UNIVERSITY OF LJUBLJANA
SCHOOL OF ECONOMICS AND BUSINESS

NATAŠA VRH

CAUSES AND CONSEQUENCES OF POSITIONING WITHIN GLOBAL VALUE CHAINS: INDUSTRY AND FIRM-LEVEL ANALYSIS ON CEE COUNTRIES

DOCTORAL DISSERTATION

Ljubljana, 2019

AUTHORSHIP STATEMENT

The undersigned Nataša Vrh, a student at the University of Ljubljana, School of Economics and Business, (hereafter: SEB LU), author of this written final work of studies with the title Causes and consequences of positioning within global value chains: industry and firm-level analysis on CEE countries, prepared under supervision of prof. dr. Jože Damijan and co-supervision of prof. dr. Črt Kostevc.

D E C L A R E

1. this doctoral dissertation to be based on the results of my own research;
2. the printed form of this written final work of studies to be identical to its electronic form;
3. the text of this doctoral dissertation to be language-edited and technically in adherence with the SEB LU's Technical Guidelines for Written Works, which means that I cited and / or quoted works and opinions of other authors in this doctoral dissertation in accordance with the SEB LU's Technical Guidelines for Written Works;
4. to be aware of the fact that plagiarism (in written or graphical form) is a criminal offence and can be prosecuted in accordance with the Criminal Code of the Republic of Slovenia;
5. to be aware of the consequences a proven plagiarism charge based on the this doctoral dissertation could have for my status at the SEB LU in accordance with the relevant SEB LU Rules;
6. to have obtained all the necessary permits to use the data and works of other authors which are (in written or graphical form) referred to in this doctoral dissertation and to have clearly marked them;
7. to have acted in accordance with ethical principles during the preparation of this doctoral dissertation and to have, where necessary, obtained permission of the Ethics Committee;
8. my consent to use the electronic form of this doctoral dissertation for the detection of content similarity with other written works, using similarity detection software that is connected with the SEB LU Study Information System;
9. to transfer to the University of Ljubljana free of charge, non-exclusively, geographically and time-wise unlimited the right of saving this doctoral dissertation in the electronic form, the right of its reproduction, as well as the right of making this doctoral dissertation available to the public on the World Wide Web via the Repository of the University of Ljubljana;
10. *[please include only if your doctoral dissertation consists of several articles]* to have acquired from publishers, to whom I have previously exclusively transferred material copyrights for articles, all the necessary permissions for the inclusion of articles in the printed and electronic forms of this dissertation. These permissions enable the University of Ljubljana to save this doctoral dissertation in the electronic form, to reproduce it, as well as to make it publicly available on the World Wide Web via the Repository of the University of Ljubljana free of charge, non-exclusively, geographically and time-wise unlimited;
11. my consent to publication of my personal data that are included in this doctoral dissertation and in this declaration, when this doctoral dissertation is published.

Ljubljana, June 10th, 2019 Author's signature: _____

CAUSES AND CONSEQUENCES OF POSITIONING WITHIN GLOBAL VALUE CHAINS: INDUSTRY AND FIRM-LEVEL ANALYSIS ON CEE COUNTRIES

SUMMARY

The common feature of contemporary production chains is an internationally fragmented production process. The emergence of new trade patterns has brought an expansion of global trade in intermediates, continuously eroded the industrial base and the middle-income class in developed countries while questioned the existing concepts of measuring international trade. The dissertation emphasises that trading countries can encounter a great challenge regarding the share of exports created in the country and their position in global value chains (GVCs). On top of participation in GVCs, the amount of value created in export-related industries is hugely important since it affects domestic employment and growth (Banga, 2014). The main aim of the dissertation is to study the impact of GVC participation on the structure of value added in gross exports and to determine which factors affect the share of domestic value added in exports (DVA).

The dissertation is divided into three chapters. **The first chapter** is based on the decomposition model of gross exports (into domestic and foreign value added) as proposed by Koopman, Powers, Wang, & Wei (2010). Using the World Input-Output Database, this chapter analyses industry-level data on value added in exports in all EU countries and focuses on the position of EU member states from Central and Eastern Europe (CEE-10) in GVCs compared to 'old' member states (EU-15). The results show that the CEE-10 creates lower DVA than the EU-15. Beside this, the differences in terms of the DVA share in the manufacturing sector have persistently increased since 1995, but started to shrink during the observed period while services exports registered a constant decline. The smaller DVA gap can be explained by the fact that after 2004 the share of imported intermediates in total intermediates used in the CEE-10 starts to decline, while at the same time this share is slightly increasing in the EU-15. The degree of GVC participation is, on average, slightly higher in the CEE-10. Although greater participation in GVCs is usually related to lower DVA in exports, empirical evidence for the CEE-10 shows that the negative relationship between GVC participation and DVA decreases slightly over time in both sectors.

Estimated data on DVA in exports represent the basis for empirical models in the **second chapter,** which analyses the core drivers of differences in DVA between the CEE-10 and the EU-15. The analysis focuses on the role played by selected determinants, for example intangible investments, human capital and foreign direct investment (FDI). The results reveal that differences in shares of DVA are influenced by investments in intangible capital. The CEE-10 suffer from a significant lack of investment in intangible capital that is currently only sufficient to facilitate their participation in GVCs without supporting any significant development breakthrough. In addition, both groups show a negative correlation

between inward FDI and DVA, suggesting that inward FDI reduces demand for domestic inputs and thus contributes to lower DVA in exports. Moreover, the positive correlation between outward FDI and DVA is limited to the CEE-10, suggesting that GVC upgrading through outward FDI is primarily a feature of the CEE-10. Surprisingly, in the EU-15, firms with a bigger share of non-production workers create lower DVA in exports while this effect is smaller for the CEE-10. Different impacts on DVA in the CEE-10 than in the EU-15 are also observed for some other determinants (exports to the EU's most developed countries and imports from China).

The **third chapter** examines firms' upgrading process in GVCs in terms of DVA in exports, depending on the form of GVC participation and the firm characteristics. Although using industry-level data from input-output tables is the approach most commonly taken in literature, this chapter develops a method for evaluating DVA in exports with firm-level data by adjusting the Kee & Tang (2016) approach. Analysis is based on detailed firm-level data for the whole population of Slovenian exporting firms for the period 2002–2014. Firm decisions about the form of participation are analysed at the firm-country-product level by exploiting FDI flows and the stability of trade flows. The results show that, in DVA terms, domestically owned exporting firms outperform more productive foreign-owned firms and that unaffiliated firms with permanent suppliers from abroad capture higher DVA than unaffiliated firms identified as independent permanent suppliers to foreign firms. Other firm characteristics with a positive impact on the DVA share are intangible capital per worker, relative wage, capital intensity and share of final products in the firm's exports, while the level of indebtedness and share of exports based on imports of the same products have a negative impact on the DVA share. Moreover, firms with a larger share of exports to less demanding markets, such as the countries of former Yugoslavia, benefit more in terms of higher gains of DVA in exports.

This doctoral dissertation makes several contributions to the existing field of knowledge. It is one of the first to examine the evolution of the DVA gap between the CEE-10 and EU-15 and thus, among others, to investigate the success of export restructuring in the CEE-10. Previous studies focus chiefly on the dynamics of DVA in all EU countries together. The second chapter goes beyond empirical studies in this field by accounting for both the heterogeneity of two groups of EU countries and the heterogeneity of industries. The third chapter considers firm heterogeneity, which is not very common in empirical literature, and for the first time evaluates and analyses DVA in exports using data for Slovenian export firms. In addition, it proposes an approach for identifying a potential contractual relationship by examining the product-destination stability of trade flows. Thus, for the first time the level of Slovenian firms' GVC involvement through a contractual relationship is defined.

Key words: global value chains, domestic value added in exports, forms of GVC participation, GVC upgrading

VZROKI IN POSLEDICE POZICIONIRANJA ZNOTRAJ GLOBALNIH VERIG VREDNOSTI: ANALIZA NA RAVNI PANOG IN PODJETIJ V DRŽAVAH SREDNJE IN VZHODNE EVROPE

POVZETEK

Glavna značilnost sodobnih proizvodnih verig je mednarodno razdrobljen proizvodni proces. Pojav novih vzorcev trgovine je prinesel širitev mednarodne trgovine s polproizvodi, nenehno zmanjševanje industrijske baze in srednjega dohodkovnega razreda v razvitih državah ter postavil pod vprašaj obstoječe načine merjenja mednarodne trgovine. Disertacija poudarja dejstvo, da se lahko države, ki trgujejo, soočajo z velikim izzivom glede dela ustvarjenega izvoza v državi in njihovega položaja v globalnih verigah vrednosti (GVV). Poleg vključenosti v GVV je pomembna tudi vrednost, ki nastaja v izvozno orientiranih panogah, saj dejansko vpliva na domačo zaposlenost in gospodarsko rast (Banga, 2014). Glavni namen disertacije je preučiti učinek vključenosti v GVV na strukturo dodane vrednosti v bruto izvozu in določiti dejavnike, ki vplivajo na delež domače dodane vrednosti v izvozu (DVA).

Disertacija je razdeljena na tri poglavja. Prvo poglavje temelji na modelu razčlenitve bruto izvoza (na domačo in tujo dodano vrednost), kot so ga predlagali Koopman, Powers, Wang & Wei (2010). V tem poglavju so z uporabo podatkovne zbirke World Input-Output Database za obdobje od leta 1995 do 2011 analizirani podatki o dodani vrednosti v izvozu na sektorski ravni v vseh državah EU s poudarkom na položaju držav EU iz srednje in vzhodne Evrope (CEE-10) v GVV v primerjavi s "starimi" članicami (EU-15). Rezultati kažejo, da CEE-10 ustvarijo nižjo DVA v primerjavi z EU-15. Poleg tega so se razlike med CEE-10 in EU-15 z vidika deleža DVA v predelovalnem sektorju od leta 1995 vztrajno povečevale, vendar so se nato v opazovanem obdobju začele zmanjševati, medtem ko se je v storitvenem sektorju razlika v DVA nenehno zmanjševala. Zmanjšanje vrzeli v DVA lahko razložimo z dejstvom, da se po letu 2004 delež uvoženih polproizvodov v celotnih uporabljenih polproizvodih v CEE-10 začenja zmanjševati, hkrati pa se v EU-15 ta delež rahlo povečuje. Stopnja vključenosti v GVV je v povprečju nekoliko višja v CEE-10 kot v EU-15. Čeprav je povečana vključenost v GVV običajno povezana z zmanjšanim DVA v izvozu, za CEE-10 empirični dokazi kažejo, da se negativna povezava med vključenostjo v GVV in DVA v predelovalnem in storitvenem sektorju skozi čas nekoliko zmanjšuje.

Ocenjeni podatki o DVA v izvozu predstavljajo osnovo za empirične modele v drugem poglavju, ki analizira glavne gonilne sile razlike v DVA med CEE-10 in EU-15. Analiza se osredotoča na vlogo izbranih determinant, na primer neotipljivih investicij, človeškega kapitala in tujih neposrednih investicij (TNI). Rezultati kažejo, da na razlike v deležih DVA vplivajo investicije v neotipljivi kapital. CEE-10 čutijo posledice nezadostnih investicij v neotipljivi kapital, ki trenutno zadostujejo le za spodbujanje vključenosti v

GVV brez znatnega razvojnega preboja. Poleg tega obe skupini kažeta negativno korelacijo med vhodnimi TNI in DVA, kar kaže, da vhodne TNI zmanjšujejo povpraševanje po domačih inputih in tako prispevajo k nižji DVA v izvozu. Poleg tega je pozitivna korelacija med izhodnimi TNI in DVA omejena na CEE-10, kar kaže, da je nadgradnja GVV prek izhodnih TNI predvsem značilnost CEE-10. Presenetljivo podjetja v EU-15 z večjim deležem neproizvodnih delavcev ustvarijo nižjo DVA, ta učinek pa je za CEE-10 manjši. Različne vplive na DVA v CEE-10 kot v EU-15 je mogoče opaziti tudi pri nekaterih drugih determinantah (izvoz v najbolj razvite države EU in uvoz iz Kitajske).

Tretje poglavje preučuje proces nadgradnje podjetja v GVV z vidika DVA v izvozu glede na obliko vključenosti v GVV in značilnosti podjetja. Čeprav je uporaba podatkov iz input-output tabel na sektorski ravni v literaturi najpogosteje zastopan način, to poglavje predstavi metodo ocenjevanja DVA v izvozu s podatki na ravni podjetja, temelječo na prilagojenem pristopu, ki sta ga razvila Kee in Tang (2016). Analiza temelji na podrobnih podjetniških podatkih za celotno populacijo slovenskih izvoznih podjetij za obdobje 2002–2014. Odločitve posameznega podjetja glede oblike vključitve v GVV so analizirane na ravni podjetje-država-proizvod z upoštevanjem tujih neposrednih tokov in stabilnosti trgovinskih tokov. Rezultati kažejo, da so z vidika DVA izvozna podjetja v domači lasti uspešnejša od sicer produktivnejših podjetij v tuji lasti in da nepovezana podjetja s stalnimi dobavitelji iz tujine dosegajo višji DVA kot nepovezana podjetja, ki predstavljajo stalne neodvisne dobavitelje tujim podjetjem. Druge značilnosti podjetja, ki pozitivno vplivajo na delež DVA, so neotipljivi kapital na delavca, relativna plača, kapitalska intenzivnost in delež končnih proizvodov v izvozu podjetja, medtem ko imata stopnja zadolženosti in delež izvoza, ki temelji na uvozu istih proizvodov, negativen vpliv na delež DVA. Poleg tega imajo podjetja z večjim deležem izvoza na manj zahtevne trge, kot so države nekdanje Jugoslavije, več koristi z vidika DVA v izvozu.

Doktorska disertacija na več načinov prispeva k obstoječemu znanju na tem področju. Je med prvimi, ki preučujejo razvoj vrzeli v DVA med CEE-10 in EU-15 ter med drugim preučuje uspeh prestrukturiranja izvoza v CEE-10. Prejšnje študije se namreč osredotočajo predvsem na dinamiko DVA v celotni EU. Drugo poglavje presega obstoječe empirične študije, saj raziskuje razlike v determinantah DVA v CEE-10 in EU-15, pri čemer upošteva tako heterogenost med skupinama držav kot heterogenost sektorjev. Tretje poglavje upošteva heterogenost podjetij, kar v empirični literaturi ni pogosto, ter tako prvič ocenjuje in analizira DVA v izvozu s podatki slovenskih izvoznih podjetij. Poleg tega predlaga pristop za ugotavljanje morebitnega pogodbenega razmerja s preučevanjem stabilnosti trgovinskih tokov podjetij na podlagi proizvodne in destinacijske stabilnosti. Tako prvič opredeljuje stopnjo vključenosti slovenskih podjetij v GVV prek pogodbenega razmerja.

Ključne besede: globalne verige vrednosti, domača dodana vrednost v izvozu, oblike vključenosti v GVV, nadgradnja znotraj GVV

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

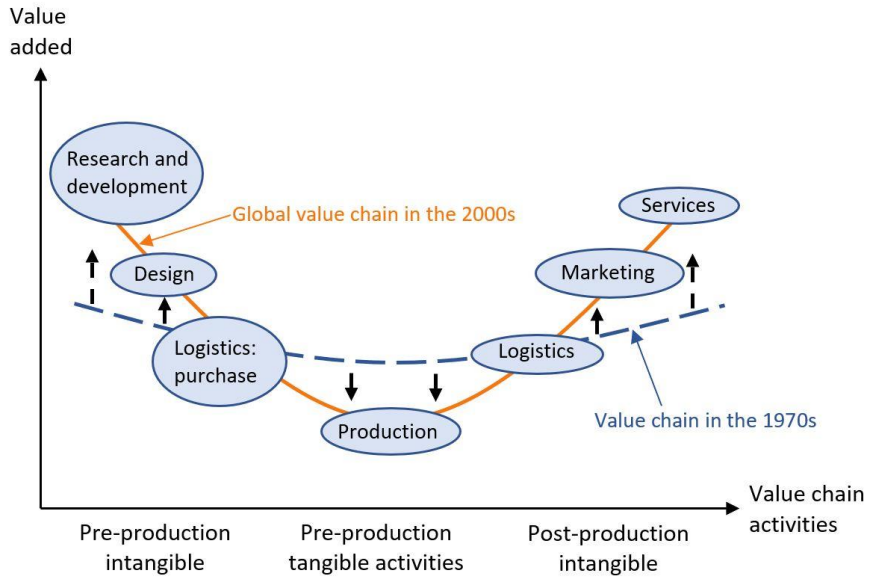
INTRODUCTION

Description of the topic area

The volume of world exports as a share of global GDP has grown threefold since the mid-20th century. This is largely a result of increased fragmentation of production across national borders caused by the growing importance of trade in intermediate goods. In 2006, intermediate goods represented (for OECD countries) 56 percent of world trade in goods and 73 percent in services (Miroudot, Lanz, & Ragoussis, 2009). The fragmentation of production processes enabled by technological progress, the liberalisation of trade and international diversification of tasks and activities led to the emergence of production systems, at either regional or global level, known as global value chains (GVCs) (UNCTAD, 2013).

A value chain can be defined simply as the "full range of activities that firms and workers do to bring a product from its conception to its end use and beyond" (Gereffi & Fernandez-Stark, 2010). A value chain usually consists of design, production, marketing activities, distribution and support to the final consumer. Value added is the highest in the initial stages of the production process (concept, design, R&D) and in the final stages (sales, marketing and after-sales services) while the lowest is in the middle stages (manufacturing). The share of value added in different production stages is represented by the 'smile curve' (Figure 1).

Figure 1: The smile curve of global value chain in the 1970s and 2000s



Source: World Bank, Measuring and Analysing the Impact of GVCs on Economic Development, 2017, p. 70.

GVCs have risen to the fore in the last four decades when during 'second unbundling' (Baldwin, 2011) manufacturing stages of the production process were gradually moved (with support of information-communication technology) to countries with lower labour costs (e.g. China). In the past 40 years, the situation has changed such that the share of value added in manufacturing stages has dropped compared with the earlier or latter stages. This phenomenon is depicted as "deepening of the smile curve" (Baldwin, 2012) for which a simple explanation can be found in the offshoring of manufacturing enabled by technological advances.

During the 20th century, a country could not become globally competitive without a broad and deep industrial base, which was a fundamental precondition for its export success. Even before, from the mid-19th century, the adjectives industrialised and rich were used as synonyms. Industrialisation was based on building the whole supply chain at home. In some cases, establishing of the whole value chain even lasted decades and depended on a large market to support the industrial base. Namely, in the 20th century a country's exports embodied its technology, labour and capital whereas the inclusion of foreign factors or technology was a second-order issue. As such, a country's exports offered a sense of its technological, labour and capital base since goods were the 'results' of a single country's productive factors, technology, social capital and governance capacity. This approach became obsolete over the last four decades when production phases have been spread across several countries (Baldwin, 2011).

Baldwin (2012) outlines the existence of two types of economy: headquarter and factory economies. Headquarter economies have a relatively small share of imported intermediates in exports and are countries in which international corporations or 'lead firms' are situated. On the other hand, factory economies' exports contain a large share of imported intermediates, with these countries being places where supplier companies are located. Further, Baldwin (2012) observes that GVCs have a predominantly regional rather than global character, which he calls "Factory Asia", "Factory North America" and "Factory Europe". Similarly, Stehrer et al. (2012) explain that the offshoring and outsourcing of a company's activities from Western to Central and Eastern Europe may be regarded as 'nearshoring' and 'nearsourcing'. The title of the 'hub' of 'Factory Europe' is held by Germany (Baldwin, 2012), followed by Italy, the Netherlands, the UK and France (as presented by Rahman and Zhao (2013) in terms of value-added trade), with Central and Eastern European countries being characterised as factory economies (Damijan, Kostevc & Rojec, 2015). Similarly, from the EU perspective, Stöllinger (2016) describes more technologically-advanced member states as mostly offshoring countries and Central and Eastern European countries as mostly offshoring destinations. Consequently, firms from different countries perform different functions and engage in different stages of GVCs.

Where there are high shares of imported inputs of exports and GVC participation limited to low-skilled and low-value parts of the chain, the domestic value-added share can be relatively small. The latter represents the share of exports created in the country, and contributes to its GDP (UNCTAD, 2013, p. 126). The optimal outcome with the highest GDP per capita growth arises from high GVC participation combined with high growth in domestic value added in exports. Even if countries initially increase foreign value added in exports, in the long run they can upgrade their positions within production networks and increase their domestic value added in exports.

Firms integrating into GVCs must at one point consider the possibilities for upgrading their GVC positions. They can achieve this by moving to higher-value activities within the chains and thereby increasing their benefits from GVC participation (Gereffi & Fernandez-Stark, 2011). A firm's decision to upgrade often entails a choice to retain its competitiveness and ultimately securing its survival in a very dynamic environment. Otherwise, firms risk losing their market position and may face the threat of being replaced by competitors from countries with lower production costs. Such circumstances therefore require a prompt response from firms to new challenges appearing in both the market and GVCs (Holste Hauke, 2015). By upgrading within GVCs, firms encounter higher entry barriers but, once they overcome them, they benefit from a smaller number of competitors and thus higher returns (Bair & Mahutga, 2016).

In the firm-upgrading process, Giuliani, Pietrobelli, and Rabellotti (2005) distinguish between endogenous and exogenous factors. The latter relate to the collective efficiency of the firm's cluster, governance of the value chain in which the firm is engaged, and the learning and innovation patterns of the corresponding industry sector (Park, Nayyar, & Low, 2013). Following Humphrey & Schmitz (2002), endogenous factors or internal firm efforts to upgrade within GVCs may be classified as being of four types:

- process upgrading, which relates to the more efficient transformation of inputs into outputs due to the reorganisation of production or introduction of superior technology;
- product upgrading or the firm's movement into more sophisticated product lines;
- functional upgrading or the firm's process of acquiring new functions or abandoning existing ones in order to enhance the skill content of activities; and
- chain or inter-sectional upgrading, describing the firm's progress by entering into a new value chain.

More recently, Fernandez-Stark, Bamber and Gerefi (2014) identified three other upgrading types:

- entry to the value chain which is the initial and also the most challenging step as it is refers to the first time the firm participates in a GVC;

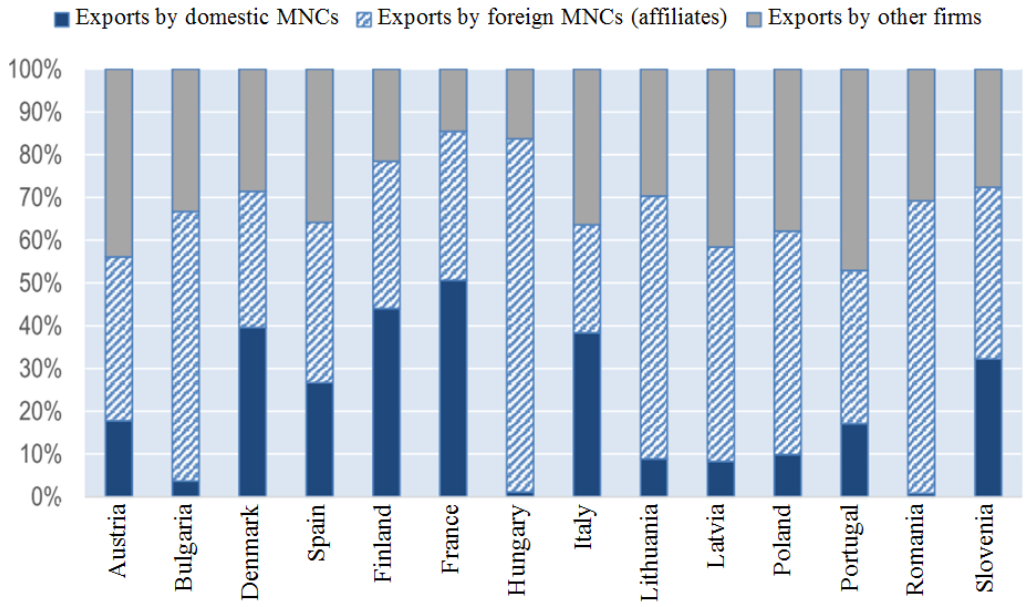
- backward linkages upgrading, referring to the situation when local firms start supplying inputs (and/or services) to firms already engaged in GVCs (usually MNCs located in the country); and
- end-market upgrading, which relates to the firm's movement into more sophisticated or larger markets that require stricter standards or large-scale production to be adopted.

Among the mentioned types of upgrading, functional upgrading is the most typical form. This is in fact the type of upgrading usually illustrated by the "smile curve", which is used to describe the movement away from manufacturing to other functions (Damijan & Rojec, 2015). In addition, Morrison, Pietrobelli, and Rabellotti (2008) highlight a generally neglected source of DVA growth originating from expanding firm capabilities in each stage of the value chain instead of focusing exclusively on moving along the value chain (Park et al., 2013).

GVCs are often coordinated by multinational companies (MNCs) based on complex networks of supplier connections and different types of corporate governance which may take the form of direct ownership of foreign affiliates through to contractual relationships or other forms (UNCTAD, 2013, p. 141). Depending on the type of GVC, there are differences in the distribution of power and direction of knowledge flows which may be accumulated in the lead firm or divided between the lead firm and supplier (OECD & World Bank Group, 2015). UNCTAD estimates that MNCs coordinate 80 percent of global trade through arms-length trade (where MNCs trade with final consumers or non-MNC firms), intra-firm trade (where MNCs trade with affiliates or parent company) and trade associated with 'non-equity modes' of production (trade with firms connected through licensing, franchising, contract manufacturing or other types of contractual relationships without any ownership element present). In 2014, MNCs generated half of world gross exports, with domestic MNCs holding a share of 19 percent (Cadestin et al., 2018).

The composition of gross exports by type of firm (domestic non-MNC, domestic MNC and foreign affiliate) is presented in Figure 2, where arm's-length and intra-firm transactions in an MNC's gross exports are not distinguished due to data unavailability. Data reveal the presence of high heterogeneity across countries. For example, in France and Hungary more than 80 percent of exports are performed by MNCs but with a diametrically opposite structure. While in France a large share of gross exports are exports by domestic MNCs, in Hungary almost all gross exports are generated by foreign MNCs. Among the presented countries, Slovenia ranks above the average with a relatively large share of exports generated by domestic MNCs.

Figure 2: Decomposition of gross exports by firm type, latest available year



Source: C. Cadestin et al., Multinational enterprises and global value chains: new insights on the trade–investment nexus, 2018, p. 25.

MNCs have a large impact on the evolution of GVCs. They influence their development with the choice of source destinations, choice of suppliers and decisions on which stages of the production process they will retain. In the period between 1990 and 2008, their total sales grew almost five-fold, from USD 6 to USD 30 trillion, which demonstrates the increasing importance of MNCs and backs the rise of GVCs (Sydor, 2011).

Research purpose and contributions of the dissertation

Not all countries are equally engaged in GVCs, just like they are not equally engaged in international trade. They participate in GVCs as both users of foreign inputs and suppliers of intermediate goods and services that can be used in another country's exports.

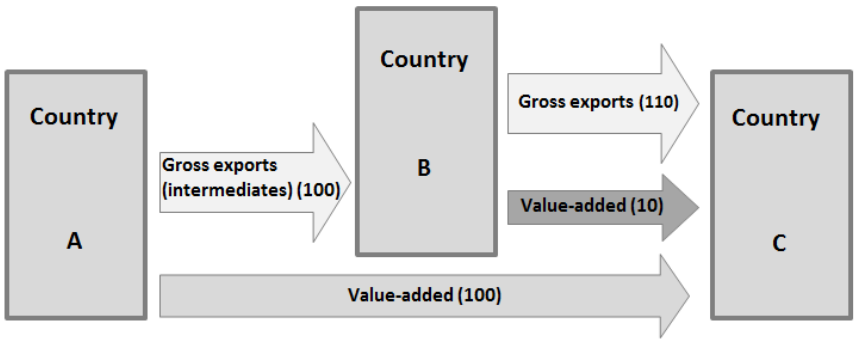
To describe the process of a country importing an input from another country, applying it in the production of its own good and then exporting it to another country, Hummels *et al.* (2001) use the term *vertical specialisation*[1]. The opposite term 'horizontal specialisation' thus means that trade goods are produced in one country from start to finish. Based on case studies and the estimated degree of vertical-specialisation trade, Hummels *et al.* (2001) argue an increasingly important role is played by vertical specialisation in international trade. Their analysis is based on OECD input-output tables for the period 1968–1990 and the results are presented as the value of imported inputs further exported or

[1] The papers of Balassa (1967) and Findlay (1978) were the first to note this phenomenon.

foreign value added embodied in exports. They show that the world's largest economies (e.g. the USA, Germany, Japan) are less likely to be involved in vertical trade than smaller ones (e.g. Netherlands) since (due to economies of scale) it is easier for them to keep every stage of production at home.

A simple illustration of trade from the aspect of value added is presented in Figure 3. The example starts with country A which exports EUR 100 worth of intermediates to country B, which further upgrades them (by adding EUR 10), and exports the item now valued at EUR 110 to country C for final consumption. Although only EUR 110 of value added was produced in this process, official statistics show that total export and import is EUR 210. Moreover, it shows that country C has a trade deficit with country B that amounts to EUR 110, and that country C does not trade with country A even though country A is a source country for that good consumed by country C (Ahmad, 2013, pp. 86–87).

Figure 3: Trade in terms of value added



Source: N. Ahmad, Estimating trade in value-added: why and how? In D. K. Elms & P. Low (Eds.), Global Value Chains in a Changing World (pp. 85–108), 2013, p.86.

Several studies have adopted and improved the measures presented by Hummels *et al.* (2001) since the inter-country input-output tables (Asian I-O tables from IDE-JETRO, OECD/WTO TiVA Database, GTAP, WIOD, UNCTAD EORA database) that reflect inter-industrial trade linkages enable more global analyses. As Koopman *et al.* (2010) explain, these databases support analysis of bilateral trade flows on a global scale and allow production networks in various regions to be compared based on value added terms in addition to gross terms.

The purpose of this doctoral dissertation is to present the importance of the DVA concept in exports for analysing a country's/firms' position within GVCs, with the aim to empirically test which factors drive the process of firms' upgrading in terms of DVA in exports. The core of the dissertation has three main chapters.

The chief aim of the **first chapter** of the thesis is to present the theoretical framework, which enables a country's GVC participation and its contribution to exports in value added terms to be estimated. I distinguish between two groups of EU countries, 'old' EU countries (EU-15) and EU countries from Central and Eastern Europe (CEE-10). The CEE-10 recently underwent the transition from socialist to market economies and the question is whether export restructuring in the CEE-10 economies is causing a corresponding rise of DVA in exports that is sufficiently large to approach the EU-15. I also differentiate between the manufacturing and services sectors since services generally engage less in production networks. This chapter considers the following issues: (1) *Does the CEE-10 create lower domestic value added in exports than the 'old' EU member states (EU-15)?*; (2) *Are these differences narrowing over time, i.e. is the gap between the CEE-10 and EU-15 shrinking in time?*; and (3) *What are the sectoral-level differences in the levels and trends?* This enables a greater insight into whether EU-15 countries are gaining more in DVA terms from their participation in GVCs than the CEE-10, and whether and why this gap is narrowing (or not) over time. The chapter's main contribution lies in the analysis of possible evidence of convergence in terms of domestic content in exports between CEE-10 and EU-15 countries. According to Baldwin (2011), GVCs are a way for the cross-border dispersion of advanced know-how. I thus make the assumption that the CEE-10 have acquired new knowledge by participating in GVCs and, hence, have started gradually increasing their DVA (Baldwin, 2011). Given that GVC participation is characterised by greater use of foreign inputs, this chapter also examines differences in gains from GVC integration for these two groups of countries. Estimates of domestic value added in exports provide the basis of the empirical model in the following chapter.

The second chapter empirically examines what influences the differences in DVA between the EU-15 and CEE-10 by taking account of heterogeneity across industries. The analysis seeks to answer the questions *what are the main determinants of measured DVA in exports in the EU-15 and CEE-10* and *whether they have a different impact in each of the two groups*. In other words, attention is placed on studying the extent to which intangible capital, human capital, exposure to foreign investment etc. determine the measured DVA in the exports in either group of countries. The aim is thus to contribute to understanding of the characteristics of EU countries' trade by industry within the GVCs and to assess the factors leading some EU countries to more successfully integrate with GVCs. Since the concepts of GVCs and VA in exports are relatively new, empirical studies are rare and do not often focus on the differences between countries, let alone attempt to explain them. Existing empirical studies primarily aim to investigate the factors that may facilitate the establishment of supply links i.e. factors that influence foreign value added in exports (Stehrer & Stöllinger, 2015; Rahman & Zhao, 2013), while this research will also try to explain the mixed trends seen among countries in terms of DVA in exports.

Finally, the **third chapter** examines firm-level data. The intention is to estimate DVA in exports for Slovenian exporting firms and empirically examine two core research questions: *(1) how does DVA in exports vary depending on the way a firm participates in GVCs (through a network of affiliates or via inter-firm trade) by distinguishing firms that are themselves suppliers or have their own suppliers from abroad;* and *(2) which firm characteristics affect firms' 'success in DVA' as measured by the ratio of DVA in exports?* This chapter makes two contributions to the literature. First, unlike the most common approach in the literature based on using industry-level data from I-O tables (Amador & Cabral, 2014), this chapter develops a method for estimating DVA in exports with firm-level data by adjusting the approach proposed by Kee and Tang (2016). Second, the literature does not propose a 'rule' for how to define firms that engage in GVCs via a contractual relationship (between unaffiliated firms) and there is a lack of data to allow a better definition of such trade linkages. The third chapter addresses this issue by exploring the stability of firm trade flows and introducing a proxy for the possible underlying relationship, where stable sales indicate a firm is a permanent supplier (or has a permanent supplier from abroad) based on product-destination stability.

Research methods and data

The main emphasis of the **first chapter** of the dissertation is given to the sources of value added in exports for each EU country and their participation in GVCs. For this purpose, information on value added in exports is required and a detailed structure of value added in gross exports for each analysed country must be constructed. The dissertation follows the widely used decomposition of gross exports into value-added exports developed by Koopman et al. (2010), which requires the use of inter-country input-output tables and is based on matrix equations. A brief description of the methodology is presented in the first chapter while a detailed description is given in Appendix 4. The estimated data of DVA in exports from the first chapter provide a basis for the analysis in **the second chapter**, which uses the fixed-effects method for the panel data analysis. In addition, to check the robustness of the results I also employ the GMM estimator and several different alternatives of the basic specification. **The third chapter** follows the recently provided methodology of measuring value added in exports using firm-level data developed by Kee and Tang (2016). To define a possible contractual relationship (between unaffiliated firms), I explore the stability of firm trade flows based on detailed export (import) data by firms, years, destination country (country of dispatch) and products on the HS6 level. Again, the empirical analysis uses a different method for the panel data analysis (pooled OLS, fixed effects). In order to increase the robustness of the results, I perform several robustness checks of my basic specification.

The whole dissertation is based on estimated value added in exports. The data used to estimate value added in exports at the industry level were obtained from the publicly

available World Input-Output Tables (henceforth the WIOT) from the World Input-Output Database (henceforth the WIOD). The database was developed to analyse the effects of globalisation on trade patterns, environmental pressures and socio-economic development across a wide set of countries. The WIOD combines data on national production activities (national supply and use tables, national accounts time series on industry output and final use) and international trade data[2]. The WIOT differs from national tables in the use of products which is broken down on the basis of their origin in the way each product is produced by either domestic industry or foreign industry. Another difference from the national tables is that the WIOD makes it clear from which foreign industry imports originate and how the exports of a specific country are being used by the rest of the world, by which industry and final user (Timmer et al., 2012, p. 5).

The WIOD database contains world tables, national tables, socio-economic accounts and environmental accounts, and provides annual data for 17 years, namely for 1995 to 2011 for 35 industries, 27 EU countries and 13 other major countries.

Table 1: Countries included in the WIOD database

EU-15		**CEE-10**	**Other EU**	**NAFTA**	**BRIIAT**	**East Asia**
Austria	Luxembourg	Bulgaria	Cyprus	Canada	Brazil	Japan
Belgium	Netherlands	Czech Rep.	Malta	Mexico	Russia	Korea
Finland	Portugal	Estonia		USA	India	Taiwan
France	Spain	Hungary			Indonesia	China
Germany	Denmark	Latvia			Australia	
Greece	Sweden	Lithuania			Turkey	
Ireland	UK	Poland				
Italy		Romania				
		Slovakia				
		Slovenia				

Source: Dietzenbacher et al., The Construction of World Input–Output Tables in the Wiod Project, 2013 , p. 95.

Since the dissertation focuses on comparing ‘old’ EU countries (EU-15) and ‘new’ EU countries from Central and Eastern Europe (CEE-10), the next part of the dissertation concentrates on these 25 countries.

The empirical analysis in the second chapter combines the presented data with the OECD, Eurostat, World Bank, and Intan-Invest databases and data from the WIOD socio-economic accounts for EU countries. The third chapter uses customs-transaction-level data provided by the Slovenian Financial Administration (“FARS”), firms’ accounting data from AJPES (Agency of the Republic of Slovenia for Public Legal Records and Related

[2] A detailed description of construction of the WIOT tables is given in Appendix 2.

Services) and data on foreign direct investment flows provided by the Bank of Slovenia for the period 2002–2014. For the purpose of estimating DVA on the firm level, I also rely on OECD TiVA data at the industry level, which I adjust to the firm level. Obtaining the detailed export and import data by firms, years, destination country and products on the HS6 level as provided by FARS allows me to measure firms' export-sales and import-sales stability.

Structure and content of the doctoral dissertation

The doctoral dissertation contains three chapters with interrelated content built around the concept of value added in exports. The first chapter studies the possible convergence in terms of DVA in exports between EU-15 and CEE-10 countries. The second chapter is based on empirical research of factors that influence DVA differences in exports for EU-15 and CEE-10 countries. The third chapter considers the determinants of DVA in exports at the firm level in Slovenia.

The first chapter presents the theoretical framework which allows the GVC participation of each country and its export contribution in terms of added value to be estimated. The first section introduces the motivation and research question of the analysis. Section 1.2 reviews the literature on evolution of the GVC concept and highlights the issue of double counting in official statistical categories that quantify trade in gross terms. Further, it presents different empirical measures of participation in vertical specialised trade. Section 1.3 presents the methodological framework for measuring value added in exports developed by Koopman et al. (2010) that is adopted in this dissertation and the regression specification applied in this chapter. Section 1.4 describes the estimated DVA data based on WIOD tables. Section 1.5 presents the results and is divided into four subsections. The first subsection compares the volume of exports in gross and value-added terms, the second subsection presents the structure of manufacturing and services sector exports, the third concentrates on integration into GVCs and, finally, the fourth subsection considers the gains from participation in GVCs. The last part of the chapter, section 1.6, provides a review of the basic results, and concludes.

The estimates of DVA in exports shown in the first chapter are then used in the **second chapter,** which investigates the main driving forces that create differences in DVA between EU-15 and CEE-10 countries. The first section presents the motivation, research questions and contribution of the analysis. Section 2.2 presents in more detail the patterns of DVA in exports for the EU-15 and CEE-10. Section 2.3 focuses on the existing theoretical background and empirical findings concerning upgrading in terms of DVA. Section 2.4 outlines the empirical strategy in three subsections. The first subsection describes the regression specification, while the second presents data and descriptive statistics. The third subsection gives the main results using the fixed-effects model, as well

as various robustness checks using different estimation methods, different time lags or alternative explanatory variables. The chapter concludes with an overview of the key findings.

The third chapter analyses the determinants of DVA in Slovenian exporting firms. Like the previous two, this chapter starts by introducing the topic, presenting the aim, research question and its contribution to the literature. Section 3.2 offers the findings of related empirical literature while section 3.3 provides the details of the DVA estimation at the firm level. Section 4 describes the data used in detail. It shows a comparison of the estimated DVA results from firm-level data with the estimated DVA on the industry level using data from the WIOD I-O tables. It also describes the procedure for estimating the main variables of interest in the regression analysis concerning different modes of firms' organisational structure in global production networks. This section is followed by a presentation of the empirical framework used. Section 5 sets out the results and section 6 concludes.

1 THE CONVERGENCE IN DOMESTIC VALUE ADDED OF EXPORTS IN THE EU

Abstract

Difficulties in measuring domestic value-added in exports (DVA) have led to the development of alternative measures of trade in value-added terms. These new measures have enabled more accurate estimates that reveal that the EU countries from Central and Eastern Europe (CEE-10) exhibit an approximately five percentage points lower DVA share of exports compared with other EU countries (EU-15). The lag is on average the highest in knowledge-intensive manufacturing sectors (eight percentage points) and the lowest in knowledge-intensive services (0.3 percentage points). However, this chapter argues that the CEE-10 economies have acquired new knowledge by participating in GVCs and thus have gradually started increasing their level of DVA. Based on EU trade data, this chapter presents evidence of convergence of DVA in manufacturing and especially in the services sector. It is also shown that a negative relationship exists between participation in GVCs and DVA in the CEE-10 economies that is declining over time in both manufacturing and services exports.

1.1 Introduction

The organisation of world trade into 'global value chains' has led to the problem of so-called 'double counting' of trade data. The value of raw materials and intermediate products is counted in the value of world exports each time they cross a border (UNCTAD, 2013, p.122), and the full value is attributed to the last country and industry that shipped the product. This is reflected in global export data, expressed as a percentage of the total output, which has increased almost three-fold since 1960. New EU member countries from Central and Eastern Europe (i.e. former transition economies, hereafter labelled as CEE-10) have, on average, seen their export–GDP ratio double in size between 1990 and 2013.

Recognition of this phenomenon has led to the development of alternative approaches for measuring trade in value-added terms (Daudin, Rifflart, & Schweisguth, 2011; Johnson & Noguera, 2012a; Koopman, Powers, Wang, & Wei, 2010; Koopman, Wang, & Wei, 2014). Trade in value-added terms may provide information about whether a country participates (and to what extent) in these new trading patterns created by the fragmentation of international trade (Dean, 2013, p. 51), and may yield insights into the position of a country's sectors within global value chains (Koopman et al., 2014, p. 485). The value-added created in the country is referred to as the 'domestic value-added' (henceforth DVA) and represents the component of exports which contributes to a country's GDP (UNCTAD, 2013, p. 126).

Since a country's export success (by volume of exports) is not necessarily reflected in its rate of economic growth, the question is whether export restructuring in the CEE-10 economies is causing a corresponding increase of DVA in exports. Based on the interrogation of EU trade data, this chapter addresses the following questions. (1) Do the CEE-10 economies create lower domestic value-added in exports compared to older EU member states (henceforth EU-15)? (2) Do these differences diminish over time, i.e. does the gap between the CEE-10 and EU-15 economies narrow over time? And (3), what are the differences in the levels and trends at the sectoral level? Answers to these questions will yield more insights into the question of whether EU-15 countries gain more in terms of DVA from participation in GVCs than CEE-10 countries, and as well whether and why this gap closes over time (or not).

The primary contribution of this chapter lies in the analysis of evidence of convergence in terms of domestic content in exports between CEE-10 and EU-15 countries. Since GVCs, as stated by Baldwin (2011), represent the primary means of cross-border dispersion of advanced know-how, I follow the assumption that CEE-10 economies have acquired new knowledge by participating in GVCs, and thus have gradually started increasing their DVA.

Since participation in GVCs is characterised by the increased use of foreign inputs, this chapter also explores the differences in the gains from GVC integration for these two groups of countries. The main methodology used in this chapter represents the decomposition of gross exports into value-added exports, as developed by Koopman et al. (2010).

The rest of the chapter is structured as follows. Section 1.2 reviews the extant literature on the evolution of GVCs. Sections 1.3 and 1.4 present the methodological framework and data used. Section 1.5 reports the results, while the final section summarises the main findings and presents the conclusions.

1.2 Global value chains (GVCs)

GVCs became a channel through which countries and companies gained access to global markets, and so discovered new opportunities for income and profits. GVCs can represent an entrance onto global markets for developing countries, enabling them to develop their productive capabilities and enable long-term industrial upgrading through the acquisition or absorption of technology and skills (UNCTAD, OECD, & WTO, 2013, pp. 24–26). This section describes how GVCs emerged and the way researchers approached this new phenomenon which has changed many aspects of international trade relations.

1.2.1 The emergence of GVCs

As stated by Baldwin (2011), the 'second unbundling' in the mid-1980s, enabled by advances in information and communication technology, opened a new path of industrialisation. The ICT revolution allowed the coordination of complex activities at a distance and wage differences between developed and developing nations made the separation profitable (Baldwin, 2012). Additionally, containerised shipping, standardisation, automation and improved inter-modality of freight have all facilitated the movement of goods in GVCs (OECD, 2013a), while many services that were formerly untradeable became tradable (Godart & Görg, 2011). Financial and trade liberalisation supported the expansion of foreign direct investment (FDI) flows. In this context, multinational companies were the main drivers of GVCs (Amador & Cabral, 2014, p. 5; Saito, Ruta, & Turunen, 2013).

Policies have played an important role in improving efficiency since trade liberalisation had an impact on further cost reduction, and has facilitated the extension of GVCs[3] beyond industrialised countries. Countries are now able to industrialise easier and faster by joining GVCs since they have no need to build their own supply chain (Baldwin, 2011, pp. 4–9).

Baldwin (2012, p. 7), as well as Gereffi and Luo (2014, p. 5), explain that advanced industrial countries usually represent 'headquarter economies' whose exports are characterised as having relatively little imported intermediates and countries where transnational corporations or 'lead firms' are situated. These transnational corporations coordinate GVCs as complex networks of supplier connections. Developing countries generally act as 'factory economies', whose exports contain a large share of imported intermediates and where the supplier companies are located (Baldwin, 2012, p. 7; Gereffi & Luo, 2014, p. 5).

The greatest change brought about by the second unbundling is that companies from advanced countries, motivated by a desire to lower their production costs (especially labour costs), started offshoring labour-intensive stages of their value chains to developing countries with favourable business environments and reliable workforces (Baldwin, 2011, p. 9). The decision-making process within firms in relation to outsourcing was studied by Swenson (2000) who observed the effects of international cost changes on outsourcing of US companies located in foreign trade zones. This research suggested that companies reduced the consumption of domestic inputs when their relative price increased compared to the price of imported inputs. Amiti and Konings (2007) show based on data for Indonesian manufacturing firms that productivity gains which result from lower input

[3] These new forms of trade have also been referred to as global commodity chains (Gereffi & Korzeniewicz, 1994), international production networks (Borrus, Ernst, & Haggard, 2000; Ernst, 1997), global production networks (Henderson, Dicken, Hess, Coe & Yeung, 2002) and global supply chains (Baldwin, 2011, 2012; Baldwin & Lopez-Gonzalez, 2015).

tariffs on intermediate goods are higher than those from lower output tariffs. Elsewhere, Hanson, Mataloni, and Slaughter (2005) analysed the trade in intermediate inputs for further processing between parent companies and their foreign affiliates and found that demand for imported inputs is higher in cases when lower trade costs, lower wages (for less skilled labour) and lower income taxes are experienced by foreign affiliates. Even if manufacturing stages were offshored, key employees still had to travel among factories and opportunity costs of time still existed, so distance still represented an important factor (Baldwin, 2011, p. 28). Consequently, value chains are mostly formed within large regional economic blocs (e.g. European Union) rather than between them.

Falling trade costs (e.g. tariffs, transport and communication costs) brought benefits to those sectors of the EU and US economies which had the highest comparative advantage, while sectors with the lowest comparative advantage were unable to compete with cheap labour abroad (van der Ploeg & Poelhekke, 2008, p. 483). Textiles, electrical products and other manufacturing sectors which were relying on low-skilled labour in Europe were among those primarily affected by the process of globalisation in the early 1990s. Later in the same decade, the process rapidly expanded to other sectors, and connected companies from many developing countries (Nicita, Ognivtsev, & Shirotori, 2013).

However, GVCs contain more than just trade in goods and services. As Taglioni and Winkler (2016, p. 13) explain, foreign-originated intellectual property, trademarks, managerial and business practices, marketing expertise, and organisational models can also serve as a benefit for developing countries. Industry in developing countries can thus be completely transformed with firm-specific technology that is usually lent to foreign factories (Baldwin, 2011). The basic difference between GVCs and other types of trade and investment are the cross-border flows of know-how (Taglioni & Winkler, 2016). A study by Amiti and Konings (2007) also shows that technology transfers are stronger for imports of inputs than final products.

1.2.2 Scholarly discussion of GVCs

As Grossman and Rossi-Hansberg (2008, p. 1978) state, for centuries international trade has represented only an exchange of goods, but now it can be regarded as a trade in tasks. Put simply, value is added in many different locations across the globe and countries tend to specialise in specific business functions rather than in specific industries (Backer & Miroudot, 2013, p. 9). The rapid expansion in offshoring of manufacturing and other business tasks in countries where some production factors may be hired at much lower prices than at home, challenged the traditional Ricardian and Heckscher–Ohlin models of comparative advantage (i.e. ‘old trade theory’; see Escaith, Lindenberg, & Miroudot, 2010, p. 79).

1.2.2.1 Fragmentation of production process

The offshoring/outsourcing[4] of activities and the fragmentation of the production process do not represent a new phenomenon. Different researchers have used different names to describe the same phenomenon of breaking production processes up within many different countries. In the 1980s, Fröebel, Heinrichs, and Kreye (1980) studied the phenomenon of firms in advanced industrial countries using cheap labour in less developed countries. They presented the case of textile and garment industries in the Federal Republic of Germany, and portrayed this as an example of what they referred to as the *new international division of labour*. Elsewhere, Dixit and Grossman (1982) discussed the process of *multi-stage production*, where the pattern of production specialisation by stages across countries is determined by comparative advantage. They created a model of trade in intermediate goods and studied how changes of endowment and policy changes moved the margin of comparative advantage.

GVCs appeared more frequently in the literature during the 1990s when research was driven by the need to gain better insights into how manufacturers dealt with the process of globalisation and its impact on the development of productive capabilities. Gereffi (1994) distinguished between producer-driven and buyer-driven commodity chains. According to Backer and Miroudot (2013, p. 8) producer-driven chains were especially common in capital and technology-intensive industries (e.g. automobiles, computers, aircraft, electrical machinery). Production that can be completely outsourced tended to be controlled by retailers and branded marketers. As Gereffi (1994, p. 99) explained, companies in buyer-driven chains are merchandisers that design and market, but which do not produce the products they sell.

Elsewhere, Krugman (1995, pp. 334–337) described the rise of trade in similar goods between similar countries (intra-sectoral trade). Here, he observed the trend in manufacturing towards the production of goods in a number of stages in a number of locations or *slicing up the value chain*. He also noted the emergence of countries with high trade-to-GDP ratios and the rapid growth of exports of manufactured goods from newly industrialising, low wage economies. He developed a model of global trade, employment and wages to show how wages and unemployment in advanced economies – and trade with the newly industrialising economies – might be contemporarily determined. In that period, the relationship between wages and employment changes was also studied by Baldwin (1994), Lawrence (1994) and Messerlin (1995).

[4] Although these terms are often used interchangeably, 'outsourcing' refers to when a company relocates its activity (e.g. production process) to an outside provider (at home or in foreign country). By contrast, 'offshoring' denotes the geographic relocation of activity that can take the form of relocation to independent contracted providers abroad or relocation of particular tasks to a company's foreign affiliates (De Backer & Yamano, 2012).

Since the early 2000s, the increasing process of international fragmentation of production started to receive greater attention and challenged traditional interpretations of trade. The main driver of this process was the technological progress that was accompanied by lower costs (Ahmad, 2013, p. 85; Gereffi & Lee, 2012, p. 24). As Baldwin and Venables (2013, p. 246) state, technology plays an important role in determining the connections between production stages that can take the form of 'snakes' (a sequence in which value is added at each stage) and 'spiders' (multiple connections join together to form a component or the final product).

In the context of the fragmentation of production, the tendency of some companies to transfer parts of the production process overseas (offshoring/outsourcing) also became an important subject of research. Researchers presented several models of offshoring (Baldwin & Robert-Nicoud, 2007; Grossman & Rossi-Hansberg, 2008; Harms, Lorz, & Urban, 2012) and outsourcing (Grossman & Helpman, 2005; Ornelas & Turner, 2008). Some dealt with the characteristics of countries/companies that engaged in offshoring (Agnese & Ricart, 2009), while others studied the influence of offshoring activities on firm performance on global markets (Coucke & Sleuwaegen, 2008). Others examined the impact of offshoring on wages and unemployment (Mitra & Ranjan, 2010).

Other theories of offshoring are based on property-rights models of firm boundaries based on concepts of incomplete contracts and relationship-specific investments for producing particular inputs (Antràs, 2003; Antràs & Helpman, 2004). Within the framework of incomplete contracts and sequential production, Antràs and Chor (2013) perform an analysis of ownership rights and their optimal allocation, based on property-right model of firm boundaries. Their analysis shows that suppliers in the upstream stages and their relationship-specific investments can affect the investment decisions of suppliers in downstream stages. The magnitude of this effect depends on whether investments are sequential complements or sequential substitutes which is determined by price-elasticity of demand for its final good and elasticity of substitution across production stages.

Alfaro et al. (2015) expand the model and examine the ownership rights and their optimal allocation across the value chain. They show that firm's capacity for integration of certain stage of the value chain depends on relative contractibility of upstream stages compared to downstream stages from that stage. In the case of sequential complementarity, improved relative contractibility in the upstream part of firm's production process can increase firm's capacity for integration. In the case when stages represent sequential substitutes, improved relative contractibility increases outsourcing.

Boehm and Oberfield (2018) studied the importance of the contract enforcement in intermediate input markets. They found out that in case of weaker enforcement firms are more prone to integration i.e. to retain more production stages within the firm's boundaries

or to decide (from technological perspective) for such input mix that eliminates relationship-specific components.

These theoretical models are beyond the scope of this thesis. However one could extend these models to partially explain the individual firm's position in the value chain or firm's decision on organization of their global value chains. Moreover, firm's prospects and boundaries to capture value added in their export could be examined in terms of general firm's characteristics, product/process characteristics, trade partner characteristics, logistics and supply chain, etc.

Increasingly, other research began to focus on value creation since the increased fragmentation of production challenged the traditional trade indicators measured according to gross values. These give only a partial and consequently less reliable picture of bilateral trade balances. As Koopman et al. (2010, p. 24) state, if the proper data on domestic value-added in exports are available, even a revealed comparative advantage can be altered considerably.

1.2.2.2 The issue of double counting

The fragmentation of production causes different stages of production to be divided across different countries, with intermediate goods crossing borders on multiple occasions. Each producer purchases inputs and then adds value, which is then included in the cost of the next stage of production. However, existing official statistical categories quantify trade in gross terms.

To address these issues (already identified by Feenstra (1998)), researchers began to measure a country's trade flows according to the value that is added in the production process (labour compensation, taxes on production and operating surplus or profits) to any exported good or service. To deal with this issue, micro and macro approaches have been used (Ahmad, 2013, p. 87).

A micro approach can generally be applied to a specific product and explains only a part of the story of how global value chains function. Examples of micro studies include description of the manufacturing process of iPods and notebook PCs (Dedrick, Kraemer, & Linden, 2010), the iPhone (Kraemer, Linden, & Dedrick, 2011; Xing & Detert, 2010), and the iPad (Kraemer et al., 2011). These studies highlight evidence from China, which has specialised in the assembly of final products in the electronics industry and has become the largest exporter of ICT products. However, the largest proportion of the product's value is created by the producers of high value components (in the USA and Japan), and by the retailers of the electronic devices in high-income markers (Stehrer & Stöllinger, 2013, pp. 4–5).

Conversely, a macro approach, based on the construction of inter-country or world input–output tables, provides an extensive description of a country's participation in cross-border production chains (Koopman et al., 2010, p. 2). Hummels, Ishii, and Yi (2001) presented the first empirical measures of participation in vertical specialised trade. The first of these measures determines the value of imported inputs embodied in exported goods, or in other words the foreign value-added embodied in exports (henceforth VS). With the use of input–output tables for 10 OECD countries and four (at the time) emerging market countries over the period 1968–1990, they found that the USA, Japan and Australia had VS shares of about 5–10%, while Canada, Denmark and the Netherlands had VS shares of around 30–35%. Their conclusion that smaller countries exhibited higher VS shares was based on the correlation between the VS share of exports and GDP. They also found that during the period under examination the VS share increased by about 30% for the entire sample of countries. The second measure, marked as VS1, represented the value of exports embodied in a second country's export of goods. For the group of 10 OECD countries they found that the share of VS1 was 4–5%.

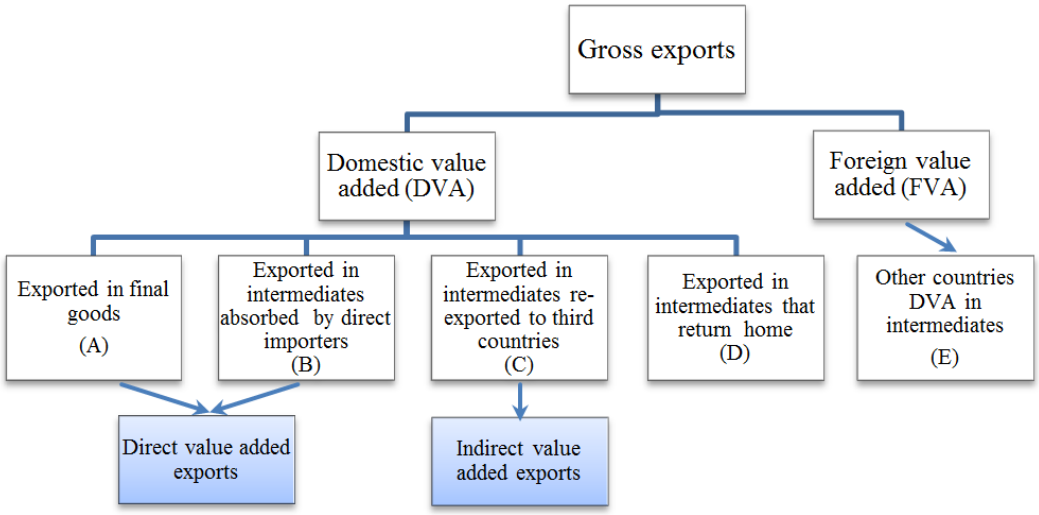
Daudin et al. (2011) used a similar method to that of Hummels et al. (2001), but the use of the GTAP database (for 66 regions and 55 sectors in 1997, 2001 and 2004) allowed them to compute the share of imported inputs in exports (VS) and the share of exports used as inputs intended for further exports (VS1). They proposed a third measure (VS1*) to describe the share of exports that are embodied in goods which are further used as inputs for the production of final products that are shipped back to a home country for consumption.

Johnson and Noguera (2012a) similarly softened the assumption of Hummels et al. (2001) that a country's exports are completely consumed by final demand abroad (which excludes cases where country exports intermediates which are then used in production of final goods at home). They defined the 'VAX ratio' as a measure of the value-added content in trade (value-added in exports divided by gross exports), which can represent the 'domestic content of exports'. The VAX ratio includes two components: the first describing the equivalent to a measure of domestic content presented by Hummels et al. (2001), with the second representing exported intermediates for the production of goods at the end consumed at home. With the use of the GTAP database for 94 countries and 57 sectors in 2004, they found that value-added exports (across all countries) accounted for 73% of gross exports. At the regional level, the lowest VAX ratios were recorded in Central and Eastern Europe (68%) and East Asia (62%).

Later, Koopman et al. (2010) provided a model which incorporated all previous measures of vertical integration to facilitate the complete decomposition of gross exports into value-added components (Figure 4). With decomposition results at the country-sector level, Koopman et al. (2010, p. 22) pointed out, *inter alia*, that in many sectors the old EU

members (EU-15) generated higher domestic value-added and were positioned at the upstream end, while the newer members were positioned at the downstream end of the value chain. Moreover, they emphasised that decomposition results (i.e. through the use of value-added terms instead of gross terms) can lead to different estimates of a country's revealed comparative advantages and bilateral trade balances.

Figure 4: Decomposition of gross exports into value-added exports



Source: R. Koopman, W. Powers, Z. Wang and S.-J. Wei, Give Credit Where Credit is Due: Tracing Value-Added in Global Production Chains, 2010, p. 34.

1.3 Methodology

This chapter adopts the methodology developed by Koopman et al. (2010, pp. 5–21) for measuring value-added in exports. This methodology requires the use of inter-country input–output tables, which contain information on the source and destination country of all transaction flows by industry, separately for the use of intermediates, and the use of final products (Koopman et al., 2014, p. 485).

The model assumes an *m*-country world, where each country produces goods in *n* tradable sectors, and thus the *m*-country production and trade system can be presented in a block matrix structure as (Koopman et al., 2010; Rahman & Zhao, 2013):

$$\begin{bmatrix} X_1 \\ \vdots \\ X_m \end{bmatrix} = \begin{bmatrix} A_{11} & \dots & A_{1m} \\ \vdots & \ddots & \vdots \\ A_{m1} & \dots & A_{mm} \end{bmatrix} \begin{bmatrix} X_1 \\ \vdots \\ X_m \end{bmatrix} + \begin{bmatrix} Y_{11}+\dots+Y_{1m} \\ \vdots \\ Y_{m1}+\dots+Y_{mm} \end{bmatrix} \quad (1)$$

This structure shows that all gross output produced by country g is used as an intermediate or final good by the home country or by foreign countries (h). X_g thus represents the n×1 gross output vector of country m and each block matrix A_{gh} represents n×n I–O matrix of coefficients that stand for intermediate use in country h of goods produced in country g. Y_{gh} denotes the n×1 final demand vector, which represents the demand of country h for final goods produced in country g.

By reorganising Equation (1), the gross output vector X can be expressed as

$$X = (I - A)^{-1}Y = BY \tag{2}$$

where B_{gh} represents an n×n Leontief inverse matrix.

Further, the gross export $E_{g*\_}$ from country g to the world has to be defined by composing the final demand matrix Y_{gh} and intermediates $A_{gh}X_h$ (I–O matrix of coefficients multiplied by gross output vector):

$$\mathrm{E}_{g*\_} = \sum\nolimits_{h \neq g} E_{gh} = \sum\nolimits_{h \neq g} (Y_{gh} + A_{gh}X_h). \tag{3}$$

For measuring domestic and foreign contents the direct value-added coefficient vector V_g (1×n) is defined as one minus the intermediate input share from all countries (with domestically produced intermediates counted in), where u is a 1×n unity vector:

$$V_g = u(I - \sum\nolimits_h A_{gh}) \tag{4}$$

After certain procedures involving matrix calculations, domestic value-added can be expressed as:

$$DVA_g = V_g B_{gg} E_{g*} \tag{5}$$

where $\mathrm{V_g}$ presents the direct value-added coefficient vector, B_{gg} stands for diagonal elements of an n×n Leontief inverse matrix, and $\mathrm{E_{g*}}$ is an export matrix. Finally, the gross export $\mathrm{E_{gh}}$ can be broken down into two main categories: domestic value-added in exports (DVA); and foreign value-added in exports (henceforth FVA). The DVA is further divided in several other sources, depending on the stage of production process, whereby (A) represents a final good, (B) denotes an intermediate product not prepared for further exports, (C) denotes intermediate goods produced for re-export to third countries and (D) denotes an intermediate good that returns to the home country as presented before in Figure 4:

$$E_{g*} = DVA_g + FVA_g = V_g B_{gg} \sum_{h \neq g} Y_{gh}\ (A) + V_g B_{gg} \sum_{h \neq g} A_{gh} X_{hh} (B) + V_g B_{gg} \sum_{h \neq g} \sum_{r \neq g,h} A_{gh} X_{hr}\ (C) + V_g B_{gg} \sum_{h \neq g} A_{gh} X_{hg}\ (D) + FVA_g\ (E) \quad (6)$$

As stated in Koopman et al. (2010), the sum of (D) and (E) represents a part of exports that is double counted in official trade statistics. The components (A) and (B) represent the exports of a country outside the supply chain, while components (C), (D) and (E) relate to the exports linked to the supply chain (Augustyniak, Ebeke, Klein, & Zhao, 2013, p. 9).

To address the issue of whether differences in DVA in exports between CEE-10 and EU-15 countries diminish over time, I intend to perform the following regression analysis, both for the manufacturing and services sectors:

$$DVA_{ijt} = \alpha + \beta_1 CEE + \beta_2 t + \beta_3 t^2 + \beta_4 CEE * t + \beta_5 CEE * t^2 + u_{ij} + \varepsilon_{ijt} \quad (7)$$

where t represents a trend variable (t=1,…,17), CEE=1 for CEE-10 countries and CEE=0 for EU-15, μ_{ij} is a country–industry fixed effect and ε_{ijt} is a random error term. The variables in the model relate to country i, industry j and year t. I opt to use a quadratic trend in the model since the difference in DVA between CEE-10 and EU-15 in the observed period shows a nonlinear trend (especially in the manufacturing sector).

Furthermore, I explore the impact of participation in GVCs on DVA in exports separately for both groups of countries and changes in the relationship through the observed years. For that purpose I will estimate the following regression (again, separately for manufacturing and services sectors):

$$DVA_{ijt} = \alpha + \beta_1 Part + \beta_2 Part * t + \beta_2 Part * CEE + \beta_3 Part * CEE * t + u_{ij} + \varepsilon_{ijt} \quad (8)$$

where *Part* represents an estimated measure for participation rate in GVCs and is defined as a share of (1) foreign inputs in gross exports, plus (2) domestically produced inputs used in third countries' exports (forward participation) in gross exports (methodology is provided in Appendix 4). Trend variable is represented as t (t=1,…,17), CEE=1 stands for CEE-10 countries, μ_{ij} is a country–industry fixed effect, and ε_{ijt} is a random error term. The variables in the model relate to country i, industry j and year t.

1.4 Data

The data used to analyse the value-added in exports were obtained from publicly available World Input–Output Tables (henceforth WIOT) from the World Input–Output Database (henceforth WIOD). WIOD data contain information for 27 EU countries and 13 other

major countries, which account for approximately 85% of global GDP. To complete the WIOD, a region denoted 'Rest of the world' was added as a proxy for all other countries in the world.

For the purpose of calculating value-added in exports, WIOT were used at current basic prices. The calculation included complete bilateral data for all 40 available countries (Table 1) and 'Rest of the world', 35 sectors[5] (see Timmer, Dietzenbacher, Los, & Stehrer, 2015, p. 599; Appendix 3) for all 17 available years (for the period from 1995 to 2011), therefore each studied year contained 2,059,225 observations. After finishing the calculation of value-added by countries and sectors using the described method, each year contains 1435 observations and thus after the data 'transformation' the entire time period accounts for 24,395 observations. The main characteristics of the data used are presented in Table 2.

The analysis focuses on EU countries, especially on the comparison between CEE-10 and EU-15 countries. The decision to analyse the differences is based on the fact that the CEE-10 economies represent former transition countries with a similar socialist heritage that influenced the development of international trade across the region in a different way to that observed in the EU-15 economies. Since GVCs represent a way to generate cross-border dispersion of advanced know-how, I follow the assumption that the CEE-10 economies have acquired new knowledge by participating in GVCs, and so have started increasing their DVA. Cyprus and Malta are excluded from the analysis since they do not share a similar economic (and political) background with the rest of the new EU countries. The subsequent part of the dissertation concentrates on these 25 countries (14,875 observations).

I expect that DVA in exports will be, on average, smaller in the CEE-10 economies than in the EU-15 because: (1) the majority of CEE-10 countries exhibit a relatively low R&D intensity, and are heavily dependent on R&D embodied in imported inputs, and so mostly rely upon imported technology (Reinstaller & Unterlass, 2011); and since (2) CEE-10 have attracted a relatively high volume of FDI. As Aminian, Fung, and Iizaka (2007) claim, this can initially be associated with a higher volume of host country imports from the FDI source country, due to a rise in imports of intermediate and capital goods connected with production offshoring. However, over time the effect of FDI can change if foreign affiliates begin to source intermediate products from local firms. Moreover, offshoring to CEE-10 countries has gradually shifted from routine activities in the early years of transition (Gál, 2014) to higher value-added and skill-intensive activities (Lorentowicz,

[5] Two sectors are excluded from the following stages of the analysis: Coke, Refined Petroleum and Nuclear Fuel (since EU countries (except UK) do not have their own production) and Sector Private Households with Employed Persons (since the estimated DVA in the majority of countries has extreme values 0 or 1).

Marin, & Raubold, 2005; Marin, 2004, 2011; Sass & Fifekova, 2011). As a result, I expect that the differences in DVA will diminish over time.

Table 2: Countries by structure of exports, 1995-2011 (average share)

Country	EXPORT Mio $	% of world exports	FVA (%) (E)	Total DVA (%)	(A)	DVA (%) (B)	(C)	(D)
AUS	142319	1.40	13.1	86.9	26.2	44.7	15.7	0.3
AUT	125954	1.24	23.8	76.2	25.0	34.3	16.4	0.4
BEL	234608	2.31	31.5	68.5	22.2	30.5	15.3	0.5
BGR	12874	0.13	30.5	69.5	26.8	29.7	13.0	0.0
BRA	122758	1.21	8.4	91.6	22.4	46.4	22.5	0.3
CAN	354060	3.48	16.7	83.3	24.9	46.6	11.2	0.6
CHN	767222	7.54	13.9	86.1	34.7	37.2	13.2	1.0
CYP	3193	0.03	26.2	73.8	30.6	31.7	11.5	0.0
CZE	75936	0.75	28.5	71.5	23.3	31.6	16.3	0.4
DEU	971739	9.55	15.7	84.3	29.2	36.7	16.0	2.2
DNK	99915	0.98	22.0	78.0	27.7	34.2	15.8	0.4
ESP	218884	2.15	18.1	81.9	28.5	35.7	16.9	0.8
EST	6663	0.07	31.1	68.9	20.1	31.1	17.6	0.1
FIN	71531	0.70	20.6	79.4	24.9	36.9	17.4	0.3
FRA	469931	4.62	16.1	83.9	31.8	35.7	15.1	1.2
GBR	489037	4.81	14.6	85.4	27.6	39.5	17.0	1.5
GRC	29202	0.29	18.7	81.3	30.9	36.3	14.0	0.2
HUN	57514	0.57	30.9	69.1	23.1	31.1	14.7	0.1
IDN	96164	0.95	16.4	83.6	26.8	40.6	16.0	0.2
IND	140896	1.38	12.7	87.3	35.8	36.2	15.5	0.3
IRL	131109	1.29	33.3	66.7	23.1	31.1	12.7	0.2
ITA	390534	3.84	16.1	83.9	32.2	35.3	15.5	0.9
JPN	597068	5.87	9.3	90.7	27.7	44.9	17.4	1.6
KOR	296268	2.91	21.6	78.4	27.7	37.6	12.8	0.3
LTU	10211	0.10	25.5	74.5	27.0	32.1	15.2	0.1
LUX	46788	0.46	35.0	65.0	20.0	27.6	17.6	0.1
LVA	5691	0.06	25.9	74.1	25.9	32.1	15.9	0.1
MEX	193630	1.90	14.8	85.2	27.0	44.0	13.7	0.5
MLT	3545	0.03	30.8	69.2	25.4	30.8	13.2	0.0
NLD	318099	3.13	27.2	72.8	25.3	31.2	15.8	0.6
POL	101732	1.00	20.5	79.5	29.4	32.3	17.5	0.3
PRT	43002	0.42	21.2	78.8	25.8	37.2	15.5	0.3
ROM	26894	0.26	23.0	77.0	28.8	33.3	14.7	0.1
RUS	202069	1.99	9.5	90.5	26.4	44.5	19.2	0.5
RoW	1678834	16.50	23.1	76.9	22.0	40.2	11.6	3.2
SVK	32106	0.32	30.0	70.0	22.3	30.4	17.0	0.3
SVN	17102	0.17	25.5	74.5	26.1	32.9	15.4	0.1
SWE	153123	1.51	22.3	77.7	23.8	36.1	17.4	0.4
TUR	76364	0.75	13.9	86.1	34.1	35.1	16.8	0.3
TWN	202897	1.99	24.4	75.6	29.2	34.3	11.9	0.2
USA	1156020	11.36	9.3	90.7	25.5	45.9	13.0	6.3
Total	10173483	100						
Mean			21.3	78.7	26.8	36.0	15.4	0.7

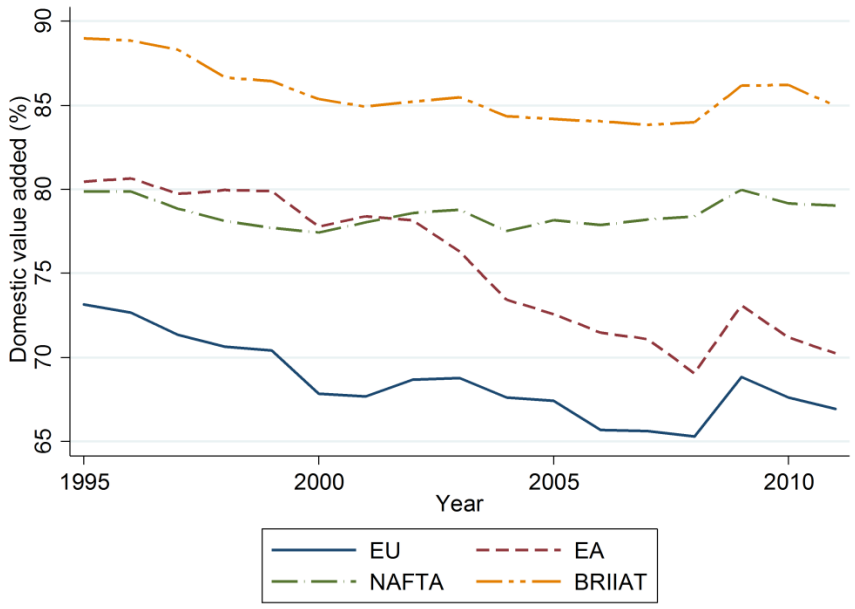
Note: Labels (A) - (E) represent individual components of gross exports as defined in the decomposition of gross exports into value-added exports provided by Koopman *et al.* (2010), presented in Figure 4.

Source: WIOD tables, author's calculations.

1.5 Results and discussion

The starting point of the analysis is the identification of EU countries' positions among other major groups of economies in terms of value-added in exports. As Figure 5 demonstrates, EU countries have the lowest DVA share in exports amongst the selected groups of countries. Compared to some developed countries outside the EU DVA in exports in the EU-25 during the period 1995–2011 is on average 15 percentage points lower than in the USA and Japan. As pointed by López-González and Kowalski (2017), countries like the USA and Japan have bigger shares of DVA since they are technologically advanced and can rely on their larger domestic markets to provide intermediates. At the same time countries rich in natural resources (e.g. India, Russia, Brazil, Australia) are also likely to have higher DVA in their exports (López-González & Kowalski, 2017).

Figure 5: Domestic value added in exports by major group of world countries, 1995-2011



Source: WIOD tables, author's calculations.

Figure 5 clearly shows that DVA in exports has on average declined across all groups of countries (the largest decline was experienced in East Asian countries[6]) with a rise in the year 2009 due to the beginning of the global financial crisis. The details of these features are further discussed in the following sections focusing on EU-15 and CEE-10 countries.

[6] Although East Asian countries registered (on average) a declining trend in DVA, this was not the case in China, where DVA was increasing from 2005 to 2009.

1.5.1 Exports in gross and value-added terms

Since a country's export success (by volume of exports) is not necessarily reflected in its rate of economic growth, one of the key questions is how large is the difference between the volume of exports and the value-added in those exports? The gross export structures of the sample countries are presented across the three main sectors – manufacturing, services and natural resources. As illustrated in Table 3, manufacturing accounts for the majority of exports (on average almost 75%) in all EU countries, while exports in services amount to, on average, just over 20%. The share of manufacturing in exports declined during the observed period (by 7.5 percentage points) in the EU-15 economies, while the share of services exports increased (by 7.6 percentage points). The opposite process can be observed in the CEE-10 countries, where the share of manufacturing exports increased by 7.7 percentage points and exports in services declined by 4.3 percentage points.

Table 3: Gross and value-added exports by main sectors for CEE-10 and EU-15, 1995-2010 (per cent of total exports)

	1995	2000	2005	2010	Average 1995-2011	Average annual growth 1995-2011 (%)
EXPORTS IN GROSS TERMS						
	CEE-10					
Manufacturing	66.5	72.0	76.1	73.3	72.5	0.7
Natural resources	7.1	3.4	3.1	3.7	3.9	-3.5
Services	26.5	24.6	20.8	23.0	23.5	-1.0
	EU-15					
Manufacturing	78.8	76.3	73.2	70.3	74.5	-0.6
Natural resources	3.7	3.4	3.2	3.7	3.4	0.0
Services	17.5	20.2	23.6	26.0	22.1	2.3
EXPORTS IN VALUE ADDED TERMS						
	CEE-10					
Manufacturing	63.2	65.9	69.5	66.0	66.5	0.4
Natural resources	8.0	4.2	4.2	4.6	4.8	-3.0
Services	28.9	29.9	26.4	29.4	28.7	0.0
	EU-15					
Manufacturing	76.5	73.6	70.0	66.9	71.6	-0.8
Natural resources	4.1	4.0	3.6	4.1	3.8	0.1
Services	19.4	22.4	26.3	29.0	24.5	2.4

Source: WIOD tables, author's calculations.

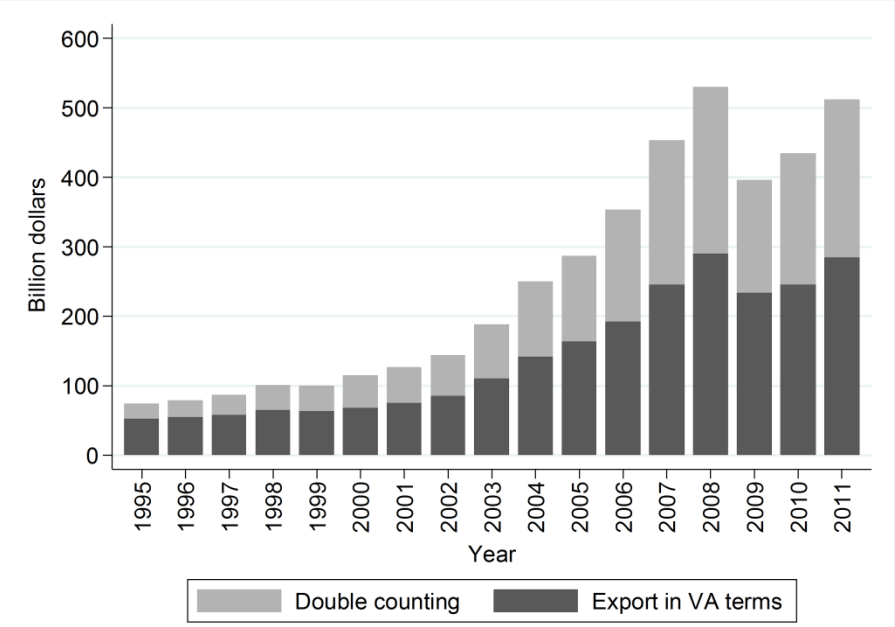
Comparing exports expressed in gross terms and exports in value-added terms yields even more interesting results. The latter is lower than gross exports for DVA incorporated in intermediates used by direct importers to produce goods, exported back to the source country ('reflected DVA') and for value-added from the foreign country incorporated in gross exports (foreign value-added). In this case the shares of services in total exports are higher, accounting for, on average, 28.7% of exports in the CEE-10 economies and 24.5%

in the EU-15 economies. According to Drake-Brockman and Stephenson (2012, p. 7), services add significant value to manufacturing and agricultural output since they are 'embodied' in products in the production process (e.g. energy, communications, transport insurance, software, accountancy, design and other technical expertise). Other services, such as financing, training, maintenance, repair and other after-sales services can be 'embedded' at the point of product sale. Embodied services represent a large share of the value of goods for many products, but the full export value of embodied services is considered (for trade purposes) as manufactured exports without export value attributed to services. Thus, the traditional statistical approach neglects the value of 'embodied' and 'embedded' services.

Exports in services and natural resources in value-added terms are on average lower compared to exports in services and natural resources in gross terms (for approximately 20%), while in manufacturing the difference is larger (on average 40% in the CEE-10 group and 30% in the EU-15). As mentioned, these differences result from double counting of value-added from foreign countries incorporated in gross exports and so-called 'reflected domestic value added'. As shown in Figure 6, the share of double counted exports in the manufacturing sector in CEE-10 increased over time. From the beginning of the observed period (1995) to the end of the period in 2011, the gap between exports in value-added and gross terms increased from almost 30% to 44%. Similarly, in the same period the share of double counting in EU-15 countries increased from 26% to 34%.

Figure 6 reveals a decline in exports in the manufacturing sector due to the global economic crisis of 2008 that is reflected in export data for 2009. Both the EU-15 and CEE-10 economies registered a smaller decline in exports in value-added terms (20.2% for the EU-15 and 19.2% for the CEE-10) than in gross terms (23.7% for the EU-15 and 25.2% for the CEE-10). As Bems, Johnson, and Yi (2011) explain, this signifies that the vertical specialisation of trade contributed to a large reduction in overall trade. The drop in demand, which occurred during the crisis, did not only affect trade flows of finished products, but had also a negative impact on related trade flows of intermediate products and components (Stehrer et al., 2011). Usually, when facing a sudden drop in demand, companies delay acquisitions and reduce inventories. Consequently, the fall in demand extends along the supply chain and can lead to a reduction in output for firms that are located upstream (Ahmad, 2013, p. 89). The role of GVCs during the collapse of international trade in 2009 was studied by Altomonte, Di Mauro, Ottaviano and Vicard (2012), who found that trade in intermediate products was the primary determinant of the significant decline in trade observed over the crisis.

Figure 6: The structure of gross export in the manufacturing sector in the CEE-10 economies, 1995-2011 (billion dollars)



Source: WIOD tables, author's calculations.

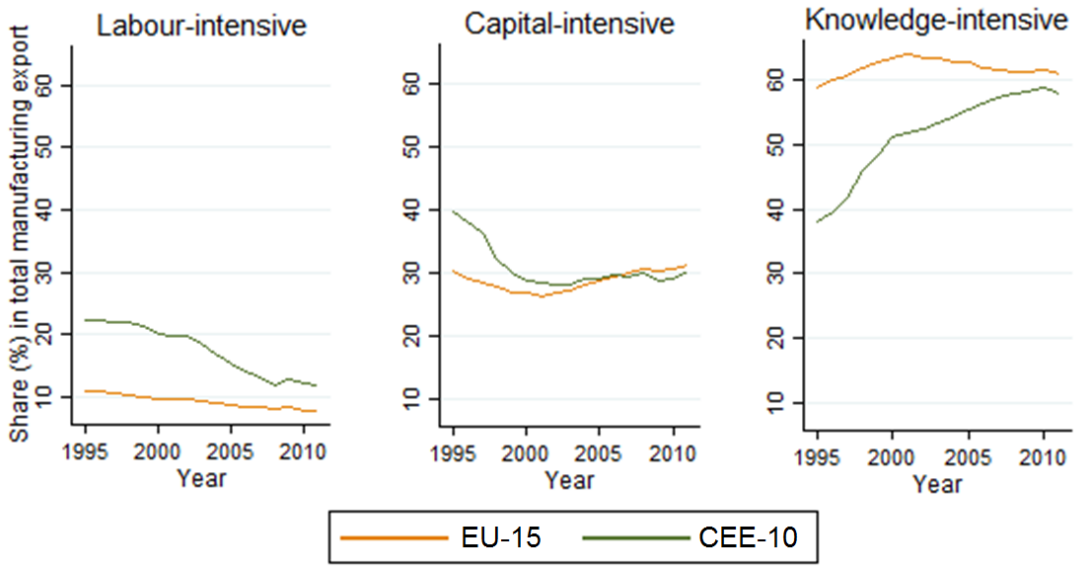
Another question to be explored is whether the gap in domestic value-added in exports between the CEE-10 and EU-15 countries persisted or decreased over time, both at the aggregate as well as at the sectoral level. The next section provides a broader picture of the export structures of labour-, capital- and knowledge-intensive manufacturing and services sectors.

1.5.2 The structure of manufacturing and services sector exports across the EU

1.5.2.1 Manufacturing exports

As illustrated in Figure 7, knowledge-intensive exports are the predominant group of manufacturing exports, both in the EU-15 (account for, on average, 62% of manufacturing exports) and in the CEE-10 countries (52%). During the observed period the share of knowledge intensive exports in the EU-15 increased by 2.3 percentage points, while in the CEE-10 the share rose from 38% to 58%, and has thus almost converged with the share in EU-15 countries (62% in 2011). The reverse occurred in capital-intensive manufacturing exports, where the share for the CEE-10 economies declined (from 40% to 30%), and the share for EU-15 countries rose slightly (from 30% to 31%). Labour-intensive manufacturing exports account for the smallest share of manufacturing exports.

Figure 7: Share of exports in manufacturing sub-groups for the EU-15 and CEE-10 economies, 1995-2011 (% of total manufacturing exports)



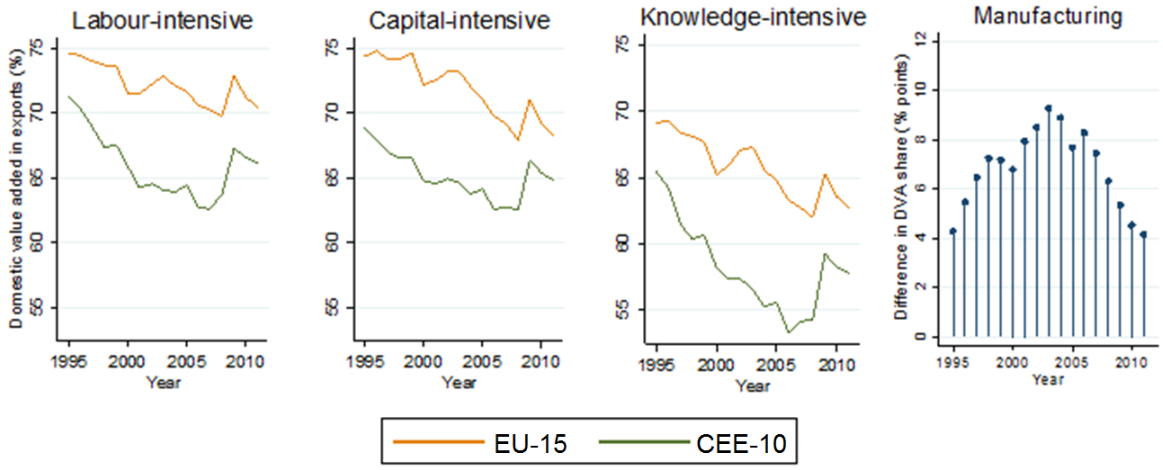
Source: WIOD tables, author's calculations.

A sharp increase in knowledge-intensive exports can be explained by the fact that multinationals from hub countries, like Austria and Germany, are outsourcing the lower value-added segments of knowledge-intensive production to Eastern Europe. The CEE-10 countries (and within them especially the so-called Visegrad or CE4 countries: Poland, Slovakia, Hungary and the Czech Republic) attracted greenfield investments contributing to the expansion of production. Inward FDI was mostly directed towards the car industry, which occurred alongside offshoring of the German automotive industry. This process spurred the transfer of technology (Augustyniak et al., 2013). Rahman and Zhao (2013) computed the revealed comparative advantage index (using domestic value-added in exports). They found that all four Visegrad countries improved their comparative advantage in knowledge-intensive sectors, even though none of these countries had a comparative advantage in 1995. Nevertheless, Labaye et al. (2013) comment that the development of the automobile and electronics centres across the region remains behind the level of similar clusters in the United States, the EU-15 and BRIC countries. In order to expand knowledge-intensive manufacturing in CEE countries, investment in R&D and innovation is required.

As shown in Figure 8, DVA in exports by manufacturing subgroups in the EU-15 group was higher than in the CEE-10 group, with the highest shares exhibited in labour-intensive

activities. On average, it amounts to 72% in the EU-15 and 65% in the CEE-10[7]. In all subgroups both the CEE-10 and EU-15 economies recorded rapid growth in 2009. One possible explanation for why DVA increased in 2009 is that the crisis could have caused firms to favour re-shoring before offshored activities, which lead to higher DVA in exports. This effect was even more pronounced if re-shoring activities were present in sectors with relatively high foreign VA in exports (Stehrer & Stöllinger, 2013, p.40). Los, Timmer, and de Vries (2015, p. 78) explain that firms' long production chains became more vulnerable during the crisis. They argue that the decline in fragmentation can be driven by rising transportation costs (due to higher fuel prices) and rising wages in China.

Figure 8: Share of DVA in exports for EU-15 and CEE-10 economies, 1995-2011 (% of total exports, and % difference in manufacturing DVA between EU-15 and CEE-10 groups)



Source: WIOD tables, author's calculations.

Although the differences between CEE-10 and EU-15 in terms of DVA share have persistently increased since 1995 and divergence could be noticed, they started diminishing over the observed period and thus the convergence could be observed (Figure 8). Estimation of the presented model (7), by using DVA data for manufacturing, provides significant regression results which show that the trend for EU-15's share of DVA is almost linear and decreasing, but starts at higher values of DVA compared to CEE-10 (Table 4). On the other hand, a positive value of the quadratic trend term for CEE-10 indicates the curvature is upwards sloping, which shows that a difference in share of DVA between both groups of countries systematically closes over time.

[7] Figure 5-1 (Appendix 5) additionally provides median values of the share of DVA in exports in manufacturing. The difference between median and mean values for CEE-10 is negligible, while for EU-15 median is on average for 2 percentage points higher (in every manufacturing subgroup).

Table 4: Convergence of DVA in the manufacturing sector

Dependent variable: DVA in exports in manufacturing

VARIABLES	POLS	FE (1)	FE (2)
CEE	-3.172***		
	(0.908)		
t	-0.473***	-0.445***	-0.0551
	(0.156)	(0.0599)	(0.0620)
t^2	0.0059	0.0040	-0.0172***
	(0.0085)	(0.00317)	(0.0034)
CEE*t	-1.209***	-1.250***	-1.249***
	(0.234)	(0.135)	(0.135)
CEE*t^2	0.0690***	0.0714***	0.0714***
	(0.0127)	(0.0068)	(0.0068)
Constant	73.73***	72.44***	71.64***
	(0.610)	(0.275)	(0.257)
Observations	5,493	5,493	5,493
R-squared	0.129	0.310	0.364
# of country-industry		325	325
Country-industry FE		YES	YES
Year FE		NO	YES

Notes: Regression estimates of the model (7) for the manufacturing sector; robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; *CEE* = 1 if the observation belongs to CEE-10, *CEE* = 0 if the observation belongs to EU-15.

Source: WIOD tables, author's calculations.

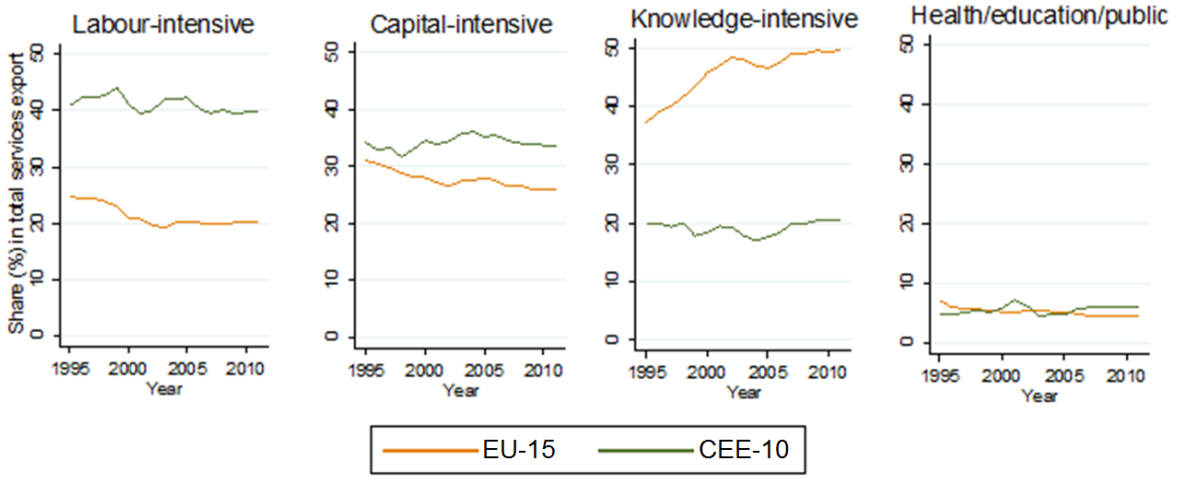
The decline in the DVA gap can be explained by the fact that the share of imported intermediate products in total intermediate products used in the CEE-10 declined after 2004 (–1.2% per year from 2004 to 2011). At the same time, this share rose slightly in the EU-15 (0.5% per year). Nonetheless, it is important to note that the average share of imported intermediate products in the CEE-10 remains higher than in the EU-15. Regarding the exports of intermediate products, Behar and Freund (2011) found (using sophistication measure developed by Hausmann, Hwang, and Rodrik (2007)) that exports by new EU member countries of intermediate product have become 15% more sophisticated.

1.5.2.2 Services sector exports

As Low (2013, p. 73) argues, services represent an increasingly important component of international trade. They play an important part in international trade and investment flows by facilitating the development of value chains of goods which usually start and end with a series of service activities or with the creation of services value chains (Stephenson, 2012, p. 17). This is because firms outsource not only the assembly of goods, but also many services.

In the EU-15 countries, the highest shares of services exports can be observed in knowledge-intensive or business services (almost 50% in 2011), an increase of 12 percentage points over the period under examination (Figure 9). These are followed by capital-intensive (26% in 2011) and labour-intensive services (20% in 2011) for which the share has declined over time. By contrast, the CEE-10 countries display the highest share of services exports in labour-intensive services (40% in 2011), followed by capital-intensive services (34% in 2011). Positive annual growth is recorded in health, education and public services (2.4% average annual growth) and in knowledge-intensive industries (0.2% average annual growth).

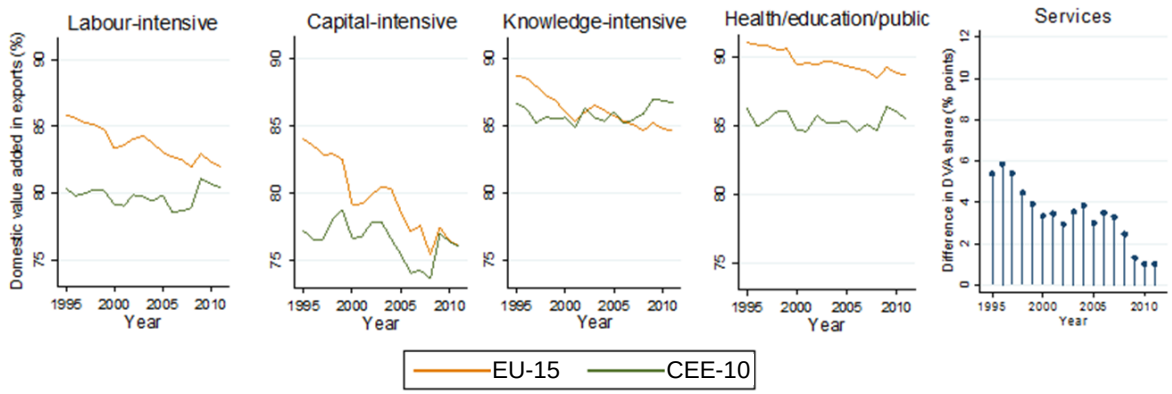
Figure 9: Share of exports in service sub-groups for EU-15 and CEE-10 economies, 1995-2011 (% of total services exports)



Source: WIOD tables, author's calculations.

The highest DVA shares in exports across the EU-15 economies (on average) were registered in health, education and public services (89.6%) and knowledge-intensive services (86.2%) (Figure 10). Similarly, in CEE-10 the knowledge-intensive services (85.9%) and health, education and public services also recorded the highest share (85.4%). The largest average decline of DVA share in EU-15 was recorded in the capital-intensive sector (0.6% per year), while for the CEE-10, it was only 0.1% per year. While in EU-15 the share of DVA in exports decreases in all services groups, in NMS-10 DVA has a relatively stable path. Towards the end of the observed period, the share of DVA in the CEE-10 converged with the share of the EU-15 (76% for both groups in 2011).

Figure 10: Share of DVA in exports for the EU-15 and CEE-10 economies, 1995-2011 (% of total exports)



Source: WIOD tables, author's calculations

Labaye et al. (2013) argue that CEE countries have created highly competitive outsourcing and offshoring capabilities in knowledge-intensive services exports and are positioned to move into new activities with higher value-added. They also argue that the competitive advantage of outsourcing and offshoring companies from CEE is usually based on skills, not on scale, and so offers higher value-added services compared to their competitors from other countries.

The results displayed in Table 5 show that the differences between the CEE-10 and EU-15 in terms of DVA in services exports have declined over time. DVA in exports from the CEE-10 countries was approximately 0.2 percentage points higher each year compared with the EU-15 average, which again shows that the difference between both groups of countries has declined. One possible explanation of the decline in the DVA gap can be found in the fact that the share of imported intermediates in total intermediates used in the EU-15 increased by 1.3% per year, while in the CEE-10 this share has remained relatively stable (with only a 0.2% increase per year).

Sass and Fifekova (2011), who focused on business services offshoring, found that FDI in CEE initially comprised less complicated activities. However, over time activities with higher value-added and skill intensity were also offshored to this region. Indeed, Gereffi and Fernandez-Stark (2010) also found that some Eastern European countries have emerged as popular locations for offshore services, which have expanded the most among all industries in many of these countries. Offshore services can be associated with certain positive externalities (e.g. knowledge transfer, employment, access to new markets).

Table 5: Convergence of DVA in the services sector

Dependent variable: DVA in exports in services			
VARIABLES	POLS	FE (1)	FE (2)
CEE	-5.618***		
	(0.750)		
t	-0.464***	-0.449***	-0.228***
	(0.128)	(0.0448)	(0.0453)
t^2	0.008	0.0080***	-0.0040*
	(0.0072)	(0.0023)	(0.0024)
CEE*t	0.224	0.180*	0.180*
	(0.194)	(0.0948)	(0.0949)
CEE*t^2	0.0019	0.0043	0.0043
	(0.0105)	(0.0045)	(0.0046)
Constant	87.23***	85.00***	84.71***
	(0.471)	(0.221)	(0.215)
Observations	7,554	7,554	7,554
R-squared	0.042	0.144	0.171
# of country-industry		450	450
Country-industry FE		YES	YES
Year FE		NO	YES

Notes: Regression estimates of the model (7) for the services sector; robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; *CEE* = 1 if the observation belongs to CEE-10, *CEE* = 0 if the observation belongs to EU-15.

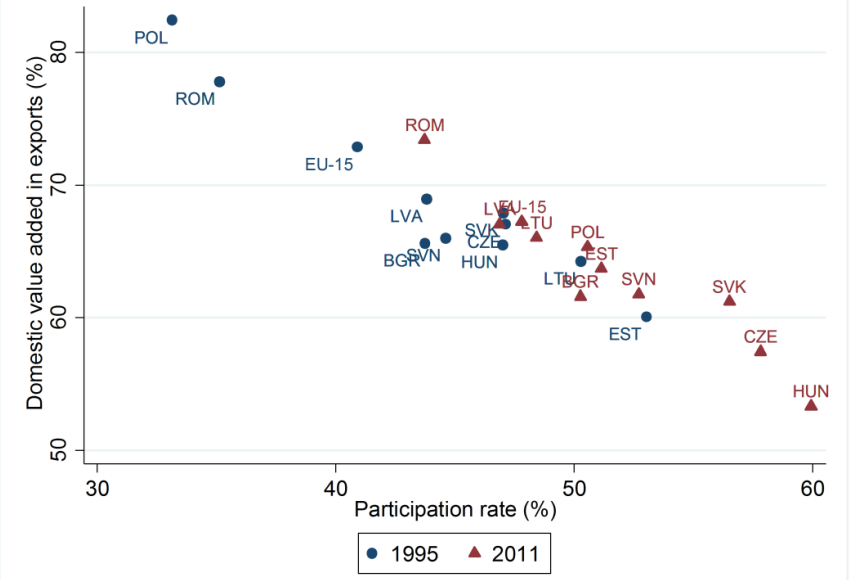
Source: WIOD tables, author's calculations.

1.5.3 Integration in GVCs and domestic content in exports

The extent to which countries are involved in GVCs is measured by the participation index at the country-sector level which indicates the presence of the selected sector and country in GVCs. The participation index is calculated as a share of foreign inputs (backward participation) and domestically produced inputs used in third countries' exports (forward participation) in gross exports.

As illustrated in Figure 11, it can be observed that in the manufacturing sector all countries increased their participation in GVC in the period from 1995 to 2011, except Estonia and Lithuania, which decreased their participation in GVCs. At the same time, almost all countries shifted downwards (their DVA declined) which suggests they moved down the value chains. In 2011 in almost all sectors Hungary had the highest participation rate (60%), followed by Czech Republic and Slovakia (both approximately 57%) and Slovenia (53%), while the smallest participation rate was recorded in Romania (44%).

Figure 11: Extent of participation in GVCs and DVA in exports for the manufacturing sector in the CEE-10 and EU-15 economies, 1995 and 2011



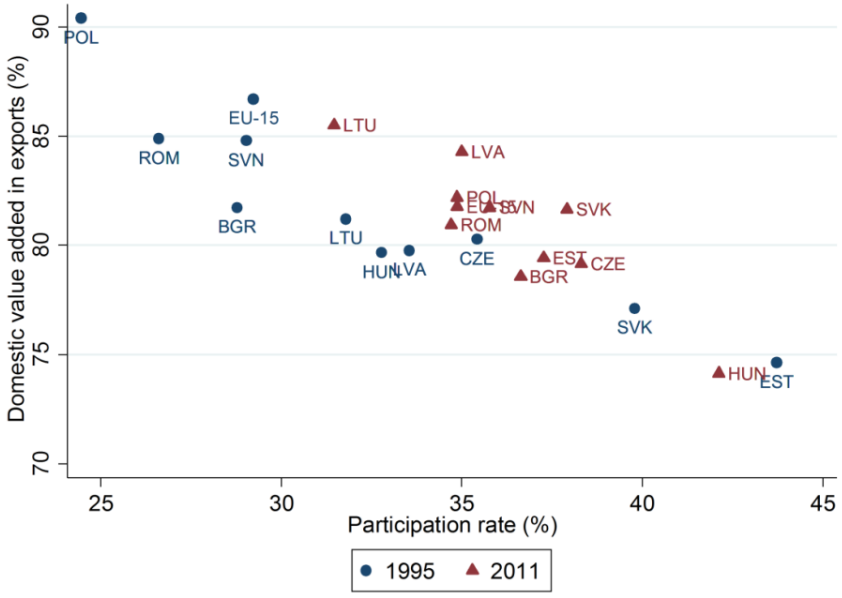
Note: The participation rate identifies the extent to which countries are involved in GVCs and is defined as a share of: (1) foreign inputs in gross exports, plus (2) domestically produced inputs used in third countries' exports (forward participation) in gross exports.

Source: WIOD tables, author's calculations.

Similarly, a rise in the participation share in the services sector can be observed in almost all countries (Figure 12), although there are some exceptions where countries reduced their participation rate from 1995 to 2011 (Estonia and Lithuania). The highest participation rate was in 2011 in Hungary (50%), followed by Czech Republic and Slovakia (both 38%).

The participation rate in services is still lower than that in manufacturing GVCs. In the CEE-10 it was 36% in 2011, while in manufacturing it was on average 52%. In the EU-15 the average growth in share of participation in GVCs in the services sector was even higher (1.2%) than growth of participation in GVCs for the manufacturing sector (1%). As explained by Stephenson and Drake-Brockman (2014), this was enabled by the application of information technology which allowed a segregation of business functions in which intangible knowledge can be commoditised. Consequently, production and trade became geographically separated.

Figure 12: Extent of participation in GVCs and DVA in exports for the services sector in the CEE-10 and EU-15 economies, 1995 and 2011



Note: The participation rate identifies the extent to which countries are involved in GVCs and is defined as a share of: (1) foreign inputs in gross exports, plus (2) domestically produced inputs used in third countries' exports (forward participation) in gross exports.

Source: WIOD tables, author's calculations.

The estimation results of model (8) shown in Table 6 indicate a negative relationship between participation in GVCs and DVA in exports in both sectors. For the services sector this negative relationship increased slightly over time, while for the manufacturing sector this relationship is imprecisely estimated. However, results for the CEE-10 countries show that the negative relationship between participation in GVCs and DVA in exports declined slightly over time in both the manufacturing and services sectors.

This is in line with results provided by UNCTAD (2013), showing that even countries with higher foreign value-added in exports can be in a better position in the long run if their GVC's participation rate is higher, since companies can expand into activities with higher value-added and upgrade their positions within GVCs. Companies create greater DVA from trade for the home country due to the development of domestic productive capabilities. Elsewhere, Rahman and Zhao (2013, p. 11) found a positive and statistically significant relationship between foreign value-added export growth lagged up to five years and DVA export growth (measured as a share of GDP).

Table 6: Dynamics of DVA in exports in relation to participation in GVCs

Dependent variable: DVA in exports

VARIABLES	POLS	FE	POLS	FE
	Manufacturing		Services	
Part	-0.615***	-0.743***	-0.674***	-0.271***
	(0.0090)	(0.0383)	(0.0118)	(0.0442)
Part*t	-0.0018***	-0.0009	-0.001	-0.0056***
	(0.0005)	(0.0005)	(0.0007)	(0.0007)
Part*CEE	-0.0712***	-0.189***	-0.100***	-0.253***
	(0.0079)	(0.0472)	(0.0094)	(0.0642)
Part*CEE*t	0.0017**	0.0026***	0.0063***	0.0087***
	(0.0007)	(0.0007)	(0.0009)	(0.001)
Constant	98.20***	106.1***	107.1***	96.40***
	(0.275)	(1.061)	(0.278)	(1.047)
Observations	5,493	5,493	7,554	7,554
R-squared	0.703	0.824	0.662	0.466
# of country*industry		325		450
Country-industry FE		YES		YES

Notes: Regression estimates of the model (8); robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; *CEE* = 1 if the observation belongs to CEE-10, *CEE* = 0 if the observation belongs to EU-15.

Source: WIOD tables, author's calculations.

1.5.4 Gains from participation in GVCs

Since domestic value-added is composed of (1) components from outside the GVCs and (2) components from within the GVCs, higher DVA does not necessarily imply higher gains from GVCs. The structure of a country's participation in GVCs is composed of two parts: foreign value-added (backward linkages), and value-added created by goods and services to be used as intermediates in third countries' exports (forward linkages). As stated by Banga (2014), the ratio between forward and backward linkages can present an estimate of the range of gains from participation in GVCs. The higher this ratio, the higher are gains for the domestic economy. If the ratio is higher than one, this implies that a country by its participation in GVCs creates and exports more domestic than foreign value-added. Table 7 shows that the ratios are higher than one only in the services sector, and that EU-15 countries have higher ratios than the CEE-10 countries.

However, the evolution of the ratios over time shows that the majority of EU-15 economies experienced a declining trend in gains from GVC participation, while the opposite is recorded in almost all CEE-10 economies. The latter saw their ratios rise, especially in the services sector (positive changes are recorded also in manufacturing, but of a smaller magnitude). However, in both groups of countries exports contain more domestic than foreign value-added in the services sector, while the opposite is observed in manufacturing. These results suggest that gains from participation in GVCs are not assured

(OECD, WTO, & World Bank Group, 2014) since firms have to expand into higher value-added activities in GVCs.

Table 7: Estimation of the gains from participation in GVCs by EU countries, 1995 and 2011

	EU-15						CEE-10						
	Manufacturing			**Services**				**Manufacturing**			**Services**		
	1995	**2011**	**Diff.**	**1995**	**2011**	**Diff.**		**1995**	**2011**	**Diff.**	**1995**	**2011**	**Diff.**
AUT	0.5	0.5	-0.1	1.5	1.1	-0.5	BGR	0.3	0.3	0.0	1.1	0.8	-0.3
BEL	0.3	0.3	0.0	1.4	1.0	-0.4	CZE	0.4	0.4	-0.1	0.8	0.9	0.1
DEU	1.0	0.6	-0.4	3.1	1.8	-1.2	EST	0.3	0.4	0.1	0.9	1.0	0.1
DNK	0.5	0.4	0.0	1.7	0.9	-0.8	HUN	0.4	0.3	-0.1	0.7	0.8	0.1
ESP	0.8	0.6	-0.1	2.8	2.1	-0.7	LTU	0.4	0.4	0.0	0.8	1.5	0.7
FIN	0.7	0.6	-0.1	1.1	1.1	0.0	LVA	0.4	0.4	0.0	1.0	1.6	0.6
FRA	0.8	0.6	-0.2	1.8	2.0	0.2	POL	0.9	0.5	-0.4	1.9	1.1	-0.7
GBR	0.7	0.7	0.0	2.1	1.9	-0.2	ROM	0.6	0.7	0.0	1.1	1.3	0.2
GRC	0.5	0.6	0.0	2.3	1.9	-0.4	SVK	0.5	0.5	0.1	1.0	1.2	0.2
IRL	0.3	0.2	-0.1	0.8	0.5	-0.3	SVN	0.3	0.4	0.1	1.2	1.2	0.0
ITA	0.6	0.6	-0.1	2.5	2.3	-0.2	*Mean*	0.5	0.4	0.0	1.1	1.1	0.1
LUX	0.3	0.3	0.0	1.2	0.9	-0.2							
NLD	0.4	0.4	0.0	1.0	0.9	-0.1							
PRT	0.4	0.5	0.1	1.9	2.0	0.1							
SWE	0.6	0.5	-0.1	1.6	1.3	-0.2							
Mean	0.6	0.5	-0.1	1.8	1.4	-0.3							

Note: Gain from participation in GVC's present ratio between goods and services for intermediate use in the exports of third countries (forward linkages) and foreign value-added (backward linkages).

Source: WIOD tables, author's calculations.

Nevertheless, a country's participation in GVCs can stimulate growth and employment by creating demand for supplementary products and services in host countries (Aiyar et al., 2013). Participation in GVCs thus represents an opportunity for the emergence of a wider range of supporting activities (e.g. transport, logistics, finance, communication, and other business and professional services) (UNCTAD et al., 2013). Additionally, Kim and Li (2014) find that inward FDI is positively related to the level of newly registered firms. Countries can thus benefit from participation in GVCs as the increase in FVA cannot be simply regarded as the replacement of their domestic production, but as their supplement.

1.6 Conclusion

This chapter compares DVA in exports between the CEE-10 and EU-15 countries at the sectoral level with the use of WIOD and the methodology developed by Koopman et al. (2010). The results show that between 1995 and 2011 the gap between exports in value-added and gross terms has increased by almost 15 percentage points in CEE-10. Within the EU-15 economies, this gap increased by little under five percentage points in the EU-15, suggesting that FVA represents a larger share of exports within the CEE-10 countries.

DVA in exports is thus higher in the EU-15, while the decline in DVA share is primarily observable in the manufacturing sector compared to some services sectors where DVA for CEE-10 remained stable (knowledge-intensive and labour-intensive services). DVA in exports recorded a noticeable rise in 2009 compared to 2008, especially in the manufacturing sector in CEE-10 countries (almost 7% growth compared to 4% growth in the EU-15), which suggests that the collapse of international trade due to the crisis had a larger impact on the share of DVA in exports where value chains were more internationally fragmented (OECD, 2013c).

The degree of participation in GVCs was also investigated. For CEE-10 countries, the degree of participation in GVCs is, on average, slightly higher than the EU-15 average, both in the services and manufacturing sectors. Regression results for CEE-10 countries show that the negative relationship between participation in GVCs and DVA in exports weakened slightly over time in both the manufacturing and services sectors. This is in line with research suggesting that even countries with higher FVA in exports can benefit if their GVC participation rate is higher, since in the long run, countries can upgrade their positions within GVCs and increase their DVA in exports even if they initially increase FVA in exports (Rahman & Zhao, 2013, p. 11; UNCTAD, 2013, p. 170).

It should be noted that even though all current EU member countries are generally referred to as developed, the CEE-10 countries had a different historical background which influenced their trade and economic development. The analysis exposes the differences between CEE-10 and EU-15 regarding the structure of the value-added in their exports. Despite the fact that CEE-10 countries became important suppliers of intermediate parts and components, semi-finished and finished goods, it is shown that CEE-10 still have a higher proportion of imports embodied in their exports than EU-15, even though for some sectors convergence is observed. Nevertheless, gains from participation in GVCs are not assured (OECD et al., 2014). Observed data show that CEE-10 countries slowly increased their gains from participation in GVCs, especially in the services sector. However these gains remain lower than in the EU-15 economies.

Certain limitations of the analysis contained within this chapter should be noted. Most importantly, the construction of input–output tables requires extensive global databases which are often incomplete. As a result, the use of some simplified assumptions is required, which may result in an underestimation of the effects of international participation on a domestic economy (Powers, 2012). In particular, trade data for services are not as sophisticated as trade data for merchandise goods, although the WIOD offers the best currently available approximation of global trade flows for services (Dietzenbacher, Los, Stehrer, Timmer, & de Vries, 2013, p. 86).

2 WHAT DRIVES THE DIFFERENCES IN DOMESTIC VALUE ADDED IN EXPORTS BETWEEN OLD AND NEW EU MEMBER STATES?

Abstract

Domestic value added in exports has lately become a key measure of a country's global competitiveness. This chapter analyses the potential drivers of the differences in domestically generated value added in exported goods between 'new' (CEE-10) and 'old' (EU-15) countries. The analysis focuses on the role played by intangible investments, human capital and foreign direct investment. By studying export performance at the industry level for the period 2000–2011, this chapter finds that differences in the share of domestically generated value added depend on investments in intangible capital, in particular investments in research and development. CEE-10 countries suffer from a distinct lack of investments in intangible capital, which is currently only sufficient to enable their mere participation in global value chains without significant development breakthrough. Further, inward FDI causes a reduction in demand for domestic inputs for both groups of countries and hence lowers DVA in exports, while CEE-10 countries are also found to be upgrading global value chains by undertaking outward FDI.

2.1 Introduction

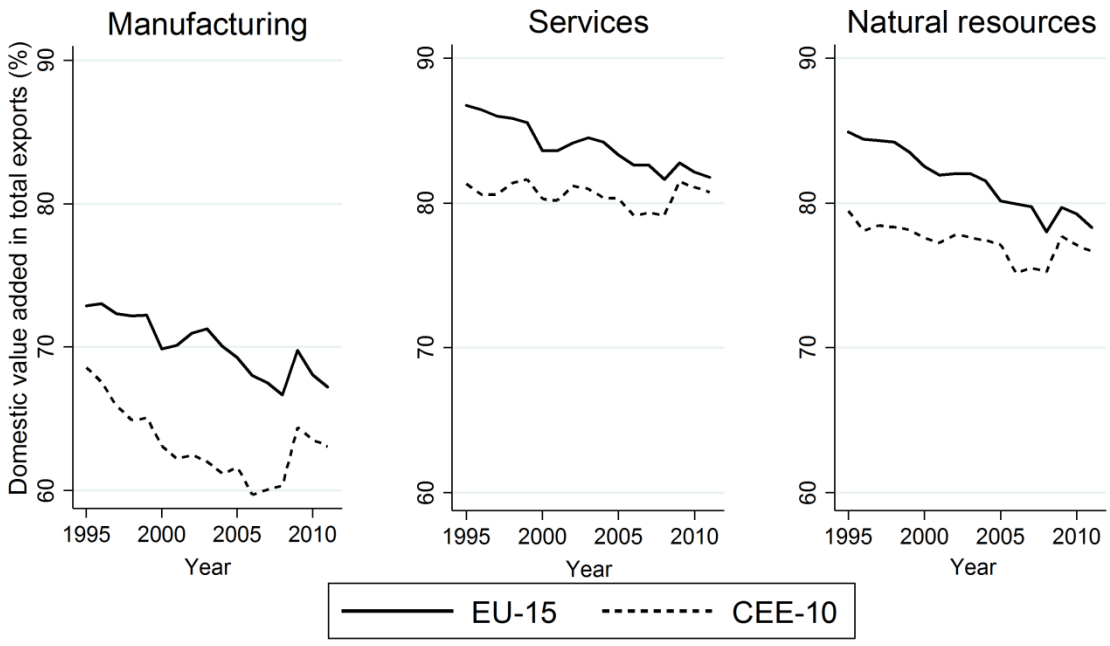
With the emergence of global value chains (henceforth GVCs), different countries in the production chain add value before final consumption. Consequently, most of today's exports are not fully or originally produced in the exporting country since it incorporates a certain share of imported intermediate goods (Cheng & Fukumoto, 2010). Therefore, around one-fifth of a country's exports represents other countries' value added in imported intermediates.

Domestic value added (henceforth DVA) in a country's exports indeed represents an important measure of income from trade and thus acts as an important guideline for development policy (Caraballo & Jiang, 2016). Namely, the high country's volume of exports is not necessarily reflected in its economic growth as it was in the past, since only the domestic part of the country's total exports contributes to its GDP (UNCTAD, 2013).

Focusing on the EU countries, some features of DVA in export dynamics can be identified (Figure 13). First, in the period 1995–2011 a general downward trend in DVA in exports in all sectors is evident, which may be seen using different measures of DVA in exports (Daudin, Rifflart, & Schweisguth, 2011; Dean, Fung, & Wang, 2007; Hummels, Ishii, & Yi, 2001; Johnson & Noguera, 2012b; Koopman, Powers, Wang, & Wei, 2010; Koopman, Wang, & Wei, 2014). Second, the manufacturing sector has the lowest shares of DVA in

export shares compared to services and natural resources, which may indicate the greater fragmentation of cross-border production (Johnson & Noguera, 2012b). Third, a structural break may be observed after 2009 when the trend value of DVA in exports suddenly increased by a great margin. Regarding this sudden increase in DVA, Stehrer and Stollinger (2013) argue that the crisis may have caused firms to start re-shoring part of their offshore activities, which led to higher DVA in exports, especially if such re-shoring activities were present in sectors with relatively high foreign VA in exports. Fourth, although export restructuring within the CEE-10 countries caused the DVA gap to decline relative to the EU-15 countries after 2003, the CEE-10 countries still have a systematically smaller share of DVA in exports compared to the EU-15 countries.

Figure 13: Share (%) of domestic value added in exports for core EU countries (EU-15) and EU countries from Central and Eastern Europe (CEE-10), 1995–2011, by sector groups



Source: WIOD tables, author's calculations.

Since many debates on global value chains ultimately converge on the question of how to upgrade or move up the value chain (Sydor, 2011), it is becoming ever more important to understand the drivers of high-value activities that contribute to greater domestic content in exports. Besides the fact that higher domestic value added in exports is associated with larger or more developed countries (higher income per capita) and countries that are geographically farther from the 'headquarter' economies (Kowalski, Lopez Gonzalez, Ragoussis, & Ugarte, 2015; Stehrer & Stollinger, 2015), research (OECD, 2013b; Stehrer & Stollinger, 2015) shows that progress in GVC upgrading can be attributed to a larger stock of knowledge-based capital (or intangible assets) and more sophisticated exports.

Indeed, intangible assets represent crucial non-material resources that enable a firm's upgrading and are required for the creation of new or improved products and processes (Arrighetti, Landini, & Lasagni, 2014; OECD, 2013b), while more sophisticated exports signal a country's greater accumulation of skills and capacities (Stehrer & Stollinger, 2015).

This chapter considers which factors may be relevant for countries to focus on in order to 'capture' more domestic value from their exports. Following the major findings of existing research and given the limitations on data availability, this chapter's primary research question considers what is mainly driving the differences in DVA shares between EU-15 and CEE-10 countries by exploring the roles of intangible investments, human capital and FDI (the latter represents an important driver of participation in GVCs). Although both groups (EU-15 and CEE-10) are very heterogeneous, this division, while nominally resulting from their later accession to the EU, is based on the fact that CEE-10 had relatively recently undergone the transition from socialist to market economies. This feature provides a common reference for these countries in particular vis-a-vis those of EU-15. To decompose each country's exports into domestic and foreign content, the Koopman et al. (2010) methodology and data from the World Input-Output Database (henceforth WIOD; Timmer, Dietzenbacher, Los, & Stehrer, 2015) are used.

The results provide a solid basis for understanding whether the CEE-10 countries can gain in terms of DVA from higher investments in intangible capital and improved human capital as well as what is the possible different impact of FDI investments in both the CEE-10 and EU-15. This chapter goes beyond the analysis of Koopman et al. (2010) by exploring the determinants of DVA in exports in EU countries and explaining the heterogeneity among two groups of EU countries in their DVA in exports using industry-level data. Further, the existing empirical studies largely focus on evaluating the determinants that may facilitate the establishment of supply links, namely those: influencing foreign value added (FVA) in exports (Rahman & Zhao, 2013; Stehrer & Stollinger, 2015), of participation in GVCs (Kowalski et al., 2015; Stehrer & Stollinger, 2015; Van der Marel, 2015) and of trade in value added (Baldwin & Taglioni, 2011; Brooks & Ferrarini, 2014; Cheng & Fukumoto, 2010; Choi, 2013; Noguera, 2012).

The rest of the chapter is structured as follows. Section 2.2 presents global value chains in the EU and illustrates DVA patterns in the exports of EU countries in light of the differences between CEE-10 and EU-15 countries. Section 2.3 presents the existing empirical research evidence on the determinants of DVA (FVA) and upgrading within GVCs. Section 2.4 describes the regression specification and presents the results, while section 2.5 concludes.

2.2 Global value chains and the determinants of DVA in exports

2.2.1 Global value chains: an overview with a focus on Europe

The simplest and most popular measure of GVCs considers the exports of a specific product and examines the addition of value from country (or industry) to country (industry) along the entire production chain until it is finally consumed (Ye, Meng & Wei, 2015). Activities related with the highest level of value creation are regarded as upstream activities (involving high-skill-intensive activities such as new concept design, research and development etc.) and downstream activities (including marketing, customer service etc.). These activities commonly include "tacit and non-codified" knowledge which is difficult to replicate and they determine the extent of a final product's differentiation in consumer markets (OECD, 2013, p. 219).

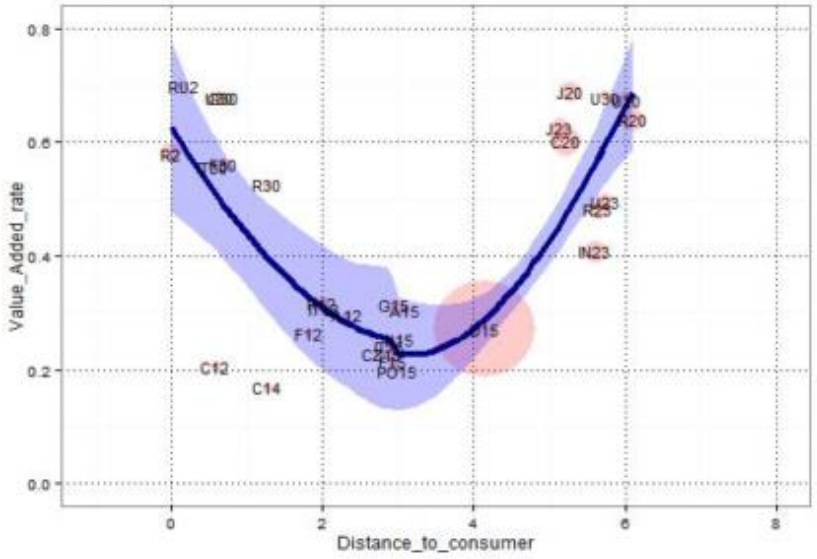
The share of value added in different stages of production can be represented (in a simplified way) by the so-called smiling curve[8] which Ye et al. (2015) identify for several countries and industries in the GVC context by using World Input-Output Tables. As an example, they examine German automobile exports where they find the smile curve was becoming deeper and wider in 2011 compared to that in 1995. In German auto exports, they find that more foreign participants (e.g. French and Chinese industries) characterised by relatively low value added are progressively included in pre-fabrication stages while certain Eastern EU countries (e.g. Czech Republic and Poland) have acquired a greater role in this value chain (Figure 14).

Cieślik (2014) finds that a considerable share of exported goods from the CEE-10 goes through Western Europe's GVCs and that exporters from the CEE-10 are predominantly positioned in the downstream stages of production[9]. In addition, CEE-10 countries with greater connections to Western European countries (particularly with Germany) are more integrated into GVCs (Cieślik, 2014). However, Behar and Freund (2011) observe that new EU member states have become an important source of intermediates for the core EU members (EU-15), while the EU-15 has not become a more significant trading partner for the new EU member states. Further, Amador et al. (2015) showed that the majority of euro area countries has strong international production connections both inside and outside the monetary union, especially with China and Eastern European countries.

[8] A smile curve is a U-shaped curve with pre-manufacturing, manufacturing and post-manufacturing stages on the X-axis in connection with value added on the Y-axis.

[9] If a country has high DVA in a trading partner's exports, it means that the country is positioned in the upstream stages of GVCs. As the country increases the share of FVA embodied in total domestic exports, its position approaches downstream stages (Cieślik, 2014).

Figure 14: The "smile curve" for the German automobile value chain: foreign participants in 2011.



Legend A-Australia, RU-Russia, C-China, J-Japan, F- France, PO-Poland, CZ-Czech Republic, R-Rest of the world, U-USA, IN-India; Numbers: see Appendix 3 (Sector number).

Source: M. Ye, B. Meng and S. Wei, Measuring Smile Curves in Global Value Chains, 2015, p. 20.

Following the EU enlargement process in particular, firms from EU hub countries (e.g. Germany at the top, followed by Italy, France, Netherlands and UK) have engaged in trade with Eastern European countries. The key factors in Central and Eastern Europe that attracted foreign investors were the lower labour costs, strategic location, diversified economy, development strategies fostering innovative sectors of the economy, the lower risk of business performance, the relatively well-developed infrastructure and liberalisation of trade and capital flows (Cieslik, 2014; Giedraitis & Rastenienė, 2009; Sass & Fifekova, 2011). The leading countries in terms of inward foreign direct investments per capita in 2013 were Estonia (USD 16,000), Czech Republic (USD 12,700), Hungary (USD 10,900), and Slovakia (USD 10,700) (UNCTAD STAT, 2016).

Yeats (1999) argues that the economic incentives (often wage differentials) which drove the sharing of production in Europe appeared to be similar to those motivating such behaviour in North America. Manufacturers from Europe's high labour cost regions transferred some of their (mostly more labour-intensive) production and assembly to countries with lower labour costs. Other important determinants of the scale of the outsourcing, apart from labour costs, were education and skills, transportation and financial infrastructure. In a survey of firms conducted by Marin (2011), 660 Austrian and German firms with 2,200 investment projects in Eastern Europe between 1990 and 2001 classified

the factors motivating their investments in Eastern Europe. The factors considered were related to access to Eastern Europe's market, its size, lower production costs, the availability of trained and skilled labour and the avoidance of exchange rate risk and transport costs. Interestingly, Marin (2011) also finds that Austrian and German multinationals are likely to outsource the most skill- and R&D-intensive activities to Eastern Europe and specialise in the more labour-intensive stages of production.

2.2.2 Patterns of domestic value added in exports: a comparison between EU-15 and CEE-10 countries

The decline in value added relative to gross exports corresponds to the rapid changes that started to occur in the world economy after 1990, such as information technology revolution, emerging markets' trade liberalisation, accession of new member countries to the EU and ratification of regional trade agreements. All of the above helped reduce the costs of international trade, prompted the replacement of domestic input suppliers with foreign ones and lowered the domestic value-added content of trade (Johnson, 2014). However, as stressed by the IMF (2015) high DVA can be an indicator of a good structure of domestic value chains, but can also suggest slower integration into GVCs.

In the period 1995–2011, the DVA[10] in exports for all EU countries declined from 79.2 to 74.9 percent, i.e. by 0.3 percent per year on average. The EU-15 recorded a 0.4 percent average decline per year, while for the CEE-10 countries the average decline was slightly lower (0.2 percent per year). The overall fall in the average DVA share is primarily the result of a noticeable drop in DVA in the manufacturing sector, while for the services sector DVA in exports remains stable. As Rahman and Zhao (2013) explain, this may indicate less fragmentation in international trade for the services sector.

Based on a multi-sector structural gravity model and input-output linkages, Johnson and Noguera (2012b, 2017) show that the changes in value added to gross exports[11] over time can be explained by such increased fragmentation supported by regional trade agreements. Moreover, they find that the emerging markets' increased importance in global GDP and changes in the sectoral structure of world output cannot explain the decline in value added in exports over time. Johnson and Noguera (2012b) mention cases from Europe (e.g. Poland, Germany) where value added fell possibly as a result of the country's integration into the European production structure and cases from non-European countries (e.g.

[10] The methodology for measuring value added in exports (Appendix 4) used in this chapter is the conceptual framework developed by Koopman et al. (2010, pp. 5-21) and incorporates all previous measures of vertical integration (Hummels et al., 2001; Dean et al., 2007; Daudin et al., 2011; Johnson & Noguera, 2012a; Koopman et al., 2010).

[11] The ratio of value added to gross exports in Johnson and Noguera (2012b, 2017) is denoted as the VAX ratio and equals the sum of (A), (B) and (C) divided by gross exports, as defined by Koopman et al. (2010).

Mexico) where a similar situation emerged, first due to the unilateral trade liberalisation and second due to the North American integration (NAFTA).

Further, Johnson and Noguera (2012 in Noguera (2012)) studied whether the fact that the VAX ratio in the manufacturing sector is considerably lower than in agriculture and the services sector is a consequence of the increased fragmentation of cross-border production (within effect), or simply the outcome of changing the sectoral structure of exports (between effect). They find that the increased fragmentation of cross-border production determines approximately 85 percent of the total change in the world VAX ratio and that it accounts for the large drop in the manufacturing sector's VAX ratio.

As seen in Figure 13, DVA in exports is higher for EU-15 countries (on average by 5 percentage points) than for the CEE-10. Table 8 further shows significant heterogeneity across manufacturing industries in terms of DVA between CEE-10 and EU-15 countries. Indeed, the difference between the highest share (Leather and Footwear in EU-15; Food & Tobacco in CEE-10) and the lowest share (Metals in EU-15; Rubber & Plastics in CEE-10) of DVA is 15 percentage points in 2011. In all industries, DVA in exports has decreased over time. The biggest drop in the CEE-10 on average is registered in Electrical & Optical Equipment, while in the EU-15 the greatest drop is registered in Chemicals, Metals and Transport Equipment (the car industry), which are the industries with the highest export shares in total exports.

Table 8: Domestic value added by industry in the manufacturing sector

	EU-15			**CEE-10**		
	2011	**1995**	**Δ pp.**	**2011**	**1995**	**Δ pp.**
Food & tobacco	71.9	78.6	-6.7	72.5	77.1	-4.6
Textiles & clothing	68.1	71.2	-3.1	62.7	67.7	-5.1
Leather	75.2	77.8	-2.5	63.7	68.1	-4.5
Wood	70.5	75.0	-4.5	71.4	75.9	-4.4
Paper & publishing	71.2	75.7	-4.5	68.7	70.8	-2.1
Chemicals	64.0	72.5	-8.5	57.0	63.5	-6.5
Rubber & plastics	65.1	70.1	-5.0	56.8	61.3	-4.5
Other non-met. min.	73.4	80.0	-6.6	68.9	70.5	-1.6
Metals	60.1	67.6	-7.4	57.2	64.6	-7.4
Machinery	66.2	70.8	-4.6	62.5	69.8	-7.3
Electrical & optical eq.	62.9	68.0	-5.1	54.0	63.6	-9.6
Transport eq.	57.7	64.9	-7.2	57.8	65.0	-7.2
Manufacturing. nec	68.3	74.3	-6.1	66.8	73.3	-6.5
Mean	*67.3*	*72.8*	*-5.5*	*63.1*	*68.2*	*-5.5*

Note: Δ pp is the percentage point change in the DVA share between 1995 and 2001

Source: WIOD, own calculations.

Especially in Germany, the car industry accounts for almost 20 percent of total exports, but it is also the industry with the highest offshoring intensity (Stehrer et al., 2012). Due to the availability of cheap and relatively skilled labour, firms from Austria and Germany in particular relocated parts of their production processes to Eastern Europe after the fall of the Berlin Wall in 1989 (Marin, 2011). For example, in Germany the DVA share in the automobile industry dropped from 79 percent in 1995 to 65.5 percent in 2011. As explained by Timmer et al. (2014), this drop can be associated with the decline in value added generated by less skilled workers, while at the same time the shares of value added of high-skilled workers and capital remained almost unchanged. On the contrary, the foreign value added share increased due to the imported intermediates, which generated income for capital and labour employed outside of Germany.

However, there is also heterogeneity between countries. Figure 15 presents deviations from the average EU-15 DVA share in every CEE-10 country in industries with the highest export shares in total exports in the CEE-10[12] (the difference in all other industries is presented in Appendix 7). These are, however, also the industries with the highest level of foreign value added in CEE-10 countries' exports. The transport equipment and electrical and optical equipment industries (especially in Czech Republic, Slovakia, Poland and Hungary) are regarded as very attractive to foreign investors (Cieślik, 2014).

The very same countries (Czech Republic, Hungary and Slovakia) are characterised by the biggest negative DVA difference in exports from the EU-15's share in electrical and optical equipment industries. Although total DVA is much lower than in the EU-15, the Czech Republic and Hungary (beside Romania and Estonia) are lagging behind the EU-15 countries[13] the least among the CEE-10 in this industry's global production chains in 2009, but still cannot compare with the countries known as 'Asian Tigers' where the electrical and optical equipment industry has an important tradition (Cieślik, 2014). On the other side, in Estonia the DVA difference in exports from the EU-15's share fell by 20 percentage points from 2001–2006 to 2007–2011.

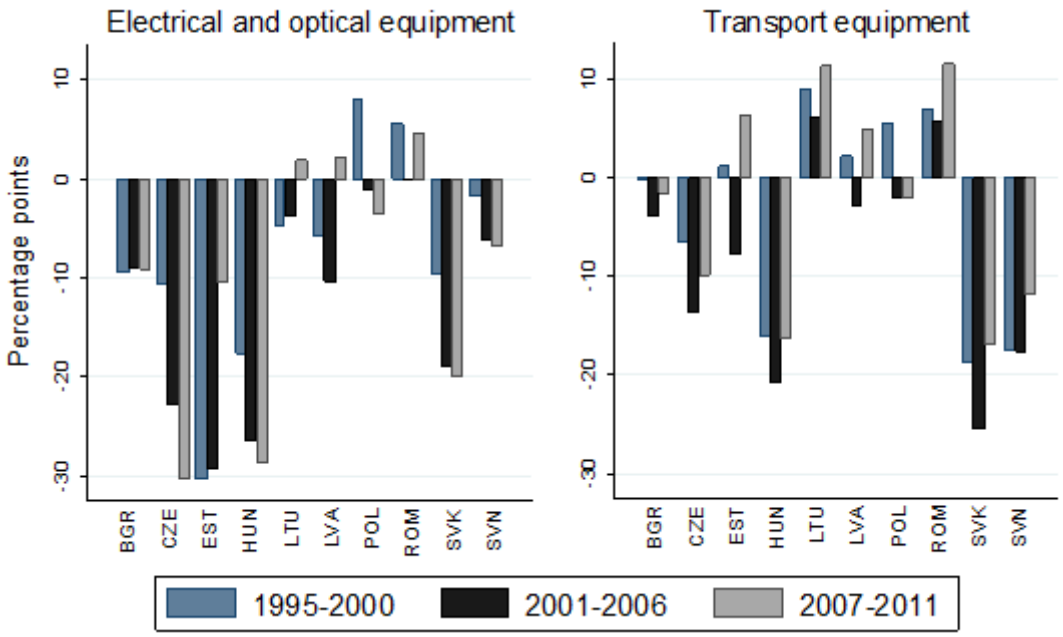
Considering the transport equipment industry, the deviation in DVA in exports is the highest in Slovakia, Hungary, Slovenia and the Czech Republic. As explained by Cieślik (2014), these countries are locations where the world's largest car producers have established factories. This conforms with the view of Baldwin and Lopez-Gonzalez (2015) that multinationals do not depend on local know-how, but use their own knowledge and technology. On the other hand, other CEE-10 countries have even higher DVA in transport

[12] Electrical and optical equipment and Transport equipment account for 20 percent of total exports in the CEE-10.

[13] Higher DVA in exports of trading partners signifies that a country has a higher position in GVCs, suggesting that the country is moving to upstream segments. On the contrary, a country's position in GVCs is declining with an increasing share of FVA in domestic exports, suggesting the country's movement towards downstream segments (Cieślik, 2014).

equipment industry exports compared to the EU-15 average. Regarding the production of transport equipment, Cieślik (2014) found that five of the CEE-10 countries were positioned in an upstream global production chain in 2009 (Czech Republic, Romania, Hungary, Slovakia and Poland) while Slovenia, Bulgaria and the Baltic States had a low position in GVCs as the transport industry there does not have such a long tradition.

Figure 15: Differences in DVA in exports between individual CEE-10 and EU-15 countries' average in two industries with the highest export shares, in percentage points in the observed -periods.



Source: WIOD, own calculations.

Based on empirical evidence from the literature and theoretical predictions concerning upgrading within GVCs, the next section discusses possible determinants of DVA in exports and analyses their impact on DVA in each group of EU countries.

2.3 Theoretical background and existing research findings

Although the theoretical and empirical literature regarding GVC trade is developing very quickly, the GVC literature is mainly empirical. However, certain GVC-related theoretical literature is emerging. For example, Milberg (2004) describes the endogenous asymmetry of the market structure in GVCs where firms located at the top of GVCs are likely to hold monopolistic power. Due to the market structure's asymmetry, the bargaining power between the firms at the top and firms at the bottom of GVCs is also asymmetric, thus creating huge obstacles for the latter in value-added upgrading. Heintz (2005) developed a

model in the unequal exchange tradition with the aim of analysing the distributive dynamics of global commodity chains. The model observes corporations that specialise in high value-added activities (e.g. product branding), intermediaries (which coordinate the production) and subcontractors (generally from other countries) that specialise in low value-added activities (production), with an unequal distribution of gains from globalisation as an outcome of such dynamics.

The latest research from Li and Liu (2014) provides a theory regarding GVCs evolving through time, with a focus on moving up the value chain. In their theory, developed countries (North) offshore certain tasks to developing countries (South) that use technology which is as efficient or slightly less efficient than the North's. Both Southern and Northern countries move up the value chain with Southern countries performing more difficult tasks to a greater extent while Northern countries are specialising in highly sophisticated tasks. However, productivity in both groups of countries increases over time as the South achieves productivity improvements via learning-by-doing, while the North does so via specialisation. In their theoretical model, increased wages represent the key mechanism of the convergence. Yet, due to the equalised wages between countries, no further tasks are offshored to the South and thus its technologies lag behind the North's. Ultimately, this prevents the South from performing more sophisticated tasks.

As explained by mainstream economic theory, cost reduction is the prime reason behind the reallocation of part of production processes to foreign countries (Galar, 2012). Since activity offshoring is mostly associated with low-skilled parts of production, its outcome for the destination countries is quite apparent as they should enjoy the benefits of low-skilled labour (Bottini, Ernst & Luebker, 2007). Outsourcing's effects on the ratio of the skilled to unskilled labour wage bill in Hungary, Czech Republic and Poland are studied by Egger and Stehrer (2003). They examine the effect of intermediate goods trade on unskilled labour and find that exports and imports of intermediate goods have affected unskilled labour positively in terms of wage bill growth in these countries

Yet, as explained by Feenstra and Hanson (1997), this is not necessarily the case. They argue that within-industry shifts in labour demand (for skilled labour) are completely consistent with increased trade in general and specifically with greater outsourcing. They thus suggest that activities considered low-skilled in developed countries might be regarded as high-skilled in developing countries.

Elms and Low (2013) observe a trend of decreasing differences in wages (or wage convergence) between developed and developing countries, and describe it as important since it influences GVCs by changing the nature of trade between countries. This is related to: (1) the situation when developing countries (e.g. China) are producing sophisticated intermediates that had previously been imported; and (2) the widening geographical extent

of GVCs to new countries (e.g. Vietnam) with lower wages (due to wage increases in countries that have primarily participated in GVCs, e.g. China, Mexico, Poland).

2.3.1 Upgrading within GVCs

Upgrading can be described as a process in which firms (economies) move to (production) activities with higher valued added in order to increase their gains and profits resulting from GVC participation (Gereffi, 2005 in Barrientos et al., 2011). The extent of the GVC participation's impact on economic development depends on how deeply the domestic economy is integrated into the global economy. Domestic firms can gain from GVC participation opportunities, but there are crucial factors (e.g. human capital, infrastructure, access to finance) that can restrict their ability to do so (Fernandez-Stark et al., 2013; Bamber et al., 2014). As Stöllinger (2016) mentions, variations in firms' (countries') innovative capabilities can be the main factor in successful GVC participation.

However, for local firms, the opportunities to increase productivity and upgrade to higher value-added parts of GVCs depend on the type of GVCs in which they are engaged, the economy's business and institutional environment, the creation of domestic value added and the ability to move to exports entailing increased technological sophistication (UNCTAD, OECD & WTO, 2013). The process of upgrading is regarded (following Kaplinsky and Morris (2001)) as a competitive process where successful and faster (compared to competitors) innovation is required. Regarding such upgrading, Humphrey and Schmitz (2002) identify four different ways: (1) *process upgrading* which refers to more efficient and organised production or implementation of new technologies; (2) *product upgrading* which relates to the production of more complex products; (3) *functional upgrading* which relates to an increase in the production's overall skill content; and (4) *inter-sectoral upgrading* that is related to the move to new productive activities (industries). Upgrading can also be realised by stronger inter-industry interdependencies based on the gradual inclusion of domestic value added in final exports (Escaith, 2016).

Still, as explained by Pietrobelli and Rabellotti (2011), the challenge of upgrading is not always about moving along the value chain (into more advanced activities). Upgrading also concerns deepening technological capabilities within the existing position in the chain. This refers to the situation when firms can capitalise on opportunities for upgrading in each part of the value chain (exploring new original characteristics and features), which also requires higher skills and technological capability.

Upgrading in GVCs is driven by knowledge-based capital which is a key factor in a mature economy's manufacturing competitiveness. Further, activities with higher value added are generally in parts of the value chain that intensively employ human and knowledge-based capital (OECD, 2013b). Thus, in order for a firm to upgrade within GVCs a country has to

provide an efficient business and institutional environment that supports innovation, investment in knowledge, upgrading of skills, diffusion of technology and entrepreneurship that can enhance the country's development level and its technological and export sophistication (OECD et al., 2014).

As stated by Zhu and Fu (2013), a country can create or acquire knowledge capital from domestically created knowledge or by incorporating international knowledge obtained through trade participation and openness to FDI. Countries usually foster FDI with the aim of obtaining dynamic benefits for their domestic economies by relying on so-called spillovers from FDIs, which relate to the diffusion of knowledge (technology and all forms of explicit and implicit knowledge related to production) from the affiliates of multinationals to domestic firms (Winkler, 2013, p. 2). Damijan et al. (2013) studied spillovers in ten transition countries for period 1995-2005 and arrived at the conclusion that spillovers to domestic firms depend upon their absorptive capacity and productivity. In many developing and transition economies policy-makers make attracting FDI one of their top policy priorities since they expect the FDI inflows to provide capital, management skills, new technologies and marketing approaches (Javorcik, 2004, p. 605). However, Konings (2001) analysed data for three transition economies for period 1993-97 and found negative spillovers to domestic firms in Bulgaria and Romania and no spillovers in Poland. On the other hand, for advanced economies, upgrading can entail acquiring general competitiveness based on outsourcing inputs not related to core activities and thus focusing on parts of the value chain where firms (economies) have a bigger competitive advantage (Escaith, 2016).

2.3.2 Potential factors of value added in exports

Stehrer and Stollinger (2015) research potential factors that foster or hinder the further economic integration of the manufacturing sector. Assuming Germany to be the 'anchor' of the Central European supply chain, this enables them to use the classical gravity model (country-level version) and thus to introduce 'distance to Germany' and 'relative GDP to Germany' as control variables. They find that greater inward FDI is associated with higher foreign content in gross exports and that larger countries tend to have, *ceteris paribus*, a lower FVA, but they do not find a statistically significant result between outward FDI and FVA in exports. Similarly, using TiVA data for 57 countries Kowalski et al. (2015) find a positive and significant correlation between FVA and revealed openness to FDI (measured as a share of inward FDI stock as a percent of GDP). As they explain in their analysis, in the observed countries inward FDI is likely to be more related with imports of foreign intermediates for export processing. They also find that the larger the distance from the main manufacturing hubs, the lower the FVA in exports.

Regarding the skill structure of the workforce, Stehrer and Stollinger (2015) find a negative coefficient for medium-skilled labour, suggesting that more medium-skilled labour (including an important group of skilled production workers) reduces FVA Surprisingly, they do not find any correlation of FVA in exports with the share of high-skilled labour. They also determine a negative correlation for export sophistication since, as they explain, the more sophisticated a country's export base is, the greater the country's skills and capacities. Hence, the country uses fewer imported inputs and thus decreases the FVA share in exports.

An important function of promoting an upgrade in GVCs can be attributed to investment in knowledge-based capital (or intangible assets), which is also an essential source of competitiveness (De Backer & Miroudot, 2014). Intangible assets represent the set of resources that promote a firm's upgrading of its GVC activities (OECD, 2013b) or the crucial non-material resources required for new or improved products and processes to be created or sold (Arrighetti et al., 2014). Strategic resources define a firm's capacities which are compared to the capacities of the firm's competitors, and provide a platform for the creation of greater value added in GVCs (OECD, 2013b). Following Corrado, Hulten, and Sichel (2005), intangible assets are classified in three main groups: (1) Computerised information; (2) Innovative property; and (3) Economic competencies. The first group includes software and databases, the second encompasses science and engineering R&D, non-science innovation efforts such as product design, copyrights and trademarks, while the third group relates to brand equity, firm-specific technological and managerial skills, networks and organisational structure. The importance of economic competencies for competitiveness is pointed out by a survey of Japanese firms, with manufacturing skills, brand and customer recognition and agile and flexible organisation being the crucial ones (OECD & World Bank Group, 2015). The survey results suggest that globalised firms' advantage lies in their larger distribution of knowledge-based capital forms that are more difficult to copy or imitate (OECD, 2013b).

The OECD (2013b) studies the role of knowledge-based capital (proxied by intangible capital stock) in GVC upgrading. Using data from the Intan-Invest database for 14 European countries (where only two countries in the sample belong to the CEE-10 group), they find that a larger stock of knowledge-based capital stimulates greater value added in exports (measured in VAX terms). They find notable differences in size and significance when they observe estimated coefficients among the three subgroups of intangible capital (computerised information, innovative property and economic competencies). Among all subgroups, the coefficient on economic competencies appears to be the largest and most significant, while for computerised information it is considerably smaller and non-significant. Jona-Lasinio, Manzocchi, and Meliciani (2016) use the same data for 14 European countries and find that intangible assets contribute positively to both forward and

backward participation[14]. R&D and training and organisational capital seem to be more important for forward participation while market and advertising seem to be more relevant for backward participation. They also find that intangible assets positively affect value appropriation (higher DVA relative to FVA).

Caraballo and Jiang (2016, p. 294) focus on the determinants that may explain the 'value-added erosion' and find that an increase in the foreign high-skilled labour share embodied in a country's imports has a negative impact on the share of value added generated by exports. In addition, they find a positive correlation between the tariffs applied to manufactured products and the DVA share, suggesting that countries which practise greater protectionism or have strong industrial policies are likely to increase their DVA share in exports. Albeit with smaller significance, Caraballo and Jiang (2016) also find a positive correlation between the number of patent applications made by residents and the DVA share.

However, for firms seeking to upgrade their role in GVCs based on the formation of knowledge-based capital access to finance is vital in this process. As noted by Manova and Yu (2012, 2016) strengthening capital markets represents an important precondition. In their study they present that credit-constrained exporting firms from China are likely to conduct pure assembly with low value added (thereby earning low profits) compared to less financially constrained firms which conduct import and assembly or even normal trade. However, as explained by the OECD (2013b) financial development might have a more significant contribution to DVA (in VAX terms) in emerging economies. Namely, its study sample includes European economies that have relatively developed (advanced) financial institutions which may explain the insignificant coefficient on the measure of financial development when DVA is regressed on the financial development indicator.

The key ideas from the existing research findings suggest that the main factors that could improve firms' movement towards the upper levels of the global value chain are more sophisticated exports, a larger stock of knowledge-based capital, an increase in patent applications and better financial development. In addition, lower FVA in exports can be found in larger or more developed countries (higher income per capita) and countries that are geographically farther from the 'headquarter' economies.

The next section follows the main findings while analysing the impact of possible DVA determinants in exports in each group of EU countries.

[14] Backward participation refers to the foreign value-added content of gross exports. Forward participation refers to domestic value-added embodied in foreign exports (Jona-Lasinio et al., 2016).

2.4 Empirical strategy

2.4.1 Regression specification

If a conclusion is drawn based solely on the observations and findings already presented, one could say there is a significant difference in the share of DVA in exports between the CEE-10 and the EU-15. This chapter attempts to explain these DVA differences in exports between the two groups of countries by analysing possible determinants that are expected to drive the share of DVA in exports. As mentioned by Kowalski et al. (2015), there is no common principle for exploring the determinants of GVC trade so I rely on the theoretical predictions concerning upgrading within GVCs and predominantly on the existing research findings. To distinguish between the two groups of EU countries, a dummy variable (*CEE*) is introduced in order to compare the partial elasticities. The indicator variable is interacted with each of the selected variables and thus the following empirical specification is estimated:

$$DVA_{ijt} = \alpha + \delta CEE + (\mathrm{X}_{ijt-1})\beta + \left(\mathrm{X}_{ijt-1} x CEE\right)\gamma + \mu_i + \mu_j + \mu_t + \varepsilon_{ijt} \qquad (9)$$

where *DVA* represents the estimated measure of DVA in exports as a share of total exports relating to country *i*, industry *j* and time *t*. ε_{ijt} is the random error term, while μ's are country-, industry- and time-fixed effects. X_{ijt-1} represents the vector of explanatory variables, $X_{ijt-1}xCEE$ represent interaction terms between the explanatory variable and the *CEE* dummy variable, where *CEE* = 1 if the observation belongs to the CEE-10 and *CEE* = 0 for the EU-15. All variables are transformed using a natural logarithm which allows the coefficients to be interpreted as elasticities. A unit of observation in the fixed-effect estimation is a country-industry pair.

The main explanatory variables (*X*) included in equation (1) are business enterprise research and development expenditure as a share of value added (*BERD*) as a form of intangible capital investments, human capital proxied by skill intensity (*SKILL*) measured as a share of hours worked by high-skilled workers in total hours worked, openness to FDI as a share of inward FDI stock in GDP (*IFDI*), firms' capability of economic integration as a share of outward FDI stock in GDP (*OFDI*), the share of exports to the EU's five most developed countries (*EXPTOP5*) and the share of imports from the EU's five most developed countries (*IMPTOP5*), imports of intermediates from China as a share of total intermediates consumption (*IMintCHN*) and hourly wage as a proxy for productivity (*WAGE*).

There are other potential variables that might be differently correlated with DVA in exports in both groups of countries, such as export sophistication, capital intensity, access to finance and economic complexity but are not available at the industry level.

Additionaly, variable that controls for exchange rate between countries was initially included in the regression analysis, but it didn't turn out significant.

All regression specifications are estimated with a fixed-effects model, which allows a correlation between the vectors of industry- and country-specific time-invariant effects (μ_{ij}) and the independent variable. The Sargan–Hansen test statistic confirms the fixed effects as more appropriate than the random-effects model, meaning that unobservable factors (i.e., shocks in business cycles, differences between industries, culture and history, participation in GVCs) are important for determining DVA in exports. In all regressions, standard errors are calculated using White's heteroscedasticity robust standard errors.

To reduce potential concerns with endogeneity and to allow for a deferred reaction of DVA, all explanatory variables are lagged by one year. Further, in the robustness check the explanatory variables are also lagged by two and three years. As an alternative method for estimating the regression model, I also employ the difference GMM estimator in the robustness check.

However, when considering the effect of selected determinants on DVA in exports, the fact that the causality can also operate in the other direction has to be taken into account. A possible endogeneity problem can exist between some independent variables and the dependent variable. For example, a higher share of R&D can lead to higher DVA, but the direction of causation may also be reversed, i.e., a higher share of DVA can lead to higher R&D investments. The same problem can appear with *IFDI* and *WAGE*. The endogeneity problem could also arise due to the measurement error (regressors correlated with the regression error ε_{ijt}). In my case, the regression error can, for example, be correlated with *SKILL* due to the omission of ability and quality of education. In addition, there are other omitted and unobservable variables correlated with DVA such as managerial skills or firm-specific investments. Thus, the purpose of my research is not to determine the existence of a direct causal relationship between the selected determinants and DVA, but to examine the conditional correlations of individual factors with DVA.

2.4.2 Data and descriptive statistics

To undertake my analysis, I combine several datasets available at the industry level for EU-25 countries in the period 2000–2011. The main data used come from the World Input–Output Tables (WIOT) which serve as a basis for estimating the shares of DVA discussed above. An important advantage of the World Input-Output Tables is that the data are available on an annual basis for every EU-25 country, although where data were unavailable they were compensated by use of the extrapolation and interpolation procedure, approximations of global trade flows and simplifying assumptions. Regarding the I-O Tables, Kee and Tang (2016) explain that samples of I-O Tables mainly consist of

large firms which tend to have lower DVA and consequently a bigger sample of large firms can lead to lower estimates of aggregate DVA.

Table 9 presents descriptive statistics for the variables used in the main regression[15]. It includes averages at the industry level, separately for both groups of countries. Lower investments in intangible capital, a lower share of skilled labour, lower OFDI investments, a lower hourly wage etc. can be observed for the CEE-10 compared to the EU-15[16].

Table 9: Descriptive statistics of the variables used in the main regression, manufacturing (mean values 2000–2011)

VARIABLES	EU-15	CEE-10
DVA_{ijt} (%)	69.06	61.98 [a]
$BERD_{ijt}$ (%)	4.76	1.82 [a]
$IFDI_{ijt}$ (%)	1.09	1.10
$OFDI_{ijt}$ (%)	1.14	0.09 [a]
$SKILL_{ijt}$ (%)	17.88	10.76 [a]
$WAGE_{ijt}$ ($)	28.74	5.88 [a]
$IMintCHN_{ijt}$ (%)	1.30	1.38
$EXPTOP5_{ijt}$ (%)	42.38	38.17 [a]
$IMPTOP5_{ijt}$ (%)	41.16	37.10 [a]

Legend: [a] the difference between EU-15 and CEE-10 is significant at $p<0.001$, [b] the difference between EU-15 and CEE-10 is significant at $p<0.05$.

Source: Author's calculations.

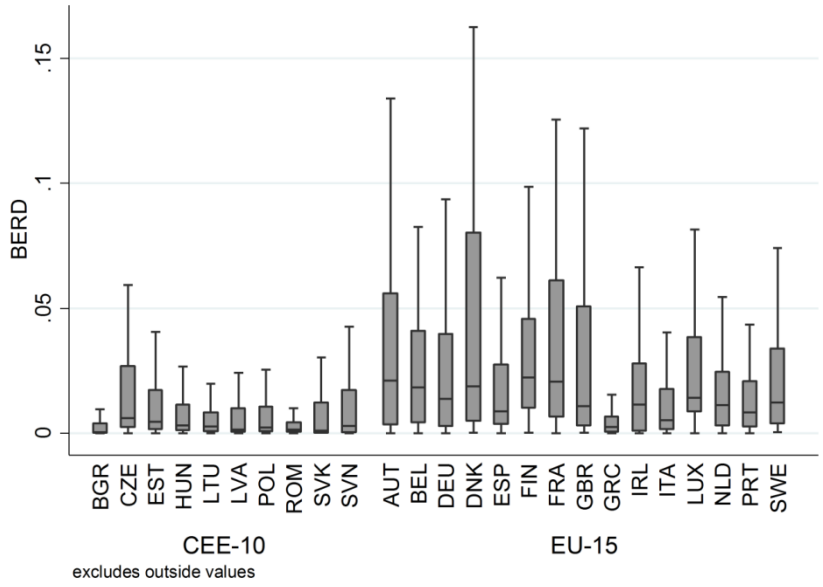
The greatest problem lies in gathering the data for intangible investments at the industry level. To capture the role of intangible capital investments, I rely on business enterprise research and development expenditure (*BERD*). This is the only available proxy for intangible investments on the industry level for all EU countries provided by Eurostat and can be used as a measure of innovation (Bogliacino, Piva, & Vivarelli, 2012; Klette & Forre, 1998). The bottleneck regarding the BERD data is the variety in the annual and sectoral availability of data for an individual country. *BERD* expenditure data are divided by value added generated in the same industry. Figure 16 shows the differences and variability of these values across countries. Among the EU-15 countries, these investments are highest in Denmark while for the CEE-10 they are highest in the Czech Republic. In manufacturing industries, the biggest investments are recorded in the industries Leather and Footwear, Electrical and Optical Equipment and Transport Equipment. The highest

[15] Descriptive statistics for the variables used in the robustness check is presented in Appendix 9, Table 9-1.
[16] For a more detailed description of the data sources and the way in which the variables are defined, see Appendix 6.

value of the *BERD* coefficient indicates that firms can benefit from greater investments in intangible capital in their process of upgrading within GVCs.

The empirical literature offers no clear evidence on the relationship between innovation and involvement in a GVC. A country's participation in GVCs may affect its innovation performance in either direction, as Felice and Tajoli (2015) explain. They refer to Eaton and Kortum (2001) when mentioning that the international fragmentation of production may increase the incentive for investment in R&D based on stronger foreign demand for domestic inputs. As participation's negative effect, they mention the decrease in the incentive for innovation and patenting due to possibility of accepting an alternative strategy (based on lower costs or the use of foreign technology) for competing in international markets.

Figure 16: Heterogeneity of business enterprise research and development expenditure (BERD) across countries



Source: Eurostat, OECD, author's calculations.

Data on inward and outward FDI stocks (*IFDI* and *OFDI*) are acquired from Eurostat combined with OECD data and are available for 11 out of 13 manufacturing industries and for all service industries. Kowalski et al. (2015) note that openness to FDI can be related to the type and extent of GVC participation. Firms can integrate into GVCs through FDI based on mergers and acquisitions by foreign MNEs which can result in foreign markets entry, use of new technology, development of new products but also in an increase in intermediate imports. However, firms seeking new markets can access host countries through FDI with the aim of servicing local markets (Kowalski et al., 2015). In exploring the impact of *IFDI* on DVA, a positive value of the inward FDI coefficient would indicate

that the recipient countries indeed did not increase imports from the countries of origin of the FDIs.

As a proxy for international outsourcing (offshoring), I use the outward FDI activities (*OFDI*) indicator devised by Kleinert (2003). The measure only comprises the production of intermediates within a firm's or firm group's boundaries and, as such, is not appropriate for measuring offshoring in the case where a firm purchases intermediates from suppliers outside the firm's or firm group's boundaries (Pilat & Wolfl, 2005). Another indicator by Feenstra and Hanson (1999) measures foreign outsourcing as imported intermediates that are acquired from the same two-digit industry. However, it does not consider the situation where outsourced services that were separated from the firm group are not classified in the same industry as they were outsourced from (Feenstra & Hanson, 1999; Pilat & Wolfl, 2005).

The data source for hourly wages (*WAGE*) and share of skilled labour (*SKILL*) is the WIOD Socio-Economic accounts and is available for all industries and countries. A higher value of the wage[17] coefficient would indicate that high-wage countries mainly outsource low value-added activities to countries with a lower wage. For the share of skilled labour, I use data of hours worked by high-skilled persons engaged as a share of total hours worked. High-skilled workers represent workers holding a tertiary education (ISCED levels 5 and 6). A higher value of the coefficient would indicate that more skilled human capital supports the country in upgrading to higher value-added parts of GVCs. I also included data regarding imported intermediates from China (*IMintCHN*) given that China has become the EU's biggest supplier of intermediates. For example, in 1995 the EU imported 6 percent of its intermediates from sources outside the EU, mainly represented by the USA and the Rest of the world. In 2009, the share increased to 9 percent and China became a significant supplier to the EU with over 1 percent of its total intermediates (Gasiorek et al., 2014).

In addition, I introduced the geographical concentration of trade (by observing the share of exports to the EU's five most developed countries (*EXPTOP5*) and the share of imports[18] from the EU's five most developed countries (*IMPTOP5*)) calculated from World I-O Tables available for the entire period and for all industries. The decision to include these variables is based on the non-negligible importance of the development and size of the economy (country) which an individual country is trading with. Countries with high-skilled labour that performs more complex tasks in later stages of production usually specialise in products based on costly intermediates, while countries with low-skilled labour mainly specialise in basic production. Thus, in a very generalised view, the 'rich' or skilled

[17] Wage is defined as labour compensation and in the case of WIOD also comprises an imputation for self-employed workers (Timmer et al., 2012).

[18] Due to the data unavailability of total imports at the industry level, I use data for imports of intermediates.

countries produce more advanced goods with a high value while the 'poor' countries chiefly focus on basic production, raw materials and goods with a low value (Felipe, Kumar & Abdon, 2014). Although the CEE-10 cannot be classified as poor countries, Cieślik et al. (2016) noted that in post-communist countries high-tech products still account for a low share of their exports. The assumption that follows is that if one country exports to another relatively more developed country, the former should have lower DVA in exports since the probability that this country exports low value-added goods should be higher.

Table 10 presents the correlation matrix for the manufacturing sector, which reveals the high correlation of *WAGE* with *SKILL* and especially *OFDI*. This may lead to multicollinearity problems which I address by separately including *WAGE* and *OFDI* in the regression. Other explanatory variables included in my regression are not highly correlated.[19]

Table 10: Correlation matrix for the period 2001–2011 – manufacturing sector

Variable	lnDVA	$lnBERD_{t-1}$	$lnSKILL_{t-1}$	$lnIFDI_{t-1}$	$lnOFDI_{t-1}$	$lnEXPTOP5_{t-1}$	$lnIMPTOP5_{t-1}$	$lnIMintCHN_{t-1}$
lnDVA	1							
$lnBERD_{t-1}$	-0.16***	1						
$lnSKILL_{t-1}$	0.10***	0.31***	1					
$lnIFDI_{t-1}$	-0.21***	-0.08**	-0.17***	1				
$lnOFDI_{t-1}$	0.28***	0.33***	0.38***	0.22***	1			
$lnEXPTOP5_{t-1}$	-0.22***	0.01	-0.26***	0.13**	-0.01	1		
$lnIMPTOP5_{t-1}$	-0.07***	0.08***	-0.31***	0.00	-0.06**	0.59***	1	
$lnIMintCHN_{t-1}$	-0.28***	0.32***	0.24***	-0.20	-0.03***	0.01	0.02	1
$lnWAGE_{t-1}$	0.17***	0.54***	0.61***	-0.07**	0.67***	0.05**	0.04**	0.18***

Note: Data for the manufacturing sector. All independent variables are lagged by one year. Significance: *** p<0.001, **p<0.05, *p<0.1.

Source: Author's calculations.

2.4.3 Results

2.4.3.1 Main results

The results for the manufacturing sector[20] are presented in Table 11. All regressions include time, industry and country fixed effects. In column 1, I report a specification with

[19] The correlation matrix of data for the services sector is presented in Appendix 8.

[20] In the services sector (Appendix 8, Table 8-2) *BERD* and *SKILL* do not play an important role in the share of DVA. Estimations show negative and significant elasticities with DVA for *IFDI* and imports of intermediates from China for EU-15 countries, while these results are not significantly different for the CEE-

the main variables of interest while in the following columns 2–6 I gradually add in variables. Due to the high correlation of *WAGE* with *SKILL* and *WAGE* with *OFDI*, I separately include in the regression *WAGE* (column 4) or *OFDI* and *SKILL* (column 5). I will use the specification shown in columns 4 and 5 as my main regression specification for the remainder of the analysis (robustness checks). Column 7 includes nominal *GDP* to control for the size of the country (and excludes *WAGE* because of high correlation), but there are no substantial differences in the main regression coefficients.

The estimates confirm that business enterprise research and development expenditure (*BERD*) is positively correlated with DVA in the EU-15. The estimated association between DVA and BERD for the EU-15 is 0.018 and significant (column 3), which indicates that a 10 percent rise in business enterprise R&D investments in the manufacturing sector is, *ceteris paribus*, correlated with a 0.18 percent increase in DVA The coefficient for the CEE-10 is 0.026 percentage points lower and statistically significant, which results in a slightly negative and significant coefficient for the CEE-10 (joint significance verified by an F-test). A possible explanation is that higher investments in intangible capital reduces the need for imported inputs in the EU-15, however in the CEE-10 a specific level of investments[21] in intangible capital is required in order to integrate into a GVCs.[22]

Surprisingly, the coefficient on high-skill labour (*SKILL*) is statistically significant and negative, which suggests that, *ceteris paribus*, in the EU-15 countries firms with a greater share of non-production workers negatively affect DVA in exports and that high-skilled labour does not contribute (at least not directly) to GVC upgrading in the EU-15. For the CEE-10 countries, the effects are smaller, but the overall correlation remains negative. These results may also suggest that hours worked by high-skilled employees (relative to total hours worked) are not an appropriate measure for the quality of human capital as the same level of investment in education can result in diverse sets of skills or skills with a different value in the labour market. Further, education can be used as a labour market indicator of capability rather than the skills supply source. Since the competencies of an individual are difficult to identify and measure, the economic literature commonly uses educational attainment or acquired level of education as the estimate (Borghans, Green, & Mayhew, 2001).

---

10. Imports from the EU's most developed countries are positively correlated with DVA in exports for EU-15 countries, with no significant difference for the CEE-10. Interestingly, in services compared to manufacturing, wage is positively correlated with DVA for the CEE-10 countries.

[21] Similarly to *relationship-specific investments*. These represent investments made by suppliers in the value chain in order to obtain a certain required level of compatibility of their components with the components of other suppliers (Alfaro, Antras, Chor, & Conconi, 2015)

[22] The explanation is based on the findings of Stehrer and Stollinger (2015) for export sophistication.

Table 11: Determinants of domestic value added in exports in the manufacturing sector – comparison between CEE-10 and EU-15 countries, FE estimation results

Dependent variable: DVA in exports

VARIABLES	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE (6)	FE (7)
lnBERD$_{t-1}$	0.0215**	0.0206***	0.0179*	0.0129*	0.0110	0.0100	0.0139**
	(0.00762)	(0.00629)	(0.00937)	(0.00608)	(0.00676)	(0.00680)	(0.00549)
lnBERD$_{t-1}$ x CEE	-0.0264**	-0.0271**	-0.0258**	-0.0151**	-0.0126*	-0.0126*	-0.0126*
	(0.00928)	(0.00878)	(0.00991)	(0.00598)	(0.00668)	(0.00662)	(0.00670)
lnSKILL $_{t-1}$	-0.108**	-0.0840*	-0.0843***		-0.140***	-0.117**	
	(0.0443)	(0.0383)	(0.0251)		(0.0306)	(0.0424)	
lnSKILL $_{t-1}$ x CEE	0.0754*	0.0119	0.0226		0.110**	0.0908*	
	(0.0348)	(0.0363)	(0.0215)		(0.0413)	(0.0454)	
lnIFDI $_{t-1}$	-0.0204***	-0.0152**	-0.0188***	-0.0129*	-0.0104*	-0.0105	-0.0136**
	(0.00493)	(0.00575)	(0.00439)	(0.00637)	(0.00475)	(0.00709)	(0.00468)
lnIFDI $_{t-1}$ x CEE	0.0104	0.00639	0.0142	0.00123	-0.000478	-0.00306	0.00367
	(0.0121)	(0.0155)	(0.0118)	(0.0139)	(0.0163)	(0.0183)	(0.0121)
lnOFDI $_{t-1}$		0.00167	-1.64e-05		0.00038	0.000757	
		(0.00264)	(0.00256)		(0.00220)	(0.00240)	
lnOFDI $_{t-1}$ x CEE		0.0139*	0.0137***		0.0148***	0.0141***	
		(0.00626)	(0.00375)		(0.00408)	(0.00367)	
lnEXPTOP5$_{t-1}$			0.00360	0.000239	0.0067	0.00296	0.00260
			(0.0212)	(0.0158)	(0.0191)	(0.0171)	(0.0180)
lnEXPTOP5$_{t-1}$ x CEE			-0.0819***	-0.0752***	-0.0796***	-0.0724***	-0.0751***
			(0.0131)	(0.0131)	(0.0161)	(0.0162)	(0.0141)
lnIMPTOP5$_{t-1}$			0.0667	0.0684	0.0674	0.0695	0.0357
			(0.0572)	(0.0449)	(0.0525)	(0.0559)	(0.0414)
lnIMPTOP5$_{t-1}$ x CEE			0.0742	0.0922	0.100	0.0998	0.129**
			(0.0748)	(0.0581)	(0.0661)	(0.0674)	(0.0521)
lnIMintCHN $_{t-1}$				-0.00742	0.0013	0.0021	0.00424
				(0.00593)	(0.0044)	(0.0049)	(0.00600)
lnIMintCHN$_{t-1}$x CEE				-0.0358	-0.0500**	-0.0491*	-0.0522**
				(0.0216)	(0.0224)	(0.0231)	(0.0207)
lnWAGE $_{t-1}$				0.0150		0.0437	
				(0.0306)		(0.0367)	
lnWAGE $_{t-1}$ x CEE				0.0409		0.0026	
				(0.0267)		(0.0311)	
lnGDP $_{t-1}$							0.103*
							(0.0465)
lnGDP $_{t-1}$ x CEE							0.0825*
							(0.0416)
Constant	-0.690***	-0.596***	-0.592***	-0.506***	-0.694***	-0.769***	-1.652**
	(0.116)	(0.110)	(0.0731)	(0.134)	(0.0779)	(0.215)	(0.551)
Observations	1,240	1,084	1,084	1,386	1,084	1,084	1,386
R-squared (within)	0.666	0.676	0.739	0.744	0.762	0.765	0.754
Number of industries	11	11	11	11	11	11	11
Number of countries	23	23	23	23	23	23	23
Country FE	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y

Note: Robust standard errors in parentheses: *** p<0.001 **p<0.05 *p<0.1. All variables are in natural logarithm. Explanatory variables are lagged by 1 year. *CEE=1* if the observation belongs to the CEE-10. *CEE=0* if the observation belongs to the EU-15. Data included in the regression cover the period 2000–2010. All regressions include a constant term. Estimation is set up in a way that estimation fixed effects appear at the country-year-industry level.

Source: Author's calculations.

IFDI has a negative sign for the EU-15 in all specifications, as expected. Inward FDI can be associated (particularly in the initial stages) with a higher volume of a destination country's imports from the country of origin of FDIs due to increased imports of intermediates and capital goods related to the offshoring of production (Aminian, Fung, & Iizaka, 2007). In manufacturing, inward FDI is, as already found by Stehrer and Stollinger (2015), positively correlated with the share of foreign value added. Interestingly, the difference for the CEE-10 in terms of the impact of inward FDI is not statistically different from zero, indicating that inward FDI generally leads to reduced demand for domestic inputs and hence lower DVA in exports.

In a general sense, outsourcing can support GVC upgrading since it enables firms to focus on their core competencies (Mudambi, 2008; Ylömäki, 2016). As noted by Pietrobelli and Rabellotti (2011), firms commonly outsource previously internally managed activities and retain those activities that represent the source of their core competencies. The estimation results show, however, that OFDI is not significant for the EU-15, while the difference for the CEE-10 is significant and positive. This means that GVC upgrading by undertaking OFDI is primarily an issue within the CEE-10 countries.

Other variables also reveal some interesting results. The geographical structure of exports (the share of exports to the EU's five most developed countries) seems to be important as well, but again only for the CEE-10. As predicted, the higher share of exports from the CEE-10 to the EU's most developed countries is negatively correlated with DVA. The results remain robust in all specifications. Higher imports of intermediate shares from China are, as expected, negatively correlated with the DVA share, but only in the CEE-10. Taglioni (in World Bank, 2016) investigated China's GVC upgrading and observed that the availability of Chinese intermediate inputs of higher quality enables its trade partners to gain from China's upgrading process, particularly when imported Chinese intermediates are complements to their domestic production instead of substitutes. The negative relationship between DVA and imports from China most likely implies that intermediates from China are more substitutes than complements for the CEE-10, although more research on the topic is required. Contrary to my expectations, no significant (positive) effects of wage on DVA are revealed for either the EU-15 or the CEE-10.

2.4.3.2 Robustness checks

In this section, I perform a number of robustness checks of my basic specification estimations. In the first check, I test the robustness of the intangible investment measure. I start by using various proxies to capture intangible capital. All regressions where I include *WAGE* are presented in Table 9-2, Appendix 9.

First, I proxy *BERD* with an alternative measure of intangible capital, i.e. patent applications, that captures innovation output (column 1 in Table 5 and column 1 in Table 9-2, Appendix 9). Patent applications to the EPO are provided by Eurostat and are only available for the manufacturing sector. For patents, I find significantly negative effects for CEE-10 countries (Table 9-2, Appendix 9), while the correlation is non-significant for the EU-15. However, there is potentially a heterogeneous impact of different types of patents, i.e. product or process patents, between which the data do not allow me to differentiate. Process patents relate to the advancement of a specific production process, while product patents relate to novel products. Zolas and Lybbert (2014) explain that if a firm, for example, exports more process patents that could indicate it is planning to move its production abroad. This could mean that reflected trade would increase, signalling a supposed decline in the ratio of value-added exports to gross exports (VAX). A different outcome for VAX would most likely be seen in the case of product patents which are more probably related with higher exports of final goods. Since the lion's share of Europe's product innovative activities is realised in the EU-15, e.g. in the regions of Germany, Scandinavia and the UK (Capello & Lenzi, 2013), one might conclude that product innovation is essential for GVC upgrading.

Second, I proxy intangible capital in columns 2 to 5 (Table 12 and Table 9-2, Appendix 9) by the alternative measures of intangible capital investments provided by the Intan-Invest database[23] (all intangible assets, computerised information, innovative property, economic competencies). This is indeed the only dataset with internationally comparable data on intangible investment. The Intan-Invest database only covers 14 EU countries at the industry level, i.e. the 'core' EU countries. Along the lines of the OECD (2013b) and Klasinc (2016)[24], I used data on intangible investments at the country level and combined them with knowledge intensity in each industry and country (data from WIOD Socio-Economic accounts). In this form (first used by Rajan & Zingales, 1998) and followed by Romalis (2004), Nunn (2007) and Barone and Cingano (2011), the dependent variable is explained by interactions of a country characteristics with an industry's characteristics (Nunn, 2007; OECD, 2013b).

Thus, following the OECD (2013b) and Klasinc (2016), industry-level estimates of intangible capital are proxied by industry-knowledge intensity:

$$INTAN = k * IK, \tag{10}$$

where *k* represents the industry-knowledge intensity in each country (high-skilled labour compensation as a share of total labour compensation) and *IK* is the investment in the

[23] For the methods and data sources for the estimates, see Corrado et al. (2012).
[24] The OECD (2013b) and Klasinc (2016) use data for intangible capital stock which is only available for 14 (especially EU-15) countries. Data for intangible capital investments are available for all EU countries.

intangible capital of country *j* at time *t*. Similarly as for *BERD*, I use nominal *IK* values relative to the corresponding country's value added. In my specifications, *IK* will either measure all intangible investments or the three constituent subsets (computerised information, innovative property, economic competencies)[25]. As pointed out by the OECD (2013b) and Klasinc (2016), the use of proxies is reasonable since sophisticated knowledge, in order to create and manage it, requires advanced educational attainment. Following the explanation by Nunn (2007), a positive coefficient indicates that countries with higher intangible capital investment (*IK*) will have relatively higher DVA in industries for which knowledge intensity (*k*) is more relevant. A positive correlation thus suggests that the association between DVA and investments in intangible capital is higher for knowledge-intensive industries.

The estimates confirm that investments in intangible capital are positively correlated with DVA for the EU-15, as in the main regression. The estimated results indicate that a 10 percent increase in intangible investments in high knowledge-intensive sectors (*ALLintan*) is associated with a 0.3 percent rise in DVA (column 2). The coefficient for the CEE-10 is 0.05 percent lower, which results in a negative and significant coefficient for the CEE-10, as in the main regression. EU-15 countries have sufficient knowledge-based capital (USD 3.31 per hour worked) and investments in intangible capital play a significant role in GVC upgrading, while the CEE-10 lack investments in intangible capital (USD 0.67 per hour worked), which are only sufficient for enabling their participation in a GVC, but not above the GVC upgrading threshold. The largest magnitude of the impact on DVA between the different subgroups of intangible investments is observed for investments in economic competencies and computerised information. The correlation coefficients between DVA and investment in: (1) economic competencies; and (2) computerised information, in sectors which are highly knowledge-intensive, are positive for the EU-15 but again negative for the CEE-10. The results suggest that the difference in DVA between CEE-10 and EU-15 countries varies with respect to intangible capital investments in sectors which are highly knowledge-intensive, especially investments in economic competencies. Similarly, the OECD (2013b) finds that the stock of economic competencies has the strongest correlation between all intangible capital stock subgroups with the VAX ratio.

[25] *Computerised information* includes investments in software and databases. *Innovative property* includes expenses for R&D, design, new products and financial services, and mineral exploration. *Economic competencies* include investments in brand equity (advertising and market research) and firm-specific resources (training, firm-specific skills, organisational structure) (Corrado et al., 2012).

Table 12: Determinants of domestic value added in exports in the manufacturing sector – comparison between CEE-10 and EU-15 countries (Robustness check I)

Dependent variable: DVA in exports

VARIABLES	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)
ln*PAT* $_{t-1}$	0.0065				
	(0.007)				
ln*PAT* $_{t-1}$ x CEE	-0.0057				
	(0.005)				
ln*ALLintan* $_{t-1}$ x *k*		0.029**			
		(0.012)			
ln*ALLintan*$_{t-1}$ x *k* xCEE		-0.051**			
		(0.020)			
ln*COMPinf*$_{t-1}$ x *k*			0.0225**		
			(0.00750)		
ln*COMPinf*$_{t-1}$ x *k* x CEE			-0.0218*		
			(0.0119)		
ln*INNOVprop*$_{t-1}$ x *k*				0.018**	
				(0.00770)	
ln*INNOVprop*$_{t-1}$ x *k* x CEE				-0.0237*	
				(0.0131)	
ln*ECONcomp*$_{t-1}$ x *k*					0.026**
					(0.00951)
ln*ECONcomp*$_{t-1}$ x *k* x CEE					-0.0416**
					(0.0152)
ln*SKILL* $_{t-1}$	-0.153***	-0.0314	-0.0174	-0.0378	-0.0272
	(0.027)	(0.0315)	(0.0272)	(0.0369)	(0.0299)
ln*SKILL* $_{t-1}$ x CEE	0.163***	-0.0311	0.00505	0.00725	-0.0335
	(0.05)	(0.0402)	(0.0464)	(0.0425)	(0.0418)
ln*IFDI* $_{t-1}$	-0.0048	-0.00207	-0.00203	-0.00200	-0.00200
	(0.005)	(0.00423)	(0.00425)	(0.00427)	(0.00426)
ln*IFDI* $_{t-1}$ x CEE	-0.0025	0.00621	0.00645	0.00638	0.00626
	(0.019)	(0.0150)	(0.0149)	(0.0150)	(0.0150)
ln*OFDI* $_{t-1}$	-0.0005	0.0003	0.0006	0.0002	0.0003
	(0.002)	(0.00237)	(0.00235)	(0.00239)	(0.00238)
ln*OFDI* $_{t-1}$ x CEE	0.014***	0.011**	0.010**	0.011**	0.011**
	(0.003)	(0.00402)	(0.00398)	(0.00410)	(0.00404)
ln*EXPTOP5*$_{t-1}$	0.00125	0.00310	0.00415	0.00297	0.00322
	(0.0134)	(0.0152)	(0.0151)	(0.0152)	(0.0153)
ln*EXPTOP5*$_{t-1}$ x CEE	-0.0582**	-0.069***	-0.071***	-0.069***	-0.070***
	(0.022)	(0.0216)	(0.0217)	(0.0216)	(0.0214)
ln*IMPTOP5*$_{t-1}$	0.115***	0.121**	0.123**	0.122**	0.121**
	(0.032)	(0.0433)	(0.0440)	(0.0430)	(0.0435)
ln*IMPTOP5*$_{t-1}$ x CEE	0.0234	0.00146	-0.000575	0.000541	0.00109
	(0.054)	(0.0689)	(0.0690)	(0.0689)	(0.0691)
ln*IMintCHN* $_{t-1}$	-0.0056	0.00162	0.00180	0.00135	0.00159
	(0.008)	(0.00837)	(0.00820)	(0.00842)	(0.00828)
ln*IMintCHN* $_{t-1}$ x CEE	-0.0448*	-0.0520*	-0.0518*	-0.0516*	-0.0516*
	(0.022)	(0.0269)	(0.0268)	(0.0269)	(0.0268)
Observations	1,746	1,464	1,464	1,464	1,464
R-squared (within)	0.744	0.781	0.781	0.781	0.781
Number of industries	11	11	11	11	11
Number of countries	23	23	23	23	23
Country FE	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Note: Robust standard errors in parentheses: *** p<0.001 **p<0.05 *p<0.1. All variables are in natural logarithm. Explanatory variables are lagged by 1 year. *CEE=1* if the observation belongs to the CEE-10, *CEE=0* if the observation belongs to the EU-15. Data included in the regression cover the period 2000–2010. All regressions include a constant term.

Source: Author's calculations.

Other coefficients remain robust. The negative correlation between *IFDI* and DVA (Table 9-2, Appendix 9) and between *SKILL* and DVA (column 1, Table 12) for the EU-15 remains significant. The latter have indeed a relatively high share of skilled workers compared to the majority of countries of origin of EU-15 imports. Zhu and Fu (2013), for example, find the that positive (and significant) effect of education on export sophistication is limited to the world's low-income country group. The coefficient of *OFDI* remains positive for the CEE-10 and is non-significant for the EU-15, as in the benchmark specification. The higher share of exports from the CEE-10 to the EU's most developed countries remains negatively correlated with DVA, while in these new estimations higher imports from the EU's most developed countries benefits the EU-15 countries' DVA.

In the second part of the robustness checks, I changed the number of lags of the key regressors in the regression specification. Up to now, all explanatory variables were lagged by one period. In the robustness check, I also experiment with explanatory variables lagged by two and three years. The results are presented in Appendix 9, Table 9-3 and 9-4. Interestingly, when the data are lagged by two years all the variables remain robust but have higher significance, suggesting that two years of lagged data for the explanatory variables fit the model better. For example, the results show no correlation between DVA and *WAGE* for the EU-15, while for the CEE-10 the correlation between DVA and labour compensation is positive (column 4) (joint significance verified by an F-test). When the explanatory variables are lagged by three years, the results do not change substantially (Appendix 9, Table 9-4).

In order to deal with inherent endogeneity, I employ the difference GMM estimator (Arellano & Bond, 1991). As an alternative transformation to the common differencing, I used forward orthogonal deviations as proposed by Arellano and Bover (1995) which entails subtracting the average of available future observations and not the previous observation as in the first-difference transformation. The loss of data is minimised since the sample size is preserved (Roodman, 2006). To detect any serial autocorrelation problems, autocorrelation tests were performed. A first-order correlation, but therefore no higher-order autocorrelation, supports the assumption of a lack of autocorrelation. The suitability of the instrumental variables is examined by Hansen's J test for overidentifying restrictions where an insignificant *p*-value of the test is preferred.

Table 13 presents the estimation results of the baseline model. All estimations include year-fixed effects. Second- to fourth-level lags of the endogenous variables (*BERD*, *IFDI*, *SKILL* and *WAGE*) were used as instruments in the GMM style. The autocorrelation tests of the residual show there is a significant first-order autocorrelation, but no significant second-order autocorrelations in columns 2 and 4. The Hansen test confirms the validity of the instruments. Columns 1–2 report the two-step difference GMM, columns 3–4 report the estimation results for the two-step difference GMM with a forward orthogonal deviation.

Table 13: Determinants of domestic value added in exports in the manufacturing sector – comparison between CEE-10 and EU-15 countries, difference GMM estimation results

VARIABLES	Diff-2 GMM (1)	Diff-2 GMM (2)	Orth Dev-2 GMM (3)	Orth Dev-2 GMM (4)
lnBERD$_{t-1}$	0.0123*	0.0198*	0.0220***	0.0473***
	(0.00678)	(0.0102)	(0.00668)	(0.0104)
lnBERD$_{t-1}$ x CEE	-0.0137*	-0.0247**	-0.0166	-0.0384***
	(0.00825)	(0.0106)	(0.0105)	(0.0134)
lnSKILL $_{t-1}$		-0.0544**		-0.116***
		(0.0221)		(0.0273)
lnSKILL $_{t-1}$ x CEE		0.00999		0.0654*
		(0.0290)		(0.0363)
lnIFDI $_{t-1}$	0.0108***	0.00387	0.00627	0.00281
	(0.00370)	(0.00594)	(0.00544)	(0.00740)
lnIFDI $_{t-1}$ x CEE	-0.0547***	-0.0336**	-0.0433***	-0.0435**
	(0.0142)	(0.0158)	(0.0136)	(0.0172)
lnOFDI $_{t-1}$		0.00301*		0.00131
		(0.00164)		(0.00171)
lnOFDI $_{t-1}$ x CEE		-0.00457		-0.00103
		(0.00300)		(0.00334)
lnEXPTOP5$_{t-1}$	-0.0185	0.00973	0.0213	-0.0125
	(0.0309)	(0.0278)	(0.0334)	(0.0268)
lnEXPTOP5$_{t-1}$ x CEE	-0.0111	-0.0250	-0.0356	-0.0134
	(0.0356)	(0.0292)	(0.0379)	(0.0326)
lnIMPTOP5$_{t-1}$	0.0160	0.00948	0.0301	-0.00508
	(0.0266)	(0.0361)	(0.0237)	(0.0312)
lnIMPTOP5$_{t-1}$ x CEE	0.0388	0.000546	0.0812*	0.0867*
	(0.0434)	(0.0450)	(0.0430)	(0.0505)
lnIMintCHN $_{t-1}$	-0.0243***	-0.0190**	-0.0261***	-0.0325***
	(0.00678)	(0.00805)	(0.00645)	(0.00651)
lnIMintCHN $_{t-1}$ x CEE	0.0409***	0.0381***	0.0214*	0.0397***
	(0.0113)	(0.0110)	(0.0119)	(0.0119)
lnWAGE $_{t-1}$	-0.0331***		-0.0566***	
	(0.0127)		(0.0133)	
lnWAGE $_{t-1}$ x CEE	0.00832		0.0659***	
	(0.0188)		(0.0193)	
# observations	1,057	811	1,153	873
# country x industry	178	161	210	188
# instruments	280	197	256	179
Hansen test	169.6	144.6	206.9	177
	(1)	(0.983)	(0.959)	(0.247)
AR(1) test	-2.097	-2.610	-2.972	-3.056
	(0.0360)	(0.00906)	(0.00296)	(0.00225)
AR(2) test	-2.218	-0.554	-2.470	-1.390
	(0.0266)	(0.580)	(0.0135)	(0.165)

Notes: Estimates from difference GMM models with time-fixed effects. Second- to fourth-level lags of the endogenous variables (*BERD*, *IFDI*, *SKILL* and *WAGE*) were used as instruments in the GMM style. The p-values of the Hansen J test of overidentifying restrictions and p-values of the Arellano and Bond (1991) test of qth order serial correlation are reported in brackets. Robust standard errors in parentheses, *** p<0.001 **p<0.05 *p<0.1.

Source: Author's calculations.

The main results in Table 13 are generally consistent with the fixed-effects model estimates. Business enterprise research and development expenditure (*BERD*) demonstrates a positive and significant impact on DVA in exports for the EU-15. The difference for the CEE-10 is also statistically significant albeit lower, but it does not result in a statistically significant coefficient for the CEE-10. The coefficient of high-skilled labour (*SKILL*) for the EU-15 is negative and significant as in the basic specification, while for the CEE-10 the negative effects are different and smaller only in specification (4).

The results suggest a slightly positive or no effect of *IFDI* on DVA in exports in the EU-15 countries, but a significantly negative effect of *IFDI* on DVA for the CEE-10 countries. Empirical evidence shows that *OFDI* is positive and significant for the EU-15 (column 2), while there is no significant difference for the CEE-10. This suggests that GVC upgrading by undertaking *OFDI* may indeed be generally the case.

Higher imports of intermediate shares from China are surprisingly negatively correlated with the DVA share only in the EU-15, while for the CEE-10 the effects are significantly positive. As Amador et al. (2015) show when using the WIOD tables for the period 2000–2011, China represents an increasingly important source of imported value added for euro area economies. The relationship between DVA and *WAGE* yields quite interesting results, showing that higher labour compensation is negatively correlated with DVA, at least for the EU-15. For the CEE-10, the correlation between DVA and labour compensation is positive (column 3), but not precisely estimated (joint significance verified by an F-test). Nevertheless, the results confirm that for the CEE-10 lower wages are correlated with a higher FVA share, which is in line with the theory of offshoring which assumes that firms offshore tasks to countries with lower wages.

To summarise the regression results, these suggest that differences in the extent of DVA between the CEE-10 and EU-15 countries vary with respect to intangible capital investments. The elasticities between DVA and investments in intangible capital are positive for the EU-15, but not for the CEE-10. Surprisingly, the negative coefficient on high-skilled labour reveals that, ceteris paribus, in the EU-15 countries firms with a greater share of non-production workers create lower DVA in exports. For the CEE-10 countries this effect is smaller. The negative correlation of inward FDI with DVA for the EU-15 and the CEE-10 indicates that inward FDI generally leads to reduced demand for domestic inputs and hence lower DVA in exports. The positive coefficient of outward FDI for the CEE-10 countries reveals that GVC upgrading by undertaking outward FDI is primarily an issue within CEE-10 countries. The negative relationship between DVA and imports from China implies that intermediates from China are more substitutes than complements in the CEE-10. The results also confirm that CEE-10 countries export goods with lower value added to more developed countries. The results by and large remain robust in all robustness checks.

2.5 Conclusion

In this chapter, I rely on the recent methodology for decomposing gross exports into value-added exports provided by Koopman et al. (2010) and recent research findings regarding the potential factors of value added in exports (Caraballo & Jiang, 2016; Kowalski et al., 2015; OECD, 2013b; Stehrer & Stollinger, 2015). I particularly focused on: (1) DVA in exports, which represents an important measure of income from trade and can thus be recognised as a crucial guideline for development policy (Caraballo & Jiang, 2016); and (2) EU countries. The main contribution of my research compared to previous work is the distinction between CEE-10 and EU-15 countries in order to explain the main drivers of the differences in DVA in export shares between EU-15 and CEE-10 countries using industry-level data.

Fixed-effects and GMM regression analysis is used to examine whether the selected main economic indicators influence DVA in exports differently in each of the two groups of EU countries. Estimates based on industry- and country-level data show that investments in intangible capital play an important role in GVC upgrading for the EU-15 countries, while the results are negative for the CEE-10. I found that most of the other determinants (OFDI, exports to the EU's most developed countries and imports from China) have different effects on the domestic content of exports in CEE-10 than in EU-15 countries. The results, by and large, remain robust under alternative specifications.

Based on the presented results, it follows that investments of CEE-10 in intangible capital are only sufficient to enable their participation in a GVC, but not above the GVC upgrading threshold. Thus they support enabling absorptive capacity but without significant development breakthrough. Further investigation is required to determine the exact value of the critical threshold of intangible investments beyond which the CEE-10 can gain from intangible investments in terms of higher DVA in exports.

Finally, it has to be acknowledged that the subjects which participate in GVCs and that should represent the units of analysis are not countries, but firms. However, due to the lack of data and methodology, country-industry analysis is still the traditional approach used in the literature. Nevertheless, considering the limitations the results presented in this chapter offer an insight into the possible determinants of EU countries' domestic content of exports from the value-added perspective. Most of all, one could improve the methodology for decomposing exports into value added terms and use a different source of input-output tables to compare the estimated results. Moreover, instead of using industry-level data one could extend this research and use firm-level data.

3 WHAT UNDERPINS DOMESTIC VALUE ADDED IN EXPORTS? A FIRM-LEVEL ANALYSIS

Abstract

This chapter sheds light on the relationship between domestic value added in exports (DVA) and the different ways firms participate in GVCs by exploiting a detailed firm-level dataset for the whole population of Slovenian exporting firms for the period 2002–2014. This chapter draws attention to those firm characteristics that allow a greater share of DVA to be captured. Although reliance on industry-level data from input-output tables is the most common way of doing this in the literature, this chapter develops a method for estimating DVA in exports using firm-level data by adjusting the approach taken by Kee and Tang (2016). This chapter finds that, in terms of DVA, domestic-owned exporting firms outperform more productive foreign-owned firms and that firms not affiliated with permanent suppliers from abroad capture higher DVA in exports. Positive outcomes of DVA in exports can be observed, all else being equal, for firms with a larger share of intangible capital per worker, firms with a higher relative wage, firms with greater capital intensity, less indebted firms, firms with a bigger share of final products in their export and firms with a smaller share of exports based on imports of the same products. The results also show that when exporting more to less demanding markets, like the countries of former Yugoslavia, firms benefit more in terms of greater DVA gains in exports.

3.1 Introduction

The emergence of global value chains has greatly transformed the ways multinational companies (MNCs) are organised (Lanz & Miroudot, 2011), with international trade in tasks overtaking trade in goods. By geographically spreading different stages of production, the value added across the value chain has become unevenly distributed. Thus, a firm's position in the value chain plays an important role in its ability to create, improve and retain value and considerably affects its competitiveness (Pavlínek & Ženka, 2010). Firms broadening their boundaries and having a stronger focus on their core competencies, outsourcing and offshoring have grown in importance. Offshoring was initially mainly concerned with an MNC relocating its manufacturing stages of production to affiliates or local suppliers in countries with low labour costs. More recently, offshore activities have evolved to also include upstream tasks previously performed solely in the parent firm's home country, like R&D or the design of advanced technology (Antràs & Yeaple, 2014; Nieto & Rodríguez, 2011).

Firms participating in GVCs interact with each other through a network of affiliates (via

foreign direct investment; FDI) or have contractual/arm's-length trade connections[26] to ensure they are supplied with inputs (thus playing the role of 'value chain organisers') or as suppliers themselves. Firms that create their 'own' GVC perform (depending on their strategic orientation) one or more key production process stages/functions together with their affiliates ('offshoring'), while the other stages required to achieve the final product are contracted to arm's-length suppliers at home or abroad (outsourcing) (Stare, 2016). The first approach associates GVCs with FDI flows and is characterised by a relationship whereby the parent provides its subsidiaries with inputs or as part of a relationship among subsidiaries with the same parent. In this case, the trade in intermediate goods entails intra-firm transactions with production stages located around the world (Amador & Cabral, 2014). In the second approach, firms engage in GVCs through arm's-length/contractual transactions or inter-firm trade with unrelated parties where firms export inputs to international buyers or import intermediates in the role of domestic final producers (Taglioni & Winkler, 2016).

However, it is only the United States collects detailed trade statistics that distinguish between intra- and inter-firm trade (Antràs, 2016). In 2009, US intra-firm trade accounted for 48% imports and about 30% exports of goods, while US arm's-length trade between unrelated parties represented 50% of imports and almost 70% of exports of goods. Such statistics are rare for other countries and only available for exports by foreign affiliates (Lanz & Miroudot, 2011, pp. 5-18). It is therefore difficult to estimate the average share of intra- and inter-firm trade at the global level due to the large variations across countries and industries.

The central aim of this chapter is to analyse the process of firms upgrading GVCs in terms of domestic value added in exports (DVA) relative to forms of GVC participation and selected firm characteristics. My analysis concentrates on exporting firms which, in theory (Melitz, 2003; Helpman, Melitz, & Yeaple, 2004), are relatively more productive than firms that exclusively supply domestic markets. Only the most productive exporting firms engage in FDI (i.e. foreign-owned firms exhibit higher productivity than locally-owned firms). However, based on existing theory and empirical findings for Austrian firms, Pfaffermayr and Bellak (2002) investigate possible reasons for one type of firm's superior performance vis-à-vis another. They notice that in certain cases domestic-owned firms may even outperform foreign ones so long as the firm has a multinational character.

This chapter examines possible evidence in support of the claim that, in terms of DVA in exports, locally-owned exporting firms outperform more productive foreign-owned firms

[26] Beside intra-firm trade (via FDI), firms can participate in GVCs through a contractual relationship with an MNC (in non-equity modes – NEMs) or through arm's-length transactions. The GVC literature mentions three main NEM types: captive, modular and relational. It is estimated that around 16% of total global trade that involves an MNC is linked to NEMs related trade. Arm's-length and intra-firm trade each separately represent 6.3% of total global trade that involves an MNC (UNCTAD, 2013).

that generally supply more demanding and developed markets. The analysis builds on two main research questions: (1) how does DVA in exports vary depending on the way a firm participates in GVCs (through either a network of affiliates or inter-firm trade) by distinguishing firms that are themselves suppliers or have their own suppliers located abroad; and (2) which firm characteristics affect a firm's 'success in DVA' as measured by the ratio of DVA in exports. In order to control for firms' heterogeneity, this chapter adjusts the recently established methodology for measuring value added in exports using firm-level data developed by Kee and Tang (2016).

I focus on these questions by examining Slovenian exporting companies, which are (compared to MNCs from the region) smaller but relatively more engaged in global trade and have functionally and geographically dispersed affiliates (Jaklič & Svetličič, 2008). The GVC participation index[27] for Slovenia (58.7) is above the average for developed (48.0) and developing (48.6) economies and one of the highest among CEE countries according to WTO data for 2011 (WTO, 2017). The recent AMNE database shows that exports by MNCs (foreign-affiliate and domestic MNCs) account for more than 70 percent of Slovenian gross exports (Cadestin et al., 2018).

Decisions by firm regarding their participation form are analysed at the firm-country-product level by considering foreign direct flows and the stability of trade flows. To define inter-firm relationships, I rely on detailed transaction-level data for the population of Slovenian firms at the level of 6-digit product groups (HS6) and country of destination for the period 2002–2014. The detailed export data by firms, years, destination country (country of dispatch) and products on the HS6 level so obtained allow me to measure firms' export-sales stability (the stability of a firm's supply from abroad) where stable sales indicate a firm is a permanent supplier (or has a permanent supplier from abroad) based on product-destination stability. In addition, I matched these data with data on FDI flows and firms' balance sheets.

The primary task of many global manufacturing firms in developed economies today is actually not manufacturing but to provide product design, marketing, logistics etc., since the goal of their offshoring activities (through either FDI or at arm's length) is to transfer other stages and functions (usually production-related) to others, while focusing on their core competencies (Milberg & Winkler, 2010). Based on this international trade phenomenon, I expect firms with foreign ownership and unaffiliated firms identifiable as independent permanent suppliers for foreign firms to have a lower DVA value, while firms that themselves have foreign affiliates and unaffiliated firms with permanent suppliers from abroad will capture higher DVA in exports.

[27] The participation index consists of two components: share of foreign inputs (backward GVC participation) and domestically produced inputs used in third countries' exports (forward GVC participation) in gross exports. (WTO, 2018)

This chapter makes two contributions to the literature. First, departing from the most common approach in the literature of using industry-level data from I-O tables (Amador & Cabral, 2014), this chapter develops a method for estimating DVA in exports with firm-level data by adjusting the approach taken by Kee and Tang (2016). The use of firm-level data allows smaller firms not captured in I-O tables (i.e. firm size sample used to construct IO tables may be consisted only from large firms) to be included and avoids possible aggregation biases (i.e. establishing a common classification while constructing the WIOD tables necessitates the aggregation and disaggregation of national supply and use tables; trade flow data in WIOD are based on the UN COMTRADE database which includes trade statistics by commodities and partner countries on an annual basis etc.). A micro-level approach considers firm heterogeneity and controls for firm characteristics to estimate a firm's DVA in exports. Second, since the literature does not provide guidance on how to define firms participating in GVCs via a contractual relationship (between unaffiliated firms) and there is insufficient data to allow a better definition of such trade linkages, I proxy for the possible underlying relationship by exploring the stability of firm trade flows. The availability of highly detailed import and export flow information by products at the 6-digit level and origin/destination country helps identify unrelated firms participating in GVCs via a contractual relationship (on both import and export sides) by using a correlation method between trade and their lagged values (month/month(year-1)) by firm, year, 6-digit product and country of destination/country of dispatch to define trade flow stability. This enables me to distinguish two modes of firms' organisational structure in GVCs (through either FDI or a contractual relationship).

The rest of the chapter is structured as follows. Section 3.2 presents the related empirical literature, section 3.3 provides details of the DVA estimation at the firm level, section 3.4 describes the data used and empirical framework, section 3.5 outlines the results while section 3.6 concludes.

3.2 Related research literature

In the area of the ways firms upgrade[28] in GVCs, the micro-level empirical evidence on the factors influencing how firms achieve such GVC upgrades remains underexplored. Existing evidence is still mostly based on case studies or company interviews and is frequently limited to certain sectors (e.g. Pickles, Smith, and Begg (2006); Tokatli (2007); Aspers (2010); Isaksen and Kalsaas (2009); Jürgens and Krzywdzinski (2009); Kadarusman and Nadvi (2013); Azmeh and Nadvi (2014) among many others). One example of such a study is based on interviews of SMEs from the textile and IT industries

[28] Humphrey and Schmitz (2002) identify four different ways of upgrading: (1) *process upgrading* refers to more efficient and organised production or implementation of new technologies; (2) *product upgrading* relates to the production of more complex products; (3) *functional upgrading* relates to an increase in the production's overall skill content; and (4) *inter-sectoral upgrading* is related to the move to new productive activities (industries).

in Taiwan and shows the importance of endogenous factors. Of these, the role of the company's CEO is highlighted as the key driver of a local firm's upgrading due to efforts made to innovate the current business model (Holste Hauke, 2015). Tang, Wang and Wang (2015) considered the importance of ownership types for upgrading and found that state-owned enterprises and SMEs have substantially bigger shares of value added to gross exports than large domestic private and foreign-investing firms.

Pavlínek and Ženka (2010) rely on firm-level financial and R&D data while analysing the upgrading process among suppliers in the Czech automotive industry. Their results suggest that process upgrading is simply necessary for all automotive suppliers to remain competitive due to the continuous pressure of higher-tier suppliers to lower production costs and assure high product quality. Evidence of product and functional upgrading was less convincing than for process upgrading that is largely a characteristic of larger and higher-tier suppliers. Firms with high value added are able to provide inputs which cannot be (simply) substituted and are thus characterised as a "GVC bottleneck". The latter reflects firms' incentive to maintain a certain level of entry barriers driven by the motive to safeguard the value added of their products and services (Jacobides, Knudsen, & Augier, 2006; OECD, 2013b). Kee and Tang (2016) perform a more detailed analysis using customs transaction-level data and firm-survey data for Chinese firms for the period 2000–2007. Since in this timeframe China had a growing trend in the DVA share (unlike most other countries), they looked at what had led to China's resistance to falling DVA in exports despite China's strongly involvement in GVCs. They find the rising DVA share can be linked to firms' substitution of imported materials with domestic ones in terms of both volume (the lower share being attributed to the costs of imported intermediates) and varieties (a smaller variety of imported intermediates). The authors explain the "substitution effect" is driven by falling prices of domestic intermediates relative to imported ones. Further, the increase in domestic input varieties may be influenced by the lower input tariffs for upstream suppliers and the greater number of foreign firms in processing exports. In addition, they found that trade and FDI liberalisation after 2000 promote a country's DVA through input-output linkages and spillover effects.

An individual firm's prospects for upgrading rely heavily on the level of autonomy they possess within the production network, with the latter being influenced by the uneven distribution of power between lead firms and suppliers (Henderson et al., 2002; Humphrey & Schmitz, 2002; Pavlínek & Ženka, 2010). The lead firm faces strategically important issues (i.e. competition in the input market) that affect its decision whether to keep certain activities 'in-house' or to outsource them (Dedrick, Kraemer, & Linden, 2010). Although lead firms may support their suppliers' process and product upgrading, they are less supportive when it comes to their functional upgrading. This may indicate a move towards the lead firms' core competency areas (e.g. design, branding, marketing etc.), thereby challenging the main source of lead firms' value capture (Pavlínek & Ženka, 2010). Unlike

lead firms, most subsidiaries have a small impact on the actions taken by their headquarters (Sass & Szalavetz, 2013). In addition, subsidiaries are limited in reaping the benefits of upgrading by the asymmetric power relations in GVCs as lead firms can exert pressure in the form of expected cost reductions and the increased efficiency of suppliers' production processes (Szalavetz, 2017). Based on interviews with MNC subsidiaries situated in Hungary, Szalavetz (2017) finds that local suppliers benefited little from functional upgrading due to its limited impact on their value capture. Similarly, but with emphasis on the transfer of knowledge from MNCs to domestic suppliers, Gentile-Lüdecke and Giroud (2012) study the upgrade possibilities for local suppliers by using survey data from foreign affiliates and domestic suppliers of the Polish auto industry. They find that the degree of autonomy of the affiliates represents a crucial determinant of knowledge transfer to domestic suppliers and confirm the existence of possibilities for local suppliers to upgrade, particularly by way of product and process upgrading.

The empirical literature discussing what determines the choice between two alternative sourcing modes chiefly relies on seminal, pioneering theoretical works by Antràs (2003), Grossman & Helpman (2003, 2004) and Antràs and Helpman (2004). Due to data availability, most research analysing firms' choices between intra-firm and arm's-length trade focuses on the USA. Empirical evidence for the USA shows the capital intensity of an industry and capital abundance of a country importantly determine a firm's organisational structure in GVCs. Generally, imports of capital-intensive goods and imports from capital-abundant countries mostly represent intra-firm trade, while imports of labour-intensive goods and imports from capital-scarce countries are mainly realised through arm's-length trade. Evidence thus suggests that MNCs importantly contribute to their foreign affiliates by providing capital (Antràs, 2003). Similarly, Yeaple (2006) finds that in capital- and R&D-intensive industries intra-firm trade tends to be an important global outsourcing mode, which points to the value of proprietary knowledge in intra-firm trade. Bernard et al. (2010) consider variation in intra-firm trade intensity across products and countries. Relying on US intra-firm trade data, they find that intra-firm trade is more likely to occur in countries with better governance, even though governance improvements can largely reduce intra-firm trade for products with low contractibility. They also find that the share of intra-firm trade depends on the skill intensity of the industry and capital intensity of products from capital-abundant countries. Likewise, Nunn and Trefler (2013) support the findings showing that higher relationship-specific investments and greater firm productivity is associated with a bigger share of intra-firm trade. Despite the negative correlation of both arm's-length trade and intra-firm trade with geographical distance, Bombarda (2013) observes distance has a greater effect in the case of arm's-length trade.

Studies for other countries mostly depend on firm-level survey data. For the case of France, Jabbour and Kneller (2010), Jabbour (2012), Defever and Toubal (2013) and Corcos, Irac, Mion and Verdier (2013) all rely on survey data from 1999. Jabbour and

Kneller (2010) show a negative relationship between aspects of the input (skill and equipment intensity) and the possibility of vertical integration (FDI). Jabbour (2012) as well as Defever and Toubal (2013) find that more productive firms are also more likely to outsource through arm's-length arrangements while less productive firms engage in FDI. Corcos et al. (2013) match survey data with customs trade data and find the contrary; namely, that more productive firms participate in GVCs through FDI. Moreover, they show this is generally the case for firms with high capital and skill intensity. They also find that imports from countries with better institutional quality are more likely occur through FDI. In separate studies on Spanish (Kohler & Smolka, 2012) and Japanese firms (Tomiura, 2007), it is also concluded that firms which have foreign affiliates record higher productivity. More recently, Bolatto, Naghavi, Ottaviano & Zajc Kejžar (2017) studied the importance of intangible assets with a stress on intellectual property rights protection. Using data for Slovenian firms, they establish that better intellectual property rights protection in a supplier country can promote outsourcing more than intra-firm transactions.

In their study, Altomonte, Mauro, Ottaviano, Rungi & Vicard (2012) use novel data for French firms (combined customs and detailed ownership data for the period 2007–2009) to compare the performance of trade in intermediates among different modes of firms' organisational structure in GVCs during the trade collapse. They find that trade among parties related through FDI dropped faster than arm's-length trade but also rebounded faster than the latter. Lakatos and Fukui (2013) focus on MNC trade between the EU and the USA and determine that the GDP of the exporter country is more important for arm's-length trade while the GDP of the importer country is more important for trade between affiliates. They also find that a reduction in tariffs is more favourable for related-party imports. In the context of liquidity constraints and supply linkages with MNCs, while studying Czech firms, Javorcik and Spatareanu (2009) observe that those with lower liquidity constraints self-select into arm's-length supply relations with MNCs.

Still, to my knowledge, the evidence that relates the different modes of a firm's organisational structure in global production networks (intra-firm or arm's-length trade) with GVC upgrading measured by domestic value added in exports has yet to be fully explored. For instance, the study by Nieto and Rodríguez (2011) analyses the impact of two governance models of R&D offshoring on a firm's innovation. However, the ability to innovate is often presented as a basic precondition for firms to be able to develop new products, processes and functions and thereby capture higher value added. Nieto and Rodríguez (2011) use panel data for Spanish manufacturing and services firms to show that offshoring through affiliate firms abroad more strongly affects innovation than an arm's-length relationship. Gereffi, Humphrey and Sturgeon (2005) mention five GVC governance types that vary in the lead firm's function and thus range from market or arm's-length governance through modular, relational, captive to the hierarchical type or vertical integration. Based on a rich survey database for Italian companies, Brancati,

Brancati & Maresca (2014) observe that mere integration into a GVC is insufficient for a company to prosper since the form of GVC governance considerably influences firms' chances of upgrading. The authors note that the probability of innovation (as a measure of upgrading) is higher for final producers and firms connected through a relational type of GVC governance. On the contrary, arm's-length, captive and hierarchical GVC relationships appear to be less important for promoting a firm's innovation competence. As Park, Nayyar and Low (2013) suggest, a balanced GVC governance type (modular and relational) provides better upgrading conditions as power and responsibility among firms is more evenly shared. Ylömäki (2016) uses survey data for Finnish companies and finds that the tendency to upgrade falls when a firm is positioned as a retailer and increases where a firm is positioned as the main supplier and system supplier (characterised by relational, modular or arm's-length GVC governance). The lowest, albeit still positive tendency for upgrading is observed when firms are positioned as subcontractors (characterised by a captive or hierarchical relationship with the leading firm). A positive relationship with upgrading is also recorded with respect to innovativeness and the young age of a firm while there is no correlation with a firm's inclusion in a group or concern.

3.3 Estimation of DVA at the firm level

This chapter adopts the methodology introduced by Kee and Tang (2016) for measuring value added in exports using firm-level data. The approach primarily concentrates on processing exporters and is further extended to non-processing exporters. As defined by Kee and Tang (2016), processing exporters export their entire output. The model first defines accounting identity (11) of the firm's total revenue (PY) as the sum of profits (π), wages (wL), capital costs (rK), cost of domestic materials ($P^{\mathrm{D}}M^{\mathrm{D}}$) and cost of imported materials ($P^{\mathrm{I}}M^{\mathrm{I}}$):

$$PY = \pi + wL + rK + P^{D}M^{D} + P^{I}M^{I} \tag{11}$$

where $\mathrm{P^{D}M^{D}} \equiv \delta^{\mathrm{F}} + \mathrm{q^{D}}$. The term δ^{F} represents "foreign content in domestic materials" and $\mathrm{q^{D}}$ stands for purely domestic content of the materials purchased. Similarly, $P^{\mathrm{I}}M^{\mathrm{I}} \equiv \delta^{D} + q^{F}$, where δ^{D} stands for the "domestic content of imported materials" and q^{F} represents purely foreign content.

Following a definition of gross domestic product, Kee and Tang (2016) then define the firm's DVA as "total value of domestic goods and services embodied in the firm's output" (12). More precisely, DVA can be defined as the sum of profits (π), wages (wL), capital costs (rK) and domestic content of the materials purchased ($q^{D},\ \delta^{D}$):

$$DVA = \pi + wL + rK + q^{D} + \delta^{D} \tag{12}$$

Focusing on processing firms, their exports equal its total revenue (EXP = PY) while imports equal to the costs of imported intermediates and imported capital (IMP = $P^I M^I + \delta^K$). It follows from (11) and (12) that the DVA of a processing firm equals $EXP - IMP$ after adjusting for δ^D, δ^K and δ^F:

$$\pi + wL + rK + q^D + \delta^D = \pi + wL + rK + (\delta^F + q^D) + P^I M^I - (P^I M^I + \delta^K) + (\delta^D + \delta^K - \delta^F)$$

$$DVA^P = EXP - IMP + (\delta^K - \delta^F + \delta^D) \quad (13)$$

On this basis, the methodology is extended to non-processing exporters that, in contrast to processing firms, export only part of their whole output and use part of their imported materials for products sold in the domestic economy. As Kee and Tang (2016) explain, insufficient information is available on what share of their imported materials firms use for domestic production and what goes for exports. Consequently, the methodology assumes that "the allocation of the firm's inputs to the production for exports is proportional to the share of exports in total sales". This is tantamount to assuming that the DVA of exported and domestic sales is the same.

The DVA for ordinary exporters can be defined as:

$$DVA = EXP - (IMP - \delta^K + \delta^F - \delta^D)\left(\frac{EXP}{PY}\right) \quad (14)$$

and the DVA as the share of total exports as:

$$DVAR = \frac{DVA}{EXP} = 1 - \left(\frac{IMP - \delta^K + \delta^F - \delta^D}{PY}\right) \quad (15)$$

where IMP represents the total imports made by each individual firm. Following the above equation, a firm's DVAR increases when it imports fewer materials and has a lower share of foreign content in domestic materials. Vice versa, a lower domestic content of imported materials and a lower total revenue decrease a firm's DVAR.

3.4 Empirical analysis

3.4.1 Data and descriptive statistics

The analysis focuses on Slovenian exporting firms from the manufacturing sector. Although manufacturing firms represent only around 35% of all exporting firms, more than 80% of all exports is attributable to them. The largest proportion of Slovenian exporting firms from the manufacturing sector (around 40%) are micro firms, one-third are small

firms while the rest are medium (19%) and large firms (5%). However, large firms employ more than half the export-related manufacturing workforce.

To estimate firm-level DVA, I use customs transaction-level data provided by the Slovenian Financial Administration (FURS) and firms' accounting data from AJPES (Agency of the Republic of Slovenia for Public Legal Records and Related Services) for the period 2002–2014. This timeframe includes important milestones in the country's integration process with the EU; namely, in 2004 Slovenia became an EU member state, and in 2007 Slovenia adopted the euro, thereby becoming the first EU country from Central and Eastern Europe to do so. The period also covers the global financial crisis and the great trade collapse that started in 2009.

Similar to the categorisation used by Kee and Tang (2016), I classify imported capital δ^{K} as defined by broad economic categories (BEC, as the sum of categories 41 and 521). In the absence of firm-level data on the foreign content of domestic materials (δ^F)[29] and on the domestic content of imported materials (δ^D)[30], I rely on OECD TiVA data at the industry-level, which I adjust to the firm-level using (16) and (17). Since the OECD TiVA database is only available for certain years (2000, 2005, 2009, 2010 and 2011), I use a linear interpolation procedure to estimate the data for the period 2001–2004 and 2006–2008 and a linear extrapolation to estimate the data for the period 2012–2014.

Thus, foreign content in domestic materials (δ^F) is defined as:

$$\delta^F = MATx\frac{REII}{IMGR}, \tag{16}$$

where REII and IMGR represent industry-level data for re-exported intermediate imports and gross imports, while MAT are firm-level data for the cost of material used from the income statement (AOP130).

The domestic content of imported materials (δ^{D}) is defined as:

$$\delta^D = IMP\_INTx\frac{EXGR\_RIM}{IMGR}, \tag{17}$$

where *EXGR_RIM* represent industry-level data for re-imported domestic value-added

[29] Kee and Tang (2016) concentrate on Chinese processing exporters and to estimate δ^F they refer to the industry-level estimates of Koopman, Wang and Wei (2012). Their δ^F/EXP ranges from 0.4 to 5.7 percent. In my case, δ^F/EXP ranges from 0.14 to 1.04.

[30] Kee and Tang (2016) assume that in case of China δ^D is almost equal to 0. Their final equation for DVAR does not include δ^D and thus equals:

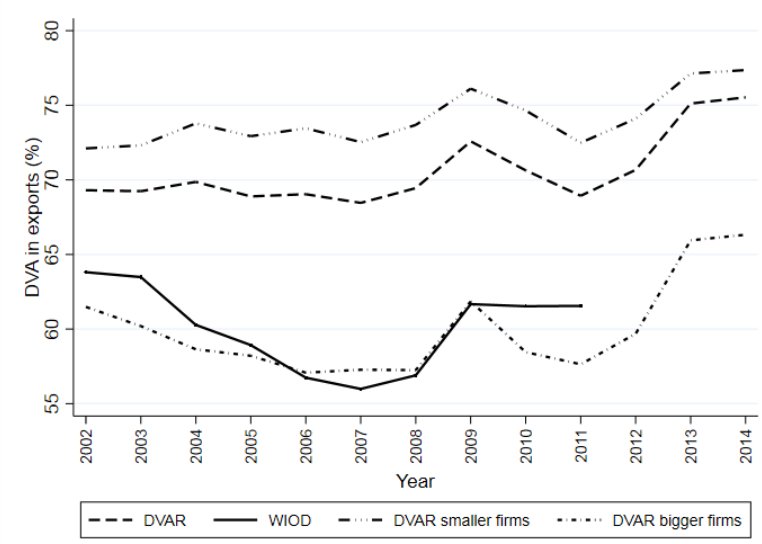
$$DVAR = \frac{DVA}{EXP} = 1 - \left(\frac{IMP - \delta^K + \delta^F}{PY}\right)$$

content and *IMGR* gross imports, while *IMP_INT* is the value of imported intermediates at the firm level.

Following Kee and Tang (2016), I exclude observations of "firms that sell imported materials to another firm" or "excessive importers", i.e. those firms whose imports are higher than their total material costs (6.5% of all observations). The latter could underestimate the results and even lead to negative DVA values. Those observations with negative DVA values (0.3% of all the remaining observations) are also excluded from the database. It is possible the negative values are a result of measurement or reporting errors.

Figure 17 shows the estimated results of DVAR from firm-level data separately for the Slovenian manufacturing sector. These are then compared with the estimated DVA on the industry-level using the data from the WIOD I-O tables (Timmer, Dietzenbacher, Los & Stehrer, 2015) and the method provided by Koopman et al. (2010). It shows that in the manufacturing sector the DVAR estimated on firm-level data is, on average, higher than that estimated from the WIOD tables.

Figure 17: Comparison of the estimated DVA in exports (%) for the manufacturing sector using industry- (WIOD) and firm-level data, Slovenia, 2002–2014



Note: Estimations based on WIOD data available for the period until 2011

Source: Author's calculations based on WIOD, TiVA (OECD), FURS and AJPES data

As already noted by Kee and Tang (2016), omitting firm heterogeneity may cause a downward aggregation bias in the approach based on I-O tables. Figure 17 also separately shows the results for smaller (less than 50 employees) and larger firms (more than 50 employees). It suggests that larger firms have lower DVA and their DVA is closer to the estimation from the WIOD tables. This is in line with the limitations of I-O tables which

usually include in the sample only the largest firms in a country (Kee & Tang, 2016) (Spearman's correlation coefficient between the estimated DVAR and DVA from WIOD for larger firms in manufacturing is 0.26 and significant).

Table 14 shows the distribution of Slovenian exporting firms within the manufacturing industries (by number of companies, number of employees and export value) and the heterogeneity of the estimated industry DVAR. Machinery and equipment industry records the highest share of DVA in exports (80%) while the lowest average in Basic metals is almost 30 p.p. lower. The highest share, more than 20% of all exporting firms, is accounted for by firms which export Fabricated metal products, followed by Machinery and equipment (12%) and Rubber and plastics products (11%). Firms engaged in fabricated metal products are the biggest employers among the manufacturing exporters (13% of total workforce), although the largest export shares are recorded in the chemical (18%) and auto industries (16%).

Table 14: Heterogeneity within Slovenian manufacturing industries, 2002–2014

Code	Industry	DVA %	n %	Employees (%)	Export (%)
3	Food, beverages and tobacco	77.0	5.3	8.7	3.1
4	Textiles, textile products, leather	65.2	6.3	6.3	5.1
5	Wood, products of wood and cork	65.5	8.5	4.6	2.6
6	Pulp, paper products	77.8	9.9	6.1	4.6
8	Chemicals and chemical products	56.6	3.8	9.8	17.8
9	Rubber and plastics products	58.0	11.2	6.9	6.4
10	Other non-metallic mineral products	70.8	4.0	4.9	3.2
11	Basic metals	52.5	2.2	4.3	5.2
12	Fabricated metal products	70.0	21.3	13.2	10.1
13	Machinery and equipment, nec	80.0	12.4	8.6	7.1
14	Computer, Electronic and optical equipment	75.5	5.2	5.3	3.8
15	Electrical machinery and apparatus, nec	70.6	5.8	12.8	13.8
16	Motor vehicles, trailers	65.5	3.1	7.8	16.4
17	Other transport equipment	70.9	1.0	0.6	0.7
	Total manufacturing industries		100.0	100.0	100.0

Source: Author's calculations based on TiVA (OECD), FURS and AJPES data

The main variables of interest in the regression analysis concern the different modes of firms' organisational structure in global production networks (either through a network of affiliates or arm's-length trade). With data on foreign direct flows provided by the Bank of Slovenia for the period 2002–2014, I capture firms that are directly incorporated into GVCs via intra-firm relations. A minimum 10-percent share of inward FDI in total equity is used to determine if the firm is an affiliate or subsidiary of foreign company (in this case, the dummy variable *IFDI* takes a value of 1). With the *OFDI* data, I capture domestic firms that have affiliates abroad. Since information on the foreign firms' total assets is missing, I assume a firm is engaged in an investment relationship abroad where it holds equity capital abroad (the dummy variable *OFDI* takes a value of 1).

Since the existing literature does not provide guidance on how to define firms which participate in GVCs via contractual relationship (between unaffiliated firms) and there is insufficient data to allow a better definition of such trade linkages, I proxy for the possible underlying relationship by exploring the stability of firms' trade flows. The use of sales stability may provide a reasonable proxy for contractual trade partners. The rationale for such decision could be based on the example of US data which show that nearly half of importer-exporter relationships entailing arms-length imports last at least three years (Monarch & Schmidt-Eisenlohr, 2016). "Long-lasting and significant relationship with foreign companies" is one subject of study in the survey by Brancati, Brancati & Maresca (2017) seeking to identify quasi-hierarchical and relational GVCs. Alternatively, Bolatto et al. (2017) differentiate intra-firm and outsourcing organisational modes in GVCs by considering the main activity of the firm's affiliate. Imported inputs from a country that hosts a firm's affiliate (classified under the affiliate's main activity) are referred to as intra-firm, while other imported inputs from the same country are related to the outsourcing type of trade relationship. If a firm is not engaged in an intra-firm relationship in a partner country, then all imported inputs from that country are related to outsourcing.

The obtained detailed export data by firms, years, destination country and products on the HS6 level provided by FURS allows me to measure firm export-sales stability, where stable sales indicate a firm is a permanent supplier based on product-destination stability. During the observed period, the HS6 nomenclature was changed in 2002, 2007 and 2012. I use the HS conversion and correspondence tables provided by UNSTAT to ensure compliance of HS6 products to the base year 2002[31]. For each firm, I first sum up all export transactions by HS6 products, country of destination, month and year. After removing duplicates, I compute the correlation coefficient (*Corr*) for each firm between the monthly data for exports and their lagged values (month/month(year-1)) considering HS6 products and country of destination. Next, I keep only products categorised as intermediates. After computing the correlation values, I introduce a dummy variable which is equal to 1 if the correlation coefficient is higher than or equal to |0.7|[32]. The sum of the weighted average is then used to acquire the firm-year data in the way presented by equation (18):

$$Contractual\_exporter_{it} = \sum_{cp} Dummy_{cpit} * \left(\frac{EXPI_{cpit}}{EXI_{it}}\right) > 0 \qquad (18)$$

where *Dummy* stands for the dummy variable defined above, *EXPI* for the export of intermediates classified by HS6 categories (*p*) of firm *i* in year *t* to certain destination country *c*, and *EXI* for total intermediate exports of firm *i* in year *t*.

[31]See https://unstats.un.org/unsd/trade/conversions/HS%20Correlation%20and%20Conversion%20tables.htm
[32] Robustness was also tested with a dummy variable equal to 1 if the correlation coefficient is lower (|0.5|) or higher (|0.8|) without any significant difference in the main results.

In a similar way, I use import data by firms, years, month, country of dispatch and products on the HS6 level to define the stability of a firm's supply from abroad, which may help indicate whether a firm has a permanent supplier from abroad. Like before, after the HS6 compliance to the base year 2002, I calculate the correlation coefficient (*Corr*) by HS6 products, month and country of dispatch. Then I introduce a dummy variable which equals 1 if the correlation coefficient is higher than or equal to |0.7|. The sum of weighted average is subsequently used to compute the firm-year data in the way shown in equation (19):

$$Contractual\_importer_{it} = \sum_{dp} Dummy_{dpit} * \left(\frac{IMPI_{dpit}}{IMI_{it}}\right) > 0 \qquad (19)$$

where *Dummy* stands for the dummy variable, *IMPI* for the import of intermediates as classified by HS6 categories (*p*) from a certain exporting country, *IMI* for total intermediate imports of the firm in a certain year, *i* for firm, *t* for year, *d* for the country of dispatch and *p* for the product.

Firms that appear to have a permanent supplier from abroad (*Contractual importers*) are the largest group, accounting for 33% of all manufacturing exporters, while firms which are affiliates or subsidiaries of a foreign company (*Foreign owned)* are the smallest, with 8.5% of all exporters (Table 15). All forms of GVC organisational structures are more prevalent among the bigger exporting firms and firms from high-technology industries.

Table 15: Modes of a firm's organisational structure in GVCs by firm size and technological intensity, manufacturing, 2002–2014 (%)

Percentage of observations	*Foreign owned*	*Outward investors*	*Contractual exporters*	*Contractual importers*	*All exporters*
All Manufacturing	8.5	9.1	25.5	33.5	100
Size					
Smaller firms (<50 employees)	5.0	2.6	15.6	21.1	100
Bigger firms (>=50 employees)	18.8	28.3	54.9	70.1	100
Technology					
Low	5.1	9.0	18.2	25.2	100
Medium-low	8.3	6.7	23.8	31.1	100
Medium-high and high	11.9	12.2	34.6	44.4	100

Note: the sum of columns does not equal 100 since: (1) firms are not uniquely identified, i.e. one firm might be defined as having more than one organisational structure at the same time; and (2) firms that are not classified in any of these categories represent exporters that are not directly involved in GVCs. Industry groups based on technology intensity are defined according to OECD classification (Table 10-2 in the Appendix 10).

Source: Author's calculations based on TiVA (OECD), FURS and AJPES data

In Table 16, I take a first look for the existence of differences in the DVA in the export share between different forms of firms' GVC participation. All firms seem to have a lower DVA than the average exporting firm. The highest average DVA is recorded where a firm is a contractual exporter or has affiliates abroad, while in the case where firms are foreign affiliates they produce the lowest DVA in exports.

Table 16: Average share of DVA by main forms of GVC participation, manufacturing, 2002–2014

mean DVAR (%)	*Foreign owned*	*Outward investors*	*Contractual exporters*	*Contractual importers*	*All exporters*
All manufacturing	55.8	59.6	59.6	58.8	69.7
Size					
Smaller firms (<50 employees)	61.7	66.1	65.6	61.7	73.1
Bigger firms (>=50 employees)	51.1	57.8	54.7	56.1	59.5
Technology					
Low	52.7	62.0	56.9	58.3	71.5
Medium-low	52.9	52.9	55.7	53.0	65.6
Medium-high and high	59.4	62.5	64.3	64.0	72.9

Note: Industry groups based on technology intensity are defined according to OECD classification (Table 10-2 in the Appendix 10).

Source: Author's calculations based on TiVA (OECD), FURS and AJPES data

To capture other relevant firm characteristics, I use the balance-sheet data provided by the Slovenian business register (AJPES) for the period 2002–2014. Table 17 reveals the basic descriptive statistics of Slovenian firms by main forms of GVC participation. It shows that firms which participate through a network of affiliates (via FDI) have on average a higher relative wage and a higher share of exports that are based on imports of the same products compared to firms engaged in contractual relationships. Outward investors are, on average, larger as measured by the number of employees and stand out for their highest productivity, larger average amount of intangible capital, highest capital intensity and share of final goods in total exports. However, compared to the average exporting firms, firms that participate in GVCs perform better, are bigger and much less indebted, export smaller shares of their sales to ex-Yugoslav markets and, on average, have higher shares of exports based on imports of the same products.

Table 17: Firm characteristics by main forms of GVC participation, manufacturing, mean values 2002–2014

	Foreign owned	*Outward investors*	*Contractual exporters*	*Contractual importers*	*All exporters*
Productivity (EUR per empl.)	185783.6	283224.3	211895.8	193371.1	162823
Relative wage (coefficient)	1.12	1.11	1.05	1.06	1.00
Intangible capital (EUR per empl.)	3935.628	5853.019	3342.36	2567.029	2626.156
Capital intensity (EUR per empl.)	79597.55	145474.5	93095.05	87814.77	84801.01
Indebtedness (coefficient)	0.49	0.50	0.55	0.56	17.04
SIZE (No. of empl.)	176.70	348.81	172.70	155.72	69.35
Share EXYU	0.20	0.26	0.24	0.27	0.37
Share POT	0.72	0.70	0.63	0.64	0.38
Share FP	0.15	0.23	0.13	0.19	0.21
EX_OR (dummy)	0.83	0.88	0.88	0.78	0.61
Share EU	0.58	0.45	0.51	0.50	0.43

Source: Author's calculations based on TiVA (OECD), FURS and AJPES data

3.4.2 Empirical framework

To estimate the role of a firm's organisational structure for participating in GVCs, I employ the selected determinants of domestic value added in exports (*DVAR*) in the following regression specification:

$$\begin{aligned} lnDVAR_{it} = \ & \alpha + \beta_1 Foreign\_owned_{it-1} + \beta_2 Outward\_investor_{it-1} \\ & + \beta_3 Conctractual\_exporter_{it-1} + \beta_4 Contractual\_importer_{it-1} \\ & + (lnX_{it-1})\gamma + (Z_{it-1})\delta + \mu_t + \varepsilon_{it} \end{aligned} \quad (20)$$

where *Foreign_owned* is a dummy variable representing firms that are foreign affiliates (Dummy=1), *Outward_investor* is a dummy variable representing firms that have affiliates abroad (Dummy=1), *Contractual_exporters* represents firms that participate in GVCs as unrelated parties and can be characterised as permanent suppliers and *Contractual_importers* firms that participate in GVCs as unrelated parties and have their own suppliers from abroad. *X* controls for firm performance indicators and *Y* for firm export characteristics, μ_j are industry-fixed effects, μ_t are year-fixed effects and ε_{it} is a random error term. The variables in the model relate to firm *i* and year *t*.

Firm performance indicators X are 1-year lagged and transformed using a natural logarithm which allows the coefficients to be interpreted as elasticities. *X* includes productivity (*PROD1*) defined as operating income per employee, firm average wage relative to the average wage in the industry (*REL_WAGE)*, capital intensity (*C_INT*)

measured by fixed assets per employee, intangible capital (*INTG_C*) defined as intangible assets per employee, the indebtedness coefficient (*INDEB*) defined as a share of financial and operating liabilities in total liabilities and size of a firm measured by number of employees (*SIZE*).

Firm export characteristics Z are 1-year lagged and include the variables "pass-on-trade[33]" that measure the proportion of firm exports that is based on imports of the same 8-digit products (*sharePOT*), geographical component of exports measured as the share of exports to countries of former Yugoslavia (*shareEX-YU*) or share of export to EU countries (*shareEU*), share of final products in total export (*shareFP*) and a dummy variable export orientation (*EX_OR*) which takes the value of 1 if the share of exports in the total sales of a firm exceeds 10 percent (introduced in order to eliminate 'apparent' exporters).

In addition, Cook's distance is used to identify and remove outliers. Productivity is further measured as value added per employee (*PROD2*). Table 10-1 in Appendix 10 presents a correlation matrix of the variables used, revealing the high correlation of *shareEU* and *shareEX-YU*, which are then separately used in the basic specification.

There are other aspects that could potentially affect DVA in exports, such as transfer prices, heterogeneous prices in domestic and foreign markets and exchange rate shocks. Although I am aware that excluding these elements from consideration may bias the results, the available data related to these concepts do not enable their proper quantification.

From the econometric point of view, an important concern is endogeneity. The latter could arise due to unobserved firm-specific factors (i.e. managerial skills or product quality) which are included in the error term. This indeed suggests that some regressors may be correlated with the regression error. Thus, to mitigate the endogeneity issue, dependent variables are 1-year lagged. In addition, in the robustness check I employ the system GMM estimator.

3.5 Results

3.5.1 Benchmark results

Table 18 contains the results of the basic specification, which demonstrate the effect of both the form of a firm's participation in GVCs and a firm's characteristics in terms of DVA in exports. Columns 1 to 6 present the results of a pooled OLS regression while

[33] Similar as used in Damijan et al. (2013). As explained by the authors the category could be regarded as a sub-set of Carry-along-trade (CAT) by Bernard et al. (2012, 2018) which refers to exported goods not produced by the firm.

columns 7 to 12 the results with firm-fixed effects. Preliminary results that include only variables relating to the form of GVC participation (in columns 1 and 7) confirm a negative relation between foreign affiliates (*Foreign owned*) and DVA in exports, and a positive correlation in the case of unaffiliated firms which have a permanent foreign supplier (*Contractual importer*).

Other columns introduce additional control variables of firms' characteristics. The negative relation between foreign affiliates (*Foreign owned*) and DVA in exports remains highly significant. This suggests the results are in line with the prediction that offshored activities mainly include stages and functions with lower DVA in exports. The expected results that firms with foreign affiliates abroad (*Outward investor*) capture higher DVA are only confirmed in the case of OLS estimation results (columns 2 to 6), otherwise the coefficients are not significant. One explanation of the results could be that the majority of outward FDI flows of Slovenian manufacturing companies are directed towards retail activities (OFDI flows into the sectors Wholesale trade and Retail trade) and not to production. The results for firms that are themselves permanent suppliers (*Contractual exporter)* are again only significant for the OLS estimations (columns 1 to 6), and have the anticipated negative sign, suggesting that unaffiliated firms that could be identified as independent permanent suppliers for foreign firms have a lower DVA value. Moreover, results in all specifications strongly confirm the expectation that unaffiliated firms which have a permanent foreign supplier capture higher DVA in exports (*Contractual importer*). This reveals the positive impact on DVA in exports where firms are in the position of "value chain organiser" in a contractual relationship with arm's-length suppliers, allowing them to focus on their core competencies.

Regarding the other variables, the regression results support the presumption that bigger firms have smaller DVA in exports, as noted by Kee and Tang (2016) due to the high ratio between imports and sales. The coefficients are negative and significant in all specifications. On the other side, a positive outcome can be observed, all else being equal, for firms with a larger share of intangible capital per worker (*INTG_C*) and firms with a higher relative wage. The importance of the role of intangible assets agrees with the findings of Dedrick and Kraemer (2017) for the case of Apple, where its success in value capture is based on its capability to build a brand name and develop its own intellectual property. Similarly, the OECD (2013b) finds positive results between knowledge-based capital and DVA for the EU-15. A firm's average wage compared to the industry's average wage could indicate the relative prevalence of human capital, i.e. a higher ratio suggests that firms employ more skilled workers' profiles with higher wages and thus have greater human capital. The results also reveal that firms with greater capital intensity (*C_INTEN*) add more domestic value to exports. I additionally find that less indebted firms (*INDEB*) capture higher DVA in exports.

Table 18: Determinants of domestic value added in exports using firm-level data for period 2002–2014, manufacturing

VARIABLES	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	FE (7)	FE (8)	FE (9)	FE (10)	FE (11)	FE (12)
Foreign_owned	-0.202***	-0.135***	-0.115***	-0.112***	-0.113***	-0.167***	-0.0497***	-0.0498***	-0.0487***	-0.0492***	-0.0487***	-0.0638***
	(-0.0121)	(-0.0119)	(-0.0119)	(-0.0119)	(-0.0119)	(-0.013)	(-0.0155)	(-0.0155)	(-0.0154)	(-0.0155)	(-0.0155)	(-0.0163)
Outward_investor	-0.0156	0.0471***	0.0482***	0.0463***	0.0541***	0.0216*	-0.0187	-0.0133	-0.0135	-0.0127	-0.0135	-0.0133
	(-0.0113)	(-0.0119)	(-0.0118)	(-0.0119)	(-0.0118)	(-0.013)	(-0.013)	(-0.0131)	(-0.0131)	(-0.0131)	(-0.0131)	(-0.0138)
Contractual exporter	-0.158***	-0.116***	-0.0889***	-0.0855***	-0.0900***	-0.146***	-0.0309	-0.0163	-0.00935	-0.00817	-0.00933	-0.0225
	(-0.031)	(-0.0292)	(-0.0292)	(-0.0292)	(-0.0291)	(-0.0321)	(-0.035)	(-0.035)	(-0.0353)	(-0.0354)	(-0.0353)	(-0.0372)
Contractual importer	0.350***	0.290***	0.270***	0.270***	0.269***	0.302***	0.136***	0.142***	0.143***	0.142***	0.143***	0.115***
	(-0.0446)	(-0.0417)	(-0.0414)	(-0.0414)	(-0.0413)	(-0.0455)	(-0.0365)	(-0.0364)	(-0.0363)	(-0.0364)	(-0.0363)	(-0.0382)
lnPROD1		-0.263***	-0.253***	-0.254***	-0.254***			-0.0470***	-0.0439***	-0.0460***	-0.0440***	
		(-0.00803)	(-0.008)	(-0.00799)	(-0.008)			(-0.0116)	(-0.0117)	(-0.0117)	(-0.0117)	
lnREL_WAGE		0.317***	0.315***	0.309***	0.315***	0.141***		0.0576**	0.0540**	0.0560**	0.0539**	0.0338
		(-0.0186)	(-0.0184)	(-0.0184)	(-0.0183)	(-0.0224)		(-0.0225)	(-0.0225)	(-0.0225)	(-0.0225)	(-0.0241)
lnINTG_C		0.00430***	0.00435***	0.00428***	0.00457***	0.00349**		0.00369**	0.00363**	0.00367**	0.00363**	0.00436***
		(-0.00155)	(-0.0015)	(-0.0015)	(-0.0015)	(-0.0017)		(-0.00148)	(-0.0015)	(-0.00148)	(-0.00148)	(-0.00156)
lnC_INTEN		0.0302***	0.0297***	0.0294***	0.0292***	0.00301		0.00654	0.00669	0.00669	0.00669	0.00165
		(-0.0043)	(-0.0043)	(-0.0043)	(-0.0043)	(-0.0050)		(-0.0055)	(-0.0055)	(-0.00552)	(-0.00552)	(-0.00572)
lnINDEB		-0.0271***	-0.0235***	-0.0239***	-0.0236***	-0.0649***		-0.0264***	-0.0249***	-0.0253***	-0.0249***	-0.0270***
		(-0.00758)	(-0.0075)	(-0.0075)	(-0.0075)	(-0.0084)		(-0.0087)	(-0.0087)	(-0.00874)	(-0.00874)	(-0.00932)
lnSIZE		-0.0612***	-0.0526***	-0.0554***	-0.0524***	-0.0189***		-0.0602***	-0.0572***	-0.0588***	-0.0572***	-0.0441***
		(-0.00358)	(-0.0038)	(-0.0037)	(-0.0038)	(-0.0041)		(-0.0101)	(-0.0101)	(-0.0101)	(-0.0101)	(-0.01)
shareEXYU			0.0749***		0.0326**	0.0839***			0.0671***		0.0674***	0.0757***
			(-0.014)		(-0.0153)	(-0.0154)			(-0.0206)		(-0.0209)	(-0.0217)
sharePOT			-0.106***	-0.107***	-0.101***	-0.148***			-0.0139	-0.0142	-0.0139	-0.0155
			(-0.011)	(-0.011)	(-0.011)	(-0.0121)			(-0.0097)	(-0.00971)	(-0.00971)	(-0.0102)
shareFP			0.119***	0.122***	0.124***	0.129***			0.0813**	0.0828**	0.0813**	0.0947***
			(-0.0174)	(-0.0174)	(-0.0173)	(-0.0192)			(-0.0328)	(-0.0329)	(-0.0328)	(-0.0347)
shareEU				-0.0623***						-0.0394**		
				(-0.012)						(-0.0197)		
EX_OR					-0.0906***						0.00126	
					(-0.0134)						(-0.0126)	
lnPROD2(DV)						-0.0905***						0.00473
						(-0.0137)						(-0.0111)
Observations	8,331	8,331	8,331	8,331	8,331	8,325	8,331	8,331	8,331	8,331	8,331	8,325
R-squared	0.248	0.343	0.356	0.356	0.36	0.275	0.21	0.217	0.219	0.219	0.219	0.208
No. of firms							1.432	1.432	1.432	1.432	1.432	1.428

Note: Data for the manufacturing sector. Independent variables lagged by one year. Time and industry dummy included. Dependent variable: DVA in exports (*DVAR*). All regressions include a constant term. Significance: *** p<0.001 **p<0.05 *p<0.1; *Source: Author's calculations.*

Interestingly, firms characterised by higher domestic value added in their exports are not necessarily more productive. Regression coefficients are negative in all specifications. A possible explanation is the behaviour of more productive firms which tend to import more (intermediate goods), become even more productive, and thus increase their exports which are on average more import-intensive (Lu & Ulu, 2014), i.e. a greater share of import content in exports reduces value added in exports (Johnson, 2014). However, it should be considered that my analysis is solely based on a sample of exporting firms. According to mainstream theory (Melitz, 2003; Helpman, Melitz, & Yeaple, 2004) and empirical evidence (Bernard, Jensen, Redding, & Schott, 2012), only the most productive firms export due to high entry costs. In columns 4 and 8, *PROD1* (defined as operating income per employee) was replaced by an alternative measure based on value added per employee (*PROD2*). One coefficient remains negative (column 6) while the other is not significant (column 12).

Regarding export characteristics, the results show a positive coefficient for the share of exports of Slovenian firms to countries of former Yugoslavia, while revealing negative coefficients (columns 4 and 10) for exports to EU countries. The results thus indicate that the average Slovenian firm achieves higher DVA in exports by exporting to less demanding markets. As expected, firms with a higher share of final products in their exports and firms with lower share of exports that is based on imports of the same products (sharePOT) also capture higher DVA in exports.

As seen in Table 14, manufacturing industries are very heterogeneous. The main exporting firms in Slovenia in the period 2002–2014 come from medium-high and high-tech-industries: Chemicals and chemical products (CHM), Electrical Machinery and apparatus (ELQ), and Motor vehicles (MTR). As reported by the OECD (2017), MNCs are the primary traders in Slovenia. In the Electrical Machinery and apparatus industry (ELQ), the main share of exports is due to domestic MNCs, while exports from the Motor vehicles industry (MTR) are chiefly the results of foreign-owned enterprises. The high share of import content in exports of the Motor vehicles industry (MTR) reflects this industry's strong involvement in GVCs.

To address the issue of heterogeneity, each 2-digit manufacturing industry is analysed separately. Table 19 presents the results of the basic specification for each industry individually, with all selected explanatory variables included (as in Table 18, column 5 for manufacturing as a whole) using the ordinary least squares (OLS) estimation method.

Contrary to the general findings, the correlation between foreign affiliates (*Foreign owned*) and DVA in exports is positive in medium-high and high-tech industries, Chemicals and chemical products (CHM), and Electrical Machinery and apparatus (ELQ). However, this is in line with findings that positive FDI spillovers are more likely found in technologically

more advanced sectors (Aghion, Blundell, Griffith, Howitt, & Prantl, 2009; Keller & Yeaple, 2009; Haskel, Pereira, & Slaughter, 2007; Benfratello & Sembenelli, 2006; Zámborský, 2006). A positive correlation in the case of unaffiliated firms that are themselves permanent suppliers (*Contractual exporter*) is revealed in Chemicals and chemical products (CHM) and Motor vehicles (MTR), as well as in Other non-metallic mineral products (NMM), which is contrary to the general findings. This may indicate that foreign-owned firms and firms that are permanent suppliers for foreign firms are not simply producers but also exploit their own innovation capacities in medium-high and high-tech industries.

Firms with foreign affiliates abroad (*Outward investor*) capture higher DVA in the industries Pulp, paper, paper products (PAP), Machinery and equipment (MEQ), and Computer, electronic and optical equipment (CEQ). The expectations that unaffiliated firms with a permanent foreign supplier capture higher DVA in exports (*Contractual importer*) are only confirmed in low-tech and medium-low-tech industries.

The general results I obtained regarding the firm performance shown in Table 18 are confirmed the most by Textiles, textile products (TEX) and the least in Other transport equipment (TRQ). There is evidence of slightly different behaviour in the case of Other non-metallic mineral products (NMM) where smaller firms do not have higher DVA and a bigger share of intangible capital does not contribute to capturing a higher DVA share. Interesting results are also seen in Motor vehicles (MTR) where the high share of POT is positively correlated with DVA, and in Basic metals (MET) and Fabricated metal products (FBM) where firms do not achieve higher DVA in exports with when exporting to less demanding markets.

To sum up the main findings, the results confirm the negative correlation of DVA in exports and foreign affiliates (*Foreign owned*) in almost all industries, except in two medium-high and high-tech industries. The positive correlation of contractual importer and the negative correlation of contractual exporter is largely confirmed in low- and medium-low-tech industries, while in medium-high and high-tech industries it is possible to reveal positive correlation of contractual exporter. By observing the variable values regarding the participation modes, one may conclude that correlations with the most outstanding values (i.e. the opposite sign) compared to the main results (Table 18) are found in medium-high and high-tech industries.

Regarding firm-performance variables, the results for low-tech and medium-high and high-tech industries (except in the industries electrical machinery (ELQ) and other transport equipment (TRQ)) are the most consistent with the main findings, while in medium-low-tech industries we can find some opposite correlations.

Table 19: Determinants of domestic value added in exports using firm-level data for the period 2002–2014, manufacturing industries (2-digit)

	low-tech				medium-low-tech				medium-high and high-tech					
VARIABLES	FOD	TEX	WOD	PAP	RBP	NMM	MET	FBM	CHM	MEQ	CEQ	ELQ	MTR	TRQ
Foreign_owned	**-0.0890****	**-0.131****	**-0.296*****	0.0333	**-0.115****	**-0.178*****	0.109	**-0.218*****	**0.117****	**-0.130*****	**-0.172*****	**0.0766***	**-0.337*****	0.0294
	(-0.0447)	(-0.0518)	(-0.0585)	(-0.0603)	(-0.0547)	(-0.0345)	(-0.0698)	(-0.0314)	(-0.0539)	(-0.0168)	(-0.0294)	(-0.0411)	(-0.0481)	(-0.367)
Outward_investor	0.0353	0.00288	0.0339	0.163***	0.0953*	-0.0481	0.0332	0.0455	0.0711	0.0881***	0.142***	0.0213	0.00524	-0.285**
	(-0.031)	(-0.0378)	(-0.064)	(-0.0491)	(-0.0513)	(-0.0368)	(-0.0913)	(-0.0357)	(-0.0513)	(-0.0173)	(-0.0341)	(-0.0359)	(-0.0446)	(-0.131)
Contractual exporter	0.204	-0.0486	**-0.200****	**-0.352****	**-0.384*****	**0.355*****	0.333	**-0.235*****	0.500***	**-0.114***	-0.0349	0.0342	0.212**	1.367
	(-0.178)	(-0.128)	(-0.0779)	(-0.145)	(-0.104)	(-0.0839)	(-0.235)	(-0.0723)	(-0.153)	(-0.0614)	(-0.117)	(-0.107)	(-0.0855)	(-3.4)
Contractual importer	**0.595*****	**0.582*****	**0.254****	-0.0733	0.550***	0.0677	0.675**	0.372***	0.115	0.0646	0.0389	0.135	0.19	0.245
	(-0.179)	(-0.21)	(-0.116)	(-0.146)	(-0.155)	(-0.141)	(-0.3)	(-0.0986)	(-0.19)	(-0.0752)	(-0.14)	(-0.159)	(-0.169)	(-0.535)
lnPROD1	**-0.148*****	**-0.211*****	**-0.212*****	**-0.516*****	**-0.372*****	**-0.206*****	**-0.521*****	**-0.239*****	**-0.425*****	**-0.162*****	**-0.255*****	**-0.105*****	**-0.195*****	**-0.419*****
	(-0.0301)	(-0.0282)	(-0.0344)	(-0.0481)	(-0.0408)	(-0.0326)	(-0.0722)	(-0.0189)	(-0.0501)	(-0.0121)	(-0.0188)	(-0.0244)	(-0.03)	(-0.123)
lnREL_WAGE	**0.268*****	**0.173****	**0.154****	**0.352*****	**0.311*****	**0.344*****	**0.584*****	**0.242*****	**0.429*****	**0.244*****	**0.553*****	**0.120****	**0.140***	0.14
	(-0.07)	(-0.0751)	(-0.0658)	(-0.0926)	(-0.0752)	(-0.0769)	(-0.162)	(-0.0522)	(-0.103)	(-0.0261)	(-0.0428)	(-0.0483)	(-0.0765)	(-0.239)
lnINTAN_C	0.00675	**0.0157*****	**0.0117***	**0.0131***	0.00897	-0.0255***	**0.0215****	-0.0028	0.0135	**0.00728*****	0.00399	0.00569	-0.00026	-0.00708
	(-0.0057)	(-0.0057)	(-0.00637)	(-0.00748)	(-0.00591)	(-0.00627)	(-0.0108)	(-0.0038)	(-0.00863)	(-0.00219)	(-0.00396)	(-0.00455)	(-0.00596)	(-0.0195)
lnC_INTEN	0.0209	**0.0489*****	0.00513	0.00049	**0.0858*****	**0.0630*****	-0.0167	**0.0404*****	**0.0846*****	**-0.0379*****	**0.0334*****	0.0256	**0.0728*****	0.000508
	(-0.0135)	(-0.0159)	(-0.0205)	(-0.0202)	(-0.0185)	(-0.017)	(-0.0362)	(-0.0092)	(-0.0236)	(-0.00645)	(-0.0111)	(-0.0172)	(-0.0189)	(-0.0652)
lnINDEB	**0.114*****	**-0.0496****	-0.0351	-0.0578	**0.123*****	**-0.126*****	0.0167	**-0.0574*****	-0.0639	**-0.0421*****	**-0.0256***	-0.0305	**-0.0882****	**-0.456****
	(-0.0276)	(-0.0207)	(-0.0347)	(-0.0376)	(-0.0347)	(-0.0266)	(-0.0449)	(-0.0198)	(-0.0391)	(-0.0126)	(-0.0147)	(-0.021)	(-0.0387)	(-0.179)
lnSIZE	**0.0304*****	**-0.0574*****	**-0.0378****	**-0.105*****	**-0.103*****	**0.0551*****	**-0.134*****	**-0.0644*****	**-0.0906*****	**-0.0662*****	**-0.0595*****	**-0.0241****	**-0.0528*****	**0.0766***
	(-0.0115)	(-0.0146)	(-0.0174)	(-0.0165)	(-0.0158)	(-0.0131)	(-0.0275)	(-0.0105)	(-0.0224)	(-0.0065)	(-0.01)	(-0.0112)	(-0.0144)	(-0.0411)
shareEXYU	0.0403	**0.163*****	0.0134	**0.125***	-0.0243	-0.0451	**-0.333****	**-0.231*****	**0.341*****	-0.0659***	**0.176*****	**0.373*****	0.134	-0.24
	(-0.0461)	(-0.0528)	(-0.0615)	(-0.0694)	(-0.0613)	(-0.0431)	(-0.153)	(-0.0383)	(-0.0932)	(-0.0237)	(-0.0465)	(-0.0453)	(-0.0913)	(-0.28)
sharePOT	**-0.127*****	**-0.0759***	**-0.197*****	**-0.140*****	-0.00515	**-0.127*****	0.038	**-0.113*****	**-0.184*****	**-0.0538*****	-0.0184	-0.0454	**0.124*****	-0.202**
	(-0.0374)	(-0.0451)	(-0.0401)	(-0.0529)	(-0.0438)	(-0.0382)	(-0.0775)	(-0.0256)	(-0.0658)	(-0.0162)	(-0.034)	(-0.0381)	(-0.0451)	(-0.0938)
shareFP	**0.166*****	**0.101*****	-0.158*	0.0697	0.0323	0.111	1.146	-0.0588	**0.456*****	**-0.136****	**0.226*****	**0.0967***	0.246	0.230*
	(-0.0467)	(-0.0376)	(-0.0881)	(-0.0562)	(-0.0545)	(-0.0828)	(-1.419)	(-0.0607)	(-0.079)	(-0.0553)	(-0.0608)	(-0.0552)	(-0.262)	(-0.119)
EX_OR	**-0.118*****	**-0.159*****	0.035	-0.0864	**-0.157*****	**-0.122*****	0.12	**-0.173*****	**-0.151****	0.0111	0.0209	0.0693	**-0.148****	0.00151
	(-0.032)	(-0.052)	(-0.0656)	(-0.0541)	(-0.0555)	(-0.0418)	(-0.118)	(-0.033)	(-0.0656)	(-0.0202)	(-0.0453)	(-0.0428)	(-0.0649)	(-0.262)
Observations	391	506	479	408	956	456	245	1519	524	1286	524	599	379	59
R-squared	0.382	0.391	0.288	0.506	0.243	0.36	0.405	0.257	0.427	0.307	0.521	0.28	0.449	0.718

Legend: FOD - food products, beverages; TEX - textiles, textile products; WOD - wood products; PAP - pulp, paper, paper products; CHM - chemical, chemical products; RBP - rubber and plastics products; NMM - other non-metallic mineral products; MET - basic metals; FBM - fabricated metal products; MEQ - machinery and equipment; CEQ - computer, electronic; ELQ - electrical machinery; MTR - motor vehicles, trail; TRQ - other transport equipment

Note: Data for the manufacturing sector. Independent variables lagged by one year. Time dummy included. Dependent variable: DVA in exports (*DVAR*). All regressions include a constant term. Significance: *** p<0.001 **p<0.05 *p<0.1. *Source: Author's calculations.*

3.5.2 Robustness checks

In this section, I perform several robustness checks of my basic specification estimations. In the first robustness test, I employ two-step system GMM estimator in order to address the presence of endogeneity. Table 20 presents the estimation results for the baseline empirical specifications. All estimations include year-fixed effects. Third- and deeper lags of the endogenous variables were used as instruments in the GMM style. The autocorrelation tests of the residual show there is significant first-order autocorrelation, but no significant second-order autocorrelations, thereby supporting the assumption of a lack of autocorrelation. The Hansen test confirms the validity of the instruments.

Table 20: Determinants of domestic value added in exports in the manufacturing sector, Robustness test I – GMM estimation results

VARIABLES	GMM (1)	GMM (2)	GMM (3)	GMM (4)	GMM (5)
Foreign_owned	-0.138**	-0.132**	-0.114*	-0.118*	-0.115*
	(-0.0609)	(-0.0624)	(-0.0619)	(-0.0613)	(-0.0619)
Outward_investor	-0.0123	0.0135	0.00506	0.00955	0.0135
	(-0.0626)	(-0.068)	(-0.0647)	(-0.0656)	(-0.065)
Contractual exporter	-0.146	-0.0574	-0.0212	-0.00551	-0.00679
	(-0.201)	(-0.147)	(-0.152)	(-0.149)	(-0.153)
Contractual importer	0.602**	0.368***	0.375***	0.364**	0.392***
	(-0.251)	(-0.14)	(-0.144)	(-0.142)	(-0.145)
lnPROD1		-0.350***	-0.331***	-0.335***	-0.329***
		(-0.0511)	(-0.0516)	(-0.0523)	(-0.0508)
lnREL_WAGE		0.358***	0.336***	0.337***	0.331***
		(-0.0958)	(-0.0954)	(-0.0958)	(-0.0983)
lnINTG_C		0.00576	0.00705	0.00718	0.00703
		(-0.0053)	(-0.00531)	(-0.00528)	(-0.0053)
lnC_INTEN		0.0725***	0.0751***	0.0730***	0.0765***
		(-0.0249)	(-0.0245)	(-0.0247)	(-0.0246)
lnINDEB		-0.0313	-0.0344	-0.0329	-0.0334
		(-0.0262)	(-0.0258)	(-0.026)	(-0.0258)
lnSIZE		-0.0695***	-0.0622***	-0.0661***	-0.0615***
		(-0.0136)	(-0.0139)	(-0.0138)	(-0.0138)
shareEXYU			0.0691**		0.048
			(-0.0295)		(-0.0315)
sharePOT			-0.0533***	-0.0539***	-0.0528***
			(-0.0143)	(-0.0145)	(-0.0142)
shareFP			0.0937**	0.0962**	0.0963***
			(-0.0377)	(-0.0379)	(-0.0373)
shareEU				-0.0576**	
				(-0.027)	
EX_OR					-0.0477***
					(-0.0183)
Observations	8,331	8,331	8,331	8,331	8,331
No. of firms	1.432	1.432	1.432	1.432	1.432
No. of instruments	225	496	499	499	500
Hansen test	185.9	422.1	420.8	420.3	420.1
Hansen (p)	(0.29)	(0.734)	(0.748)	(0.754)	(0.756)
AR1 test	-4.273	-4.578	-4.598	-4.612	-4.633
AR1(p)	(1.93E-05)	(4.71E-06)	(4.27E-06)	(3.98E-06)	(3.60E-06)
AR2 test	-0.793	-1.047	-1.033	-1.015	-0.984
AR2 (p)	(0.428	(0.295)	(0.301)	(0.31)	(0.325)

Note: Data for the manufacturing sector. Independent variables lagged by one year.
Significance: *** p<0.001 **p<0.05 *p<0.1. Dependent variable: DVA in exports (*DVAR*).

Source: Author's calculations.

Columns 1 to 5 confirm a negative correlation between foreign affiliates (*Foreign owned*) and DVA in exports as well as a positive correlation between unaffiliated firms which have a permanent foreign supplier (*Contractual importer*) and DVA in exports, both with higher coefficients than in the basic specification estimated with fixed effects. The results of other variables regarding the form of GVC participation are not significant, which is similar to the results using fixed effects in Table 18. Other results that concern firm characteristics are consistent with the results given in Table 18. A higher relative wage, higher capital intensity, bigger share of exports to countries of ex-Yugoslavia and a higher share of final goods remain positively correlated with DVA in exports. The only exception from the basic estimation is the coefficient for intangible capital per worker, which is not significant.

Given that no guidelines exist on how to define contractual trading partners, in the second set of robustness checks I employ various alternatives for defining contractual importers and contractual exporters (Table 21). In the first (I) and second (II) sets, I define contractual importers and exporters with use of a different correlation boundary than in the basic specification, where the limit of the correlation coefficient is set to |0.7|. In columns 1 to 3, I test the estimation results with the dummy variable equal to 1 if the correlation coefficient is |0.5|, i.e. lower than in the basic specification, in columns 4 to 6 I test the estimation results with the dummy variable equal to 1 if the correlation coefficient is |0.8|, i.e. higher than in the basic specification. In both cases, the regression results are estimated using the OLS, fixed effects and GMM estimation methods. The coefficients for firms that are foreign affiliates (*Foreign_owned*) remain robust, negative and significant. Coefficients for unaffiliated firms which have a permanent foreign supplier (*Contractual_importer*) remain significant and positive, except in column 1. The results for firms with foreign affiliates abroad (*Outward_investor*) are positive and significant only when estimated with OLS (columns 1 and 4), which gives the same results as in the basic specification. Estimates for firms that are themselves permanent suppliers (*Contractual exporter)* are significant only for the OLS estimations when the correlation coefficient is |0.5| (column 1). Other results concerning the correlations between firm characteristics and DVA in exports remain highly robust.

Table 21: Determinants of domestic value added in exports in the manufacturing sector, Robustness test II

VARIABLES	I			II			III			IV		
	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM
	1	2	3	4	5	6	7	8	9	10	11	12
Foreign_owned	-0.114***	-0.0495***	-0.113*	-0.111***	-0.0482***	-0.108*	-0.113***	-0.0495***	-0.124**	-0.115***	-0.0491***	-0.120*
	(-0.0119)	(-0.0155)	(-0.0606)	(-0.0119)	(-0.0155)	(-0.0629)	(-0.0119)	(-0.0155)	(-0.0606)	(-0.0118)	(-0.0154)	(-0.0626)
Outward_investor	0.0517***	-0.0128	0.0169	0.0557***	-0.0127	0.0294	0.0542***	-0.0123	0.0321	0.0562***	-0.0134	0.015
	(-0.0118)	(-0.0131)	(-0.0672)	(-0.0118)	(-0.0131)	(-0.0647)	(-0.0118)	(-0.0131)	(-0.0633)	(-0.0118)	(-0.0131)	(-0.0658)
Contractual exporter (corr>0.5)	-0.108***	-0.0119	0.0145									
	(-0.0198)	(-0.0253)	(-0.117)									
Contractual importer (corr>0.5)	0.0319	0.0746***	0.259**									
	(-0.0266)	(-0.0267)	(-0.104)									
Contractual exporter (corr>0.8)				-0.0405	0.0194	0.145						
				(-0.0395)	(-0.0438)	(-0.229)						
Contractual importer (corr>0.8)				0.308***	0.151***	0.501**						
				(-0.0498)	(-0.0433)	(-0.198)						
Contractual exporter (cv)							0.184*	-0.0369	0.233			
							(-0.112)	(-0.111)	(-0.409)			
Contractual importer (cv)							0.536***	-0.0169	0.835**			
							(-0.096)	(-0.0738)	(-0.417)			
Contractual exporter (all goods)										-0.0119	-0.0148	0.0103
										(-0.0252)	(-0.0321)	(-0.129)
Contractual importer (all goods)										0.318***	0.137***	0.513***
										(-0.0384)	(-0.0336)	(-0.137)
lnPROD1	-0.253***	-0.0441***	-0.333***	-0.254***	-0.0439***	-0.331***	-0.254***	-0.0430***	-0.311***	-0.256***	-0.0445***	-0.320***
	(-0.00801)	(-0.0117)	(-0.0512)	(-0.00798)	(-0.0117)	(-0.0491)	(-0.00798)	(-0.0117)	(-0.0483)	(-0.00797)	(-0.0117)	(-0.0489)
lnREL_WAGE	0.312***	0.0533**	0.300***	0.313***	0.0536**	0.345***	0.314***	0.0530**	0.303***	0.315***	0.0546**	0.308***
	(-0.0184)	(-0.0225)	(-0.0922)	(-0.0183)	(-0.0225)	(-0.0971)	(-0.0183)	(-0.0226)	(-0.104)	(-0.0183)	(-0.0225)	(-0.0973)
lnINTG_C	0.00450***	0.00361**	0.00819	0.00467***	0.00364**	0.0073	0.00457***	0.00365**	0.00898*	0.00452***	0.00367**	0.00457
	(-0.00154)	(-0.00148)	(-0.00521)	(-0.0015)	(-0.0015)	(-0.0053)	(-0.00154)	(-0.0015)	(-0.0054)	(-0.0015)	(-0.0015)	(-0.0052)
lnC_INTEN	0.0300***	0.00707	0.0822***	0.0285***	0.00693	0.0743***	0.0291***	0.007	0.0751***	0.0293***	0.00689	0.0836***
	(-0.00428)	(-0.00552)	(-0.0258)	(-0.0043)	(-0.0055)	(-0.0259)	(-0.00427)	(-0.0055)	(-0.0239)	(-0.0043)	(-0.0055)	(-0.0247)
lnINDEB	-0.0253***	-0.0249***	-0.0278	-0.0221***	-0.0245***	-0.0263	-0.0225***	-0.0250***	-0.0437*	-0.0234***	-0.0250***	-0.0454*
	(-0.00751)	(-0.00875)	(-0.0256)	(-0.0075)	(-0.0087)	(-0.0264)	(-0.0075)	(-0.0088)	(-0.0264)	(-0.0075)	(-0.0087)	(-0.0275)
lnSIZE	-0.0514***	-0.0577***	-0.0665***	-0.0529***	-0.0573***	-0.0632***	-0.0529***	-0.0564***	-0.0613***	-0.0531***	-0.0574***	-0.0609***
	(-0.0038)	(-0.0101)	(-0.014)	(-0.0038)	(-0.0101)	(-0.0135)	(-0.00376)	(-0.0101)	(-0.0132)	(-0.0038)	(-0.0101)	(-0.0136)
shareEXYU	0.0310**	0.0674***	0.0582*	0.0311**	0.0681***	0.04	0.0278*	0.0664***	0.0409	0.0301**	0.0668***	0.0471
	(-0.0153)	(-0.0209)	(-0.0313)	(-0.0153)	(-0.0209)	(-0.0319)	(-0.0153)	(-0.021)	(-0.0305)	(-0.0153)	(-0.0209)	(-0.0314)

(table continues)

(continued)

VARIABLES	I			II			III			IV		
	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM
	1	2	3	4	5	6	7	8	9	10	11	12
sharePOT	-0.104***	-0.0132	-0.0542***	-0.101***	-0.0136	-0.0515***	-0.102***	-0.0141	-0.0487***	-0.101***	-0.014	-0.0510***
	(-0.011)	-0.0097)	(-0.0145)	(-0.011)	(-0.0097)	(-0.0143)	(-0.011)	(-0.0097)	(-0.0128)	(-0.011)	(-0.0097)	(-0.0139)
shareFP	0.106***	0.0830**	0.0996**	0.129***	0.0840**	0.101***	0.131***	0.0805**	0.0938***	0.124***	0.0808**	0.0932***
	(-0.0178)	(-0.033)	(-0.0424)	(-0.0172)	(-0.0327)	(-0.035)	(-0.0172)	(-0.0326)	(-0.0343)	(-0.0172)	(-0.0326)	(-0.0341)
EX_OR	-0.0900***	0.00107	-0.0496***	-0.0904***	0.00157	-0.0445**	-0.0928***	0.0013	-0.0423**	-0.0911***	0.00135	-0.0439**
	(-0.0134)	(-0.0126)	(-0.0175)	(-0.0134)	(-0.0126)	(-0.0184)	(-0.0135)	(-0.0126)	(-0.0172)	(-0.0134)	(-0.0126)	(-0.0186)
Constant	2.351***	0.212	0	2.348***	0.22	3.036***	2.349***	0.208	2.735***	2.358***	0.227	0
	(-0.101)	-0.207)	(0)	(-0.101)	(-0.207)	(-0.577)	(-0.101)	(-0.207)	(-0.595)	(-0.101)	(-0.207)	(0)
Observations	8,331	8,331	8,331	8,331	8,331	8,331	8,331	8,331	8,331	8,331	8,331	8,331
R-squared	0.358	0.219		0.359	0.219		0.359	0.218		0.361	0.22	
No. of firms		1.432	1.432		1.432	1.432		1.432	1.432		1.432	1.432
No. of instruments			500			500			503			500
Hansen test			428			413.2			434.4			411.4
Hansen(p)			(0.663)			(0.825)			(0.619)			(0.841)
AR1 test			-4.557			-4.673			-4.993			-4.795
AR1 (p)			(5.19E-06)			(2.96E-06)			(5.94E-07)			(1.63E-06)
AR(2) test			-0.954			-0.974			-1.214			-0.991
AR2 (p)			(0.34)			(0.33)			(0.225)			(0.322)

Note: Data for the manufacturing sector. Independent variables lagged by one year. Dependent variable: DVA in exports (*DVAR*). Significance: *** p<0.001 **p<0.05 *p<0.1

Source: Author's calculations.

In set III of the robustness tests (columns 7 to 9), I use a coefficient of variation instead of a correlation coefficient to define the stability of trade flows. The estimation method is the same as in the basic definition, except that I compute the coefficient of variation (*cv*) instead of the correlation coefficient, again for each firm between the monthly data for exports and their lagged values (month/month(year-1) considering HS6 products and country of destination/country of dispatch. In the same way, I retain only products categorised as intermediates. After computing the coefficient of variation, I introduce a dummy variable which is equal to 1 if the correlation coefficient is lower than or equal to |0.3|. The sum of the weighted average is then used to acquire the firm-year data in the way presented in equations (18) and (19). The estimates for both forms of GVC participation as well as for firm characteristics remain highly robust also when the coefficient of variation is used to determine the trade flow stability.

In the fourth check (columns 10 to 12), I use the same method for defining a contractual relationship as in the basic definition, except that the correlation is not limited to products categorised as intermediates and I instead compute the correlation using all product categories. The estimates again confirm a negative correlation with DVA in exports when firms are foreign affiliates (*Foreign_owned*) as well as a positive correlation with DVA in exports when firms have a permanent foreign supplier (*Contractual importer*). Coefficients regarding the firm characteristics remain highly robust.

3.6 Conclusion

This chapter analyses the process of firms' GVC upgrading in terms of domestic value added in exports (DVA) relative to the form of a firm's participation in GVCs and selected firm characteristics. The analysis is based on detailed firm-level data for Slovenian exporters for the period 2002–2014 and rely on the methodology recently proposed by Kee and Tang (2016) for estimating DVA using firm-level data. For the purpose of the analysis, I define four different types of GVC participation – two refer to intra-firm trade and are defined by inward and outward FDI, while the other two refer to inter-firm trade and are estimated indirectly.

The contribution of this chapter to the literature is twofold. First, this chapter develops a method for estimating DVA in exports with firm-level data by adjusting the approach of Kee and Tang (2016). Second, I proxy for a possible contractual relationship by exploring the stability of firm trade flows given that the existing literature does not propose a 'rule' for how to define firms which participate in GVCs via contractual relationship and there is insufficient data to allow any better definition of such trade linkages.

The results strongly confirm the expectation that firms with foreign ownership capture lower value of DVA in exports and that unaffiliated firms with permanent suppliers from

abroad capture higher DVA in their exports. However, the positive correlation of firms that themselves have foreign affiliates and the negative correlation of unaffiliated firms which could be identified as independent permanent suppliers for foreign firms with DVA are not precisely estimated. Concerning the other variables, the regression results support the prediction that bigger Slovenian firms have smaller DVA in exports. A positive outcome of DVA in exports can be observed, all else being equal, for firms with a larger share of intangible capital per worker, firms with a higher relative wage, firms with greater capital intensity, less indebted firms, firms with a bigger share of final products in their exports and firms with a lower share of exports that is based on imports of the same products. Interestingly, firms that have higher value added in their exports are not necessarily more productive. One explanation could be that as such firms become more productive they tend to import more and, consequently, the share of imported content in exports increases more than their value added in exports (Lu & Ulu, 2014; Johnson, 2014). Regarding export characteristics, the results show a positive coefficient for the share of exports by Slovenian firms to countries of former Yugoslavia, thereby indicating that the average Slovenian firm achieves higher DVA in exports when exporting to less demanding markets.

At the end, it must be acknowledged, that despite the availability of detailed data, and the intention to obtain the best possible proxy for contractual trade partners, the results are still based on estimations. However, detailed trade statistics that distinguish between intra- and inter-firm trade are required for any precise analysis. In addition, while the methodology used to estimate firm-level DVA by Kee and Tang (2016) relies on many assumptions, it is so far one of the few, if not the only one, to propose estimating the DVA in exports using firm-level data. Notwithstanding all the limitations, based on Slovenian data the results show that, besides participation in GVCs itself, it is important to observe the way firms participate in GVCs, i.e. which mode of GVC participation they adopt while also identifying their performance and export characteristics that allow them to capture a greater share of DVA in their exports.

CONCLUSIONS AND DISCUSSION

The doctoral dissertation analyses a country's participation in GVCs by decomposing the creation of value in exports. It studies differences in domestic value added (DVA) between two groups of EU countries and variations in DVA by types of firms' GVC participation. This chapter summarises the main findings of the doctoral dissertation, presents the limitations, contributions, policy implications and possibilities for future research.

Main findings

The **first chapter** presents the theoretical framework, which allows each country's GVC participation and its export contribution in terms of added value to be estimated. To decompose a country's exports into domestic and foreign components, I apply the methodology proposed by Koopman et al. (2010) relying on data from the World Input-Output Database (WIOD) for the period 1995–2011. The estimated results show that DVA in exports in EU-15 countries is higher than in the CEE-10 group in both the manufacturing and services sectors. In the manufacturing sector, it averages 72% in the EU-15 and 65% in the CEE-10 with the highest shares of DVA seen in labour-intensive manufacturing activities. Although the gap in the share of DVA between the CEE-10 and EU-15 countries in DVA terms has persistently grown since 1995, it started to decline in the period under observation.

A possible explanation for the narrowing of the gap can be found in the share of imported intermediates in total intermediates used. Although the average share of imported intermediate products in the CEE-10 remains higher than in the EU-15, it starts to decline after 2004 in the CEE-10 while at the same time in the EU-15 this share is slightly increasing. In the services sector, the biggest DVA shares in exports in the EU-15 are recorded in services related with health, education, and public services (89.6%) and knowledge-intensive services (86.2%). Similarly, in the CEE-10 knowledge-intensive services (85.9%) together with health, education, and public services also registered the highest share (85.4%). In later years of the observed period, the share of DVA in the CEE-10 approached the share in the EU-15 (76% for both groups in 2011). The shares of DVA in services sectors' exports are, on average, higher than in manufacturing while the participation rate in GVCs for services (36% in 2011 for the CEE-10) is still lower than in manufacturing (52% in 2011 for the CEE-10). Participation in GVCs indeed often indicates entry to a more fragmented value chain, characterised by greater use of inputs with foreign contents. The results show that in the manufacturing sector all countries increased their GVC participation in the period under study (except Estonia and Lithuania) while at the same time in almost all countries DVA declined.

A similar trend can be seen in the services sector. The estimation results indicate a negative relationship between GVC participation and DVA in exports in both sectors. However, the results for CEE-10 countries show the negative relationship between GVC participation and DVA in exports in the manufacturing and services sectors decreased slightly over the observed period.

This finding is in line with UNCTAD (2013) which shows that even countries with high foreign added value in exports are in a better long-term position if their GVC participation rate is high because companies can extend to activities with greater value added and upgrade their positions in the GVC. The higher DVA does not necessarily result in bigger benefits from the GVCs as domestic added value in exports consists of: (1) components outside the GVC; and (2) components within the GVC. Yet, the development of relationships through the observed period shows that most EU-15 economies saw a decline in benefits arising from GVC participation, while the opposite is recorded in almost all CEE-10 economies. This indicates that gains from GVC participation are not guaranteed per se (OECD, WTO, & World Bank Group, 2014) since firms must shift towards higher value-added activities in GVCs.

The estimated values for DVA in exports are further employed in the **second chapter**, which considers the main driving forces of the differences in DVA shares between EU-15 and CEE-10 countries. Since there is no generally accepted approach to researching the determinants of DVA, I focus primarily on the theoretical predictions of upgrading within GVCs and on some existing research findings. The estimated results reveal a positive correlation between intangible capital investments and DVA in exports for the EU-15, while the relationship results show slightly negative coefficient for the CEE-10. One explanation may be that the level of CEE-10 investment in intangible assets is sufficient for their participation in GVCs, but still below the threshold level that allows GVC upgrading. Somewhat surprisingly, the estimated results show a negative correlation between high-skill labour and DVA in exports. These indicate that in the EU-15 a higher proportion of non-production workers has a negative impact on DVA in exports and that a highly qualified workforce does not directly contribute to GVC upgrading in the EU-15. For the CEE-10, these effects are smaller but remain negative. However, these results also cast doubt on the choice of proxy measure for the quality of human capital. Inward FDI is often, especially in the early stages, linked to a larger volume of imports from the country of origin of FDI due to increased imports of intermediates and capital goods related to the off-shored production. The results show that IFDI generally leads to a reduction of demand for domestic inputs and thus lower DVA in exports. By contrast, GVC upgrading is driven by outsourcing since it enables firms to focus on their key competencies (Mudambi, 2008; Ylömäki, 2016). The estimation results show that, particularly for CEE-10 countries, OFDI represents an important driver for GVC upgrading. Other variables also provide interesting results. The geographical structure of exports (the share of exports to the five most

developed EU countries) appears to be an important factor for the CEE-10. A larger share of exports from the CEE-10 to the most developed countries of the EU is negatively linked to their share of DVA in exports. Higher imports of intermediate products from China are negatively linked to the DVA share, but again for the CEE-10 only. The negative relationship between DVA and imports from China may imply that in the CEE-10 intermediates from China are more likely to be substitutes than complements, although further research on this subject is required. Finally, I perform a number of robustness tests to control the results of my basic specification (applying different proxies for measuring intangible assets, changing the number of lags of the main regressors and employing the GMM estimator). The results generally remain robust in all these robustness checks.

The **third chapter** examines the determinants of DVA in exports at the firm level in Slovenia and analyses the process of firms' upgrading in GVCs in DVA terms in exports depending on the form of GVC participation and the firms' characteristics. For the purpose of the analysis, I define four different types of firms' GVC cooperation – two refer to trade between affiliates and are defined by inward and outward FDI, while the other two concern trade between non-affiliated firms and are identified indirectly.

Since the existing literature does not provide a 'rule' for identifying firms that are part of GVCs through contractual relations (the non-equity link between firms) and because there is insufficient data to enable a better definition of such trade connections, I identify potential links by exploring the stability of the firms' trade flows. In this context, stable sales indicate that a firm is a permanent supplier (or has a permanent supplier from abroad). The analysis focuses on Slovenian exporting firms from the manufacturing sector using available firm-level data (customs-transaction-level data provided by FARS, firms' accounting data from AJPES and data on foreign direct flows of capital provided by the Bank of Slovenia for the period 2002–2014), which enable a more detailed analysis of the position of Slovenian firms in the value chain.

To assess DVA at the level of firms in Slovenia, the analysis follows a slightly adjusted methodology of Kee and Tang (2016). First, I compare the results of DVA estimated by using firm-level data with DVA estimated from the WIOD industry-level data based on methodology provided by Koopman et al. (2010). The results show the estimated DVA on industry-level data is on average lower than from firm-level data, where the estimations for larger firms are closer to the estimations from the WIOD tables, which usually only include a country's largest firms.

The results show a negative relationship between foreign affiliates and DVA in exports, which confirms that the outsourced activities mainly include stages and functions with lower DVA in exports and that domestic-owned exporting firms outperform more productive foreign-owned firms. This is further supported by the finding that firms

characterised by higher DVA in their exports are not necessarily more productive. A possible explanation is found in the behaviour of more productive firms that import a large part of intermediates, become even more productive but at the same time their exports contain a large proportion of imports, which reduces the value added in exports (Lu & Ulu, 2014; Johnson, 2014). For unaffiliated firms which have a permanent foreign supplier (firms that hold the position of 'value chain organiser', which allows them to focus on their core competencies), a positive impact on DVA in exports is observed. The expected results that firms with foreign affiliates abroad capture higher DVA are confirmed only in the case of OLS estimations. The results for firms that are themselves permanent suppliers for foreign firms are again significant only with the OLS estimations, and have the anticipated negative sign.

A positive DVA outcome can be observed for smaller firms, firms with a larger share of intangible capital per worker, and firms with a higher relative wage. The results also reveal that firms with greater capital intensity, less indebted firms, firms with a bigger share of final products in their exports, and firms with a smaller share of exports that is based on imports of the same products add more domestic value to their exports. The findings also indicate that the average Slovenian firm achieves higher DVA in exports when exporting to less demanding markets. Finally, a number of robustness tests (two-step system GMM estimator, various alternatives for defining contractual importers and contractual exporters, coefficient of variation instead of correlation coefficient to define the stability of trade flows) confirm my basic specification estimations.

Limitations of the dissertation

The analysis is based on the concept of value added and has certain limitations. The most evident one regarding the data used arises from the assumptions related to construction of the WIOD database. Usually, input-output tables are available only for discrete years (for example, for every fourth year). Yet the data in the WIOD tables are available for every year – but as a result of an extrapolation procedure. Besides this, construction of world input-output tables requires extensive global databases which are often incomplete and thus make some simplified assumptions. These may underestimate the effects of international participation on the domestic economy (Powers, 2012). In comparison, the new OECD Inter-Country Input- Output Tables (TiVA database) are not available for every year and have different construction techniques. However, as noted by (Kummritz, 2015) they still generate results consistent with those based on the WIOD database.

Further limitations stem from the absence of economic theory among conceptual and empirical literature on GVCs that would allow the testing of verifiable hypotheses related to domestic value added in exports (Damijan & Rojec, 2015). The theoretical papers related to the topic of GVCs primarily concentrate on the development of GVCs with a

focus on the fragmentation of production processes and vertical specialisation (Dixit & Grosman, 1982; Grossman & Rossi-Hansberg, 2008; Costinot, Vogel, & Wang, 2012; Markusen & Venables, 2007) and GVCs as a link between low-wage countries (South) and technologically advanced high-wage countries (North) (Baldwin & Robert-Nicoud, 2014; Li & Liu, 2014). In this context, the differences between countries from South and North produce incentives to trade tasks or offshore with the accompanying advantages and disadvantages (Kummritz, 2015). Other literature related to GVCs deals with property-rights theories (Antràs & Chor, 2013; Alfaro, Antràs, Chor, & Conconi, 2015) where a consideration of the type of value chain governance is required to address the problem of the "incompleteness of contract" (World Bank, 2017; Brancati et al., 2017).

Although the data set applied in the dissertation is very extensive, there are many potencial variables that could be correlated with DVA when estimating the differences in DVA in exports between EU-15 and CEE-10 countries. Unfortunately, many variables are unavailable on the industry level (e.g. export sophistication, economic complexity, access to finance, capital intensity, etc.). In other cases, data are available on the industry level but only for EU-15 countries or for particular years (e.g. data for intangible investments or knowledge capital – ICT capital per hour worked, level of education of employees etc.). A problem could also arise in measurement of human capital and is related to the use of a very common estimate for the acquired level of education. Although the level of investment in education can be the same it can result in diverse sets of skills or skills with a different value in the labour market. All of the mentioned issues may bias the existing estimation. Similar holds for the estimation of the determinants that affect DVA with firm level data in the fourth chapter. There are additional important aspects that might affect the share of DVA in exports and may bias the results but are not measurable with the use of existing dataset, such as transfer prices, heterogeneous prices in domestic and foreign markets and exchange rate shocks. Furthermore, the availability of the data regarding the structure of employees (task they perform or occupation/position they have) would allow one to build a model of the firms' position along GVCs with value added taken into account.

Another limit of the research arises when the focus shifts towards the integration of Slovenian firms into GVCs based on firm-level data because the methodology for measuring DVA in exports using firm-level data is still in development. The existing analysis and discussions on GVC integration almost exclusively occur at the sectoral level, with the availability of the required firm-level data in export being largely limited. The methodology used to estimate DVA with firm-level data (Kee & Tang, 2016) is based on certain assumptions. The share of firms' imported inputs used for domestic sales and the share used for external demand are generally unknown. Kee & Tang (2016) build the methodology by assuming that the ratio of inputs for the production of exported goods is comparable with the share of exports in total sales. This is similar to assuming that a firm's

DVA in exports is the same for exports and for domestic sales. A necessary precondition for any more detailed analysis at the firm level would be having input-output tables available at the firm level.

In addition, in the third chapter I distinguish firms that participate in GVCs through a network of affiliates from firms that participate via inter-firm trade. Since the characterisation of the former through inward and outward FDI data is obvious, the definition of inter-firm participation is not so straightforward. Existing literature does not provide guidance on how to define firms which are integrated into GVCs through a contractual relationship, while detailed trade statistics distinguishing intra- and inter-firm trade are also only collected in the USA (Antràs, 2016). Thus, it is necessary to use a proxy variable for the inter-firm relationship. Inter-firm trade statistical data would be required for a more accurate analysis of inter-firm participation.

Contributions of the dissertation and future research recommendations

In the **first chapter** of the dissertation, I compare the movement of DVA during the period 1995–2011 in order to determine whether export restructuring in CEE-10 economies causes a corresponding increase of DVA in exports. The dissertation is among the first to study the change in the gap in DVA between these two groups of countries and to find evidence of convergence since previous studies, to the best of my knowledge, chiefly focus on the pattern of DVA in all EU countries. The presented results reveal that CEE-10 countries are starting to show the gains of their GVC participation, especially in the services sector, although their gains remain lower than for the EU-15. Greater emphasis should be put on promoting a business environment that not only attracts FDI to the CEE-10 or increases a country's participation in GVCs, but which also promotes higher value-adding activities. For firms it is not only important whether they participate in GVCs or not, but also what position they hold within the value chain. Thus industrial and other policies could and should be oriented at providing support already in the stage before a firm enters the chain or when it tries to upgrade within the chain by fostering innovativeness and export restructuring.

In terms of a country's competitiveness and export performance measures, the difference between trade statistics in gross terms (traditional) and in value-added terms should not only be highlighted but considered when analysing a country's economic performance. This chapter offers several possibilities for future research where the main and most obvious one would entail establishing an appropriate model for analysing trade within GVCs. Further, it would be interesting to apply the WIOD tables with updated observations in terms of a longer time frame to check whether the convergence of DVA between the CEE-10 and the EU-15 is of a continuous nature or not. Moreover, one could

compare the results of estimated DVA values with estimated results based on use of other available I-O tables or the use of an alternative decomposition methodology.

The analysis in the **second chapter** goes beyond existing empirical studies from this field by exploring the determinants of DVA in exports in the CEE-10 and EU-15. It takes account of the heterogeneity of these two groups of EU countries and the heterogeneity of industries (since it relies on data at the industry level). Existing empirical studies mainly employ country-level data and focus on assessing the factors influencing foreign value added on exports (Rahman & Zhao, 2013; Stehrer & Stollinger, 2015), participation in GVCs (Kowalski et al., 2015; Stehrer & Stollinger, 2015; Van der Marel, 2015) and value-added trade (Baldwin & Taglioni, 2011; Brooks & Ferrarini, 2014; Cheng & Fukumoto, 2010; Choi, 2013; Noguera, 2012). The findings presented in the second chapter reveal that in the GVC-upgrading process CEE-10 countries suffer from insufficient investment in intangible capital and should thus orient their policies towards encouraging firms' investment in R&D, brand equity, firm-specific skills and organisational capital. Further, during their transition and economic restructuring in the 1990s the CEE-10 countries relied massively on attracting FDI (Narula & Guimón, 2009) in order to engage in GVCs. However, participating in GVCs should not be limited to attracting FDI in low-value-added activities but should include a shift from low-cost, labour-intensive manufacturing FDI to FDI in activities with higher value added. The emphasis should therefore be placed on specialisation and production quality. Here, it would be interesting to include intangible capital investments (on the industry level) or study the impact of additional factors which might influence DVA but are currently not measurable (for example, the quality of human capital, skills, knowledge capital etc.). Yet, as explained in the previous chapter, due to unavailability of industry-level data for CEE-10 countries intangible capital investments data could not be included directly in the analysis. Moreover, it would also be interesting to allow for the heterogeneity of CEE-10 countries and classify them in subgroups, for instance based on their trade linkages with the EU-15, to analyse the impact of these countries' greater integration into GVCs on DVA in exports.

Finally, the **third chapter** makes several contributions to the literature by considering firm heterogeneity, which is usually not accounted for in empirical literature on GVCs. To the best of my knowledge, so far there is only one empirical study regarding research of DVA at the firm level, namely that by Kee and Tang (2016). The mentioned study is based on Chinese processing exporters and is currently the sole study to propose a method for such estimation. This chapter builds on a adjusted approach for estimating DVA in exports with firm-level data provided by Kee and Tang (2016) and, for the first time, estimates and analyses DVA in exports using data for Slovenian exporting firms. Moreover, due to the lack of information regarding inter-firm or contractual GVC trade relations, this chapter proposes an approach for defining a possible contractual relationship by exploring the stability of firm trade flows based on product-destination stability. I determine, for the first

time, how Slovenian firms are incorporated in GVCs via a contractual relationship (contractual importers or contractual exporters). However, having data on inter-firm trade (for now collected only in the USA (Antras, 2016)) available would enable a more detailed analysis. It would also be interesting to separately define domestically owned firms that are part of MNCs and domestically owned firms that do not form part of MNCs to further investigate the correlation with DVA in exports.

An obvious possibility for future research is to further improve the methodology for measuring DVA using firm-level data, at a minimum by reducing or eliminating some assumptions. The results provide new insights into the structure of Slovenian exports in terms of DVA and highlight the main factors of firms' success in GVCs, indicating the importance of the type of a firm's engagement in GVCs. Nonetheless, from the perspective of DVA in exports it is quite a different situation, for example, whether a firm acts as a contractual importer or as a foreign-owned firm. Countries fostering the participation of domestic firms in GVCs should thus be able to recognise and facilitate the type of participation which would be optimal for an individual firm as well as for the country's competitiveness and sustainable economic development. This goal should be achieved by changing the production structure rather than by increasing the production volume. Hence, policy support would be of considerable importance in many respects, such as government policies promoting R&D and innovation, government policies focusing on quality of education and in particular higher education, government policies building the ecosystem of high-tech firms (technological parks, incubators, etc.) and improving business conditions for startups (in particular access to finance), industrial policies favoring certain industries (compare the EU-wide smart-specialization strategy) and, least but not last, government policies promoting matching between domestic and foreign firms to build partnerships. By employing such a mix of policies, the governments can proactively affect future evolution of domestic industrial structures, the technological advancement of domestic industries and, indirectly, the evolution of the DVA. This may ensure domestic firms will not only serve as assemblers but they would position themselves more optimally on the so-called "smile curve" to allow them to make use of their own knowledge base and to keep and further develop activities with high value added.

However, it should not be overlooked that the country and firm perspectives on upgrading may differ. Firms often position themselves in GVCs based on profit and thus from their perspective upgrading sometimes entails moving to parts of the value chain with lower labour productivity yet higher profits. On the other side, despite firms' higher profits and employment, countries can face lower productivity and lower GDP. One possible approach a country can take to prevent such an outcome is to motivate firms to upgrade to parts of the value chain with higher labour productivity or higher skilled parts of the value chain (World Bank, 2017).

The future development of GVCs is unpredictable. Technologies powering 'Industry 4.0', such as 3D-printing, autonomous robots, the Internet of Things, big data, cloud computing etc. are gradually enabling the creation of customised products at the cost level of a standardised product (De Backer & Flaig, 2017). Industry 4.0 may deeply affect the way production chains are organised nowadays. GVCs could become simplified with lower and less geographically dispersed activities and individually defined relationships between trade partners (Strange & Zucchella, 2017). Although the growth of new manufacturing technologies is driving "new restructuring dynamics" (Baldwin, 2016), the impact is not so straightforward. For example, 3D-printing has real potential in specific industries (e.g. manufacturing of machinery and equipment), but there are still industries where new technology has a limited impact (e.g. manufacture of basic metals, textiles) (Laplume, Petersen, & Pearce, 2016). Rehnberg and Ponte (2018) predict two possible scenarios for describing the impact of 3D-printing on the development of GVCs. In the first scenario, 3D-printing would complement traditional manufacturing and be especially used in prototyping. This scenario would see further deepening of the smile curve whereby firms with prompt access to big data and the ability to respond quickly to changing customer needs would be able to retain competitive advantage. The second scenario would see 3D-printing substituting traditional manufacturing such that products would be entirely or almost entirely manufactured by 3-D printing. In this case, GVCs would thus become more compact (with the smile curve becoming shorter and flatter) as the number of functions in GVCs would decrease. In this scenario, the traditional characteristics of trade would be radically changed as trade would increasingly involve immaterial data such as designs and software. The development opportunities Industry 4.0 offers as well as its impact on GVCs and the composition of value added in exports constitutes an interesting and important topic for future research.

GVC research has become increasingly relevant in the last few decades. Due to the interconnectedness of firms and countries, new challenges for GVC research are constantly emerging alongside global developments in politics and trade. The most recent challenge for GVC-organised world trade involves the reintroduction of protectionist measures and thus investigating the ways in which they impact the trade of individual firms and countries.

REFERENCE LIST

1. Aghion, P., Blundell, R., Griffith, R., Howitt, P., & Prantl, S. (2009). The Effects of Entry on Incumbent Innovation and Productivity. *The Review of Economics and Statistics*, *91*(1), 20–32.
2. Agnese, P., & Ricart, J. E. (2009). Offshoring: Facts and numbers at the country level (MPRA Paper No. 16503). Retrieved from http://mpra.ub.uni-muenchen.de/16503/1/ MPRA_paper_16503.pdf
3. Ahmad, N. (2013). Estimating trade in value-added: Why and how? In D. K. Elms & P. Low (Eds.), *Global value chains in a changing world* (pp. 85–108). Geneva: WTO Publications.
4. Aiyar, S., Augustyniak, B., Ebeke, C., Ebrahimy, E., Elekdag, S., Klein, N., … Muir, D., et al. (2013). German- Central European Supply Chain—Cluster Report. In IMF Multi-Country Report No. 13/263. (pp. 2–16). Washington: International Monetary Fund.
5. Alfaro, L., Antras, P., Chor, D., & Conconi, P. (2015). *Internalizing global value chains: A firm-level analysis* (NBER working paper, No. w21582).
6. Altomonte, C., Mauro, F. Di, Ottaviano, G., Rungi, A., & Vicard, V. (2012). *Global Value Chains during the Great Trade Collapse. A Bullwhip Effect?* In S. Beugelsdijk, S. Brakman, H. van Ees & H. Garretsen (Eds.), *Firms in the International Economy: Firm Heterogeneity Meets International Business*, (pp.277-308). Cambridge, London: MIT.
7. Amador, J., & Cabral, S. (2014). *Global Value Chains: Surveying Drivers, Measures and Impacts* (Working Papers 3/2014). Lisboa, Banco de Portugal.
8. Amador, J., Cappariello, R., & Stehrer, R. (2015). Global Value Chains: A View from the Euro Area. *Asian Economic Journal*, *29*(2), 99-120.
9. Aminian, N., Fung, K. C., & Iizaka, H. (2007). *Foreign direct investment, intra-regional trade and production sharing in East Asia* (RIETI Discussion Paper Series 07-E-064). Tokyo: The Research Institute of Economy, Trade and Industry.
10. Amiti, M., & Konings, J. (2007). Trade liberalization, intermediate inputs, and productivity: Evidence from Indonesia. *American Economic Review*, *97*(5), 1611-1638.
11. Antràs, P. (2003). Firms, Contracts, and Trade Structure. *The Quarterly Journal of Economics*, *118*(4), 1375–1418.
12. Antràs, P. (2016). *Global Production: Firms, Contracts, and Trade Structure*. Princeton, Oxford: Princeton University Press.
13. Antràs, P., & Helpman, E. (2004). Global Sourcing. *Journal of Political Economy*, *112*(3), 552–580.
14. Antràs, P., & Chor, D. (2013). Organizing the Global Value Chain. *Econometrica*, *81*(6), 2127–2204.
15. Antràs, P., & Yeaple, S. R. (2014). *Multinational Firms and the Structure of*

International Trade. *Handbook of International Economics* (Vol. 4). Elsevier B.V. http://doi.org/10.1016/B978-0-444-54314-1.00002-1

16. Arellano, M., & Bond, S. (1991). Some tests of specification for panel Carlo application to data: Evidence and an employment equations. *The Review of Economic Studies*, *58*(2), 277–297.
17. Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of errorcomponents models. *Journal of Econometrics*, *68*, 29–51.
18. Arrighetti, A., Landini, F., & Lasagni, A. (2014). Intangible assets and firm heterogeneity: Evidence from Italy. *Research Policy*, *43*(1), 202–213.
19. Aspers, P. (2010). Using design for upgrading in the fashion industry. *Journal of Economic Geography*, *10*, 189–207. http://doi.org/10.1093/jeg/lbp030
20. Augustyniak, B., Ebeke, C., Klein, N., & Zhao, H. (2013). German-Central European supply chain—Cluster Report—First background note—Trade linkages. In IMF Multi-Country Report No. 13/263 (pp. 17–35). Washington: International Monetary Fund.
21. Azmeh, S., & Nadvi, K. (2014). Asian firms and the restructuring of global value chains. *International Business Review*. http://doi.org/10.1016/j.ibusrev.2014.03.007
22. Backer, K. D., & Miroudot, S. (2013). *Mapping global value chains* (OECD Trade Policy Papers No. 159). Paris: OECD Publishing.
23. Bair, J., & Mahutga, M. (2016). Commodity Chains and Development. In G. Hooks (Ed.), *Sociology of Development Handbook* (pp. 645-666) . Berkeley: UC Press.
24. Balassa, B. (1967). *Trade Liberalization among Industrial Countries*. New York: McGraw-Hill.
25. Baldwin, R. (2011). *Trade and industrialisation after globalisation's 2nd unbundling: How building and joining a supply chain are different and why it matters* (Working paper No. 17716). National Bureau of Economic Research.
26. Baldwin, R. (2012). *Global supply chains: Why they emerged, why they matter, and where they are going* (Working paper FGI-2012-1). Fung Global Institute.
27. Baldwin, R. (2016). *The great convergence: information technology and the new globalization*. Cambridge, Massachusetts: Harvard University Press.
28. Baldwin, R. E. (1994). *The effect of trade and foreign direct investment on employment and relative wages* (OECD Economic Studies No. 23). Paris: OECD.
29. Baldwin, R., & Lopez-Gonzalez, J. (2015). Supply-chain trade: A portrait of global patterns and several testable hypotheses. The World Economy, 38(11), 1682-1721.
30. Baldwin, R., & Robert-Nicoud, F., 2007. Offshoring: General equilibrium effects on wages, production and trade (Working paper No. 12991). National Bureau of Economic Research.
31. Baldwin, R., & Robert-Nicoud, F. (2014). Trade-in-goods and trade-in-tasks : An integrating framework. *Journal of International Economics*, *92*(1), 51–62. http://doi.org/10.1016/j.jinteco.2013.10.002
32. Baldwin, R., & Taglioni, D. (2011). *Gravity chains: Estimating bilateral trade flows*

when parts and components trade is important (ECB working paper series No-1401).

33. Baldwin, R., & Venables, A. J. (2013). Spiders and snakes: Offshoring and agglomeration in the global economy. *Journal of International Economics, 90*, 245–254.
34. Bamber, P., Fernandez-Stark, K., Gereffi, G., & Guinn, A. (2014). Connecting Local Producers in Developing Countries to Regional and Global Value Chains: Update. *OECD Trade Policy Papers No. 160.* Paris: OECD Publishing.
35. Banga, R. (2014). Linking into global value chains is not sufficient: Do you export domestic value added contents? *Journal of Economic Integration, 29*, 267–297.
36. Barone, G., & Cingano, F. (2011). Service Regulation and Growth: Evidence from OECD Countries. *The Economic Journal*, *121*(555), 931–957.
37. Barrientos, S., Gereffi, G., & Rossi, A. (2011). Economic and social upgrading in global production networks: A new paradigm for a changing world. *International Labour Review*, *150*, 319–340.
38. Behar, A., & Freund, C. (2011). Factory Europe? Brainier but not Brawnier. Retrieved from http://siteresources.worldbank.org/ECAEXT/Resources/258598-1284061150155/7383639-1323888814015/022302_01.pdf
39. Bems, R., Johnson, R. C., & Yi, K.-M. (2011). Vertical linkages and the collapse of global trade. *American Economic Review*, *101*, 308–312.
40. Benfratello, L., & Sembenelli, A. (2006). Foreign ownership and productivity: Is the direction of causality so obvious ? *International Journal of Industrial Organization*, *24*(4), 733–751.
41. Bernard, A. B., Blanchard, E. J., Van Beveren, I., & Vandenbussche, H. (2012). Carry-along trade. *NBER working paper 18246*.
42. Bernard, A. B., Blanchard, E. J., Van Beveren, I., & Vandenbussche, H. (2018). Carry-along trade. *The Review of Economic Studies*, *86*(2), 526-563.
43. Bernard, A. B., Jensen, J. B., Redding, S. J., & Schott, P. K. (2010). Intrafirm Trade and Product Contractibility. *The American Economic Review*, *100*(2), 444–448.
44. Bernard, A. B., Jensen, J. B., Redding, S. J., & Schott, P. K. (2012). The Empirics of Firm Heterogeneity and International Trade. *Annual Review of Economics*, *4*(1), 283–313.
45. Boehm, J., & Oberfield, E. (2018). *Misallocation in the Market for Inputs: Enforcement and the Organization of Production*(No. w24937). National Bureau of Economic Research.
46. Bogliacino, F., Piva, M., & Vivarelli, M. (2012). R&D and employment: An application of the LSDVC estimator using European microdata. *Economics Letters*, *116*(1), 56–59.
47. Bolatto, S., Naghavi, A., Ottaviano, G., & Zajc Kejžar, K. (2017). Intangible Assets and the Organization of Global Supply Chains. Quaderni - Working Paper DSE N°1105, University of Bologna.

48. Bombarda, P. (2013). Intra-firm and arm's length trade: how distance matters? In S. Beugelsdijk, S. Brakman, H. van Ees & H. Garretsen, *Firms in the International Economy: Firm Heterogeneity Meets International Business* (pp. 205-240). Cambridge, London: MIT.
49. Borghans, L., Green, F., & Mayhew, K. (2001). Skills measurement and economic analysis: An introduction. *Oxford Economic Papers, 53*(3), 375–384.
50. Borrus, M., Ernst, D., & Haggard, S. (Eds.). (2000). *International production networks in Asia*. London/New York: Routledge.
51. Bottini, N., Ernst, C., & Luebker, M. (2007). *Offshoring and the labour market: What are the issues?* Geneva: International Labour Office.
52. Brancati, E., Brancati, R., & Maresca, A. (2014). Global Value Chains, Governance, and Upgrading Processes: Firm-Level Evidence from Italy. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.712.1748
53. Brancati, E., Brancati, R., & Maresca, A. (2017). Global Value Chains, Innovation and Performance : Firm-Level Evidence from the Great Recession. *Journal of Economic Geography*, *17*(5), 1039–1073.
54. Brooks, D. H., & Ferrarini, B. (2014). *Vertical gravity. Journal of Asian Economics*, *31-32*, 1-9.
55. Cadestin, C., De Backer, K., Desnoyers-James, I., Miroudot, S., Ye, M., & Rigo, D. (2018). Multinational enterprises and global value chains: new insights on the trade–investment nexus. OECD Science, Technology And Industry Working Papers, 2–36.
56. Capello R, & Lenzi, C. (2013). The knowledge–innovation nexus in European regions. In R. Capello & C. Lenzi (Eds.), *Territorial Patterns of Innovations: an inquiry on the knowledge economy in European regions* (pp. 93-126). London/New York: Routledge.
57. Caraballo, J. G., & Jiang, X. (2016). Value-added erosion in global value chains: An empirical assessment. *Journal of Economic Issues, 50*(1), 288–296.
58. Cheng, L., & Fukumoto, M. (2010). *Vertical specialization and its implications for the gravity model of international trade*. Hong Kong University of Science and Technology.
59. Choi, N. (2013). *Measurement and determinants of trade in value added*. KIEP Working Paper No. 13-01.
60. Cieślik, E. (2014). Post-Communist European countries in Global Value Chains. *Ekonomika*, *93*(3), 25–38.
61. Cieślik, E., Biegańska, J., & Środa-Murawska, S. (2016). Evaluation of trends in foreign trade development in the post-communist countries of Europe in the years 2000–2012 following their accession to the EU. *Quaestiones Geographicae, 35*(4), 35–48.
62. Corcos, G., Irac, D. M., Mion, G., & Verdier, T. (2013). The determinants of intrafirm trade: evidence from French firms. *The Review Of Economics and Statistics*, *95*(3), 825–838.

63. Corrado, C., Haskel, J., Jona-lasinio, C. & Iommi, M.. (2012). Intangible Capital and Growth in Advanced Economies: Measurement Methods and Comparative Results. Retrieved from www.INTAN-Invest.net.
64. Corrado, C., Hulten, C., & Sichel, D. (2005). Measuring capital and technology an expanded framework. In C. Corrado, J. Haltiwanger, & D. Sichel (Eds.), *Measuring capital in the new economy* (pp. 11–46). Chicago: University of Chicago Press.
65. Costinot, A., Vogel, J., & Wang, S. (2012). An Elementary Theory of Global Supply Chains. *Review of Economic Studies*, *80*(1), 109–144.
66. Coucke, K., & Sleuwaegen, L. (2008). Offshoring as a survival strategy: Evidence from manufacturing firms in Belgium. *Journal of International Business Studies, 39,* 1261–1277.
67. Damijan, J. P., Konings, J., & Polanec, S. (2013). Pass-on trade: why do firms simultaneously engage in two-way trade in the same varieties?. *Review of World Economics, 149*(1), 85-111.
68. Damijan, J., Kostevc, Č., & Rojec, M. (2015). Bright past, shady future? Past and potential future export performance of CEE countries in a comparative perspective. *Post-Communist Economies, 27*(3), 306-335.
69. Damijan, J., & Rojec, M. (2015). Topical issues in global value chains research: a 'factory economy' perspective. *Teorija in Praksa*, *52*(5).
70. Damijan, J. P., Rojec, M., Majcen, B., & Knell, M. (2013). Impact of firm heterogeneity on direct and spillover effects of FDI: Micro-evidence from ten transition countries. *Journal of comparative economics*, *41*(3), 895-922.
71. Daudin, G., Rifflart, C., & Schweisguth, D. (2011). Who produces for whom in the world economy? *Canadian Journal of Economics, 44*, 1403–1437.
72. Dean, M. J. (2013). Why measuring value-added trade matters for developing countries. In A. Mattoo, Z. Wang, & S.-J. Wei (Eds.), *Trade in value added: Developing new measures of cross-border trade* (pp. 47–58). Washington: The World Bank.
73. Dean, M. J., Fung, K. C., & Wang, Z. (2007). *Measuring the vertical specialization in Chinese trade* (U.S. International Trade Commission Working Paper No. 07-01).
74. De Backer, K., & Flaig, D. (2017). The future of global value chains: Business as usual or "a new normal"?. *OECD Science, Technology and Industry Policy Papers* No. 41. Paris: OECD Publishing.
75. De Backer, K., & Miroudot, S. (2014). *Global value chains reshape our policy thinking* (Compnet Policy Brief No 6).
76. De Backer, K., & Yamano, N. (2012). *International comparative evidence on global value chains.* OECD Science, Technology and Industry Working Papers 2012/03. Paris: OECD Publishing.
77. Dedrick, J., Kraemer, K. L., & Linden, G. (2010). Who profits from innovation in global value chains?: A study of the iPod and notebook PCs. *Industrial and Corporate Change*, *19*, 81–116.

78. Dedrick, J., & Kraemer, K. L. (2017). Intangible assets and value capture in global value chains: the smartphone industry. World Intelectual Property Organisation Working Paper No. 41.
79. Defever, F., & Toubal, F. (2013). Productivity, relationship-specific inputs and the sourcing modes of multinationals. *Journal of Economic Behavior & Organization*, *94*, 345–357.
80. Dietzenbacher, E., Los, B., Stehrer, R., Timmer, M., & de Vries, G. (2013). The construction of world input–output tables in the WIOD project. *Economic Systems Research, 25*, 71–98.
81. Dixit, A. K., & Grossman, G. M. (1982). Trade and protection with multistage production. *The Review of Economic Studies, 49*, 583–594.
82. Drake-Brockman, J., & Stephenson, S. (2012). *Implications for 21st century trade and development of the emergence of services value chains*. Prepared for IADB and ICTSD E-15 experts dialogue on GVCs. Geneva.
83. Eaton, J., & Kortum, S. (2001). Technology, trade, and growth: A unified framework. *European Economic Review, 45*, 742–755.
84. Egger, P., & Stehrer, R. (2003). International Outsourcing and the Skill-Specific Wage Bill in Eastern Europe. *The World Economy*, *26*(1), 61–72.
85. Elms, D. K., & Low, P. (2013). *Global value chains in a changing world*. Geneva: World Trade Organization.
86. Ernst, D. (1997). *From partial to systemic globalization: International production networks in the electronics industry*. Berkeley Roundtable on the International Economy Working Paper No. 98. University of California at Berkeley.
87. Escaith, H. (2016). Revisiting Growth Accounting From A Trade In Value-Added Perspective. WTO Working Paper ERSD-2016-0.
88. Escaith, H., Lindenberg, N., & Miroudot, S. (2010). Global value chains and the crisis: Reshaping international trade elasticity? In O. Cattaneo, G. Gereffi, & C. Staritz (Eds.), *Global value chains in a postcrisis world* (pp. 73–124). Washington: The World Bank.
89. Feenstra, R. C. (1998). Integration of trade and disintegration of production in the global economy. *The Journal of Economic Perspectives, 12*, 31–50.
90. Feenstra, R. C., & Hanson, G. H. (1997). Foreign direct investment and relative wages: Evidence from Mexico's maquiladoras. *Journal of International Economics, 42*, 371–393.
91. Feenstra, R. C., & Hanson, G. H. (1999). The impact of outsourcing and high-technology capital on wages: Estimates for the United States, 1979–1990. *The Quarterly Journal of Economics, 114*(3), 907–940.
92. Felice, G., & Tajoli, L. (2015). Innovation and the international fragmentation of production: Complements or substitutes? Retrieved November 15, 2016, from http://www.siecon.org/ online/wp-content/uploads/2016/09/TAJOLI.pdf

93. Felipe, J., Kumar, U., & Abdon, A. (2014). Japan and the world economy how rich countries became rich and why poor countries remain poor: It's the economic structure… duh! *Japan and the World Economy, 29*, 46–58.
94. Fernandez-Stark, K., Bamber, P., & Gereffi, G. (2013). Costa Rica in the Offshore Services Global Value Chain: Opportunities for Upgrading. Durham, N.C.: Duke University Center on Globalization, Governance and Competitiveness.
95. Fernandez-Stark, K., Bamber, P., & Gereffi, G. (2014). Global value chains in Latin America: A development perspective for upgrading. In R. A. Hernández, M. J. Martínez-Piva, & N. Mulder (Eds.), *Global value chains and world trade: Prospects and challenges for Latin America* (pp. 79–106). Santiago de Chile: UN ECLAC.
96. Findlay, R. (1978). An 'Austrian' Model of International Trade and Interest Rate Equalization. *Journal of Political Economy, 86*(6), 989–1008.
97. Fröebel, F., Heinrichs, J., & Kreye, O. (1980). *The new international division of labour: Structural unemployment in industrialised countries and industrialisation in developing countries*. Cambridge: Cambridge University Press.
98. Gál, Z. (2014). Relocation of business services into Central and Eastern Europe (evidence from trade and location statistics). *Romanian Review of Regional Studies, 10*, 67–78.
99. Galar, M. (2012). Competing within global value chains. *ECFIN Economic Brief* 17. Brussels: European Commission.
100. Gasiorek, M., Lopez-Gonzalez, J., Holmes, P., Mendez Parra, M., Rollo, J., Strange, R., Winters, A., Cirera, X., Navas-Aleman, L. & Gorg, H. (2014). *China-EU global value chains: Who creates value, how and where?* Luxembourg: Publications Office of the European Union.
101. Gentile-Lüdecke, S., & Giroud, A. (2012). Knowledge Transfer from TNCs and Upgrading of Domestic Firms: The Polish Automotive Sector. *World Development, 40*(4), 796–807.
102. Gereffi, G. (1994). The organization of buyer-driven global commodity networks chains: How U.S. retailers shape overseas production. In G. Gereffi & M. Korzeniewicz (Eds.), *Commodity chains and global capitalism* (pp. 95–122). Westport (USA): Praeger Publishers.
103. Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy, 12*(1), 78–104.
104. Gereffi, G., & Fernandez-Stark, K. (2010). *The offshore services value chain: Developing countries and the crisis.* Policy Research Working Paper Series No. 5262. The World Bank.
105. Gereffi, G., & Fernandez-Stark, K. (2011). Global Value Chain Analysis: A Primer. Center on Globalization, Governance & Competitiveness (CGGC). Durham, North Carolina: Duke University.
106. Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy, 12*(1), 78–104.

107. Gereffi, G., & Lee, J. (2012). Why the world suddenly cares about global supply chains. *Journal of Supply Chain Management, 48*, 24–32.
108. Gereffi, G., & Luo, X. (2014). *Risks and opportunities of participation in global value chains.* Policy Research Working Paper No. 6847. Washinghton, D. C.: The World Bank.
109. Gereffi, G., & Korzeniewicz, M. (Eds.). (1994). *Commodity chains and global capitalism*. Westport: Praeger Publishers.
110. Giedraitis, V., & Rastenienė, A. (2009). Crisis as a catalyst: the role of Schumpeterian innovation in the Lithuanian economy. *Perspectives of Innovations, Economics and Business*, *2*(2), 11–13.
111. Giuliani, E., Pietrobelli, C., Rabellotti, R. (2005). Upgrading in global value chains: lessons from Latin American clusters. *World Development*, *33*(4), 549–573.
112. Godart, O., & Görg, H. (2011). The role of global value chains for German manufacturing. In A. Sydor (Ed.), *Trade policy research 2011 - Global value chains* (pp. 335–366). Ottawa: Department of Foreign Affairs and International Trade Canada.
113. Grossman, G. M., & Helpman, E. (2003). Outsourcing Versus FDI In Industry Equilibrium. *Journal of the European Economic Association, 1*(2–3), 317–327.
114. Grossman, G. M., & Helpman, E. (2004). Managerial incentives and the international organization of production. *Journal of International Economics*, *63*(2), 237–262.
115. Grossman, G. M., & Helpman, E. (2005). Outsourcing in a global economy. *Review of Economic Studies,72*, 135–159.
116. Grossman, G. M., & Rossi-Hansberg, E. (2008). Trading tasks: A simple theory of offshoring. *American Economic Review, 98*, 1978–1997.
117. Hanson, G. H., Mataloni, R. J., Jr, & Slaughter, M. J. (2005). Vertical production networks in multinational firms. *Review of Economics and Statistics, 87*, 664–678.
118. Harms, P., Lorz, O., & Urban, D. (2012). Offshoring along the production chain. *Canadian Journal of Economics, 45*, 93–106.
119. Hausmann, R., Hwang, J., & Rodrik, D. (2007). What you export matters. *Journal of Economic Growth,12*(1), 1–25.
120. Haskel, J. E., Pereira, S. C., & Slaughter, M. J. (2007). Does Inward Foreign Direct Investment Boost the Productivity of Domestic Firms? *The Review of Economics and Statistics*, *89*(3), 482–496.
121. Helpman, E., Melitz, M. J., & Yeaple, S. R. (2004). Export Versus FDI with Heterogeneous Firms. *The American Economic Review*, *94*(1), 300–316.
122. Henderson, J., Dicken, P., Hess, M., Coe, N., Wai-chung, H., & Yeung, H. W. (2002). Global Production Networks and the Analysis of Economic Development. *Review of International Political Economy*, *9*(3), 436–464.
123. Holste Hauke, J. (2015). *Local Firm Upgrading in Global Value Chains - A Business Model Perspective*. Wiesbaden: Springer Gabler.

124. 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.
125. Humphrey, J., & Schmitz, H. (2002). How does insertion in global value chains affect upgrading in industrial clusters? *Regional Studies*, *36*(9), 1017–1027.
126. IMF. (2015). Romania: Selected Issues. IMF Country Report No. 15/79. Washinghton: IMF.
127. Isaksen, A., & Kalsaas, B. T. (2009). Suppliers and Strategies for Upgrading in Global Production Networks: The Case of a Supplier to the Global Automotive Industry in a High-cost Location. *European Planning Studies*, *17*(4), 569-585.
128. Jabbour, L. (2012). 'Slicing the Value Chain' Internationally: Empirical Evidence on the Offshoring Strategy by French Firms'. *The World Economy*, *35*(11), 1417-1447.
129. Jabbour, L., & Kneller, R. (2010). Input Characteristics and the Mode of Offshoring: Evidence for French Firms. Research Paper 2010/22. University of Nottingham.
130. Jacobides, M. G., Knudsen, T., & Augier, M. (2006). Benefiting from innovation: Value creation , value appropriation and the role of industry architectures. *Research Policy, 35*, 1200–1221.
131. Jaklič, A., & Svetličič, M. (2008). Največje slovenske multinacionalke - majhnost presegajo z večjo internacionalizacijo. *IB Revija*, *2*, 40–51.
132. Javorcik, B. S. (2004). Does Foreign Direct Investment Increase the Productivity of Domestic Firms ? In Search of Spillovers Through Backward Linkages. *The American Economic Review*, *94*(3), 605–627.
133. Javorcik, B. S., & Spatareanu, M. (2009). Liquidity Constraints and Linkages with Multinationals. LICOS Discussion Paper No. 225.
134. 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.
135. Johnson, R. C., & Noguera, G. (2012a). Accounting for intermediates: Production sharing and trade in value added. *Journal of International Economics, 86*, 224–236.
136. Johnson, R. C., & Noguera, G. (2012b). *Fragmentation and trade in value added over four decades.* NBER Working Paper 18186.
137. Johnson, R. C., & Noguera, G. (2017). A portrait of trade in value-added over four decades. *Review of Economics and Statistics*, *99*(5), 896-911.
138. Jona-Lasinio, C., Manzocchi, S., & Meliciani, V. (2016). *Intangible assets and participation in global value chains: An analysis on a sample of European countries*. LLEE Working Paper Series No. 129.
139. Jürgens, U., & Krzywdzinski, M. (2009). Changing East−West Division of Labour in the European Automotive Industry. *European Urban and Regional Studies*, *16*(1), 27–42.
140. Kadarusman, Y., & Nadvi, K. (2013). Competitiveness and Technological Upgrading in Global Value Chains: Evidence from the Indonesian Electronics and Garment Sectors. *European Planning Studies*, *21*(7), 1007–1028.

141. Kaplinsky, R., & Morris, M. (2001). *A Handbook for Value Chain Research*. Ottawa: IDRC
142. Kee, H. L., & Tang, H. (2016). Domestic Value Added in Exports: Theory and Firm Evidence from China. *American Economic Review*, *106*(6), 1402–1436.
143. Keller, W., & Yeaple, S. R. (2009). Multinational Enterprises, International Trade , and Productivity Growth : Firm Level Evidence from the United States. *The Review of Economics and Statistics*, *91*(4), 821–831.
144. Kim, P. H., & Li, M. (2014). Injecting demand through spillovers: Foreign direct investment, domestic socio-political conditions, and host-country entrepreneurial activity. *Journal of Business Venturing*, *29*, 210–231.
145. Klasinc, J. (2016). Investment in green economy as a potential source of value added. *International Journal of Business and Economic Sciences Applied Research*, *8*(3), 109–118.
146. Kleinert, J. (2003). Growing trade in intermediate goods: Outsourcing, global sourcing, or increasing importance of MNE networks? *Review of International Economics*, *11*(3), 464–482.
147. Klette, J., & Forre, S. E. (1998). Economics of innovation and new technology innovation and job creation in a Small open economy - evidence from Norwegian manufacturing plants 1982–1992. *Economics of Innovation and New Technology*, *5*, 2–4.
148. Kohler, W. K., & Smolka, M. (2012). Global sourcing: Evidence from Spanish firm-level data. In R. M. Stern (ED.), *Quantitative Analysis of Newly Evolving Patterns of International Trade: Fragmentation, Offshoring of Activities, and Vertical Intra-Industry Trade* (pp. 139-193). London: World Scientific Publishing Co.
149. Konings, J. (2001). The effects of foreign direct investment on domestic firms: Evidence from firm-level panel data in emerging economies. *Economics of transition*, *9*(3), 619-633.
150. Koopman, R., Powers, W., Wang, Z., & Wei, S.-J. (2010). *Give credit where credit is due: Tracing value added in global production chains.* NBER Working Paper No. 16426.
151. Koopman, R., Wang, Z., & Wei, S. J. (2012). Estimating domestic content in exports when processing trade is pervasive. *Journal of development economics*, *99*(1), 178-189.
152. Koopman, R., Wang, Z., & Wei, S. (2014). Tracing value-added and double counting. *American Economic Review*, *104*(2), 459–494.
153. Kowalski, P., Lopez Gonzalez, J., Ragoussis, A., & Ugarte, C. (2015). *Participation of developing countries in global value chains.* OECD Trade Policy Papers No. 179.
154. Kraemer, K., Linden, G., & Dedrick, J. (2011). *Capturing value in global networks: Apple's iPad and iPhone*. Retrieved from http://econ.sciences-po.fr/sites /default/files/file/Value_iPad_iPhone.pdf
155. Krugman, P. (1995). Growing world trade: Causes and consequences. *Brookings Papers on Economic Activity*, *26*, 327–377.

156. Kummritz, V. (2015). *Global value chains: Benefiting the domestic economy?* Working paper No. 02/2015. Graduate Institute of International and Development Studies Working Paper.
157. Labaye, E., Sjatil, P. E., Bogdan, W., Novak, J., Mische, J., Fruk, M., & Ionuţiu, O. (2013). *A new dawn:Reigniting growth in Central and Eastern Europe*. Budapest, Warsaw, Prague: McKinsey Global Institute.
158. Lakatos, C., & Fukui, T. (2013). EU-US Economic Linkages: The Role of Multinationals and Intra-Firm Trade. Chief Economist Note, 2.
159. Lanz, R., & Miroudot, S. (2011). Intra-Firm Trade: Patterns, determinants and policy implications. OECD Trade Policy Papers No. 114. Paris: OECD Publishing.
160. Laplume, A. O., Petersen, B., & Pearce, J. M. (2016). Global value chains from a 3D printing perspective. *Journal of International Business Studies*, 47(5), 595-609.
161. Lawrence, R. Z. (1994). *Trade, multinationals, & labor.* Working Paper No. 4836. National Bureau of Economic Research.
162. Li, B., & Liu, Y. (2014). *Moving Up the Value Chain. Boston, MA: Boston College.*
163. López-González, J., & Kowalski, P. (2017). Global value chain participation in Southeast Asia: Trade and related policy implications. In L. Yan Ing & F. Kimura (Eds.), *Production Networks in Southeast Asia* (pp. 13-39). London/New York: Routledge.
164. Lorentowicz, A., Marin, D., & Raubold, A. (2005). Is human capital losing from outsourcing? Evidence for Austria and Poland. In S. Brakman & H. Garretsen (Eds.), *Foreign direct investment and the multinational enterprise* (pp. 225–258). Massachusetts: MIT Press.
165. Los, B., Timmer, M. P., & de Vries, G. J. (2015). How global are global value chains? A new approach to measure international fragmentation. *Journal of Regional Science, 55*, 66–92.
166. Low, P. (2013). The role of services in global value chains. In D. K. Elms & P. Low (Eds.), *Global value chains in a changing world* (pp. 61–82). Geneva: WTO Publications.
167. Lu, D., & Ulu. (2014). Firm Size, and Import Content of Production. Working paper, 1–26.
168. Marin, D. (2004). *A nation of poets and thinkers' - Less so with eastern enlargement? Austria and Germany.* SFB/TR 15 Discussion Paper No. 77.
169. Marin, D. (2011). The opening up of Eastern Europe at 20: Jobs, skills and reverse maquiladoras in Austria and Germany. In M. N. Jovanović (Ed.), *International handbook on the economics of integration* (Volume II, 296–323). Edward Elgar Publishing Ltd.
170. Manova, K., & Yu, Z. (2012). *How firms export: Processing vs. ordinary trade with financial frictions.* NBER Working Paper 18561.
171. Manova, K., & Yu, Z. (2016). How firms export: Processing vs. ordinary trade with financial frictions. *Journal of International Economics, 100*, 120–137.

172. Markusen, J. R., & Venables, A. J. (2007). Interacting factor endowments and trade costs: A multi-country, multi-good approach to trade theory. *Journal of International Economics*, *73*(2), 333–354.
173. Melitz, M. J. (2003). The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica*, *71*(6), 1695–1725.
174. Messerlin, P. A. (1995). The impact of trade and capital movements on labour evidence on the French case. *OECD Economic Studies*, *24*, 89–124.
175. Milberg, W., & Winkler, D. (2010). Trade, Crisis, and Recovery: Restructuring Global Value Chains. In O. Cattaneo, G. Gereffi & C. Staritz (Eds.), *Global Value Chains in a Postcrisis World* (pp.23-72). Washington, D.C.: The World Bank.
176. Mitra, D., & Ranjan, P. (2010). Offshoring and unemployment: The role of search frictions labor mobility. *Journal of International Economics*, *81*, 219–229.
177. Miroudot, S., Lanz, R., & Ragoussis, A. (2009). Trade in intermediate goods and services. *OECD Trade Policy Papers* No. 93. Paris: OECD Publishing.
178. Monarch, R., & Schmidt-Eisenlohr, T. (2016). Learning and the Value of Relationships in International Trade. CESifo Area Conferences 2016.
179. Morrison, A., Pietrobelli, C. & Rabellotti, R. (2008). Global Value Chains and Technological Capabilities: A Framework to Study Learning and Innovation in Developing Countries. *Oxford Development Studies*, 36(1), 39-58.
180. Mudambi, R. (2008). Location, control and innovation in knowledge-intensive industries. *Journal of Economic Geography*, *8*(5), 699–725.
181. Narula, R., & Guimón, J. (2009). The contribution of multinational enterprises to the upgrading of national innovation systems in the EU new member states: policy implications. In *Paper submitted to the OECD Global Forum on International Investment, Investment Division, Global Forum VIII on International Investment, Session* (Vol. 2).
182. Nicita, A., Ognivtsev, V., & Shirotori, M. (2013). *Global supply chains: Trade and economic policies for developing countries*. Policy Issues In International Trade And Commodities Study Series No. 55. Geneva: UNCTAD.
183. Nieto, M. J. & Rodríguez, A. (2011). Offshoring of R&D: Looking abroad to improve innovation performance. *Journal of International Business Studies*, (42), 345–361.
184. Noguera, G. (2012). *Trade costs and gravity for gross and value added trade.* University of Warwick Unpublished Manuscript.
185. Nunn, N. (2007). Relationship-specificity, incomplete contracts, and the pattern of trade. *Quarterly Journal of Economics*, *122*(2), 569–600.
186. Nunn, N., & Trefler, D. (2013). Incomplete contracts and the boundaries of the multinational firm. *Journal of Economic Behavior and Organization*, *94*, 330–344.
187. OECD. (2011). ISIC Rev. 3 technology intensity definition. Retrieved from https://www.oecd.org/sti/inno/48350231.pdf
188. OECD. (2013a). *Interconnected economies: Benefiting From global value chains*.

Paris: OECD Publishing.
189. OECD. (2013b). Knowledge-based capital and upgrading in global value chains. In *Supporting Investment in Knowledge Capital, Growth and Innovation* (pp. 215–252). Paris: OECD Publishing.
190. OECD. (2013c). OECD-WTO database on trade in value-added. Retrieved from http://www.oecd.org/sti/ind/TIVA%20flyer%20FINAL.pdf
191. OECD. (2017). Slovenia Trade and Investment Statistical Note. Paris: OECD Publishing.
192. OECD & World Bank Group. (2015). *Inclusive global value chains policy options in trade and complementary areas for GVC integration by small and medium enterprises and low-income*. Report prepared for submission to G20 Trade Ministers Meeting Istanbul.
193. OECD, WTO, & World Bank Group. (2014). *Global value chains: Challenges, opportunities, and implications for policy*. Report prepared for submission to the G20 Trade Ministers Meeting Sydney, Australia.
194. Ornelas, E., & Turner, J. L. (2008). Trade liberalization, outsourcing, and the hold-up problem. *Journal of International Economics, 74*, 225–241.
195. Park, A., Nayyar, G., & Low, P. (2013). *Supply Chain Perspectives and Issues - A Literature Review*. Geneva and Hong Kong: Fung Global Institute and World Trade Organization.
196. Pavlínek, P., & Ženka, J. (2010). Upgrading in the automotive industry: firm-level evidence from Central Europe. *Journal of Economic Geography, 11*(3), 559–586.
197. Pfaffermayr, M., & Bellak, C. (2002). Why Foreign-owned Firms are Different: A Conceptual Framework and Empirical Evidence for Austria. In R. Jungnickel (Ed.), *Foreign-owned Firms* (pp.13-57). London: Palgrave Macmillan.
198. Pickles, J., Smith, A., & Begg, R. (2006). Upgrading, changing competitive pressures, and diverse practices in the East and Central European apparel industry. *Environment and Planning, 38*(1), 2305–2325.
199. Pietrobelli, C., & Rabellotti, R. (2011). Global value chains meet innovation systems: Are there learning opportunities for developing countries? *World Development, 39*(7), 1261–1269.
200. Pilat, D., & Wolfl, A. (2005). *Measuring the interaction between manufacturing and services.* STI Working Paper Series 2005/5.
201. Powers, W. (2012). *The Value of Value Added: Measuring global engagement with gross and value-added trade.* Working paper No. 2012-11A. Washington, DC: U.S. International Trade Commission.
202. Rahman, J., & Zhao, T. (2013). *Export performance in Europe: What do we know from supply links?* IMF Working Paper No. 13/62.
203. Rajan, R. G., & Zingales, L. (1998). Financial Dependence and Growth. *The American Economic Review, 88*(3), 559–586.
204. Rehnberg, M., & Ponte, S. (2018). From smiling to smirking? 3D printing, upgrading

and the restructuring of global value chains. *Global Networks*, *18*(1), 57–80.
205. Reinstaller, A., & Unterlass, F. (2011). *Sectoral innovation modes and the distance to the technological frontier*. Paper presented at the DIME Final Conference Maastricht, the Netherlands.
206. Romalis, B. J. (2004). Factor Proportions and the Structure of Commodity Trade. *American Economic Review*, *94*(1), 67–97.
207. Roodman, B. D. (2006). *How to do xtabond2: An introduction to difference and system GMM in Stata.* Center for Global Development Working Paper No. 103.
208. Saito, M., Ruta, M., & Turunen, J. (2013). *Trade interconnectedness: The world with global value chains*. Washington: International Monetary Fund.
209. Sass, M., & Fifekova, M. (2011). Offshoring and outsourcing business services to central and eastern Europe: Some empirical and conceptual considerations. *European Planning Studies*, *19*, 1593–1609.
210. Sass, M., & Szalavetz, A. (2013). Crisis and Upgrading: The Case of the Hungarian Automotive and Electronics Sectors. *Europe-Asia Studies*, *65*(3), 37–41.
211. Stare, M. (2016). *Vloga storitev v globalnih verigah vrednosti*. Ljubljana: Fakulteta za družbene vede, Založba FDV.
212. Stehrer, R., Ali-Yrkkö, J., Hanzl-Weiss, D., Foster, N., Rouvinen, P., Seppälä, T., Stöllinger, R. & Ylä-Anttila, P. (2011). *Trade in intermediate products and EU manufacturing supply chains.* Research Reports 369. The Vienna Institute for International Economic Studies.
213. Stehrer, R., Borowiecki, M., Dachs, B., Hanzl-Weiss, D., Kinkel, S., Pöschl, J., Sass, M., Schmall, T. C. & Szalavetz, A. (2012). *Global Value Chains and the EU Industry*. Research Reports 383. The Vienna Institute for International Economic Studies.
214. Stehrer, R., & Stöllinger, R. (2013). *Positioning Austria in the global economy: Value added trade, international production sharing and global linkages*. FIW Research Reports 2013 N°02. Vienna: Forschungsschwerpunkts Internationale Wirtschaft.
215. Stehrer, R., & Stollinger, R. (2015). *The Central European manufacturing core: What is driving regional production sharing?* FIW Research Reports 2014/15 N°02. Vienna: Forschungsschwerpunkts Internationale Wirtschaft.
216. Stephenson, S. (2012). Services and global value chains. In *The shifting Geography of global value chains:Implications for developing countries and trade policy* (pp. 18–23). Geneva: World Economic Forum.
217. Stephenson, S., & Drake-Brockman, J. (2014). *The services trade dimension of global value chains: Policy implications for commonwealth developing countries and small states.* Commonwealth Trade Policy Discussion Papers 2014/04. London: Commonwealth Secretariat.
218. Stöllinger, R. (2016). Structural change and global value chains in the EU. *Empirica*, *43*(4), 801–829.

219. Strange, R., & Zucchella, A. (2017). Industry 4.0, Global Value Chains and International Business. *Multinational Business Review*, *25*(3), 174-184.
220. Swenson, D. L. (2000). Firm outsourcing decisions: Evidence from U.S. foreign trade zones. *Economic Inquiry, 38*, 175–189.
221. Sydor, A. (2011). Global value chains: Impacts and implications editor's overview. In A. Sydor (Ed.), *Global value chains – impacts and implications* (pp. 1–16). Ottawa: Foreign Affairs and International Trade Canada.
222. Szalavetz A. (2017) Upgrading and Value Capture in Global Value Chains in Hungary: More Complex than What the Smile Curve Suggests. In Szent-Iványi B. (Ed.), *Foreign Direct Investment in Central and Eastern Europe. Post-crisis perspectives* (pp. 127-150). Basingstoke: Palgrave Macmillan.
223. Taglioni, D., & Winkler, D. (2016). *Making Global Value Chains Work for Development*. Trade and Development series. Washington, DC: World Bank.
224. Tang, H., Wang, F., & Wang, Z. (2015). *The Domestic Segment of Global Supply Chains in China under State Capitalism*. HKIMR Working Paper No. 05/2015.
225. Timmer, M. P., Dietzenbacher, E., Los, B., & Stehrer, R. (2015). An Illustrated User Guide to the World Input – Output Database: the Case of Global Automotive Production. *Review of International Economics*, *23*(3), 575–605.
226. Timmer, M., Erumban, A. A., Gouma, R., Los, B., Temurshoev, U., de Vries, G. J., Arto, I., Aurélien Genty, V. A., Neuwahl, F., Rueda-Cantuche, J. M., Villanueva, A., Francois, J., Pindyuk, O., Pöschl, J., Stehrer, R. & Streicher, G. (2012). *The world input-output database (WIOD): contents, sources and methods*. Working paper No. 20120401. Rotterdam: Institute for International and Development Economics.
227. Timmer, M. P., Erumban, A. A., Los, B., Stehrer, R., & de Vries, G. J. (2014). Slicing Up Global Value Chains. *Journal of Economic Perspectives*, *28*(2), 99–118.
228. Tokatli, N. (2007). Asymmetrical power relations and upgrading among suppliers of global clothing brands: Hugo Boss in Turkey. *Journal of Economic Geography*, *7*(1), 67–92.
229. Tomiura, E. (2007). Foreign outsourcing, exporting, and FDI: A productivity comparison at the firm level. *Journal of International Economics*, *72*(1), 113–127.
230. UNCTAD. (2013). *Global Value Chains: Investment and Trade for Development*. New York/Geneva: United Nations.
231. UNCTAD, OECD and WTO. (2013). *Implications of global value chains for trade, investment, development and jobs.* Prepared for the G-20 Leaders Summit. Saint Petersburg: Russian Federation.
232. UNCTAD STAT. (2016). Foreign Direct Investment-US Dollars at current prices per capita. Retrieved from http://unctadstat.unctad.org/wds.
233. van der Marel, E. (2015). Positioning on the global value chain map: Where do you want to be? *Journal of World Trade, 49*, 915–949.
234. van der Ploeg, F., & Poelhekke, S. (2008). Globalization and the rise of mega-cities in the developing world. *Cambridge Journal of Regions, Economy and Society*, *1*, 477–501.

235. Winkler, D. (2013). Potential and Actual FDI Spillovers in Global Value Chains - The Role of Foreign Investor Characteristics, Absorptive Capacity and Transmission Channels. *Policy Research Working Paper 6424*. Washinghton, D. C.: The World Bank.
236. World Bank. (2016). *Growing Challenges*. World Bank East Asia And Pacific Economic Update April 2016. Washinghton, D. C.: The World Bank.
237. World Bank. (2017). *Measuring and Analyzing the Impact of GVCs on Economic Development*. Washington, D.C.: World Bank Group.
238. WTO. (2017). Trade in value-added and global value chains: statistical profiles. Retrieved on 17 August 2018 from https://www.wto.org/english/res_e/statis_e/ miwi_e/SI_e.pdf
239. WTO. (2018). Trade in Value-Added and Global Value Chains profiles - Explanatory notes. Retrieved from https://www.wto.org/english/res_e/statis_e/ miwi_e/ Explanatory_Notes_e.pdf
240. Xing, Y., & Detert, N. (2010). *How the iPhone widens the United States trade deficit with the People's Republic of China.* ADBI Working Paper 257. Tokyo: Asian Development Bank Institute.
241. Ye, M., Meng, B., & Wei, S. (2015). *Measuring Smile Curves in Global Value Chains*. IDE Discussion Paper 530. Chiba: Institute of Developing Economies.
242. Yeaple, S. R. (2006). Offshoring, Foreign Direct Investment, and the Structure of U.S. Trade. *Journal of the European Economic Association*, *4*(2–3), 602–611.
243. Yeats, A. J. (1999). Just How Big Is Global Production Sharing? *Policy Research Working Papers*. Washinghton, D. C.: The World Bank.
244. Ylömäki, T. (2016). Global value chain upgrading. *ETLA Working Papers 2420*(36).
245. Zámborský, P. (2006). FDI and OECD Industry Productivity: Technology, Capital and Country Size. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download? doi=10.1.1.535.2081&rep=rep1&type=pdf
246. Zhu, S., & Fu, X. (2013). Drivers of Export Upgrading. *World Development*, *51*, 221–233.
247. Zolas, N. J., & Lybbert, T. J. (2014). How Do Patents Shape Global Value Chains? International and Domestic Patenting and Value-Added Trade. Retrieved from http://funginstitute.berkeley.edu/wp-content/uploads/2014/11/IP-and-Value-Added-Trade-Flows-in-Global-Value-Chains_v41.pdf

APPENDICES

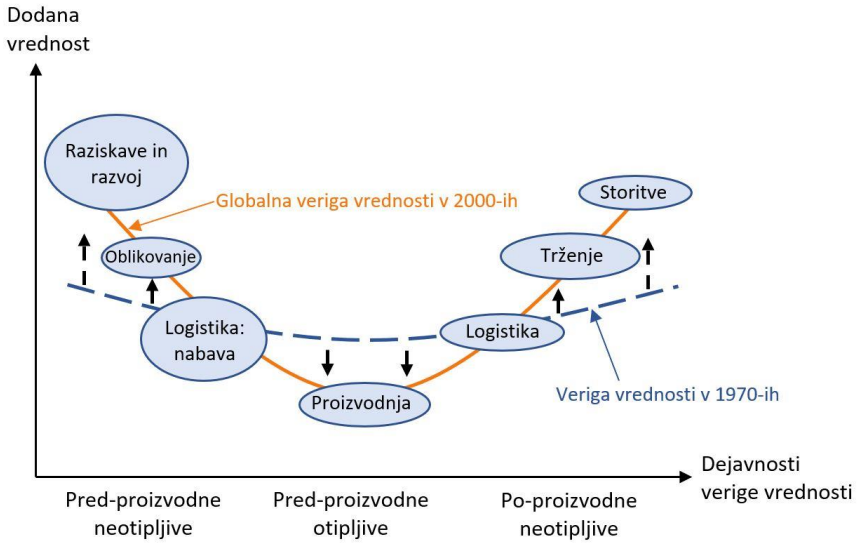
Appendix 1: Summary in Slovenian language/Daljši povzetek disertacije v slovenskem jeziku

Opis raziskovalnega področja

Obseg svetovnega izvoza kot deleža svetovnega bruto domačega proizvoda se je od sredine 20. stoletja trikratno povečal. To je v glavnem posledica povečane razdrobljenosti proizvodnje prek nacionalnih meja zaradi naraščajočega pomena trgovine z vmesnimi proizvodi. V letu 2006 so tako vmesni proizvodi (v državah OECD) predstavljali 56 odstotkov svetovne trgovine s proizvodi in 73 odstotkov s storitvami (Miroudot, Lanz, & Ragoussis, 2009). Razdrobljenost proizvodnih procesov, ki so jo omogočili tehnološki napredek, liberalizacija trgovine ter diverzifikacija nalog in dejavnosti na mednarodni ravni, je privedla do nastanka proizvodnih sistemov na regionalni ali globalni ravni, poznanih kot globalne verige vrednosti (v nadaljevanju GVV; UNCTAD, 2013).

Verigo vrednosti lahko enostavno opredelimo kot "celoten obseg dejavnosti, ki jih podjetja in delavci izvajajo od same zasnove izdelka do njegove končne uporabe" (Gereffi & Fernandez-Stark, 2010). Običajno je veriga vrednosti sestavljena iz oblikovanja, proizvodnje, trženja, distribucije in podpore končnemu potrošniku. Dodana vrednost je najvišja v začetnih fazah proizvodnega procesa (koncept, oblikovanje, raziskave in razvoj) in v končnih fazah (prodaja, trženje in poprodajne storitve), najnižja pa v srednjih fazah (proizvodnja). Delež dodane vrednosti v različnih fazah proizvodnje pa je pogosto predstavljen s t. i. "krivuljo nasmeha" (angl. *smile curve*) (slika 1-1).

Slika 1-1: Krivulja nasmeha za globalno verigo vrednosti v letih 1970 in 2000



Source: World Bank, Measuring and Analysing the Impact of GVCs on Economic Development, 2017, p. 70.

GVV so v zadnjih štirih desetletjih prišle v ospredje zanimanja, ko so se med t. i. "drugo razvezavo" (angl. *second unbundling*) (Baldwin, 2011) predelovalne faze proizvodnega procesa postopoma preselile (s pomočjo informacijsko-komunikacijske tehnologije) v države z nižjimi stroški dela (npr. Kitajska). V tem obdobju se je stanje spremenilo, tako da se je delež dodane vrednosti v predelovalnih fazah zmanjšal v primerjavi s prvimi in zadnjimi fazami proizvodnega procesa. Pojav je prikazan kot "poglabljanje krivulje nasmeha" (Baldwin, 2012), za katerega je mogoče najti preprosto razlago v zunanjem izvajanju (angl. *offshoring*) proizvodnih procesov, ki ga je omogočil tehnološki napredek.

V 20. stoletju nobena država ni mogla postati globalno konkurenčna brez močne in široke industrijske baze, ki je predstavljala temeljni pogoj za njen izvozni uspeh. Še pred tem sta se od sredine 19. stoletja, pridevnika industrializiran in bogat uporabljala kot sopomenki. Industrializacija je temeljila na izgradnji celotne proizvodne verige doma. V nekaterih primerih je vzpostavitev celotne verige vrednosti trajala celo desetletja in je bila odvisna od velikega trga, ki je podpiral industrijsko bazo. V 20. stoletju je namreč izvoz države predstavljal tehnologijo, delo in kapital države, medtem ko je bila vključitev tujih dejavnikov ali tehnologije vprašanje drugotnega pomena. Kot tak je izvoz države predstavljal njene tehnološke, delovne in kapitalske zmogljivosti, saj so proizvodi predstavljali "rezultat" proizvodnih dejavnikov, tehnologije, družbenega kapitala in sposobnosti upravljanja posamezne države. Ta koncept izvoza pa je v zadnjih štirih desetletjih postal zastarel s tem, ko so se faze proizvodnje sčasoma razširile na več držav (Baldwin, 2011).

Baldwin (2012) opisuje obstoj dveh vrst gospodarstev, t. i. "središčnih gospodarstev" (angl. *headquarter economies*) in "tovarniških gospodarstev" (angl. *factory economies*). Središčna gospodarstva imajo razmeroma nizek delež uvoženih polproizvodov v celotnem izvozu in predstavljajo države, v katerih so mednarodne korporacije ali "vodilna podjetja". Po drugi strani izvoz tovarniških gospodarstev vsebuje velik delež uvoženih polproizvodov, medtem ko te države predstavljajo lokacije, kjer so dobaviteljska podjetja. Poleg tega Baldwin (2012) opozarja, da imajo GVV pretežno regionalne in ne globalne značilnosti, in tako uporablja izraze, kot so "tovarna Azija" (angl. *"Factory Asia"*), "tovarna Severna Amerika" (angl. *"Factory North America"*) in "tovarna Evropa" (angl. *"Factory Europe"*). Podobno Stehrer et al. (2012) pojasnjujejo, da bi lahko zunanje izvajanje dejavnosti podjetja (angl. *offshoring/outsourcing*) iz zahodne v srednjo in vzhodno Evropo šteli za t. i. "*nearshoring*" ali "*nearsourcing*". Naziv "vozlišča" (angl. *hub*) t. i. "tovarne Evrope" je mogoče pripisati Nemčiji (Baldwin, 2012), sledijo ji Italija, Nizozemska, Združeno kraljestvo in Francija (kot sta jih predstavila Rahman in Zhao (2013) z vidika dodane vrednosti v trgovini), pri čemer so srednje- in vzhodnoevropske države označene kot tovarniška gospodarstva (Damijan, Kostevc & Rojec, 2015). Podobno z vidika EU Stöllinger (2016) označuje tehnološko naprednejše države članice kot večinoma offshoring države ter države srednje in vzhodne Evrope kot večinoma offshoring

destinacije. Posledično podjetja iz različnih držav opravljajo različne funkcije in sodelujejo v različnih fazah GVV.

V primeru visokih deležev uvoženih polproizvodov v celotnem izvozu in vključenosti v GVV, omejene na dele verige vrednosti z "nižjo kvalifikacijo" (angl. *low-skilled*) ter majhno dodano vrednostjo, je običajno delež domače dodane vrednosti v izvozu relativno majhen. Zadnja predstavlja del izvoza, ki nastaja v določeni državi in prispeva k njenemu BDP (UNCTAD, 2013, str. 126). Optimalni rezultat z najvišjo rastjo BDP na prebivalca predstavlja visoka vključenost v GVV ter hkrati visoka rast domače dodane vrednosti v izvozu. Tudi če države prvotno povečajo tujo dodano vrednost v izvozu, lahko na dolgi rok nadgradijo svoj položaj v proizvodnih omrežjih in povečajo svojo domačo dodano vrednost v izvozu.

Podjetja, ki se vključijo v GVV, se v določeni fazi soočijo s situacijo, ko je potrebno preučiti možnosti za nadgradnjo (ang. *upgrading*) njihovega položaja v GVV. To lahko dosežejo tako, da se preusmerijo na dejavnosti z večjo dodano vrednostjo znotraj verige in na ta način povečajo svoje koristi od sodelovanja v GVV (Gereffi & Fernandez-Stark, 2011). Odločitev podjetij za nadgradnjo pogosto predstavlja možnost za ohranjanje njihove konkurenčnosti in konec koncev zagotavljanje njihovega preživetja v zelo dinamičnem okolju. Drugače bi lahko podjetja tvegala izgubo svojega tržnega položaja in se lahko soočila z grožnjo izginjanja s strani konkurentov iz držav z nižjimi proizvodnimi stroški. Take okoliščine tako zahtevajo hiter odziv podjetij na nove izzive na trgu in v GVV (Holste Hauke, 2015). Z nadgrajevanjem v GVV se podjetja soočajo z višjimi vstopnimi ovirami, vendar imajo v primeru uspeha kasneje večje koristi zaradi manjšega števila konkurentov in posledično večjih donosov (Bair & Mahutga, 2016).

V procesu nadgradnje podjetja Giuliani, Pietrobelli in Rabellotti (2005) razlikujejo med endogenimi in eksogenimi dejavniki. Zadnji se nanašajo na skupno učinkovitost podjetniškega grozda, upravljanje verige vrednosti, v katero je podjetje vključeno, ter na učne in inovacijske vzorce pripadajočega industrijskega sektorja (Park, Nayyar, & Low, 2013). V okviru endogenih dejavnikov oziroma notranjih prizadevanj podjetij za nadgradnjo znotraj GVV Humphrey & Schmitz (2002) razlikujejo štiri tipe, in sicer:

- nadgradnjo procesov (angl. *process upgrading*), ki se nanaša na učinkovitejšo pretvorbo inputov v outpute zaradi reorganizacije proizvodnje ali uvedbe vrhunske tehnologije;
- nadgradnjo izdelka (angl. *product upgrading*) ali premik podjetja v bolj izpopolnjene proizvodne linije;
- funkcionalno nadgradnjo (angl. *functional upgrading*) ali postopek pridobivanja novih funkcij podjetja ali opustitev obstoječih z namenom vsebinskega izboljšanja dejavnosti z vidika znanj in spretnosti;

- verižno ali medsektorsko nadgradnjo (angl. *chain or inter-sectional upgrading)*, ki opisuje napredovanje podjetja v novo vrednostno verigo.

Fernandez-Stark, Bamber in Gerefi (2014) so kasneje opredelili tri dodatne tipe procesa nadgradnje:
- vstop v vrednostno verigo, ki predstavlja prvi in tudi najzahtevnejši korak, saj se nanaša na podjetje, ki prvič sodeluje v GVV;
- nadgradnja vzvodnih povezav (angl. *backward linkages*), ki se nanaša na situacijo, ko lokalna podjetja začnejo dobavljati inpute (in/ali storitve) podjetjem, ki že sodelujejo v GVV (navadno multinacionalna podjetja – v nadaljevanju MNP, ki so v državi);
- nadgradnja, usmerjena na končne trge, ki se nanaša na premik podjetja k bolj izpopolnjenim ali večjim trgom, ki zahtevajo prilagoditev strožjim standardom ali obsežno proizvodnjo

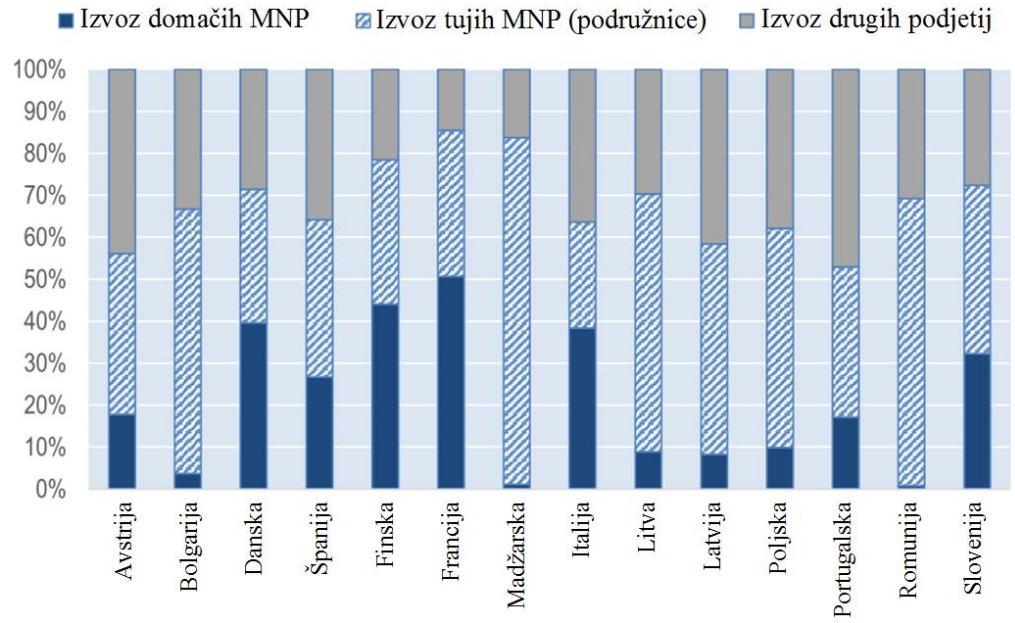
Med predstavljenimi tipi nadgradnje je funkcionalna nadgradnja najpogostejša oblika. To je pravzaprav vrsta nadgradnje, običajno ponazorjena z uporabo "krivulje nasmeha", ki se uporablja za prikaz gibanja stran od predelovalnih proti drugim fazam proizvodnega procesa (Damijan & Rojec, 2015). Poleg tega Morrison, Pietrobelli in Rabellotti (2008) poudarjajo običajno zanemarjeni vir rasti DVA, ki izhaja iz širjenja zmogljivosti podjetja znotraj vsake faze verige vrednosti namesto osredotočanja samo na premikanje vzdolž verige vrednosti (Park et al., 2013).

GVV pogosto vodijo in usklajujejo MNP na podlagi zapletenih mrež povezav dobaviteljev in različnih vrst korporacijskega upravljanja v obliki, ki lahko sega od neposrednega lastništva tujih povezanih podjetij do pogodbenih razmerij ali drugih oblik (UNCTAD 2013, str. 141). Glede na vrsto GVV obstajajo razlike v porazdelitvi moči in smeri tokov znanja, ki bi se lahko zbralo v vodilnem podjetju ali razdelilo med vodilno podjetje in dobavitelje (OECD & World Bank Group, 2015). Ocena UNCTAD kaže, da MNP usklajujejo 80 odstotkov svetovne trgovine prek trgovine z lastniško nepovezanimi subjekti (angl. *arm's-length*; trgovina MNP s končnimi potrošniki ali ne-MNP), trgovine med povezanimi podjetji (trgovina MNP s podružnicami ali matično družbo) in trgovine, povezane z drugačnimi oblikami proizvodnje (trgovina z družbami, ki so povezane prek licenciranja, franšizinga, pogodbene proizvodnje ali drugih vrst pogodbenih razmerij brez prisotnosti katerega koli lastniškega elementa). V letu 2014 so MNP ustvarila polovico svetovnega bruto izvoza, od tega 19 odstotkov predstavlja delež, ki so ga ustvarila domača MNP (Cadestin et al., 2018).

Sestava bruto izvoza po vrsti podjetja (domača ne-MNP, domača MNP in tuje podružnice) je prikazana na sliki 1-2, ki zaradi nerazpoložljivosti podatkov ne razlikuje med trgovino z lastniško nepovezanimi subjekti (angl. *arm's-length*) in trgovino znotraj podjetij (angl. *intra-firm*) v bruto izvozu MNP. Podatki pokažejo veliko heterogenost med državami. Na

primer v Franciji in na Madžarskem več kot 80 odstotkov izvoza opravijo MNP, vendar s popolnoma nasprotno strukturo. Medtem ko v Franciji velik del bruto izvoza predstavlja izvoz domačih MNP, na Madžarskem skoraj celoten bruto izvoz ustvarijo tuja MNP. Med predstavljenimi državami se Slovenija uvršča nad povprečje z relativno velikim deležem izvoza domačih MNP.

Slika 1-2: Sestava bruto izvoza glede na vrsto podjetja, zadnje dostopno leto



Vir: C. Cadestin et al., Multinational enterprises and global value chains: new insights on the trade–investment nexus, 2018, str. 25.

MNP imajo velik vpliv na razvoj GVV. Nanj vplivajo z izbiro lokacije izvajanja dejavnosti, izbiro dobaviteljev in odločitvijo, katere faze proizvodnega procesa bodo obdržali. V obdobju med letoma 1990 in 2008 se je tako njihova skupna prodaja povečala skoraj petkrat, s 6 na 30 trilijonov ameriških dolarjev, kar kaže na vedno večji pomen MNP in rast GVV (Sydor, 2011).

Raziskovalni namen disertacije

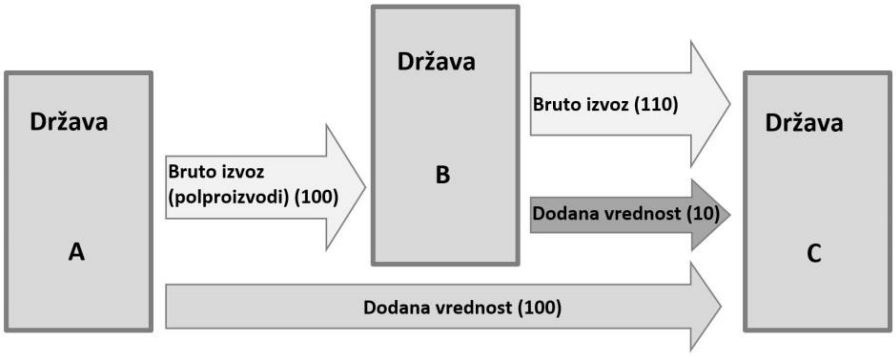
Države niso vse enako vključene v GVV, prav tako kot niso vse enako vključene v mednarodno trgovino. V GVV sodelujejo tako kot uporabnice tujih inputov kot dobaviteljice polproizvodov in storitev, kasneje vključenih v izvozu druge države.

Za opis procesa, ko država uvozi inpute iz druge države, jih uporabi pri proizvodnji lastnega blaga in to nato izvozi v drugo državo, Hummels et al. (2001) uporabijo izraz vertikalna specializacija. Nasprotni izraz "horizontalna specializacija" pa pomeni, da se

blago, ki je predmet trgovine, proizvaja v eni državi od začetka do konca. Na podlagi študij primerov in ocenjene stopnje vertikalne specializacije mednarodne trgovine Hummels et al. (2001) ugotavljajo, da v mednarodni trgovini narašča pomen vertikalne specializacije. Njihova analiza temelji na OECD input-output tabelah za obdobje 1968–1990, rezultati pa so predstavljeni kot vrednost uvoženih inputov, ki se nato izvozijo, ali kot tuja dodana vrednost, vključena v izvoz. Ti kažejo, da za največja gospodarstva na svetu (npr. ZDA, Nemčija in Japonska) obstaja manjša verjetnost vključitve v vertikalno trgovino kot za manjša gospodarstva (npr. Nizozemska), saj večji donosi obsega (angl. *economies of scale*) omogočajo lažje ohranjanje vseh faz proizvodnega procesa doma.

Na sliki 1-3 je predstavljen enostaven primer trgovine z vidika dodane vrednosti v izvozu. Primer se začne z državo A, ki izvozi polproizvode v vrednosti 100 EUR v državo B. Ta jih naprej nadgradi (doda 10 EUR) in izvozi predmet za končno potrošnjo, vreden 110 EUR, v državo C. Čeprav je v tem postopku nastalo le 110 EUR dodane vrednosti, uradni statistični podatki kažejo, da skupni izvoz oziroma uvoz znaša 210 EUR. Poleg tega kažejo, da ima država C trgovinski primanjkljaj z državo B v višini 110 EUR in da država C ne trguje z državo A, kljub temu da A predstavlja izvorno državo za blago, ki ga porabi država C (Ahmad, 2013, str. 86–87).

Slika 1-3. Trgovina z vidika dodane vrednosti



Vir: N. Ahmad, Estimating trade in value-added: why and how? In D. K. Elms & P. Low (Eds.), Global Value Chains in a Changing World (str. 85–108), 2013, str.86.

Številne študije so povzele in izboljšale mere, ki so jih predstavili Hummels et al. (2001), saj so meddržavne input-output tabele (azijske I-O tabele iz IDE-JETRO, podatkovna baza OECD/WTO TiVA, podatkovne baze GTAP, WIOD, UNCTAD EORA), ki odražajo medsektorske trgovinske povezave, omogočile obsežnejše globalne analize. Kot razlagajo Koopman et al. (2010), navedene podatkovne baze omogočajo analizo bilateralnih trgovinskih tokov na globalni ravni in primerjavo produkcijskih omrežij v različnih svetovnih regijah. Te poleg bruto vrednosti omogočajo tudi analizo z vidika dodane vrednosti v izvozu.

Namen doktorske disertacije je predstaviti pomen koncepta DVA v izvozu za analizo položaja države znotraj GVV in empirično preučiti, kateri dejavniki spodbujajo proces njihove nadgradnje z vidika DVA v izvozu. Disertacija je sestavljena iz treh osrednjih poglavij.

Glavni cilj prvega poglavja doktorske disertacije je predstaviti teoretični okvir, ki omogoča ocenjevanje vključenosti posamezne države v GVV in njenega prispevka v izvozu z vidika dodane vrednosti. Poglavje razlikuje med dvema skupinama držav EU, "starimi" državami EU (EU-15) in državami EU iz srednje in vzhodne Evrope (CEE-10). CEE-10 predstavlja skupino držav, ki so prestopile iz socialističnega v tržno gospodarstvo, in vprašanje, ki se tu pojavi, je, ali je prestrukturiranje izvoza v gospodarstvih CEE-10 vodilo v ustrezno povečanje DVA v izvozu, ki bi bila dovolj visoka, da bi se te države približale EU-15. Poleg tega poglavje razlikuje med proizvodnim in storitvenim sektorjem, saj so storitve na splošno manj vključene v proizvodna omrežja. To poglavje obravnava naslednja vprašanja: (1) *Ali CEE-10 ustvarijo nižjo domačo dodano vrednost v izvozu v primerjavi s "starimi" državami članicami EU (EU-15)*?, (2) *Ali se te razlike sčasoma zmanjšujejo oziroma ali se vrzel med CEE-10 in EU-15 sčasoma zapira*? in (3) *Kakšne so razlike v ravneh in trendih na sektorski ravni?* Odgovori na ta vprašanja omogočajo večji vpogled v to, ali države EU-15 z vidika DVA pridobijo več od sodelovanja v GVV kot CEE-10, pa tudi, ali in zakaj se ta vrzel zapira s časom (ali ne).

Drugo poglavje empirično preučuje, kaj vpliva na razlike v DVA med EU-15 in CEE-10, pri čemer se upošteva heterogenost v različnih sektorjih. Analiza naj bi odgovorila na vprašanje, *kateri so glavni dejavniki ocenjene DVA v izvozu v EU-15 in CEE-10 in ali imajo drugačen vpliv v vsaki od teh dveh skupin*. Z drugimi besedami, pozornost je usmerjena v preučevanje, v kolikšni meri neotipljivi kapital, človeški kapital, izpostavljenost tujim investicijam ipd. določajo ocenjeno DVA v izvozu v obeh skupinah držav.

Tretje poglavje se osredotoča na podatke na ravni podjetja. Cilj je oceniti DVA v izvozu slovenskih izvoznih podjetij in empirično preučiti dve glavni raziskovalni vprašanji: *(1) Kako se DVA v izvozu razlikuje glede na način sodelovanja podjetja v GVV (prek mreže povezanih podjetij ali prek zunajpodjetniške menjave (angl. inter-firm trade)) z razlikovanjem podjetij, ki so sami dobavitelji ali imajo svoje lastne dobavitelje iz tujine? in (2) Katere značilnosti podjetja vplivajo na "uspeh podjetja v DVA", merjenega z razmerjem DVA v izvozu?*

Raziskovalne metode in podatki

Glavni poudarek prvega poglavja disertacije je na virih dodane vrednosti v izvozu za vsako državo EU in na njihovi vključenosti v GVV. Za analizo so tako potrebne informacije o

dodani vrednosti v izvozu ter ocena podrobne strukture dodane vrednosti v bruto izvozu za posamezno državo. Disertacija sledi pogosto uporabljenemu načinu razčlenitve bruto izvoza na dodano vrednost, kot so ga razvili Koopman et al. (2010). Ta temelji na matričnih enačbah in zahteva uporabo meddržavnih input-output tabel. Kratek opis metodologije je predstavljen v prvem poglavju, podrobnejši opis pa je v prilogi C. Ocenjeni podatki DVA v izvozu iz prvega poglavja predstavljajo osnovo za analizo v drugem poglavju, ki za analizo panelnih podatkov uporablja metodo s fiksnim učinkom. Poleg tega se za preverjanje robustnosti rezultatov uporabi posplošena metoda momentov (angl. *Generalized Method of Moments* – v nadaljevanju GMM) in več različnih alternativ osnovne specifikacije. Tretje poglavje sledi nedavno predstavljeni metodologiji merjenja dodane vrednosti v izvozu z uporabo podatkov na ravni podjetja, ki sta jo razvila Kee in Tang (2016). Morebitna pogodbena razmerja (med nepovezanimi podjetji) so določena na podlagi stabilnosti trgovinskih tokov podjetij, ki temelji na podrobnih podatkih o izvozu (uvozu) podjetja, letu, državi prejemnici (državi odpreme) in o proizvodih na ravni HS6. Empirična analiza temelji na različnih metodah za analizo panelnih podatkov (metoda najmanjših kvadratov – OLS, metoda fiksnih učinkov). Za povečanje veljavnosti rezultatov je opravljenih več testov robustnosti osnovne specifikacije.

Celotna disertacija temelji na oceni dodane vrednosti v izvozu. Podatki, uporabljeni za oceno dodane vrednosti v izvozu na sektorski ravni, so pridobljeni iz javno dostopnih svetovnih input-output tabel (v nadaljevanju WIOT) iz podatkovne baze World Input-Output Database (v nadaljevanju WIOD). WIOT združuje podatke o nacionalnih proizvodnih dejavnostih (nacionalne tabele ponudbe in porabe, časovne vrste nacionalnih računov o industrijski proizvodnji in o končni uporabi) ter podatke o mednarodni trgovini. WIOT se razlikuje od nacionalnih tabel v kategorizaciji uporabe proizvodov, ki so razvrščeni glede na svoje poreklo na način, da vsak proizvod proizvaja domača ali tuja industrija. Druga razlika z nacionalnimi tabelami je, da je v WIOD razvidno, iz katere tuje industrije izvira uvoz in kako drugod po svetu uporabljajo izvoz iz določene države, v katerem sektorju in za katerega končnega uporabnika (Timmer et al., 2012, str. 5).

Baza podatkov WIOD, ki vsebuje svetovne tabele, nacionalne tabele, socialno-ekonomske račune in okoljske račune, zagotavlja letne podatke za 17 let, za obdobje od leta 1995 do 2011, za 35 industrij, 27 držav EU in 13 drugih večjih držav (Tabela 1-1). Ker je disertacija osredotočena na primerjavo med "starimi" državami EU (EU-15) in "novimi" državami EU iz srednje in vzhodne Evrope (CEE-10), je analiza skoncentrirana na teh 25 držav.

Tabela 1-1: Države, vključene v podatkovno bazo WIOD

EU-15		CEE-10	Druge EU	NAFTA	BRIIAT	Vzhodna Azija
Avstrija	Luksemburg	Bolgarija	Ciper	Kanada	Brazilija	Japonska
Belgija	Nizozemska	Češka	Malta	Mehika	Rusija	Koreja
Finska	Portugalska	Estonija		USA	Indija	Tajvan
Francija	Španija	Madžarska			Indonezija	Kitajska
Nemčija	Danska	Latvija			Avstralija	
Grčija	Švedska	Litva			Turčija	
Irska	Vel. Britanija	Poljska				
Italija		Romunija				
		Slovaška				
		Slovenija				

Vir: Dietzenbacher et al., The Construction of World Input–Output Tables in the Wiod Project, 2013, str. 95.

Empirična analiza v drugem poglavju združuje predstavljene podatke s podatkovnimi bazami OECD, Eurostat, WorldBank, podatkovno bazo Intan-Invest in podatki iz socialno-ekonomskih računov WIOD za države EU. V tretjem poglavju so uporabljeni podatki na ravni carinskih transakcij, ki jih zagotavlja Finančna uprava Republike Slovenije (FURS), računovodski podatki podjetij AJPES (Agencija Republike Slovenije za javnopravne evidence in povezane storitve) in podatki o tujih neposrednih investicijah, ki jih zagotavlja Banka Slovenije za obdobje 2002–2014. Za namene ocene DVA na ravni podjetij so uporabljeni tudi podatki OECD TiVA na sektorski ravni, prilagojeni podjetniškemu nivoju. Dostop do podrobnih podatkov o izvozu in uvozu po podjetjih, letih, ciljni državi in proizvodih na ravni HS6, ki jih zagotavlja FURS, omogoča oceno izvozne in uvozne stabilnosti prodaje.

Povzetek glavnih ugotovitev

V prvem poglavju je predstavljen teoretični okvir, ki omogoča ocenjevanje vključenosti posamezne države v GVV in njenega prispevka k izvozu z vidika dodane vrednosti. Za razčlenitev izvoza države na domačo in tujo komponento je uporabljena metodologija, ki jo predlagajo Koopman et al. (2010) in se opira na podatke iz podatkovne zbirke WIOD za obdobje 1995–2011. Ocenjeni rezultati kažejo, da je DVA v izvozu v državah EU-15 v primerjavi z državami CEE-10 višja tako v predelovalnem kot v storitvenem sektorju. DVA v predelovalnih dejavnostih povprečno znaša 72 odstotkov v EU-15 in 65 odstotkov v CEE-10, z najvišjimi deleži v delovno intenzivnih predelovalnih dejavnostih. Čeprav se je razlika med deležem DVA med CEE-10 in državami EU-15 z vidika DVA od leta 1995 najprej vztrajno povečevala, se je nato v opazovanem obdobju začela zmanjševati.

Mogočo razlago za zmanjšanje vrzeli je mogoče najti v deležu uvoženih polproizvodov v celotnih uporabljenih polproizvodih. Čeprav povprečni delež uvoženih polproizvodov v CEE-10 ostaja višji kot v EU-15, se ta začne po letu 2004 v CEE-10 zmanjševati, hkrati pa

se v EU-15 ta delež rahlo povečuje. V storitvenem sektorju so najvišji deleži DVA v izvozu v EU-15 opaženi v storitvah, povezanih z zdravjem, izobraževanjem in javnimi storitvami (89,6 odstotka), in v storitvah, ki temeljijo na znanju (86,2 odstotka). Podobno je v CEE-10 najvišji delež opažen v storitvah, ki temeljijo na znanju (85,9 odstotka), ter v zdravstvu, izobraževanju in javnih storitvah (85,4 odstotka). V zadnjih letih opazovanega obdobja se je delež DVA v CEE-10 približal deležu EU-15 (76 odstotkov v obeh skupinah v letu 2011). Deleži DVA v izvozu v storitvenem sektorju so v povprečju višji kot v predelovalnih dejavnostih, medtem ko je stopnja vključenosti v GVV v storitvenem sektorju še vedno nižja (36 odstotkov v letu 2011 za CEE-10) kot v predelovalnih dejavnostih (52 odstotkov v letu 2011 za CEE-10). Sodelovanje v GVV pogosto pomeni vstop v bolj razdrobljeno verigo vrednosti, za katero je značilna večja uporaba tujih inputov. Rezultati kažejo, da so v predelovalnem sektorju vse države v opazovanem obdobju povečale svojo vključenost v GVV (razen Estonije in Litve), medtem ko se je v skoraj vseh državah DVA zmanjšala.

Podoben trend je mogoče opaziti tudi v storitvenem sektorju. Ocenjeni rezultati kažejo na negativno razmerje med vključenostjo v GVV in DVA v izvozu v obeh sektorjih. Vendar pa za CEE-10 rezultati kažejo, da se je v opazovanem obdobju negativno razmerje med vključenostjo v GVV in DVA v izvozu v predelovalnem in storitvenem sektorju nekoliko zmanjšalo.

Ta ugotovitev je v skladu z ugotovitvami UNCTAD (2013), da so tudi države z velikim deležem tuje dodane vrednosti v izvozu na dolgi rok v boljšem položaju. Vendar le, če je njihova stopnja vključenosti v GVV visoka, saj lahko podjetja razširijo obseg svojih dejavnosti na dejavnosti z višjo dodano vrednostjo in tako nadgradijo svoj položaj v GVV. Višja DVA pa ne pomeni nujno večjih koristi od GVV, saj je domača dodana vrednost v izvozu sestavljena iz (1) komponente zunaj GVV in (2) komponente znotraj GVV. Razvoj povezav skozi opazovano obdobje kaže, da je večina gospodarstev EU-15 doživela upad koristi od vključenosti v GVV, medtem ko je mogoče opaziti nasprotno v skoraj vseh gospodarstvih CEE-10. To kaže, da koristi iz vključenosti v GVV niso same po sebi umevne (OECD, WTO, & World Bank Group, 2014), saj se morajo podjetja preusmeriti k dejavnostim z višjo dodano vrednostjo v GVV.

Ocenjene vrednosti DVA v izvozu so nadalje uporabljene v drugem poglavju, ki obravnava glavne gonilne sile razlik v deležih DVA med državami EU-15 in CEE-10. Ker trenutno še ni splošno sprejetega pristopa k raziskovanju determinant DVA, se zanašam predvsem na teoretične predpostavke nadgradnje v GVV in na nekatere ugotovitve obstoječih raziskav. Ocenjeni rezultati kažejo pozitivno korelacijo med investicijami v neotipljivi kapital in DVA v izvozu za EU-15, medtem ko rezultati pokažejo rahlo negativno povezavo za CEE-10. Mogoča razlaga je, da stopnja investicij CEE-10 v neotipljiva sredstva zadostuje za njihovo vključenost v GVV, vendar je ta še vedno pod pragom, ki omogoča nadgradnjo

v GVV. Nekoliko presenetljivo je, da ocenjeni rezultati kažejo na negativno korelacijo med visoko usposobljeno delovno silo in DVA v izvozu. To kaže, da v EU-15 večji delež neproizvodnih delavcev negativno vpliva na DVA v izvozu in da visoko kvalificirana delovna sila ne prispeva neposredno k nadgradnji GVV v EU-15. Za CEE-10 so ti učinki manjši, vendar še vedno negativni.

Vendar pa ti rezultati zbujajo dvom o ustreznosti nadomestne spremenljivke za merjenje kakovosti človeškega kapitala. Predvsem v začetnih fazah so vhodne tuje neposredne investicije pogosto povezane z večjim obsegom uvoza iz države, iz katere izvirajo te investicije. To je v večini mogoče pripisati povečanemu uvozu polproizvodov in investicijskega blaga, povezanega z "off-shored" proizvodnjo. Rezultati kažejo, da vhodne TNI (IFDI) na splošno privedejo do zmanjšanja povpraševanja po domačih inputih in tako zmanjšajo DVA v izvozu. Nasprotno pa nadgradnja GVV temelji na zunanjem izvajanju (angl. *outsourcing*), saj ta podjetjem omogoča, da se osredotočijo na svoje ključne kompetence (Mudambi, 2008; Ylomaki, 2016). Ocene rezultatov kažejo, da izhodne TNI (OFDI) zlasti za države CEE-10 predstavljajo pomemben gonilnik za nadgradnjo v GVV. Tudi v primeru drugih spremenljivk je mogoče opaziti zanimive rezultate. Geografska struktura izvoza (delež izvoza v pet najrazvitejših držav EU) se kaže kot pomemben dejavnik za CEE-10. Večji delež izvoza iz srednje in vzhodne Evrope v najbolj razvite države EU je negativno povezan z njihovim deležem DVA v izvozu. Višji uvoz polproizvodov iz Kitajske je negativno povezan z deležem DVA, vendar samo za CEE-10. Negativni odnos med DVA in uvozom iz Kitajske bi lahko pomenil, da v CEE-10 polproizvodi iz Kitajske pogosteje predstavljajo substitute kot komplemente, čeprav bi bile na tem področju potrebne nadaljnje raziskave. Na koncu so opravljeni številni testi robustnosti za preverjanje rezultatov moje osnovne specifikacije (uporaba različnih načinov merjenja neotipljivih sredstev, spreminjanje števila odlogov glavnih regresorjev in uporaba cenilke GMM). Rezultati v splošnem ostajajo robustni pri vseh načinih preverjanja robustnosti.

Tretje poglavje preučuje dejavnike DVA v izvozu na ravni podjetij v Sloveniji in analizira proces nadgradnje podjetij v GVV z vidika DVA v izvozu glede na obliko vključenosti v GVV ter značilnosti podjetij. Za namene analize so opredeljene štiri različne vrste sodelovanja podjetij v GVV – dve se nanašata na trgovino med povezanimi družbami, ki jih opredeljujejo vhodne in izhodne neposredne investicije, medtem ko se drugi dve nanašata na trgovino med nepovezanimi podjetji ter sta identificirani posredno.

Ker obstoječa literatura ne predlaga nobenega "pravila" za identificiranje podjetij, ki so del GVV prek pogodbenih razmerij (nelastniška povezava med podjetji), in ker ni dovolj podatkov, ki bi omogočili boljšo opredelitev takih trgovinskih povezav, so potencialne povezave določene z raziskovanjem stabilnosti trgovinskih tokov podjetja. V tem kontekstu stabilna prodaja pomeni, da je podjetje stalni dobavitelj (ali ima stalnega

dobavitelja iz tujine). Analiza se osredotoča na slovenske izvozne družbe iz predelovalnega sektorja in uporablja razpoložljive podatke na ravni podjetja, ki omogočajo podrobnejšo analizo položaja slovenskih podjetij v verigi vrednosti. Gre za podatke o carinskih transakcijah, ki jih zagotavlja FURS, AJPES-ove računovodske podatke podjetij in podatke o tujih neposrednih tokovih kapitala, ki jih je zagotovila Banka Slovenije za obdobje 2002–2014.

Za oceno DVA na ravni podjetij v Sloveniji analiza sledi nekoliko spremenjeni metodologiji Keeja in Tanga (2016). Najprej primerjam rezultate DVA, ocenjene z uporabo podatkov na ravni podjetij, z DVA, ocenjeno na podlagi podatkov iz sektorske ravni, z uporabo metodologije Koopman et al. (2010). Rezultati kažejo, da je DVA, ocenjena s podatki iz sektorske ravni, v povprečju nižja kot tista, ocenjena z uporabo podatkov na ravni podjetja. V tem primeru so sicer ocene za večja podjetja bližje ocenam iz tabele WIOD, saj ta običajno vključuje le največja podjetja v državi.

Rezultati kažejo negativno povezavo med tujimi podružnicami in DVA v izvozu, kar potrjuje, da dejavnosti v zunanjem izvajanju vključujejo predvsem stopnje in funkcije z nižjo DVA v izvozu in da izvozna podjetja v domači lasti presegajo produktivnejša podjetja v tuji lasti. To še dodatno podpira ugotovitev, da podjetja, za katera je značilna višja DVA v izvozu, niso nujno produktivnejša. Razlago je mogoče najti v obnašanju produktivnejših podjetij, ki uvažajo velik del polproizvodov, postajajo še produktivnejša, hkrati pa njihov izvoz vsebuje velik delež uvoza, kar zmanjšuje dodano vrednost v izvozu (Lu & Ulu, 2014; Johnson, 2014). Za nepovezana podjetja, ki imajo stalnega tujega dobavitelja (podjetja imajo položaj "organizatorja vrednostnih verig", kar jim omogoča, da se osredotočijo na svoje ključne kompetence), je opazen pozitiven vpliv na DVA v izvozu. Pričakovani rezultati, da podjetja s tujimi podružnicami v tujini dosegajo višji DVA, se potrdijo samo v primeru ocenjevanja z metodo OLS. Rezultati za podjetja, ki so stalni dobavitelji za tuje družbe, so spet značilni samo v primeru ocenjevanja z metodo OLS in imajo pričakovan negativni predznak.

Pozitiven rezultat z vidika DVA je mogoče opaziti za manjša podjetja, podjetja z večjim deležem neotipljivega kapitala na delavca in za podjetja z večjo relativno plačo. Rezultati še dodatno kažejo, da kapitalsko intenzivnejša podjetja, manj zadolžena podjetja, podjetja z večjim deležem končnih izdelkov v svojem izvozu in podjetja z nižjim deležem izvoza, ki temelji na uvozu enakih izdelkov, dosežejo večjo domačo vrednost v svojem izvozu. Rezultati kažejo tudi, da povprečno slovensko podjetje doseže višji DVA v izvozu z izvozom na manj zahtevne trge. Številni preizkusi robustnosti (dvostopenjska sistemska GMM cenilka, različne možnosti za opredelitev pogodbenih uvoznikov in pogodbenih izvoznikov, koeficient variacije namesto korelacijskega koeficienta za določitev stabilnosti trgovinskih tokov), potrjujejo moje osnovne ocene specifikacij.

Znanstveni prispevek disertacije in priporočila za nadaljnje raziskave

V prvem poglavju disertacije primerjam gibanje DVA v opazovanem obdobju 1995–2011, da bi ugotovila, ali je izvozno prestrukturiranje v gospodarstvih CEE-10 povzročilo ustrezno povečanje DVA v izvozu. Disertacija je med prvimi, ki preučuje spremembo vrzeli v DVA med tema dvema skupinama držav in najde dokaze o konvergenci, za razliko od prejšnjih študij, ki se osredotočajo predvsem na gibanje DVA v vseh državah EU. Predstavljeni rezultati kažejo, da se v državah CEE-10 začenjajo kazati koristi od sodelovanja v GVV, zlasti v storitvenem sektorju, vendar so te koristi še vedno nižje v primerjavi z EU-15. Večji poudarek bi bilo tako treba nameniti spodbujanju poslovnega okolja, ki ne bi samo privlačilo tuje neposredne investicije v CEE-10 ali povečevalo vključenost države v GVV, ampak bi predvsem spodbujalo dejavnosti z višjo dodano vrednostjo.

V kontekstu konkurenčnosti države in njene izvozne uspešnosti je potrebno ne samo poudariti razliko med trgovinskimi statistikami v bruto vrednostih (običajen način) in trgovino z vidika dodane vrednosti, ampak to razliko tudi upoštevati pri analizi gospodarske uspešnosti države. To poglavje ponuja več mogočih izhodišč za prihodnje raziskave, kjer bi bila glavna in najočitnejša vzpostavitev primernega modela za analizo trgovine znotraj GVV. Poleg tega bi bilo zanimivo uporabiti posodobljene tabele WIOD v smislu daljšega časovnega obdobja, da bi lahko preverili, ali konvergenca DVA med CEE-10 in EU-15 kaže znake kontinuitete ali ne. Lahko bi tudi primerjali rezultate ocenjenih vrednosti DVA z ocenjenimi rezultati, ki bi temeljili na uporabi drugih razpoložljivih I-O tabel ali uporabi alternativne metodologije razčlenitve izvoza.

Analiza v drugem poglavju presega okvirje obstoječih empiričnih študij s tega področja z raziskovanjem determinant DVA v izvozu v državah CEE-10 in EU-15. Pri tem upošteva heterogenost med tema dvema skupinama držav EU in heterogenost sektorjev (ker temelji na podatkih na sektorski ravni). Od obstoječih empiričnih študij se razlikuje v tem, da zadnje uporabljajo predvsem podatke na ravni države in se osredotočajo na oceno dejavnikov, ki vplivajo na tujo dodano vrednost v izvozu (Rahman & Zhao, 2013; Stehrer & Stollinger, 2015), vključenost v GVV (Kowalski et al., 2015; Stehrer & Stollinger, 2015; Van der Marel, 2015) in dodano vrednost v trgovini (Baldwin & Taglioni, 2011; Brooks & Ferrarini, 2014; Cheng & Fukumoto, 2010; Choi, 2013; Noguera, 2012). Ugotovitve, predstavljene v drugem poglavju, kažejo, da v procesu nadgradnje GVV države CEE-10 čutijo posledice nezadostnih investicij v neotipljivi kapital in bi zato morale svoje politike usmeriti v spodbujanje podjetij k vlaganju v raziskave in razvoj, vrednost blagovne znamke, specifične veščine in organizacijski kapital. Poleg tega so se v CEE-10 v obdobju tranzicije in gospodarskega prestrukturiranja v devetdesetih letih močno zanašali na privabljanje tujih neposrednih investicij (Narula & Guimón, 2009) z namenom sodelovanja v GVV. Vendar pa sodelovanje v GVV ne bi smelo biti omejeno samo na pritegnitev tujih

neposrednih investicij v dejavnosti z nizko dodano vrednostjo, ampak bi moralo vključevati premik iz nizkostroškovnih, delovno intenzivnih neposrednih investicij v tuje neposredne investicije v dejavnostih z višjo dodano vrednostjo. Poudarek bi tako moral biti na specializaciji in kakovosti proizvodnje. Tu bi bilo zanimivo vključiti investicije v neotipljivi kapital (na sektorski ravni) ali preučiti vpliv dodatnih dejavnikov, ki bi lahko vplivali na DVA, vendar trenutno niso izmerljivi (na primer kakovost človeškega kapitala, znanja in spretnosti, kapital znanja itd.). Kot je pojasnjeno v prejšnjem poglavju, pa zaradi nerazpoložljivosti podatkov na sektorski ravni za CEE-10 podatki o investicijah v neotipljivi kapital niso mogli biti neposredno vključeni v analizo. Poleg tega bi bilo zanimivo omogočiti heterogenost med državami CEE-10 in jih razvrstiti v podskupine, na primer na podlagi njihovih trgovinskih povezav z EU-15 ter analizirati vpliv večjega vključevanja teh držav v GVV na DVA v izvozu.

Tretje poglavje ponuja kar nekaj prispevkov k obstoječi literaturi na tem področju. Upošteva namreč heterogenost med podjetji, kar ni običajno v empirični literaturi na področju GVV. Glede na moje poznavanje je doslej le ena empirična študija (Kee & Tang, 2016) ocenjevala DVA na ravni podjetja. Navedena študija temelji na kitajskih izvoznikih in je trenutno edina študija, ki predlaga način za takšno oceno. To poglavje temelji na spremenjenem pristopu za ocenjevanje DVA v izvozu na ravni podjetij, ki sta ga predstavila Kee in Tang (2016) ter prvič ocenjuje in analizira DVA v izvozu s podatki za slovenska izvozna podjetja.

Poleg tega je v tem poglavju zaradi pomanjkanja informacij o zunajpodjetniških ali pogodbenih trgovinskih tokovih predlagan pristop za opredelitev morebitnega pogodbenega razmerja z raziskovanjem stabilnosti trgovinskih tokov podjetij na podlagi proizvodne in destinacijske stabilnosti. V okviru tega poglavja je tako prvikrat identificiran oziroma določen način, kako so slovenska podjetja vključena v GVV prek pogodbenega razmerja (pogodbeni uvozniki ali pogodbeni izvozniki). Razpoložljivost podatkov o zunajpodjetniški trgovini (za zdaj so takšni podatki zbrani samo v Združenih državah Amerike (Antras, 2016)) bi omogočila podrobnejšo analizo. Poleg tega bi bilo zanimivo ločeno opredeliti domače družbe, ki so del MNP, in domača podjetja, ki niso del MNP, da bi na ta način dodatno raziskali povezavo z DVA v izvozu.

Eno izmed priporočil za prihodnje raziskave se nanaša na dodatno izboljšanje metodologije merjenja DVA z uporabo podatkov na ravni podjetij, vsaj v smeri zmanjšanja ali odprave nekaterih predpostavk. Rezultati dajejo nov vpogled v strukturo slovenskega izvoza z vidika DVA in poudarjajo glavne dejavnike uspeha podjetij v GVV ter izpostavljajo pomembnost načina vključenosti podjetij v GVV. Z vidika DVA v izvozu se namreč pokaže precej drugačna situacija, če podjetje deluje kot pogodbeni uvoznik ali kot podružnica v tujini. Države, ki spodbujajo sodelovanje domačih podjetij v GVV, bi zato morale prepoznati in spodbujati tisto vrsto sodelovanja, ki bi bila optimalna za posamezno

podjetje, pa tudi za konkurenčnost države in trajnostni gospodarski razvoj. To bi bilo mogoče doseči s povečanjem obsega proizvodnje ali s spremembo proizvodne strukture. Zato bi bila zelo pomembna podpora države v smislu usmerjanja podjetij na poti k iskanju pravih trgovinskih partnerjev. Vendar pa se ne sme zanemariti dejstva, da se pogled države in pogled podjetja glede nadgradnje v GVV lahko razlikujeta. Podjetja se pogosto pozicionirajo v GVV na podlagi dobička, tako da se z njihovega vidika nadgrajevanje včasih pomika na dele verige vrednosti z nižjo produktivnostjo dela, čeprav še vedno z višjimi dobički. Na drugi strani pa se lahko država kljub višjim dobičkom in zaposlovanju podjetij sooča z nižjo produktivnostjo in nižjim BDP. Eden od mogočih pristopov, da lahko država poskuša preprečiti takšne rezultate, je, da podjetja spodbudijo k nadgradnji v dele verige vrednosti z višjo produktivnostjo dela ali dele verige vrednosti z "višjo kvalifikacijo" (angl. *high-skilled*) (Svetovna banka, 2017).

Prihodnji razvoj GVV je nepredvidljiv. Tehnologije, ki predstavljajo t. i. "industrijo 4.0", kot so tridimenzionalno tiskanje ali aditivna proizvodnja, avtonomni roboti, internet stvari, velepodatki (angl. *big data*), računalništvo v oblaku itd., postopno omogočajo izdelavo prilagojenih proizvodov na ravni stroškov standardiziranega proizvoda (De Backer & Flaig, 2017). Industrija 4.0 lahko močno vpliva na organiziranost proizvodnih verig, kot jo poznamo danes. GVV bi se lahko "poenostavile" z nižjimi in manj geografsko razpršenimi dejavnostmi ter individualno opredeljenimi odnosi med trgovinskimi partnerji (Strange & Zucchella, 2017). Čeprav rast novih proizvodnih tehnologij "spodbuja novo dinamiko prestrukturiranja" (Baldwin, 2016), učinek ni tako preprost. Na primer, tridimenzionalno tiskanje ima visoko stopnjo uporabnosti v določenih industrijah (npr. v proizvodnji strojev in opreme), vendar še vedno obstajajo panoge, kjer ima nova tehnologija omejen vpliv (npr. proizvodnja kovin, proizvodnja tekstilij) (Laplume, Petersen in Pearce, 2016). Rehnberg in Ponte (2018) napovedujeta dva mogoča scenarija vpliva tridimenzionalnega tiskanja na razvoj GVV. V prvem scenariju bi tridimenzionalno tiskanje postalo komplementarno tradicionalni proizvodnji in bi se še posebej uporabljalo pri izdelavi prototipov. Ta scenarij bi bilo mogoče ponazoriti z nadaljnjim poglabljanjem krivulje nasmeha, kjer bi podjetja s hitrim dostopom do velepodatkov in sposobnostjo hitrega odzivanja na spreminjajoče se potrebe strank, ohranila konkurenčno prednost. V drugem scenariju bi tridimenzionalno tiskanje nadomestilo tradicionalno proizvodnjo, kjer bi bili izdelki v celoti ali skoraj v celoti izdelani s tridimenzionalnim tiskanjem. V tem primeru bi GVV postale kompaktnejše (pri čemer bi krivulja nasmeha postala krajša in bolj sploščena), saj bi se število funkcij v GVV zmanjšalo. Po tem scenariju bi se tradicionalne značilnosti trgovine korenito spremenile, saj bi trgovina vse bolj vključevala nematerialne podatke, kot so modeli in programska oprema. Razvojne možnosti, ki jih ponuja industrija 4.0, kot tudi njen vpliv na GVV in sestavo dodane vrednosti v izvozu, bodo vsekakor predstavljale zanimivo in pomembno temo za prihodnje raziskave.

Pomembnost raziskav GVV se je skozi zadnja desetletja povečevala. Zaradi velike medsebojne povezanosti podjetij in držav se vedno znova pojavljajo novi izzivi za raziskave GVV tudi z razvojem dogodkom v mednarodni politiki in trgovini. Najnovejši izziv za svetovno trgovino, organizirano prek GVV, tako predstavlja raziskovanje vpliva ponovne uvedbe protekcionističnih ukrepov na trgovino posameznih podjetij in držav.

Appendix 2: Construction of WIOD database

As described by Dietzenbacher, Los, Stehrer, Timmer, & de Vries (2013) the starting point of the construction process of WIOD database were the national Supply and Use tables (SUT henceforth), which represent the basic source from which National Statistical Offices construct the national input-output tables. Usually, SUTs are available for a limited set of years therefore a construction of a time series of national SUTs follows a three step method to estimate national SUTs for non-benchmark years as well.

The first of the three steps was the harmonisation and standardisation of the published SUTs. In this step the National SUTs were transformed into tables that include 59 products (based on Classification of Products by Activity, CPA) and 35 industries (based on NACE Rev.1 which is harmonised with ISIC Rev.3). Harmonisation in some cases included aggregation of products or industries, which is straightforward, but in some cases disaggregation was required as well. To disaggregate an industry in a supply/use table, the assumption of common product sales shares of the sub-industries and common intermediate input coefficients in sub-industries was used. For disaggregation of products in the supply/use table common industry production shares and common use shares were used. Prices for gross output (at basic prices) and intermediate inputs (at purchasers' prices) have been harmonised across countries.

In the second step the harmonised national SUTs were compared to National Accounts benchmark. National SUTs were re-estimated on the basis of the data that come from National Accounts: total exports, total imports, value added by industry, gross output by the industry at basic prices, total final use at purchasers' prices, total changes in inventories, total margins and total net taxes. In this step the data in purchasers' prices in the Use table were transformed into basic prices.

The last (third) step represents the development of the time series of national SUTs by interpolation using the annual growth rates of international trade statistics at the product level.

After the time series of national SUTs are translated in basic prices, the construction of the international SUTs, with product-by-industry structure, is possible. For that purpose the raw data for the trade in goods from the UN Comtrade database was used and bilateral services flows data sets from the UN, Eurostat and OECD were combined. Dietzenbacher et al. (2013, p.86) noted that quality of trade data for services cannot be compared with trade data for goods. WIOT is stated at basic prices[34]. These best reflect covered

[34] Basic prices indicate the costs related to the production carried by the manufacturer, while the purchasers' prices reflect the amount paid by the consumer. The difference between the two represent trade, transportation margins and net taxes (Timmer et al., 2012)

fundamental cost structures of industries due to a distinct separation of transport services from the use of goods.

The WIOD data should be presented as the best currently available approximation of the global trade flows in services. In this step all data were converted into current US dollars ($) where exchange rates (year averages) were gathered from the International Financial Statistics database of the International Monetary Fund. The potential use of the International SUTs enabled a construction of the symmetric WIOTs of the industry-by-industry type. In these WIOT tables the estimated values indicate, for example how many dollars from the selected industry in a country are used by another industry in a different country (e.g. how many dollars of German chemical and chemical equipment is used by Czech rubber and plastic industry).

The difference between methods used by GTAP, OECD, IDE-JETRO, and WIOT is that the latter rely on national Supply and Use tables rather than input-output tables as basic building blocks. In relation to this Timmer et al. (2012) argue, that SUTs represent a more logical starting point for this type of analysis since they provide information on both products and (using and producing) industries.

Appendix 3: Sectors included in the WIOD database

Table 3-1: Sectors included in the WIOD database

Sector group	Sector code	Sector number	Sector description
Categories Primary and Natural resources	AtB	1	Agriculture, Hunting, Forestry and Fishing
	C	2	Mining and Quarrying
Labour-intensive manufacturing	17t18	4	Textiles and Textile Products
	19	5	Leather, Leather and Footwear
	20	6	Wood and Products of Wood and Cork
	36t37	16	Manufacturing, Nec; Recycling
Capital-intensive manufacturing	15t16	3	Food, Beverages and Tobacco
	21t22	7	Pulp, Paper, Paper , Printing and Publishing
	23	8	Coke, Refined Petroleum and Nuclear Fuel*
	25	10	Rubber and Plastics
	26	11	Other Non-Metallic Mineral
	27t28	12	Basic Metals and Fabricated Metal
Knowledge-intensive manufacturing	24	9	Chemicals and Chemical Products
	29	13	Machinery, Nec
	30t33	14	Electrical and Optical Equipment
	34t35	15	Transport Equipment
Labour-intensive services	F	18	Construction
	50	19	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel
	51	20	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles
	52	21	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods
	H	22	Hotels and Restaurants
	63	26	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies
	P	35	Private Households with Employed Persons*
Capital-intensive services	E	17	Electricity, Gas and Water Supply
	60	23	Inland Transport
	61	24	Water Transport
	62	25	Air Transport
	64	27	Post and Telecommunications
	70	29	Real Estate Activities
Knowledge-intensive services (Business services)	J	28	Financial Intermediation
	71t74	30	Renting of M&Eq and Other Business Activities
Health/education/public service	L	31	Public Admin and Defence; Compulsory Social Security
	M	32	Education
	N	33	Health and Social Work
	O	34	Other Community, Social and Personal Services

* Excluded sectors from the analysis

Source: Rahman, J. and Zhao, T. 2013. Export Performance in Europe: What Do We Know from Supply Links?. IMF Working Paper No. 13/62.

Appendix 4: Methodology of measuring value-added in exports (detailed)

The previously mentioned framework requires the use of inter-country input-output tables, which contain information on the source and destination country of all transaction flows by industry, separately for the use of intermediates and the use of final products (Koopman *et al.* 2014, p. 485). The model assumes an *m*-country world, where each country produces goods in *n* tradable sectors, and so the *m*-country production and trade system can be presented in block matrix structure as (Koopman *et al.* 2010, Rahman and Zhao 2013):

$$\begin{bmatrix} X_1 \\ \vdots \\ X_m \end{bmatrix} = \begin{bmatrix} A_{11} & \dots & A_{1m} \\ \vdots & \ddots & \vdots \\ A_{m1} & \dots & A_{mm} \end{bmatrix} \begin{bmatrix} X_1 \\ \vdots \\ X_m \end{bmatrix} + \begin{bmatrix} Y_{11}+\dots+Y_{1m} \\ \vdots \\ Y_{m1}+\dots+Y_{mm} \end{bmatrix} \quad (1)$$

This structure shows that all gross output produced by country *g* is used as an intermediate or final good by home country or by foreign countries (*h*). X_g *thus* represents the *n x 1* gross output vector of country *m* and each block matrix A_{gh} represents *n x n* I-O matrix of coefficients that stand for intermediate use in country *h* of goods produced in country *g*. Y_{gh} denotes the *n x 1* final demand vector, which represents a country's *h* demand for the final goods produced in country *g*. To simplify, this can be (for all countries and sectors) also presented as $\hat{X}=\hat{A}\hat{X}+\hat{Y}$, where $\hat{X}$ and $\hat{Y}$ are *mn x 1* vectors and $\hat{A}$ is an *mn x mn* matrix.

By reorganizing the equation, the gross output vector $\hat{X}$ can be expressed as

$$\begin{bmatrix} X_1 \\ \vdots \\ X_m \end{bmatrix} = \begin{bmatrix} I-A_{11} & \dots & A_{1m} \\ \vdots & \ddots & \vdots \\ A_{m1} & \dots & I-A_{mm} \end{bmatrix}^{-1} \begin{bmatrix} Y_{11}+\dots+Y_{1m} \\ \vdots \\ Y_{m1}+\dots+Y_{mm} \end{bmatrix} = \begin{bmatrix} B_{11} & \dots & B_{1m} \\ \vdots & \ddots & \vdots \\ B_{m1} & \dots & B_{mm} \end{bmatrix} \begin{bmatrix} Y_{11}+\dots+Y_{1m} \\ \vdots \\ Y_{m1}+\dots+Y_{mm} \end{bmatrix}, \quad (2)$$

where B_{gh} represents an *n x n* Leontief inverse matrix, which defines the amount of gross output in producing country *g*, needed to increase the final demand in country *h* for one-unit.

If the results should be expressed by sector, instead of a final demand vector (which represents the sums of final demand amounts along the row), then the final demand matrix has to be used. The entire matrix $\hat{X}$ now represents an *mn x n* gross output matrix:

$$\begin{bmatrix} X_{11} & \dots & X_{1m} \\ \vdots & \ddots & \vdots \\ X_{m1} & \dots & X_{mm} \end{bmatrix} = \begin{bmatrix} I-A_{11} & \dots & A_{1m} \\ \vdots & \ddots & \vdots \\ A_{m1} & \dots & I-A_{mm} \end{bmatrix}^{-1} \begin{bmatrix} Y_{11} & \dots & Y_{1m} \\ \vdots & \ddots & \vdots \\ Y_{m1} & \dots & Y_{mm} \end{bmatrix} \quad (3)$$

Further, the gross export $E_{g*\_}$ from country g to the world has to be defined by composing the final demand matrix Y_{gh} and intermediates $A_{gh}X_h$ (I-O matrix of coefficients multiplied by gross output vector)

$$\mathrm{E}_{g*\_} = \sum_{h \neq g} E_{gh} = \sum_{h \neq g} (Y_{gh} + A_{gh}X_h). \tag{4}$$

For each country, the result represents an *n x 1* vector, so for the purpose of consistency the diagonal matrix $\mathrm{E}_{g*}(n\ x\ n)$ is defined from each vector E_{g*} All diagonal matrices are combined together to form $\hat{E}$, an *mn x mn* diagonal matrix:

$$\hat{E} = \begin{bmatrix} diag(E_{1*\_}) & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & diag(E_{m*\_}) \end{bmatrix} = \begin{bmatrix} E_{1*} & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & E_{m*} \end{bmatrix} \tag{5}$$

For measuring domestic and foreign contents the direct value-added coefficient vector V_g (*1 x n*) is defined as one minus the intermediate input share from all countries (with domestically produced intermediates counted in), where *u* is *1 x n* unity vector:

$$V_g = u(I - \sum_h A_{gh}) \tag{6}$$

Each element of V_g signifies the ratio of direct domestic value-added in total output for country *g*. For consistency, $\hat{V}$ is defined, an *m x mn* matrix of direct value-added for all countries:

$$\hat{V} = \begin{bmatrix} V_1 & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & V_m \end{bmatrix} \tag{7}$$

The direct domestic value-added matrix $\hat{V}$ multiplied with Leotief inverse matrix $\hat{B}$ forms a matrix VA, which is a basic measure of value-added shares by source. Each column in the diagonal block matrices represents the domestic value-added share of domestically produced products for each sector. Each column in off-diagonal block matrices represents another country's value-added in the same sector. Since all value-added is either domestic or foreign, the sum of each column represents unity (*u*).

The multiplication of value-added share VA matrix and export matrix $\hat{E}$ results in a sectoral measure of value-added by the source country or $\hat{V}\hat{B}\hat{E}$:

$$\hat{V}\hat{B}\hat{E} = \begin{bmatrix} V_1B_{11}E_{1*} & V_1B_{12}E_{2*} & \cdots & V_1B_{1m}E_{m*} \\ V_2B_{21}E_{1*} & V_2B_{22}E_{2*} & \cdots & V_2B_{2m}E_{m*} \\ \vdots & \vdots & \ddots & \vdots \\ V_mB_{m1}E_{1*} & V_mB_{m2}E_{2*} & \cdots & V_mB_{mm}E_{m*} \end{bmatrix} \tag{8}$$

Diagonal block row vectors (1 x n) of matrix $\hat{V}\hat{B}\hat{E}$ indicate domestic value-added *(DVA)* in exports for each country (by sectors), and can be expressed as:

$$DVA_g = V_g B_{gg} E_{g*} \tag{9}$$

The off-diagonal row vectors, summed along a column, indicate foreign value-added *(FVA)* in exports for each country (by sectors) and can be expressed as:

$$FVA_g = \sum\nolimits_{h \neq g} V_h B_{hg} E_{g*} \tag{10}$$

As already mentioned, the sum of foreign and domestic value-added share in exports forms a unity which implies that sum of domestic and foreign value-added in exports represents the official value of gross export:

$$\mathrm{E}_{g*} = DVA_g + FVA_g \tag{11}$$

The gross export E_{gh} can be broken down into final demand (A) and intermediates. Intermediates can than be further divided into (B) goods that are consumed by direct importer, (C) goods that are processed and exported to third countries ($\mathrm{X_{hr}}$ is the output of country *h* used to produce goods absorbed in country *r*) and (D) goods that are processed and exported back to the source country:

$$\begin{aligned} \mathrm{E}_{gh} &= Y_{gh} + A_{gh} X_h \\ &= Y_{gh}(A) + A_{gh} X_{hh}(B) + \sum\nolimits_{r \neq g,h} A_{gh} X_{hr}\,(C) + A_{gh} X_{hg}(D) \end{aligned} \tag{12}$$

Connecting the equation (9) and (12), summing over all trading partners and inserting in the equation (11) gives an equation that presents the breakdown of the country's gross export into five categories:

$$\begin{aligned} E_{g*} = DVA_g + FVA_g = {} & V_g B_{gg} \textstyle\sum_{h \neq g} Y_{gh}\,(A) + V_g B_{gg} \sum_{h \neq g} A_{gh} X_{hh}(B) + \\ & V_g B_{gg} \textstyle\sum_{h \neq g} \sum_{r \neq g,h} A_{gh} X_{hr}\,(C) + V_g B_{gg} \sum_{h \neq g} A_{gh} X_{hg}\,(D) + FVA_g\ (\mathrm{E}) \end{aligned} \tag{13}$$

(A) Domestic value-added in exports of final goods/services consumed by the direct importer

(B) Domestic value-added in exports in intermediates used by the direct importer to produce products needed in the domestic country

(C) "Indirect value-added exports" - domestic value-added incorporated in intermediates used by direct importer to produced goods for third countries

(D) "Reflected domestic value-added" - domestic value-added incorporated in intermediates used by the direct importer to produce goods exported back to the source country

(E) Foreign value-added – value-added from a foreign country incorporated in gross exports

As it can be seen from the equation (13), the sum of (A), (B), (C), and (D) is equal to the domestic content in each country's gross export. The components (A) and (B) represent the exports of a country outside of the supply chain, while components (C), (D), and (E) regard the exports related with the supply chain (Augustyniak *et al.* 2013, p. 9). As mentioned in Koopman *et al.* (2010), the sum of (D) and (E) represents a part of export that is double counted in the official trade statistics, and the sum of (A), (B), and (C) divided by gross exports equals to Johnson and Noguera's (2012b) VAX ratio.

As further mentioned in Koopman *et al.* (2010), the sum of (C) and (D) equals to the measure of vertical specialisation of Hummels *et al.* (2001) which represents the domestic value-added in inputs exported indirectly to third countries. The before mentioned indirectly exported value-added was mathematically defined by Koopman *et al.* (2010) as:

$$IVA_g = \sum_{h \neq r} V_g B_{gh} E_{hr} \tag{14}$$

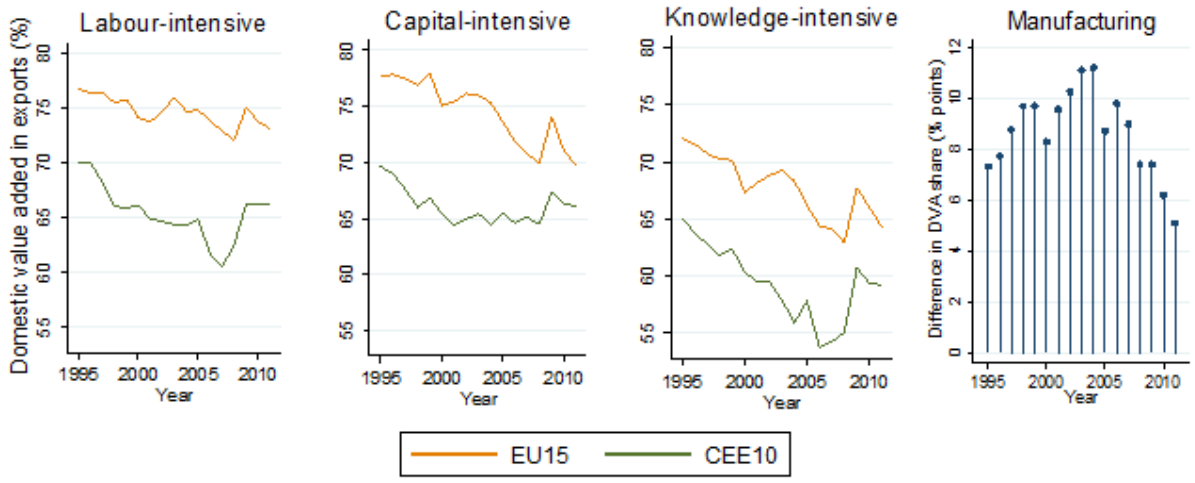
On the basis of the decomposition described above (country-sector level) Koopman *et al.* (2010, str. 21) defined the GVC participation index as:

$$\mathrm{GVC}_{\mathrm{participation}} = \frac{IVA_g}{E} + \frac{FVA_g}{E} \tag{15}$$

which summarises the importance of the GVC for the selected sector.

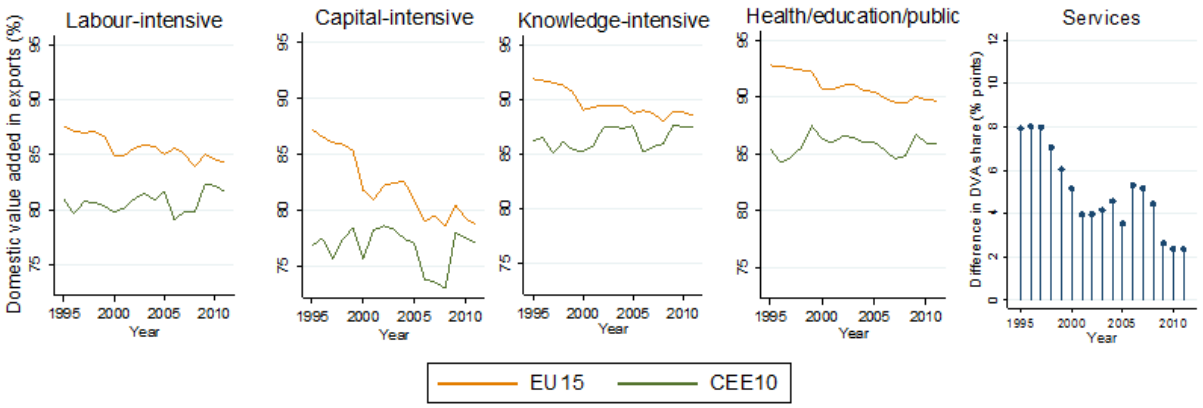
Appendix 5: Share of DVA in exports and difference in DVA between EU-15 and CEE-10 (median values)

Figure 5-1: Share of DVA in exports for EU-15 and CEE-10 (median values) by manufacturing subgroups in period 1995-2011, in percentage of total exports and the difference in median values of manufacturing DVA between EU-15 and CEE-10, in percentage points



Source: WIOD, own calculations

Figure 5-2: Share of DVA in exports for EU-15 and CEE-10 (median values) by services subgroups in period 1995-2011, in percentage of total exports and the difference in median values of services DVA between EU-15 and CEE-10, in percentage points



Source: WIOD, own calculations.

Appendix 6: Description of the variables included in the regression analysis (Chapter 2)

Table 6-1: Description of the variables included in the regression analysis (Chapter 2)

Variable name	*Variable label*	*Defined as*	*Unit*	*Source*
Domestic value added in exports	$DVAshare_{ijt}$	DVA/EX	%	WIOD
- Exports	EX_{ijt}		USD million	WIOD
Business enterprises research and development expenditure	$BERD_{ijt}$	BERDijt/VAijt	%	Eurostat, OECD
- Value added	VA_{ijt}		USD million	WIOD SEA
Knowledge intensity	$SKILL_{ijt}$	Hours worked by high-skilled person engaged (share in total hours)	%	WIOD SEA
Openness to FDI	$IFDIshare_{ijt}$	IFDI stock/GDP	%	Eurostat, OECD
Outward FDI	$OFDIshare_{ijt}$	OFDI stock/GDP	%	Eurostat, OECD
- GDP	GDP		USD million	World Bank
Share of imports from the EU's 5 most developed countries[35]	*IMPTOP5*	$Import\_int_{ijt}^{top5}/import\_int_{ijt}$	%	WIOD
Share of exports to the EU's 5 most developed countries	*EXPTOP5*	$export_{ijt}^{top5}/export_{ijt}$	%	WIOD
Import of intermediates from China	$IMintCHN_{ijt}$	IM_int_CHN/TINP	%	WIOD
- Total intermediates used	$TINP_{ijt}$		USD million	WIOD
Hourly labour compensation	$WAGE_{ijt}$	Labour compensation/ HEMP	USD	WIOD SEA
- Hours worked by persons engaged	$HEMP_{ijt}$		USD million	WIOD SEA

[35] The largest and most developed countries in the EU as measured by GDP: DEU, UK, FR, IT, ESP.

Appendix 7: Difference between EU-15 and CEE-10 domestic value added in exports by industries

Figure 7-1: Deviation of average domestic value added in the CEE-10 from the EU-15 average by industries, in percentage points in the observed periods

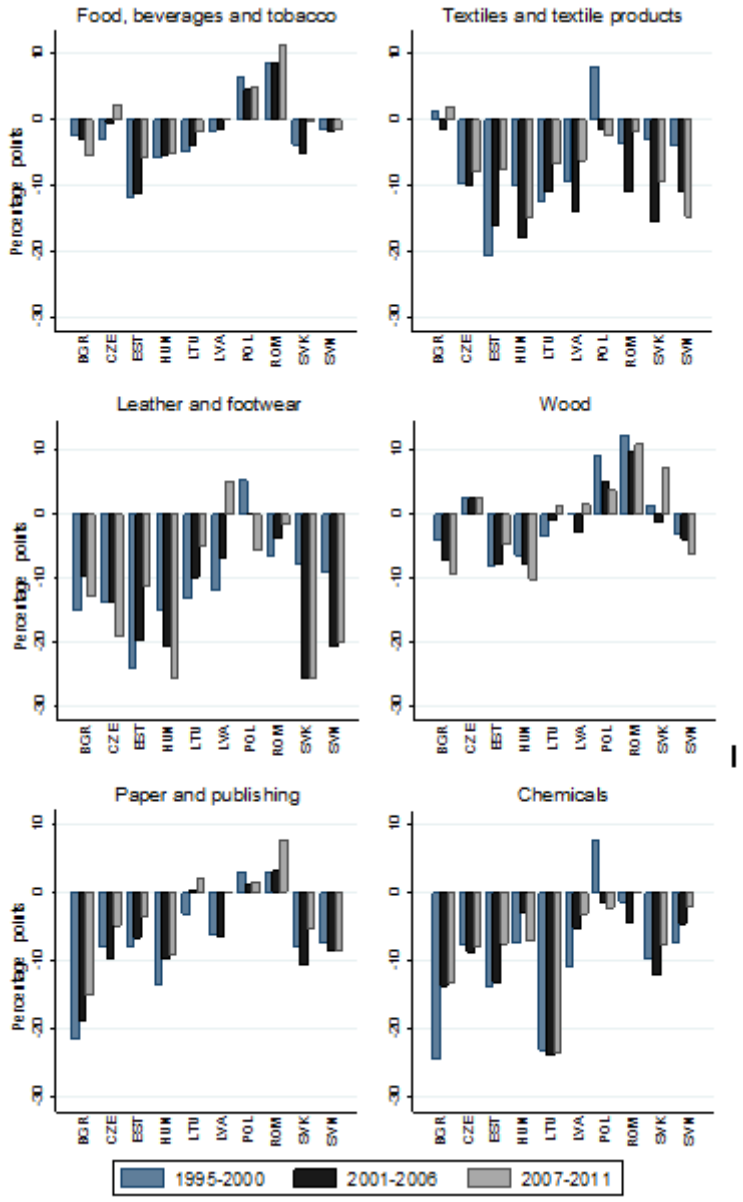
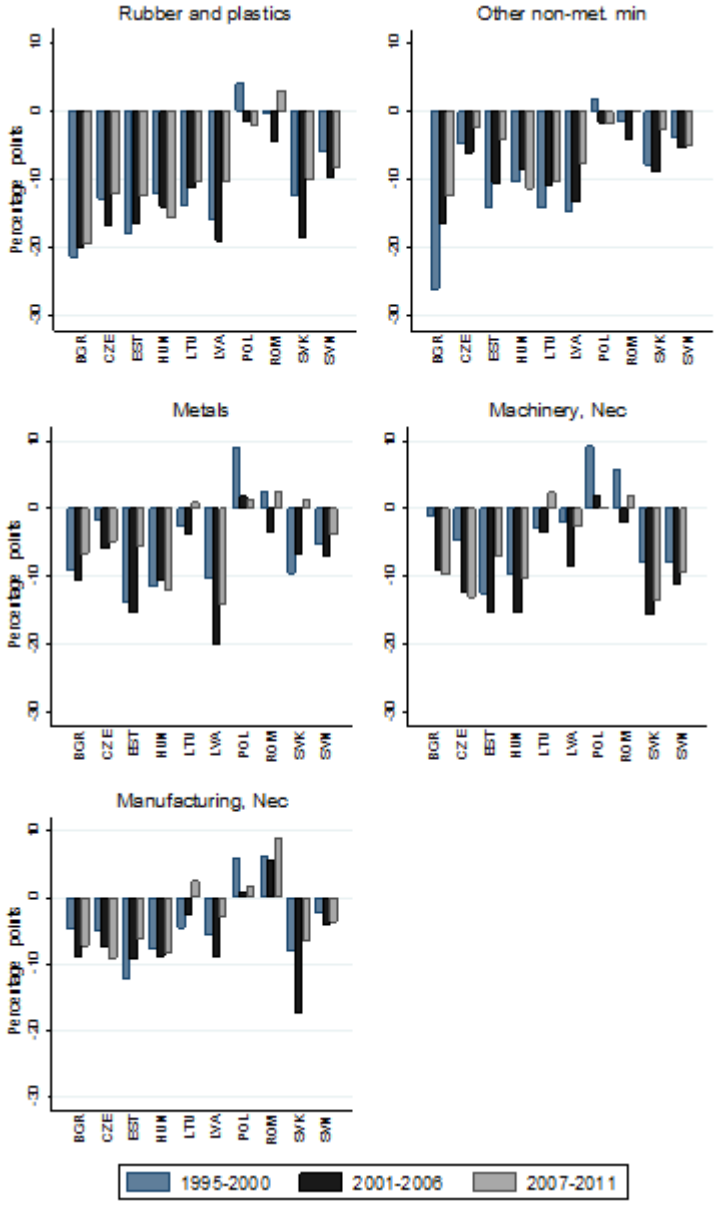


Figure 7-1 (Cont.): Deviation of average domestic value added in the CEE-10 from the EU-15 average by industries, in percentage points in the observed periods



Source: WIOD, own calculations

Appendix 8: Domestic value added in exports in the services sector

Table 8-1: Correlation matrix for the period 2001–2011 – services sector

Variable	lnDVA	$lnBERD_{t-1}$	$lnSKILL_{t-1}$	$lnIFDI_{t-1}$	$lnOFDI_{t-1}$	$lnEXPTOP5_{t-1}$	$lnIMPTOP5_{t-1}$	$lnIMintCHN_{t-1}$
lnDVA	1							
$lnBERD_{t-1}$	-0.26***	1						
$lnSKILL_{t-1}$	0.27***	-0.02	1					
$lnIFDI_{t-1}$	0.07***	0.01	0.24***	1				
$lnOFDI_{t-1}$	0.04**	0.12***	0.05*	0.02	1			
$lnEXPTOP5_{t-1}$	-0.02	0.04*	-0.07***	-0.07***	0.03*	1		
$lnIMPTOP5_{t-1}$	0.07***	-0.02	-0.20***	-0.09***	-0.01	0.22***	1	
$lnIMintCHN_{t-1}$	-0.26***	0.13***	0.04**	0.00	0.10***	-0.03	-0.01	1
$lnWAGE_{t-1}$	0.02	0.26***	0.28***	-0.01	0.52***	0.14***	-0.01	0.16***

Note: Data for the manufacturing sector. All independent variables are lagged by one year. Significance: *** p<0.001 **p<0.05 *p<0.1.

Source: WIOD, author's calculations.

Table 8-2: Determinants of domestic value added in exports in the services sector – comparison between CEE-10 and EU-15 countries

Dependent variable: DVA in exports

VARIABLES	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE (6)
lnBERD$_{t-1}$	-0.000500	-0.00142	-0.00184	0.00155	-0.00170	0.000166
	(0.00429)	(0.00497)	(0.00511)	(0.00395)	(0.00509)	(0.00485)
lnBERD$_{t-1}$ x CEE	-0.00211	-0.00138	-0.000550	-0.00386	-0.000627	-0.00213
	(0.00322)	(0.00383)	(0.00401)	(0.00291)	(0.00402)	(0.00368)
lnSKILL $_{t-1}$	-0.00722	-0.0100	-0.00913		-0.0134	-0.0151
	(0.0116)	(0.00949)	(0.0107)		(0.00961)	(0.0105)
lnSKILL $_{t-1}$ x CEE	0.00495	0.00568	0.00497		0.0111	0.00453
	(0.0124)	(0.0165)	(0.0167)		(0.0163)	(0.0157)
lnIFDI $_{t-1}$	-0.00888***	-0.0107***	-0.00932***	-0.0059***	-0.00893***	-0.00833***
	(0.00262)	(0.00316)	(0.00285)	(0.00204)	(0.00288)	(0.00271)
lnIFDI $_{t-1}$ x CEE	0.00272	0.00149	0.000261	0.000748	0.00135	-0.000328
	(0.00333)	(0.00316)	(0.00348)	(0.00239)	(0.00346)	(0.00299)
lnOFDI $_{t-1}$		-0.000459	-0.00146		-0.00216	-0.00155
		(0.00200)	(0.00239)		(0.00254)	(0.00253)
lnOFDI $_{t-1}$ x CEE		-0.00240	-0.00126		-0.00112	-0.00235
		(0.00184)	(0.00151)		(0.00171)	(0.00162)
lnEXPTOP5$_{t-1}$			0.000506	0.00117	0.000338	-0.000424
			(0.00550)	(0.00451)	(0.00482)	(0.00480)
lnEXPTOP5$_{t-1}$ x CEE			-0.00539	-0.00429	-0.00581	-0.00480
			(0.00669)	(0.00630)	(0.00646)	(0.00624)
lnIMPTOP5$_{t-1}$			0.0525*	0.0586**	0.0566*	0.0543*
			(0.0255)	(0.0268)	(0.0298)	(0.0295)
lnIMPTOP5$_{t-1}$ x CEE			-0.00592	-0.00150	-0.00747	-0.00255
			(0.0135)	(0.0114)	(0.0152)	(0.0145)
lnIMintCHN$_{t-1}$				-0.0161**	-0.0210**	-0.0184**
				(0.00710)	(0.00787)	(0.00754)
lnIMintCHN$_{t-1}$ x CEE				0.00136	0.0145	0.00883
				(0.00958)	(0.00863)	(0.00921)
lnWAGE $_{t-1}$				0.00957		0.0133
				(0.0122)		(0.0126)
lnWAGE $_{t-1}$ x CEE				0.0314**		0.0263*
				(0.0129)		(0.0151)
Constant	-0.276***	-0.300***	-0.250***	-0.285***	-0.371***	-0.372***
	(0.0402)	(0.0474)	(0.0430)	(0.0632)	(0.0536)	(0.0829)
Observations	1,748	1,410	1,404	1,864	1,404	1,404
R-squared (within)	0.596	0.432	0.448	0.618	0.460	0.472
Number of industries	18	18	18	18	18	18
Number of countries	25	22	22	25	22	22
Country FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Note: Robust standard errors in parentheses: *** p<0.001 **p<0.05 *p<0.1. All variables are in natural logarithm. Explanatory variables are lagged by 1 year. *CEE=1* if the observation belongs to the CEE-10, *CEE=0* if the observation belongs to the EU-15. Data included in the regression cover the period 2001–2010. All regressions include a constant term.

Source: Author's calculations.

Appendix 9: Robustness check

Table 9-1: Descriptive statistics of the variables in the robustness checks (mean values 2000– 2011)

VARIABLES	Manufacturing		Services	
	EU-15	CEE-10	EU-15	CEE-10
PAT_{ijt} (#)	2.09	0.15 [a]	-	-
$ALLintan_{it\,x}\ k_{ijt}$ (%)	1.85	1.02 [a]	2.34	1.90 [a]
$COMPinf_{it}\ x\ k_{ijt}$ (%)	0.31	0.11 [a]	0.39	0.21 [a]
$ECONcomp_{it}$ x k_{ijt} (%)	0.92	0.62 [a]	1.16	1.16
$INNOVprop_{it}$ x k_{ijt} (%)	0.62	0.29 [a]	0.78	0.53 [a]

Legend: [a] the difference between EU-15 and CEE-10 is significant at $p<0.001$

Source: Author's calculations.

Table 9-2: Determinants of domestic value added in exports in the manufacturing sector – comparison between CEE-10 and EU-15 countries (Robustness check I, cont.)

Dependent variable: DVA in exports

VARIABLES	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)
ln*PAT* $_{t-1}$	0.0126				
	(0.00726)				
ln*PAT* $_{t-1}$ x CEE	-0.018***				
	(0.00516)				
ln*ALLintan* $_{t-1}$ x *k*		0.0491***			
		(0.0123)			
ln*ALLintan*$_{t-1}$x *k*		-0.068***			
xCEE		(0.0141)			
ln*COMPinf*$_{t-1}$ x *k*			0.0321***		
			(0.00736)		
ln*COMPinf*$_{t-1}$ x *k* x			-0.037***		
CEE			(0.00827)		
ln*INNOVprop*$_{t-1}$ x *k*				0.0337***	
				(0.00823)	
ln*INNOVprop*$_{t-1}$ x *k* x CEE				-0.047***	
				(0.0103)	
ln*ECONcomp*$_{t-1}$ x *k*					0.0412***
					(0.0104)
ln*ECONcomp*$_{t-1}$ x *k* x CEE					-0.055***
					(0.0114)
ln*IFDI* $_{t-1}$	-0.0115*	-0.0142**	-0.0140**	-0.0143**	-0.0141**
	(0.00546)	(0.00588)	(0.00589)	(0.00590)	(0.00593)
ln*IFDI* $_{t-1}$ x CEE	-0.00117	0.0155	0.0152	0.0157	0.0154
	(0.0164)	(0.0126)	(0.0126)	(0.0126)	(0.0126)
ln*EXPTOP5*$_{t-1}$	-0.00272	0.00243	0.00334	0.00252	0.00252
	(0.0133)	(0.0129)	(0.0129)	(0.0129)	(0.0129)
ln*EXPTOP5*$_{t-1}$ x CEE	-0.0516**	-0.068***	-0.069***	-0.068***	-0.068***
	(0.0197)	(0.0179)	(0.0180)	(0.0180)	(0.0179)
ln*IMPTOP5*$_{t-1}$	0.0812**	0.0779**	0.0812**	0.0784**	0.0781**
	(0.0331)	(0.0323)	(0.0332)	(0.0318)	(0.0328)
ln*IMPTOP5*$_{t-1}$ x CEE	0.0561	0.0491	0.0446	0.0486	0.0486
	(0.0481)	(0.0592)	(0.0593)	(0.0591)	(0.0595)
ln*IMintCHN* $_{t-1}$	-0.0200*	-0.00698	-0.00741	-0.00748	-0.00718
	(0.00918)	(0.00931)	(0.00922)	(0.00926)	(0.00935)
ln*IMintCHN* $_{t-1}$ x CEE	-0.0338	-0.0492*	-0.0483*	-0.0489*	-0.0488*
	(0.0191)	(0.0253)	(0.0253)	(0.0253)	(0.0253)
ln*WAGE* $_{t-1}$	-0.00841	0.0376	0.0379	0.0366	0.0367
	(0.0209)	(0.0320)	(0.0314)	(0.0319)	(0.0321)
ln*WAGE* $_{t-1}$ x CEE	0.0839***	-0.0281	-0.0258	-0.0267	-0.0267
	(0.0249)	(0.0251)	(0.0249)	(0.0258)	(0.0253)
Constant	-0.512***	-0.826***	-0.861***	-0.816***	-0.835***
	(0.105)	(0.164)	(0.163)	(0.162)	(0.166)
Observations	2,268	1,713	1,713	1,713	1,713
R-squared (within)	0.723	0.758	0.758	0.758	0.758
Number of industries	11	11	11	11	11
Number of countries	23	23	23	23	23
Country FE	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Note: Robust standard errors in parentheses: *** p<0.001 **p<0.05 *p<0.1. All variables are in natural logarithm. ***Explanatory variables are lagged by 1 year***. *CEE=1* if the observation belongs to the CEE-10, *CEE=0* if the observation belongs to the EU-15. All regressions include a constant term.

Source: Author's calculations.

Table 9-3: Determinants of domestic value added in exports in the manufacturing sector – comparison between CEE-10 and E U-15 countries (Robustness check II - explanatory variables are lagged by 2 years)

Dependent variable: DVA in exports

VARIABLES	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE (6)
$lnBERD_{t-2}$	0.0226**	0.0227***	0.0219*	0.0150**	0.0153*	0.0148*
	(0.00753)	(0.00694)	(0.0104)	(0.00628)	(0.00797)	(0.00778)
$lnBERD_{t-2}$ *x CEE*	-0.0243**	-0.0252**	-0.0252**	-0.0146*	-0.0121	-0.0126*
	(0.00947)	(0.00908)	(0.0106)	(0.00681)	(0.00700)	(0.00690)
$lnSKILL_{t-2}$	-0.110***	-0.0981**	-0.0958***		-0.156***	-0.122**
	(0.0318)	(0.0344)	(0.0267)		(0.0423)	(0.0463)
$lnSKILL_{t-2}$ *x CEE*	0.0980***	0.0400	0.0469***		0.155**	0.120**
	(0.0244)	(0.0305)	(0.0143)		(0.0497)	(0.0490)
$lnIFDI_{t-2}$	-0.0194***	-0.0165**	-0.0194***	-0.0120	-0.0114*	-0.00925
	(0.00508)	(0.00580)	(0.00530)	(0.00687)	(0.00541)	(0.00749)
$lnIFDI_{t-2}$ *x CEE*	0.00959	0.00504	0.0117	0.000834	-0.00244	-0.00743
	(0.0137)	(0.0166)	(0.0128)	(0.0147)	(0.0171)	(0.0196)
$lnOFDI_{t-2}$		0.00148	-0.000120		0.000232	0.000704
		(0.00247)	(0.00238)		(0.00182)	(0.00190)
$lnOFDI_{t-2}$ *x CEE*		0.0132**	0.0130***		0.0138***	0.0131***
		(0.00535)	(0.00314)		(0.00377)	(0.00326)
$lnEXP\_TOP5_{t-2}$			0.00514	0.0127	0.0104	0.00843
			(0.0178)	(0.0159)	(0.0156)	(0.0144)
$lnEXP\_TOP5_{t-2}$ *x CEE*			-0.0886***	-0.0902***	-0.0885***	-0.0828***
			(0.0110)	(0.0130)	(0.0137)	(0.0149)
$lnIMP\_TOP5_{t-2}$			0.0443	0.0485	0.0459	0.0492
			(0.0510)	(0.0380)	(0.0458)	(0.0485)
$lnIMP\_TOP5_{t-2}$*x CEE*			0.0930	0.116*	0.119*	0.118*
			(0.0702)	(0.0538)	(0.0609)	(0.0618)
$lnIM\_CHN_{t-2}$				0.00430	0.00853	0.0105
				(0.00562)	(0.00572)	(0.00632)
$lnIM\_CHN_{t-2}$ *x CEE*				-0.0443*	-0.0539**	-0.0550**
				(0.0229)	(0.0225)	(0.0236)
$lnWAGE_{t-2}$				-0.0122		0.0202
				(0.0335)		(0.0369)
$lnWAGE_{t-1}$ *x CEE*				0.0570*		0.0201
				(0.0287)		(0.0298)
Constant	-0.684***	-0.623***	-0.622***	-0.353**	-0.690***	-0.650**
	(0.0970)	(0.101)	(0.0736)	(0.148)	(0.121)	(0.228)
Observations	1,338	1,167	1,167	1,338	1,167	1,167
R-squared (within)	0.655	0.663	0.723	0.731	0.745	0.747
Number of industries	11	11	11	11	11	11
Number of countries	23	23	23	23	23	23
Country FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Note: Robust standard errors in parentheses: *** p<0.001 **p<0.05 *p<0.1. All variables are in natural logarithm. ***Explanatory variables are lagged by 2 years***. *CEE=1* if the observation belongs to the CEE-10. *CEE=0* if the observation belongs to the EU-15. Data included in the regression cover the period 2000–2010. All regressions include a constant term.

Source: Author's calculations.

Table 9-4: Determinants of domestic value added in exports in the manufacturing sector – comparison between CEE-10 and EU-15 countries (Robustness check III – explanatory variables are lagged by 3 years)

Dependent variable: DVA in exports

VARIABLES	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE (6)
lnBERD$_{t-3}$	0.0245***	0.0258***	0.0258**	0.0179**	0.0201**	0.0201**
	(0.00697)	(0.00701)	(0.0104)	(0.00692)	(0.00807)	(0.00773)
lnBERD$_{t-3}$ x CEE	-0.0218**	-0.0229**	-0.0233**	-0.0130	-0.0113	-0.0120
	(0.00879)	(0.00859)	(0.0102)	(0.00784)	(0.00746)	(0.00714)
lnSKILL $_{t-3}$	-0.0888***	-0.0785**	-0.0725***		-0.139***	-0.109**
	(0.0264)	(0.0289)	(0.0208)		(0.0386)	(0.0372)
lnSKILL $_{t-3}$ x CEE	0.102***	0.0509*	0.0552***		0.176***	0.142**
	(0.0240)	(0.0265)	(0.0132)		(0.0539)	(0.0492)
lnIFDI $_{t-3}$	-0.0162***	-0.0130**	-0.0145**	-0.00898	-0.00822	-0.00597
	(0.00487)	(0.00473)	(0.00545)	(0.00589)	(0.00491)	(0.00555)
lnIFDI $_{t-3}$ x CEE	0.00551	0.00150	0.00602	-0.00219	-0.00668	-0.0112
	(0.0145)	(0.0176)	(0.0141)	(0.0140)	(0.0171)	(0.0187)
lnOFDI $_{t-3}$		0.00111	-7.86e-05		2.19e-05	0.000532
		(0.00255)	(0.00238)		(0.00185)	(0.00192)
lnOFDI $_{t-3}$ x CEE		0.0123**	0.0115***		0.0126***	0.0118***
		(0.00448)	(0.00259)		(0.00344)	(0.00308)
lnEXP_TOP5$_{t-3}$			-0.00650	0.00204	-5.96e-06	-0.000450
			(0.0181)	(0.0162)	(0.0151)	(0.0152)
lnEXP_TOP5$_{t-3}$ x CEE			-0.0822***	-0.0856***	-0.0814***	-0.0785***
			(0.0138)	(0.0141)	(0.0152)	(0.0166)
lnIMP_TOP5$_{t-3}$			0.0397	0.0428	0.0377	0.0412
			(0.0523)	(0.0380)	(0.0474)	(0.0490)
lnIMP_TOP5$_{t-3}$ x CEE			0.0900	0.118*	0.124*	0.124*
			(0.0719)	(0.0565)	(0.0641)	(0.0643)
lnIM_CHN $_{t-3}$				0.00176	0.0104	0.0122*
				(0.00698)	(0.00611)	(0.00658)
lnIM_CHN $_{t-3}$ x CEE				-0.0442*	-0.0573**	-0.0587**
				(0.0224)	(0.0223)	(0.0231)
lnWAGE $_{t-3}$				-0.0230		0.00288
				(0.0366)		(0.0383)
lnWAGE $_{t-3}$ x CEE				0.0572*		0.0256
				(0.0263)		(0.0252)
Constant	-0.608***	-0.547***	-0.535***	-0.313*	-0.617***	-0.530**
	(0.0943)	(0.0930)	(0.0616)	(0.149)	(0.115)	(0.210)
Observations	1,272	1,105	1,105	1,272	1,105	1,105
R-squared (within)	0.643	0.655	0.712	0.717	0.738	0.740
Number of industries	11	11	11	11	11	11
Number of countries	23	23	23	23	23	23
Country FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Note: Robust standard errors in parentheses: *** p<0.001 **p<0.05 *p<0.1. All variables are in natural logarithm. ***Explanatory variables are lagged by 3 years***. *CEE=1* if the observation belongs to the CEE-10. *CEE=0* if the observation belongs to the EU-15. Data included in the regression cover the period 2000–2010. All regressions include a constant term.

Source: Author's calculations.

Appendix 10: Correlation matrix of the variables used and industry classification according to technology intensity (Chapter 3)

Table 10-1: Correlation matrix for the period 2002–2014

	lnDVAR	Foreign_ owned	Outward_ investor	Contract. exporter	Contract. importer	ln_PROD1	lnREL_ WAGE	lnINTG_C	lnC_INTEN	lnINDEB	SIZE	Share EXYU	Share POT	Share FG	Share EU
lnDVAR	1														
Foreign_owned	-0.19***	1													
Outward_inv.	-0.11***	0.07***	1												
Contract. exp.	-0.06***	0.03**	-0.01	1											
Contract. imp.	0.05***	-0.03**	-0.04***	0.09***	1										
ln_PROD1	0.21***	0.13***	0.08***	0.03**	-0.04***	1									
lnREL_WAGE	-0.05***	0.10***	0.11***	0.03**	-0.017*	0.39***	1								
lnINTG_C	-0.09***	0.13***	0.22***	0.01	-0.03**	0.16***	0.18***	1							
lnC_INTEN	-0.07***	0.05***	0.15***	0.04***	-0.005	0.32***	0.23***	0.28***	1						
lnINDEB	-0.04***	-0.11***	-0.07***	-0.01	0.01	-0.01*	-0.19***	0.01	-0.11***	1					
lnSIZE	-0.24***	0.23***	0.42***	0.02**	-0.06***	-0.15***	0.12***	0.35***	0.12***	-0.05***	1				
shareEXYU	0.11***	-0.13***	-0.08***	0.02*	0.02*	-0.02**	-0.05***	-0.13***	-0.07***	-0.002	-0,30***	1			
sharePOT	-0.30***	0.23***	0.22***	0.002	-0.09***	0.15***	0.14***	0.22***	0.08***	-0.03***	0.40***	-0.16***	1		
shareFG	0.05***	-0.06***	0.03***	-0.11***	0.01	-0.03***	-0.03***	0.04***	-0.04***	0.03***	-0.01*	0.06***	-0.04***	1	
shareEU	-0.12***	0.12***	0.01*	-0.002	0.01	-0.03***	0.011	0.07***	0.03***	0.01*	0.24***	-0.75***	0.12***	-0.06***	1
EX_OR	-0.18***	0.12***	0.16***	-0.06***	-0.02**	0.01*	0.04***	0.11***	0.04***	-0.008	0.25***	-0.396***	0.22***	-0.09***	0.37***

Note: Data for the manufacturing sector. Independent variables are lagged by one year . Significance: *** p<0.001 **p<0.05 *p<0.1

Source: Author's calculations.

Table 10-2: Classification of manufacturing industries based on technology intensity

Technology intensity	*Code*	*Industry description*
Low-techology	*FOD*	Food products, beverages and tobacco
	TEX	Textiles, textile products, leather and footwear
	WOD	Wood and products of wood and cork
	PAP	Pulp, paper, paper products, printing and publishing
Medium low-technology	*RBP*	Rubber and plastics products
	NMM	Other non-metallic mineral products
	MET	Basic metals
	FBM	Fabricated metal products except machinery and equipment
Medium-high and high-technology	*CHM*	Chemicals and chemical products
	MEQ	Machinery and equipment n.e.c
	CEQ	Computer, electronic and optical products
	ELQ	Electrical machinery and apparatus n.e.c
	MTR	Motor vehicles, trailers and semi-trailers
	TRQ	Other transport equipment

Source: OECD (2017) and OECD (2011)