pissarenko, 2003) The set of equations (1) can be rewritten as follows:

$$\begin{aligned} X_1 &= a_{11}X_1 + a_{12}X_{12} + \cdots + a_{1j}X_{1j} + \cdots + a_{1n}X_{1n} + Y_1 \\ X_2 &= a_{21}X_{21} + a_{22}X_{22} + \cdots + a_{2j}X_{2j} + \cdots + a_{2n}X_{2n} + Y_2 \\ &\cdots \\ X_i &= a_{i1}X_{i1} + a_{i2}X_{i2} + \cdots + a_{i2}X_{ij} + \cdots + a_{i3}X_{in} + Y_i \\ &\cdots \\ X_n &= a_{n1}X_{n1} + a_{n2}X_{n2} + \cdots + a_{nj}X_{nj} + \cdots + a_{nn}X_{nn} + Y_n \end{aligned} \tag{6.2}$$

This set of equations can be also expressed in matrix notation as $X = AX + Y$. We obtain $X = (I - A)^{-1}$ where the inverse matrix $(I - A)^{-1}$ is also referred to as Leontief inverse matrix L (e.g. Lábaj, 2014):

$$L = (I - A)^{-1} \tag{6.3}$$

The Leontief inverse matrix helps to understand the total direct and indirect effects of any increase in the final demand for production in each sector. It represents the base for the IO analysis. By adding up each column vector of the matrix L, we obtain simple output multipliers (soms). The simple output

multiplier can be equally viewed as the backward linkage of the particular sector. (Reis, Rua, 2006) (Miller, Blair 2009) (Timmer, 2012) The output multiplier measures the effects of one monetary unit change (e.g. 1 euro or 1 dollar change) in the final demand for each sector on total output of all sectors (including the sector itself).

Assessing impacts of changing demand in domestic sectors on imported inputs can be calculated via import multipliers. The calculations requires knowing the vector of import coefficients "*im*", then calculating the matrix $im(I + A)^{-1}$, and lastly adding up column vector of this matrix. Simple import multipliers (simps) can be defined as the total change in imports (endogenous variable) when the final demand (exogenous variable) changes by one unit. (McLennan 1995) (Trinh, Le Hoa, Giang 2009) Using a similar approach, we can also calculate simple income multiplier and simple employment multiplier (e.g. Lábaj 2014; McLennan 1995; Miller, Blair 2009).

In addition to demand side analysis, the IO tables equally allow studying the supply side perspective. This type of analysis works with allocations coefficients and input multipliers (sims), reflecting the forward linkage of the particular sector. (Reis, Rua 2006) This approach means that the vertical (column) view of the model is transposed to a horizontal (row) one. Instead of dividing each column of Z by the gross output of the sector associated with that column, it is necessary to divide each row of Z by the gross output of the sector associated with that row. Miller, Blair 2009) In other words, the coefficients and multipliers are calculated using the row vectors. The allocation coefficients represent the distribution of sector "i's" outputs across other sectors of economy that purchase inputs from "i". The value of input multiplier shows the total new sector "I" intermediate sales to all sectors. We can say that these multipliers measure the effects of one monetary unit change in primary inputs of each sector on total output of all sectors (including sector itself).

Input output approach is also focused on the analyses of the strength of demand and supply linkages between various sectors (demand and forward linkages). The strength of these linkages points out to the most important sectors in the economy, either on the demand or on the supply side. Sectors that have strong both backward and forward linkages are usually qualified as key sectors to the economy. According to Rasmussen (1956, in Reis, Rua 2006), normalized backward linkages that are higher than 1 $(\mathrm{BL_j} > 1)$, point out to the backward oriented sector while strong forward linkages $(\mathrm{FL_i} > 1)$ suggest that the sector is forward oriented. If both backward and forward linkages are strong and higher than 1, i.e. $(\mathrm{BL_j} > 1)$ and $(\mathrm{FL_i} > 1)$, such sectors can be classified as key sectors. Miller and Blair (2009) also use the term "leading" sector. Strong linkages mean that these sectors are the most significant ones as they are the most connected to others serving at the same time as important purchasers and suppliers for other industries of analysed economy. What is more, with the use of BL and FL, it is possible to determine to what extent a particular sector impacts all other sectors of national economy. In other words we can verify whether these impacts are concentrated on a smaller number of other sectors or they are evenly dispersed throughout of the whole economy.

One of the most important advantages of IO analyses is that the values of multipliers remain relatively stable even for longer periods of time. It means that even older values can be used for e.g. the assessment of the current situation or for predicting future impacts of changing demand. The stability of multipliers is linked to the structure of the economy and can be explained by the frequency of the occurrence of technological changes. The most important technological changes do not appear neither frequently nor often. As a result, the economic structures of national economies can remain relatively similar for longer periods of time. The only exceptions are the sectors that are sensitive to the world prices fluctuations or those depending on the climate conditions. (McLennan, 1995)

Leontief (1953) was the first to use an IO model on a national level in order to study structural changes. In his view, structural changes corresponded to the technical coefficient matrix of the model. When economy is undergoing important changes (technological changes, new production techniques, large increases in sector demands, new products, important shifts from domestically produced to imported

inputs, etc.) an economy's technical coefficient matrix and the whole model will change over time. Therefore a study of technological changes can be carried out by studying the changes in the IOT data over the time. (Miller, Blair, 2009) For example Kanemitsu and Ohnishi (1989) used a similar partial substitution method to study technological change in the Japanese economy for the l970-1980 period.

Nowadays, productions in various countries are interlinked and production processes are fragmented. That is why it is important to take into consideration the volume of imports that are generated by domestic production (volume of the imported inputs due to the increased domestic demand) as well as the volume of exports transported abroad.

6.3 Results and discussion

With regards to the limited extent, this paper presents only selected results of the previous research. More detailed results can be provided upon request. The focus of the presented analysis is narrowed to the evolution of two sectors, namely Agriculture and Food production - sectors noted A01 and C10-12 according to the International Industrial Classification, revision 4 (ISIC Rev.4). The research was based on data from the WIOD Database covering the period 2000-2014. (WIOD, 2018; UN, 2017) The latest WIOD update was published in 2016, the socio-economic part in 2018 and they include the period up until 2014.

The choice of sectors can be linked to the certain trend of decline of domestic production in these sectors even though they can still be considered as important or basic ones in each economy. We would like to verify their current positions, similarities in their evolution and to compare possible changes in their positions over the period 2000-2014.

When we look at the latest EU data, according to the agricultural census of Eurostat in 2016 (2018), the utilized agricultural area (UAA - corresponding to total arable land, permanent grassland and meadow, permanent crops and kitchen gardens) represented 1.9 million hectares in the Slovak Republic, 3.5 million ha in the Czech Republic, 4.7 million ha in Hungary and 14.4 million ha in Poland. In case of Austria it corresponded to 2.9 million ha, 16.7 million ha in Germany and 29 million ha in France. As for the Baltic countries, UAA represented 0.9 million ha in Estonia, 2.7 million ha in Lithuania and 1.8 million ha in Latvia.

When compared to the "biggest" European agriculturers such as France (16% of EU's total UAA) or, Spain (13.6% of EU's total UAA), the shares of V4 countries (e.g. 1.1% for the Slovak Republic) or Austria (1.65%) might not seem very significant. However, from the national point of view, the shares of national UAA on overall countries' area, it corresponded to 39% in the Slovak Republic, 44% in the Czech Republic, 57% in Hungary and 46% in Poland, or 32% in Austria. In Baltic countries these shares are a bit lower for Latvia (28%) or Estonia (22%). In Lithuania, however, this share is close to the half of the whole territory (42%). This share is quite similar to those of Germany (47%) and France (45%), that represent the ones of the highest shares within EU-28. (Eurostat 2018)

One of the latest trends in agriculture in EU is a gradual increase of interest in organic farming, especially after 2000 (increase by 18.7% between 2012 and 2016 with the expected upward trend). Organic farming can be described as an agricultural production which uses organic production methods and places the highest emphasis on environmental and wildlife protection. This is accomplished by avoiding, or largely reducing, the use of synthetic chemicals such as fertilizers, pesticides or various additives and replacing them with biological or mechanical methods. (European Commision, 2018)

Over the period 2000-2016, the utilized agricultural area under organic farming was slowly increasing in all EU countries. E.g. in the last 4 years (2012- 2016) the EU's UAA under organic farming increased by 18.7%. It is also expected that these shares would continue to grow in the years to come. (European Commision, 2017)

From the point of view of national economies, the size of the organic area differs considerably from one EU country to another. In 2016, the highest shares of organically farmed land could have been attributed to the largest EU economies, i.e. Spain (16.9%), Italy (15.1%) France (12.9%) and Germany (9.5%), together making up 54.4% of the total EU-28 organic area. These countries also represent the ones with the highest increases in this area (e.g. +50% in case of France). On the other hand, in V4 countries, the conversions of UAA organic areas were following a slower pace: from relatively low shares around 2-5% in 2000 to almost 10% in 2016 (SK), 14% (CZ). However, the shares of Hungary and Poland remained quite low. According to Eurostat agricultural census, in 2016, there were only around 4% of UAA under organic farming. This may seem a bit of a paradox, as these countries are important agricultural producers. On the other hand, the upcoming trend can be measured by the area under conversion, as it can give an indication of the potential growth in the organic sector in the years to come. In this case, Hungary accounts for one of the largest shares, i.e. 51%. In case of Baltic countries, the utilized agricultural area under organic farming increased by 27.3% in Estonia, 32.4% in Latvia, 41.6% in Lithuania over the period 2000-2016, (European Commission, 2018, (Melnikienė, 2018; Central Statistical Bureau of Latvia, 2017; Koov, 2017) (European Commission, 2018) (Eurostat, 2018)

As mentioned before, the importance or the position of any sector can be described by basic indicators, such as the sector's share on total output, on overall employment, on total value added, on total exports or on total imports. IO analysis represents another, more detail approach for evaluating possible impacts of each studied sector. The next part of the text will present in more detailed analyses of selected countries, divided in three groups: "V4 countries", "Baltic countries" and "Old EU member countries". The latter two would be also compared with the Slovak Republic.

6.3.1 V4 countries

This analysis starts with the comparison of position of two sectors by basic indicators (the sector's share on total output, on overall employment, on total value added, on total exports or on total imports). When we compare the characteristics of V4 countries, out of the 56 sectors, there are only few sectors with average sector shares exceeding 5 % of total values for the whole economy.

It was confirmed for all of observed indicators, i.e. average production share on total country's production (SK– 4 sectors, CZ– 3 sectors, HU- 5 sectors, PL- 4 sectors), average employment share on total employment (SK– 6 sectors, CZ– 5 sectors, HU- 6 sectors, PL- 6 sectors), average export share on total exports (SK– 5, CZ– 5, HU- 3, PL- 2), average import share on total imports (SK– 6 sectors, CZ– 4, HU- 3, PL- 4) and average value added share on total value added (SK– 5 sectors, CZ- 0, HU- 3, PL- 6).

Table 6.1 shows that the most important producers were the sectors of motor vehicles manufacturing - C29 (SK and HU), construction - F (CZ and PL). The most important employers were the sectors of education - P85 (SK), construction -F (CZ), retail trade - G47 (HU) and agriculture -A01 (PL). As for the exporting sectors, the highest average shares for all four countries were observed in the manufacture of motor vehicles (C29). On the import side, the highest average shares were present for the sector of motor vehicles manufacturing only in the Slovak Republic and the Czech Republic. In Hungary the most important importing sector was on average the sector of manufacture of computer, electronic and optical products – C26 and in Poland the sector of construction – F. The highest share of value added on total value added was created in construction (SK), retail trade – G47 (PL) and public administration and defence (HU). In case of the Czech Republic there was no sector with the share of valued added on total value added exceeding 5%.

From this point of view we could state that there are certain similar traits in the structure of national economies. Especially the domain of foreign trade seems to be rather similar. As for the position of two studied sectors, i.e. agriculture and food production, they have an important position only in

Hungary and Poland, especially from the point of view of employment (PL and HU) and exportations (PL).

Table 6.1 V4's the most important sectors from the point of view of output, employment, export, import and value added (1st and 2nd position), 2000-2014, average shares

	Output 1st	Output 2nd	Empl 1st	Empl 2nd	Export 1st	Export 2nd	Import 1st	Import 2nd	Va 1st	Va 2nd
SK	C29 8.42%	F 8.03%	P85 9.26%	G47 8.09%	C29 22.23%	C26 8.97%	C29 19.45%	C26 9.21%	F 7.84	L68 7.34
CZ	F 8.66%	C29 7.06%	F 8.69%	G47 7.36%	C29 18.9%	C26 9.22%	C29 14.86%	C26 8.67%	-	-
HU	C29 6.98%	C26 6.53%	G47 9.16%	A01 7.96%	C29 18.67%	C26 18.51%	C26 18.18%	C29 15.88%	O84 8.68	L68 8.14
PL	F 8.96%	G46 6.64%	A01 15.07%	E 7.03%	C29 11.71%	C1012 6.54%	F 8%	C19 7.84%	G47 7.91	F 7.63

Source: Calculated by the author (WIOD data)

In Table 6.2 we can see selected values for agriculture and food sectors over the observed period. The shares of agriculture and food sectors were relatively low, in general not exceeding 5 % for the whole analysed period in case of production. The exceptions were, as mentioned before, the Hungarian and Polish employment in agriculture – approximately 8 % and 15 % average shares on the total country's employment. These two countries present also values for shares of food production on total production slightly higher than 5 %. It can be seen that countries experienced declines in both production and employment shares vis-à-vis the overall production and overall employment. The most significant reductions (more than 50 %) appeared in the Slovak Republic in case of food sector (for production share) and agriculture (for employment share). As for the overall evolution, we can see mostly decreases in the values; the only increase was recorded in Poland.

Table 6.2 Shares of sector output on total economy's output, shares of sector employment on total economy's employment

	Sector output on total output (%)					Sector employment on total employment (%)				
country	**2000**	**2008**	**2010**	**2014**	**Δ%**	**2000**	**2008**	**2010**	**2014**	**Δ%**
SK a01	3.75	2.51	1.96	2.47	-34.1	4.78	2.61	2.34	2.18	-54.4
CZ a01	2.52	1.60	1.39	1.95	-22.62	3.82	2.66	2.58	2.78	-27.23
HU a01	5.73	3.95	3.58	4.26	-25.65	12.01	6.70	6.75	6.08	-49.38
PLa01	4.05	3.22	3.04	3.02	-25.43	19.81	13.53	12.58	10.53	-46.85
SK c1012	4.49	2.62	2.26	2.22	-50.7	3.51	2.54	2.42	2.14	-39.0
CZ c1012	5.39	3.67	3.43	3.42	-36.55	3.16	2.52	2.52	2.45	-22.47
HU c1012	6.35	4.50	4.38	4.72	-25.67	3.71	3.14	3.11	2.83	-23.72
PLc1012	6.37	6.10	6.01	6.73	+5.65	3.12	3.44	3.34	3.47	+11.22

Source: Calculated by the author (WIOD data)

As for the exports and imports, the shares of agriculture and food production do not exceed 5 % reference value (Table 6.3). When compared to the average shares of exports and imports of other sectors, agriculture and food production shares could be considered as almost negligible, with relatively low values. The shares increased mainly on the export side (e.g. a01 in SK, HU, PL or c1012 in CZ, HU, PL). Overall, the evolution in Polish food sector can be described as the most favourable one with the increases for all 5 observed indicators. These sectors represent neither important exporters (importers) nor they produce important volumes of value added.

Table 6.3 Shares of sector export on total economy's export, shares of sector import on total economy's import

	Sector export on total export (%)					Sector import on total import (%)				
country	2000	2008	2010	2014	Δ%	2000	2008	2010	2014	Δ%
SK a01	0.92	1.54	1.53	1.55	+68.48	3.18	1.51	1.55	1.91	-39.94
CZ a01	1.16	1.09	0.93	1.14	-1.72	1.71	1.07	1.10	1.94	+13.45
HU a01	1.18	1.40	1.35	1.80	+52.54	2.85	2.29	2.07	2.36	-17.19
PLa01	5.39	3.73	3.32	4.22	-21.71	3.90	2.90	2.52	2.56	-34.36
SK c1012	1.49	1.63	1.51	1.03	-30.87	3.59	2.11	1.96	1.90	-47.08
CZ c1012	2.59	3.28	3.34	4.14	+59.85	2.98	2.01	2.05	2.03	-31.88
HU c1012	4.33	4.07	4.38	5.18	+19.63	3.81	3.00	2.86	3.16	-17.06
PLc1012	5.24	6.83	6.54	7.70	+46.95	4.40	4.23	4.48	5.49	+24.77

Source: Calculated by the author (WIOD data)

Table 6.4 shows the comparison of values added in agriculture and food productions. Here again, the values stayed at the relatively low levels (range 1 - 3.50 %). As for the evolution over the period 2000-2014, there are no discernible similar traits.

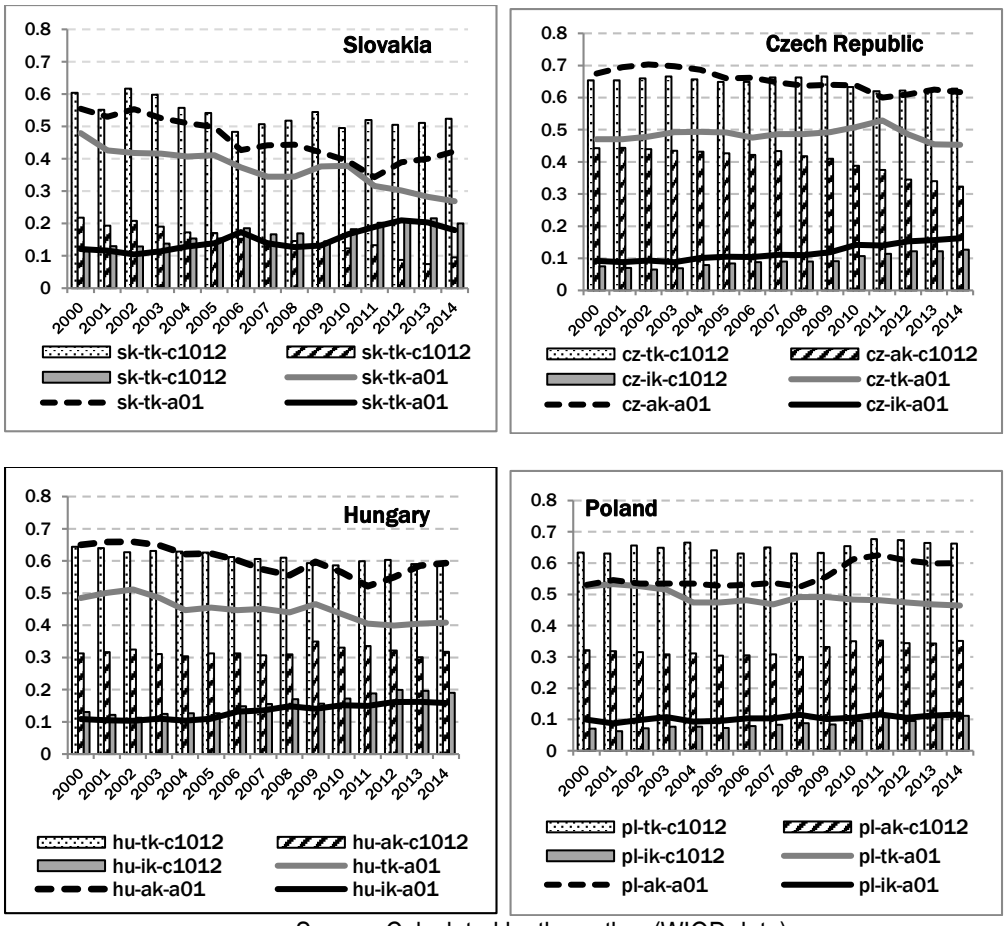
Table 6.4 Shares of sector value added on total economy's value added

	Sector value added on total value added (%)				
country	2000	2008	2010	2014	Δ%
SK a01	3.58	3.20	2.07	3.31	-7.54
CZ a01	2.56	0.92	0.55	1.00	-60.94
HU a01	1.92	2.62	2.79	2.46	+28.13
PLa01	2.88	2.57	2.62	2.67	-7.29
SK c1012	2.94	1.83	1.60	1.47	-50.00
CZ c1012	0.87	1.13	1.18	1.16	+33.33
HU c1012	3.26	2.22	2.37	2.37	-27.30
PLc1012	3.41	3.20	3.41	3.44	+0.88

Source: Calculated by the author (WIOD data)

The next part of the analysis was based on the input output tables representing intersectorial relationships within each economy. Firstly, the basic IO coefficients were calculated, i.e. technical coefficients (tk, for output), allocation coefficients (ak, for input) and import coefficients (ik, for import). These coefficients were then used to calculate simple output, input and import multipliers (som, sim, simp). And lastly, the analysis proceeded to verify the importance of both industries by studying the strength of demand and supply linkages (BL, FL) as well as concentrations of their impacts.
In order to calculate multipliers, firstly the basic IO technical, allocation and import coefficients had to be determined. The study of these coefficients for both sectors (Figure 6.1) shows that they were mainly marked by steady declines (SK, CZ and HU). The only exceptions were the values for both Polish sectors with their coefficients increasing. On the other hand, import coefficients were showing the opposite trend, i.e. a gradual increase in values, confirming growing significance of the imported inputs for both sectors and both countries. It can be also interpreted as an increasing share of domestic inputs that are being replaced by the imported ones.

Figure 6.1 Technical, allocation, import coefficients – sectors a01, c1012 (SK, CZ, HU, PL), 2000-2014



Source: Calculated by the author (WIOD data)

Table 6.5 shows the sectors' values of output, input and import multipliers at the beginning and the end of the observed period, namely for the years 2000 and 2014, as well as the average values of these multipliers. In most cases the values of output and input multipliers for both sectors were following the decreasing trend. The only exceptions are values of Polish sectors. As for the import multipliers, the values were slowly increasing.

When we compare multipliers for these sectors, it is obvious that on the demand side (som) the food sectors impact national economies more significantly than the agriculture sectors : average values of multipliers from the range (1.617 - 1.957) for a01 compared to C1012 values from the range (1.931 – 2.308). A closer look at the results shows that higher average demand impacts (som) appear in case of food production. While in the Slovak Republic each 1€of demand increase in agriculture would generate 1.62€ in case of Czech agriculture sector, the impact would be almost 1.97€ The same can be said for food sector, the lowest impact was in case of the Slovak Republic (1.93€for 1€increase) and the highest in case of the Czech Republic (2.25€for 1€increase).

Middle section of the table shows the multiplier values from the supply side point of view (sim), i.e. the case when sectors serve as the suppliers as input to other sectors. When we compare both sectors, we can state that sector of agriculture is more important supplier of inputs than food sector (sims for a01 > sims for c1012) what is also logical as most of the food production would serve the final consumptions. 1€increase in supply in Czech or Hungarian agricultural production could stimulate

other production by 2 - 2.13€ In case of food production the highest impacts would be at the level of 1.50€(HU, PL).

Table 6.5 Output, input and import multipliers

country	Som min	Som max	Som av	Som med	Sim min	Sim max	Sim av	Sim med	Simp min	Simp max	Simp av	Simp med
SK a01	1.40	1.90	1.62	1.61	1.47	2.11	1.68	1.62	0.18	0.31	0.24	0.23
CZ a01	1.83	2.04	1.96	1.97	1.98	2.29	2.14	2.15	0.17	0.30	0.23	0.22
HU a01	1.66	1.94	1.78	1.77	1.84	2.17	2.00	1.99	0.18	0.27	0.23	0.24
PL a01	1.84	2.00	1.90	1.88	1.71	2.10	1.92	1.88	0.17	0.22	0.20	0.19
SK c1012	1.79	2.19	1.93	1.87	1.11	1.69	1.24	1.19	0.25	0.39	0.32	0.31
CZ c1012	2.15	2.35	2.25	2.30	1.53	1.82	1.71	1.74	0.15	0.27	0.21	0.21
HU c1012	1.97	2.18	2.06	2.03	1.44	1.53	1.48	1.48	0.24	0.40	0.32	0.32
PL c1012	2.15	2.29	2.21	2.21	1.08	1.59	1.50	1.51	0.14	0.25	0.19	0.18

Source: Calculated by the author (WIOD data)

Each additional domestic production equally stimulates the imports of foreign inputs. In this case, the values of multipliers are usually lower but their trend is in general increasing. It confirms the current tendencies of increasing importance of cross border transactions between countries. Increases in agriculture sectors would generate approximately 0.20-0.23€ of foreign inputs, in food sector approximately 0.20 – 0.32€of foreign inputs that would be needed.
Values of multipliers also permit to verify the sectors' stability. When compared, values of average and median can be used for a simple evaluation of the stability of these sectors. Closer values of average and median could be interpreted as a higher stability of multipliers. Values that are more far apart would thus mean a higher fluctuation or presence of a certain trend in the evolution of multipliers. In the table 6.5, we can see that in most cases these values are very close to each other. Slightly higher differences can be observed in case of Slovak and Polish food productions (som, sim). This could be considered as an indirect confirmation of a relative stability of observed sectors.

The next step consisted of the analysis of the normalized values of output and input multipliers. We can also speak of demand, or backward linkages in case of output multipliers and supply, or forward linkages in case of input multipliers. Table 6.6 shows the average values for normalised backward (nBL) and forward linkages (nFL) in agriculture and food production as well as their variation coefficients (VK) expressed in %. The right part of the table presents these values for the whole national economy (all sectors). Values of nBLs and nFLs that exceed 1, indicate the orientation of the sector either backward (strong demand linkage, nBL>1) or forward (strong supply linkage, nFL>1). It can be said that a particular sector is important for the economy and its changes generate an over-average impact on other sectors either backward or forward. If both linkages exceed 1, this sector can be considered as a key sector to the economy (nBL>1 and nFL>1).
From the results presented in Table 6.6 (left part), agriculture can be considered as one of the key sectors in the Czech Republic (1.11 and 1.15), Hungary (1.19 and 1.25) and Poland (1.12 and 1.11). The strength of the linkages seems to be the most significant for Hungarian agriculture (the highest numbers) what could point out to a relatively strong position of this sector in national economy. In the Czech Republic and Poland the similar values of nBL and nFL confirm also similar positions of their agricultures. On the other hand, in case of the Slovak Republic, average values show the stronger backward orientation. However, more detailed analysis confirms that the agriculture could have been qualified as key also in the Slovak Republic, at the beginning of the observed period, notably over the period 2000-2005.

Table 6.6 nBL and nFL, VK

	nBL	nBL	nFL	nFL	Total	VK	min	max	av
country	av	VK %	av	VK %	econ	%	(sector)	(sector)	
SK a01	0.98	4.41	0.99	6.12	SK	nBL	1.33 (C23)	23.07 (R-S)	4.86
CZ a01	1.11	1.90	1.15	3.39		nFL	1.75 (N)	28.65 (G46)	10.14
HU a01	1.19	2.21	1.25	2.84	CZ	nBL	0.93 (P85)	14.01 (A03)	3.73
PL a01	1.12	1.74	1.11	10.20		nFL	0.97 (P85)	27.25 (K66)	6.31
SK c1012	1.17	2.46	0.73	8.51	HU	nBL	0.71 (N)	5.41 (C29)	2.65
CZ c1012	1.29	1.14	0.93	3.70		nFL	1.05 (G46)	19.93 (B)	5.60
HU c1012	1.38	1.18	0.92	4.21	PL	nBL	0.90 (C22)	12.50 (H50)	2.89
PL c1012	1.30	2.54	0.86	3.80		nFL	2.21 (J61)	27.49 (C26)	8.41

Source: Calculated by the author (WIOD data)

The lower part of the Table 6.6 presents normalized values of BL and FL for food productions. It is obvious that this sector has strong backward orientation and weaker supply linkages. It is quite logical as the products of food sectors serve mainly for final consumption of various economic subjects. At the same time food production is strongly dependent on the supply of inputs, especially from the agriculture productions.

Based on demand and supply relationships we can also determine the extent of the sector's impact, namely whether the effects of the particular sector are concentrated on few other industries, or its impacts are scattered across a large number of other sectors. The range of influence can be determined thanks to the variation coefficient (VK). Higher values indicate a stronger concentration on interconnected industries; lower values refer to lower concentration and thus evenly dispersed impacts across the economy. As for the two observed sectors, their values of variation coefficients are lower than the countries' average VK (right side of Table 6.6). The only exception is Slovak and Polish agriculture production with higher VK for backward linkages.

The comparison of most and least important sectors in four observed countries from the point of view of the concentration is also presented in this table. The highest concentration is present on the supply side (nFL av > nBL av, also nFL max > nBL max). The highest concentration on supply side seems to be similar for the Slovak Republic, the Czech Republic and Poland (27-29%), the sectors are however different. The sectors with the most concentrated impacts on the demand side (the highest values of VK for nBL) are: R-S - Other services sector (SK); A03 – Fishing and aquaculture (CZ), C29 – manufacture of motor vehicles (HU) and water transport (PL). On the supply side (VK for nFL) the highest values and thus the most concentrated impacts are in case of G46 - Wholesale trade sector (SK) and K66 – financial services and insurance activities (CZ), B – mining and quarrying (HU) and C26 – manufacture of computer, electronic and optical products (PL).

The max VK values on demand side are from the rage (5% for HU to 23% in SK). As for the average values, these could be interpreted as a measure of the economic structure from the concentration point of view. Low average values confirm a more balanced structure of national economy while higher values (e.g. 10% in SK) point to strong position of certain sectors. This could be seen as less favourable as their impacts are also stronger and more concentrated. From this point of view we cannot affirm that countries have similarly interlinked sectors with similarly distributed concentrations of effects. However it is obvious that the maximum values for nFL are higher that maximum values for

nBL. The same can be said for average values. It can be interpreted as a stronger concentration when looking forward and lower concentration (even distribution of effects) when looking backward.

6.3.2 "Old" EU members and the Slovak Republic

As mentioned before, the importance or the position of any sector can be described by basic indicators, such as the sector's share on total output, on overall employment, on total value added, on total exports or on total imports. When we compare the characteristics of four selected countries, i.e. the Slovak Republic, Austria, Germany and France, out of the 56 sectors, here again we can only find few sectors with average sector shares exceeding 5% of total values for the whole economy. It is confirmed for all of observed indicators, i.e. average production share on total country's production (SK– 4 sectors, AT– 3 sectors, DE- 2 sectors, FR- 4 sectors), average employment share on total employment (SK– 6 sectors, AT– 7 sectors, DE- 7 sectors, FR- 6 sectors), average export share on total exports (SK– 5 sectors, AT– 5 sectors, DE- 5 sectors, FR- 5 sectors), average import share on total imports (SK– 6 sectors, AT– 4 sectors, DE- 5 sectors, FR- 6 sectors) and average value added share on total value added (SK– 5 sectors, AT- 6 sectors, DE- 3 sectors, FR- 5 sectors). The most important producers were the sectors of motor vehicles manufacturing (SK), construction (AT) and real estate activities together with motor vehicles manufacturing (DE and FR); the most important employers were the sectors of education (SK and AT) and human health and social services (FR and DE). As for the exporting and importing sectors, the highest average shares for all four countries were observed in the manufacture of motor vehicles. The highest share of value added on total value added was created in construction (SK) and real estate (AT, DE and FR) sectors. From this point of view we could state that the Slovak Republic does not share many similar traits with France, Austria and Germany (from the economic structure point of view). On the other hand, we can find some similarities for Austria and Germany France and Germany. (Table 6.7)

Table 6.7 The most important sectors from the point of view of output, employment, export, import and value added (1st and 2nd position) – average shares, 2000-2014

	Output 1st	Output 2nd	Empl 1st	Empl 2nd	Export 1st	Export 2nd	Import 1st	Import 2nd	Va 1st	Va 2nd
SK	C29 8.42%	F 8.03%	P85 9.26%	G47 8.09%	C29 22.23%	C26 8.97%	C29 19.45%	C26 9.21%	F 7.84%	L68 7.34%
AT	F 7.91%	L68 6.55%	Q 9.34%	G47 8.68%	C29 10.01%	C28 9.83%	C29 8.97%	F 7.26%	L68 8.92%	F 6.86%
DE	L68 7.52%	C29 6.27%	Q 11.40%	G47 7.83%	C29 16.55%	C28 12.32%	C29 11.60%	C19 6.92%	L68 11.39%	Q 6.78
FR	L68 7.67%	F 7.27%	Q 12.84%	O84 9.26%	C29 9.75%	G46 7.94%	C19 9.29%	F 8.88%	L68 12.52%	Q 8.43%

Source: Calculated by the author (WIOD data)

In Table 6.8 we can see selected values for agriculture and food sectors. We compared the values at the beginning and at the end of the observed period as well as the years of crisis. The average shares of agriculture (a01) and food (c1012) sectors were low, not exceeding 5% for the analysed period. The only exception is the Austrian agriculture sector in 2000-2004 that covered slightly more than 5% of the total employment. As for the overall trend in evolution, countries experienced declines in both production and employment shares vis-à-vis the overall production and employment. The most significant reductions (more than 50%) appeared in the Slovak Republic in case of c1012 (for production share) and a01 (for employment share). The least significant changes (decreases) could be observed in German agriculture and food sectors where the shares remained fairly stable.

Table 6.8 Shares of sector output on total economy's output, shares of sector employment on total economy's employment

	Sector output on total output (%)					Sector employment on total employment (%)				
country	2000	2008	2010	2014	Δ%	2000	2008	2010	2014	Δ%
SK a01	3.75	2.51	1.96	2.47	-34.1	4.78	2.61	2.34	2.18	-54.4
AT a01	3.00	2.03	2.29	2.25	-25.0	3.31	1.82	2.20	2.01	-39.3
DE a01	1.05	0.95	0.87	0.89	-15.2	1.74	1.53	1.50	1.42	-18.4
FR a01	2.52	2.03	2.03	2.10	-16.7	3.43	2.76	2.67	2.62	-23.6
SK c1012	4.49	2.62	2.26	2.22	-50.7	3.51	2.54	2.42	2.14	-39.0
AT c1012	5.58	4.12	4.18	4.20	-24.7	4.13	3.25	2.36	2.89	-30.0
DE c1012	3.51	3.42	3.33	3.48	-0.85	2.32	2.26	2.25	2.17	-6.47
FR c1012	4.65	4.24	3.99	4.11	-11.6	2.50	2.33	2.30	2.31	-7.60

Source: Calculated by the author (WIOD data)

Table 6.9 compares the average values of sectors' exports and imports on total exports and imports. It can be seen that the values are lower for agriculture exports with an increasing trend. The food production exports recorded a slight decrease in average shares in case of the Slovak Republic and increases for Austria, Germany and France. On the other hand, agriculture imports showed mainly decreasing trends, with the exception of imported food products in Austria, Germany and France that augmented by almost 9% (FR), 12% (AT) and 23% (DE) between 2000-2014.

However, when compared to the average shares of exports and imports of other sectors (Table 6.7), agriculture and food sectors' shares could be considered as almost negligible, with relatively low values. E.g. in case of motor vehicles manufacturing, exports accounted on average for about 22% of exports and 19.5% of imports in the Slovak Republic. This sector was the biggest exporter and importer also in Austria and Germany with average shares of 10% for exports and almost 9% for imports (AT) and 16.6% for exports and 11.6% for imports (DE). The structure of French foreign trade was similar to other studied countries on the export side, i.e. 10% of exports ensured by motor vehicles manufacturing. On the import side, however, the sector of manufacture of coke and refined petroleum products is the most significant one (9.3%).

This comparison confirms similar economic structures of studied countries from the point of view of exports and imports, especially for the Slovak Republic, Austria and Germany. In this case France foreign trade shows comparable results mainly on the export side.

Table 6.9 Shares of sector exports and imports on total country's exports and imports

	Sector export on total export (%)					Sector import on total import (%)				
country	2000	2008	2010	2014	Δ%	2000	2008	2010	2014	Δ%
SK a01	0.92	1.54	1.53	1.55	+68.48	3.18	1.51	1.55	1.91	-39.94
AT a01	0.67	0.71	0.78	0.77	+14.92	1.29	1.10	1.12	1.10	-14.73
DE a01	0.62	0.61	0.73	0.76	+22.58	1.06	0.97	0.98	1.02	-3.77
FR a01	2.29	2.36	2.56	2.43	+6.11	2.65	2.56	2.27	2.53	-4.53
SK c1012	1.49	1.63	1.51	1.03	-30.87	3.59	2.11	1.96	1.90	-47.08
AT c1012	3.64	4.66	5.43	5.74	+57.69	3.32	3.35	3.34	3.71	+11,75
DE c1012	3.22	3.68	4.16	4.52	+40.37	4.31	4.30	4.51	4.63	+23.20
FR c1012	5.50	5.63	5.68	6.03	+9.64	3.47	3.58	3.64	3.77	+8.65

Source: Calculated by the author (WIOD data)

Table 6.10 shows average shares of value added on total value added. Here again, we can state that none of the observed sectors exceeded 5% average share and were mostly below 3% share. What is more, shares of value added for agriculture and food sectors decreased over this period. The highest decline appeared in case of Slovak food sector (about -50%), the lowest was recorded in Slovak agriculture (-7.54%). As for all other sectors in the Slovak Republic, Austria, Germany and France, the

highest shares of value added were identically recorded in construction and real estate sectors. From this point of view, countries could be again considered as similar.
When we compare the period of crisis in all previous tables, we can conclude that the effects of crisis were rather mixed. The average shares of production, employment, export, import and value added on the total countries' value suggest in some cases a slight decline around 2000-2009 with a subsequent recovery after 2010 or a continuing decline in others.

Table 6.10 Shares of sector value added on total country's value added

	Sector value added on total value added (%)				
country	**2000**	**2008**	**2010**	**2014**	**Δ%**
SK a01	3.58	3.20	2.07	3.31	-7.54
AT a01	1.40	1.11	1.02	0.98	-30.00
DE a01	0.96	0.78	0.64	0.60	-37.50
FR a01	2.14	1.51	1.63	1.52	-28.97
SK c1012	2.94	1.83	1.60	1.47	-50.00
AT c1012	2.08	1.81	1.95	1.87	-10.10
DE c1012	1.91	1.59	1.65	1.62	-15.18
FR c1012	2.73	2.27	2.10	2.23	-18.32

Source: Calculated by the author (WIOD data)

The next step consisted of the analysis using input output tables with data representing intersectorial relationships within each economy. Firstly, we looked closely at the coefficients that represent intermediate production: technical coefficients (tk, for output), allocation coefficients (ak, for input) and import coefficients (ik, for import). The coefficients were used to calculate simple output, input and import multipliers (som, sim, simp). Finally, we proceeded to verify the importance of sectors by analyzing the strength of demand and supply linkages (BL, FL).
In order to calculate multipliers, we firstly had to look more closely on basic IO coefficients. (Figure 6.2) Technical and allocation coefficients were marked by steady declines (mainly SK). In Austria, Germany and France, these coefficients remained fairly stable, the increases were almost negligible. On the other hand, import coefficients were showing the opposite trend, i.e. a gradual increase in values, confirming growing significance of the imported inputs for both sectors and all observed countries. It can be also interpreted as an increasing share of domestic inputs that are being replaced by the imported ones. This is especially visible in case of the Slovak Republic.
As for the particular values, import coefficients were rather similar, mainly around the value 0.10 (AT, DE, FR) and almost at the value 0.2 (SK). Similar values for three "old" members appear also for technical coefficients (a01) and allocation coefficients (c1012). This again points to different results and situation for "old" and "new" EU members.

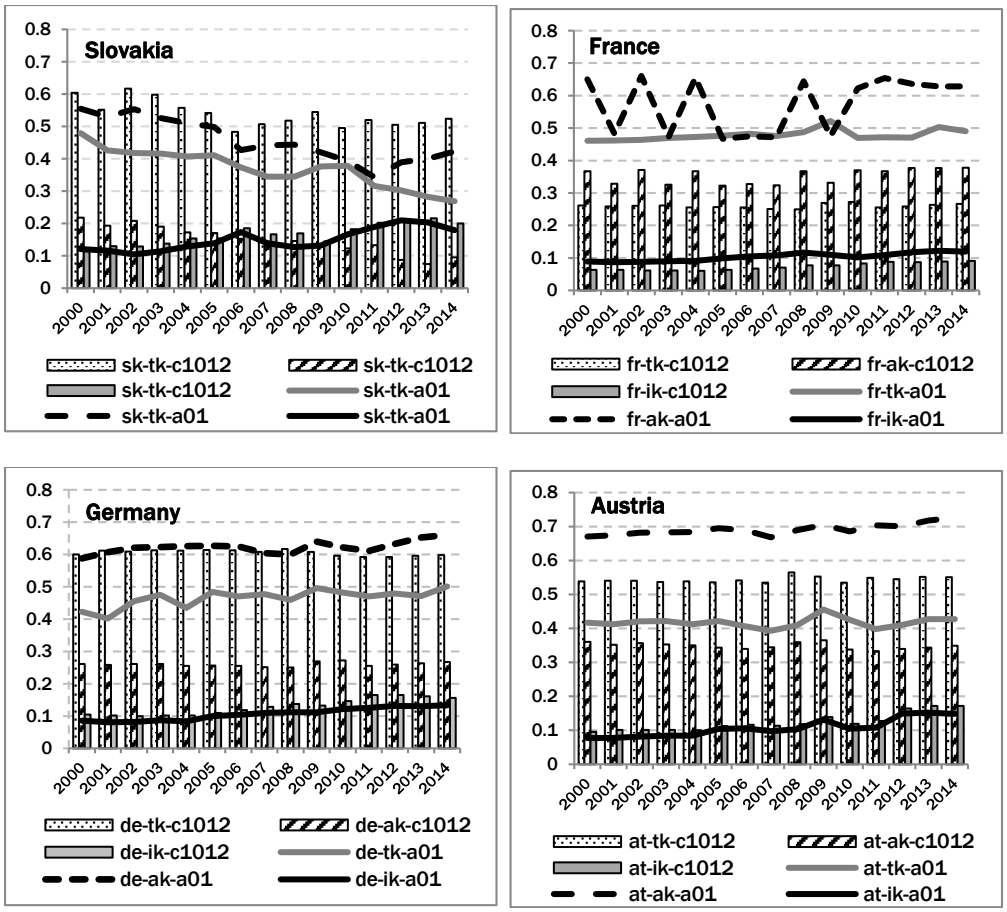


Figure 6.2 Technical, allocation, import coefficients – sectors a01, c1012 (SK, FR, DE, AT), 2000-2014

Source: Calculated by the author (WIOD data)

Table 6.11 shows the minimum and maximum values of three multipliers as well as their average and median values. The results tell that higher average demand impacts (som) appear in case of food production. Each demand increase of 1€in food sector should generate 1.93€(SK), 1.94€(AT), 2.08€ (DE) or even 2.19€(FR) of additional productions in supplying sectors. The highest supply impact (sim average) means that 1€of agricultural production could generate 2.12€in Austria or 2.16 €in France of new production when looking forward. As for import multipliers (simp), these values are usually lower than som and sim. Here the average values range from 0.16 (French food sector) to 0.32 (Austrian food sector) meaning that for 1€increase in demand, new imports of about 0.16 - 0.32€would be needed.

When compared, values of average and median can be used for a simple evaluation of the stability of these sectors. Closer values of average and median could be interpreted as a higher stability of multipliers. Values that are more far apart would thus mean a higher fluctuation or presence of a certain trend in the evolution of multipliers. Table 6.11 shows that these values are mostly identic or very close to each other. Slightly higher differences can be observed in case of SK c1012 (som, sim) and FR a01 (sim).

From the point of view of IOT analysis, we can see similar average results for agriculture in the Slovak Republic and Austria (som – a01, c1012), France and Austria (sim - a01) or Germany and Austria

(simp – a01, c1012). As a result, it is possible to conclude that these sectors do have some similar traits but only to a limited extent. In general these similarities appear mainly in the group of "old" members.

Table 6.11 Output, input and import multipliers

country	Som min	Som max	Som av	Som med	Sim min	Sim max	Sim av	Sim med	Simp min	Simp max	Simp av	Simp med
SK a01	1.40	1.90	1.62	1.61	1.47	2.11	1.68	1.62	0.18	0.31	0.24	0.23
AT a01	1.67	1.82	1.71	1.71	2.06	2.19	2.12	2.11	0.13	0.26	0.18	0.18
DE a01	1.70	1.86	1.80	1.81	1.82	1.92	1.87	1.87	0.14	0.25	0.19	0.20
FR a01	1.86	2.01	1.90	1.88	1.97	2.50	2.16	2.10	0.16	0.23	0.20	0.20
SK c1012	1.79	2.19	1.93	1.87	1.11	1.69	1.24	1.19	0.25	0.39	0.32	0.31
AT c1012	1.91	1.99	1.94	1.94	1.47	1.53	1.49	1.49	0.18	0.33	0.24	0.22
DE c1012	2.06	2.11	2.08	2.08	1.33	1.36	1.34	1.34	0.21	0.34	0.27	0.27
FR c1012	2.15	2.23	2.19	2.19	1.57	1.86	1.66	1.60	0.13	0.20	0.16	0.16

Source: Calculated by the author (WIOD data)

The next step consisted of the analysis of the normalised values of output and input multipliers (som and sim) or demand and supply linkages as they are also referred to. Table 6.12 (left part) shows the average values for normalised backward (nBL) and forward (nFL) linkages in case of studied sectors of agriculture and food production. Values of nBLs and nFLs higher than 1 indicate the orientation of the sector either backward or forward (strong demand or supply linkage). If both linkages exceed 1, this sector can be considered as a key sector to the economy.

Table 6.12 nBL and nFL, VK

	nBL	nBL	nFL	nFL	Total	VK	min	max	av
country	av	VK %	av	VK %	econ	%	(sector)	(sector)	
SK a01	0.98	4.41	0.99	6.12	SK	nBL	1.33 (C23)	23.07 (R-S)	4.86
AT a01	1.17	2.46	0.73	8.51		nFL	1.75 (N)	28.65 (G46)	10.14
DE a01	1.06	1.71	1.24	2.03	AT	nBL	0.80 (G47)	10.32 (C19)	2.55
FR a01	1.20	1.01	0.88	1.05		nFL	0.74 (G47)	17.04 (A03)	3.84
SK c1012	1.07	2.40	1.08	2.38	DE	nBL	0.57 (C1012)	11.91 (C19)	2.64
AT c1012	1.24	0.58	0.78	1.31		nFL	0.61 (M71)	23.25 (M72)	2.38
DE c1012	1.10	1.98	1.18	5.36	FR	nBL	0.62 (I)	11.77 (D35)	2.43
FR c1012	1.27	0.87	0.91	3.33		nFL	1.29 (H53)	28.20 (M72)	5.73

Source: Calculated by the author (WIOD data)

From the results presented in Table 6.12, agriculture can be on average considered as key in Austria (1.06 and 1.24), in Germany (1.07 and 1.08) and also in France (1.10 and 1.18). On the other hand, food sector in these three countries is only backward oriented (nBL>1 and nFL<1). More detailed analysis confirms that the agriculture could have been qualified as key also in the Slovak Republic but only at the beginning of the observed period, notably over 2000–2005. For Slovak food production we can again observe stronger demand orientation. This points out to the probable linkage between

agriculture and food production, where the agriculture serves as a supplier of inputs to the food sector. Comparison of values by individual countries shows higher similarity for "old" EU members.
Based on demand and supply relationships we can determine the extent of the sector's impact; whether its effects are more or less concentrated on other industries. The influence can be determined thanks to variation coefficient (VK). As mentioned before, higher values of VK indicate a stronger concentration on interconnected industries; lower values refer to lower concentration and evenly dispersed impacts across the economy.
When comparing all sectors in selected countries, we can see some differences (right side of Table 6.12). Table shows the sectors with the most and the least concentrated average impacts on both demand and supply side in the Slovak Republic, Austria, Germany and France. From this point of view, we cannot affirm that countries have similarly interlinked sectors with similarly distributed concentrations of effects. Countries' average VK for backward or forward linkages are mainly lower, indicating a rather even distribution of various sectors' impacts on national economies. The only exception is 10% value of VK in case of Slovak forward linkages. Comparison of minimum and maximum VK values shows again many differences for these countries.
As for the observed sectors of agriculture and food production, their values of VK are lower than the countries' average VK. The only exception is SK c1012 with VK for FL at the level of 8.51%. This again could point out to a higher level of similarity for "old" EU members and different situation in case of a "new" member. In general we can conclude that on average, impacts on the demand side are more evenly distributed than on the supply side (VK for nBL > VK for nFL).

6.3.3 Baltic countries and the Slovak Republic

The analysis of Baltic countries starts again with the comparison of the most important countries' sector and the positions of the agriculture and food sectors. Here again, we can see similar results to those of other group of countries. In general, the number of sectors with average production share exceeding 5% of total economy's output (or respectively average employment share > 5% of total employment) are: SK - 4 sectors, EST - 4, LIT- 7, LAT - 7 (SK - 6, EST - 5, LIT - 5, LAT - 6). More specifically (Table 6.13), the most important producing sectors are manufacture of motor vehicles (SK), construction (EST, LAT) or manufacture of coke and refined petroleum products (LIT). The biggest employers are mostly services sectors, such as education, whole and retail sale trade, construction, public administration and health and social services. As for the foreign trade, here we can see similarities within the group of Baltic countries, mainly between Estonia and Latvia – sectors of manufacturing of wood and wooden products (export in EST and LAT) or construction (import in EST and LAT). The highest value added is created in real estate sector (EST and LAT) or retail trade (LIT).

Table 6.13 Most important sectors from the point of view of output, employment, export, import and value added (1st and 2nd position), 2000-2014, average shares

	Output 1st	Output 2nd	Empl 1st	Empl 2nd	Export 1st	Export 2nd	Import 1st	Import 2nd	Va 1st	Va 2nd
SK	C29 8.42%	F 8.03%	P85 9.26%	G47 8.09%	C29 22.23%	C26 8.97%	C29 19.45%	C26 9.21%	F 7.84%	L68 7.34%
EST	F 8.75%	L68 5.98%	P85 9.29%	G47 8.37%	C16 10.33%	H52 8.92%	F 10.33%	C26 7.13%	L68 10.13%	F 7.40%
LIT	C19 7.80%	F 7.50%	P85 12.14%	G47 9.39%	C19 17.25%	G46 12.65%	C19 30.29%	C1012 8.49%	G47 8.04%	F 7.40%
LAT	F 11.13%	L68 6.65%	G47 10.79%	P85 10.04%	C16 12.67%	G49 12.65%	F 12.98%	H49 8.25%	L68 10.12%	O84 7.67%

Source: Calculated by the author (WIOD data)

Table 6.14 shows the evolution of these indicators for four observed countries in case of agriculture and food sectors. One can see that out of these four countries, the shares of the agriculture and food sectors on the total production are the highest in Lithuania.

Table 6.14 Shares of sector output on total economy's output, shares of sector employment on total economy's employment

	Sector output on total output (%)					Sector employment on total employment (%)				
country	2000	2008	2010	2014	Δ%	2000	2008	2010	2014	Δ%
SK a01	3.75	2.51	1.96	2.47	-34.1	4.78	2.61	2.34	2.18	-54.4
EST A01	3.00	2.03	2.29	2.25	-25.1	3.31	1.82	2.20	2.01	-39.1
LIT A01	6.05	4.18	4.23	4.05	-33.1	4.39	2.75	3.03	3.19	-27.2
LAT A01	3.30	2.32	2.65	2.79	-15.4	4.54	2.35	2.31	2.59	-43.0
SK C1012	4.49	2.62	2.26	2.22	-50.7	3.51	2.54	2.42	2.14	-39.0
EST C1012	5.58	4.12	4.18	4.20	-24.8	4.13	3.25	2.36	2.89	-30.0
LIT C1012	7.68	5.57	6.18	6.72	-12.5	4.81	3.82	3.72	3.74	-22.1
LAT C1012	6.93	4.24	4.73	4.02	-42.0	4.54	3.46	3.74	3.16	-30.5

Source: Calculated by the author (WIOD data)

For other countries they do not exceed 5% share neither for total output nor for total employment. What is more, the numbers confirm gradual decreases for both sectors over the observed period. This decline was the most pronounced in case of the Slovak Republic where the production share in agriculture was reduced by 34% and the employment share by 54%. As for the food sector, the share on total output fell by almost 51% and the share on total employment by almost 40%. This clearly confirms that the positions of these sectors are becoming less and less "important". But in some cases it can also point out to certain changes in production processes, such as their continuing higher automatisation or replacement of workforce by machines. The "least significant" production decreases appeared in Latvian agriculture sector (decline by 15%) and Lithuanian food sector (decline by 12.5%). In case of employment, the least important reductions of shares were recorded in Lithuania: decline by 27% in agriculture and by 22% in food production.

Table 6.15 Shares of sector export on total economy's export, shares of sector import on total economy's import

	Sector export on total export (%)					Sector import on total import (%)				
country	2000	2008	2010	2014	Δ%	2000	2008	2010	2014	Δ%
SK a01	0.92	1.54	1.53	1.55	+68.48	3.18	1.51	1.55	1.91	-39.94
EST A01	1.60	1.36	1.62	1.31	-18.13	3.23	2.33	2.37	2.12	-34.37
LIT A01	1.87	5.60	5.44	5.36	+186.63	5.92	5.85	6.05	5.32	-10.14
LAT A01	0.34	3.54	4.23	4.63	+1261.76	4.78	4.94	5.51	6.12	+28.03
SK C1012	1.49	1.63	1.51	1.03	-30.87	3.59	2.11	1.96	1.90	-47.08
EST C1012	4.27	5.11	5.26	5.40	+26.46	6.58	4.59	4.43	4.42	-32.83
LIT C1012	7.16	6.20	7.59	8.22	+14.80	10.30	7.31	6.67	7.55	-26.70
LAT C1012	3.38	6.31	6.92	8.55	+152.96	7.92	6.74	7.31	6.77	-14.52

Source: Calculated by the author (WIOD data)

Table 6.15 compares the average values of sectors' exports and imports on total exports and imports. It can be seen that the values on the export side mainly increased. In some cases this increase was very significant between 2000 and 2014 – e.g. Latvian agriculture (almost +1262 %), Latvian food production (153%) and Lithuanian agriculture (+187%). The imports from these two sectors recorded

mostly slight decreases. However, when compared to the average shares of exports and imports of other sectors (Table 6.13), agriculture and food sectors' shares could be considered as almost negligible, with relatively low values. E.g. in case of motor vehicles manufacturing, exports accounted on average for about 22% of exports and 19.5% of imports in the Slovak Republic. The most important Lithuanian sector from the point of view of foreign trade is Manufacture of coke and refined petroleum products (about 17 % of total exports and 30% of imports). Estonia and Latvia export mostly wood and wooden products (10%) and import construction products (10% and 13%). From the point of view of production, employment or foreign trade, we can see many similarities for Baltic countries, Slovak values, however, are rather different.

Table 6.16 Shares of sector value added on total economy's value added

	Sector value added on total value added (%)				
Country	**2000**	**2008**	**2010**	**2014**	**Δ%**
SK a01	3.58	3.20	2.07	3.31	-7.54
EST A01	2.77	1.51	1.83	1.95	-29.60
LIT A01	5.63	3.10	2.71	2.90	-48.49
LAT A01	3.19	1.81	1.97	1.63	-48.90
SK C1012	2.94	1.83	1.60	1.47	-50.00
EST C1012	3.18	2.03	2.08	2.11	-33.65
LIT C1012	4.78	3.41	4.49	4.59	-3.97
LAT C1012	5.95	2.64	3.29	2.48	-58.32

Source: Calculated by the author (WIOD data)

Table 6.16 shows average shares of value added on total value added. Here again, we can state that almost none of the observed sectors exceeded 5% average share What is more, shares of value added for agriculture and food sectors decreased over this period. The highest decline appeared in case of Slovak food sector (about -50%) and Latvian food sector (about -58%), the lowest was recorded in Slovak agriculture (-7.54%) and Latvian food production (-4%). As for the sectors accounting for the highest value added it is mostly sector of real estate activities (10% in both EST and LAT) or retail trade (LIT, 8%). From this point of view, certain similar traits could be seen.

When we compare the period of crisis in all previous tables, we can conclude that the effects of crisis were rather mixed. The average shares of production, employment, export, import and value added on the total countries' value suggest in some cases a slight decline around 2000-2009 with a subsequent recovery after 2010 or a continuing decline in others.

The next step was the analysis using the IO tables with data representing the intersectorial relationship within each economy. Firstly, the analysis started with a closer look at the coefficients that represent intermediate production, i.e. technical coefficients (*tk*, for output), allocation coefficients (*ak*, for input) and import coefficients (*ik*, for import). The next step was the analysis of simple output, input and import multipliers (*som*, *sim*, *simp*). And lastly, the importance of these industries was verified, namely by studying the strength of demand and supply linkages (*BL, FL*).

Table 6.17 and Figure 6.3 show the minimum and maximum values of three observed multipliers as well as general trends in evolution of partial coefficients (*tk, ak, ik*) for all four selected countries. As it can be seen, technical and allocation coefficients followed decreasing trends for agriculture in case of all countries except for Latvia. For food production the same trend appeared in the Slovak Republic, Lithuania and Latvia. The numbers for import coefficients confirm the growing importance of foreign productions that are slowly replacing domestic intermediate products. As for the particular values, we can see a certain similarity in evolution for the Slovak Republic and Estonia on one side and Latvia and Lithuania on the other.

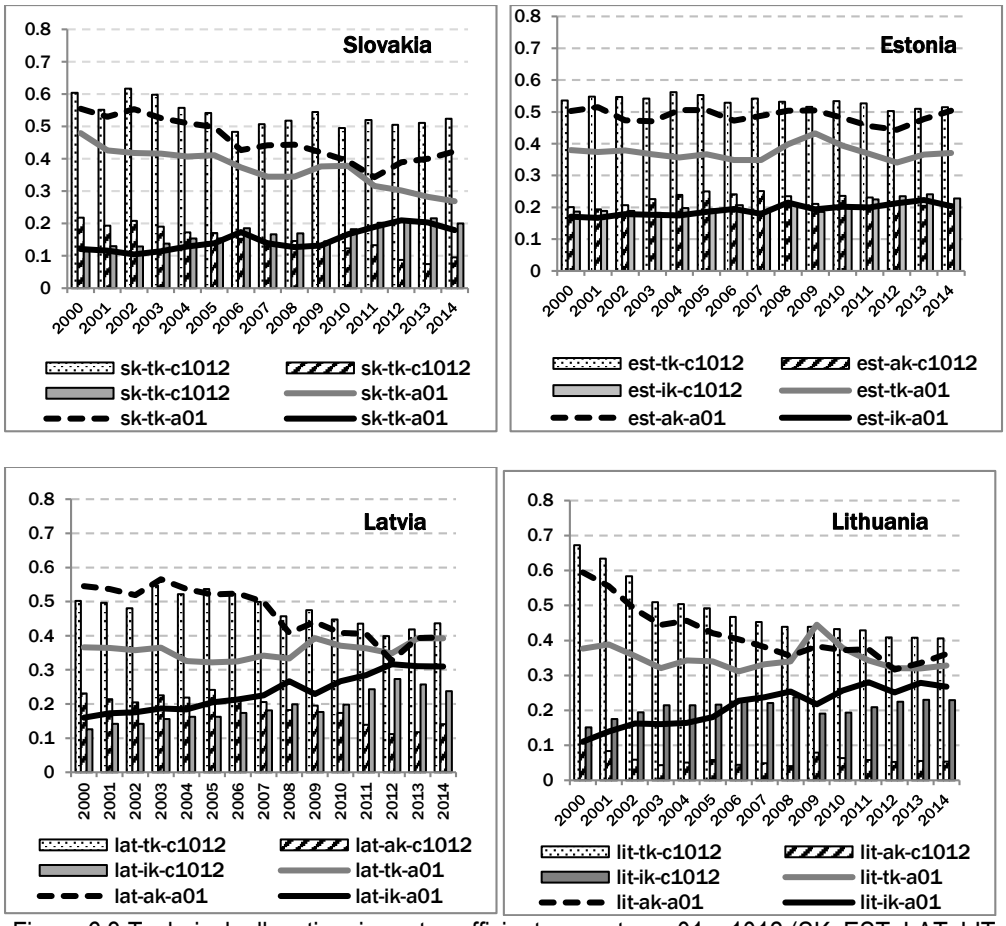


Figure 6.3 Technical, allocation, import coefficients – sectors a01, c1012 (SK, EST, LAT, LIT, 2000-2014

Source: Calculated by the author (WIOD data)

A closer look on the results indicates that the highest average demand impact appears in case of Slovak food production (som av, 1.931). It means that each demand increase of 1€in food sector should generate 1.93€of additional productions in all supplying sectors. The highest supply impact (sim av, 1.832 for Latvian agricultural sector) means that 1€of additional agricultural production could generate 1.83€of additional production when looking forward. As for import multipliers (simp av), average values range from 0.238 (SK A01) to 0.384 (EST C1012) meaning that in case of 1€increase in demand, additional imports of approximately 0.33€would be needed.

As for the stability of these two sectors, a simple evaluation can be made by comparing average and median values of multipliers. Closer values of average and median could be interpreted as a higher stability of multipliers. Values that are more far apart would thus mean higher fluctuations or presence of a certain trend in the evolution of multipliers. In the Table 6.17, it can be seen that higher differences are present in food production (both som, sim).

The next step consisted of the analysis of the normalised values of output and input multipliers or demand and supply linkages as they are also referred to. The Table 6.18 (left part) shows the average values for normalised backward (nBL) and forward linkages (nFL) in agriculture and food productions. Values of nBLs and nFLs higher that 1 indicate the orientation of the sector either backward (strong demand linkage) or forward (strong supply linkage). It is possible to say that a particular sector is

important for the economy and its changes generate an over-average impact on other sectors. If both linkages exceed 1, this sector can be considered as key sector to the economy.

Table 6.17 Output, input and import multipliers

Country	Som min	Som max	Som av	Som med	Sim min	Sim max	Sim av	Sim med	Simp min	Simp max	Simp av	Simp med
SK a01	1.40	1.90	1.62	1.61	1.47	2.11	1.68	1.62	0.18	0.31	0.24	0.23
EST A01	1.53	1.71	1.61	1.60	1.62	1.74	1.69	1.69	0.27	0.31	0.18	0.30
LIT A01	1.44	1.66	1.51	1.49	1.35	1.65	1.40	1.42	0.18	0.32	0.19	0.35
LAT A01	1.51	1.70	1.61	1.60	1.69	1.96	1.83	1.85	0.26	0.38	0.20	0.36
SK c1012	1.79	2.20	1.93	1.87	1.11	1.69	1.24	1.19	0.25	0.39	0.32	0.31
EST c1012	1.80	1.95	1.88	1.88	1.27	1.35	1.30	1.31	0.34	0.38	0.24	0.38
LIT c1012	1.56	2.11	1.73	1.69	1.05	1.11	1.01	1.01	0.30	0.36	0.27	0.36
LAT c1012	1.43	2.23	1.69	1.74	1.41	1.32	1.25	1.27	0.24	0.34	0.16	0.33

Source: Calculated by the author (WIOD data)

From the results presented in Table, agricultural production can be on average considered as key only in Estonia. As for the food sector, or other three countries in general, the demand linkages (nBL values > 1) are on average much stronger than supply linkages (NFL values < 1). However, more detailed analysis confirms that the agriculture could have been considered as key also in the Slovak Republic, Lithuania and Latvia in the beginning of the observed period (SK: period 2000-2005, LIT: period 2000-2002, LAT: period 2001-2003).

Table 6.18 nBL and nFL, VK

	nBL	nBL	nFL	nFL	Total	VK	min	max	av
country	av	VK %	av	VK %	econ	%	(sector)	(sector)	
SK a01	0.98	4.41	0.99	6.12	SK	nBL	1.33 (C23)	23.07 (R-S)	4.86
EST A01	1.03	3.45	1.04	4.42		nFL	1.75 (N)	28.65 (G46)	10.14
LIT A01	1.05	3.48	0.95	9.11	EST	nBL	0.76 (H49)	7.38 (K66)	2.82
LAT A01	0.98	3.10	0.87	23.42		nFL	1.34 (H49)	38.21 (C30)	6.54
SK C1012	1.07	2.40	1.08	2.38	LIT	nBL	1.40 (E3739)	17.24 (C21)	4.31
EST C1012	1.21	1.62	0.80	5.51		nFL	2.33 (M71)	29.47 (C21)	11.07
LIT C1012	1.20	4.92	0.71	12.41	LAT	nBL	1.69 (N)	18.48 (C19)	4.66
LAT C1012	1.12	4.72	0.64	21.23		nFL	1.49 (M7475)	34.27 (C19)	5.63

Source: Calculated by the author (WIOD data)

Based on demand and supply relationships it is also possible to define the extent of the sector's impact, namely whether the effects of the particular sector are concentrated on few other industries, or its impacts are scattered across a large number of other sectors. The range of influence can be determined based on the variation coefficient (VK). Higher values indicate a stronger concentration on interconnected industries; lower values refer to evenly dispersed impacts across the economy.
When comparing all sectors in selected countries, there are some differences that could be pointed out (right side of Table 6.18). The sectors with the most concentrated impacts on the demand side (the highest values of VK for nBL) are: R-S - Other services sector (SK); K66 - Auxiliary activities to

financial and insurance services (EST), C21 - Manufacture of basic pharmaceutical products (LIT) and C19 - Manufacture of coke and refined petroleum products (LAT). On the supply side (VK for nFL) the results are the same for Latvia and Lithuania (C21 and C19); in the Slovak Republic there is a Wholesale trade sector (G46) and Manufacture of transport equipment (C30) in Estonia. The lowest values of VK, and thus more even distribution of impacts on the whole economy, are shown in case of following sectors: C23 - Manufacture of other non-metallic mineral products and N - Administration services (SK), H49- Land transport and transport via pipeline (EST), E3739 - Sewage, waste collection, disposal activities and M71 - Architectural and engineering activities (LIT), N- Administrative activities and M7475- Other professional, scientific and technical activities (LOT). From this point of view, i.e. the sectors with most and least concentrated overall impacts, four studied economies cannot be considered as very similar.

The same can be stated for the two observed sectors; there are no distinctive common features. It can be seen that sector values of VK compared to countries' average variation coefficients are lower in the Slovak Republic (A01, C1012, for both nBL, nFL) and, in Estonia (C1012 for nBL, A01, C1012 for nFL). In Latvia and Lithuania the VK values are in general lower for A01 sector and higher for C1012 sector. To conclude, the impacts on the demand side are more evenly distributed than on the supply side (VK for nBL > VK for nFL). In other words, the effects are more concentrated from the supply point of view.

6.4 Conclusions

The aim of this paper was to present and compare the main characteristics of two selected sectors, namely the sectors of agriculture and food production for three groups of European countries: V4 countries, Baltic countries and old EU member countries. The later were also compared to the Slovak Republic. Analyses compared the shares of sectors on the total output, employment, exports, imports and value added but also on the use of principal input output coefficients and multipliers. The objective was to verify the similarities in the position and the development of these sectors within each group of countries and these results were also compared to results for the Slovak Republic. Another part of the analysis was focused on the examination of backward and forward linkages and their strength in order to identify countries' key sectors and to measure possible concentration of their impacts. A certain decline of importance was expected, especially in the terms of production, employment but also in overall effects on the whole economy.

The analyses of the shares of output, employment, export, import and value added on the total countries' values showed that there are certain similar traits in the structure of economies of V4 countries. Especially the domain of foreign trade seems to be rather similar. Two studied sectors have an important position only in Hungary and Poland, notably from the point of view of employment (PL and HU) and exportations (PL). In general, it can be said that the shares of production, employment, exports and value added were decreasing while the import shares became more important.

We compared also basic input output coefficients and multipliers for the period of 2000-2014. Here again, the descending trend was fairly visible for technical and allocation coefficients as well as for output and input multipliers of the Slovak Republic, the Czech Republic and Hungary. Coefficient values for Polish sectors, were, however, increasing. The import coefficients were in general gradually increasing what could be seen as a confirmation of a growing significance of the imported inputs for both sectors in V4 countries. It also speaks of the trend of replacing domestic inputs by the imported ones. The analyses of IO multipliers revealed also mostly decreasing trend with the exception of the values for Polish sectors. On average, the multipliers seem to be stronger on the demand side (output multipliers), especially for the food sectors. The numbers also confirm the stronger impacts of agriculture from the supply side point of view.

As for the positions of two studied sectors, only agriculture can be considered as one of the key sectors in all four countries. However, in case of the Slovak Republic it was true only until 2005. Food sector, on the other hand presented only strong backward orientation and weaker supply linkages. It is quite logical as the products of food sectors serve mainly for final consumption of various economic subjects. At the same time food production is strongly dependent on the supply of inputs, especially from the agriculture productions. The comparison of variation coefficients did not revealed any important similarities in sectors' concentrations.

In general, the maximum values for nFL were higher that maximum values for nBL. The same can be said for average values. It can be interpreted as a stronger concentration when looking forward and lower concentration (even distribution of effects) when looking backward. As for the average values, these could be interpreted as a measure of the economic structure from the concentration point of view. Low average values confirm a more balanced structure of national economy while higher values (e.g. 10 % in SK) point to strong position of certain sectors. This could be seen as less favorable as their impacts are also stronger and more concentrated.

The next analyzed group represented old EU members, notably France, Germany and Austria that were also compared to the Slovak Republic. Analyses started with the comparison of the shares of sectors on the total output, employment, exports, imports and value added. With the exception of food sector in Austria, neither agriculture nor food sector, exceeded 5% share in total values. While the shares of production, employment, exports and value added were decreasing, the import shares became more important. From the similarity point of view, the calculated shares point to many common traits between structures of national economies in France and Germany on one side and Austria and Germany on the other side (production and, employment). However, the foreign trade (exports, imports) points to higher similarity for the Slovak Republic, Austria and Germany.

We compared basic input output coefficients and multipliers for the period of 2000-2014. Here again, the descending trend was fairly visible for technical and allocation coefficients as well as for output and input multipliers of the Slovak Republic and Austria. In Germany and France the values of coefficients and multipliers remained almost at the same level or recorded only slight increases. The results for import (observed increases in simp) confirmed the growing importance of foreign products on domestic markets. The stability of sectors was verified by comparison of average and median values. Higher differences were present only in case of food production confirming a possible trend (downward in the Slovak Republic, upward in Austria, Germany and France).

The analysis enabled the verification of key industries. We expected that in accordance with weakening importance and shares of the sectors, they would not present the characteristics of the key sectors. However, this was not confirmed by the calculations. The analysis showed that the Austrian, German and French agriculture sectors presented at the same time strong backward and forward linkages, meaning they could be marked as key sectors. Slovak agriculture could have been considered as the key sector only at the beginning of the observed period. In case of food productions only stronger demand linkages were confirmed.

Lastly the distribution of impacts was verified via variation coefficients. These coefficients were lower than average countries' VK, meaning that agriculture and food sectors have their impacts much more evenly distributed than are Slovak, Austrian, German and French averages. The impacts on the demand side could be considered as more evenly distributed than on the supply side. This part of analysis could again confirm a higher level of similarity for "old" EU members and different situation in case of a "new" member.

The last part of the analysis was aimed on the Baltic countries and their comparison to the Slovak Republic. Firstly, the shares of these sectors on the overall output as well as on the overall employment were compared. From this point of view, neither agriculture nor food sector, exceeded 5 % share on

total production or total employment for the Slovak Republic, Estonia and Latvia. It was also possible to observe the slowly decreasing trend with both declines in production and employment shares.
The next step consisted of comparisons of basic input output coefficients and multipliers, for the period of 2000-2014. Here again, the descending trend was fairly visible for technical and allocation coefficients as well as output and input multipliers. On the other hand, the observed increases in import coefficients and import multipliers confirmed the growing importance of foreign products on domestic markets. We can conclude that observed countries present some common traits in the evolution of IO coefficients and multipliers.
The analysis then proceeded to the verification of the overall stability of two industries, the verification of the presence of the similarities in their development and the strength of their backward and forward linkages. As for the stability of sectors' evolution, comparisons of average and median values were used. In all four countries, higher differences were present only in case of food production (both som, sim) clearly indicating a presence of the trend, in this case slightly downward sloping. The analysis also enabled the identification of key sectors. It was expected that in accordance with weakening importance and shares of the sectors, they would not present characteristics of key sectors what was then confirmed by the calculations. However, there was one exception, i.e. the sector of agriculture in Estonia that could be considered as a key (strong backward and forward linkages).
The last part of the analysis consisted of the studying to what extent are the effects of these sectors dispersed or concentrated in the national economies. It was found out that for observed sectors, there were no distinctive common features. To conclude, the impacts on the demand side could be considered as more evenly distributed than on the supply side.
The paper presented the IOT analysis of the agriculture and food sectors supplemented by the analysis of the economic structure by the average shares of all sectors of three groups of European countries, namely V4 countries, Baltic countries and old EU member countries. Based on these findings it would be interesting to compare the positions and the main characteristics of these sectors with those of other former transition countries, namely Balkan states. In some of these countries it is expected that both sectors would still hold an important place in national economies (from the point of view of employment and production) and that they would probably show traits of key sectors with significant impacts on other sectors.

References

ABOOTALEBI, M., AKBARI, N., KHOSHAKHLAGH, R. 2017. Input -output analysis of interregional effects. Journal of Applied Economic Sciences, Volume XII, Spring, 1(47): 95-106.

BEDNAŘÍKOVÁ, Z. (2012). Ekonomický přínos zemědělství pro venkovskou ekonomiku : Aplikace input-output analýzy. *Politická ekonomie*. 60(2), 265-285. DOI: https://doi.org/10.18267/j.polek.841

BENEŠOVÁ, I., NOVOTNÁ, Z., ŠÁNOVÁ, P. and LAPUTKOVÁ, A. (2016) "Economic Comparison of Agricultural Sector of Eurasian Countries – Is There Any Potential for Development Through Economic Cooperation?",AGRIS on-line Papers in Economics and Informatics, Vol. 8, No. 2, pp. 19-31. ISSN 1804-1930. DOI: 10.7160/aol.2016.080202.

Central Statistical bureau of Latvia. (2017). Agriculture in Latvia. Collection of Statistics. ISSN 2501-0085. Retrieved from: https://www.csb.gov.lv/en/statistics/statistics-by-theme/agriculture/agricultural-prices/search-in-theme/146-agriculture-latvia-2017

D'HERNONCOURT, J., CORDIER, M. & HADLEY, D. (2011). Input- output multipliers- specification sheet and supporting material. Spicosa Project Report. (2011). Retrieved from: http://www.coastal-saf.eu/output-step/pdf/Specification%20sheet%20I_O_final.pdf

DUPUIS Jean-Marc, CHESNAIS Michel. Le tableau d'échanges interindustriels : un outil de l'analyse régionale. In: Espace géographique, tome 5, n°2, 1976. pp. 123-131; doi : https://doi.org/10.3406/spgeo.1976.1617

DUJAVA, D., LÁBAJ, M. & WORKIE, M. (2011). Štruktúra ekonomiky a ekonomický rast: Ako naplniť teóriu číslami. Bratislava: Iris, 2011. 269 p. ISBN 978-80-89256-66-2.

DUVAJOVÁ, L. (2014). Využitie multiplikátorov na kvantifikáciu objemu domácej produkcie vyvolanej výdavkami návštevníkov v cestovnom ruchu. *Trendy v podnikání.* 5(1). 55-63. Retrieved from: https://www.dfek.zcu.cz/tvp/doc/akt/tvp-1-2015-clanek-6.pdf

European Commission (2018). Agriculture in the European Union. Statistical and Economic Information. Retrieved from: https://ec.europa.eu/agriculture/sites/agriculture/files/statistics/agricultural/2012/pdf/full-report_en.pdf

European Commission (2018). Agriculture and rural development. What is organic farming? Retrieved from: https://ec.europa.eu/agriculture/organic/organic-farming/what-is-organic-farming_en

European Commission (2018). Agriculture and rural development. Agriculture in the European Union and the member states – Statistical factsheets. Retrieved from: https://ec.europa.eu/agriculture/statistics/factsheets_en

Eurostat (2017). Statistics explained: Organic farming statistics. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Organic_farming_statistics

Eurostat (2016). Statistics explained: Agricultural census in Austria. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_census_in_Austria

Eurostat (2016). Statistics explained: Agricultural census in Czech Republic. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_census_in_the_Czech_Republic&oldid=379567

Eurostat (2010). Statistics explained: Agricultural census in Estonia. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_census_in_Estonia

Eurostat (2016). Statistics explained: Agricultural census in Germany. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_census_in_Germany&oldid=379544

Eurostat (2016). Statistics explained: Agricultural census in Hungary. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:Agricultural_census_in_Hungary

Eurostat (2016). Statistics explained: Agricultural census in France. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_census_in_France&oldid=379543

Eurostat (2010). Statistics explained: Agricultural census in Latvia. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_census_in_Latvia

Eurostat (2010). Statistics explained: Agricultural census in Lithuania. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_census_in_Lithuania

Eurostat (2016). Statistics explained: Agricultural census in Poland. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_census_in_Poland&oldid=379560

Eurostat (2016). Statistics explained: Agricultural census in Slovakia. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_census_in_Slovakia

Eurostat (2018). Statistics explained: Organic farming statistics. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Organic_farming_statistics

GEBELTOVÁ, Z. (2017) "Exploitation of Agricultural land in the Czech Republic and EU Countries", AGRIS on-line Papers in Economics and Informatics, Vol. 9, No. 4, pp. 33-44. ISSN 1804-1930. DOI 10.7160/aol.2017.090404.

HABRMAN, M. (2013). Vplyv exportu na pridanú hodnotu a zamestnanosť v slovenskej ekonomike. EÚ SAV Working Papers, 53. Retrieved from: http://www.ekonom.sav.sk/uploads/journals/239_wp_53_habrman.pdf>. ISSN 1337-5598.

KANEMITSU, Hideo and HIROSHI Ohnishi. 1989. An Input-OutputAnalysis of Technological Changes in the Japanese Economy: 1970–1980, *Frontiers of Input-Output Analysis*. New York: Oxford University Press, pp. 308–323.

KOOV, M. (2017). Food, agriculture, rural life, fisheries in facts 2017. Ministry of rural affairs of the Republic of Estonia. ISSN 2346–5670. Retrieved from: https://www.agri.ee/sites/default/files/content/valjaanded/2017/valjaanne-2017-faktitrukis-eng.pdf

LÁBAJ, M. (2017). Štruktúrna dekompozícia globálnych hodnotových reťazcov : Slovenská ekonomika v medzinárodnom porovnaní. *Politická ekonomie*. 65(5), 562-582. DOI: 10.18267/j.polek.1162

LÁBAJ, M. (2014). Štrukturálne aspekty ekonomického rozvoja - Slovenská ekonomika v globálnych súvislostiach. Bratislava: Ekonóm. ISBN 978-80-7144-223-3.

LAURI, M. 2012. General overview of Estonian economy. Agriculture and Forestry. Estonica. Retrieved from: http://www.estonica.org/en/Economy/General_overview_of_Estonian_economy/Agriculture_and_forestry/

LEONTIEF, W. (1953) Domestic Production and Foreign Trade; The American Capital Position Re-Examined. *Proceedings of the American Philosophical Society*, 97(4). 332-349.

McLennan, W. (1995). Australian national accounts: Introduction to input-output multiplier. Retrieved from: http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5246.01989-90?OpenDocument

MELNIKIENÉ, R. & et. al. (2018). Agricultural and food sector in Lithuania, 2017. Lithuanian institute of agrarian economics. ISSN 2351-6321. Retrieved from: https://www.laei.lt/?mt=aktualijos&naujiena=476

MILLER, R. E. & BLAIR, P. D. (2009). Input - Output analysis. Foundation and Extentions (2nd ed.). Cambridge, New York: Cambridge University Press. ISBN 978-0-521-739-02-3.

NÉMÉTHOVÁ, J. & CIVÁŇ, M. (2017). Regional differences in agriculture in Slovakia after its accession to the European Union. *Quaestiones Geographicae 36(2), 9-21.* Retrieved from: https://doi.org/10.1515/quageo-2017-0011

PISSARENKO, D. (2003). Basics of input-output analysis. Retrieved from: http://demetrix.sourceforge.net/resources/2003_02_20_ioAnalysis/ioAnalysis.pdf

POKRIVČÁK, J. (2003) Development of the Slovak agriculture and agricultural policies during the transition period. *Agricultural Economics* 49(11). 553-539. Retrieved from: https://doi.org/10.17221/5443-AGRICECON

REIS, H. & RUA, A. (2009). An input-output analysis: Linkages vs leakages. *International Economic Journal*, 23(4), 527-544. DOI: 0.1080/10168730903372323

TIMMER, M. (2012). The world input-output database (WIOD): Contents, Sources and Methods. Retrieved from: http://www.wiod.org/publications/source_docs/WIOD_sources.pdf

TRINH, B., Le HOA, P. & GIANG, B., C. (2009). Import multiplier in input-output analysis. *Journal of science, economics and business*. 25(5), 41-45.

TURČEKOVÁ, N., SVETLANSKÁ, T., KOLLÁR, B. and ZÁHORSKÝ, T. (2015) "Agri-environmental Performance of EU member states", AGRIS on-line Papers in Economics and Informatics, Vol. 7, No. 4, pp. 199 - 208, ISSN 1804-1930.

UN. (2017) United Nations International Industrial Classification revision 4. Detailed structure and explanatory notes. Retrieved from: https://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27

VAISHAR, A., ZAPLETALOVÁ, J. (2009). Sustainable development of rural microregions in the Czech borderland. *Moravian Geographical Reports* 17(4): 34–43. Retrieved from:

VĚŽNÍK, A., KRÁL, M. & SVOBODOVÁ, H. (2013) Agriculture of the Czech Republic in the 21st Century: From Productivism to Post-productivism. *Quaestiones geographicae*, 32(4), 7-14. Retrieved from: doi:10.2478/quageo-2013-0029.

WIOD. (2018). World Input Output Database National Input Output Tables – Slovakia, Austria, Germany, France. 2000 - 2016. 2016 release. (2017). Retrieved from: http://www.wiod.org/database/niots16.

WIXTED, B., YAMANO, N., WEBB, C. (2006). Input-output analysis in an increasingly globalised world. Application of OECD's harmonised international tables. DOI: 10.1787/18151965

ZÁHORSKÝ, T. and POKRIVČÁK, J. (2017) "Assessment of the Agricultural Performance in Central and Eastern European Countries", AGRIS on-line Papers in Economics and Informatics, Vol. 9, No. 1, pp. 113 - 123. ISSN 1804-1930. DOI 10.7160/aol.2017.090110.

Chapter 7

International fragmentation of production and export-import determination in the EU member countries

by ***Rajmund Mirdala***
Faculty of Economics, Technical University of Košice, **Slovak republic**
rajmund.mirdala@tuke.sk

Anna Ruščáková
Faculty of Economics, Technical University of Košice, **Slovak republic**
anna.ruscakova@tuke.sk

and ***Jozefína Semančíková***
Faculty of Economics, Technical University of Košice, **Slovak republic**
jozefina.semancikova@tuke.sk

7.1 Introduction
7.2 External imbalances in the Euro Area
7.3 Global value chains and external imbalances
7.4 Research motivation behind overview of empirical literature
7.5 Methodology
7.5.1 ARDL dynamic panel model
7.5.2 Robustness check of estimated ARDL results
7.6 Empirical results
7.6.1 Aggregate export and import functions
7.6.2 Disaggregated export and import functions
7.7 Conclusion
References

http://dx.doi.org/10.14505/gvcifpieu.2018.ch 7

International fragmentation of production and export-import determination in the EU member countries

Rajmund Mirdala
Faculty of Economics, Technical University of Košice, **Slovak republic**
rajmund.mirdala@tuke.sk

Anna Ruščáková
Faculty of Economics, Technical University of Košice, **Slovak republic**
anna.ruscakova@tuke.sk

Jozefína Semančíková
Faculty of Economics, Technical University of Košice, **Slovak republic**
jozefina.semancikova@tuke.sk

Abstract:
Intra-Eurozone current account imbalances represent one of the most discussed topics related to the competitiveness issues of the common currency area since its establishment. Many authors examined this phenomenon considering possible linkages to effects of common monetary policy, real exchange rates movements, variety of demand drivers (fiscal imbalances included) and capital flows. However, as a result of increasing specialization on the individual country level during past few decades that stimulated distribution of individual stages of production across countries, dynamics of exports and imports of final goods, intermediate goods as well as primary inputs was associated with generally ambiguous effect on the external balance.
The paper investigates the main determinants of aggregate and disaggregated export and import demand functions on the sample of 21 the European Union member countries. Our results from estimated ARDL model based on the panel data indicate relatively high role of imports in aggregate export functions while estimated aggregate functions indicated relatively high contribution of domestic demand to the dynamics of imports. Disaggregated analysis revealed significant importance of intermediate goods in the formation of external trade balances within as well as outside European Union from both territorial and commodity aspects

Keywords: current account, external balance, export, import, global value chains

JEL Classification: F13, F41, H62

7.1 Introduction

Enlarging external (current account) imbalances in the Eurozone (Pisani-Ferry, 2012) represents one of the key design failures that emerged soon after its establishment (De Grauwe, 2013) and significantly contributed to the emergence of the European debt crisis (Mirdala and Ruščáková, 2015). Moreover, the deteriorating external imbalances were associated with cross-country expenditure shifting effects driven by the real exchange rates adjustments in the Eurozone member countries (Belke and Dreger, 2011). However, many authors promoted demand drivers (Gaulier and Vicard, 2012) that fueled asynchronous current account imbalances in the Eurozone considering price and cost related determinants as less important. However, increasing specialization during past few decades stimulated distribution of individual stages of production across countries and associated dynamics of exports and imports of final goods, intermediate goods as well as primary inputs with generally ambiguous effect on the external (current account) balance. International fragmentation of production and related higher share of intermediate goods led economists not only to revise the obvious measures of external trade across countries but also engage them to examine the implications associated with widen trade imbalances and excessive trade fluctuations before and during the crisis period (Cingolani, Felice and Tajoli, 2015). As a result, examination of the most crucial causes of excessive current account imbalances in the Eurozone considering existence of global value chains and possible solutions that would contribute to their reduction still represents a challenging topic.

From the global perspective, maintaining external macroeconomic equilibrium of the country considering different factors has been difficult predominantly in the past decades due to increasing degree of openness and liberalization of foreign trade policies. Moreover, increased specialization, intensified by trade-liberalizing policies and decreasing transport costs stimulated distribution of individual stages of production across countries that even intensified exports and imports of final goods, intermediate goods as well as primary inputs with generally ambiguous effect on the external balance (Cingolani, Felice and Tajoli, 2015). Recent economic crisis induced redistributive effects across countries, that is why a relative importance of traditional current account determinants have changed (Christodoulopoulou and Tkačevs, 2014). As a result, current account sustainability remains a crucial issue in designing sustainable path of economic growth of the country.

Main objective of the chapter is to examine effects of price and non-price determinants of exports and imports in 21 EU member countries. The main motivation that is behind this idea is to (a) identify the key drivers of export and import path (relative importance price/cost and demand drivers will be examined); b) reveal mutual relationship between exports and imports (considering that international fragmentation of production chains makes exports and imports mutually dependent and thus affects their long-term convergent/divergent movement); c) examine effects of the crisis period on estimated results. To meet above mentioned objectives we estimate aggregate and disaggregated export and import functions that are based on Autoregressive Distributed Lag (ARDL) dynamic model.

The remainder of the chapter is organized into six sections. Following the introduction the section 7.2 provides brief summary of the recent facts on external imbalances in the Euro Area. Section 7.3 highlights the key empirical evidence on external imbalances in terms of global value chains (GVCs). Section 7.4 presents an overview of the relevant literature. Section 7.5 describes the data and introduces the methodology. Section 7.6 presents the main results. Section 7.7 summarizes key findings of the chapter.

7.2 External imbalances in the Euro Area

Intra-European current account imbalances have grown significantly since the establishment of the Euro Area (Bonatti and Fracasso (2013). It reflects diverging trends in competitiveness between core countries and periphery countries of the Euro Area. Introduction of the single currency and the single monetary policy significantly contributed to this divergent trend. Similarly, Cesaratto (2015) insists that the Euro Area sovereign debt crisis is a balance of payments crisis, tied to current account deficits and capital outflows (Lavoie, 2015). De Grauwe (2013) supports this opinion and he argues that the absence of a sovereign central bank caused a liquidity crisis followed by a solvency crisis in the Euro Area. He states that Euro Area member states had to issue debt in a new currency that is not under their control (De Grauwe, 2013; Caseratto, 2015). Additionally, Weeks (2014) argues that when the global financial and economic crisis struck the continent in 2008, the trade-based deficits of the periphery countries of the Euro Area proved unsustainable. However, for example Brancaccio (2012) states that internal imbalances in the Euro Area are an integral part of a monetary union attributable to the greater degree of financial integration between the Euro Area member countries and thus it depends only on by the individual country followed theoretical approach to the issue how to secure economic growth.

Sinn and Wollmershäuser (2012) emphasize that the root of the current European sovereign debt crisis lies in the external imbalances between its core and periphery countries and they claim that these imbalances occur as a reaction on optimistic expectations about income convergence generated in the Euro Area and as a reaction on an investment boom in the Euro Area periphery, which was accompanied by ballooning current account deficits financed by private capital inflows (Bonatti and Fracasso, 2013).

Economic crisis intensified demand driven redistributive effects that induced diverse and spurious effects on current account adjustments within the Euro Area. While current accounts temporary deteriorated (with quite different intensity in each particular economy) at the beginning of the crisis period (Kang and Shambaugh, 2013), at the later stages we have observed a positive trend (either improvement or stable outlook) in almost all Euro area member countries reflecting intensified redistributive effects of the crisis on the cross-country expenditure shifting (Gaulier and Vicard, 2012). However, existing nexus between surpluses in the core with deficits in the periphery addresses issues in both trade and financial linkages (Hobza and Zeugner, 2014). While current accounts between North and South of the Euro Area do not necessarily have to be balanced, existence of large and persisting bilateral current account imbalances may induce policy tensions or rigidities (Berger and Nitsch, 2012). Euro area is in a vicious circle and economic policy of European Union faces a real challenge.

Intra-Eurozone current account imbalances among countries with different income levels per capita fuel discussions on competitiveness channels under common currency (Belke and Dreger, 2011). Disinflation followed by deflationary pressures induced shifts in competitiveness associated with real exchange rate adjustments through relative price levels. While external imbalances in countries on the periphery of the Euro Area were mainly driven by domestic demand boom fueled by increasing financial integration (Chen, Milesi-Ferretti and Tressel, 2012), the role of changes in the competitiveness of the Euro Area core countries may be disputable. As a result, limited effectiveness of internal devaluation in reducing current account imbalances in the Euro Area could be expected (Sanchez and Varoudakis, 2013). However, asynchronous current account trends between North and

South of the Euro Area were accompanied by significant appreciations of real exchange rate in the periphery economies originating in the strong shifts in consumer prices and unit labor costs in these countries relative to the countries of the Euro Area core (Holinski, Kool and Muysken, 2012). As a result, the issue is whether the real exchange rate is a significant driver of persisting current account imbalances in the Euro Area (Lane and Milesi-Ferretti, 2002).

7.3 Global value chains and external imbalances

International fragmentation of production draws increasing attention in both theoretical literature in the area of foreign trade (i.e. Grossman and Rossi-Hansberg, 2008; Costinot, Vogel, and Wang, 2013) and empirical literature (i.e. Feenstra, 1998; Hummels, Ishii, and Yi, 2001; Johnson and Noguera, 2012; Baldwin and Lopez-Gonzalez, 2013; Los, Timmer and De Vries, 2015). Due to international fragmentation of production in the world economy, we may observe changes in understanding of international competitiveness. Traditional measures of export performance provide biased information for policy decisions (Lábaj, 2014). As a result, many authors focus on estimations of domestic value added shares in unit of exports that are used as a measure of vertical specialization in foreign trade.

We may observe high dynamics of fragmentation of value chains on global level than on regional level (Ng, 2010). Territorial proximity or common trade areas are still considered as key determinants of distribution of value added within production chains though with reduced importance that 15-20 years ago (Ederer and Reschenhofer, 2014).

Intention of countries to participate in new international division of labor based on participation in the global value chains reveals lot of opened questions for industrial policy framework.

Examination of relative importance of individual sectors of the economy in the international production chains naturally corresponds to a requirement to use appropriate methodology (Lábaj, 2014). In order to examine structural and intra-industrial linkages, empirical literature tends to implement input-output analysis that is based on the use of multiregional input-output tables that provide crucial information not only on value added within individual segments of production chains but also on quantitative and qualitative features of inputs (labor and capital) (Backer and Miroudot, 2013).

Empirical literature on input-output analysis concentrates on examination of equilibrium in the individual country (Leontief, 1953). Such studies are based on the use of input-output tables due to their precise ability to monitor not only value added in export industries but also on the individual levels of a production chain. Johnson and Noguera (2012) investigated that most of the export production consists of industrial products while the key portion of value added may be concentrated in non-industrial sectors providing materials and services for upper segments of a production process. Such information reveals a relative importance of intra-industrial linkages (Hirschman, 1958). Feenstra a Hong (2007) in their paper based on the use of input-output tables focused on examination of direct and indirect effects of export industries on employment while their also examined the key features of export oriented production chains.

Input-output analysis enables us to examine intra-industrial linkages while it improves the quality of analysis due to its focus on relative importance of international trade in the whole production process. For evaluation of such linkages, the empirical literature suggests to use a coefficient of industrial interdependence or coefficient of leakages from foreign trade (Reis, Rua, 2006; Bess, Ambargis, 2011). Employment of above mention methods on long-term time series enables us to identify and

analyze important structural changes in the economy and estimate its changes in the future. Some papers confirm that a variety of countries experienced a reduced importance of production industries while the role of service industries clearly increased during last two decades. Authors also highlight reduced mutual intra-industrial linkages in the analyzed countries while the relative importance of imports for domestic production increased (Guo, Planting, 2000; Reis, Rua, 2006; Rayner, Bishop, 2013).

Considering narrow trade linkages among Eurozone member countries and their high external trade openness, the analysis of mutual flows of production among countries represent another interesting area for a research. Mutual linkages among national productions can be also examined according to their contribution to external imbalances (Ederer, Reschenhofer, 2014). Some authors analyze flows of goods and intermediate goods within the global supply chains, volumes of cross-country flows of production employed in domestic production that is subsequently exported abroad. Baldwin, Lopez-Gonzalez (2013) examine relationship between participation of country in these flows and the overall advancement of the country while they also identified high importance of regionalism in these production chains with clearly identified regional centers and regional structure.

Analysis of interdependence of countries due to fragmentation of production is also crucial for examination of effects on business cycle of countries and its synchronization. Authors highlight positive effects of fragmentation of production on correlation of cyclical development in countries (Ng, 2010; Takeuchi, 2011; Amighini, 2012).

7.4 Research motivation behind overview of empirical literature

According to Goldstein and Khan (1985), who estimated the long-run income and price elasticity of export and import of the largest industrialized economies, empirical analysis of trade flows is traditionally based on a partial equilibrium model and the hypothesis of imperfect substitutes between foreign and domestic goods. In a simple example of two economies, the partial equilibrium model assumes that each country produces only one tradable good, which is an imperfect substitute for good produced in the other country. Based on the partial equilibrium model, the most widely used method for estimating aggregate export and import demand functions is the method based on the Marshallian demand function. The model can also be expanded to "n" number of economies, where the symmetry between import and export demand functions disappears. The total import of the economy faces only the competition from domestic producers, whereas the overall export of the economy is a subject to competition not only from domestic producers in the importing country or region but also from other countries or regions exporting to the given country or region. Therefore, it can be assumed that the relative price competition between exporters, expressed as a ratio of export prices to export prices of the competitor adjusted for the exchange rate, is in this case dominant. Consequently, a standard function of the aggregate export can be expressed as follows:

$$X_d = f\left(Y^*, \frac{P_x}{ER}.P^*\right) \tag{7.1}$$

where X_d is the volume of export required by foreign countries, Y^* is the economic activity of the world economy, P_x are the export prices, P^* are the export prices of competitors, and ER is the nominal

exchange rate in units of foreign currency per unit of domestic currency. The relative price indicator $\left(\frac{P_x}{ER}.P^*\right)$ represents terms of trade or a real exchange rate. The indicator of economic activity should have a positive sign with a positive effect on export development, while the real exchange rate should have a negative sign for export promotion.

Similarly, import demand can be expressed as follows:

$$M_d = f\left(Y, P_M / P\right) \tag{7.2}$$

where M_d is the total import volume requested by domestic consumers, Y is the domestic economic activity, P_M are the import prices in domestic currency, and P is the price of products that are domestic substitutes for import (Camarero and Tamarit, 2004). Models (7.1) and (7.2) can be used for both aggregate and disaggregated data.

Stern, Francis and Schumacher (1976) provide another concept regarding demand-supply relationships in the export and import functions. The theory assumes that the system of export and import demand and supply functions should consider the simultaneous relationship between quantity and price and to avoid bias. However, most empirical studies focus on estimating export and import demand functions, while supply relationships are analyzed under the assumption of infinite price elasticity. Infinite price elasticity is legitimate in the case of an import supply, though considering the small open economy, it is hard to believe that infinite price elasticity also applies to the export supply. Especially, considering the increase in world demand for the goods of a small open economy, this economy is unlikely to be able to meet this demand without changing export prices (unless there are large supplies of inexhaustible resources) (Goldstein and Khan, 1978). However, an important condition of this assumption is that it allows the estimation of export and import functions by methods of a single equation in which price variables are exogenous (Mervar, 1994).

While empirical literature provides rich evidence of studies examining determinants of export (e.g., Ca' Zorzi and Schnatz, 2007; European Commission, 2010; Bayoumi, Harmsen and Turunen, 2011) and import (e.g., Barrell and Dées, 2005; Stirböck, 2006), increased attention of authors to estimate import functions can be seen in the literature only in recent years (e.g., Kostoska and Petreski, 2009; Bussière et al., 2013). However, only a few studies examined both functions simultaneously to deal with possible causes of converging and diverging trends in the external balance in terms of revealed interactions between imports and exports (e.g., Hooper, Johnson and Marquez, 2000; Allard et al., 2005).

Considering aggregate analysis, our chapter is based on the findings of studies examining simultaneously aggregate export and import functions. Regarding aggregate functions, it is worth mentioning the study of Comunale and Hessel (2014), who examined the relative importance of price competitiveness and domestic demand as a source of current account imbalances in the Euro Area countries. The results confirm the significant effect of price competitiveness, though a much more significant impact of the domestic demand boom driven by the financial cycle. The authors emphasize an increased significance of price competitiveness, especially in export performance, considering that the effect of foreign export demand is much larger. Moreover, they confirm that domestic demand is the most important determinant of import. In addition, the authors excluded import as a determinant in

the export equation as they did not consider this variable as significant. The results of Communal and Hessel (2014) are also endorsed by Christodoulopoulou and Tkačevs (2014), who emphasize the effect of price competitiveness on export rather than on import. Similarly, the study of Hooper, Johnson and Marquez (2000) examined trade elasticities in the G7 countries using short-term and long-term cointegration techniques. Their results agree with the results of Christodoulopoulou and Tkačevs (2014) that the most important determinant of export is foreign demand, while the most important determinant of import is domestic demand. The authors also state that the price elasticities for import are much lower than those mentioned in the literature.

Considering disaggregated analysis, our chapter focuses on patterns of final production and trade in intermediate products. Intermediate goods may be used as inputs to the manufactory production for final consumers. The chapter points to the significant trend related to the GVCs as the fragmentation of production obviously causes multiple exports and imports of individual components and semi-finished products till the final product is produced and traded on the markets of the final production (Fukumoto (2012), Jlassi (2015)). For this reason, we apply the BEC classification (i.e. the Classification by Broad Economic Categories, reclassify the SITC classification, i.e. the Standard International Trade Classification) revision no. 4 (In March 2016, the 5th revision of the BEC classification was introduced, i.e. services were added to the BEC classification. As the chapter is mainly deals with foreign trade in goods, it uses the BEC revision no. 4. The chapter also does not consider the category of so-called "unclassified".) implemented by the United Nations in 2002, which divides the goods into three categories depending on the end use, namely capital goods, intermediate products and consumer goods. The BEC classification is becoming more and more popular thanks to its usage in more than 300 research studies since 2000 and its link to the GVCs, where the analysis is focused mainly on the trade with intermediate goods.

The BEC classification has been so far used mainly in emerging market economies for the estimation of export and import functions, including examples of empirical studies covering Turkey, China, and India or other areas of foreign trade. Table 1 provides an overview of selected empirical studies that examine aggregate and disaggregated export and import functions based on the BEC classification.

Table 7.1 Overview of empirical studies of aggregate and disaggregated foreign trade analysis and BEC classification

#	Author(s)	Publication	Scope of analysis
1	Belessiotis and Carone (1997)	„A Dynamic Analysis of France´s External Trade"	Analysis of the determinants of the export and import of goods and their role in the surplus of France in the 90s.
2	Hooper, Johnson and Marquez (2000)	„Trade Elasticities for the G-7 Countries"	Estimation of short-term and long-term import and export coefficients for G7 countries.
3	Lemoine and Ünal-Kesenci (2003)	„International Trade and Technology Transfer: the Cases of Turkey, India and China Compared"	Examining industry specialization of India, China and Turkey based on different production stages and technology levels.

4	Allard et al. (2005)	„Explaining Differences in External Sector Performance Among Large Euro Area Countries“	Analysis of the traditional determinants of export and import of four largest EU economies, namely Germany, Italy, France and Spain.
5	Gaulier, Lemoine and Ünal-Kesenci (2007)	„China’s Emergence and the Reorganization of Trade Flows in Asia“	Examining the impact of China's rise as a global manufacturing base to other Asian economies.
6	Fontagné , Gaulier and Zignago (2007)	„Specialization across Varieties within Products and North-South Competition”	Analysis of the similarity of the export structure and the transformation process among countries.
7	Miroudot, Lanz and Ragoussis (2009)	„Trade in Intermediate Goods and Services”	Analysis of the significance of vertical specialization networks.
8	Gozgor and Oktay (2012)	„Estimation of Disaggregated Import Demand Functions for Turkey“	Estimation of Turkey's disaggregated import demand.
9	Comunale and Hessel (2014)	„Current Account Imbalances in the Euro area: Competitiveness or Financial Cycle?“	Analysis of the determinants of export and import functions together with the trade balance function in Euro Area countries.
10	Giordano and Zollino (2015)	„Exploring Price and Non-Price Determinants of Trade Flows in the Largest Euro-Area Countries“	Analysis of price and non-price determinants of export and import in the countries of Germany, Italy, France and Spain.
11	Ali-Yrkkö, Mattila and Seppälä (2017)	„Estonia in Global Value Chains“	Analysis of Estonian involvement in the global value chains in exploring the commodity and territorial structure of final goods and intermediate products.

Source: Compiled by the authors

7.5 Methodology

The analysis is carried out on the panel data of 21 EU member states (rest of EU member countries are excluded from analysis due to data inconsistency). Quarterly time series that are employed in the model cover the period 1995Q4-2016Q2 (83 observations) for aggregate export and import functions estimation and 1999Q1-2016Q4 (72 observations) for disaggregated export and import functions estimation. The number of observations is limited due to the availability of data and the need to preserve the integrity of the panel as a balanced model. In both cases, export and import of goods, as components of the trade balance, represent dependent variables. The variables are vis-à-vis the rest of the world and expressed in fixed prices. The data in EUR are drawn from the Eurostat database, and the data in USD are drawn from the International Monetary Fund - Direction of Trade Statistics (IMF DOTS) database. In order to obtain nominal values in EUR, the average exchange rate of the ECU/USD and EUR/USD from the Eurostat database is used (the combination of data in EUR and data in USD should not cause significant differences in results as the evolution of selected variables is almost identical in the analyzed countries). We apply the quarterly HICP (2005-100) as a deflator (import and export price indices were not available for more than a half of the analyzed countries in the sample). The data are seasonally adjusted using Census X-13 Arima-SEATS. Seasonally adjusted data are used in logarithm due to the need to reduce the variability of the data. Disaggregated data for the BEC classification are drawn from the Eurostat database in seasonally adjusted form. Consequently, these data are deflated and transformed into the logarithm.

The definition of export and import functions is based on the standard reduced form of dynamic trade equations presented by Goldstein and Khan (1985) and later reviewed by Sawyer and Sprinkle (1996). The export and import functions of these studies are based on a partial pattern of international trade balance. We apply not only traditional business determinants but also custom variables (e.g., foreign demand expressed in the form of the export demand index proposed by Hubrich and Karlsson (2010)), as well as explanatory variables to determine the significance of an export and import destination or commodity structure.

In the previous years, there has been a great interest in dynamic panel models with many cross-sectional units and many observations. However, there are several problems with models using such datasets. According to Pesaran and Smith (1995), Im, Pesaran and Shin (2003) and other authors, one of these problems is, e.g., the inability to assume the homogeneity of the parameters of the slopes. Also, another problem may be the non-stationarity of dynamic panel models. To estimate non-stationary dynamic panels characterized by heterogeneity of parameters within groups, Pesaran, Shin and Smith (1997, 1999) propose two estimation techniques, namely the Mean-group estimator (MG) and the Pooled mean-group estimator (PMG).

For the previous reasons, the chapter, regarding the analysis of aggregate and disaggregated export and import functions, is based on the so-called Autoregressive Distributed Lag dynamic model (ARDL) $\left(p,q_1,\ldots,q_k\right)$ which can be expressed as follows:

$$y_{it}=\sum_{j=1}^{p}\lambda_{ij}y_{i,t-j}+\sum_{j=1}^{p}\delta_{ij}^{'}X_{i,t-j}+\mu_i+\grave{o}_{it} \tag{7.3}$$

where $i=1,\ldots,N$ is the number of cross-section units, $i=1,\ldots,T$ is the number of observations, X_{it} is $k\times1$ vector of explanatory variables, $\delta_{ij}^{'}$ is $k\times1$ vector of coefficients, λ_{ij} are scalars and μ_i is an individual effect. The ARDL model assumes a sufficient number of T.

If variables are integrated of order $I(1)$ and cointegrated, then the error term process is $I(0)$ for all i. The basic feature of cointegrated variables is their response to any deviation from long-term equilibrium, what indicates usability of the Error Correction Model (ECM). In this model, the short-term dynamics of the variables in the system are affected by the equilibrium deviation. For this reason, the common practice is to re-parametrize the equation (7.3) into the EC equation as follows:

$$\Delta y_{it}=\phi_i\left(y_{i,t-j}-\theta_i^{'}X_{it}\right)+\sum_{j=1}^{p-1}\lambda_{ij}^{*}\Delta y_{i,t-j}+\sum_{j=1}^{q-1}\delta_{ij}^{'*}\Delta X_{i,t-j}+\mu_i+\grave{o}_{it} \tag{7.4}$$

where the parameter ϕ_i represents an error-correcting speed of adjusted member. If it is true that $\phi_i=0$, then the long-term relationship is not present. This parameter should be significantly negative on the underlying assumption that variables show the return to long-term equilibrium. The vector $\theta_i^{'}$ contains long-term relationships among variables.

Aggregate export function with the implementation of the panel dynamic ARDL model is defined in the chapter as follows:

$$lx_{it} = \lambda_{ij} lx_{i,t-j} + \delta_{10i} lreer_{it} + \delta_{11i} lreer_{i,t-1} + \delta_{20i} lfd_{it} + \delta_{21i} lfd_{i,t-1} + \delta_{30i} lm_{it} + \delta_{31i} lm_{i,t-1} + \mu_i + \partial_{it} \quad (7.5)$$

where the export is expressed as a function of export (lagged), two indicators (current and lagged) of price competitiveness $(lreer)$, foreign demand (lfd) and import (lm). All variables are expressed in logarithm.

Two different real effective exchange rate (REER) indicators are used to measure price competitiveness. REER is calculated against a group of 37 trade partners deflated by the consumer price index (CPI) and unit labor costs (ULC) of the particular country, similarly as in the study of Comunale and Hessel (2014) and Darvas (2012). We have employed two measures of REER because ULC covers only domestically produced goods while CPI includes prices of imported goods as well. Moreover, with the development of GVCs, the share of intermediate goods has significantly increased in the international trade (and hence in external balance). Prices of intermediate production are better covered in ULC than CPI. Similarly, CPI covers non-tradable goods more broadly, whereas ULC tends to reflect mostly tradable goods (Ahn, Mano and Zhou, 2018). We assume that growth in price competitiveness, associated with REER decline, would support export growth. The fall in relative domestic prices due to exchange rate depreciation makes exports cheaper on international markets that is why the export of the country tends to increase.

Involvement of foreign demand (FD) as explanatory endogenous variable in the equation 7.5 is followed by the idea that trade balance and current account balance are affected by the destination and composition of exports (Chen, Milesi-Ferretti and Tressel, 2012; Comunale and Hessel, 2014). Construction of the foreign demand indicator is based on the calculation proposed by Hubrich and Karlsson (2010), who define the foreign demand of a country as an export demand index (WDR_k) that is calculated as the geometric average of the import volumes of the trading partners of country k as follows:

$$log\lfloor WDR_k(t)\rfloor = \sum_j x_{kj}(t)\, log\lfloor MTR_j(t)\rfloor \quad (7.6)$$

where MTR_j is the total real import of the country j and x_{kj} is the three-year moving average of the exports' share of country k flowing to the country j. The weight x_{kj} can be interpreted as the elasticity of the export demand of the country k in relation to the import of the trade partner j. Bilateral trade data of the individual economy against its partners are drawn from the IMF DOTS database (The partners are the EU, Japan, the US and the Commonwealth of Independent States - CIS, Emerging and Developing Asia - EDA, Middle East and North Africa - MENA, Subsaharan Africa - SSA, Latin America and Carribean - LAC), the Rest (see table – Appendix 7.1). We assume that growth in the foreign demand would have a favourable effect on export growth.

Aggregate import function with the implementation of the panel dynamic ARDL model is defined in the chapter as follows:

$$lm_{it} = \lambda_{ij} lm_{i,t-j} + \delta_{10i} lreer_{it} + \delta_{11i} lreer_{i,t-1} + \delta_{20i} ldd_{it} + \delta_{21i} ldd_{i,t-1} + \delta_{30i} lx_{it} + \delta_{31i} lx_{i,t-1} + \mu_i + \partial_{it} \quad (7.7)$$

where the import is expressed as a function of import (lagged), two indicators (current and lagged) of price competitiveness $(lreer)$, domestic demand (ldd) and export (lx). All variables are expressed in logarithm.

Domestic demand (DD) is calculated as a difference of GDP and net export. We expect that the increase in domestic demand would positively affect the growth of import. Changes in domestic demand and associated effects on external balance have been recently discussed, e.g., in the studies of Wyplosz (2013) and Gabrish and Staehr (2012).

On the other hand, competitiveness growth (associated with REER decline) may negatively affect import because domestic goods become less expensive for consumers relatively to the imported goods. The impact of price competitiveness and domestic demand are discussed, e.g., by Wyplosz (2013) and Christodoulopoulou and Tkačevs (2014).

Involvement of variable lm (current and lagged) into the equation (7.5) as the determinant of export and variable lx (current and lagged) into the equation (7.7) as the determinant of import follows the idea that internationalization of production activities together with emergence of GVCs strengthens mutual relationship and dependence between exports and imports.

7.5.1 ARDL dynamic panel model

The estimation of the ARDL dynamic panel model is based on three estimation methods that are used in the empirical literature, namely Dynamic Fixed Effect Method (DFE), MG, and PMG. The first two estimation methods can be considered as extreme. Regarding DFE method, the time series for each group of countries are pooled, and only intercepts can be changed across groups. However, if the coefficients of the slopes are not the same, the DFE approach produces inconsistent and misleading results. Furthermore, the MG method introduced by Pesaran and Smith (1995) calculates the different coefficients in each cross-sectional unit and results in a simple arithmetic average of individual coefficients. In comparison to DFE method, intercepts, slopes, and error terms may vary within cross-sectional units. Finally, the PMG method, proposed by Pesaran, Shin and Smith (1997, 1999), combines the previous two methods (pooling and averaging). This estimator allows the intercepts, short-term coefficients, and error terms within the cross-section units of the panel to be different (as in the case of the DFE method). Since the equation (7.4) is nonlinear in the parameters, Pesaran, Shin and Smith (1999) introduced the method of maximum probability to estimate the parameters of the model (Blackburne and Frank, 2007).

However, Blackburne and Frank (2007) state that if the model is heterogeneous, PMG estimates are not consistent, and thus it is necessary to apply the Hausman test to determine the appropriate model. At the same time, Baltagi, Griffin and Xiong (2000) note that dynamic DFE models can lead to a bias of the simultaneous equation due to the endogenousness of the error term and the lag dependent variable. Therefore, we have decided to not include the DFE method in the analysis. In addition, the

authors recommend using a traditional Hausman test to determine the appropriate estimation method as stated above. The null hypothesis of the Hausman test is that the difference in the coefficients is not systematic.

According to Bayoumi, Harmsen and Turunen (2011), aggregate trade panels are non-stationary, i.e., integrated of order $I(1)$ and cointegrated. Therefore, the identification of integration order is based on IPS (Im-Pesaran-Shin) and CIPS (cross-sectional augmented IPS IPS) stationary tests, similarly as the approach of Comunale and Hessel (2014). At the same time, a cross-sectional dependency test is performed concerning the determination of the appropriate method for stationary testing since in the case of a larger number of observations T than the number of cross-sectional units N , the presence of cross-sectional dependence is highly probable. As a consequence of the above statements, the situation may be that some variables act as a common factor for export, respectively as a common factor for import. Consequently, the Westerlund cointegration test based on structural dynamics is applied.

At the same time, Comunale and Hessel (2014), and Blackburne and Frank (2007) state, that assuming dynamic panel data with more observations T compared to the number of cross-sectional units N , it is usual to apply the FE estimator. However, the authors point out that in the presence of non-stationarity and cointegration in a dynamic model, it is normal to re-parametrize the model into an ECM model. Subsequently, after the ARDL dynamic panel re-parametrization into an ECM model, the export and import functions would have the following forms:

$$\Delta lx_{it} = \phi_i \left(lx_{i,t-1} - \theta_{01}^{'} - \theta_{1i}^{'} lreer_{it} - \theta_{2i}^{'} lfd_{it} - \theta_{3i}^{'} lm_{it} \right) + \delta_{11i}^{'*} \Delta lreer_{it} + \delta_{21i}^{'*} \Delta lfd_{it} + \delta_{31i}^{'*} \Delta lm_{it} + \mu_i + \dot{o}_{it} \quad (7.8)$$

$$\Delta lm_{it} = \phi_i \left(lm_{i,t-1} - \theta_{01}^{'} - \theta_{1i}^{'} lreer_{it} - \theta_{2i}^{'} ldd_{it} - \theta_{3i}^{'} lx_{it} \right) + \delta_{11i}^{'*} \Delta lreer_{it} + \delta_{21i}^{'*} \Delta ldd_{it} + \delta_{31i}^{'*} \Delta lx_{it} + \mu_i + \dot{o}_{it} \quad (7.9)$$

Later, we estimate the non-stationary panel with the application to a smaller number of cross-sectional units N compared to the number of observations T using two methods, namely MG estimator and PMG estimator.

7.5.2 Robustness check of estimated ARDL results

The robustness of the ARDL results can be carried out by re-estimating the elasticities of the aggregate and disaggregated export and import equations using dynamic OLS (DOLS) and fully modified OLS (FMOLS) techniques. DOLS estimator proposed by Stock and Watson (1993) extends the traditional (static) OLS regression by employing lags, leads and contemporaneous values of the explanatory variable in first difference. DOLS is employed to estimate long-run equilibria that is corrected for potential simultaneity bias among explanatory variables. FMOLS as developed by Phillips and Hansen (1990) has advantages such as correcting for endogeneity and serial correlation effects (Narayan and Narayan, 2004).

Suitability of proposed methods to estimate cointegrating coefficients was discussed, among others, by McCoskey and Kao (1998) and Kao and Chiang (2001). Authors confirmed that FMOLS and DOLS

techniques are preferable methods suggesting that DOLS estimator outperforms other asymptotically efficient panel cointegration estimators Therefore, this DOLS estimator is our preferred estimator.

7.6 Empirical results

The results of the Pesaran CD and Breusch-Pagan LM statistics confirm cross-sectional dependencies in all variables in the panel. Therefore, the chapter focuses on the CIPS stationarity test that considers cross-sectional dependencies. Also, the IPS stationarity test is used to compare the results when not considering the previous dependence. The results confirm non-stationary data on the levels and stationary data in the first differences. Therefore, the analysis of the chapter is based exclusively on the data of the order $I(1)$, or $I(0)$ respectively, so that the presence of undesired $I(2)$ variables is eliminated. The Westerlund panel cointegration test for aggregate functions is also performed, while we assume that the results for disaggregated analysis would not be so different from the aggregate results. The detailed results of the tests are not reported here to save the space. Like any other results, they are available upon request from the author.

7.6.1 Aggregate export and import functions

We start with estimation of aggregate export and import functions. From estimated dynamic panel ARDL model we calculate long-term, short-term coefficients and the coefficient of the speed of adjustment as well. The analysis was initially performed for all available observations. However, we the results indicate a significant impact of the global financial and economic crisis on our estimates that is why we have split the analyzed period into the pre-crisis period, i.e., the period beginning in 1995Q4 and ending in 2008Q4 and the post-crisis period, i.e., the period beginning in 2010Q1 and ending in 2016Q4. The year 2009 was excluded from the reference period. This approach enables us to examine effects of the crisis on estimated results.

Tables 7.2 and 7.3 present estimates of the aggregate export function for the pre-crisis and post-crisis periods that are based on two estimation methods - PMG and MG (to save a space, the results of robustness check based on DOLS and FMOLS estimates of the aggregate export function for the pre-crisis and post-crisis periods are available upon request from the author).

Table 7.2 Estimated results of the aggregate export function for the pre-crisis period

variable	PMG		MG	
	estimated long-term elasticities			
lreer_CPI	**-0.328*** (0.024)**		-0.107 (0.056)	
lreer_ULC		**-0.298*** (0.022)**		-0.154 (0.023)
lfd	**0.372*** (0.022)**	**0.502*** (0.037)**	0.475* (0.070)	0.389** (0.046)
lm	**0.710*** (0.057)**	**0.785*** (0.061)**	0.805*** (0.126)	0.827*** (0.155)
	estimated short-term elasticities			
ECT	**-0.166*** (0.012)**	**-0.171*** (0.014)**	-0.415*** (0.057)	-0.431*** (0.062)
lreer_CPI D1	**0.149*** (0.048)**		0.140 (0.022)	
lreer_ULC D1		**0.056 (0.341)**		0.027 (0.718)
lfd D1	**-0.345*** (0.039)**	**-0.375*** (0.018)**	-0.351* (0.060)	-0.389** (0.016)
lm D1	**0.656*** (0.049)**	**0.636*** (0.025)**	0.452*** (0.041)	0.421*** (0.022)
constant	**0.207*** (0.013)**	**-0.107*** (0.055)**	-0.203* (0.060)	0.231 (0.033)

Note: Standard errors in parentheses. For calculations, 1 lag is considered (suggested by AIC). ECT (error correction term) represents the speed of adjustment. The index D1 indicates the first differences of the variable. The variables are in log form (index "l" before the variable). Lfd is foreign demand, lm is import, lreer_cpi is a REER vis-à-vis 37 partners deflated by CPI, lreer_ulc is a REER vis-à-vis 37 partners deflated by ULC. ***, ** and * are the confidence levels of 1%, 5% and 10%.
Source: Calculated by the authors

Table 7.2 shows the results of the estimation of aggregate export function for the pre-crisis period. Based on the Hausman test, we lean towards the results from PMG estimation method. Our estimates also indicate that the results are sensitive to the method used in terms of magnitude and significance of the coefficients. The long-term coefficients of both REER indicators confirm the assumption of the positive effect of REER on export dynamics as both coefficients are negative. However, estimates of short-term coefficients indicate insignificance of ULC based REER and significant, though positive (volume effect in the short-term period is smaller than the price effect), effect of CPI based REER on export. It seems that the long-term coefficients are more significant and larger compared to the short-term estimates. Our result is consistent with most studies that argue that price competitiveness matters in the Euro Area and the EU (see, e.g., Communal and Hessel, 2014; Bayoumi, Harmsen and Turunen, 2011; Mirdala, 2015). The findings also confirm a significant positive long-term effect of foreign demand on the export (thought short-term coefficient is negative). Similarly, our results indicate strong positive effects of imports on export performance that reveals significant mutual relationship between exports and imports in both short-term and long-term period. Finally, the ECT has an expected

negative sign, indicating a return of the variables to the long-term equilibrium (after the initial positive shock).

Table 7.3 Estimated results of the aggregate export function in the post-crisis period

variable	PMG		MG	
	estimated long-term elasticities			
lreer_CPI	**-0.193*** (0.012)**		-0.452** (0.042)	
lreer_ULC		**-0.087* (0.008)**		-0.279* (0.071)
lfd	**0.276*** (0.019)**	**0.125*** (0.010)**	0.220 (0.016)	0.280 (0.033)
lm	**0.883*** (0.065)**	**0.822*** (0.072)**	0.691*** (0.047)	0.663*** (0.066)
	estimated short-term elasticities			
ECT	**-0.350*** (0.023)**	**-0.399*** (0.028)**	-0.640*** (0.042)	-0.669*** (0.050)
lreer_CPI D1	**-0.121 (0.017)**		0.037 (0.007)	
lreer_ULC D1		**-0.075 (0.005)**		0.020 (0.009)
lfd D1	**0.132 (0.043)**	**0.142 (0.038)**	0.100 (0.012)	0.102 (0.033)
lm D1	**0.421*** (0.038)**	**0.270*** (0.019)**	0.283*** (0.015)	0.159*** (0.022)
constant	**1.482*** (0.132)**	**1.219*** (0.099)**	1.332*** (0.359)	1.369*** (0.287)

Note: Standard errors in parentheses. For calculations, 1 lag is considered (suggested by AIC). ECT (error correction term) represents the speed of adjustment. The index D1 indicates the first differences of the variable. The variables are in log form (index "l" before the variable). Lfd is foreign demand, lm is import, lreer_cpi is a REER vis-à-vis 37 partners deflated by CPI, lreer_ulc is a REER vis-à-vis 37 partners deflated by ULC. ***, ** and * are the confidence levels of 1%, 5% and 10%.
Source: Calculated by the authors

Table 7.3 shows the results of the export determinants in the post-crisis period, with PMG results as the preferred estimation method based on the Hausman test. Coefficients on both types of REER are still negative though slightly smaller (in the long-term) that indicates reduced role of price competitiveness in determining export performance. Similarly small and negative (though insignificant) are both CPI and ULC based REER in the short-term estimates. Crisis period changed expected effect of foreign demand on export performance. Coefficients in both long term and short term (insignificant) are positive and smaller in comparison with the model for the crisis period. However, mutual dependence between exports and imports during the crisis period increased as the estimated long-term coefficients for imports are slightly higher. As a result, imports remained the most crucial determinant of export performance (especially in the long-term estimates) in our group of countries even during the crisis period (see the results from disaggregated export function estimates in table 6

for more detailed explanation). The ECT coefficient has an expected negative sign, indicating a return of the variables to the long-term equilibrium (after the initial positive shock).
Tables 7.4 and 7.5 present estimates of the aggregate import function for the pre-crisis and post-crisis periods that are based on two estimation methods - PMG and MG (to save a space, the results of robustness check based on DOLS and FMOLS estimates of the aggregate import function for the pre-crisis and post-crisis periods are available upon request from the author).

Table 7.4 Estimated results of the aggregate import function in the pre-crisis period

variable	PMG		MG	
	estimated long-term elasticities			
lreer_CPI	0.147* (0.095)		**0.190** **(0.046)**	
lreer_ULC		0.583 (0.041)		**0.616** **(0.043)**
ldd	0.804*** (0.039)	0.811*** (0.076)	**0.857***** **(0.063)**	**0.856*** **(0.079)**
lx	0.861*** (0.027)	0.862*** (0.061)	**0.682***** **(0.063)**	**0.434** **(0.021)**
	estimated short-term elasticities			
ECT	-0.114*** (0.009)	-0.123*** (0.013)	**-0.394***** **(0.028)**	**-0.366***** **(0.035)**
lreer_CPI D1	-0.388** (0.036)		**-0.310***** **(0.029)**	
lreer_ULC D1		-0.406*** (0.035)		**-0.305***** **(0.028)**
ldd D1	0.923*** (0.078)	0.950*** (0.083)	**0.712***** **(0.066)**	**0.784***** **(0.058)**
lx D1	0.531*** (0.042)	0.519*** (0.037)	**0.359***** **(0.025)**	**0.368***** **(0.042)**
Constant	-0.934*** (0.052)	-0.967*** (0.069)	**-1.256***** **(0.117)**	**-1.157***** **(0.094)**

Note: Standard errors in parentheses. For calculations, 1 lag is considered (suggested by AIC). ECT (error correction term) represents the speed of adjustment. The index D1 indicates the first difference of the variable. The variables are in log form (index "l" before the variable). Ldd is domestic demand, lx is export, lreer_cpi is a REER vis-à-vis 37 partners deflated by CPI, lreer_ulc is a REER vis-à-vis 37 partners deflated by ULC. ***, ** and * are the confidence levels of 1%, 5% and 10%.
Source: Calculated by the authors

Table 7.4 presents the estimates of the long-term and short-term coefficients of the aggregate import function in the model with pre-crisis data. The results of the Hausman test favor the results of the MG method. REER appreciation has a positive effect on import as indicated by our long-term estimates. It seems that import is more sensitive to the associated cost than price related changes in competitiveness as the REER coefficients for the model with ULC based REER are significantly higher. However, short-term estimates indicate negative effect of REER appreciation on import that similarly to our results for export function (tables 2 and 3) favors price effect to volume effect. Increase in REER reduces import prices and decreases imports in the short term (Christodoulopoulou and Tkačevs,

2014). Our results also reveal significant and positive effect of both domestic demand and import on export dynamics for both short-term and long-term estimates. ECT has an expected negative sign, indicating a return of the variables to the long-term equilibrium (after the initial positive shock).

Table 7.5 Estimated results of the aggregate import function in the post-crisis period

variable	PMG		MG	
	estimated long-term elasticities			
lreer_CPI	**0.078** **(0.006)**		0.134 (0.036)	
lreer_ULC		**0.550***** **(0.049)**		0.206 (0.023)
ldd	**0.498***** **(0.038)**	**0.689***** **(0.055)**	0.296 (0.025)	0.352* (0.075)
lx	**0.117** **(0.022)**	**0.215***** **(0.004)**	0.545 (0.038)	0.664*** (0.028)
	estimated short-term elasticities			
ECT	**-0.129***** **(0.056)**	**-0.142***** **(0.062)**	-0.387*** (0.078)	-0.491*** (0.065)
lreer_CPI D1	**0.076** **(0.003)**		0.056 (0.005)	
lreer_ULC D1		**0.151** **(0.008)**		0.072** (0.003)
ldd D1	**0.959***** **(0.041)**	**0.925***** **(0.068)**	0.830*** (0.091)	0.749*** (0.103)
lx D1	**0.624***** **(0.056)**	**0.613***** **(0.099)**	0.378*** (0.119)	0.297*** (0.093)
constant	**0.470***** **(0.065)**	**0.403***** **(0.041)**	-0.833 (0.068)	-0.868 (0.057)

Note: Standard errors in parentheses. For calculations, 1 lag is considered (suggested by AIC). ECT (error correction term) represents the speed of adjustment. The index D1 indicates the first difference of the variable. The variables are in log form (index "l" before the variable). Ldd is domestic demand, lx is export, lreer_cpi is a REER vis-à-vis 37 partners deflated by CPI, lreer_ulc is a REER vis-à-vis 37 partners deflated by ULC. ***, ** and * are the confidence levels of 1%, 5% and 10%.
Source: Calculated by the authors

Table 7.5 shows the results of the import determinants in the post-crisis period. According to the Hausman test we favor the results of the PMG model. Estimated coefficients for both REER variables have significant and positive effect on import in the long run and short run (contrary to our calculations for the pre-crisis period) as well. However, responsiveness of import to both CPI and ULC based REER slightly decreased (coefficients and slightly lower). Similar scenario (positive but lower coefficients) was observed for domestic demand and export estimates in the long run. However, short-term estimates revealed positive but higher (in comparison with a pre-crisis model) responsiveness of import to shocks in domestic demand and export. ECT has an expected negative sign, indicating a return of the variables to the long-term equilibrium (after the initial positive shock).
While a positive role of foreign demand in determining export (in the long-term) and domestic demand (in both long-run and short-run) in determining import was generally expected, high sensitivity of export

dynamics to shocks in import and import dynamics to shocks in export emphasizes the role of mutual relationship between export and import in shaping external equilibrium in our group of countries (Barrell and Dées, 2005). Moreover, demand determinants dominates to price and cost related competitiveness indicators (both REER indicators) in determining both export in import favoring demand-driven origins of export-import mismatch and thus external imbalances for our sample of countries.

7.6.2 Disaggregated export and import functions

The estimation of disaggregated export and import functions is also based on dynamic panel ARDL model for non-stationary heterogeneous panels. Both exports and imports are split into smaller parts from the territorial and commodity point of view. From the territorial point of view, our disaggregated dataset is split into export and import within and outside the EU. The motivation is based on idea to determine which trade flow destination is more relevant to the development of the explanatory variables. At the same time, export and import are divided by the BEC classification into three groups - capital goods, intermediate products and consumption goods.

Table 7.6 present estimates of the disaggregated export function for the pre-crisis and post-crisis periods that are based on two estimation methods - PMG and MG (to save a space, the results of robustness check based on DOLS and FMOLS estimates of the disaggregated export function for the pre-crisis and post-crisis periods are available upon request from the author).

Table 7.6 presents the results of the disaggregated export function estimates for both pre-crisis and post-crisis periods. According to the Hausman test, estimates based on PMG model with ULC based REER and the MG model with CPI based REER are selected as the appropriate models for the pre-crisis period while PMG model for both exchange rate variables is more appropriate for a model with post crisis data. Coefficients for exchange rates and foreign demand correspond to our estimates from aggregate export function (tables 7.2 and 7.3) that is why we focus on analysis of decomposed import components in the short-term and long-term only.

All estimates of import components for a short-term period indicate positive effect on export. However, export in our sample of countries seems to be the most responsive to the shocks in imports of intermediate goods from countries within EU (both pre-crisis and post-crisis periods) indicating effect of international fragmentation of production that makes export and import mutually dependent. Considerable increase in a positive effect on export was identified in case of import of capital goods from countries outside EU in the post-crisis period that corresponds to the rebirth of growth dynamics in our sample of countries fueled by inflows of capital goods from faster growing regions (U.S.A. and China). Responsiveness of export to import of consumption goods from countries within EU in the post-crisis period notably increased as well, however, estimated coefficients are insignificant.

Table 7.6 Estimated results of the disaggregated export function

	pre-crisis period				**post-crisis period**			
variable	PMG		MG		PMG		MG	
	estimated long-term elasticities							
lreer_cpi	-0.348 (0.017)		**-0.199 (0.033)**		**-0.328 (0.051)**		-0.347 (0.041)	
lreer_ulc		**-0.205** (0.028)**		-0.209 (0.036)		**-0.370* (0.050)**		-0.447 (0.056)
lfd	0.504 (0.021)	**0.506*** (0.057)**	**0.298* (0.089)**	0.301 (0.077)	**0.279*** (0.061)**	**0242*** (0.072)**	0.344 (0.027)	0.217 (0.025)
lm_cap$_{extra}$	-0.093 (0.010)	**-0.112*** (0.018)**	**-0.076 (0.008)**	-0.019 (0.004)	**-0.615*** (0.048)**	**-0.607*** (0.072)**	-0.714 (0.043)	-0.631 (0.069)
lm_inter$_{extra}$	0.242 (0.019)	**0.256*** (0.039)**	**0.174 (0.037)**	0.191 (0.049)	**0.221*** (0.043)**	**0.202*** (0.034)**	0.395 (0.034)	0.245 (0.043)
lm_con$_{extra}$	-0.255 (0.075)	**-0.298*** (0.080)**	**-0.132 (0.037)**	-0.144 (0.048)	**-0.069 (0.004)**	**-0.033 (0.008)**	-0.183 (0.030)	-0.103 (0.047)
lm_cap$_{intra}$	0.355 (0.029)	**0.360*** (0.048)**	**0.127*** (0.037)**	0.129 (0.042)	**0.105 (0.029)**	**0.176* (0.056)**	0.179 (0.042)	0.093 (0.009)
lm_inter$_{intra}$	0.337 (0.071)	**0.319*** (0.013)**	**0.494*** (0.039)**	0.482 (0.088)	**0.328** (0.050)**	**0.242* (0.063)**	0.287 (0.047)	0.352 (0.045)
lm_con$_{intra}$	0.369 (0.077)	**0.405*** (0.108)**	**0.113 (0.068)**	0.119 (0.047)	**0.550*** (0.118)**	**0.556*** (0.142)**	0.665 (0.136)	0.512 (0.134)
	estimated short-term elasticities							
ECT	-0.130 (0.045)	**-0.127*** (0.056)**	**-0.612*** (0.038)**	-0.609 (0.042)	**-0.367*** (0.018)**	**-0.385*** (0.028)**	-0.827 (0.104)	-0.802 (0.117)
lreer_cpi D1	0.144 (0.029)		**0.150 (0.042)**		**0.113** (0.043)**		0.092 (0.011)	
lreer_ulc D1		**0.121 (0.055)**		0.110 (0.042)		**0.097** (0.015)**		0.038 (0.006)
lfd D1	-0.111 (0.058)	**-0.050 (0.012)**	**-0.135** (0.047)**	-0.116 (0.055)	**0.264 (0.065)**	**0.318 (0.063)**	0.201 (0.086)	0.033 (0.009)
lm_cap$_{extra}$ D1	0.020 (0.012)	**0.019** (0.009)**	**0.014 (0.009)**	0.010 (0.006)	**0.171*** (0.041)**	**0.168*** (0.031)**	0.053 (0.017)	0.016 (0.007)
lm_inter$_{extra}$ D1	0.095 (0.022)	**0.094*** (0.031)**	**0.047** (0.014)**	0.040 (0.018)	**0.003 (0.001)**	**0.021 (0.005)**	0.075 (0.027)	0.077 (0.039)
lm_con$_{extra}$ D1	0.070 (0.080)	**0.069* (0.099)**	**0.051 (0.249)**	0.051 (0.229)	**0.075 (0.317)**	**0.093 (0.177)**	0.165 (0.060)	0.149 (0.044)
lm_cap$_{intra}$ D1	0.050 (0.012)	**0.049* (0.009)**	**0.030 (0.018)**	0.029 (0.013)	**0.066 (0.023)**	**0.070 (0.031)**	0.056 (0.026)	0.119 (0.029)
lm_inter$_{intra}$ D1	0.380 (0.000)	**0.380*** (0.000)**	**0.130* (0.065)**	0.131 (0.039)	**0.199* (0.066)**	**0.240** (0.020)**	0.032 (0.008)	0.028 (0.007)
lm_con$_{intra}$ D1	0.047 (0.009)	**0.040 (0.008)**	**0.029 (0.006)**	0.017 (0.007)	**0.121 (0.037)**	**0.159 (0.029)**	0.653 (0.065)	0.641 (0.060)
constant	0.369 (0.066)	**0.262*** (0.088)**	**0.343 (0.096)**	0.421 (0.148)	**1.575*** (0.229)**	**1.272*** (0.307)**	1.335 (0.082)	1.181 (0.074)

Note: Standard errors in parentheses. For calculations, 1 lag is considered (suggested by AIC). ECT (error correction term) represents the speed of adjustment. The index D1 indicates the first difference of the variable. The variables are in log form (index "l" before the variable). Lfd is foreign demand, lm is import, lreer_cpi is a REER vis-à-vis 37 partners deflated by CPI, lreer_ulc is a REER vis-à-vis 37 partners deflated by ULC, lm_cap is import of capital goods, lm_inter is import of intermediate goods,

Im_con is import of consumption goods. Index extra represents flows from countries outside EU while index intra represents flows from countries within EU.
***, ** and * are the confidence levels of 1%, 5% and 10%.
Source: Calculated by the authors

The results for a long-term period slightly differ in comparison to our short-term estimates. Our estimates indicate a decreased in export after unexpected shock in import of capital (negative response of export to this shock is even higher in the post-crisis period) and consumption goods from countries outside EU. It seems that these types of foreign trade inflows between EU and non-EU countries do not strengthens mutual links between exports and imports in our sample of countries in the long run. On the other hand, import of intermediate goods (from both EU and non-EU countries) positively affects export thought the effect slightly decreased during the crisis period. All three types of imports from EU countries have a positive impact on export in the long run. While effects of imported capital and intermediate goods on export slightly decreased due to reduced export performance (lower foreign demand) of countries during the crisis period, effect of imported consumption goods on export raised (shock in this segment of import crowded out domestic production abroad). ECT has an expected negative sign, indicating a return of the variables to the long-term equilibrium (after the initial positive shock).

Table 7.7 present estimates of the disaggregated import function for the pre-crisis and post-crisis periods that are based on two estimation methods - PMG and MG (to save a space, the results of robustness check based on DOLS and FMOLS estimates of the disaggregated import function for the pre-crisis and post-crisis periods are available upon request from the author).

Table 7.7 presents the results of the estimation of the disaggregated import function in the pre-crisis and post-crisis periods, with the same labels as the export function above. According to the Hausman test, estimates based on PMG model with ULC based REER and the MG model with CPI based REER are selected as the appropriate models for the pre-crisis period while PMG model for both exchange rate variables is more appropriate for a model with post-crisis data. Coefficients for exchange rates and domestic demand correspond to our estimates from aggregate import function (tables 7.4 and 7.5) that is why we focus on analysis of decomposed export components in the short-term and long-term only.

Short-term estimates indicate generally positive though small effect of export components to both EU and non-EU countries on import. However, export of intermediate goods to EU countries has slightly higher positive effect on import than other components in both pre-crisis and post-crisis periods. Moreover, higher, positive and statistically significant effect was also examined in case of export of capital goods to non-EU countries during the post-crisis period. Similarly to our results for disaggregated export function we suggest that flows of intermediate goods within EU countries is playing an important role (though smaller during the post-crisis period) in strengthening the mutual relationship between dynamics of exports and imports.

Table 7.7 Estimated results of the disaggregated import function

	pre-crisis period				post-crisis period			
variable	PMG		MG		PMG		MG	
	estimated long-term elasticities							
lreer_cpi	-0.102		**-0.183**		**-0.206**		0.872	
	(0.052)		**(0.052)**		**(0.092)**		(0.093)	
lreer_ulc		**-0.108**		-0.222		**-0.267****		-0.025
		(0.031)		(0.023)		**(0.020)**		(0.009)
ldd	0.197	**0.231****	**0.405**	0.474	**0.584*****	**0.742*****	0.567	0.632
	(0.055)	**(0.020)**	**(0.086)**	(0.071)	**(0.076)**	**(0.099)**	(0.089)	(0.069)
lx_cap_extra	0.061	**0.061*****	**0.102*****	0.104	**0.701*****	**0.682*****	0.548	0.563
	(0.005)	**(0.017)**	**(0.037)**	(0.021)	**(0.089)**	**(0101)**	(0.071)	(0.088)
lx_inter_extra	0.205	**0.237*****	**0.183****	0.164	**0.568*****	**0.500*****	0.502	0.526
	(0.088)	**(0.074)**	**(0.018)**	(0.051)	**(0.069)**	**(0.063)**	(0.091)	(0.102)
lx_con_extra	-0.063	**-0.066*****	**-0.046**	-0.038	**-0.153*****	**-0.139*****	-0.085	-0.171
	(0.009)	**(0.008)**	**(0.008)**	(0.006)	**(0.048)**	**(0.061)**	(0.027)	(0.106)
lx_cap_intra	0.060	**0.050*****	**0.060**	0.089	**0.052**	**0.040**	0.111	0.090
	(0.018)	**(0.029)**	**(0.015)**	(0.017)	**(0.009)**	**(0.017)**	(0.027)	(0.024)
lx_inter_intra	0.667	**0.608*****	**0.361*****	0.298	**0.286*****	**0.163****	0.391	0.359
	(0.089)	**(0.117)**	**(0.147)**	(0.065)	**(0.031)**	**(0.030)**	(0.056)	(0.090)
lx_con_intra	0.118	**0.139*****	**0.102**	0.143	**0.604*****	**0.630*****	0.408	0.453
	(0.032)	**(0.022)**	**(0.035)**	(0.040)	**(0.092)**	**(0.103)**	(0.031)	(0.026)
	estimated short-term elasticities							
ECT	-0.199	**-0.199*****	**-0.623**	0.631	**-0.432*****	**-0.417*****	-0.391	-0.384
	(0.038)	**(0.041)**	**(0.022)**	(0.047)	**(0.063)**	**(0.067)**	(0.088)	(0.092)
lreer_CPI D1	-0.214		**-0.132**		**0.153*****		0.181	
	(0.054)		**(0.041)**		**(0.065)**		(0.054)	
lreer_ULC D1		**-0.317*****		-0.327		**0.198*****		0.207
		(0.085)		(0.020)		**(0.074)**		(0.075)
ldd D1	0.395	**0.405*****	**0.160**	0.154	**0.681****	**0.627****	0.326	0.383
	(0.104)	**(0.094)**	**(0.175)**	(0.046)	**(0.125)**	**(0.137)**	(0.051)	(0.086)
lx_cap_extra D1	0.039	**0.036*****	**0.010**	0.011	**0.245*****	**0.248*****	-0.035	-0.037
	(0.011)	**(0.009)**	**(0.004)**	(0.004)	**(0.069)**	**(0.081)**	(0.007)	(0.008)
lx_inter_extra D1	0.051	**0.040**	**0.034**	0.046	**0.064**	**0.059**	0.175	0.187
	(0.033)	**(0.007)**	**(0.006)**	(0.017)	**(0.016)**	**(0.006)**	(0.032)	(0.049)
lx_con_extra D1	0.004	**-0.000**	**0.001**	-0.005	**0.020**	**-0.026**	0.084	0.146
	(0.002)	**(0.003)**	**(0.002)**	(0.003)	**(0.007)**	**(0.007)**	(0.013)	(0.067)
lx_cap_intra D1	0.026	**0.025**	**0.000**	0.009	**0.026**	**0.020**	0.011	0.040
	(0.009)	**(0.011)**	**(0.004)**	(0.005)	**(0.015)**	**(0.007)**	(0.05)	(0.006)
lx_inter_intra D1	0.282	**0.292*****	**0.188*****	0.193	**0.178****	**0.162***	0.193	0.150
	(0.1140)	**(0.128)**	**(0.096)**	(0.087)	**(0.049)**	**(0.084)**	(0.044)	(0.081)
lx_con_intra D1	0.051	**0.056**	**0.036**	0.031	**0.105**	**0.057**	0.079	0.190
	(0.008)	**(0.009)**	**(0.009)**	(0.005)	**(0.068)**	**(0.026)**	(0.037)	(0.086)
constant	-0.924	**-0.951****	**-0.946**	-1.159	**-0.817*****	**-0.707*****	-0.884	-0.682
	(0.226)	**(0.213)**	**(0.301)**	(0.197)	**(0.227)**	**(0.301)**	(0.244)	(0.189)

Note: Standard errors in parentheses. For calculations, 1 lag is considered (suggested by AIC). ECT (error correction term) represents the speed of adjustment. The index D1 indicates the first differences of the variable. The variables are in log form (index "l" before the variable). Lfd is foreign demand, lx is export, lreer_cpi is a REER vis-à-vis 37 partners deflated by CPI, lreer_ulc is a REER vis-à-vis 37 partners deflated by ULC, lx_cap is export of capital goods, lx_inter is export of intermediate goods,

lx_con is export of consumption goods. Index extra represents flows to countries outside EU while index intra represents flows to countries within EU.
***, ** and * are the confidence levels of 1%, 5% and 10%.
Source: Calculated by the authors

Almost all estimated long-term coefficients are significant. Individual export components have positive effect on import except for export of consumption goods to non-EU countries (its negative effect slightly increased during the post-crisis period). Outflows of intermediate production to EU countries represented the most contributive determinant of the import dynamics during the pre-crisis period (its effect during the post-crisis period decreased) highlighting an importance of production chains fragmentation in strengthening mutual links between export and import. Moreover, effect of intermediate production exported to non-EU countries on import significantly increased during the post-crisis period possibly substituting reduced effect of intermediate goods export to EU countries on import. Significant increase in the positive effect on import during the post-crisis period was examined in case of exports of capital goods to non-EU countries (foreign investment demand driver from faster recovered economies outside EU during the post-crisis period) and export of consumption goods to EU countries (foreign consumption demand driver from faster recovered economies within EU during the post-crisis period). ECT has an expected negative sign, indicating a return of the variables to the long-term equilibrium (after the initial positive shock).

7.7 Conclusion

Examination of the key determinants of export and import dynamics together with identification of the patterns and sources of mutual relationship between export and import in 21 EU countries from aggregate and disaggregated export and import functions revealed interesting implications of deeper economic integration in the EU and international fragmentation of production chains. While our results confirmed relative importance of price (cost) and foreign/domestic demand driven determinants in stimulating export and import, commodity and territorial decomposition of import and export components provide vital information on relative importance of mutual links and relationship between export and import and vice versa.

Our results from aggregate analysis indicate that import represented the most important determinant of export dynamics during both pre-crisis and post-crisis periods (though with lower intensity). These results are generally conformed to the outcomes of other studies (i.e. Barrell and Dées (2005), Ca'Zorzi and Schnatz (2007), Bayoumi, Harmsen and Turunen (2011)). Disaggregated estimates confirmed clearly higher importance of import links in determining export performance; particularly the role of intermediate goods flows in the short run (as documented by Fukumoto (2012) in case of China), flows of capital (as documented by Gozgor and Oktay (2013) in case of Turkey or Jlassi (2015) in case of Tunisia) (though its contribution decreased during the post-crisis period), intermediate and consumption goods in the long run (its contribution increased during the post-crisis period) within EU. Aggregate analysis of import determinants revealed a dominant role of domestic demand in driving import dynamics leaving export less important (similarly to the results presented by Bussière et al. (2013)) though still contributive factor of import. However, deeper fragmentation of production across countries within EU potentially strengthens long-term links and relationship between imports and

exports especially due to higher sensitivity to exports and imports of intermediate goods. As a result, this fact will contribute to the reduction of negative external imbalances in countries provided that value added in exports will generally rise. Otherwise, value chains distributed across borders may even deepen negative current imbalances in countries with less sophisticated exports.

Disaggregated analysis confirmed important role of intermediate goods inflows for export performance favoring substantial role of production chains fragmentation across EU (but also non-EU countries especially during the post-crisis period) countries in determining net effect on the trade balance. We suggest that international fragmentation of production may be beneficial (in terms of GDP growth performance) for export oriented countries (smaller and more open EU member countries) while larger EU economies may benefit from higher commodity diversification of their exports.

Strong mutual relationship between export and import (for more evidence in non-EU countries see i.e. Kostoska and Petreski (2009) or Mervar (1994) also indicates a significant role of outflows of consumption (to EU countries) and capital (to non-EU countries) goods in determining import during the post-crisis period.

Relative position of individual country in the process of international fragmentation of production not only affects net gains that result from participation in the process of international division of labor but related mutual links between exports and imports (and associated shares of intermediate goods in the cross-country trade flows) substantially shapes external position (trade balance, current account) of the country. Deeper are the links between exports and imports, the more emphasis should policy makers put on long-term shaping of a structure of domestic internationalized industries to preserve long-term sustainability of a trade balance.

References

AHN, J., MANO, R., ZHOU, J. (2018), Real Exchange Rate and External Balance: How Important Are Price Deflators?, *Journal of Money, Credit and Banking*, (forthcoming)

ALI-YRKKÖ, J., MATTILA, J., SEPPÄLÄ, T. (2017), Estonia in Global Value Chains, [ETLA Reports No. 69] Helsinki, Elinkeinoelämän tutkimuslaitos, 28 p.

ALLARD, C., et al. (2005), Explaining Differences in External Sector Performance Among Large Euro Area Countries, [IMF Country Report No. 05/401], Washington, D.C., International Monetary Fund, 36 p.

AMADOR, J., CAPPARIELLO, R., STEHRER, R. (2015), Global Value Chains: A View from The Euro Area, [ECB Working Paper No. 1761], Frankfurt am Main, European Central Bank, 24 p.

AMIGHINI, A.A., (2012). China and India in the International Fragmentation of Automobile Production, *China Economic Review*, 23(2): 325-341

BACKER, K. D., MIROUDOT, S., (2013). Mapping Global Value Chains, [OECD Trade Policy Papers, no. 159], Paris, Organization for Economic Cooperation and Development, 46 p.

BALDWIN, R., LOPEZ-GONZALES, J., (2013). Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses, *The World Economy*, 38(1): 1682-1721

BALTAGI, B. H., GRIFFIN, J. M., XIONG, W. (2000), To Pool or Not to Pool: Homogeneous versus Heterogeneous Estimators Applied to Cigarette Demand, *Review of Economics and Statistics*, 82(1): 117-126.

BARRELL, R., DÉES, S. (2005), World Trade and Global Integration in Production Processes : A Re-assessment of Import Demand Equations, [ECB Working Paper No. 503], Frankfurt am Main, European Central Bank, 38 p.

BAYOUMI, T., HARMSEN, R., TURUNEN, J. (2011), Euro Area Export Performance and Competitiveness, [IMF Working Paper 11/140], Washington, D.C., International Monetary Fund, 17 p.

BELKE, A., DREGER, CH. (2011) Current Account Imbalances in the Euro Area: Catching up or Competitiveness?, [DIW Discussion Papers, No. 1106/2011], Berlin, German Institute for Economic Research, 21 p.

BELESSIOTIS, T., CARONE, G. (1997), A Dynamic Analysis of France's External Trade [Munich: Munich Personal RePEc Archive], 70 p.

BESS, R., AMBARGIS, Z.O., (2011). Input-Output Models for Impact Analysis: Suggestions for Practioners using RIMS II Multipliers, [BEA Working Paper, no. 0081], Washington, Bureau for Economic Analysis, 27 p.

BLACKBURNE, E. F., FRANK, M. W. (2007), Estimation of Nonstationary Heterogeneous Panels, *Stata Journal*, 7(2): 197-208.

BRUMM, J., GEORGIAS, G., GRÄB, J. (2016) Global Value Chains Participation and Current Account Imbalances, International Trade and Macroeconomic Interdependence in the Age of Global Value Chains, 15.-16. September, 2016, Bank of Lithuania, Vilnius, 29 p.

BUSSIÈRE, M. T., et al. (2013), Estimating Trade Elasticities : Demand Composition and the Trade Collapse of 2008-2009, *American Economic Journal : Macroeconomics*, 5(3): 118-151.

CA' ZORZI, M., SCHNATZ, B. (2007), Explaining and Forecasting Euro Area Exports: Which Competitiveness Indicator Performs Best?, [ECB Working Paper No. 833], Frankfurt am Main, European Central Bank, 33 p.

CAMARERO, M., TAMARIT, C. (2004), Estimating the Export and Import Demand for Manufactured Goods : The role of FDI, *Review of World Economics*, 140(3): 347-375.

CHEN, R., MILESI-FERRETTI, G. M., TRESSEL, T. (2012), External Imbalances in the Euro Area, [IMF Working Paper 12/236], Washington, D.C., International Monetary Fund, 51 p.

CHRISTODOULOPOULOU, S., TKAČEVS, O. (2014), Measuring the Effectiveness of Cost and Price Competitiveness in External Rebalancing of Euro Area Countries: What do Alternative HCIS Tell Us?, [ECB working paper 1736], Frankfurt am Main, European Central Bank, 36 p.

CINGOLANI, I., FELICE, G., TAJOLI, L. (2015), External Imbalances in the European Union and International Fragmentation of Production : Is There a Link?, 38 p.

COMUNALE, M., HESSEL, J. (2014), Current Account Imbalances in the Euro Area: Competitiveness or Financial Cycle?, [DNB Working paper No. 443], Amsterdam, De Nederlandsche Bank NV, 51 p.

COSTINOT, A., VOGEL, J., WANG, S., (2013). An Elementary Theory of Global Supply Chains, *Review of Economic Studies*, 80(1): 109-144

DARVAS, Z. (2012), Intra-Euro Rebalancing is Inevitable, but Insufficient, [Bruegel Policy Contributions 2012/15], 12 p.

DE GRAUWE, P. (2013) Design Failures in the Eurozone: Can They Be Fixed? [LSE "Europe in Questions" Discussion Paper no. 57] London, London School of Economics, 35 p.

EUROPEAN COMMISSION. (2009), Special report : Competitiveness Developments within Euro Area, *Quarterly Report on the euro area*, 8(1): 1-54.

EUROPEAN COMMISSION. (2010), *Quarterly Report on the Euro Area II/2010*, 9(2): 1-38.

FALZONI, A. M., TAJOLI, L. (2015), International Fragmentation of Production and Trade Volatility : An Analysis for the European Countries, *Modern Economy*, 6(3): 358-369.

FONTAGNÉ, L., FREUDENBERG, M., GAULIER, G. (2007), A Systematic Decomposition of World Trade into Horizontal and Vertical IIT, *Review of World Economics*, 142(3): 459-475.

FEENSTRA, R. C. (1998) Integration of Trade and Disintegration of Production in the Global Economy, *Journal of Economic Perspectives*, 12(4): 31-50

FEENSTRA, R.C., HONG, CH., (2007). China's Exports and Employment, Chapter 5 in book edited by FEENSTRA, R.C., WEI, S.-J., (2007). China's Growing Role in World Trade, University of Chicago Press, p. 167-199

FUKUMOTO, M. (2012), Estimation of China's Disaggregate Import Demand Functions, *China Economic Review*, 23(2): 434-444.

GAULIER, G., LEMOINE, F., ÜNAL-KESENCI D. (2007), China's Emergence and the Reorganization of Trade Flows in Asia, *China Economic Review*, 18(3): 209-243.

GAULIER, G., VICARD, V. (2012) Current Account Imbalances in the Euro Area: Competitiveness or Demand Shock?, [BDF Quarterly Selection of Articles, No. 27/2012], Paris, Banque de France, 26 p.

GIORDANO, C., ZOLLINO, F. (2015), Exploring Price and Non-price Determinants of Trade Flows in the Largest Euro-Area Countries, [Working Paper Series No. 1789 / May 2015], Frankfurt am Main, European Central Bank, 35 p.

GOLDSTEIN, M., KHAN, M. S. (1985), Income and Price Effects in Foreign Trade, *Handbook of international economics*, 2(21): 1041-1105.

GOZGOR, G., OKTAY, E. (2013), Estimation of Disaggregated Import Demand Functions for Turkey, *Economics Bulletin*, 33(1): 575-585.

GROSSMAN, G.M., ROSSI-HANSBERG, E., (2008). Trading Tasks: A Simple Theory of Offshoring, *American Economic Review*, 98(5): 1978-97

GUO, J., PLANTING, M.A., (2000). Using Input-Output Analysis to Measure U.S. Economic Structural Change Over a 24 Year Period. Bureau of Economic Commerce. The 13th International Conference on Input-Output Techniques, Macerata, Italy, August 21-25, 2000

HIRSCHMAN, A., (1958). The Strategy of Economic Development, New Haven, Yale University

HOOPER, P., JOHNSON, K., MARGUEZ, J., (2000). Trade Elasticities for the G7 Countries, [Princeton Studies in International Finance 87], 72 p.

HOOPER, P., JOHNSON, K., MARGUEZ, J. (2000). Trade Elasticities for the G7 Countries, [Princeton Studies in International Finance 87], 72 p.

HUBRICH, K. S., KARLSSON, T. (2010), Trade Consistency in the Context of the Eurosystem Projection Exercises : An Overview, [ECB Occasional Paper Series No. 108], Frankfurt am Main, European Central Bank, 49 p.

HUMMELS, D., ISHII, J., YI, K.-M., (2001). The Nature and Growth of Vertical Specialization in World Trade, *Journal of International Economics*, 54(1): 75-96

IM, K. S., PESARAN, M. H., SHIN, Y. (2003), Testing for Unit Roots in Heterogeneous Panels, *Journal of Econometrics*, 115(1): 53-74.

IMF. (2017), IMF Data : Direction of Trade Statistics

JLASSI, K. (2015), Modelling and Forecasting of Tunisian Current Account: Aggregate versus Disaggregate Approach, [GIIDS Working Paper, No. 13/2015], Geneva, Graduate Institute of International and Development Studies, 47 p.

JOHNSON R.C., NOGUERA G., (2012). Fragmentation and Trade in Value Added over Four Decades, [NBER Working Paper, no. 18186], Cambridge, National Bureau of Economic Research, 61 p.

KAO, CH., CHIANG, M-H., (2001). *On the Estimation and Inference of a Cointegrated Regression in Panel Data,* In: Badi H. Baltagi, Thomas B. Fomby, R. Carter Hill (ed.): Nonstationary Panels, Panel Cointegration, and Dynamic Panels (Advances in Econometrics, Volume 15). Emerald Group Publishing Limited, pp. 179-222.

KOSTOSKA, O., PETRESKI, G. (2009), Modeling the Determinants of Exports and Imports: Assessment of the Macedonian Competitive Performances, *Management and Marketing-Craiova*, 1(38): 36-58.

LÁBAJ, M. (2014) Structural Aspects of Economic Development. Slovak Economy in the Global Context, Economic Institute, Slovak Academy of Sciences, ISBN 978-80-7144-223-3

LEMOINE, F., ÜNAL-KESENCI, D. (2003), Trade and Technology Transfers : a Comparative Study of Turkey, India and China, [CEPII Working Paper No. 16], 50 p.

LEONTIEF, W., (1953). Domestic Production and Foreign Trade; The American Capital Position Re-Examined, Proceedings of the American Philosophical Society, 97(4): 332-349

LOS B., TIMMER P.M., DE VRIES G.J., (2015). How Global are Global Value Chains? A New Approach to Measure International Fragmentation, *Journal of Regional Science*, 55(1): 66-92

MARK, N. C., SUL, D. (2003). Cointegration Vector Estimation by Panel DOLS and Long-run Money Demand, *Oxford Bulletin of Economics and Statistics*, 65(5): 655-680.

MCCOSKEY, S., KAO, CH. (1998). A Residual-Based Test of the Null of Cointegration in Panel Data, *Econometric Reviews*, 17(1): 57-84.

MERVAR, A. (1994), Estimates of the Traditional Export and Import Demand Functions in the Case of Croatia, *Croatian economic survey*, 1(42): 79-93.

MIRDALA, R. (2015), Real Exchange Rates, Current Accounts and Competitiveness Issues in the Euro Area. *Journal of Applied Economic Sciences*, 10(7): 1096-1128.

MIRDALA, R., RUŠČÁKOVÁ, A. (2015), On Origins and Implications of the Sovereign Debt Crisis in the Euro Area, *Journal of Advanced Studies in Finance*, 6(2): 87-102.

MIROUDOT, S., LANZ, R., RAGOUSSIS, A. (2009), Trade in Intermediate Goods and Services, 66 p.

NARAYAN, P.K., NARAYAN, S. (2010) Carbon Dioxide Emissions and Economic Growth: Panel Data Evidence From Developing Countries, *Energy Policy* 2010, 38(1): 661-666

NG, E.C.Y., (2010). Production Fragmentation and Business Cycle Comovement, *Journal of International Economics*, 82(1): 1-14

PESARAN, M. H., SHIN, Y., SMITH, R. (1997), Estimating Long-run Relationships in Dynamic Heterogeneous Panel, [DAE Working Papers Amalgamated Series No. 9721], Cambridge, UK. Cambridge University Press, 25 p.

PESARAN, M. H., SHIN, Y., SMITH, R. P. (1999), Pooled Mean Group Estimation of Dynamic Heterogeneous Panels, *Journal of the American Statistical Association*, 94(446): 621-634.

PESARAN, M. H., SHIN, Y., SMITH, R. P. (2003), Bounds Testing Approaches to the Analysis of Level Relationships, *Journal of applied econometrics*, 16(3): 289-326.

PESARAN, M. H., SMITH, R. (1995), Estimating Long-run Relationships from Dynamic Heterogeneous Panels*, Journal of Econometrics*, 68(1): 79-113.

PHILLIPS, P. C. B., HANSEN, B. E. (1990), Statistical Inference in Instrumental Variables Process, *Review of Economic Studies*, 53, 473-495.

PISANI-FERRY, J. (2012), The Euro Crisis and the New Impossible Trinity, [Bruegel Policy Contributions, 2012/01], 16 p.

RAYNER, V., BISHOP, J., (2013). Industry Dimension of the Resource Boom: An Input-Output Analysis, [RBA Discussion Paper, no. 2013-02], Sydney, Reserve Bank of Australia, 46 p.

REIS, H., RUA, A., (2006). An Input- Output Analysis: Linkages vs Leakages, [BP Discussion Paper, no. 17/2006], Lisboa, Banco de Portugal, 30 p.

SAWYER, W. Charles - SPRINKLE, Richard L. (1996), The Demand for Imports and Exports in the US: A Survey, *Journal of Economics and Finance*, 2(1): 147-178.

STERN, R. M., FRANCIS, J, SCHUMACHER, B. (1976), Elasticities in International Trade : An Annotated Bibliography, London: Palgrave Macmillan UK, ISBN 978-1-349-03137-5.

STOCK, J. H., WATSON, M. W. (1993) A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems, *Econometrica*, 61(4): 783-820.

TAKEUCHI, F., (2011). The Role of Production Fragmentation in International Business Cycle Synchronization in East Asia, *Journal of Asian Economics*, 22(6): 441-459

WYPLOSZ, Ch. (2013), Europe's Quest for Fiscal Discipline, [European Economy Economic Papers No. 498], ISBN 978-92-79-28580-6.

Appendix

Appendix 7.1 Geographical and integration groups of countries considered in the export demand index

Commonwealth of Independent States (CIS)	Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan
Emerging and Developing Asia (EDA)	Brunei Darussalam, Cambodia, China (Hong Kong + Macau + Mainland), Fiji, India, Indonesia, Lao P.D.R., Malaysia, Maldives, Mongolia, Myanmar, Nepal, Papua New Guinea, Philippines, Samoa, Solomon Islands, Sri Lanka, Thailand, Tonga, Vanuatu, Vietnam
European Union (EU)	Austria, Belgium, Belgium-Luxembourg, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom
Latin America and the Caribbean (LAC)	Argentina, The Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela
Middle East and North Africa (MENA)	Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Tunisia, United Arab Emirates, Yemen
Sub-Saharan Africa (SUBA)	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cabo Verde, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Republic of Congo, Côte d'Ivoire, Equatorial Guinea, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Nigeria, Rwanda, São Tomé and Príncipe, Senegal, Seychelles, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe
The Rest	Afghanistan, Albania, Aruba, Australia, Bermuda, Bosnia and Herzegovina, Canada, Cuba, Faroe Islands, New Caledonia (French territory), Greenland, Guadeloupe, French Guiana, Island, Israel, The Democratic People's Republic of Korea, Republic of Korea, Macedonia, Martinique, Montenegro, Netherlands Antilles, New Zealand, Norway, Pakistan, Réunion, Serbia and Montenegro, Serbia, Singapore, Somalia, Switzerland, Syria, Turkey

Source: Compiled by the authors

List of Tables

Table 2.1	Dynamics of changes in the gross production, total value added and GDP in the world and the Slovak Republic for the period 1995-2011 (multiple since 1995)	… 30
Table 2.2	Share of gross EXP and gross IMP of the world and the Slovak Republic in gross production and GDP, 1995-2011, %	… 32
Table 2.3	Trade partners of the Slovak Republic, number of products in the foreign trade of the Slovak Republic, 1995-2011, number	… 34
Table 2.4	Gap between gross exports and exports of domestic value added, gross imports and imports of foreign value added, the Slovak Republic, 1995-2011, mil. USD	… 42
Table 2.5	Domestic and foreign value added in gross EXP, 1995 and 2011, mil. USD, %	… 43
Table 2.6	Export performance and import intensity, openness of the Slovak Republic: world - by gross measurement and by value added, % of GDP	… 47
Table 2.7	Share of exports from AIS sectors to gross exports and share of export of domestic value added from domestic AIS on export of domestic value added, the Slovak Republic, 1995-2011, %	… 54
Table 2.8	Gross exports from the industrial sector (I), the Slovak Republic, 1995-2011, mil. USD	… 59
Table 2.9	Domestic value added in exports of industry sector (I), the Slovak Republic, 1995-2011, mil. USD	… 60
Table 2.10	Share of domestic value added in exports of the industrial sector (I) in the total domestic value added in exports, the Slovak Republic, 1995-2011, %	… 61
Table 2.11	Gross exports from the service sector (S), the Slovak Republic, 1995-2011, mil. USD	… 62
Table 2.12	Domestic value added in exports of the services sector (S), the Slovak Republic, 1995-2011, mil. USD	… 63
Table 2.13	Domestic value added in the exports of the services sector (S) to the total domestic value added in the exports, the Slovak Republic, 1995-2011, %	… 64
Table 2.14	Gross exports and imports of intermediate products and final products and their share in total exports and imports, the Slovak Republic, 1995-2011, mil. USD, %	… 69
Table 2.15	Domestic value added in exports of intermediate products and final products, the Slovak Republic, 1995-2011, mil. USD, %	… 73
Table 2.16	Domestic value added in gross OECD and non-OECD exports and the share of domestic value added in exports of intermediate and final goods on the total domestic value added in gross OECD and non-OECD exports 1995-2011, USD,%	… 75
Table 2.17	Domestic value added in exports of intermediate and final goods, OECD and non-OECD countries, 1995-2011, mil. USD, %	… 76
Table 2.18	Share of domestic value added in exports of intermediate products in the industrial sector (I) on total domestic value added in exports, Slovak Republic, 1995-2011; %	… 79
Table 2.19	Domestic value added in the exports of intermediate goods in the sector of services (S) to total domestic value added in exports, the Slovak Republic, 1995-2011; %	… 80
Table 3.1	Equivalence of gross balance of trade and balance of trade with value added on the World Trade Level according to Benedetta	… 87
Table 3.2	Domestic and foreign value added in gross exports of the Slovak Republic, 1995 and 2011, mil. USD, %	… 89

Table 3.3	Balance of trade of the Slovak Republic and the world, Slovak Republic and the OECD and Slovak Republic and non-OECD countries according to the gross measurement and value added, 1995 and 2011, mil. USD	… 90
Table 3.4	Balance of trade of the Slovak Republic and the world by gross measurement and by value added and their components, 1995 and 2011, mil. USD	… 91
Table 3.5	Balance of trade of the Slovak Republic with the world, with OECD countries and non-OECD countries according to value added and gross measurement, 1995-2011	… 92
Table 4.1	Main characteristics of selected Slovak sectors	… 102
Table 4.2	Share of labor and capital in value added creation for individual industries in the Slovak Republic, 1995 and 2011, %	… 103
Table 4.3	Share of persons engaged in total number for individual industries in the Slovak Republic, 1995 and 2011, %	… 107
Table 4.4	Results of production multiplier	… 197
Table 4.5	Results of value added multiplier	… 108
Table 4.6	Value added creation across industries	… 109
Table 4.7	Share of individual sectors on total value added generated by export, %	… 110
Table 4.8	Share of domestic value added generated by export on value added of individual sector, %	… 111
Table 4.9	Intermediate export from the Slovak Republic by industrial sectors and country of destination, %	… 115
Table 4.10	Intermediate inputs import by industrial sectors and countries, %	… 116
Appendix 4.1	Industry classification in WIOD according to ISIC Rev.4, 2000-2014	… 119
Table 5.1	Share of labor and capital in value added creation for whole industries in the Slovak Republic, 1995-2011, %	… 125
Table 5.2	Share of labor and capital in value added creation for individual sectors in the Slovak Republic, 1995 and 2011, %	… 126
Table 5.3	Share of hours worked by high, medium and low skilled labor for individual industries in the Slovak Republic, 1995 and 2009, % share in total hours	… 127
Table 5.4	Levels of offshoring, outsourcing and cost shares	… 130
Table 5.5	Descriptive statistics - average growth rates of variables, 1995-2009	… 130
Table 5.6	SUR results - the full sample of industries	… 131
Table 5.7	SUR results for manufacturing	… 133
Table 5.8	SUR results for services	… 134
Table 5.9	Levels of offshoring and cost shares for agriculture, hunting, forestry and fishing sector	… 135
Table 5.10	SUR results for agriculture, hunting, foresting and fishing sector	… 135
Table 5.11	SUR results for automotive sector	… 136
Table 5.12	SUR results for construction sector	… 137
Appendix 5.1	Appendix 5.1 Industry classification in WIOD according to ISIC Rev. 4 (2000-2014	… 140
Appendix 5.2	Notation of variables for translog cost function	… 141
Appendix 5.3	Notation of variables	… 141
Table 6.1	V4's the most important sectors from the point of view of output, employment, export, import and value added (1st and 2nd position), 2000-2014, average shares	… 150
Table 6.2	Shares of sector output on total economy's output, shares of sector employment on total economy's employment	… 150
Table 6.3	Shares of sector export on total economy's export, shares of sector import on total economy's import	… 151
Table 6.4	Shares of sector value added on total economy's value added	… 151
Table 6.5	Output, input and import multipliers	… 153
Table 6.6	nBL and nFL, VK	… 154

Table 6.7	The most important sectors from the point of view of output, employment, export, import and value added (1st and 2nd position) – average shares, 2000-2014	… 155
Table 6.8	Shares of sector output on total economy's output, shares of sector employment on total economy's employment	… 156
Table 6.9	Shares of sector exports and imports on total country's exports and imports	… 156
Table 6.10	Shares of sector value added on total country's value added	… 157
Table 6.11	Output, input and import multipliers	… 159
Table 6.12	nBL and nFL, VK	… 159
Table 6.13	Most important sectors from the point of view of output, employment, export, import and value added (1st and 2nd position), 2000-2014, average shares	… 160
Table 6.14	Shares of sector output on total economy's output, shares of sector employment on total economy's employment	… 161
Table 6.15	Shares of sector export on total economy's export, shares of sector import on total economy's import	… 161
Table 6.16	Shares of sector value added on total economy's value added	… 162
Table 6.17	Output, input and import multipliers	… 164
Table 6.18	nBL and nFL, VK	… 164
Table 7.1	Overview of empirical studies of aggregate and disaggregated foreign trade analysis and BEC classification	… 179
Table 7.2	Estimated results of the aggregate export function for the pre-crisis period	… 185
Table 7.3	Estimated results of the aggregate export function in the post-crisis period	… 186
Table 7.4	Estimated results of the aggregate import function in the pre-crisis period	… 187
Table 7.5	Estimated results of the aggregate import function in the post-crisis period	… 188
Table 7.6	Estimated results of the disaggregated export function	… 190
Table 7.7	Estimated results of the disaggregated import function	… 192
Appendix 7.1	Geographical and integration groups of countries considered in the export demand index	… 199

List of Figures

Figure 1.1	Spiders and snakes	… 21
Figure 2.1	Position of the Slovak Republic in the world economy by gross production, GDP and value added, 1995-2011 (%)	… 28
Figure 2.2	Gross production, GDP, value added in the world and the Slovak Republic, 1995-2011 (mil. USD)	… 29
Figure 2.3	Share of value added in the gross production and GDP in the world and the Slovak Republic, 1995-2011, %	… 31
Figure 2.4	Evolution of gross EXP and gross IMP in the world, 1995-2011 (mil. USD)	… 31
Figure 2.5	Development of gross EXP and gross IMP in the Slovak Republic, 1995-2011 (mil. USD)	… 32
Figure 2.6	Share of gross EXP and gross IMP in the world and the Slovak Republic in gross production and GDP, 1995-2011, %	… 33
Figure 2.7	Number of trade partners in the Slovak Republic, 1995-2011, number	… 35
Figure 2.8	Number of exported products from the Slovak Republic and number of imported products to the Slovak Republic, 1995-2011, number	… 35
Figure 2.9	Scheme of the TiVA concept	… 36
Figure 2.10	Decomposition of GDP and output of final goods within countries or sectors	… 37
Figure 2.11	Decomposition of gross exports	… 38
Figure 2.12	VAX Ratio in Selected Countries, 2011, %	… 41
Figure 2.13	Gap between gross exports and exports of domestic value added, the Slovak Republic, 1995-2018, mil. USD	… 42
Figure 2.14	Gap between gross imports and imports of foreign value added, the Slovak Republic, 1995-2018, mil. USD	… 43
Figure 2.15	Share of gross EXP, domestic and foreign value added in EXP on gross production in the Slovak Republic, 1995-2011, %	… 44
Figure 2.16	Domestic and foreign value added in gross EXP (mil. USD) and share of domestic and foreign value added to gross EXP, 1995-2011, %	… 45
Figure 2.17	Export performance and import intensity of the Slovak Republic by gross EXP and by domestic value added in EXP, % of GDP	… 49
Figure 2.18	Export performance and import intensity of the Slovak Republic and the world - comparison by gross measurement and by value added, 1995-2011, % of GDP	… 49
Figure 2.19	Openness of the economy of the Slovak Republic and the world - by gross measurement and by value added, % of GDP	… 51
Figure 2.20	Sector structure of gross exports and value added in exports, the Slovak Republic, 1995-2011, %	… 55
Figure 2.21	Domestic value added in the export of the industrial sector (I) to the total domestic value added in the exports, the Slovak Republic, 1995-2011, %	… 65
Figure 2.22	Domestic value added in the exports of the services sector (S) to the total domestic PH in the exports, the Slovak Republic, 1995-2011,%	… 66
Figure 2.23	Share of intermediate and final goods in gross world exports, 1995-2011, %	… 68
Figure 2.24	Share of gross exports of intermediate and final products to gross exports and imports of OECD and non-OECD countries, 1995-2011, %	… 69
Figure 2.25	Gross exports and gross imports of intermediate and final products, the Slovak Republic, 1995-2011, bil. USD	… 70
Figure 2.26	Share of gross exports and imports of intermediate and final products in gross exports and imports, the Slovak Republic, 1995-2011, %	… 71
Figure 2.27	Domestic value added in gross exports of the Slovak Republic and share of domestic value added in exports of intermediate and final goods of the Slovak	… 73

	Republic to total domestic value added in gross exports, the Slovak Republic, 1995-2011, mil. USD, %	
Figure 2.28	Domestic value added in OECD gross exports and the share of domestic value added in exports OECD intermediate and final goods to total domestic value added in OECD gross exports 1995-2011, mil. USD, %	… 74
Figure 2.29	Domestic value added in non-OECD gross exports and share of domestic value added in exports of intermediate and final non-OECD products to total domestic value added in non-OECD gross exports 1995-2011, mil. USD, %	… 74
Figure 2.30	Share of domestic sales of intermediate products in the industrial sectors (I) in total domestic sales, the Slovak Republic, 1995-2011; %	… 81
Figure 2.31	Domestic value added share in exports of intermediate goods in service sectors (S) to total domestic value added in exports, the Slovak Republic, 1995-2011; %	… 82
Figure 3.1	Trade of balance of the Slovak Republic and the world, Slovak Republic and the OECD by gross measurement and according to value added, 1995 and 2011, mil. USD	… 93
Figure 3.2	Balance of trade of the Slovak Republic and the world, Slovak Republic and the non-OECD by gross measurement and according to value added, 1995 and 2011, mil. USD	… 93
Figure 3.3	Share of the balance of trade of the Slovak Republic with the world and with OECD countries on GDP, 1995-2011, gross measurements and value added, %	… 94
Figure 3.4	Share of the balance of trade of the Slovak Republic with the world and with non-OECD countries on GDP, gross measurements and value added, %	… 94
Figure 4.1	Slovak sectors with the higher share on output creation, 2000-2014, %	… 101
Figure 4.2	Sectors with the higher share on Slovak export, 2000-2014, %	… 101
Figure 4.3	Development of intermediate consumption in the Slovak Republic, mil. USD	… 112
Figure 4.4	Average intermediate inputs, gross product and value added annual rates of growth, %	… 112
Figure 4.5	Share of domestic (DIM) and imported (IIM) intermediates in total Slovak intermediate consumption (II), %	… 113
Figure 4.6	Share of imported intermediates in the manufacturing and services, %	… 113
Figure 4.7	Volume of imported (IIM) and exported (IM_EXP) intermediates, mil. USD	… 114
Figure 4.8	Share of domestic intermediate consumed in the Slovak Republic (DIM) and exported from the Slovak Republic (IM_EXP), %	… 114
Figure 6.1	Technical, allocation, import coefficients – sectors a01, c1012 (SK, CZ, HU, PL), 2000-2014	… 152
Figure 6.2	Technical, allocation, import coefficients – sectors a01, c1012 (SK, FR, DE, AT), 2000-2014	… 158
Figure 6.3	Technical, allocation, import coefficients – sectors a01, c1012 (SK, EST, LAT, LIT, 2000-2014	… 163

Title: **Global Value Chains, International Fragmentation of Production and Implications for European Union**
Editor: Rajmund Mirdala
Reviewers: Daniel Dujava
Martin Lábaj
Ján Pokrivčák
Menbere Workie Tiruneh
Published by: ASERS Publishing
Craiova, Romania
apg@aserspublishing.eu
www.aserspublishing.eu
Typesetting: Arial Narrow
Edition: 1st
Printed by: Grafi Print – Printing House, M. Kogălniceanu Street, 20, Craiova, Romania
Number of pages: 204
Official webpage:
https://books.aserspublishing.eu/eoconomica

ASERS Publishing
http://www.asers.eu/asers-publishing
ISBN-L: 978-606-8689-38-8
Print ISBN: 978-606-8689-39-5

DOI: http://dx.doi.org/10.14505/gvcifpieu.2018

Oeconomica

ASERS Publishing
http://www.asers.eu/asers-publishing
ISBN-L: 978-606-8689-38-8
Print ISBN: 978-606-8689-39-5

DOI: http://dx.doi.org/10.14505/gvcifpieu.2018

ASERS
Publishing