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Yüksek Lisans Tezi

CEMRE KÜÇÜK

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SOSYAL BİLİMLER ENSTİTÜSÜ MÜDÜRLÜĞÜ

TEZ ONAY BELGESİ

İKTİSAT Anabilim Dalı İKTİSAT (İNGİLİZCE) Bilim Dalı TEZLİ YÜKSEK LİSANS öğrencisi CEMRE KÜÇÜK'nın THE EFFECT OF GLOBAL VALUE CHAIN INTEGRATION ON EXPORT GROWTH IN DEVELOPING COUNTRIES adlı tez çalışması, Enstitümüz Yönetim Kurulunun 27.06.2019 tarih ve 2019-19/15 sayılı kararıyla oluşturulan jüri tarafından oy birliği / oy çokluğu ile Yüksek Lisans Tezi olarak kabul edilmiştir.

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2.	Jüri Üyesi	Dr. Öğr. Üyesi BURCU DÜZGÜN ÖNCEL	
3.	Jüri Üyesi	Doç. Dr. B.CAN KARAHASAN	

GENERAL INFORMATION

Name Surname: Cemre KÜÇÜK
Field: Economics
Department: Economics
Thesis Advisor: Prof. Dr. İ. Mahmut TEKÇE
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ABSTRACT

Global value chains (GVC) have become an essential part of international trade in recent decades as a result of various developments such as transportation and communication technologies, changes in trade policies, and the emergence of new markets. The international fragmentation of production has made it more difficult to analyze the effect of trade directly. The complexity of trade has generated a necessity for a new method that is going to be used in the evaluation of different features of emerging GVC. One of the methods that are widely used to understand this complexity is input-output analysis.

Higher participation in GVC generates many opportunities for the countries, especially for developing ones. The most important of them is that it enables them to sell their products in different markets and integrate the global economy more. Specialization of developing countries on specific production stages via GVC can also contribute their competitiveness in international trade. The aim of thesis is to analyze the effect of GVC integration on developing countries' competitiveness. It uses the World Input-Output Database (WIOD) for the period of 1995-2011 to analyze the GVC performance of six developing countries by construction a panel framework. It calculates the GVC participation and position indices introduced by Koopman, Wang, and Wei (2014). In this direction, it includes REER as an indicator for export competitiveness and examines the effect of participation and position index separately. The results of the estimations point out that higher GVC integration cancels out some part of the positive effect of depreciation on export growth and effects competitiveness of countries negatively.

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İsim Soyisim: Cemre KÜÇÜK
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Tez Danışmanı: Prof. Dr. İ. Mahmut TEKÇE
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ÖZET

Küresel değer zincirleri, ulaşım ve iletişim teknolojilerinin ilerlemesi, ticaret politikalarındaki değişiklikler ve yeni pazarların ortaya çıkması gibi birçok gelişme sonucu son yıllarda uluslararası ticaretin önemli bir parçası haline gelmiştir. Üretimin uluslararası parçalanması, ticaretin etkisinin doğrudan analiz edilmesini zorlaştırmaktadır. Ticaretin daha karmaşık hale gelmesi, küresel değer zincirlerinin farklı özelliklerini analiz etmekte kullanılacak yeni yöntemlere ihtiyaç duyulmasına neden olmuştur. Bu yapıyı anlamak adına yaygın olarak kullanılan yöntemlerden biri girdi-çıktı analizidir.

Küresel değer zincirlerine daha yüksek katılım, özellikle gelişmekte olan ülkeler için birçok fırsat yaratmaktadır. Bunlardan en önemlisi, ülkelerin ürünlerini farklı pazarlarda satmalarına ve küresel ekonomi ile bütünleşmelerine olanak sağlamasıdır. Gelişmekte olan ülkelerin küresel değer zincirleri aracılığı ile belirli bir üretim aşamasında uzmanlaşmaları, rekabet güçlerine de katkı sağlayabilmektedir. Bu tezin amacı küresel değer zincirlerine entegrasyonun gelişmekte olan ülkelerin rekabet gücüne olan etkisini analiz etmektir. Gelişmekte olan altı ülkenin 1995 ve 2011 yılları arasında küresel değer zincirlerindeki performanslarını ölçmek için WIOD data seti ve panel veri analizi kullanılmıştır. Koopman, Wang and Wei(2011) tarafından tanıtılan küresel değer zinciri katılım ve pozisyon endeksleri hesaplanmıştır. Bu doğrultuda, ülkelerin rekabet gücünün bir göstergesi olarak reel efektif döviz oranları analize eklenmiş ve küresel değer zincirlerine katılım ve pozisyon endeksleri ayrı olarak incelenmiştir. Tahmin sonuçları, küresel değer zincirlerine katılımın, yerel paranın değer kaybetmesinin ihracat büyümesi üzerindeki pozitif etkisini bir miktar azaltarak ülkelerin rekabet gücünü olumsuz yönde etkilediğini göstermektedir.

PREFACE

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İstanbul, 2019

CEMRE KÜÇÜK

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LIST OF ABBREVIATIONS

BGR: Bulgaria

BRA: Brazil

CPI: Consumer Price Index

DVA: Domestic Value Added

FVA: Foreign Value Added

GDP: Gross Domestic Product

GNP: Global Production Network

GVC: Global Value Chain

ICIO: Inter Country Input-Output

IDN: Indonesia

IV: Indirect Value Added

HUN: Hungary

KWW: Koopman, Wang and Wei (2014)

LSDV: Least Squares Dummy Variable

MNC: Multinational Company

REER: Real Effective Exchange Rate

RER: Real Exchange Rate

TiVA: Trade in Value Added

TUR: Turkey

VAX: Value-Added Export

WIOD: World Input-Output Database

WIOT: World Input-Output Tabl

1. INTRODUCTION

The world economy has become more integrated as a result of developments in many different areas. Globalization, improvements in production, transportation, and communication technologies and the decline in borders by the help of the trade agreements and customs unions are few of these developments. All of these advancements enabled producers to disperse their production across countries. Today, a product passes through many countries in the production process. This internationally fragmented and spatially dispersed production method generates global production networks (GPN). (Coe and Yeung, 2015) Each country involved in the GPN also creates value-added in the production process. The value-added creation from the global production networks is called global value chains (GVCs). GVC of a final good is defined as the set of all value-adding activities needed in its production and it is identified by country–industry in which the last stage of production takes place. (Timmer, Dietzenbacher, Los, Stehrer, and de Vries, 2015)

Integration and higher participation can generate many opportunities for countries especially for the developing ones. First of all, it enables them to sell their products in different markets and integrate the global economy more. (Global Value Chain Development Report, 2017). If the country has a comparative advantage with cheaper products, it can compete with others via more inclusion to GVCs. The second advantage of GVCs is that, higher export creates employment and growth in the country (Global Value Chains and Development, 2013). Moreover, interaction and competition between countries with participation can contribute to the developing countries in terms of faster development of knowledge and technology. (Global Value Chains and Development, 2013).

When GVCs are considered in firm level, the firms those main objectives are the optimization of the production process and profit maximization, can benefit from other countries' opportunities such as cheaper labor force, advanced technology, existence of various natural resources, location and other economic occasions by fragmenting their production internationally. The GVC activities of the firms might be conducted by themselves as multi-

national companies performs. This kind of trade is categorized as intra-firm trade. On the other hand, the firms may choose to operate in GVC via third companies.

GVCs constitutes an essential part of the today's international trade. Understanding the impact of GVC integration on countries' economy in terms of trade and policy implication is essential especially because of the possible benefits mentioned above. For this reason, the aim of this thesis is to test whether GVC integration creates a higher competitive power which means benefits the developing countries.

The analysis in this study consist of two main parts. The first part is the input-output (I-O) analysis whose framework was founded by Leontief (1966). This analysis has been utilized to investigate developing countries' degree of integration to GVCs. Even if there exist various GVC participation indicators in the literature, the GVC measures in this thesis are based on methodology of Koopman, Wang and Wei (2011, 2014). Input-output analysis part of this study exploits World Input-Output Table (WIOT) that provides information in terms of trade flows across countries. From the production side, it describes all domestic and foreign sectors that contributes the production a specific industry. From the consumption side, it shows where the products of this specific industry are consumed

The second part of the analysis is the examination of the effect of GVC integration on competitive power of the developing countries. Real effective exchange rate (REER) has been selected as an indicator of competitiveness. The model that was established in this part is based on the studies of Rodrik (2013), Peirola and Freund (2012) and Eichgreen and Gupta (2013) who examines the effect of REER on export growth with a panel model.

The rest of the study is organized as follows; section 2 gives information about the historical evolution of I-O analysis and GVCs. It provides a review on the existing GVC measures introduced into literature and the country, sectoral and firm level studies in this area. It also includes a brief summary literature on REER and export growth relation. In section 3, the methodological framework of Leontief (1966) and GVC indicators of Koopman, Wang and Wie (2011,2014) are described. Section 4 consist of data, descriptive statistics. The degree of GVC integration of developing countries are examined in detail. In Section 5, the model and the result are presented. The estimations are separated as the base model which examines direct effect of REER on export growth and the main model that evaluates the impact of GVC

integration on competitiveness. The impact of various integration measures in gross export and manufacturing sector level have been assigned for the analysis. The last section, section 6 mainly concludes the results of the analysis and discusses the possible research questions for further studies.

2. THEORETICAL FRAMEWORKS AND LITERATURE REVIEW

As mentioned in the introduction, GVC has become an essential part of international trade as a result of many developments International fragmentation of production also resulted in increasing interest in the new methods that is used to analyze the impact of GVC integration. These new methods are mostly established on the I-O framework of Leontief (1996). This section firstly explains the main developments that triggers the fragmentation of production. It describes the evolution of I-O analysis and reviews the literature on several types of GVC participation measures.

2.1. Historical Evolution of GVC

Throughout history, there were various developments that made international fragmentation of the production more convenient. However, the main element that have crated international fragmentation is the globalization itself. Two vital developments that triggered unbundling of globalization also affected trade across countries.

The first development was the steam revolution which caused unbundling between consumer and producer (Venables and Baldwin, 2010). The usage of steam that makes transportation easier has removed the necessity of producer to be close to the consumer or natural resources used in production. It caused the clustering of factories and the formation of industrial districts. Decline in trade costs until the 1980s as a result of the steam revolution was the first unbundling of globalization (Baldwin, 2011).

The second development that brought globalization along was the rapid growth of information and communication technologies that made it possible for the firms to produce different parts of a product at different locations within and between countries (Venables and Baldwin, 2010). Information and communication technologies especially have decreased the transmission cost of the firms since the 1980s. This was the second unbundling of the globalization. According to Baldwin (2010), the effects of two unbundlings on globalization are different from each other in terms of international competition. The first unbundling of globalization caused competition across the sectoral level. However, the competition has transformed into the level of production stages with the second unbundling which is one of the

main characteristics of GVCs. Beside specific products, many countries have started to specialize in different stages of production with spreading GVCs.

In light of all these developments leading to globalization, the concept of GVC has emerged at the end of the 1970s under the name of "commodity chains" (Bair, 2005) The main idea of commodity chains was to observe all the process and transformation that an input passes until it becomes a consumption good. Gereffie (1994) who chose the case of apparel to exhibit commodity chains was the person who also introduced the term of "global commodity chain" into the literature. As a result of the increasing interest in complex trade and the impact of this trade on countries, the concept of the commodity chain has transformed into the "value chain" later. (Miroudot and De Becker, 2013)

When the historical evolution of international fragmentation is examined geographically, it is seen that the first steps were taken in America in 1965 and it became more dominant in the 1980s. Transmission of countries from import-substitution to export-oriented industrialization had an essential role in the formation of GVCs. The same process was experienced in East Asia at the same time and in Europe in 1986 with the inclusion of Portugal and Spain into the European Union. (Venables and Baldwin, 2010)

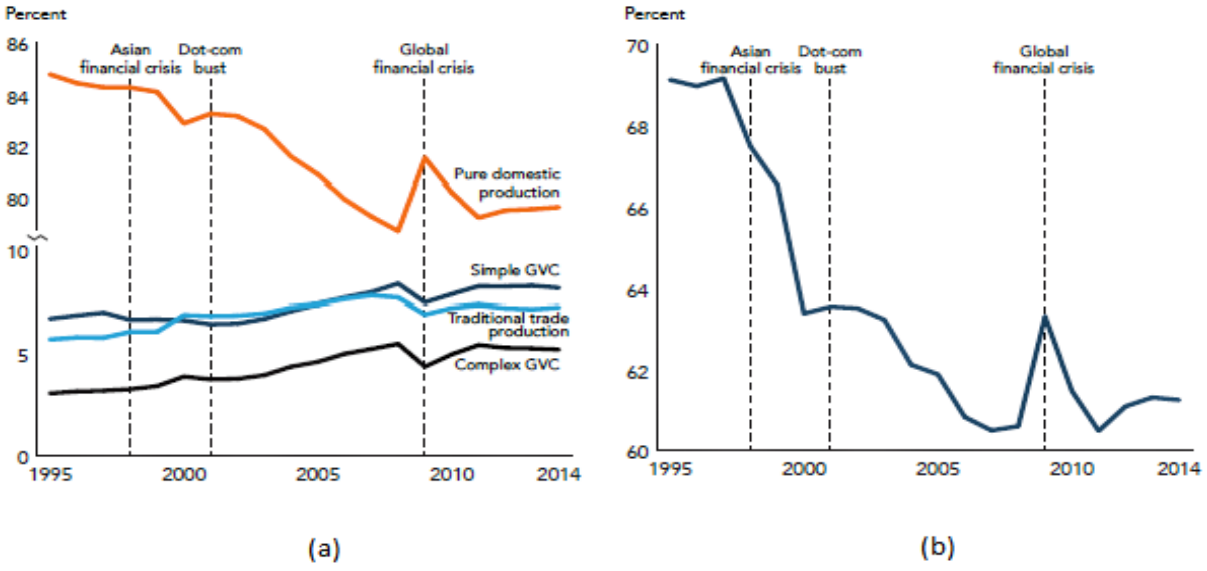

Figure 1: The Share of Different Production Activities in global GDP and the Share of Simple GVC in Total GVC Production Activities, 1995-2014

Source: World Bank, 2017

Historical changes of different production methods, namely pure domestic production, traditional trade production, simple GVC, and complex GVC, are shown in Figure 1a. The simple GVC is defined as the case where intermediate good export of the home country is absorbed by direct importer while complex GVC occurs when the direct importer re-exports the intermediate good to the third country (Wang, Wei, Yu and Zhu, 2017) As can be observed in Figure 1a, the share of GVCs has accelerated with globalization while the pure domestic production has declined on a global scale over 1995-2010 periods. At In the 1980s, the share of domestic production was around 85% and it declined to less than 80% by the year 2008. One of the stimulates of the rapid increase in the share of GVC activities between 2002 and 2008 was China that joined the World Trade Organization (WTO) (Degain, Meng, and Wang, 2017).

However, the global financial crisis in 2008-2009 resulted in a decline in external demand and a rise in pure domestic production. Since 2011, the share of GVCs in global GDP has stayed almost constant which can be interpreted as the slowdown of GVCs. There exist various theories that try to explain the reason behind this slowdown. These theories include the increase in trade cost as a result of higher protectionism, usage of domestic goods more in the production such as in China's new normal and realignment in the face of previous overshooting of fragmentation.[1]

Figure 1b shows the share of simple GVC in total GVC production activities. While the share of both simple and complex GVCs in global GDP has increased in the 1995-2014 period, the share of simple GVC in GVC production activities has fallen. This change indicates how the production became more complex and internationally fragmentated over time.

2.2. Foundations of Input-Output Models

I-O analysis the most important tool for the evaluation of GVCs different aspects. It might be used to investigate structure of employment in industries, value-added generated from production process or environmental effect of international fragmentation. For that manner, the data provided from I-O analysis can be a guide for the policy implication of the economy.

[1] See Gereffi (2018) for further discussion of these theories on slowdown of GVC.

The studies I-O analysis proceed through two channels: theoretical foundation and data construction. (Cheng and Daniels, 2017) The theoretical foundation of the I-O analysis has been established with works of Wassily Leontief starting from the 1920s. The main purpose of Leontief (1966) was to present a clear view of transactions and inter-industry relations in the economy. While he criticized the gap between existing theory and reality in economics, the first input-output tables formed by Leontief in the 1930s were an attempt to close this gap. The I-O tables in general consist of a system of linear equations. (Miller and Blair, 2009) The compelling part of the analysis was the computation process because it required organizing and updating a huge amount of quantitative data. The dependence of each sector to the other made the process more complex.

The interest on I-O analysis has increased with the concern of the reoccurring unemployment problem which had disappeared during the Second World War in the USA (Miernyk and Rose, 1989) As a result of this concern, the Bureau of Labor Statistics (BLS) started to focus on I-O tables more. The larger tables were constructed with the joint effort of the BLS and Leontief. The logic behind these larger tables was to examine the unemployment problem and form new policies with a different perspective. The national table of the USA generated for 1939 consisted of 92 sectors. After the table in 1939, the duty of table construction has taken over by the states. The regional table for the state of Utah by Moore and Peterson (1955) was the first actual regional one (Miernyk and Rose, 1989).

The insufficiency of regional tables in projecting trade linkages between regions caused the construction of inter-regional I-O tables (Miller, 1969). Studies of Chenery, Clark, and Cao-Pinna (1953) and Moses (1955) were the first studies in this area. Their studies were followed by Polenske (1980) by forming a multi-regional input-output table (MRIO). Even if the tables in the 1940s were constructed with a different purpose, today they provide information in a wide variety of subjects. The scope of the tables has expanded with globalization and trade relations across national borders. As a result of increasing dependence across countries in terms of production, the theoretical background of the I-O analysis that is used to measure the effect of GVC has evolved. New measures that offer better interpretation about the effect of fragmentation have been generated.

2.2.1. Measures of Vertical Trade

There exist various vertical specialization (VS) measures that are defined and separated according to their types. The type of vertical trade changes according to the source and destination of the value-added generated from the production process. Hummels, Ishii, and Yi (2001) introduced one of the first of vertical specialization measures into literature. The main aim of Hummels et al. (2001) was to understand the substantial changes in international trade via a high fragmentation of production across countries. They state that a production method must satisfy three conditions so that it can be categorized as vertical trade. These conditions are;

- Consisting of two or more sequential stages;

- Involvement of two or more countries in production;

- Usage of imported inputs by at least one of the countries that involve in production and export of some part of the output;

According to Hummels et al. (2001), a country can involve in GVC in two ways. The first one occurs when a country uses imported products (intermediate goods) in the production of their export. These imported goods also constitute foreign value-added in gross export. This kind of participation is denoted as VS that stands for vertical specialization. It is also named as backward participation. Backward participation reflects the import side of the vertical trade. The second type of participation occurs when intermediate good export of a country is used as also an intermediate good by the direct importer in the production of their export to third countries. It is denoted as VS1 (vertical specialization 1) and also named as forward participation. Even if there is a mathematical expression for VS in Hummels et al. (2001), they do not offer any for VS1. In line with the defined measures, they calculate vertical trade participation of ten OECD and four emerging countries. Results point out that the share of foreign goods in gross export has increased substantially from 1970 to 1990 for these countries. Additionally, the countries with lower GDP use more imported goods in their exports than the high-income countries.

Daudin, Rifflart, and Schweisguth (2011) who also work on vertical trade propose a different definition for forward participation than Hummels et al. (2001). The new definition proposed by Daudin et al. (2011), denoted as VS1*, includes domestic value added in intermediates that returns home via the imports of final or intermediate goods. It excludes intermediate exports which is re-exported by the importer to third countries. So VS1* composes a part of VS1. According to Daudin et al. (2011), two times of the summation of VS and VS1* is equal to the vertical trade of countries. If vertical trade is subtracted from gross exports in world level, world value added trade can be obtained. Subtraction of vertical trade also removes double-counted items. One of the considerable results of the study is how the usage of different indices such as VS, VS1, and VS1* that are affects the interpretation of countries' positions in GVC. The mathematical expressions of VS, VS1 and VS1* are demonstrated in the section 3.1.3.

There are also some measures that focus on where the value-added is absorbed being independent of whether it is a part of vertical trade. The concept of Value-Added Export (VAX) introduced by Johnson and Noguera (2012) describes the part of the value added that is domestic and absorbed in a foreign country via gross export. For this reason, the VAX ratio includes both domestic value-added absorbed by direct importer directly and domestic value-added in intermediate goods re-exported to third countries. The value-added in intermediate goods re-exported to third countries is also defined by Koopman et al. (2011) as indirect value-added (IV). The share of VAX in gross exports decreases as the domestic value added that returns home via re-imports rises. According to their study, the share of VAX in gross exports is significantly high. In the sectoral level, the VAX ratio of manufacturing is relatively small than the ratios of the other main sectors (agriculture, natural resources, and services). They explain the source of this variation between industries comes from the differences in the way trade is performed.

The measures mentioned in this chapter so far only examine specific parts of the value-added components of gross exports. The first complete picture that expresses each of these components separately belongs to Koopman et al. (2011). They divide domestic and foreign value-added, whose summation equals to gross exports, into five main parts. The summation of value-added that is absorbed by the direct importer, re-exported to third countries (indirect value added) and returns home via re-import generates total domestic value added. Linear

combinations of these five components also constitute different vertical trade measures that were introduced into literature such as VS and VS1. VS is the sum of IV and domestic value-added that finally returns home shares in gross export. On the other hand, VS1 is foreign value added in gross export. Koopman et al. (2011) also offer two vertical trade indices that would be beneficial in determining countries' position and participation in GVCs. The participation of and position depend on how much "upstream" and "downstream" the countries are. Upstreamness is measured according to the share of IV in gross export, while downstreamness depend on the share of foreign value-added (FVA) in gross exports. Participation of countries increases as they involve in vertical trade more no matter which type of specialization takes place. However, the position index is affected by upstreamness and downstreamness. The countries that have higher forward participation than backward will have a higher position index.

Koopman et al. (2014) brought a more comprehensive decomposition that separates gross export into nine different terms which were five in Koopman et al. (2011). The study provides a mathematical expression for each component that enables to identify double counted items in both foreign and domestic value added. The study brought two essential improvements to the literature. The first of them is the change in the calculations of some components of value added. The second is the separation of value added that finally returns home from IV. The elimination of some assumptions of Hummels et al. (2001) adopted previously, contributed to the creation of more realistic measurements.

Global value chains have emerged as a result of expanding global supply chains. For this reason, the participation measures expressed in value-added terms can also be assigned for global supply chains. The article by Baldwin and Gonzalez (2013) analyze vertical trade in terms of global supply chains. It introduces import to produce (I2P), import to export (I2E), re-exporting, and re-importing concepts. Every foreign input used in the production process of an output is a part of I2P. I2E is basically a subset of I2P. I2E and re-exporting concepts are broader definitions for VS and VS1, respectively. On the other hand, re-importing compromises VS1*. However, they also mention that these concepts are exposed to the double counting issue because they are not in value-added terms. The study gives detailed information in terms of the production and export structure of various sectors. It also assesses the position of different countries according to I2E and I2P.

In most analysis, the position and participation at country and sectoral level have been evaluated relative to the gross export. The criticism of Wang et al. (2017) is that the usage of gross exports in the evaluation process would be misleading. They offer to assess backward and forward participation according to the total value added generated in the same country or sector. Forward participation index for a specific sector is defined as the share value-added embodied intermediate export in total value added. On the other hand, backward participation is determined as the total of foreign value-added in intermediate exports and re-imported domestic value-added to satisfy domestic final demand. For this reason, Wang et al. (2017) state that the new measures they specified is different in terms of two aspects; the first one is the usage of the concept of value-added instead of gross exports, and the second is looking at the production side of participation instead of trade.

There exists an ongoing debate on how to assess countries' position and participation on vertical trade even if all these measures have been introduced in literature. The indices used in studies mostly depend on how participation is defined. The summary of the existing measures is given in the Table.

Table 1
Vertical Trade Measures in the Literature

Hummels, Ishi, and Yi (2001)	VS VS1	Backward Participation Forward Participation
Daudin, Rifflart, and Schweisguth (2011)	VS1*	Forward Participation
Johnson and Noguera (2012)	VAX	Forward Participation
Koopman, Wang and Wei (2014)	IV FVA	Forward Participation Backward Participation

Source: Author's own compilation.

2.3. Data Construction for GVC Analysis

The second major area that the studies on I-O analysis focus on is data construction. Rising interest in vertical trade and the need for more detailed and organized resources resulted in the emergence of various I-O databases. These databases are constructed by both individual countries and international organizations. Tables gathered by countries are mostly on the regional level that do not have detailed information about international trade as much as inter-regional ones. On the other hand, international organizations construct more comprehensive databases that cover most of the world trade.

Today, there are various databases such as World Input-Output Table (WIOD), Trade in Value-Added (TiVA) statistics of OECD- WTO, Global Trade Analysis Project (GTAP), Eora and Asian International Input-Output Tables. Each of these resources has different scope and features that might be beneficial depending on the studied area. Even if some of these organizations work on the same countries, there is a discrepancy between their results. The main reason for the difference between these databases is that they combine different resources besides the main trade statistics.

Each organization carries out studies to introduce their own data set and to establish a connection with existing vertical trade measures. One of these studies belongs to Meng, Zhang, and Inomata (2012) that discuss IDE-JETRO's Asian International I-O table (AIIO)[2]. They explain the scope and creation process of the table in a detailed manner. AIIO includes regions of Japan, China and most of the Asian countries. The USA was also included in the table because of its high trade volume with Asian countries. Meng et al. (2012) use the 1985 and 2005 tables to examine the trade in value-added statistics for Asia-Pacific regions. They state that the share of countries' value-added imports has changed throughout time. However, a noticeable change has been observed in China's position in GVCs. China has become the country that has the highest value-added import share from 1985 to 2005 within all the countries in AIIO data.

Another alternative database that is useful to understand the effects of GVCs is World-Input-Output Table (WIOT). The database was generated to understand the implications of

[2] Asian International I-O tables are joint effort of Institute of Development Economies (IDE) and Japan External Trade Organization (JETRO).

increasing global integration and environmental issues arising from this integration. Timmer et al. (2015) that introduces characteristics of the database describes it as a comprehensive summary of all transactions in the global economy between industries and final users across countries. They define the properties of WIOT that differentiates it from other databases such as GTAP and OECD–WTO. To show areas where the table can be used, they examine whether Europe is still strong in the production of the automobile. That sector is specifically chosen because of the increasing unbundling in automobile production. They use the VAX ratio of Johnson and Noguera (2012) in their analysis.

Databases such as IDE-JETRO and WIOD provide open source I-O tables that are utilizable to compute vertical trade statistics. On the other hand, OECD-WTO provides both I-O tables and value-added measures calculated from these tables separately. Ahmad and Yamano (2006) define the OECD I-O table as a useful tool in the estimation of income, expenditure, and productivity. They draw up a well-rounded framework that includes all the assumptions and other resources necessary for the creation of the I-O tables. The fact that the OECD works in many areas and collect data has enabled the tables to also cover information such as employment, pollution, and energy consumption. OECD-WTO also offers a calculated version of value-added statistics under the name of Trade in Value Added (TiVA). The database enables analyzing the source, destination, and performance of each sector in vertical trade explicitly.

Most of the databases generated by international organizations have the purpose of understanding complex trade relations between regions. However, some of them are also beneficial in understanding environmental issues that have appeared with intensive industrial productions. Global Trade Analysis Project (GTAP)that prepares I-O tables that describes trade relations also releases environmental I-O tables. According to Andrew and Peters (2013), the environmental table was generated to estimate the number of carbon emissions that occur as a result of international trade. However today it contains information about not only carbon emissions but also emission of methane, nitrous oxide and fluorinated gases. Andrew and Peters (2013) remark that the database consists of 129 regions provide a high variety of information in both regional and sectoral level.

2.4. Country, Industry, Firm and Product Based Studies on GVCs

Today the combination of defined vertical trade measures and various databases enables to examine the effects of international fragmentation from economic, social, and environmental perspectives at firm, industry or country level. Country-level analysis mostly focuses on the overall performance of countries in GVC. Miroudot and De Becker (2013) evaluate this performance by calculating the length of the GVC and participation. The length of the GVC depends on the number of stages that an output passes through in the production process. Miroudot and De Becker (2013) calculate the length index of Fally (2011) and the participation index of Koopman et al. (2011) by using the OECD ICIO table. The result of the country-based analysis coincides with the Hummels et al. (2001) in terms of integration via imports. The VS share of smaller economies is relatively higher compared to the share in larger countries that specialize in VS1. The length of GVCs increased from 1995 to 2005 across all countries even if it is a small rise.

Aslam, Novta and Rodrigues-Bastos (2017), who also work at the country level, computes the trade in value-added statistics based on Eora Multi-Regional Input-Output (MRIO) database. The article offers a detailed theoretical explanation for the I-O framework and uses the KWW (2014) decomposition technique. One of the essential findings is the increase in China's effect in generating VAX. The potential of China in directing world trade is also emphasized in Meng et al. (2012). When countries are clustered according to their development levels, emerging market economies have a higher involvement in GVCs. They also became more upstream in vertical trade.

In its simplest form, upstreamness expresses the distance of production to the final demand (Fally, 2011). The sectors that sell most of their products directly to the final consumer are categorized more downstream relative to the other industries. Antras and Chor (2018) determine the position of countries in GVCs according to this definition and the share of value-added to gross output. A higher value-added share also points out the upstreamness of the countries. Considering the data obtained from WIOT, it has been observed that the share of goods that are directly sold final consumer has decreased over time that verifies a spreading GVC. According to Antras and Chor (2018), the increasing distance of global production chains from both primary goods and final demand indicates that GVC becomes more complex.

Even though the country-level studies are in majority in the literature, focusing on a specific product or a product group might be more beneficial to analyze the basic structure and effects of the GVCs. Especially, electronic products those many parts produced in Asian countries, are one of the best examples of this case. Dedrick, Kraemer and Linden (2010) who are aware of how the change in production structure affected value-added distribution, choose iPod (Apple) and notebook PCs (HP) to show the case in innovation. Value-added created in each stage of production is found by using data on the cost of all intermediates. Comparative analysis of Dedrick et al. (2010) shows that lead-firms in technology have the highest margin in both products (iPod and PC). The companies that supply complementary products or services to these lead-firms also benefit highly from innovation.

A research about specific product, like the example of iPod and PCs, belongs to Timmer et al. (2014). They examine the production method and factor content of goods that come from 14 manufacturing industry of 40 countries. They use a combination of WIOT and UN COMTRADE database to understand the stages that the products pass through. Similar to other researches, in their comparison between 1995 and 2008 value-added shares, they point out the rise in foreign value-added shares in manufactures. For example, petroleum products have high value-added shares in most countries naturally because those countries do not have direct access to oil stock. On the other hand, agricultural products are rather domestic in many countries. In terms of factor contents, the share of high-skilled labor and capital has risen in manufacturing as a result of improvement in production technology.

The studies on country and industry level are essential in understanding the changing structure of trade and policy implications. However, the main source of the international fragmentation is firms. The firm which has the goal of maximizing its profits may choose offshoring (intra-firm trade) or outsourcing according to relative production costs. The majority of firm-level studies try to find the main determinants of this decision. The well-known study of Baldwin and Venables (2013) explains the offshoring decision of firms under two production technology which are symbolized as “spiders” and “snakes”. While a spider is performed by gathering multiple inputs together to form assembly, snake is the method where the good is moving in a vertical process with value added at generated in each stage. Today, most of the goods are produced by combining these two technologies.

Multinational companies (MNCs) are the major contributors of international fragmentation of production. MNCs who want convenient access to natural resources or aim to have cheaper factor costs might prefer locating their facilities across countries. This concept is also named as intra-firm trade and creates almost one-third of world trade (Antras, 2003). As in the case of offshoring, the decision of being multinational depends on many variables. According to Markusen and Venables (1996), these variables can be summarized as; economic size and relative endowments of countries, trade costs and the fixed cost of one plant compared to the operating two plants. In the case of similar endowments and economic size across countries, a firm chooses to be multinational if the cost of trade is relatively higher than the fixed cost of two plants. However, if the cost of trade and the fixed cost of operating two plants are given, there should be similarity in absolute and relative factor endowments so that a firm operates as multinational.

2.5. Real Effective Exchange Rate and Export Growth

All the advancement that triggers and boosts international trade also resulted in greater competitiveness between countries. The value of the domestic currency relative to the other currencies is a decisive factor in export demand. For this reason, governments can devaluate or allow the depreciation of the domestic currency to improve export and trade balance. There exist various indicators in literature offered to measure competitiveness. However, the most commonly used among all is the real exchange rate (RER). RER is equal to the nominal exchange rate that is adjusted according to the discrepancy in cost or price inflation between the domestic country and its trade partner (Lipschitz and McDonald, 1991). This discrepancy between countries can be adjusted by using consumer price index (CPI), unit labor cost or export unit value. The main aim of using different measures in the adjustment process is to find a good indicator that explains changes in the country's trade balances.

RER reflects the bilateral relationship between countries' currencies. For this reason, appreciation or depreciation of the domestic currency against another in real terms is not entirely adequate to assess changes in competitiveness. On the other hand, the real effective exchange rate (REER) that is constructed by weighting partner countries' currencies takes other opponent countries into account. As in the case of RER, there are different opinions about how

the effect of price differences between countries should be added to the nominal exchange rate and how weighting in REER should be done. The study of Ghose and Kharas (1993) on existing REER indicators is an example of these critics. They mention the problem arising from REER based on CPI, WPI or GDP deflator. The main criticism of the study is the weighting method of currencies according to trade relations. The drawback of this method is not including the countries that may be rivaled in trade even if they are not trading partners with the country in question. To have a better illustration of the problem, they choose the case of the Philippines which does not trade much with Korea and Hong Kong but competes with these countries. Instead of the traditional method, they construct demand equations for the two largest importers of the Philippines which are Japan and the USA. These demand equations help to determine the main competitors of the Philippines' export. There exists a substantial difference between the traditional weighting method and alternative REER in the study that shows the importance of indicators used in the evaluation process of trade competitiveness.

Although there are disagreements in the construction of REER, the traditional method by weighting is still widely used. Toulaboe and Ahmed (2004) use REER based on both CPI and export unit value to examine the competitiveness of Singapore. Singapore has accomplished a successful economic performance between 1965-1995 and experienced a financial crisis in 1997. According to the study, the crisis in 1997 caused the depreciation of the domestic currency, which was overvalued in the period 1965-1995. They use the error-correction model to understand the relationship between export volume and REER. Even if the result of the analysis does not support a considerable overvaluation before the crisis, it indicates that real depreciation of the Singapore dollars after 1997 positively contributed to export growth in the country and improved competitiveness.

Depreciation of the domestic currency may be desirable by economies to improve trade balance and increase export performance. However, the effect of depreciation that directly reflects the cost of production and prices should be taken into consideration by economies. In the case of depreciation, as the share of imported intermediates in export increases, the price of exports will also be rising. Abeysinghe and Yeok (1998) choose Singapore to analyze the inflationary effect of domestic currency depreciation. So, the study examines the case of Singapore from another perspective than Toulaboe and Ahmed (2004). To test the existence of the possible inflationary effect, they divide the export price into its components as import prices

and unit business costs. They focus on various export categories. In general, the results of the error correction model exhibit a clear relationship between export and import prices. According to Abeysinghe and Yeok (1998), the appreciation of Singapore dollars in the period of 1985-1995 provided lower import prices and production costs for domestic exporter and helped them to increase the volume of export that resulted in an export surge in the country.

It is also important to analyze the effect of REER or RER on the trade balance of countries as well as their export in terms of determining monetary and trade policy. Because the trade balance of a country expresses the difference between its exports and imports, the effect of REER on the trade balance is basically expected to be the same with the relationship between REER and export. Increasing the competitiveness of countries results in an improvement in the trade balance. The literature is quite rich in terms of articles that examine the trade balance in general terms and within the context of the Marshall-Lerner condition.

Bahmani-Oskooee (2001) assigns the ratio of imports to the export as an indicator for trade balance. He tries to exploit the long-run relation between REER and trade balance in eleven middle eastern countries. To evaluate this relation, he establishes a simple model that is widely used in the literature. The explanatory variables of trade balance have been selected as real domestic and foreign income and REER. However, the data availability problem caused the research to be limited to seven countries. The positive effect of devaluation on trade balance has also been observed for middle eastern countries.

Some research on the REER have the purpose of evaluating the effectiveness of policies implemented. Therefore , these studies investigate the case of devaluation instead of depreciation. Gylfason and Risager (1983) investigate the relationship between devaluation and current account by establishing a model in which both the aggregate demand and supply are affected by changes in the exchange rate. They specify that devaluation decision in a country to improve the current account deficit also causes an increase in the country’s debts in foreign currency. The study questions the effect of devaluation on GNP. The results indicate the negative relation between devaluation and supply because of increasing production costs. The effect of devaluation on GNP is found ambiguous.

As can be understood from the examples given in this section, the literature is quite rich in terms of examining the relationship between export growth and exchange rate from different perspectives. However, three essential studies that try to explain the relationship between export growth and RER are the benchmark for this thesis. Firs of them is the work of Rodrik (2009) that proves the positive effect of undervaluation on economic growth by combining various exchange rate measures and different methods. The findings verify undervaluation domestic currency is one of the factors that affect growth positively. The second study belongs Eichgreen and Gupta (2013) who focuses on the RER and export growth relation in services sector. They separate the sector as modern and traditional services. The main aim of the analysis is to understand whether the determinants of export growth that affects goods market also influential on services sector. The results indicate the effect of depreciation is on export growth is higher for services sector than goods sector. The last research that is used in establishing the base model of this thesis is work of Freund and Pierola (2012) that specifies the characteristics of export surges and examines developing and developed countries during and after the surges. According to Freund and Pierola (2012) , while the developed countries' export does not affect from large real depreciations, undervaluation of domestic currency generates export surges for the developing countries. The depreciations make the developing countries to export new products and reach new markets possible.

The studies that are mentioned in this section is a summary that remarks the significance of exchange rate on trade and economy in general. The main outline of these researches is following the right exchange rate policy stimulates export and helps economies to have better trade and current account balance.

3. METHODOLOGY

3.1. MEASURES OF GLOBAL VALUE CHAIN INTEGRATION

3.1.1. Fundamentals of Input-Output Analysis

Internationally fragmented and spatially dispersed production has become more efficient especially with the developments in transportation and communication technologies. However, spreading GVCs also made it difficult to distinctly analyze the effect of trade and created a necessity for new methods. One of the sources that are mostly used in this area to evaluate various aspects of GVCs is international input-output (I-O) tables.

Table 2: A Simplified Inter-Country I-O Table

		Intermediate Use				**Final Use**		**Total Use**
		Country A		**Country B**		**Country A**	**Country B**	**Gross Output**
		Sector 1	Sector 2	Sector 1	Sector 2			
Country A	Sector 1	Z_{11}^{AA}	Z_{12}^{AA}	Z_{11}^{AB}	Z_{12}^{AB}	F_1^{AA}	F_1^{AB}	X_1^A
	Sector 2	Z_{21}^{AA}	Z_{22}^{AA}	Z_{21}^{AB}	Z_{22}^{AB}	F_2^{AA}	F_2^{AB}	X_2^A
Country B	Sector 1	Z_{11}^{BA}	Z_{12}^{BA}	Z_{11}^{BB}	Z_{12}^{BB}	F_1^{BA}	F_1^{BB}	X_1^B
	Sector 2	Z_{21}^{BA}	Z_{22}^{BA}	Z_{21}^{BB}	Z_{22}^{BB}	F_2^{BA}	F_2^{BB}	X_2^B
Value Added		VA_1^A	VA_2^A	VA_1^B	VA_2^B			
Gross Output		X_1^A	X_2^A	X_1^B	X_2^B			

Source: Author's own demonstration

As can be observed from Table 2, a simplified Inter-Country Input-Output Table (ICIO) contains information on intermediate and final good usage of countries. Each column of the table exhibits the amount of input provided by domestic and foreign sectors to produce the gross output of a specific country's industry. Each row demonstrates how this gross output is consumed by both producers and consumers that are domestic or foreign.

The table consists of three main parts which are input usage of industries (intermediate use), final good consumption that belongs to households and government (final use) and lastly total use. The summation of input usage and final good gives total use that is also named as gross output. The relationship between these three can be expressed in matrix notation as;

$$X = A.X + Y \quad (1)$$

For an ICIO table that consist of G countries N industries, ***X*** stands for GN X 1 vector of gross output while ***Y*** is GN X 1 vector of final good consumed in countries. ***A*** which is the GN X GN matrix describes the amount of input used by industries from itself and other sectors, either domestic or foreign, in the production of an output. ***A*** matrix is defined as production technology matrix or input coefficient matrix.

When Equation 1 is rearranged;

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

The $(I-A)^{-1}$ which is a GN X GN matrix is Leontief inverse matrix that gives how much output directly or indirectly needed from each countries' industries to meet an extra unit of final good demand for each sector. (Koopman et al, 2011)

Every industry that contributes to the production process of output also generates domestic or foreign value-added depending on its origin. The direct domestic value-added in one unit of output for a specific sector, as stated in Equation 3, is calculated by summing each column of the input coefficient matrix, putting these elements on the diagonal of a square matrix and subtracting it from an identity matrix. (Aslam et al., 2017)

$$V = I - diagonal\,(\sum A) \quad (3)$$

Multiplication of direct domestic value-added matrix with Leontief inverse matrix forms ***VA*** value added coefficient matrix.

$$VA = V.(I - A)^{-1} = V.B \quad (4)$$

VA contains information about domestic and foreign value-added shares of each sector. For this reason, it has a wide range of use especially in measuring domestic and foreign value-added shares in both exports and gross output.[3]

3.1.2. Calculation of Domestic and Foreign Value-Added Content of Gross Export

Highly fragmented production has brought along an accelerating difference between gross export and value-added export concepts. One of the main reasons for this difference is the goods that are produced at home country which are not purely domestic. Usage of imported inputs in the production process forms the foreign value-added share of gross export. Another reason is the exported items that return the home country via re-importation. (Koopman et al. 2014) Therefore, it is essential to separate value-added shares of domestic and foreign sectors and double-counted items in gross export. Classification of value-added according to its source and destination is helpful to understand the position and participation of countries into GVC.

$$\mathrm{T} = \begin{pmatrix} V_1 & 0 & \cdots & 0 \\ 0 & V_2 & & 0 \\ \vdots & & \ddots & \\ 0 & 0 & & V_{GN} \end{pmatrix} \begin{pmatrix} \mathbf{B_{11}} & \mathbf{B_{12}} & \cdots & \mathbf{B_{1G}} \\ \mathbf{B_{21}} & \mathbf{B_{21}} & \cdots & \mathbf{B_{2G}} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{B_{G1}} & \mathbf{B_{G2}} & \cdots & \mathbf{B_{GG}} \end{pmatrix} \begin{pmatrix} E_1 & 0 & \cdots & 0 \\ 0 & E_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & E_{GN} \end{pmatrix} \quad (5)$$

The value-added shares of both foreign and domestic sectors in gross export can be obtained by the multiplication of ***VA (V.B)*** with diagonal export matrix ***E***. ***B*** in Equation 5 is a block version of the Leontief inverse matrix in which each element consists of the NXN matrix that describes the relation between domestic sectors. Each column of the T matrix shows domestic and foreign value-added whose summation equals the gross export of a specific sector. Subtraction of the share of domestic sectors in value-added from gross export gives the share of foreign value-added for each industry.

[3] Value added shares in domestic goods and export are assumed to be equal in the model.

3.1.3. Measures of Domestic and Foreign Value-Added Trade

As explained above, there are different measures in the literature to assess countries' position in the GVCs such as vertical specialization concept offered by Hummels et al. (2001) and VAX ratio introduced by Johnson and Noguera (2012). However, the decomposition of Koopman, Wang and Wei (2014) (KWW) enable to calculate various components of gross exports in terms of value-added. It also specifies double counted items in gross export explicitly. It divides gross export into nine components as can be seen in Figure 1. It provides mathematical expressions different vertical specialization measures such as VS, VS1 and VS1*.

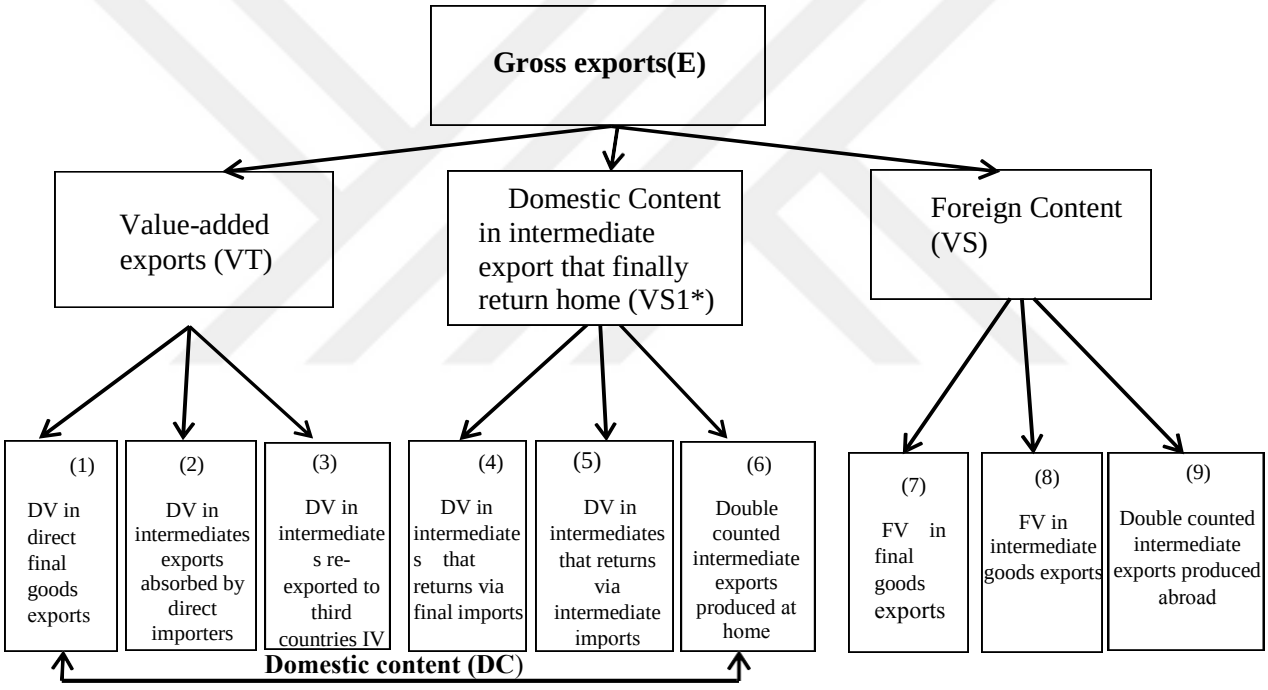

Figure 2 : Components of KWW Decomposition

Source: Koopman, Wang and Wei, 2014, s.38

Hummels et al. (2001) define two types of vertical specialization depending on the source of the value added as mentioned in the section 2.2.1. First one VS is defined as foreign value-added embodied in intermediate and final good exports of domestic industries. VS for all countries' industries can be calculated as in Equation 5.

The other measure of Hummels et al. (2001) named as VS1 is the value-added share of gross export that is re-exported by the importer to the third countries. Even if VS1 has not mathematically expressed by Hummels et al. (2001), KWW defines it as;

$$VS1_s = V_s \sum_{r\neq s}^{G} \sum_{t\neq r,s}^{G} B_{sr} Y_{rt} + V_s \sum_{r\neq s}^{G} \sum_{t\neq r,s}^{G} B_{sr} A_{rt} X_t + V_s \sum_{r\neq s}^{G} B_{sr} Y_{rs} + V_s \sum_{r\neq s}^{G} B_{sr} A_{rs} X_s \quad (6)$$

The first and second terms in Equation 6 expresses the value of intermediate and final goods that are exported by country S and re-exported by the importer. On the other hand, the third and fourth terms are the domestic value added that is exported to the foreign countries and then re-imported via separate ways by country S. For this specific reason, the VS1 definition of Hummels et al. (2001) contradicts with the value-added notion that is a net concept and does not include double-counted items (Koopman et al. 2014). KWW (2014) offers a new measure for vertical specialization VS1 that equal to the only first term of Equation 5. The term is also named as indirect value added (IV).

$$IV = V_s \sum_{r\neq s}^{G} \sum_{t\neq s,r}^{G} B_{sr} Y_{rt} \quad (7)$$

These two vertical specialization measures, VS and VS1, are the key concepts in the determination of a country's or an industry's participation and position in the GVC.

The participation rate to the GVC is measured as Equation 8. FVA (foreign value-added) of a country or a specific industry can be interpreted as the contribution provided by foreign sector to domestic sectors' export. IV expresses the contribution of the domestic sector to the foreign countries' export. These both measures are in value-added terms (Aslam et al. 2017). For this reason, FVA and IV are also the measures of backward and forward participation to the GVC in order.

$$GVC_{Participation} = \frac{FVA+IV}{Gross\ Export} \quad (8)$$

Two countries that have the same participation index might have diverse kinds of involvement because of the disparity between their IV and FVA. Understanding which country is more upstream in GVC requires to calculate position index. Between the two countries, the

one that generates higher value added by contributing others' export will be naturally more upstream and have higher position index.

$$GVC_{Position} = ln\left(1 + \frac{IV}{Gross\ Export}\right) - ln\left(1 + \frac{FVA}{Gross\ Export}\right) \quad (9)$$

3.2. PANEL DATA REGRESSION MODEL

Panel data consist of cross sections that are observed two or more periods. There are many advantages of using the panel model such as solving omitted variable bias that is caused by possible unobserved heterogeneity problem in cross-sectional data. (Dougherty, 2011) The model consists of N entities such as countries, firms, or households that were observed at T different times such as days, months, quarters or years. A simple panel can be expressed as;

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \mu_{it} \quad (10)$$

The panel data with no missing is called a balanced panel while the vice versa case is named as unbalanced. Panel data analysis are divided into two categories as fixed and random effect estimations.

3.2.1. Fixed Effect Method

The fixed effect model takes its origin from unobservable variables that differ across entities but are constant in time. Entity fixed effect enables elimination of these variables that influence the dependent variable but do not change over time while time fixed effect stands for the opposite case. (Asteriou and Hall, 2007) These unobserved effects that vary across time or entity can be eliminated as taking first differences or added into regression explicitly as the dummy. This second approach is also known as Least Squares Dummy Variable Fixed Effect (LSDV).

For an N number of cross section and T number of time period, a simple panel model with entity and time fixed effect can be written as;

$$Y_{it} = \beta_1 + \sum_{j=2}^{k} \beta_j X_{ijt} + \delta t + a_i + \varepsilon_{it} \quad , t = 1,2, \dots, T \quad (11)$$

However, when LSDV is applied the number of dummy variables in regression must be n-1 and T-1 in order so that the dummy variable trap of exact multicollinearity is prevented.

3.2.2. Random Effect Method

The basic feature that separates the random effect from the fixed effect method is assigning the unobservable variables as uncorrelated with each X_{it} variables for all periods. These variables must be independent of all X_i for all periods. This circumstance might be satisfied if observations are being drawn randomly from a given population. In this case, they can be treated as random and included in error terms.

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 X_{it} + \cdots + \beta_k X_{it} + a_i + u_{it} \quad (12)$$

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 X_{it} + \cdots + \beta_k X_{it} + v_{it} \text{ where } v_{it} = a_i + u_{it} \quad (13)$$

3.2.3. Newey-West Estimator

One of the common problems that are encountered in the panel data analysis are heteroskedasticy and serial correlation. Heteroskedasticity occurs when homoskedasticity assumption of Gauss-Markov which is variances of error terms are constant $Var(u \backslash x) = \sigma_2$ is violated (Wooldridge, 2012). Even if this problem does not affect the estimation coefficients, it causes variance and standard errors of estimation coefficients to be biased. Serial correlation is also a result of volition of one of the Gauss-Markov assumptions which is covariance of error terms is equal to zero Cov $(u_i, u_k) = 0 \; where \; i \neq k$. (Wooldridge, 2012). Existence of serial correlation also causes invalid standard errors and test statistics.

There exit various estimation methods that allows for existence of heteroskedasticity and serial correlation in the model. Newey-West estimator is that has mainly been generated for time -series data with heteroskedasticity and possible serial correlation (autocorrelation) is one of these estimators. It produces covariance matrix of standard errors which are

heteroskedasticity and autocorrelation resistant. It requires selecting maximum lag for the calculation of autocovariances.

3.2.4. Common Correlated Mean Group Estimator (CCEMG)

As defined in the section 3.2. panel data consist of cross sections that are observed two or more periods. However, in the panel data estimations correlation across variables or error terms might occur because of strong common factors such as global shocks and crisis and weak factors such as spillover effects between selected cross sections. There are different measures introduced into literature to overcome cross sectional dependence.

One of these methods is Common Correlated Mean Group Estimation introduced by Pesaran (2006). According to him, adding cross sectional means of dependent $\overline{y}_t$ and independent variable $\bar{x}_t$ in to the model as explanatory variable as in the Equation 14, includes the unobserved common factor that causes cross sectional dependence.

$$y_{it} = a_i + b_i' x_{it} + d_{1i}\overline{y}_t + d_{2i}' \bar{x}_t + e_{it} \quad (14)$$

3.2.5. Beck-Katz Estimator

Another method that was found to solve existing cross-sectional dependence in a model is Beck-Katz (1995) estimator. Beck-Katz (1995) suggest that while the model is estimated with Least Squares method, standard errors are produced with panel corrected standard errors method. While the model is estimated with Least Squares The estimator is especially suitable for the panel data that has greater time dimension T than cross-sectional dimension N. The estimator also enables to estimate models with also heteroskedasticity and serial correlation beside cross-sectional dependence.

3.3. UNIT ROOT TESTS

3.3.3. The Hausmann Test

Usage of the fixed or random effect depends on the nature of the data and the assumption of whether having an unobserved variable a_i that is correlated with explanatory variables for all periods. When the data used in analysis consist of a random sample from a population such as the way most of the surveys conducted, the random effect estimation might be more reasonable. However, having a random sample is not enough to use the random effect. Even if data in hand is a random sample, it is required to check the correlation between X_{it} and a_i. Hausmann test is one of the common methods applied for choosing on random or fixed effect estimation. The null hypothesis of the test is no correlation. Test statistics of original Hausmann (1978) as follows;

$$H = (\beta^{FE} - \beta^{RE})'[Var(\beta^{FE}) - Var(\beta^{RE})]^{-1}(\beta^{FE} - \beta^{RE}) \sim X^2(k) \quad (14)$$

The statistics can be interpreted according to the difference between these two effects. (Ahn and Moon, 2001) Large test statistics imply a significant difference between the two effects and rejects the null hypothesis and suggests the usage of the fixed effect estimation.

3.3.1. Unit Root Tests for Time Series Model

Time series analysis provides information about the effect of past values of the independent and dependent variables on the regression. This historical relationship between variables also widely used for forecasting. However, the stationarity of data is essential for the validity of results obtained from classical regression or forecasting activities. Non-stationarity causes the mean and variance of data to be time-dependent that results in inefficiency.

For a simple stationary autoregressive model, variables have probability distribution does not change over time and mean that returns its log run value after it exposes a shock. (Stock and Watson, 2015)

3.3.1.1. Dickey- Fuller and Augmented Dickey Fuller Tests

A simple autoregressive model with one lag AR (1) can be defined as;

$$Y_t = \beta Y_{t-1} + \mu_t \tag{15}$$

There exist three possibilities for lag term's coefficient β which are $|\beta| < 1$ where the Y_t will be stationary, $|\beta| = 1$ and $|\beta| > 1$. The case of $\beta = 1$ defined also called as unit root.

$$Y_t = Y_{t-1} + \mu_t \tag{16}$$

$$\Delta Y_t = \mu_t \tag{17}$$

Value of Y at time t depends on the value of previous periods $t - 1$ plus error term that includes unobserved determinants of regress that results in non-stationarity. Dickey-Fuller tests for non-stationarity by setting the null hypothesis as the existence of unit root. Augmented Dickey-Fuller is the extended version of the original test including models with extra lags of Y_t so that autocorrelation problem is solved. The number lags in the model is determined according to information criteria such as Akaike, Schwartz Bayesian.

3.3.2. Unit Root Tests for Panel Model

Panel data, observed for a given period T, also brings the possibility of the non-stationarity that invalidates the result of classical regression. Especially, the usage of panel data sets in the macroeconomic analysis that consists of wider time intervals than micro panels made the non-stationary problem more substantial. (Asteriou and Hall, 2007) Due to the stated reason, the effect of shock or drifts to a panel set must be controlled. However, unit root test for panels is more complex than time series because of large cross sections N.

3.3.2.1. Levin-Lin-Chu Test (2002)

Unit root test introduced by Levin and Lin (1992) and completed with the inclusion of Chu in 2002 is one of the first studies in the panel area and takes its origin from Dickey-Fuller. The test is suitable for panel models with both entity and time fixed effects.

$$\Delta Y_{i,t} = a_i + \rho Y_{i,t-1} + \sum_{k=1}^{n} \emptyset_k Y_{i,t-k} + \delta_i t + \theta_t + \mu_{it} \quad (17)$$

In Equation 15, while a_i stands for entity fixed effect, θ_t shows time fixed effect. Null hypothesis for the test is existence of unit root where $\rho = 0$. However, assumption of cross-sectional independence and null hypothesis of having a unit root for all cross sections are two major drawbacks of the test.

3.3.2.2. Im- Pesaran and Shin Test (1997)

The unit root test of Levin and Lu (1992) offered ρ coefficient of $Y_{i,t-1}$ that is homogenous for all observations. The addition of Im, Pesaran, and Shin (1997) to Levin and Lu was including the possibility of heterogeneity in ρ. Their version of the test was as follows;

$$\Delta Y_{i,t} = a_i + \rho_i Y_{i,t-1} + \sum_{k=1}^{n} \emptyset_k Y_{i,t-k} + \delta_i t + \theta_t + \mu_{it} \quad (18)$$

The null hypothesis of the unit root test is $\rho_i = 0$ for all observations or $\rho < 0$ for at least one observation that expressing existence of non-stationarity for all or some series. The establishment of null hypothesis of the test is the reverse of Levin and Lin test. IPS test is suitable only for balanced panels that does not have any missing observation.

4. DATA AND DESCRIPTIVE STATISTICS

4.1. Data

Many sectoral level information such as the production structure of industries, employment generated in different sectors, and the position of specific industries in international trade can be analyzed with the data provided from ICIO tables. However, the tables are also suitable for working at the country level. In this study, ICIO has been used to test whether the integration to GVC affected the competitive power of developing countries.

As explained in the section 2.3., today there are several input-output tables such as TiVA statistics, Global Trade Analysis Project (GTAP), and Eora. However, the World Input-Output Table (WIOT) has especially been selected because it offers annual data that is publicly available and is free, unlike the other sources.[4] The first publication of the data was in 2013 and updated in 2016.[5] Earlier version consists of 40 countries and covers the period between 1995-2011. Industries were categorized in ISIC Rev.3. The updated version that includes the 2000-2014 period has a broader scope with 53 countries and ISIC Rev.4 level.

The data for the study has collected from World Input-Output Database (WIOD). The analysis consists of six developing countries observed in 1995-2011 period. These countries are Brazil, Bulgaria, Hungary, Indonesia, Mexico and Turkey. The reason for the limited number of countries is the availability of data. In the selection process, attention was also paid to the classification of these countries as developing country and emerging market by IMF World Economic Outlook Database in October 2018.

The dataset for this thesis has been generated by collecting information from different resources.[6] GVC integration variables which are indirect value-added, foreign value-added, GVC participation index, and GVC position index are calculated for 1995-2011 period by using 2013 of WIOD. The control variables are real GDP of selected countries and their trade

[4] For more information regarding World Input- Output Database (WIOD); http://www.wiod.org/home

[5] There is not any methodological change between the 2013 and 2016 Releases of WIOD. The two main changes in the 2016 Release are the usage of new basic price tables and improvement in the estimation of bilateral shares in trade.

[6] The detailed information regarding the dataset can be obtained in Appendix Table 10.

partners. Real effective exchange data from 1995 to 2011 has been obtained from Bank for International Settlements.

4.2. Backward and Forward Participation of Countries into GVC

Division of gross export into its components as KWW decomposition did is necessary to determined indirect value-added (IV) and foreign value-added (FVA). The share of IV and FVA in gross export are also defined as backward and forward participation by Koopman, Wang and Wie (2011,2014) as mentioned in the section 3.1.3. This section has the purpose of examining IV and FVA shares in gross exports of selected countries to interpret their position and participation to GVCs.

4.2.1. Bulgaria

Bulgaria is 61st in rankings made according to the export volume of the countries in 2017. The main export destinations of the country are the EU and Turkey. In sectoral level, services, metals, and machinery including vehicles generate 50% of total export in 2016.[7] (atlas.cid.harvard.edu, 2019)

The political and economic transition process of Bulgaria after the end of the Soviet Union was severely interrupted by the crisis in 1996-1997. It was the combination of the financial and currency crisis. Economic downturns such as the rise in public debt and the withdrawal of foreign investors from the country resulted in the bankruptcy of some banks (Dobrinsky, 2000). The decline in foreign currency reserves as a result of withdrawals and foreign debt payments has brought deprecation of the domestic currency along (Roussenova, 2002).

[7] The services sector consists of travel and tourism, information and communication technologies, transport, and insurance and finance.

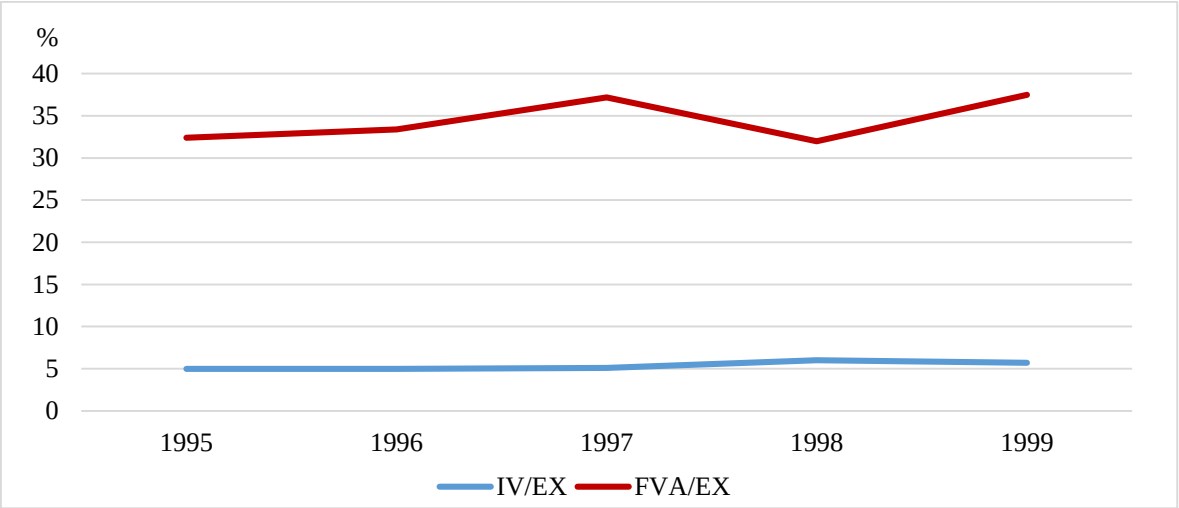

Figure 3: IV and FVA Shares (%) in Gross Export of Bulgaria, 1995-1999

Source: Author's own calculations

The FVA and IV shares of the country for 1995-1999 and 2000-2014 periods are given in Figures 2 and 3. The volume of both FVA and DVA have declined from 1995 to 1996 which was the beginning of the crises. However, the decrease in DVA part of gross export was higher than FVA. It created the impression of rising FVA share. The depreciation of the domestic currency in 1997 has improved the gross export of the country.

The share of DVA in Bulgarian exports is 64% on average between 2000 and 2014 which is higher than the FVA share. Even if gross export has remained mainly domestic in terms of value-added, FVA share has increased time to time especially in the 2002-2006 period. One of the drastic changes in FVA share has been observed in the 2009 global crisis. The main reason for this change was the decrease in demand for imported goods, for exports by foreign countries and relative change in both because of the crisis. On the other hand, the IV share in gross was mostly constant.

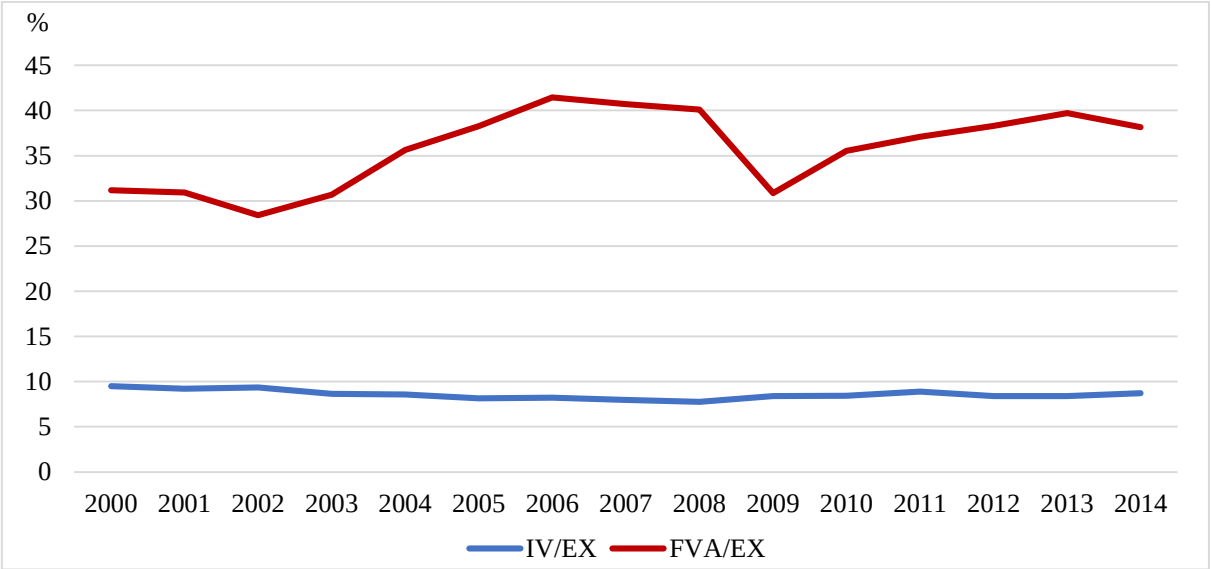

Figure 4: IV and FVA Shares (%) in Gross Export of Bulgaria, 2000-2014

Source: Author's own calculations

The participation index of the country that is the total of IV and FVA share of gross export is 43% between 1995 and 2014. The FVA share that is substantially high for all periods indicates the downstreamness of the country in GVCs and the negative GVC position index. The country has performed integration to GVCs majorly via imports.

4.2.2. Brazil

Brazil is famous for the export of coffee even if the three most important export sources are iron ore, crude petroleum, and soybeans. In 2017, the country exported 219 billion dollars and these three products created almost 30% of total export. (Atlas.media.mit.edu, 2019) The export volume in 2017 has made the country the 22nd largest exporter in the world. United States, Argentina, Indonesia, and Turkey are the locations where the exports are made the most.

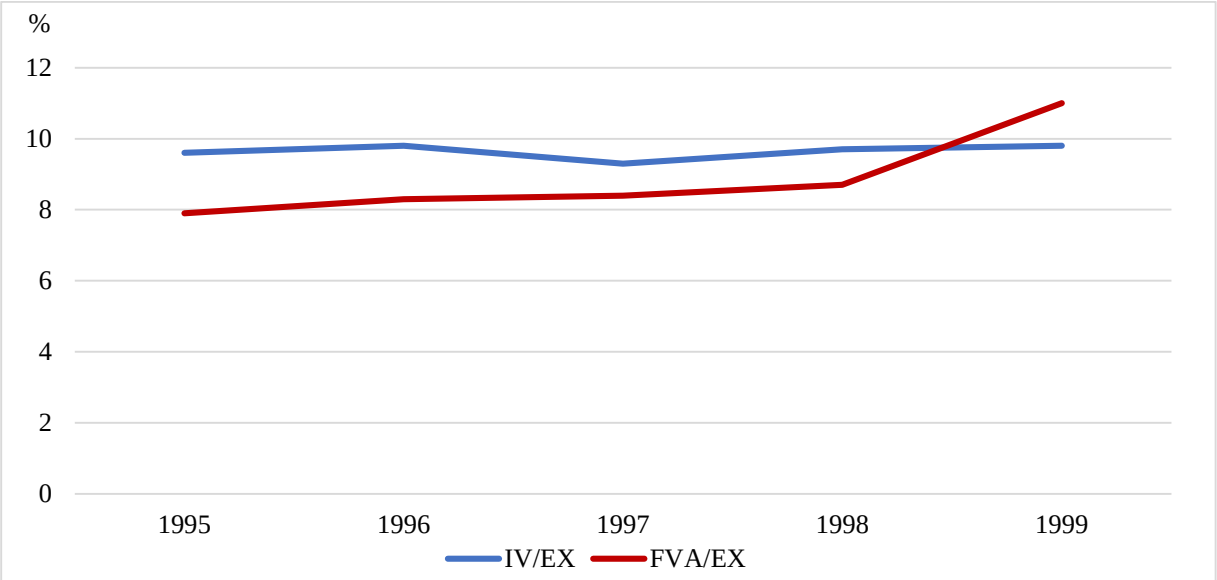

Figure 5: IV and FVA Shares (%) in Gross Export of Brazil, 1995-1999

Source: Author's own calculations

In Brazilian exports, the share of DVA is substantially high. In the 2000-2014 period, the average DVA share is almost 88%. The 2009 crisis deteriorated gross export in the country. While the DVA has fallen significantly, the demand for imported goods to export (FVA) has much more decreased. Figure 5 exhibits a sharp decline in FVA share from 2008 to 2009.

One of the properties that separate Brazil from other countries examined in this thesis is that the country has IV and FVA shares that are close. As can be observed in Figure 4, the share of IV is even higher than FVA for the 1995-1998 period.

The gap between the share of IV and FVA shares in gross export which determines the position of the country has decreased in some years. While the country was upstream until 1998, the IV share that is mostly constant and rising FVA share resulted in the position of the country in GVC to be more downstream.

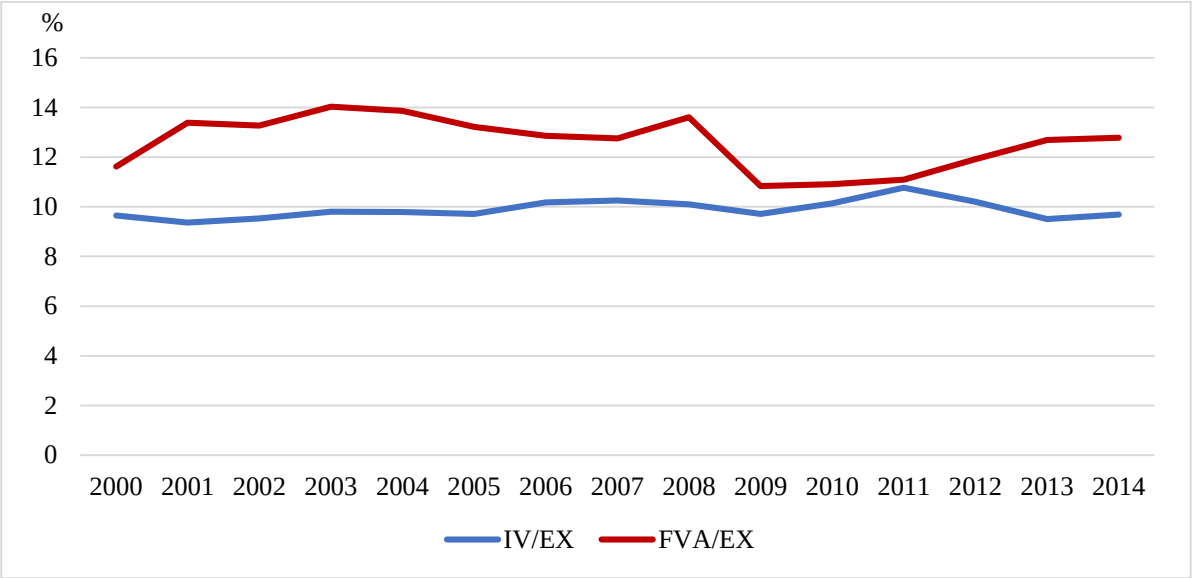

Figure 6: IV and FVA Shares (%) in Gross Export of Brazil, 2000-2014

Source: Author's own calculations

4.2.3. Hungary

While some countries suffer from the trade deficit, Hungary had a trade surplus in 2017. The gap between export and imports has been widening since 2009. The country is 35th in the list of world's largest exporters with 107 billion dollars of exports in 2017. (Atlas.media.mit.edu, 2019) Machinery and cars including vehicle parts constitute an essential part of the exports.

Even if Hungary has the trade surplus since 2009, this was not the case for the 1993-2009 period. The economy has suffered many problems some of which were government deficit, public debt, current account deficit, and inflation in 1997. (Žídek, 2014) The government decided to implement an austerity program in which the progressive devaluation of the domestic currency was involved to solve the existing problems. The gross export has continued to rise in the time of crisis because of the devaluation. The FVA share of gross export has risen in from 1996 to 1998 as a result of the demand for export.

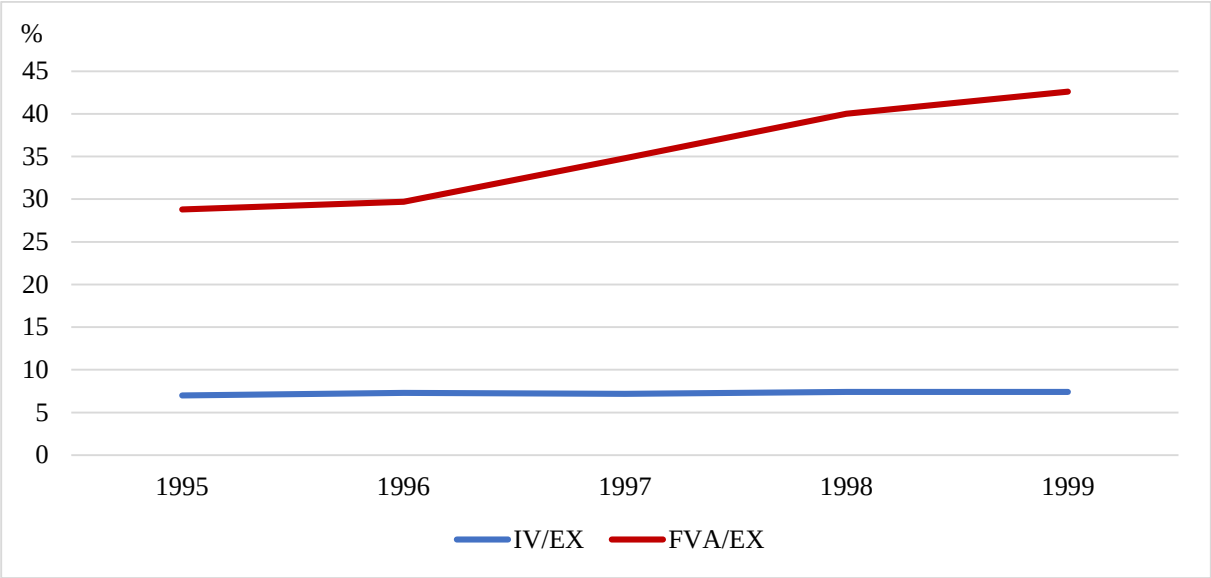

Figure 7: IV and FVA Shares (%) in Gross Export of Hungary, 1995-1999

Source: Author's own calculations

In the period 2000-2014, no major changes were observed in the FVA share. The DVA and FVA shares of the country are especially close to each other for this period. Hungary has also FVA that is considerably higher than IV. As in the case of Bulgaria, the countries position in GVC is downstream. The effect of the 2009 crisis on the FVA is similar to the other countries.

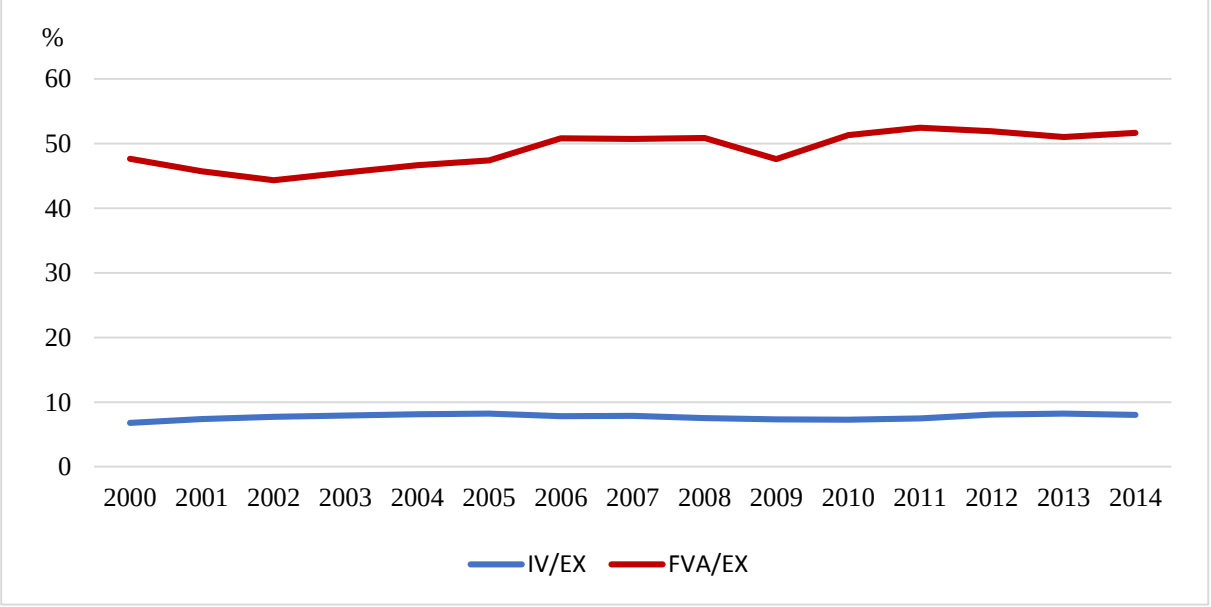

Figure 8 : IV and FVA Shares (%) in Gross Export of Hungary, 2000-2014

Source: Author's own calculations

4.2.4. Indonesia

Indonesia is a country that has achieved having a trade surplus in the period of 1999-2017. However, the slowdown in the export demand and increasing import have resulted in a trade deficit in 2018. The largest trade partners of the country are China, the USA, and Japan. The export of mineral and agricultural products and machinery creates almost 50% of the gross exports. (Atlas.media.mit.edu, 2019)

Asia Crisis in of 1997 that started in Thailand and spread to Asia caused both political and economic collapse in Indonesia. The depreciation of the Indonesian currency that has followed the fall in Thai baht triggered the inflation in the country. (Levinsohn, Berry and Friedman, 2003) Indebtedness in foreign currency has risen because of growing depreciation. The government had to agree with the IMF on the economic reform program for a more stable economy in 1997. The agreement ended in 2003.

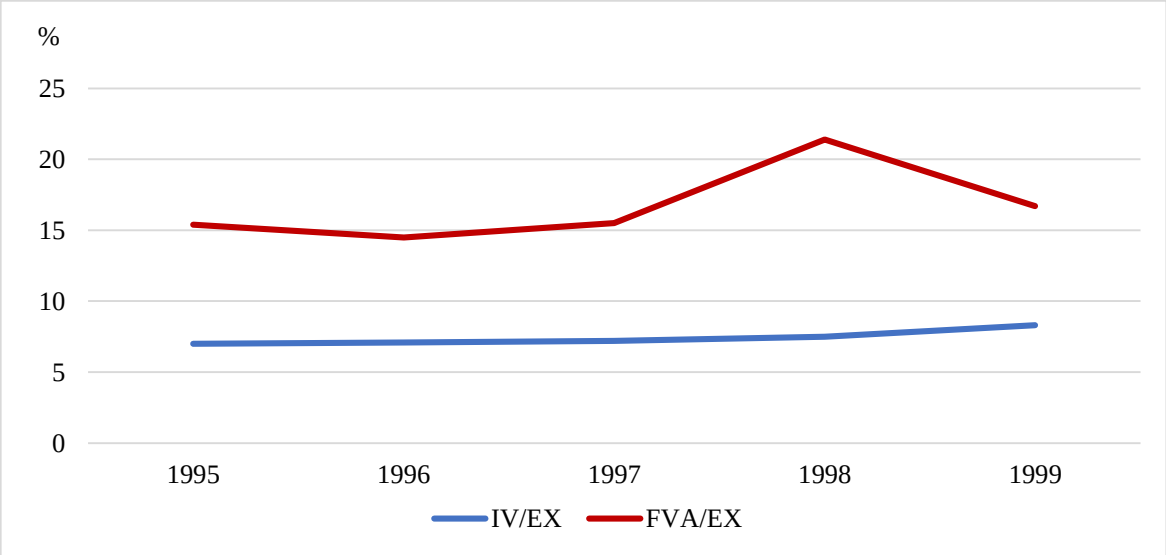

Figure 9: IV and FVA Shares (%) in Gross Export of Indonesia, 1995-1999

Source: Author's own calculations

The gross export of the country shrunk 20% in 1998 in comparison to the previous year. However, the fall in gross export has not affected the volume of FVA. The combination of

declining gross export and rising FVA resulted in a significant increase in FVA share from 1997 to 1998. Gross export has started to recover after 1997.

The IV share in gross export is around 10 % in the 2000-2014 period while FVA share is approximately 17%. Both IV and FVA shares of the country have not significantly changed as can be seen in Figure 9. The effect of the 2009 global crisis is also observed in Indonesia. The contraction in both domestic and foreign demand has resulted in a decline in FVA shares. Value-added generated from gross export is mainly domestic.

The countries' participation in the GVC that is equal to the summation of IV and FVA shares have also remained mostly constant. The average participation index for the 2000-2014 period is 25.9 % that is close to Brazil relatively low in comparison to Hungary and Bulgaria. The position of the country is classified as downstream as a result of FVA shares in gross export that is always higher than the share of indirect value added (IV).

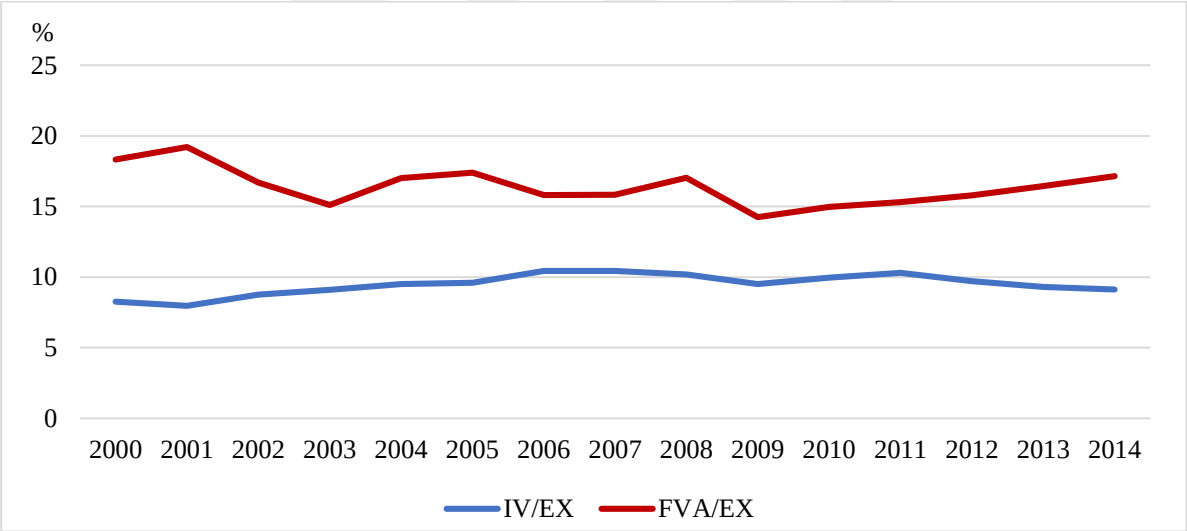

Figure 10: IV and FVA Shares (%) in Gross Export of Indonesia, 2000-2014

Source: Author's own calculations

4.2.5. Mexico

Mexico is the largest exporter among all the developing countries selected for this thesis. The country exported 418 billion dollars and is 9th in the world rankings in 2017. (Atlas.media.mit.edu, 2019) The USA is the top trading partner of Mexico and 80% of the total

demand for export comes from North America. Machinery, transportation, and mineral products are the main exporter sectors in the economy.

Mexico has experienced a currency crisis in 1994 as many developing countries did in the 1995-1999 period. As a result of political instability, the current account deficit, the increase in U.S. interest rates and lastly devaluation of the currency to prevent the decrease in foreign reserves have caused the peso crisis. The devaluation has triggered higher depreciation than intended and resulted in the withdrawal of foreign investors. (Espana, 1995) On the other hand, the depreciation of the peso that was pegged to the US dollar has improved existing trade and current account deficit. The country had a trade surplus in 1995.

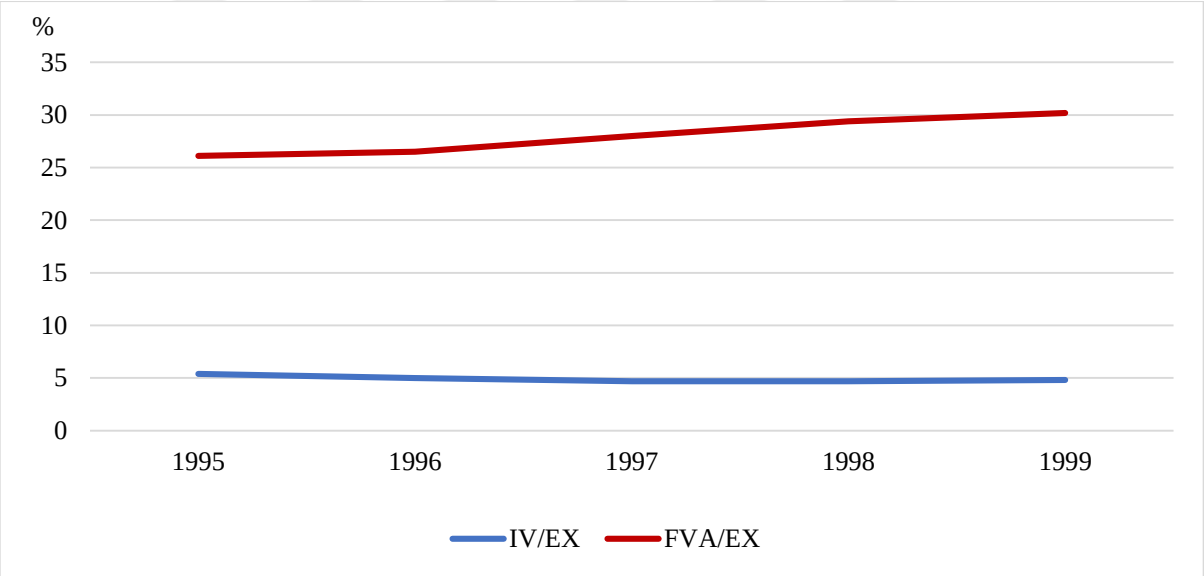

Figure 11 : IV and FVA Shares (%) in Gross Export of Mexico, 1995-1999

Source: Author's own calculations

The strong trade partnership between the U.S. and Mexico is also influential in the direction of trade. For this reason, one of the countries that were adversely affected by the 2008 recession in the U.S was Mexico. The dependence of exports to the U.S. has affected not only trade but also the whole economy. The export volume of the country has declined substantially because of reducing demand. The annual growth rate of exports in 2009 was -10.9%. The 2001

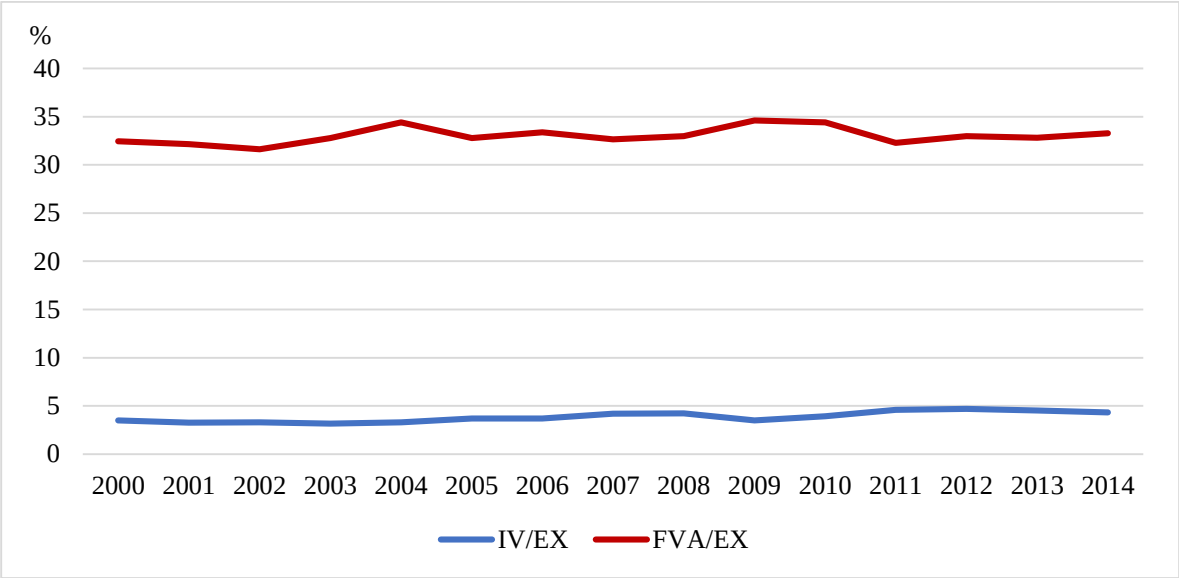

Figure 12: IV and FVA Shares (%) in Gross Export of Mexico, 2000-2014

Source: Author's own calculations

recession in the U.S. has also similar effects on Mexico. However, the effect of 2008 was more profound relatively to 2001 crisis in terms of trade.

The effects of 2001 and 2008 recessions can be seen in Figure 11. Gross export, FVA, and DVA have contracted in both crises. However, the fact that the decrease in gross export is higher than FVA created the impression that FVA has risen in for 2001 periods. On the other hand, the changes in FVA is stronger than gross export for 2009.

Strong backward participation because of high FVA share in gross is valid for Mexico. Even if IV share became higher in the 2002-2008 period, the position of the country in GVC still indicates downstreamness.

4.2.6. Turkey

Turkey exports to many different destinations where the United Kingdom, Germany, United Arab Emirates that are the countries with the highest shares. Gross exports constituted 24.8% of Turkey's GDP in 2017. Textiles, transportation, machinery, and metals are the top

exporter sectors in the economy. It is also the 27th in the worlds ranking that is made according to the export volume. (Atlas.media.mit.edu, 2019)

During the examined period, the county has suffered from two major crises in 2001 and 2008. The first signals of the 2001 crisis were observed in the 1999. The fundamental issues in the economy were accelerating government debt borrowed from the banks, high-interest rates, and inflation. The high inflation resulted in a stand-by agreement with the IMF in 1999 that included a Turkish lira that was pegged to the US dollar and aimed to reduce inflation. However, the program failed, and inflation continued to rise. Despite the measures taken such as leading the currency float and increasing interest rates, the capital began to leave the country and the Turkish lira depreciated significantly. (Akyüz and Boratav, 2003) The volume of DVA and FVA has declined because of economic instability from 1998 to 1999.

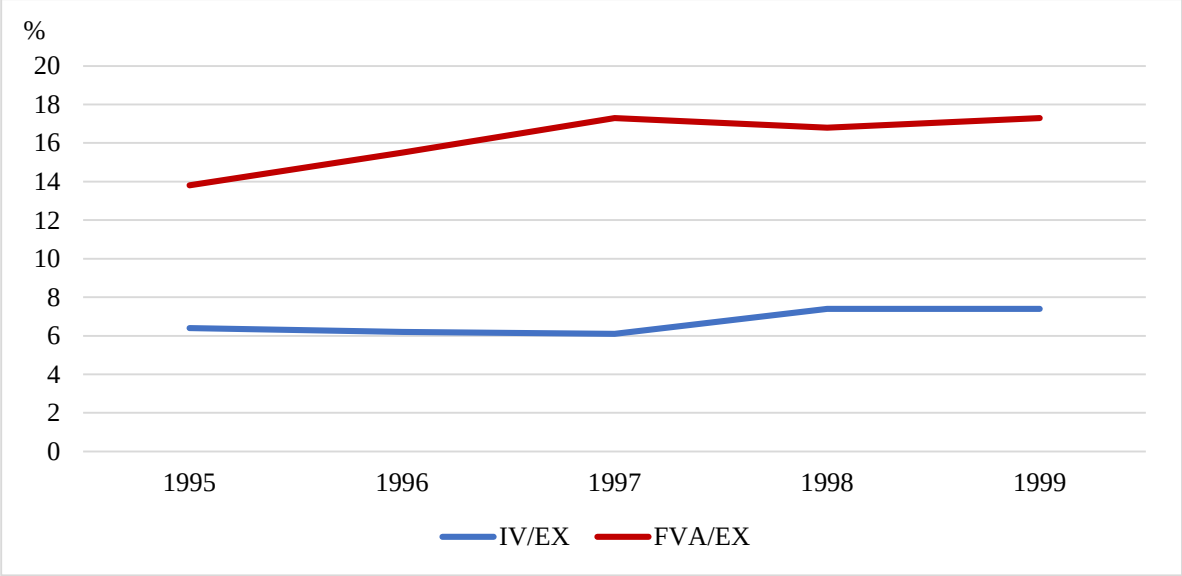

Figure 13: IV and FVA Shares (%) in Gross Export of Turkey, 1995-1999

Source: Author's own calculations

Country's rising integration to GVCs via imports has shown its effect with increasing FVA shares until the 2009 global crisis. The global crisis that started in the US also has shown its effect on the Turkish economy. The decline in external demand was the key factor affecting international trade. Both DVA and FVA content of the gross export diminished in 2009.

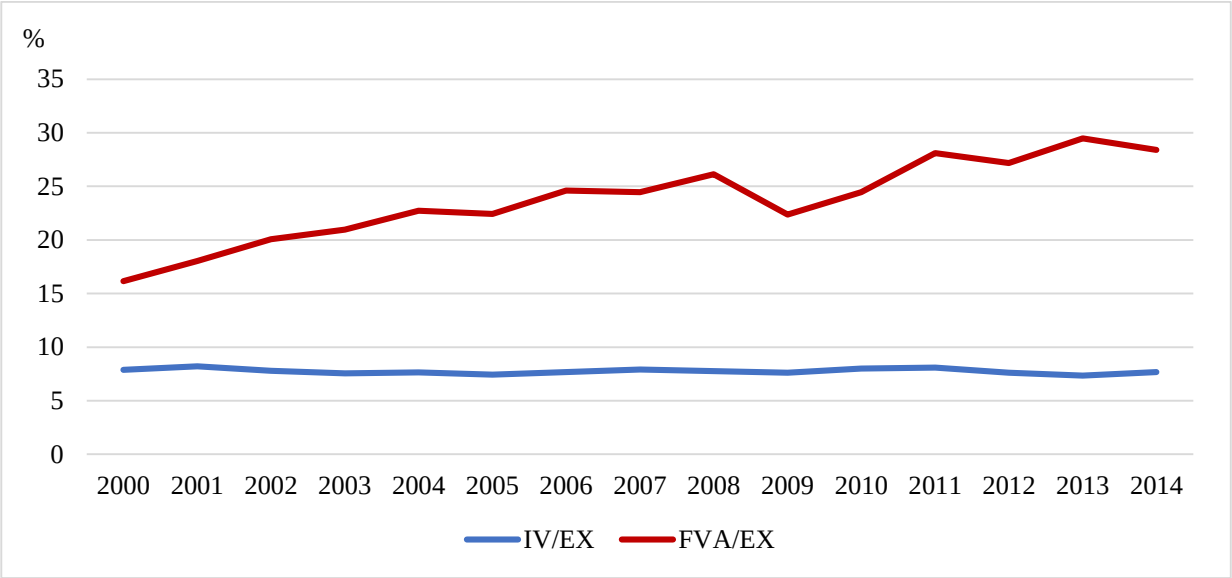

Figure 14 : IV and FVA Shares (%) in Gross Export of Turkey, 2000-2014

Source: Author's own calculations

The participation of Turkey to GVCs has mostly come from backward participation. The IV share in gross export has remained rather constant for the selected period. The position of Turkey in GVC is downstream because of rising FVA in gross export despite the fluctuations in both backward and forward participation.

All the six developing countries selected for this thesis have similar financial and currency crises experience in the 1995-1999 period. The regulations that have been taken to solve existing economic problems were mostly devaluation of the domestic currency and pegging the domestic currency to the U.S. dollar. However, failures of regulations resulted in the transition to the floating exchange rate regime.

For all countries, the FVA shares in gross export are higher than the IV share that indicates all countries' integration to the GVC mainly via imports. The trend in terms of movements in the FVA and IV shares in all countries is the rising share of imported goods in exports. Indirect value added that are exported to the third countries via re-export has remained mainly constant for all countries. While the participation of all countries to GVC has increased throughout the time, the position of all countries has become more downstream.

5. THE ESTIMATION AND RESULTS

5.1. The Effect of REER on Export Growth

Countries' competitive power in the global market depends on many economic factors. However, one of the most essential determinants of competitiveness as the literature exhibits is REER. Therefore, the base model for this thesis has been established by examining the effect of REER growth on export growth. The empirical approach followed in this model is similar to Rodrik (2009) Pierola and Freund (2012) and Eichgreen and Gupta (2013). They assign a panel framework with using log difference of the dependent and independent variables to analyze REER and export growth relationship.

$$dlnEXP_{it} = a_i + \beta_1 dlnREER_{it} + \beta_2 dlnGDP_{it} + \beta_3 dlnFGDP_{it} + \varepsilon_{it} \qquad (18)$$

Independent variable EXP_{it} in Equation 18 is export growth while dependent variable is growth of REER of countries[8]. Besides REER, Real GDP growth of home countries (GDP_{it}) and Real GDP growth of export partners $FGDP_{it}$ also added into model to control important determinants of export demand.[9] All variables are used in their log difference form to overcome unit root problem that comes from time dimension of the data.[10] Log difference of variables can be interpreted as growth rate. The results of the unit root tests for level and log difference form of the variables are in Appendix Table 11.

Summary statistics for the variables of the base model are given in Table 3. The dependent variable of the model export growth has a mean of 56 percentage point in the period of 1996-2011. The mean of REER growth, GDP growth of export partners and home countries' GDP growth and are 1.9, 2.3 and 3.2 percentage points in order. Between and within variations of selected variables points out higher variations in cross sections.[11]

[8] Export levels in US Dollar are translated into local currency with local exchange rates and deflated by CPI.

[9] Top 15 trade partners of countries between 1995-2011 are selected. GDP of these countries are weighted according to their export shares.

[10] Usage of log diference reduces time interval of the analysis by one year.

[11] See Appendix Table 12 for wtihin and between variation results.

Table 3

Summary Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
dlnEXP	96	.056	.148	-.378	.51
dlnREER	96	.019	.119	-.705	.355
dlnFGDP	96	.023	.018	-.045	.045
dlnGDP	96	.032	.039	-.141	.105

Source: Author's own calculation

The effect of an increase in the REER growth on export growth is expected to be negative because a rise in the REER expresses that domestic currency becomes more valuable against other currencies. Overvaluation of domestic currency results in more expensive exports for trade partners and thus less demand for exported goods. On the other hand, both the effect of real GDP growth of home country and trade partners are expected to be positive. The higher the GDP of trade partners generates higher demand for export.

Table 4

Diagnostic Tests for The Base Model

Heteroscedasticity	Serial Correlation	Cross Sectional Dependence***	
Wald Test*	**Wooldridge Test****	**Bruesh-Pagan LM Test**	**Pesaran (2004)**
Pr = 0.0000	Pr = 0.0081	Pr = 0.0410	Pr = 0.1816

* The null hypothesis for Wald test is $H_o: \sigma_i^2 = \sigma^2$ that indicates homoscedasticity.

** The null hypothesis for Wooldridge test is no first order autocorrelation.

*** The null hypothesis for both Bruesh-Pagan LM and Pesaran tests is no cross-sectional correlation.

Source: Author's own calculations

Before the analysis, the diagnostic tests for heteroscedasticity, serial correlation and cross-sectional dependence have been performed to detect estimation method that is suitable for the model and the data. The results of the tests are given Table 4. Wald test for heteroscedasticity and Wooldridge test for autocorrelation have indicated that the model suffers

from both problems. For cross-sectional dependence, Pesaran (2004) and Bruesh- Pagan LM cross sectional dependency tests have been used separately. While Bruesh-Pagan LM test points out the case of no cross-sectional dependence, the results of Pesaran (2004) test fail to reject cross-sectional independence. These contradictory results show a possible cross-sectional dependence problem in the model that must be considered.

To evaluate the relationship between REER growth and export growth, four different estimation methods have been assigned. These methods are fixed effect, pooled OLS, Newey-West and Beck-Katz estimators. The results are demonstrated in Table 5. Newey-West estimation have been exploited to have standard errors that are resistant to heteroscedasticity and first order autocorrelation. The model 3 and 4 have been estimated by using Newey-West estimators. The difference between these two regressions is the usage of CCE mean group estimation of Pesaran (2006) that is mentioned in section 3.4. in the last model. Cross-sectional means of dependent and independent variables have been added into the model to overcome possible cross-sectional dependence in estimation 4.

Table 5

The Effect of REER Elasticity on Export Growth, 1996-2011

VARIABLES	(1) FE	(2) POLS	(3) NEWEY-WEST	(4) NEWEY-WEST (CCEMG)	(5) BECK-KATZ
dlnREER	-1.009***	-0.987***	-1.009***	-0.984***	-1.008***
	(0.0931)	(0.0912)	(0.124)	(0.124)	(0.0888)
dlnFGDP	3.080***	2.986***	3.080***	0.981	2.932***
	(0.613)	(0.595)	(0.589)	(2.103)	(0.566)
dlGDP	1.178***	1.116***	1.178**	0.902*	1.239***
	(0.312)	(0.303)	(0.535)	(0.534)	(0.340)
Constant	-0.0330**	-0.0293*	-0.0333	-0.00923	-0.0335
	(0.0162)	(0.0160)	(0.0347)	(0.0399)	(0.0381)
Country Fixed Effect	Y		Y	Y	Y
Observations	96	96	96	96	96
R-squared	0.628	0.6169			0.636
Number of country	6	6	6	6	6

Note: *** indicates statically significant at 1%, ** indicates statically significant at 5% and * indicates statically significant at 10%.

Source: Author's own calculations

The coefficients of the REER for all five estimations are statically significant. They indicate that the appreciation of domestic currency leads negative growth in export. The REER elasticity of export is -1.009 and -0.984 respectively according to the estimation 4 and 5. These elasticities can be also interpreted as 10 percentage point increase in REER results in 9 to 10 percentage point decline in export growth. The effect of GDP growth on export growth is positive and statistically significant in all estimations. 10 percentage increase in home countries GDP and trade partners GDP creates around 11% and 30% export growth, respectively.

Table 6

The REER Elasticity of on Gross Export Growth in Sub-Periods

	1996-2003		**2004-2011**	
	(1)	(2)	(3)	(4)
VARIABLES	Newey-West	Beck-Katz	Newey-West	Beck-Katz
dlnREER	-1.095***	-1.110***	-0.544***	-0.495**
	(0.182)	(0.125)	(0.157)	(0.220)
dlnFGDP	2.533*	2.514**	2.865***	2.671***
	(1.254)	(1.090)	(0.628)	(0.974)
dlnGDP	1.139	1.264**	1.255**	1.274**
	(0.870)	(0.519)	(0.569)	(0.539)
Constant	-0.0193	-0.0246	-0.0440	-0.0436
	(0.0536)	(0.0569)	(0.0434)	(0.0443)
Country Fixed Effect	Y	Y	Y	Y
Observations	48	48	48	48
R-squared		0.709		0.596
Number of country		6		6

Note: *** indicates statically significant at 1%, ** indicates statically significant at 5% and * indicates statically significant 10%.

Source: Author's own calculations

The period of 1996-2011 includes many economic events that have affected the trade volumes, directions and types in countries. To understand the changes in the REER elasticity of exports in this period, the analysis has been divided into two main sub periods which are 1996-2003 and 2004- 2011. The period has been divided from the year of 2003 specially to consider impact of early 2000 recession on REER elasticity.

The estimation for two sub-periods clearly shows that the elasticity is reduced. The elasticity of REER in the 1996-2003 period is around -1.1 according to the column 1 and 2 in the Table 6. However, when the effect of REER growth on export growth has investigated for 2004-2011 period, the elasticity of REER has declined significantly.

5.2. The Effect of GVC Integration on Export Growth

When the relation between REER and GVC integration has been observed from the production side, for a country that performs high backward participation (usage of imported intermediates in export), a depreciation results in rise in production cost and lost in competitive power. On the other hand, a depreciation provides higher competitiveness for the countries with a high forward participation (re-export of intermediate goods by direct importer). (Ahmed et al., 2015)

As shown in the section 5.1., the REER elasticity of gross export has declined from 1996-2003 period to 2004-2011 period. The question at this point is that whether higher participation of the countries via backward or forward integration to the GVCs is one of the main reasons for the declining REER elasticity. To investigate this question, the study that was conducted by Ahmed, Appendino and Ruta (2015) has been followed as a benchmark model. They examined the effect GVC integration on REER elasticity for manufacturing sector of 46 countries in 1996-2012 period by using fixed effect panel framework. They exploited sectoral GVC indices for the analysis and use percentage change of gross export and REER instead of log differences that is used for this thesis.

The main model for this study has been formed as follows,

$$dlnMEXP_{it} = a_i + \beta_1 dlnREER_{it} + \beta_2 dlnGDP_{it} + \beta_3 dlnFGDP_{it} + \beta_4 dlnREER_{it} x\ GVCparticipation + \varepsilon_{it} \quad (19)$$

In the main model, $dlnMEXP$ stands for export growth of manufacturing sector. The reason of selecting the sector specifically instead of gross export is that first, international fragmentation of manufacturing sector is one of the main sources of existing global supply chains and GVCs. The second reason is usage of sector and subsectors is better to eliminate possible endogeneity problem that might occur. The effect of the REER elasticity, GDP growth of home countries and export partners' GDP growth are expected to be same as in the base model in the section 5.1. On the other hand, the sign of β_4 that stands for the impact of GVC integration on REER elasticity might be negative or positive.

In Table 7, different GVC participation indices that are based on gross export have been added into the model to estimate effect of integration on REER elasticity. Before the estimation, the diagnostic test has also been applied to the main model. The results indicated only existence of heteroskedasticity problem. Therefore, fixed effect with robust error have been used for the estimations to correct heteroskedastic standard errors. For better intuition and to address possible endogeneity, the GVC integration indicators which are IV, FVA and GVPA has been transformed into binary variables. The variables are equal to 1 when the developing countries' integration via backward (FVA_{exp}) forward (IV_{exp}) or total ($GVCPA_{exp}$) is higher than previous year and 0 otherwise.

The findings in Table 7 show that REER elasticity of manufacturing export is around -1 that indicates the positive effect of depreciation of domestic currency relative to others on manufacturing export growth. The coefficient of REER can also interpreted as growth rate. So, 10 %-point depreciation of domestic currency generates 10% growth in manufacturing sector. The REER elasticity of gross and manufacturing exports are close to each other. According to the result, 1% increase in export partners' GDP and home countries GDP generate 4% and 1% rise in manufacturing exports in order. When the coefficients of export partners' GDP are compared with the results in Table 5, the effect of partners' GDP is higher for the manufacturing exports than gross export which exhibits change in export partners GDP generates higher

growth for the manufacturing sector than gross export. The coefficients for the interaction terms shows that even if the GVC integration generate lower REER elasticity, they are statistically insignificant at 1%, 5% and 10%.

Table 7

The Effect of GVC Integration in Gross Export Level on REER Elasticity of Manufacturing Export, 1996-2011

VARIABLES	(1)	(2)	(3)	(4)
dlnREER	-1.053**	-1.067***	-1.057***	-0.987**
	(0.279)	(0.141)	(0.116)	(0.291)
dlnFGDP	4.088***	3.809***	3.868***	3.565***
	(0.324)	(0.341)	(0.300)	(0.436)
dlnGDP	0.966***	0.940***	0.957***	1.069**
	(0.189)	(0.215)	(0.178)	(0.293)
dlnREER # IV_{exp}	0.0808			
	(0.312)			
dlnREER#FVA_{exp}		0.109		
		(0.113)		
dlnREER#$GVCPA_{exp}$			0.0878	
			(0.0897)	
dlnREER#$GVCPO_{exp}$				-0.00708
				(0.306)
Constant	-0.0321**	-0.0486**	-0.0475**	-0.156
	(0.0112)	(0.0143)	(0.0141)	(0.0969)
Observations	96	96	96	96
R-squared	0.547	0.539	0.538	0.546
Number of country	6	6	6	6

Note: *** indicates statically significant at 1%, ** indicates statically significant at 5% and * indicates statically significant 10%.

Source: Author's own calculations

The findings from Table 7 shows that various GVC integration indices that were calculated based on gross export did not have any significant effect on REER elasticity of manufacturing export. As a second measure of integration, GVC performance of manufacturing sector have been selected as Ahmed et al. (2015) did in their study. IV, FVA, GVPCA and GVCPO indices for the sector have been calculated by using TiVA statistics of OECD for the 1996-2011 period. The same control variables are also included into the analysis. The integration indices have been transformed into binary variables as before and fixed effect with robust errors have been exploited for the estimations.

The Table 8 demonstrate the effect GVC integration of manufacturing sector on REER elasticity of the sector's export. The relationship between control variables and independent variable is similar with the Table 7. The sign of $dlnGDP$ and $dlnFGDP$ are positive and the coefficients are statically significant. The REER elasticity of manufacturing export is negative and around -0,9. The binary integration indices which are FVA_{m_exp}, IV_{m_exp} $GVCPA_{m\_exp}$ and continuous $GVCPO_{m\_exp}$ are statically insignificant.

As a last measure of integration, FVA, IV Participation and Position indices of manufacturing sector that is collected from OECD TiVA database are directly added into the main model as a continuous variable. The results of the estimations are given in the Table 9. The REER elasticity of manufacturing export is around -0,9 that also points out the 10-percentage point increase in REER creates 9 percentage point growth in the export. The coefficients for the control variables are coincides with the previous estimation. The essential result of the analysis is the effect of GVC participation on REER elasticity that is statically significant at 10%. The 3rd estimation in the model can be interpreted as the decreasing effect of GVC integration on REER elasticity. The average GVC participation ($GVCPA_{m\_exp1)}$ for the manufacturing sector of selected 6 developing countries is 34% in 1996-2011. In case no GVC participation, the elasticity is equal to -3,4. However, the REER elasticity decreases to -2,1 for a developing country with 34% GVC participation.[12] Therefore, the participation of manufacturing sector for the developing countries generate 21% decline (from -3,4 to -2,1) in the elasticity.

[12] For a 34% GVC participation the coefficient of interaction term is 34*0,0385=1,309, When it is summed up with existing coefficient of REER elasticity, the new REER elasticity will be -3,429+1,309= -2,12.

Table 8

The Effect GVC Integration in Manufacturing Sector Level on REER

Elasticity of Manufacturing Export, 1996-2011

VARIABLES	(1)	(2)	(3)	(4)
dlnREER	-0.885***	-0.964***	-0.886**	-0.911***
	(0.133)	(0.129)	(0.305)	(0.169)
dlnFGDP	3.665***	3.157***	2.899***	4.158***
	(0.455)	(0.478)	(0.487)	(0.406)
dlnGDP	0.828***	0.842***	1.037***	0.772**
	(0.123)	(0.120)	(0.192)	(0.278)
dlnREER # IV_{m_ex}	-0.0976			
	(0.130)			
dlnREER#FVA_{m_ex}		0.0649		
		(0.119)		
dlnREER#$GVCPA_{m\_exp}$			-0.0843	
			(0.330)	
dlnREER#$GVCPO_{m\_exp}$				-0.0150
				(0.198)
Constant	-0.0136	-0.0670**	-0.0737*	-0.0388**
	(0.0136)	(0.0183)	(0.0328)	(0.00973)
Observations	96	96	96	96
R-squared	0.555	0.563	0.570	0.572
Number of country	6	6	6	6

Note *** indicates statically significant at1%, ** indicates statically significant at 5% and * indicates statically significant 10%. The standard errors in parenthesis are robust.

Source: Author's own calculation

Table 9

The Effect of GVC Integration of Manufacturing Sector on REER Elasticity of The Sector, 1996-2011

VARIABLES	(1)	(2)	(3)	(4)
dlnREER	-1.315**	-1.153**	-3.429***	-0.911***
	(0.418)	(0.330)	(0.629)	(0.169)
dlnFGDP	3.642***	4.165***	3.725***	4.158***
	(0.593)	(0.477)	(0.577)	(0.406)
dlnGDP	1.080***	0.735**	1.019***	0.772**
	(0.199)	(0.243)	(0.160)	(0.278)
dlnREER # IV_{m_exp1}	0.00944			
	(0.00892)			
dlnREER#FVA_{m_exp1}		0.00848		
		(0.0109)		
dlnREER#$GVCPA_{m\_exp1}$			0.0385**	
			(0.00998)	
dlnREER#$GVCPO_{m\_exp}$				-0.0150
				(0.198)
Constant	0.312	-0.244	-0.154	-0.0388**
	(0.345)	(0.186)	(0.186)	(0.00973)
Observations	96	96	96	96
R-squared	0.562	0.566	0.573	0.572
Number of country	6	6	6	6

Note: *** indicates statically significant at1%, ** indicates statically significant at 5% and * indicates statically significant 10%. The standard errors in parenthesis are robust.

Source: Author's own calculations

The findings that are reached from the base and main model can be summarized as follows. When the determinants of developing countries' gross export have examined, REER Elasticity, GDP growth of home countries and trading partners' GDP growth have a significant effect. These variables explain almost 60% of the variation in the export growth. However, the

effect of REER elasticity of gross export has declined over time because of many factors such as global financial crisis. (Ahmed et al. 2015) When the role of GVC integration on the subject has investigated by selecting manufacturing sector specifically because of strong connection of the sector with the global supply chains, the effect of GVC participation has shown its effect even if it is slightly. The analysis that is conducted with participation indices of the sector directly, it shows that GVC participation generates 21% decrease in REER elasticity

6. CONCLUSION

GVCs have become an inseparable part of production and international trade in today's economies. The developments that have led to globalization also have brought the internationally fragmented and spatially dispersed production along. The GVCs provide many opportunities such as higher growth and employment. The integration to GVCs is also an opportunity especially for the developing countries to involve world trade more and reach new markets. Therefore, it is essential to understand and evaluate all aspects of the integration for better governance and policy implications in economies. This thesis focuses on one specific aspects of GVCs that is competitiveness. The aim of this thesis is to investigate whether higher participation to GVCs has affected developing countries' competitive power through changes in REER elasticity of export.

In general theory, a depreciation of domestic currency relative to the other currencies provides a higher competitive power for the home country with lower export prices. For products that are not purely domestic this effect has slightly canceled out. The reason for that is the depreciation also results in higher prices for the intermediate imports used in the production of exports. However, the responsiveness of gross export to the changes in REER has declined in the period of 1995-2011. One of the characteristics of the same period is rise in GVC activities that might occur in countries via backward and forward participation. When the performance of the developing countries has examined, the integration via especially backward participation by importing intermediates for export production has become more dominant. For that given reason, the share of foreign value added in export has risen significantly. One of the possible reasons of lower REER elasticity of gross export is that even if deprecation provides lower prices, the effect mostly canceled out because of higher imported good usage in the exports.

A panel framework with six developing countries have been formed for the period of 1996-2011 to observe the effect of GVC integration on REER elasticity. The base model conducted in the study aims to observe the relationship between REER elasticity and gross export growth. GDP of selected developing countries and their export partners' GDP have been also added into the model as control variables. The positive effect of depreciation on export growth was the main findings of the base model. However, when the selected period 1996-2011

have been divided into two sub-periods as 1996-2003 and 2004-2011, the declining effect of REER elasticity of gross export has been observed. The general slowdown in the world trade as a result of trade policies such as protectionism might be a possible reason of the case. Nowadays, some economies tend to focus on domestic production rather than foreign demand. Another possible explanation of decreasing REER elasticity is global financial crisis. The crisis is also one of the most essential factors of slowdown of international trade. On the other hand, as this study examines, lower REER elasticity of export might be explained with higher GVC share in gross export.

The effect of GVCs on REER elasticity of export have been evaluated by using the same panel framework established for the base model to construct the main model. The only difference between two models is employing manufacturing export as explained variable because the sector is at the center of the supply chains. To include GVC participation of developing countries into the analysis 3 different GVC measure have been assigned which are GVP participation of gross export and manufacturing sector as binary variables and participation of the sector in continuous terms. The results of the analysis have shown that GVC participation of manufacturing sector decreases REER elasticity of sector 21%.

There are still more room for improvement in terms of studies that work on the effect of GVC participation on REER elasticity and other aspect. First of all, the study can be expanded to the gross export level for developing countries by using different methods to control whether lowering REER elasticity is valid for the gross export. One of these methods might be using 5-year averages by increasing the number of countries and time interval. For more comprehensive study, other factor that are influential on export volume such as existence of trade barriers, custom unions or foreign direct investment can be added into the model. Another improvement as extension to this thesis might be analyzing the factors that affects the GVC integration of developing countries and triggers higher backward participation. The findings are especially essential for the policy implications in the future.

APPENDIX

Table 10

Variables and Data Sources

Variable	Explanation	Source
Gross Export	Real Export in Local Currency, Deflated by CPI	WIOD 2013 Release
Manufacturing Export	Real Manufacturing Export in Local Currency, Deflated by CPI	OECD-TiVA
Real Effective Exchange Rate (REER)	Real Effective Exchange Rate (Broad Indices)	Bank for International Settlements
Real GDP	GDP in 2010 Constant $	World Bank
Real GDP of Trade Partners	GDP in 2010 Constant $ weighted by Export Shares	World Bank
Consumer Price Index	Consumer Price Index	World Bank
Other Exchange Rates	Local Currency vs US Dollar	Bank for International Settlements
GVC Participation Indices (Gross Export)	Indirect and Foreign Value-Added Shares in Gross Export	WIOD 2013 Release
GVC Position Indices (Gross Export)	Position Index based on Indirect and Foreign Value-Added Shares in Gross Export	WIOD 2013 Release

Variable	Explanation	Source
GVC Participation Indices (Manufacturing Sector)	Indirect and Foreign Value-Added Shares in Manufacturing Export	OECD-TiVA
GVC Position Indices (Manufacturing Export)	Position Index based on Indirect and Foreign Value-Added Shares in Manufacturing Export	OECD-TiVA

Table 11

Im-Pesaran- Shin (1997) Unit Root Test

Variable	t-bar	t-tilde-bar	z-t-tilde-bar	p-value
EXP	-0.7058	-0.6949	2.2287	0.9871
RER	-1.9132	-1.7529	-1.1394	0.1273
GDP	0.3954	0.3338	5.5036	1.0000
FGDP	-1.1858	-1.1366	0.8227	0.7947
dlnEXP	-4.4621	-3.0323	-5.2657	0.0000
dlnREER	-4.4424	-3.0026	-5.1708 -	0.0000
dlnGDP	-3.6382	-2.7482	4.3572	0.0000
dlnFGDP	-3.1641	-2.5382	-3.6857	0.0001

Table 12

Between and Within Variation of Variables

Variable		Mean	Std.Dev.	Min	Max	Observations
dlnEXP	overall	0.054	0.166	-0.393	0.767	N = 96
	between	0.014	0.03	0.067		n = 6
	within	0.165	-0.369	0.791		T = 16
dlnREER	overall	0.019	0.119	-0.705	0.355	N = 96
	between	0.015	-0.001	0.041		n = 6
	within	0.118	-0.685	0.375		T = 16
dlnFGDP	overall	0.023	0.018	-0.045	0.045	N = 96
	between	0.004	0.019	0.028		n = 6
	within	0.017	-0.041	0.044		T = 16
dlnGDP	overall	0.032	0.039	-0.141	0.105	N = 96
	between	0.007	0.023	0.043		n = 6
	within	0.038	-0.146	0.094		T = 16

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