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The Effect of Custom Unions and Currency Unions on Bilateral Value-Added and Gross Exports at the Example of the European Union and European Monetary Union between 2005 and 2015

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Abstract

This paper examines the possible effect on international trade, measured by value-added exports and compared to gross exports, due to entering the European Union (EU) and further, adopting the Euro as the main legal tender. Using a large panel dataset, covering 64 economies over the years of 2005 until 2015 and by means of seven differentiated sectors, three hypotheses have been tested. Firstly, the effect of solely joining the EU on bilateral trade flows has been examined, showing that there seems to be negative effects on imports originating from outside the customs union. Secondly, the analysis of adopting the Euro appears to be positive, however, has also shown negative associations concerning outer-institutional trade. Lastly, the third hypothesis deals with the impact on certain sectors, where contradictional results were obtained, depending on the model chosen. Such findings can be implemented by nations considering becoming part of the EU and/or exchanging their domestic currency for the Euro, hence, giving up their independent monetary policy.

1. Introduction

Transborder unification efforts have been in place and exploited extensively over the past centuries. The phenomenon of globalisation in combination with the surging importance of Global Value Chains (GVCs), have guided countries across the globe to engage heavily in trade as well as monetary unions (Rose and Engel, 2002). One of the most famous and recent examples being the European Union (EU). A survey conducted in 2019 shows that the trade policy followed by the EU seems to be widely accepted throughout its member states. Among the roughly 30000 respondents, 60% claim that they benefit from international trade. Yet, breaking this figure down by member states, it exhibits significant variation in responses. Nearly half of the Romanian citizens for example – Romania recently joined the EU in 2007 – believe to not benefit from the EU's trade policy (European Commission, 2019). This raises interest and doubts about the effectiveness of a single trade policy, applying to all its member states.

Since the creation of the EU, a vast amount of papers have analysed the effect of further integration on international trade, especially with an emphasis on joining the European Monetary Union (EMU). According to Glick and Rose (2002), joining a currency union doubles the bilateral trade flows, while the opposite, leaving a monetary union leads to the reversed effect. Nevertheless, the rise in trade of intermediate goods and the surging interest of countries in gaining access to GVCs, namely vertical trade, has been growing substantially (Daudin, Rifflart, & Schweisguth, 2011). Traditionally, trade flows have been measured as the sum of gross exports (GX). This certainly composes a biased estimate of international trade, as inputs nowadays pass borders multiple times and thus, do not tell where the value-added is eventually consumed (Johnson 2014).

The phenomenon of a particular good or service crossing a border multiple times and each time its price being fully included into the gross exports of a nation is called "double counting" (Koopman et al., 2014). Since the measure of gross exports adds the selling value once again to the corresponding country's national account when an intermediate goods/services cross the same border another time, it could lead to overstating of international trade statistics.

At the example of the United States, Feenstra (1998) shows that the rising trade integration has been accompanied by drastic disintegration of production across borders, which makes it increasingly more difficult to determine where value has been added along the production process. In combination with double counting, traditional trade statistics become less reliable to determine the trade value contributed by any particular country.

These threats can be resolved by using value-added bilateral trade figures, which might provide a more accurate measure for analysing the effect of international integration and major economic instances on bilateral trade flows. Johnson and Noguera (2012) define value-added exports (VA) as: "the amount of value-added from a given source country that is consumed in each destination (i.e. embodied in final goods absorbed in that destination)".

Gross exports only capture the direct exports of one economy to another, whilst value-added exports also incorporate the indirect contribution made by the exporter in the final demand of the importer. Therefore, one country could have substantial contribution to the value of final demand in another, whilst not even directly exporting to this economy, which is not fully captured and visible when using gross exports. Building on the work of Johnson and Noguera (2012), Laget et al. (2018) have shown that deep trade agreements are strongly

correlated with positive effects on bilateral value-added exports. Furthermore, they also differentiate by sectors, showing that the positive impact is larger for the service sector, which is seemingly more dependent on value-added trade.

The aim of this paper is to combine the past and recent literature with new measures to study the effect of joining the European Union and especially the EMU, between 2005 and 2015, on value-added export patterns. It allows for comparison between previously obtained effects of entering a trade agreement and predominantly the impact on direct and indirect bilateral trade of joining a currency union, at the example of the EU and EMU. In addition, this will be broken down by sectors to observe the corresponding dependencies on value-added exports by industry and all results will be compared to traditional trade statistics, in form of gross exports. Johnson and Noguera (2012) illustrate, by comparing value-added to gross exports, that a considerable amount of heterogeneity between sectors exists. Regarding the Manufacturing sector value-added exports over gross exports is decreasing over time indicating that the value-added content is either decreasing or remaining steady, while gross exports are either staying the same or increasing, respectively. Contrarily, the opposite holds for the Agriculture, Forestry and Fishing sector. Henceforth, the following research question in combination with a complementary sub-question are raised:

What is the effect of joining the European Union and particularly the European Monetary Union on bilateral value-added and gross exports? And are specific sectors differently affected?

Studying this matter allows one to recognize the benefits and drawbacks of having interdependent economies, all connected by value chains. It gives insights into the value-added content of certain industries and shows which countries and industries benefit or lose from such trade agreements and adopting a more globally dealt currency. Analysing the effect of a currency union is of great interest because it composes a strong commitment. It is much more costly to break, compared to a theoretically fixed exchange rate (Alesina & Barro, 2002). It may also strengthen the stability for an economy and thus, increases certainty with regards to investment and risk in pricing when engaging in international trade. However, others have argued that increased volatility actually increases firms' exports options and leads to gains from trade, given that firms can easily reallocate their products to different markets (Broll and Eckwert, 1999). Whether this is the case for the Euro-area remains to be analysed.

Since 2005, three countries have entered the EU; Bulgaria and Romania in 2007, whilst Croatia joined in 2013 (European Union, 2020). Additionally, seven economies further integrated into the global economy by adapting the Euro as their main currency. Of these seven, Slovenia did so in 2007, Malta and Cyprus in 2008 and Slovakia in 2009. The remaining three are the Baltic states. Estonia, Latvia and Lithuania, who gave up their independent monetary policy in 2011, 2014 and 2015, respectively (European Union, 2020).

This work will analyse three hypotheses. The first, deals with the effect of joining the EU on inter- and outer-institutional trade, whereas the second one states that there is a positive impact of adopting the Euro on country-pair trade. The last hypothesis dis-aggregates the data and is concerned about the outcomes with respect to the seven different sectors. The results are based on two different models, once the traditional Fixed Effects model

with dyadic constant is considered and additionally, the PPML model, developed by Silva and Tenreyro (2006), is conducted as a robustness check.

1.1. Paper Structure

This introduction is followed by the theoretical evidence, underlying the matter raised from the related literature's point of view. This is split in the goals of the EU, the most relevant drawbacks of joining the EMU and a brief theoretical implementation of the main variables of interest, namely, value-added and gross exports. The corresponding literature review develops three hypotheses that will assist in answering the central questions to this research. Then, the data sources as well as the dependent, independent and control variables will be outlined in section 3 of this paper. Subsequently, this database is used in the methodology. All corresponding and relevant techniques to this paper will be explained and developed in the fourth section. The reasons regarding the intuition behind these will be specified, and the statistical tools to measure the validity of these methods will be familiarised. In the subsequent section, section 5, the most relevant results will be presented and discussed, linking these to each hypothesis. Eventually, the work is briefly summarized within the conclusion in section 6 and additionally, this is followed by a discussion of possible limitations, policy implications and suggestions for further research.

2. Theoretical framework

This section aims to outline the theoretical findings in the context of international trade on custom unions and monetary unions, particularly, emphasizing the effect of joining the EU and EMU. Besides that, the most relevant theoretical concepts will be analysed. Before developing several hypotheses and theoretical reasons, the main findings with regards to the dependent variable used throughout this paper will be presented. In addition, it outlines two caveats that have emerged in the recent literature when dealing with traditional trade statistics.

2.1. Trade in Value-Added and Caveats regarding Gross Exports

Previously, a formal definition of value-added exports, which is now accompanied by the related scientific context, has been given. It represents the value-added content, which sectors export both directly and indirectly through final goods and services or intermediate products, to foreign consumers, households, companies and governments. This can happen via direct trade or by passing through other countries and destinations towards its final stage of production. Traditionally, national accounts have been used to obtain and interpret the consequences of certain events on international trade. However, as these only record gross shipments one is unable to observe how the value added at various stages of production is traded amongst the global economy (Johnson and Noguera, 2012). Additionally, Feenstra (1998) has shown that rising trade integration is matched with fragmentation of production across borders. As intermediate input goods follow international GVCs, they typically pass through several countries and cross borders multiple times.

A majority of the current work is an extension to the pioneering long-run examination of vertical specialisation by Hummels et. all (2001). Using Input-Output tables covering 10 OECD and four emerging countries over the period of 20 years (1970-1990), they show that intermediate goods used in producing exports account for around 21% of a country's exports. Furthermore, this grew by roughly one-third within the timeframe taken into consideration. By developing a more focused foundation, they have tried to channel prior research, that relied heavily on arbitrary measurement concepts of intra-product specialisation, leading to highly contradictory results.

Building on this study, Johnson and Noguera (2012) formally develop the indicator of value-added exports, which is used as one of the main variables throughout this work. Their development of the input-output system consists of stacked market conditions by country and sector. These determine the total value of output of a specific domestic sector, entailing the sum of the value of all final goods shipped to the importing country as well as the summation of all intermediate input by the other country's sectors, imported from the domestic sectors. Based on that they are able to determine direct shipments of final goods to other countries and intermediate goods from industry to industry. Consolidating each of these into block matrixes and applying the Leontief inverse, they are able to determine the value of output from each nation and industry required to produce specific final goods. In addition, to finally derive at value-added exports, the authors split the vector of shipments of final goods into destination-specific vectors, which then can be used to differentiate between the various cases of an indirect contributions and direct ones, deriving the final measure of trade. This will be discussed in more detail in the next section, where the mathematical point of view is outlined further.

Based on this new concept, which is widely accepted and has been applied more frequently over the past few years[1], Johnson and Noguera (2012) developed five stylized facts about changes in value-added exports over gross exports. Interestingly to point out, the ratio of value-added content to gross exports is declining by around ten percentage points over the accounting period of four decades, which even exhibits acceleration over time for the 42 OECD countries considered in their analysis. The paper covers the years between 1970 and 2009. This is an indication that double counting in gross trade seems to be a major problem, which particularly emerged in the past decades.

A popular example to describe this issue, are goods produced by the technology company Apple. Its products are designed in the USA, while the assembly is performed in China with inputs imported from a vast array of different countries. This becomes even more complex if taken into consideration that different assembly facilities involved in the production process use intermediate inputs at different locations, yet, both contribute to the value of the product (Investopia, 2020). The question that remains with traditional trade figures is the following: where does the value-added content of final demand has been contributed to the production process and where is it eventually consumed?

Regarding this question, the publication by Koopman, Wang and Wei (2014) deals with the difference between value-added exports and gross exports. Also, they are emphasizing the rising issue of double counting when interpreting results based on gross exports. Their analysis shows that vertical trade along the supply chain seems to be especially present in emerging countries, located in Asia or South America. The Philippines express a share

[1] See Daudin, Rifflart, and Schweisguth (2011); Johnson and Noguera (2012a); Timmer et al. (2014); Koopman, Wang, and Wei (2014); Los, Timmer, and de Vries (2015); Kee and Tang (2015)

of vertical trade of over 70% of its total gross exports, indicating that more than half of their exports do not directly reach their final destination. Nevertheless, such high figures are also observed for small open economies like Singapore. Expressed as the share of total gross exports, double counting ranges from around 64% in the processing sector in Mexico to 15% in Japan. There is also great heterogeneity between western EU countries and new member states with regards to the double counting shares. These results further fuel the need for an answer to the question presented in the previous paragraph, since gross exports simply do not show where these exports are finally consumed and may be overstated.

Daudin, Rifflart and Schweisguth (2011) demonstrate that for given reference years specific sectors exhibits ratios of over 100%. This can be explained by the fact that goods produced in certain industries, like for example agriculture and utilities, rely heavily, if not nearly completely, on exporting intermediary goods. This is also supported by the findings of Johnson and Noguera (2012). They predict that there is great heterogeneity in the ratio of value-added exports to gross exports across sectors, countries and country-pairs. According to their outcomes, the ratio has fallen by almost 20 percentage points in the Manufacturing sector, whilst it increased outside manufacturing. Furthermore, adopting a regional trade agreement (RTA) has shown a 5 to 11 percentage point decrease in this ratio. Deep agreements seem to be even more negatively associated than shallow ones. This potentially predicts that the EU, which can certainly be considered as a deep trade agreement, should be correlated with further fragmentation.

Therefore, several hypotheses will be developed that try to shed light on the recent developments with regards to the ongoing fragmentation of production and changes in economic integration at the example of the EU and EMU. Additionally, the traditional trade figures are compared with value-added exports.

2.2. European Union and International Trade

As of 2020, the European Union consist of 27 member states. It is the largest trading block in the world and being the biggest exporter of manufactured goods and services. One of its main goals and values, besides promoting peace, wealth and freedom for its citizens, is free trade. Liberalised trade has actually been one of its main founding principles (European Commission, 2020). A single and integrated market combined with a unified trading strategy amongst its member states makes the EU a strong organisation which may be better in collectively generating benefits to its citizens, than each country by itself. On the other hand, small states might not be well suited with the policy implementations by the EU, because of less bargaining power compared to the larger and leading economies (Panke, 2010).

Prior to Viner (1950), it has been widely believed that custom unions are welfare improving. Since tariffs are by theory associated with a deadweight loss, a fall in these should be related to a gain in overall welfare. He shows that whether the increase in trade due to the union is indeed welfare improving, depends on the underlying source of increased exchange. Enhanced wellbeing would be caused if the weakened trade barriers lead to the domestic country being able to replace high-cost home production by imports of lower cost, called: trade creation. However, trade diversion, on the other hand, leads to imports being routed to countries within the custom union, and away from a third country, despite the fact the third country being the producer of lowest cost. This framework shows

that no general assumption should be made, and the European Union and EMU as well as other unions and free trade areas (FTAs) should be treated as unique cases of analysis.

On the contrary, researchers like Krugman (1991) have shown that arrangements between natural trading partners can possibly lead to mutually beneficial effects on the participating countries. He points out that it is most likely for these natural connections to appear anyway, given close proximity, which limits the possible damage caused and leading to an overall worldwide gain in welfare. Though, due to globalisation and reduced transport costs, this assumption might not be valid anymore.

Regarding other trade agreements, Clausing (2001) examined the effect of the Canada-United States Free Trade Agreement (CUSFTA) on trade flows between member and non-member states, finding that the agreement had substantial positive effects on trade between member states. Moreover, the treaty seemed not to have had a significant negative impact on non-members which is evidence in favour for such integration. This debate raises interest in whether lowering trade barriers leads to an increase in trade with trading partners in the union, whilst it substantially lowers trade with outside partners. Therefore, it is hypothesized:

H_1: Entering the EU increases intra-regional trade within the union but has no significant effect on trade with partners located outside of the association.

2.3. Linkages between entering the European Monetary Union and International Trade

Another major step towards international integration has been the introduction of a single currency within the EU, the Euro. It is supposed to foster sustainable economic growth and high employment through collective monetary policies (European Union, 2020). Nevertheless, the main costs associated with joining a monetary union are mostly related to the loss of exchange rate and monetary policy instruments for macroeconomic stabilization. This may be enlarged by missing fiscal and market integration needed for an optimal currency area (Mundell, 1961).

Rose (2008) argues that the Euro effect on trade is of at least 8% and perhaps even 23% magnitude for the adopting countries. This positive impact is also in line with his prior and later research together with Glick (2002 and 2016). Firstly, they analyse the effect of currency unions on bilateral trade, excluding the EMU and secondly, they re-perform their research, incorporating data also about the EMU. Nonetheless, they do raise caveats that the EMU is perhaps very different from other currency unions, which is also supported by the data. These caveats were presented based on the reasoning that it consists of an array of large economies with many small anchor countries, differentiating itself from other unions. In fact, all currency unions considered, seem to produce arbitrary results. Still, overall the findings in the first paper seem to hold with regards to their newer research and demonstrate the positive effect of such integration. The preferred augmented gravity model exhibits an increase in trade figures of about 100% after adopting the Euro as the sole legal tender. Nevertheless, this is obtained without controlling for countries already taking place in the EU, which perhaps would significantly lower this estimate, as will be done in this paper.

At the example of the UK, Lama and Rabanal (2014) outline the importance of trade and financial linkages on the decision of UK hypothetically adopting the Euro. With regards to trade, the impulse-response analysis shows that

under varying economic conditions, implementing the Euro could potentially lead to an increase in UKs' net exports over GDP. However, this effect fades away over time and merges with the state reached under following an independent monetary policy. A possible reason mentioned, is the loss of being able to align fiscal with monetary policy, which especially in times of a recession can be fatal for an economy. The EMU might not be capable of meeting all the needs of its member states simultaneously. All together, they show no significant implication for UK's trade pattern, which contradicts the positive findings of beforementioned papers.

Yet, all these studies do not consider the ongoing disintegration of production, which was not fully acknowledged until Grossman and Rossi-Hasenberg's (2006) essay, that recognized the unprecedented nature of trade within GVCs. Currently, a substantial amount of trade occurs within GVCs (Milberg & Winkler, 2010) and as mentioned earlier, possibly requires new trade measures to analyse today's fragmented trade flows. Due to this, traditional trade statistics may become biased because of double counting and it becomes increasingly more difficult to determine where the value has been added along a good's production process. Hence, observing if these results hold with respect to a different trade measure. Value-added exports could potentially be of great interest, since it offers a solution to these issues. Studying the effect of the EMU regarding value-added and gross exports content leads to the second hypothesis:

H_2: Countries that are already part of the EU and further, decide to adopt the Euro experience significant increase in their bilateral exports.

Broll and Eckwert (1999) have argued that volatility in exchange rates potentially increases trade, due to increased exporting possibilities. Fluctuations in exchange rates may give access to new exporting opportunities, given a certain flexibility in a company's strategy. On the contrary, Kenen (2003) has pointed out, that it is often not possible to fully hedge against large and long-lasting swings in exchange rates, due to the given uncertainty that not only affects prices but also demand. Hence, producers do not know how much they will sell and how much foreign currency will be earned in the forward market. However, none of the papers, with regards to the currency union effect, analyse the impact of adopting another currency on certain sectors and do not consider value-added trade when examining this phenomenon. Thus, I will rely on the finding by Johnson and Noguera (2012) which determine that sectors like agriculture, utilities and services seem to be more reliant on the trade of intermediaries. With reference to certain industries, it is hypothesized that:

H_3: There is a significantly positive currency effect when joining the EMU on bilateral exports. This outweighs for industries like Agriculture, Utilities and Services, since these being industries that rely heavily on trade of intermediate products.

3. Data

3.1. Sources

In order to analyse the research question, which examines the impact of joining the EU and especially adopting the Euro on bilateral value-added exports, two different data sources are considered. Firstly, a macro-level dataset is collected from the Organisation for Economic Co-operation and Development (OECD). The OECD is an

international organisation that intents to build better policies and works for the provision of enhanced well-being. They establish empirically driven international standards and try to find solutions for social, economic and environmental challenges. The institution provides a vast portfolio of business- and socio-economic statistics, over various lengths of timeframes.

The publicly available Trade in Value-Added database (OECD, 2018), which provides researchers with numerous indicators for bilateral trade, is of great interest to this study. It covers 64 economies including all OECD, EU28, G20 and most East and South-east Asian countries, plus a handful of South American countries (See Appendix A, Table 1). Moreover, it makes available 36 unique domestic sectors to the researcher, which will be consolidated to 7 major industries and a single total one (See Appendix A, Table 2). The reason for channelling the sectors is the following: The more these are disjointed, the more likely are value-added exports of zero for a certain sector in the imports of another, which would increase biasedness towards 0. Therefore, these are classified based on the International Standard Industrial Classification for All Economic Activities (ISIC), Rev.4 (Bundesbank, 2008). The time horizon considered in this research is ranging from 2005 to 2015.

Secondly, to complete the dataset another one will be appended that offers possible time-varying control variables: population, GDP, and being a member of the EU/EMU. All indicators are given for the exporting and the importing country. The control variable dataset is extracted from CEPII (CEPII, 2020). Although, the database provides us with more time-invariant control variables, these will not be incorporated. Since the statistical tool applied throughout this analysis is the Gravity Model with fixed effects, these would drop out anyways.

Overall, the dataset consists of a strongly balanced panel dataset that shows dyadic value-added exports and gross exports between 64 economies, over 11 years and seven different sectors. The way these are measured will be outlined in the following sub-sections.

3.2. Dependent Variables

This section will clarify the empirical nature of the two dependent variables and will describe how these are constructed. Besides simply applying the new measure of value-added exports, this work will also consider gross exports to be able to compare possible differences between these two. Both measures are extracted from the TiVA database, published by the OECD. The estimations presented in this section are based on the *Guide to OECD's Trade in Value Added (TiVA) Indicators, 2018 edition* (OECD, 2018), which shows all the calculations necessary to derive at any of their published trade measures.

In order to understand any of these, one has to present the underlying structures that are crucial for the calculations: The Inter-Country Input-Output (ICIO) tables. These are presented by the OECD, as well, and cover the years 2005 to 2015 (OECD, 2018). The ICIO table combines a vast set of annual symmetric industry-by-industry global input-output tables. All values are expressed in current US-Dollars and at basic prices, meaning that it includes taxes less subsidies on intermediate consumption as well as final demand. Figure 5 (See Appendix B) represents the structure of the ICIO tables graphically. The domestic countries, ranging from 1 to N are expressed on the vertical axis, while intermediate consumption and final demand of the importing countries are plotted on the horizontal axis. Matched to each of these are the sectors, ranging from 1 to K. Together one can observe the

contribution, thus the value of the input by the domestic country's industry, in the output of a certain sector located in the foreign country. This can be used to determine the gross trade flows, intermediate of total, intermediate and final flows, leading to the overall bilateral gross exports.

Gross exports are expressed by domestic industry and by partner country. It can be immediately calculated for a given industry k from the ICIO table by summing exports in intermediate goods and services and exports of final demand goods and services:

$$(1)\ GX_{ikj} = \sum_j (GX_{INT\,ikj} + GX_{FNL\,ikj})$$

where $GX_{INT\,ikj}$ are the gross exports of intermediate goods and services from the domestic sector k to the foreign country j. $GX_{FNL\,ikj}$ are the gross exports of final demand of goods and services. For both indicators it holds that i and $j \in [1, .., N]$ and $i \neq j$. Gross exports are in line with official National Account estimates, however, contain two crucial adjustments. Firstly, it is stated at basic prices, thus, added taxes minus subsidies, which may cause gross exports for certain countries to be slightly higher than expressed in the corresponding National Accounts. Secondly, and most importantly, the measure is adjusted for re-exports, hence, trying to tackle the issue of double counting. This might limit any differences observed when comparing it to value-added exports. Nevertheless, the ongoing fragmentation of the production process, still justifies the question whether direct exports actually reach its final destination or are exported in form of an intermediate good or service. This aspect is considered by the indicator value-added exports.

Value-added exports show the value added by domestic industry in a partner's country final demand. It does so both directly, though exports of final goods and services, and indirectly in the form of exporting intermediates used along the production process. These intermediates do not have to reach foreign consumers (households, government, business investment) directly, but can pass through multiple countries before reaching its final destination. Therefore, even if no direct trading relationship exists between a country-pair, it reflects the connections between foreign consumers and domestic industries (upstream in the value-chain). It is defined by the OECD as:

$$(2)\ VA_{ikj} = \left(\hat{V} B\ FD\right)_{ikj}.$$

VA_{ikj} is a $K\ x\ 1$ vector, and the matrix $\hat{V} B\ FD$ has a size of $KN\ x\ K$. $\hat{V}$ is the diagonalized value added share of production, B is the Leontief inverse and FD the global final demand of the partner country for goods and services from a certain domestic industry, which can be observed from the gross trade flows. The Leontief inverse (output multiplier) is used to compute a $K\ x\ K$ diagonal block matrix, representing total domestic gross output required for a one unit increase of the demand of the foreign country. Furthermore, the diagonalized value-added of production matrix is calculated by dividing value-added by gross output of a specific industry in the home country. See Appendix B for the underlying equations to the first two global matrices.

3.3. Independent Variables

To test the effect of joining the EU and/or EMU several dummy variables are created. The first set of dummies returns a value of 1 if either the importing or exporting country is part of the EU and 0 otherwise, and the other does so if both are part of the institution. Similar explanation holds for the dummy regarding the adopting of the Euro at time t. As discussed in the theoretical framework, the industry is also of great interest. Since differentiated sectors might rely to greater or less extent on trade in intermediate goods, another factorial dummy is created for the seven different categories.

As previously specified, since the beginning of the timeframe, 2005, three countries have joined the EU. Bulgaria and Romania have joined in 2007 and Croatia in 2013. Furthermore, seven have exchanged their domestic currency for the Euro. Slovenia joined the EMU in 2007, Malta and Cyprus in 2009 and Slovakia in 2009. Lastly, Estonia, Latvia and Lithuania gave up their independent monetary policy in 2011, 2014 and 2015, respectively.

3.4. Control Variables

In addition to the independent variables, several control variables are collected to add reliability to the results and may reduce possible biasedness of the models performed. Besides economic reasons, the controls used were strongly inspired by variables included in two ground-breaking papers (Glick and Rose, 2002, 2016). Overall, the parameters used as controls are highly universal among researchers (See Myka and Zymek, 2017; Baldwin and Taglioni, 2007; Anderson and Wincoop, 2003).

As Glick and Rose have shown in their traditional model performed in 2002, multiple variables that represent transaction costs are included. Namely, if the country pair shares a border, if one of them has been or is still colonized/ruled by the counterpart, and whether they speak the same official language. Besides these, several variables were added to account for the nation's size. Henceforth, Gross Domestic product (GDP) per capita, the land mass of a country and the distance between the trading partners. In addition, GDP is measured in current US Dollars (Mayer and Zignago, 2011).

However, due to the incorporation of dyadic fixed effects, the time-invariant variables drop out from the empirical estimation, which leaves us with only one the time-varying variable: GDP per capita. The literature often includes both GDP and GDP per capita, but this probably leads to biasedness given the strong correlation between these two and thus, only GDP per capita by origin and destination country will be used. It is calculated as GDP divided by the corresponding population. Including fixed effects has several advantages with regards to control variables, since it automatically accounts for all time-invariant aspects between the trading partners, omitted variable bias is reduced.

3.5. Descriptive Statistics

Table 3.1 gives statistical insights into the variables used in this work's analysis. Notably, the table does not aggregate all industries and country-pairs, henceforth, this demonstrates the summary statistics at the sectorial level. This is the reason, why the observations are 310000 instead of 44352 if aggregated. For descriptive statistics based on the aggregated level see Table 3.2 (Appendix A). The aggregated numbers express a similar picture, however, are much larger due to the overall higher level of aggregation.

Over a period of 11 years ranging from 2005 through 2015 value-added exports were on average 359.465 million of Dollars, compared to 490.784 million in gross exports which also shows more variation. Another aspect that is worth mentioning is, that a few observations for gross exports are missing. This is only the case for small and relatively distant countries to Europe, which will probably not alter the estimate substantially. It is also the reason why these will be left as missing variables and thus, dropped when performing the empirical analysis. Another reason for not altering the missing variables is to not introduce biasedness towards zero between two trading partners.

Table 3.1: Descriptive Statistics by Industry in millions of US-Dollars

Variable	Obs	Mean	Std.Dev.	Min	Max
Year	310000	2010	3.162	2005	2015
Value-Added Exports	310000	359.465	2574.234	0	234000
Gross Exports	288000	490.784	4125.756	0	441000
Ratio VA and GX	229000	11.729	110.859	0	21523
Contiguity	310000	.035	.183	0	1
Comman Language	310000	.072	.259	0	1
Distance	310000	7101.323	4876.646	160.928	19648.45
Population	310000	77.962	222.809	.297	1371.22
GDP	310000	9.46e+11	2.20e+12	5.98e+09	1.80e+13
GDP per Capita	310000	25829.49	22278.18	471.163	117000
Area	310000	1420000	3120000	316	1.71e+07
Colony	310000	.027	.161	0	1
Colony Currently	310000	.001	.031	0	1
Common Religion	310000	.167	.26	0	.988
ID	310000	16128	9311.52	1	32255
EU Member	310000	.42	.494	0	1
Both in EU	310000	.173	.378	0	1
EMU Member	310000	.244	.43	0	1
Both in EMU	310000	.058	.234	0	1
Country Pair	310000	2016.5	1163.94	1	4032
Industry Dummy	310000	4	2	1	7

To further examine differences amongst the two dependent variables, Table 3.3 (See Appendix A) lists the correlations for each country in the dataset between value-added and gross exports. It demonstrates that the correlations seem to be strongly positive amongst all economies and only range roughly between 0.85 and 0.89. This could indicate that gross exports and value-added exports are not too different in nature. Another possible explanation could be that either the most value is added in the last stage of the production process and then being shipped to its final destination or that the adjustment for re-exports has worked well. Figures 1.1 to 1.2 visualize these correlations in form of a scatterplot for certain countries, to further examine these claims. Since the plots of

all countries have only shown marginal differences and given the vast array of countries considered in this research, the USA, China, Canada and Mexico have been chosen as representatives. For both figures the most significant importing partners have been highlighted in the scatterplot. With respect to visualizing purposes, if a cluster of observations is only labeled once, then all these plots can be contributed to this importing economy. This also holds for clear diagonal lines. Moreover, the plots consists of sectorial data and hence, is not aggregated.

Figure 1.1 shows the scatterplot for the USA and China. The distribution of the US is representative for most economies under consideration, given this country being a large and open economy and due to similar volume in trade it can be easily compared to China. China, which is also represented in the same graph exhibits an interesting distribution. There seems to be two, perhaps three patterns, one following a nearly 45-degree angle, the other slightly below that and the most striking one is the correlation for low values of gross exports. There must be bilateral trade flows for China where the contribution in final demand of the importing country is significant, yet, the country is not directly exporting to these nations. Interestingly, this is actually the case for a vast amount of trade flows between China and its importers, when listing the flows with gross exports below 50 billion, but value-added exports above 50 billion. For example, the spike of the most left line resembles the trade in services between China to the USA in 2015. Value-Added Exports is nearly three times as high as gross exports in this year. Indicating that China has great contribution towards the imports of services by the US but is not supplying these via direct linkages. Although, the USA has indications of slightly similar patterns the magnitude is less obvious, which is also observed when plotting most other countries.

Still, there are two countries that have shown interesting clusters of bilateral trade: Canada and Mexico. Figure 1.2 presents the plot for these two economies. Despite their heterogeneity in size, economic development and inhabitants, both nations expressing similar patterns. The dots located towards the upper left indicate trade that does not occur via direct linkages and rather be supplied indirectly, as discussed in the Service sector example between China and the US. This may be due to both having close trading bonds with the US and many goods passing all the three country's borders multiple times, which might not be filtered out completely by the adjustment of gross exports for re-exports. Another reason could be that most volume of trade of these two nations flows through the USA, before arriving at the final destinations and thus, only appear in gross exports with the US. Indeed, taking a closer look at the data, Mexico is having trade of over 60 billion for value-added exports and 200 billion in terms of gross exports with the USA. This high correlation between the two dependent variables is observed for all years in the Manufacturing sector, which is represented by the rightest dot for Mexico. This shows that the direct gross exports are high but seem to not have reached their final destination within the US. A similar phenomenon is observed for Canada. The far most right cluster of observations is all due to trade with the USA, for all years for the Manufacturing sector in this case.

The other dots are showing similar magnitude in value with respect to both trade variables, indicating that gross exports resemble trade in final demand for these linkages. This is also only due to trade with the US, mostly observed for the Mining and Quarrying and Service sectors. Concerning Mexico, the USA is the driving force for the trade on the left of Mexico, as well. Value-added exports above 70 billion and above 40 billion for gross exports can be seen for the Manufacturing sector from 2012 onwards, only. The volume appears to be rather similar between the different measures for these sectors and years.

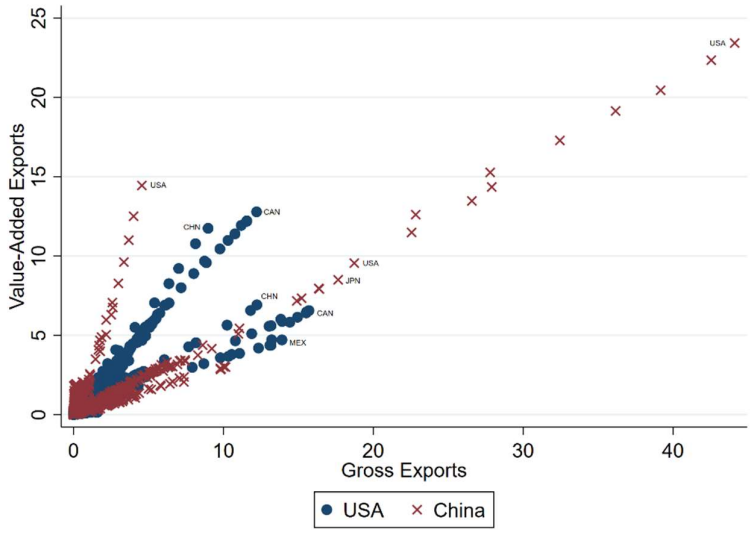

Figure 1.1 Scatterplot for bilateral Value-Added Exports and Gross Exports for the USA and China, measured in tens of billions of US-Dollars

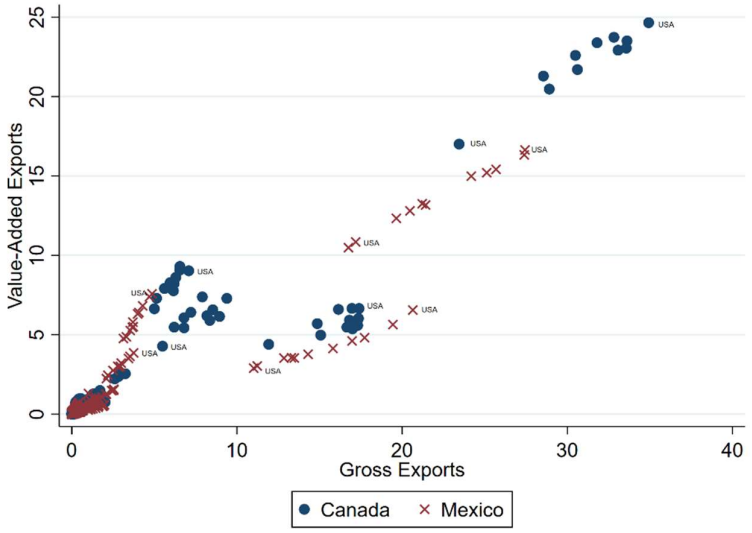

Figure 1.2 Scatterplot for bilateral Value-Added Exports and Gross Exports for Canada and Mexico, measured in tens of billions of US-Dollars

This phenomenon may also be due to certain countries relying on specific sectors to greater or less extent and henceforth, the sectors should be analysed individually, as well. Figures 2.1 to 2.7 (See Appendix) are slicing up the total value-added and gross exports by sector. Interestingly, all industries, except of the Manufacturing sector, display higher value-added exports than gross exports. the latter is simply so much larger compared to all others that by not differentiating between sectors, the larger value-added content for most categories is masked. Further, only the sectors Utilities, Public administration and perhaps, Manufacturing and Construction show significantly

different patterns when these two trade measures are plotted over time. This will be further analysed when examining the last hypothesis.

Moreover, Figures 3.1 to 3.3 display the correlations for each sector. All industries show a tendency towards a 45-degree line, Manufacturing being the strongest towards this phenomenon and Construction being certainly the weakest. Construction rather shows a tendency towards the x-axis, thus, gross exports, showing that it perhaps is not characterized by fragmented trade to great extent. Contrarily, the Utility, Agriculture, Forestry and Fishing and also, the Total Business Services industry, exhibit a stronger association between high values for value-added exports with low ones for gross exports. An example in the trade for which the direct exports are observed to be low and the value-added exports are high is the trade of agricultural goods from China to Japan and from India to the USA. A similar trade pattern with respect to the Utility sector has been observed between China and the USA. It can be seen as the observations laying above 100 billion value-added exports and to the left of roughly 30 billion in terms of gross exports in the scatterplot for the Utility sector. This is at least partly in line with the finding of Johnson and Nugera (2012), who stated in their figures that Agriculture, Utilities and Services are more reliant on fragmented trade, building the foundation for the third hypothesis of this work.

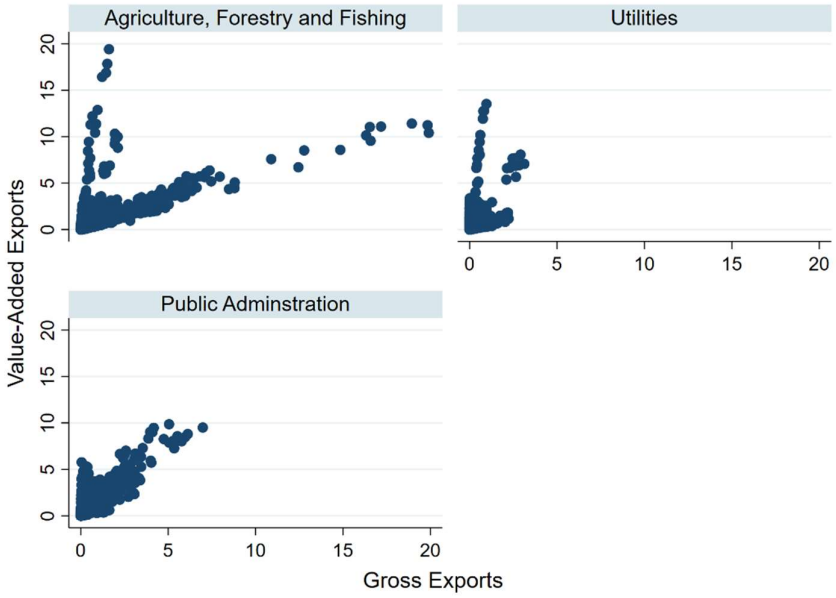

Figure 3.1 Scatterplot for Value-Added Exports and Gross Exports by Sector measured in tens of billions of US-Dollars

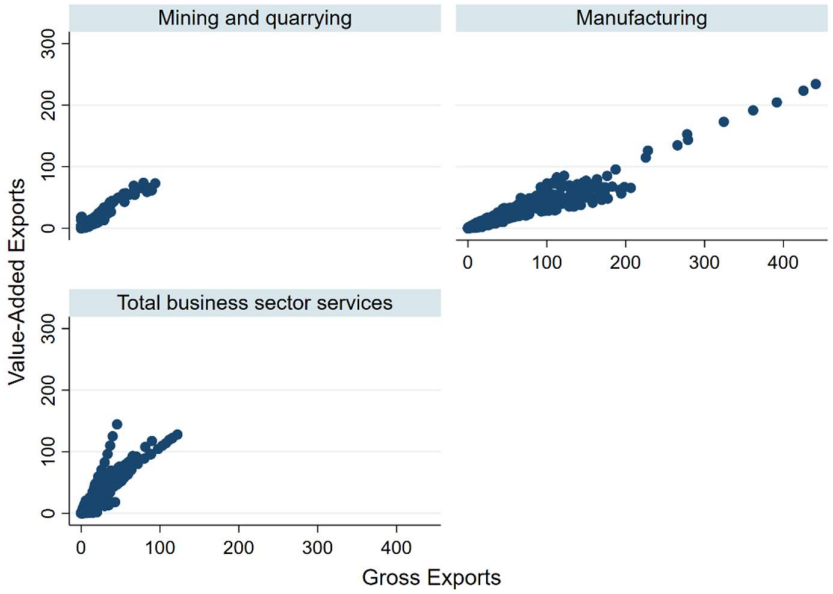

Figure 3.2 Scatterplot for Value-Added Exports and Gross Exports by Sector measured in tens of billions of US-Dollars

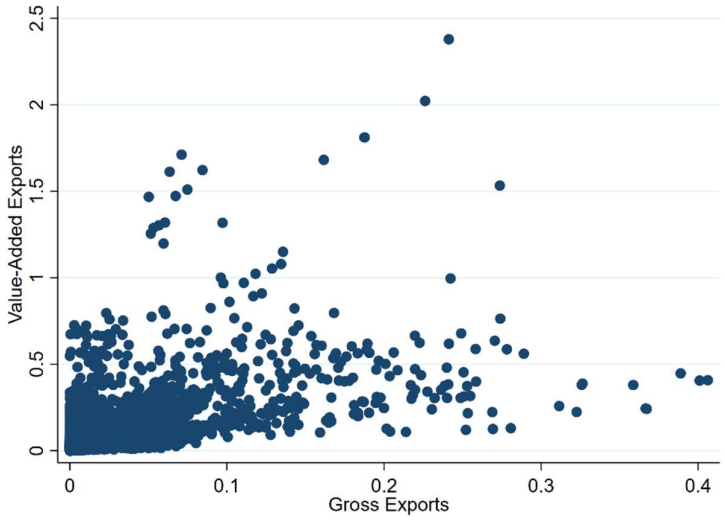

Figure 3.3 Scatterplot for Value-Added Exports and Gross Exports for the Construction Industry measured in tens of billions of US-Dollars

Figures 4.1 shows the value-added exports and gross exports, respectively, for Bulgaria, Romania and Croatia. Since the gross exports being larger than value-added exports, the large difference in value of trade for the Manufacturing sector seems to have substantial influence when plotting aggregates. Romania and Bulgaria joined the EU in 2007 and Croatia in 2013. There does not appear to be any major changes in either of the trade measure given entrance in the EU. This could be due to the fact that joining the EU is a long-term process and is

accompanied with agreements prior to the entrance of an economy. Thus, being actually part of the organisation may not change that much with regards to trade.

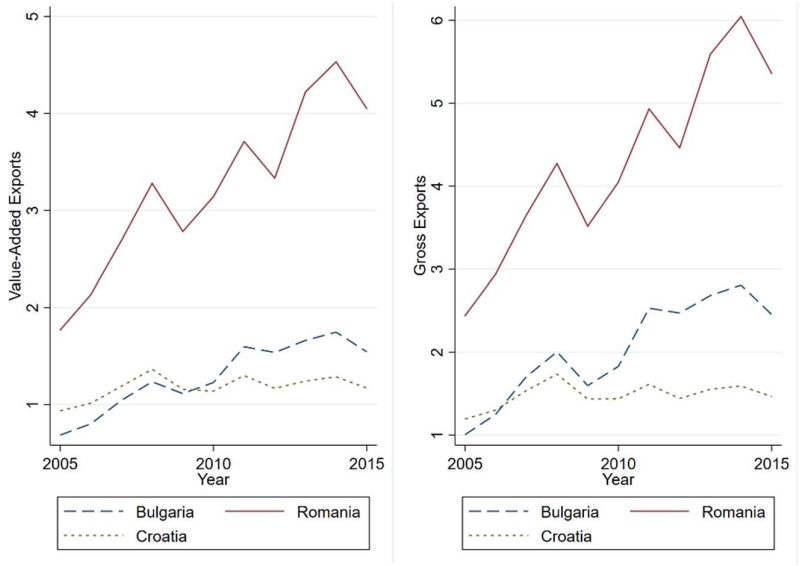

Figure 4.1 Value-Added Exports and Gross Exports between 2005 and 2015 for the countries that joined the EU
Notes: Both are measured in hundreds of billions of US-Dollars and are the sum of exports (See Figure 1.1 for the calculation). Bulgaria and Romania joined in 2007 and Croatia in 2013.

Nevertheless, when taking on the Euro, the legal tender in one nation actually changes. Henceforth, there might be an effect of joining the EMU. Again, Figures 4.2 and 4.3 display the value-added and gross exports for those states that entered the EMU. The figures do express a similar picture as its predecessor. Gross exports are larger than value-added exports and there seems to be a strong correlation between the two.

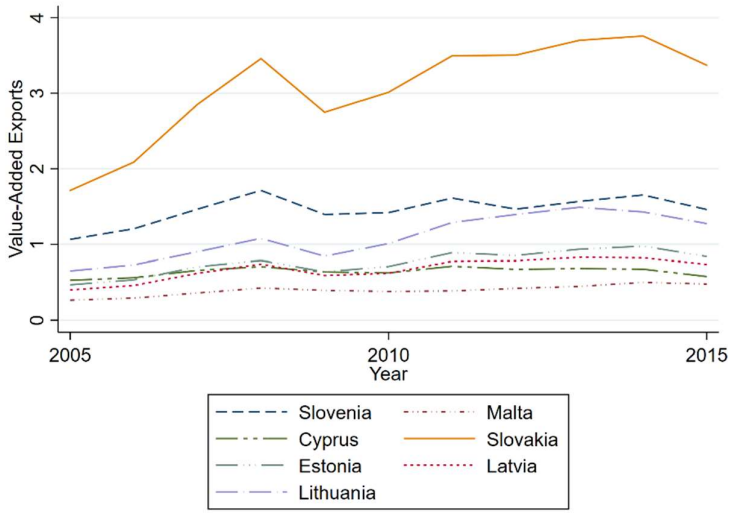

Figure 4.2 Value-Added Exports for the Euro adopters within 2005 and 2015
Notes: Measured in hundreds of billions of US-Dollars and as the sum of exports (See Figure 1.1 for the calculation). Slovenia joined the EMU in 2007, Malta and Cyprus in 2009, Slovakia in 2009 and Estonia, Latvia and Lithuania in 2011, 2014 and 2015, respectively.

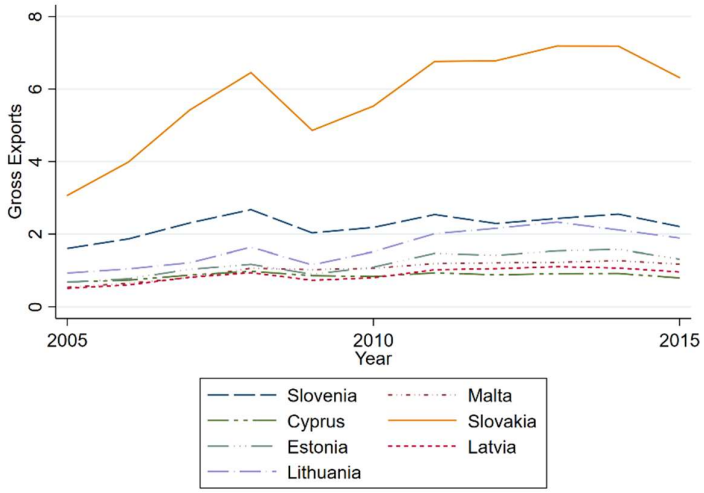

Figure 4.3 Gross Exports for the Euro adopters within 2005 and 2015
Notes: Measured in hundreds of billions of US-Dollars and as the sum of exports (See Figure 1.1 for the calculation). Slovenia joined the EMU in 2007, Malta and Cyprus in 2009, Slovakia in 2009 and Estonia, Latvia and Lithuania in 2011, 2014 and 2015, respectively.

4. Methodology

4.1. Gravity Equation

This section presents the theoretical foundation of the gravity equation which will be estimated in the empirical analysis. Its application to trade data has its origins with Tinbergen (1962) and was inspired by the field of physics. The law of gravity states that the strength of gravity between two matters is proportional to the product of the masses of the two objects divided by the square root of the distance amongst them (Baldwin and Taglioni, 2007). Applying this to trade analysis, the masses are to be replaced by the corresponding GDPs and the force is switched with bilateral trade between two countries. In symbols:

$$(3)\quad Trade_{ij} = C\frac{Y_i Y_j}{(distance_{ij})^2}$$

where C is the constant and the subscripts i and j are representing two different countries. The distance in this case is a representor for trade costs and can be replaced by a vector of variables that indicate trade barriers between two nations. These are assumed to be negatively correlated with bilateral trade between partners.

4.2. Base model specification

In order to elaborate on the hypotheses raised, a more sophisticated version of this basic gravity model is used. By applying the natural logarithm and relying on an augmented interpretation of this basic model, it allows for the estimation of a dyadic Fixed Effects model. The fundamental model for this analysis is strongly inspired by the gravity model used in the 2016 paper from Glick and Rose. They reassess their former paper (Glick and Rose,

2002), which excluded the EMU in their examination. Their more recent work does also extensively elaborate on the differences between other currency unions and the EMU and their effect on trade.

Given that we are using a panel dataset, the time dimension is also taken into consideration. Furthermore, using value-added exports as the measure for bilateral trade at the industry-level, the basic equation becomes:

$$(4)\quad \ln(VA_{ikjt}) = \gamma_1 EU_{ijt} + \gamma_2 EMU_{ijt} + \beta_1 Z_{it} + \beta_2 Z_{jt} + FE_{ij} + FE_{ik} + FE_{jk} + FE_{kt} + \varepsilon_{it}$$

where:

- VA_{ikjt} denotes the value-added exports of industry k in country i to country j at time t,
- EU_{ijt} and EMU_{ijt} are dummies that show if the exporter, the importer or both are in the EU/EMU,
- Z_{it} and Z_{jt} are vectors of theory-consistent time-varying bilateral controls for exporter i and importer j,
- FE_{ij} are dyadic fixed effects for the corresponding exporter i and importer j,
- FE_{ik} and FE_{jk} are constants that resemble industry origin and industry destination, respectively,
- FE_{kt} are industry year fixed effects and
- ε_{ikjt} is the error term.

The vector of controls Z consists of 2 different time-varying determinants. All level parameters are in logarithmic specification: the corresponding national GDPs per capita. All models are performed with robust standard errors and clustered by country-pairs, since particular sets of countries may be more similar to one another, than compared to other groups.

In order to be able to compare this model with the traditional trade measures, the same model will be raised, however, dealing with gross exports as the dependent variable, where GX_{ikjt} are the gross exports of a certain industry k located in the domestic country i to country j at time t.

This baseline specification of the model will be used to examine the first two hypothesis. Hypothesis 1 will only look at the effect of just joining the EU. It will do so by disregarding the exporter monetary union dummy, since none of the countries which joined the EU did also adopt the Euro in the given timeframe. This gives us the correlation between EU entrance and trade between 2005 and 2015. On the other hand, hypothesis 2 analyses the effect of being part of the EU and further integrating by taking on another currency, on trade, by using the base model specification. For both hypotheses the data is not limited to certain sectors and the same set of data of all available observations is used. This set will not be aggregated and instead, the sectorial level is used, to allow for the inclusion of sector dummies

To study the third hypothesis, which looks at the sub-sector level instead of all the sectors at once, the model stated in equation (4) will be slightly altered, by not looking at the constant of each sector but rather regress each sector individually. In this case VA_{ikjt} and GX_{ikjt} will be limited to only those contribution made by each distinct domestic industry in the total final demand of country j at time t, so each sector can be analysed separately. The hypothesis states that industries that rely more heavily on fragmented trade, experience larger effects than those that are less dependent. Since the specifications of the level terms are in logarithmic terms, the interpretation will be elasticities and semi-elasticities for dummy variables.

4.3. Concerns with Gravity Estimation

Due to the vast adoption of the gravity equation and the fact that there seems to be no general formal specification, researchers have raised major concerns that have to be addressed when estimating gravity equations.

The inclusion of dyadic fixed effects rather than monadic ones, is recommended by Baldwin and Taglioni (2007). Papers that followed this approach, of using dyadic instead of sperate fixed effects for each country, observed a significant decrease in the estimate of the EMU on trade (Berger and Nitsch, 2008; Baldwin and Taglioni, 2004; Bun and Klassen, 2007). However, their data spans over a short period of time and consists only of relatively small datasets. A much larger one is used in the paper of Glick and Rose (2016). They do still find significant large effects, although they included dyadic effects instead of monadic. Their reasoning for this contradiction, points back to the comparably small datasets. Moreover, most of the papers mentioned above include time trends which may mask the possible effect of joining such a union, according to Glick and Rose (2016). On the contrary, not incorporating a fixed year effect, could boost the estimates due to inflationary aspects. Therefore, a constant for the industry year will be included.

Although, applying fixed effects does not allow for the estimation of coefficients for trade barriers like distance for example, it is still chosen as the preferred method to limit possible biasedness. Furthermore, since the scope of this research is to estimate an impact of joining a custom union and especially a monetary union, the attainment of these coefficients is not of first-line priority.

Anderson and van Wincoop (2003) and Head and Mayer (2014) address the issue of multilateral resistance, which indicates that a country's magnitude of trade with another does not only depend on the direct trade barriers amongst them but also based on the barriers with all other possible partners. The more resistant, in terms of trade barriers, one nation is to all others, the higher the likelihood of trading with one specific country. This study compares gross exports. which certainly is affected by this issue since it looks at direct exports, with value-added exports. The latter observes the added content in final demand no matter how many countries the product has passed during production, this should not impose a major threat on the analysis.

Nevertheless, pointed out by Baldwin and Taglioni (2007), omitted variable bias (OVB) remains a major threat to this analysis. OVB is tried to be minimized by including various time-varying dummies, mentioned beforehand, as well as fixed effects which accounts for all time-invariant biases which may occur. Rose (2000) addresses this by constructing a counterfactual, which then allows to perform difference-in-difference. In his preferred regression the coefficient of interest is 1.21. This effect of currency unions is lowered to 0.16 when applying the difference-in-difference method. This is suggestive evidence that positive omitted variable bias inflates the estimates obtained substantially. Still, the problem of OVB will always remain when estimating least squares and can only be minimized by including the appropriate control variables.

4.4. Robustness check

Given the concerns raised, OLS estimation tools have been subject to criticism from an economic point of view. Due to the inclusion of industries as another dimension in the dataset, the data is further disaggregated which may

lead to a substantial amount of observations taking the value zero. This may reintroduce a strong bias and imposes loss of information, because the log of zero is undefined and thus, being dropped by the statistical software. Moreover, OLS runs under the assumption that the variance of the error is constant across country-pairs. Although, this should not alter the estimation, the t-values cannot be trusted in case of heteroskedasticity (Herrera, 2013). However, Silva and Tenreyro (2006) pointed out that in the presence of heteroskedasticity, the estimation made by OLS might not be consistent and argue that non-linear estimators should be applied, even if robust standard errors are used. Henceforth, this calls for a robustness check concerning the reliability of the OLS estimations. The authors present an intuitive way of handling this issue. Under the assumption that the gravity equation contains the appropriate set of control variables, the Poisson pseudo-maximum likelihood model (PPML) creates consistent estimations of the basic nonlinear gravity model. The data does not in fact have to be distributed as Poisson, since we are dealing with a pseudo-maximum likelihood estimator. Additionally, it can incorporate fixed effects and can naturally include observation were trade content is zero. Observations of zero magnitude are a common issue when studying trade patterns, as shown by (Haveman and Hummels, 2004). Furthermore, the interpretation of the coefficients attained follows the same form as under OLS, which makes it easy to compare these models. Coefficients obtained by the model for independent variables, and stated in logarithmic terms, can still be seen as simple elasticities. The ones corresponding to parameters measured in levels are to be interpreted as semi-elasticities. Again, the analysis is performed with robust standard errors and clustered by pairs, following the same reasoning as before. The models that will be estimated by this tool will be slightly altered by changing the dependent variables. The two variables, value-added and gross exports, will be introduced in levels rather than logarithmic terms whilst the model's baseline specification remains the same as stated in equation (2). Thus, the model accounts for all observations with a value of zero.

5. Results

The Results section outlines the main findings with regards to the three hypotheses raised previously. Analysing these will lead to an answer to the research question which is concerned about the effect of joining the EU and particularly the EMU on value-added and gross exports. To examine this question, two statistical models have been chosen, the Fixed Effects model and the PPML model. Moreover, value-added exports will be compared to traditional trade statistics, namely, gross exports. These gross exports are adjusted for re-exports, which may limit the differences observed between these dependent variables. Firstly, the effect of just joining the EU on intra- and outer-organisational trade will be examined. Secondly, this is followed by the second hypothesis which looks at the effect of being part of the EU and adopting the Euro as the main legal tender. Lastly, since the data has shown great heterogeneity between sectors, the data will be split into several sub-sectors.

5.1. Effect of joining the EU on intra- and outer-regional Trade

The first hypothesis assumes that entering the EU has positive effects on trade within the institution, while it has no significant effect on countries that do not take part in the EU. Table 4.1 shows all four models, as described in the Methodology section. Model 1 indicates the estimations based on fixed effects and with value-added exports

as its dependent variable, whereas model 2 performs the same model, but uses gross exports as the main variable of interest. Similarly, the models 3 and 4 represent the estimations for value-added exports and gross exports, respectively, however, using the PPML method as suggested by Silva and Tenreyro (2006).

The estimates differ greatly among the four different models, although, gross exports have been adjusted for re-exports. Concerning intra-organisational trade, meaning both trading partners being part of the EU, exhibits significant results only with respect to value-added exports and using the Fixed Effects model. The first model provides an estimate of 0.047, which is significant at a 5% significance level. Under the PPML model the estimate observed is even negative with an estimate of -0.005, however, it cannot be inferred that it is significantly different from zero. Given the underlying statistical specification, the effect in percentages of the dummy on the dependent variable can be measured by $\left(e^{\beta}-1\right)$ (See Silva and Tenreyro (2006); Glcik and Rose (2016); Larch, Wanner, Yotov and Zylkin (2019)). Therefore, when both parties are part of the EU value-added exports are predicted to increase by ($e^{0.047}-1=4.81\%$), for the first model and by -0.5% when looking at the third model, although, the latter is insignificant. Moreover, the corresponding results are negative, yet, insignificant when using gross exports as the dependent variable. The last three models would reject the first hypothesis given the non-significant effect of intra-organisational trade.

Furthermore, importing from outer-institutional trade partners suggests homogenous negative effects under all four models. The first three are significant at the 1% significance level, while the fourth is significant at the 5% significance level. Additionally, the literature suggests that the results obtained by the Fixed Effects models may be overstated since they do not include observations taking a trade value of zero (Herrera, 2013). This might be the case for value-added exports, where the first model gives an association of -16.39% and the PPML model an effect of -17.8%. Similar impact is not observed, when looking at gross exports where the Fixed Effects model estimates an even greater negative effect than the respective PPML model. Also, Herrera (2013) observes homogeneity in sign when considering various different models, including Fixed Effects models and PPML, which is indeed the case for the four models and the importer being in the EU, in this work. Due to the significantly negative impact on outer-institutional trade, the hypothesis is rejected.

Nevertheless, the results and the different statistical tools are still highly prone to omitted variable bias which may have different impact on the estimates given the model used. Evidence supporting the threat of omitted variable bias could be the highly significant results for the first model. It is likely that the entrance date into the organisation does not have such a strong impact, because of the close proximity of the states and hence, indicating pre-existing agreements. Further, before joining the EU countries often engage in trade agreements that gradually introduce a nation to the institution and take place before being a part. Although, all four models vary in results, all would reject the first hypothesis, given the significant impact on trade outside the union.

Another aspect that remains puzzling are the negative results perceived for GDP per capita considering the first two models. This indicates that the larger the GDP by population, the lower value-added and gross exports are. The occurrence of that remains unexplained, since the opposite should be the case from a logical point of view. The richer a person within a country the more able the inhabitant should be to export/import goods and services.

When studying the effects of entering the EU on intra- and outer-organisational trade, the first hypothesis is rejected, no matter which model is taken into consideration. Despite the findings of Krugman (1991) that signing

trade agreements has no major impact on outsiders, this seems not to be the case for entering the EU. Still, the results are highly contradictional and may be victims to strong omitted variable bias, that significantly alters the estimates and might even be differently incorporated depending on the statistical tool applied. On the other hand, the significant results observed when using value-added exports and non-existent results when looking at gross exports, with regards to the exporter EU dummy, could be an indication for greater access to GVCs. Yet, it remains puzzling why this only holds for the first model and not for the third, making this argument less likely.

Table 4.1: Effect of EU Membership on Value-Added and Gross Exports

	(1) Value-Added Exports FE	(2) Gross Exports FE	(3) Value-Added Exports PPML	(4) Gross Export PPML
Importer EMU	-0.016*	-0.016	-0.016	0.065***
	(0.008)	(0.016)	(0.013)	(0.023)
Importer EU	-0.179***	-0.304***	-0.196***	-0.184**
	(0.016)	(0.036)	(0.039)	(0.076)
Exporter EU	0.046***	0.001	-0.002	-0.053
	(0.016)	(0.027)	(0.033)	(0.061)
Both EU	0.047**	-0.038	-0.005	-0.013
	(0.018)	(0.035)	(0.042)	(0.073)
Log GDP per capita Origin	-0.744***	-0.487***	0.027	0.006
	(0.051)	(0.100)	(0.194)	(0.221)
Log GDP per capita Destination	1.219***	0.841***	0.610***	0.560***
	(0.049)	(0.097)	(0.132)	(0.163)
Fixed Effects	Exporter-Importer (FE_{ij}), Importer-Sector (FE_{ik}), Exporter-Sector (FE_{jk}), Year-Sect (FE_{kt})			
Obs.	296195	229002	309771	277294
R^2	0.979	0.921	0.989	0.983

Notes: Heteroskedasticity-robust std. errors clustered for the country-pairs, reported in parenthesis (*** *p<0.01, ** p<0.05, * p<0.1).* The Constant is omitted.

5.2. The Euro Effect on Trade

Further international integration by taking on the Euro as the main currency, may have substantial positive effects on the value-added and gross exports, as stated in the second hypothesis. Table 4.2 includes the monetary union dummies in order to determine the association between the Euro and value-added and gross exports.

Despite the puzzling phenomenon that the estimates varying substantially, again, the sign prediction is homogenous with respect to each EMU dummy. Only the estimate for the importer EMU dummy of the fourth model shows a positive and significant estimation, building an exception to this homogeneity in direction of sign.

Regarding the first model, entering the EMU does not significantly alter value-added exports when both are part of the currency union. This is once more homogenous in sign prediction when observing the other three models, whereas the other are actually significant. Contradicting the previously mentioned phenomenon of the Fixed Effects models overstating the results compared to the PPML models, the latter ones produce both larger, significant outcomes. Model 3 shows a correlation of 5.33% and model 4 even higher with an effect on gross exports of 17.82%. The corresponding fixed effects estimates are only 0.7% and 5.02%, respectively.

For the case in which solely the exporting country is using the Euro as its sole legal tender, all four models estimate positive and significant effects at the 1% significance level. The effect ranges from 6.18% for model 2, up to

15.95% in model 4. Both results, with regards to both countries using the Euro and only the exporter doing so, are partly in line with the finding by Rose (2008). The author predicts that the Euro effect ranges between 8 and 23%. However, the effects predicted in this work are far off the forecast made by Glick and Rose (2002; 2016) that bilateral trade doubles due to the adoption of the euro. Perhaps, this could be due to the usage of value-added exports, as it excludes re-exports. The adjustment of gross exports also tackles, at least partly, the issue of double counting.

Interestingly, importing from countries that are not part of the EMU actually has significantly negative effect on value-added exports.The estimate under the Fixed Effects model is negative regarding gross exports, whereas the one under the PPML model is positive, being significant at the 1% significant level. In general, the PPML is assumed to deliver more consistent estimates, especially, in the presence of heteroskedasticity (Silva and Tenreyro, 2006).

Overall, the Euro effect seems to be positive, especially for intra-institutional trade, as predicted by the literature. However, concerning the importing country, there is contradiction in the results and the hypothesis cannot be clearly accepted when using gross exports, instead of value-added exports. Considering the PPML models, the hypothesis is accepted, since under gross exports the effect is strictly positive regardless of the scenario and for value-added exports importing as an EMU member from outer-organisational states is insignificant. Regarding the two FE models, the effect is positive for both being EMU members and insignificant with respect to value-added exports, and significant and positive for either when looking at only the exporting country being part. Given the significant negative results when importing from countries that are not within the EMU, the hypothesis cannot be accepted concerning these two. This creates a new avenue for further research whether one outweighs the other. Once more, there might be a great threat of omitted variable bias altering all models, as mentioned previously.

Table 4.2: Euro Effect on Value-Added Exports and Gross Exports

	(1) Value-Added Exports FE	(2) Gross Exports FE	(3) Value-Added Exports PPML	(4) Gross Exports PPML
Importer EU	-0.285***	-0.375***	-0.245***	-0.228***
	(0.016)	(0.037)	(0.037)	(0.075)
Exporter EU	0.120***	0.050*	-0.005	-0.053
	(0.016)	(0.027)	(0.029)	(0.058)
Both EU	0.003	-0.068**	-0.065*	-0.067
	(0.018)	(0.035)	(0.036)	(0.068)
Importer EMU	-0.052***	-0.056***	-0.018	0.069***
	(0.009)	(0.017)	(0.015)	(0.027)
Exporter EMU	0.073***	0.060***	0.114***	0.148***
	(0.010)	(0.017)	(0.020)	(0.028)
Both EMU	0.007	0.049**	0.052**	0.164***
	(0.015)	(0.024)	(0.021)	(0.033)
Log GDP per capita Origin	0.611***	0.321***	0.613***	0.517***
	(0.009)	(0.018)	(0.023)	(0.027)
Log GDP per capita Destination	0.920***	0.774***	0.813***	0.690***
	(0.009)	(0.018)	(0.027)	(0.037)
Fixed Effects	Exporter-Importer (FE_{ij}), Importer-Sector (FE_{ik}), Exporter-Sector (FE_{jk}), Year-Sector (FE_{kt})			
Obs.	296195	229002	309771	277294
R^2	0.979	0.921	0.989	0.983

Notes: Heteroskedasticity-robust std. errors clustered for the country-pairs, reported in parenthesis (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). The Constant is omitted.

5.3. Decomposed Currency Effect on Value-Added Exports based on the Sub-Sector Level

As previously observed, there seems to be a positive effect of joining the EMU. However, plotting the data by industry and comparing it to the aggregate levels, has shown substantial differences in magnitude. This certainly alters the estimates considerably and calls for disaggregating the data.

The last hypothesis acknowledges the positive currency effects and claims that industries like Agriculture, Utilities and Services experience a greater increase in value-added exports than others. Johnson and Noguera (2012) demonstrated stronger dependence on intermediary trade for these sectors.

Table 5.1 provides an overview of value-added exports as the dependent variable and using the Fixed Effects model with GDP per capita, a time-variant dummy variable as the control variable, for all seven sectors. With regards to both countries being in the EMU, only the Agriculture and Mining and Quarrying sectors show significantly positive effects of 9.75% and 17.59%, respectively. The Utility and Public sectors also show significance at the 1% and at 10% significance level, however, exhibit negative impacts of -8.06% and -6.2%. Moreover, the exporter EMU dummy demonstrates similarity in sign for all sectors except the Utilities sector, which is negative, yet, insignificant.

The first three and the sixth industries show all positive and significant estimates and thus, seem to indicate that trade for these sectors to economies outside the currency union increases significantly. On the other hand, importing from countries outside the union does produce negative results for all industries, where the Agriculture, Manufacturing, Utility, Services and Public sectors are the only ones demonstrating significance. Because of that and regarding this model it cannot be said with certainty that specific industries exhibit greater or smaller effects than others, as predicted by the literature. The Mining and Quarrying sector seems to show positive and significant effects with respect to the exporter and both being the EMU dummies, only.

Re-performing this model with gross exports as the dependent variable (Table 5.2), draws a relatively similar picture regarding the monetary union dummy. For the first three the effect of both countries being in the EMU is estimated to be positive and significant, however, shows negative and significant results for the Utility and Construction sector. The Utility sector is negatively affected by -18.7% and Construction by -20.6%. They seem to not benefit from entering such currency unions, given the additional negative results when observing the estimates of the Exporting dummy. Although, the column 7 shows a negative estimate, it is insignificant and thus, it cannot be inferred that these are substantially different from zero. Exporting to outer-institutional countries is also predicted to increase for the sectors 1,2,3 and 7. Additionally, importing as an EMU member is mostly associated with non-significant results. Only the Agriculture and Public industries are associated with negative and significant effects of -18.45% and -11.66%, respectively, when importing as an EU member from outer-institutional economies. Regarding gross exports, solely the Mining and Quarrying and also the Manufacturing sectors show positive and significant results for the last two EMU dummies and no significance for the first.

Overall, the Euro effect appears to be positive for some industries but exhibits also negative results under certain types of trade. The Mining and Quarrying and Manufacturing seem to benefit. Indicating that the third hypothesis might hold for this sector and entering the EMU increases trade for this sector without significantly limiting outer-institutional trade. Nevertheless, Agriculture and the Public sector do not appear to produce clear results

concerning the Fixed Effects model. Contrarily, the Utilities and perhaps, the Construction sector was thought to be positively affected by the entrance in such a currency area, which has been disproven by the data. The Construction and Utility sectors have shown significantly negative results when gross exports are used as the dependent variable. Henceforth, it remains puzzling whether the other sectors stated in the hypothesis actually rely more heavily on intermediary trade, based on the arbitrary in significance and proximity in estimations.

Table 5.1: The Effect on Value-Added Exports by Sector using the Fixed Effects Model

	(1) AFF	(2) MQ	(3) MANU	(4) UTI	(5) CONS	(6) SERVICES	(7) PUBLIC
Importer EU	-0.290***	-0.317***	-0.284***	-0.278***	-0.233***	-0.276***	-0.290***
	(0.040)	(0.048)	(0.034)	(0.038)	(0.060)	(0.037)	(0.038)
Exporter EU	-0.041	-0.019	0.134***	0.359***	0.209***	-0.006	0.211***
	(0.040)	(0.040)	(0.034)	(0.033)	(0.060)	(0.031)	(0.036)
Both EU	0.013	-0.225***	0.038	0.218***	0.065	-0.130***	0.073*
	(0.048)	(0.050)	(0.038)	(0.036)	(0.070)	(0.036)	(0.041)
Importer EMU	-0.065***	-0.029	-0.045**	-0.051**	-0.016	-0.056***	-0.086***
	(0.023)	(0.020)	(0.021)	(0.020)	(0.038)	(0.019)	(0.023)
Exporter EMU	0.126***	0.186***	0.106***	-0.009	0.050	0.056***	0.031
	(0.026)	(0.023)	(0.019)	(0.020)	(0.043)	(0.020)	(0.029)
Both EMU	0.093**	0.162***	-0.012	-0.084***	-0.025	0.015	-0.069*
	(0.036)	(0.033)	(0.028)	(0.030)	(0.056)	(0.030)	(0.042)
Log GDP per capita Origin	0.324***	0.635***	0.520***	0.431***	1.158***	0.626***	0.554***
	(0.021)	(0.023)	(0.020)	(0.020)	(0.038)	(0.017)	(0.020)
Log GDP per capita Destination	0.962***	0.893***	0.980***	0.894***	0.860***	0.874***	0.919***
	(0.023)	(0.024)	(0.020)	(0.020)	(0.033)	(0.018)	(0.022)
Fixed Effects	Exporter-Importer (FE_{ij}), Year-Sector (FE_{kt})						
Obs.	42558	40879	44165	42657	38381	44350	43085
R^2	0.980	0.986	0.988	0.985	0.961	0.990	0.984

Notes: Heteroskedasticity-robust std. errors clustered for the country-pairs, reported in parenthesis (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). The Constant is omitted.

Table 5.2: Results obtained by Sector and by estimating a Fixed Effects Model using Gross Exports as the Dependent variable

	(1) AFF	(2) MQ	(3) MANU	(4) UTI	(5) CONS	(6) SERVICES	(7) PUBLIC
Importer EU	-0.498***	-0.822***	-0.335***	-0.213*	-0.211**	-0.234***	-0.322***
	(0.091)	(0.160)	(0.063)	(0.109)	(0.094)	(0.060)	(0.072)
Exporter EU	0.097	-0.009	0.127**	0.204***	-0.095	-0.069	-0.035
	(0.088)	(0.123)	(0.057)	(0.067)	(0.059)	(0.045)	(0.056)
Both EU	0.293***	-0.415***	0.027	0.173*	-0.272***	-0.160***	-0.195***
	(0.097)	(0.152)	(0.063)	(0.098)	(0.080)	(0.055)	(0.068)
Importer EMU	-0.204***	-0.028	-0.016	0.025	-0.020	-0.013	-0.124***
	(0.041)	(0.077)	(0.033)	(0.055)	(0.052)	(0.030)	(0.036)
Exporter EMU	0.168***	0.174***	0.212***	-0.294***	-0.157***	-0.032	0.133***
	(0.055)	(0.059)	(0.038)	(0.054)	(0.037)	(0.031)	(0.039)
Both EMU	0.173***	0.380***	0.128***	-0.207***	-0.231***	0.058	-0.060
	(0.060)	(0.094)	(0.042)	(0.077)	(0.059)	(0.045)	(0.053)
Log GDP per capita Origin	0.241***	0.113	0.418***	0.281***	0.865***	0.518***	0.076**
	(0.041)	(0.077)	(0.032)	(0.052)	(0.055)	(0.026)	(0.034)
Log GDP per capita Destination	0.960***	0.577***	0.899***	0.432***	0.721***	0.741***	0.946***
	(0.048)	(0.072)	(0.033)	(0.058)	(0.049)	(0.026)	(0.033)
Fixed Effects	Exporter-Importer (FE_{ij}), Year-Sector (FE_{kt})						
Obs.	35333	28611	40325	23917	22712	40620	36969
R^2	0.943	0.918	0.971	0.919	0.938	0.980	0.966

Notes: Heteroskedasticity-robust std. errors clustered for the country-pairs, reported in parenthesis (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). The Constant is omitted.

The Tables 5.3 and 5.4 (See Appendix A) display the estimation using the PPML model, by means of value-added exports and gross exports as the dependent variables, respectively. Comparing these to their counterpart using the Fixed Effects model, the PPML model displays similar or even larger magnitude concerning most estimates for the EMU dummy.

Despite the caveat of the Fixed Effects models may overstating the outcomes compared to the PPML model, the opposite seems to hold here. Looking at the PPML models, the Agriculture, Manufacturing sectors appear to significantly outperform the other sectors with respect to both countries being part of the EMU and only the exporter for both dependent variables (See Appendix A, Table 5.3 and 5.4). Mining and Quarrying also fits these criteria under value-added exports as the dependent variable, which is also the case for gross exports, yet, the latter results being insignificant. This could lead to the conclusion that the hypothesis holds for these sectors, since the impact on their contribution in the imports of other countries seem to positively outperform the contribution made by the other sectors under consideration. This is in line with the argumentation by Kenan (2003), that less volatility imposes beneficial impact on firms. Regardless of the dependent variable used, the Utility sector did not see any significant results regarding the EMU dummies under the PPML models, which raises doubts regarding the negative results obtained previously.

Surprisingly, the Construction sector demonstrates significant and positive results for value-added exports using the PPML model which contradicts the negative results of the previous models (See Tables 5.1 and 5.2). Nonetheless, this is reversed again when gross exports are used as the dependent variable and using the PPML model (See Table 5.4).

A similarity amongst all four models are the unambiguously positive results obtained for GDP per capita, all being significant at the 1% significance level. Arguing from a logical point of view, this potentially illustrates that the richer the people in one country, the more able the people to import and exports goods and services.

In conclusion the high dependency of certain sectors could only partly be observed, and henceforth, the last hypothesis cannot be accepted fully for all sectors. When considering the Fixed Effects model, only the Mining and Quarrying industry sector looks as if it fits the hypothesis under both dependent variables. In addition, under the PPML model, stronger effects are observed for the first and third sectors, which is only partly the case for the Fixed Effect models. Nonetheless, the Euro effect appears to be positive for some sectors and scenarios of entry, especially, concerning intra-organisational trade. The ambiguity in magnitude remains puzzling and certainly requires extended research in defining the best possible model for the best possible estimation.

In general, the PPML is widely accepted as the new standard tool of measurement, however, other models have been proposed, like for e.g. the Tobit model (Herrera, 2013). Moreover, a major problem with estimating fixed effects arises, when there is no within estimation, namely, every single observation exhibits a zero-trade value, because the country-pair will be dropped. Given the extended dis-aggregation of the data by analysing at the sectorial level, this might be a major threat to the analysis. On the contrary, however, it has been chosen because time-invariant omitted variable has been valued as an even larger hazard to the examination. For example, certain trade barriers which are time-invariant and yet, difficult to measure or not available due to data constraints impose such a problem of time-invariant omitted variable bias. These are included in the estimation by considering country-pair fixed effects.

6. Conclusion

In this work three hypotheses have been analysed in order to answer the research question, raised initially. The question is concerned about the effect of joining the EU and especially the EMU on value-added exports between two economies. Therefore, a dataset covering 64 countries and seven domestic sectors has been collected. Moreover, it contained data about value-added and gross exports, as well as, various control variables. By means of two different statistical modelling tools, namely, the Fixed Effects model and the PPML estimation, both dependent variables have been tested.

The first hypothesis states that joining the EU leads to substantial positive effects on trade within the organisation but does not alter trade with outer-organisational economies. However, this had to be rejected, due to trade with outer-institutional economies being significantly and negatively altered. Nonetheless, the results are contradictional and value-added exports produced different estimated than gross exports. Although, the latter has been predicted by the literature, the prior, whether the EU leads to trade diversion or creation, remains puzzling and is left for further research.

The second hypothesis deals with the Euro effect on trade. Overall, a positive currency effect has been observed which is in line with the literature presented. Yet, again, the results vary greatly and do not reach the estimates obtained by the ground-breaking paper by Glick and Rose (2002). With respect to the global economy, the positive effect of exporting from countries within the EMU seems to outweigh the negative effect of importing by countries within the union.

Furthermore, the last hypothesis predicts that certain sectors experience a stronger currency effect in magnitude than others. Although, the currency effect is predicted to be positive, when dis-aggregating the data, as well, there are only the Mining and Quarrying industry that clearly gains in trade volume from entering the EMU when considering the Fixed Effects model. Particularly, the Utilities sector has been predicted by the literature to be highly fragmented and hence, be more positively affected by higher integration, has shown mostly negative effects. Contrarily, the PPML models do seem to show larger positive effects for the Agriculture and Manufacturing sectors, compared to the other industries. Nevertheless, this remains to be analysed to greater extent. In conclusion, the outcome highly depends on the nature of trade, whether its exporting or importing and whether it occurs within the organisation or outer-organisational. Overall, the EMU is observed to produce positive impact on bilateral value-added exports in the case of both countries or only the exporting country being in the union.

7. Limitations & Suggestions

A major caveat that has been raised is the issue of time-varying omitted variable bias. Including dyadic fixed effects controls for time-invariant omitted variables, however, is still prone to biasedness when time-varying controls are not included that are correlated with EU membership and trade. A possible factor which may alter both, could be unemployment rates, since it determines the state of an economy which is crucial for being a member of the EU and the output produced by a nation. Unfortunately, due to data constraints and the vast array

of economies considered, there has not been sufficient data on hand to include unemployment rates as a possible control variable.

Additionally, the decision for including fixed effects, constrained the possibility of estimating effects of time-invariant trade barriers, which is why many researches do not consider including these as a fixed constant. Because of the threat of omitted variable bias and the scope of the research, the inclusion has been argued to deliver superior results. Since, the FE estimation requires variation within the group considered, country-pairs with zero trade observations amongst all years have been dropped which further fuels the concern of biasedness. This apprehension intensifies when disaggregating the data, as has been done when analysing the last hypothesis. Further research ought to carefully consider this issue. For example, Rose (2000) managed to construct a counterfactual which allows for the estimation of the difference-in-difference method. This substantially lowered the effect observed.

Endogeneity is another limitation that threatens the internal validity of this research. Countries themselves can choose whether they want to join a currency or customs unions and thus, entrance is not determent by an external force. In addition, most countries in the dataset are considered to be developed and henceforth, may be located towards the end on the production chain. This might substantially lower external validity. Following research could consider and differentiate various forms of development and states of the economies included in their research. Again, the effect on specific countries could be examined by applying the method used by Rose (2000).

Even though many limitations exist, the results can be used and studied by economies when considering joining the EU and particularly the EMU. Also, very limited research exists which considers various sectors in their analysis of value-added exports, as has been applied in this paper. Certain industries may use these results to lobby against or in favour of further integration. Nevertheless, one has to mention that the EU and EMU are not only concerned with trade and the consideration of more factors influenced by the institution besides trade and integration into GVCs.

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Appendix A

Table 1: List of Countries

Country	
Argentina	Korea
Australia	Latvia
Austria	Lithuania
Belgium	Luxembourg
Brazil	Malaysia
Brunei Darussalam	Malta
Bulgaria	Mexico
Cambodia	Morocco
Canada	Netherlands
Chile	New Zealand
China	Norway
Colombia	Peru
Costa Rica	Philippines
Croatia	Poland
Cyprus	Portugal
Czech Republic	Romania
Denmark	Russian Federation
Estonia	Saudi Arabia
Finland	Singapore
France	Slovak Republic
Germany	Slovenia
Greece	South Africa
Hong Kong	Spain
Hungary	Sweden
Iceland	Switzerland
India	Taiwan
Indonesia	Thailand
Ireland	Tunisia
Israel	Turkey
Italy	United Kingdom
Japan	United States
Kazakhstan	Vietnam

Table 2: Consolidation of Industries

Industry	Sub-Industries
Agriculture, Forestry and Fishing	-
Mining and quarrying	Mining and extraction of energy producing products
	Mining and quarrying of non-energy products
Manufacturing	Food products, beverages and tobacco
	Textiles, wearing apparel, leather and related products
	Wood and paper products; printing
	Chemicals and non-metallic mineral products
	Basic metals and fabricated metal products
	Computers, electronic and electrical equipment
	Machinery and equipment
	Transport equipment
	Other manufacturing; repair and installation of machinery and equipment
Utilities	Electricity, gas, water supply, sewerage, waste and remediation services
Construction	-
Total Business Services	Distributive trade, transport, accommodation and food services
	Information and communication
	Financial and insurance activities
	Real estate activities
	Other business sector services
Public administration, Defense, Education and Health	Public admin, defence; compulsory social security
	Education
	Human health and social work
	Other social and personal services

Table 3.2: Descriptive Statistics in Total

Variable	Obs	Mean	Std.Dev.	Min	Max
Year	44352	2010	3.162	2005	2015
Value-Added Exports	44352	2516.258	10460.3	.1	435000
Gross Exports	41155	3431.164	14021.14	0	489000
Contiguity	44352	.035	.183	0	1
Common Language	44352	.072	.259	0	1
Distance	44352	7101.323	4876.693	160.928	19648.45
Population	44352	77.962	222.811	.297	1371.22
GDP	44352	9.46e+11	2.20e+12	5.98e+09	1.80e+13
GDP per Capita	44352	25829.49	22278.4	471.163	117000
Area	44352	1420000	3120000	316	1.71e+07
Colony	44352	.027	.161	0	1
Colony Currently	44352	.001	.031	0	1
Common Religion	44352	.167	.26	0	.988
ID	44352	16132	9311.61	8	32256
EU Member	44352	.42	.494	0	1
Both in EU	44352	.173	.378	0	1
EMU Member	44352	.244	.43	0	1
Both in EMU	44352	.058	.234	0	1
Country Pair	44352	2016.5	1163.951	1	4032
Industry Dummy	44352	8	0	8	8

Table 3.3: Correlation between Value-Added Exports and Gross Exports by Country

Country	Correlation	Country	Correlation
Argentina	0.8778	Korea	0.8555
Australia	0.8779	Latvia	0.8608
Austria	0.8777	Lithuania	0.8605
Belgium	0.8777	Luxembourg	0.8604
Brazil	0.8778	Malaysia	0.8918
Brunei Darussalam	0.8779	Malta	0.8919
Bulgaria	0.8778	Mexico	0.8606
Cambodia	0.8555	Morocco	0.8607
Canada	0.8779	Netherlands	0.8950
Chile	0.8801	New Zealand	0.8953
China	0.8801	Norway	0.8964
Colombia	0.8694	Peru	0.8953
Costa Rica	0.8693	Philippines	0.8952
Croatia	0.8646	Poland	0.8951
Cyprus	0.8693	Portugal	0.8957
Czech Republic	0.8692	Romania	0.8957
Denmark	0.8666	Russian Federation	0.8955
Estonia	0.8665	Saudi Arabia	0.8954
Finland	0.8665	Singapore	0.8909
France	0.8664	Slovak Republic	0.8930
Germany	0.8694	Slovenia	0.8930
Greece	0.8651	South Africa	0.8825
Hong Kong	0.8650	Spain	0.8665
Hungary	0.8645	Sweden	0.8925
Iceland	0.8634	Switzerland	0.8803
India	0.8645	Taiwan	0.8912
Indonesia	0.8645	Thailand	0.8922
Ireland	0.8639	Tunisia	0.8922
Israel	0.8633	Turkey	0.8922
Italy	0.8631	United Kingdom	0.8673
Japan	0.8642	United States	0.8912
Kazakhstan	0.8557	Vietnam	0.8825

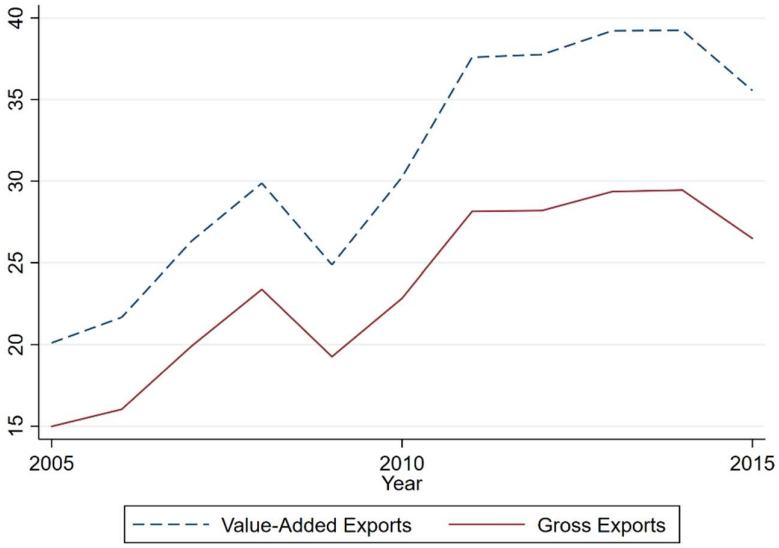

Figure 2.1 Value-Added and Gross Exports for the Agriculture, Forestry and Fishing Industry
Notes: Measured in tens of billions of US-Dollars and the sum of Value-Added Exports is by calculated $VA_{ikj} = \sum_{i \neq j} VA_{ikj}$ and Gross Exports as $GX_{ikj} = \sum_{i \neq j} GX_{ikj}$.

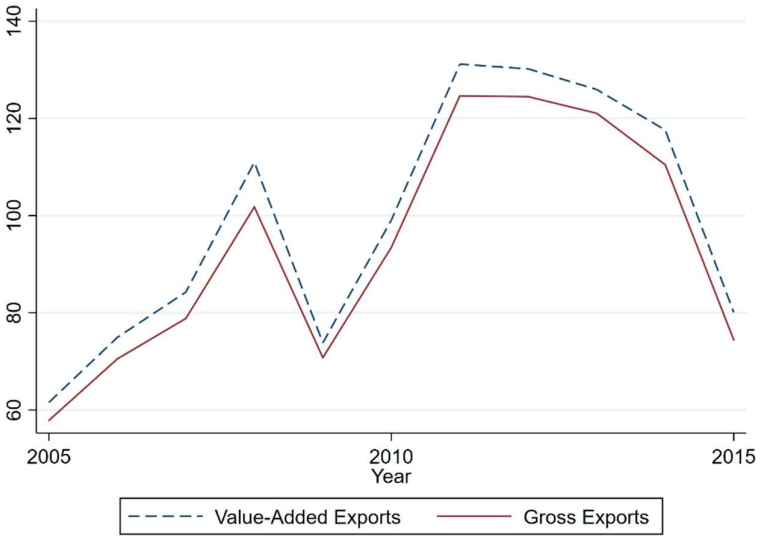

Figure 2.2 Value-Added and Gross Exports for the Mining and Quarrying Industry
Notes: Measured in tens of billions of US-Dollars. See Figure 2.1 for the summation of the two variables.

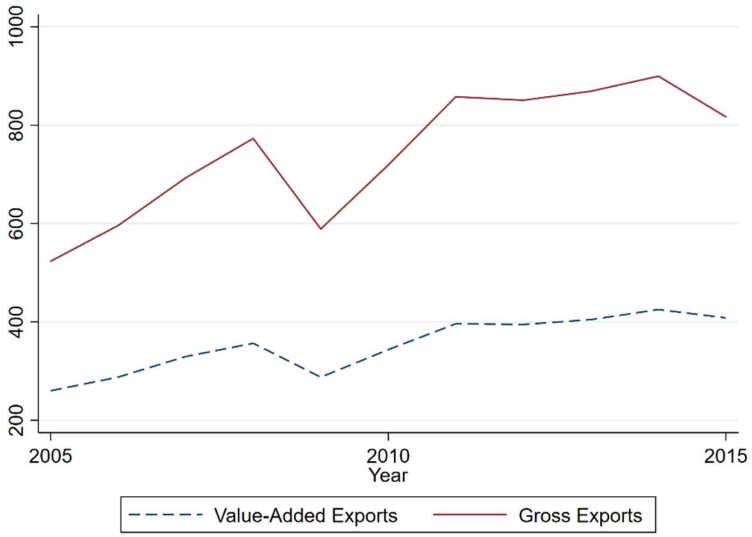

Figure 2.3 Value-Added and Gross Exports for the Manufacturing Industry
Notes: Measured in tens of billions of US-Dollars. See Figure 2.1 for the summation of the two variables.

Figure 2.4 Value-Added and Gross Exports for the Utilities Industry
Notes: Measured in tens of billions of US-Dollars. See Figure 2.1 for the summation of the two variables.

Figure 2.5 Value-Added and Gross Exports for the Construction Industry
Notes: Measured in tens of billions of US-Dollars. See Figure 2.1 for the summation of the two variables.

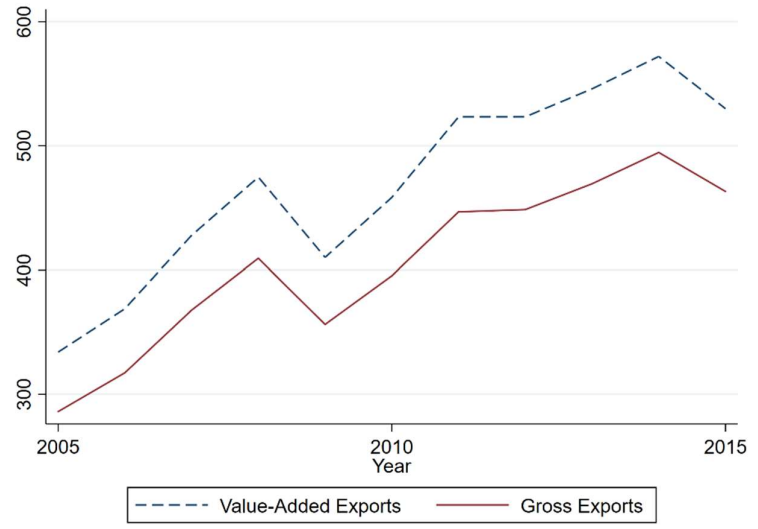

Figure 2.6 Value-Added and Gross Exports for the Total Business Services Industry
Notes: Measured in tens of billions of US-Dollars. See Figure 2.1 for the summation of the two variables.

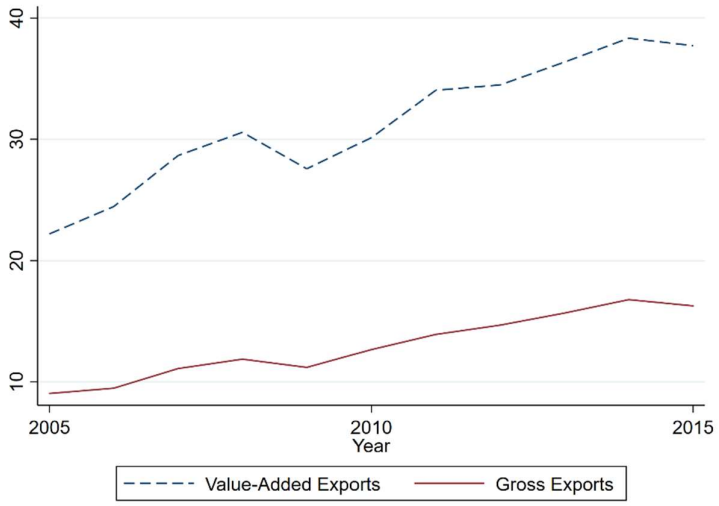

Figure 2.7 Value-Added and Gross Exports for the Public administration, Defence, Education and Health Industry
Notes: Measured in tens of billions of US-Dollars. See Figure 2.1 for the summation of the two variables.

Table 5.3: Using Value-Added Exports as the main Variable of Interest and PPML as the model, by Sector

	(1) AFF	(2) MQ	(3) MANU	(4) UTI	(5) CONS	(6) SERVICES	(7) PUBLIC
Importer EU	-0.155*	-0.272	-0.257***	-0.159***	-0.128	-0.236***	-0.226***
	(0.084)	(0.167)	(0.046)	(0.059)	(0.111)	(0.045)	(0.042)
Exporter EU	-0.100	-0.094	0.015	0.297***	0.297***	-0.052	0.111***
	(0.072)	(0.125)	(0.045)	(0.043)	(0.103)	(0.038)	(0.037)
Both EU	0.091	-0.239*	-0.033	0.302***	0.177	-0.125***	-0.063
	(0.096)	(0.142)	(0.053)	(0.056)	(0.112)	(0.046)	(0.047)
Importer EMU	-0.018	0.024	-0.014	0.027	-0.056	-0.030	-0.025
	(0.032)	(0.029)	(0.030)	(0.038)	(0.050)	(0.022)	(0.043)
Exporter EMU	0.217***	0.228***	0.168***	-0.064*	0.175***	0.067**	0.077
	(0.037)	(0.065)	(0.031)	(0.036)	(0.067)	(0.029)	(0.124)
Both EMU	0.233***	0.264***	0.097**	-0.102**	0.126*	0.012	-0.104
	(0.043)	(0.101)	(0.038)	(0.048)	(0.075)	(0.030)	(0.087)
Log GDP per capita Origin	0.379***	0.457***	0.612***	0.500***	1.095***	0.690***	0.548***
	(0.030)	(0.057)	(0.032)	(0.043)	(0.073)	(0.022)	(0.029)
Log GDP per capita Destination	0.884***	0.813***	0.850***	0.805***	0.857***	0.794***	0.927***
	(0.073)	(0.063)	(0.044)	(0.062)	(0.062)	(0.045)	(0.068)
Fixed Effects	Exporter-Importer (FE_{ij}), Year-Sector (FE_{kt})						
Obs.	43362	41943	44286	43340	40854	44352	43813
Pseudo R^2	0.979	0.987	0.994	0.975	0.940	0.995	0.981

Notes: Heteroskedasticity-robust std. errors clustered for the country-pairs, reported in parenthesis (*** *p<0.01, ** p<0.05, * p<0.1).* The Constant is omitted.

Table 5.4: Results using Gross Exports as the dependent variable and PPML as the analytical tool, by Sector

	(1) AFF	(2) MQ	(3) MANU	(4) UTI	(5) CONS	(6) SERVICES	(7) PUBLIC
Importer EU	0.052	-0.314	-0.216***	0.132	0.114	-0.210***	-0.285***
	(0.136)	(0.328)	(0.072)	(0.118)	(0.152)	(0.078)	(0.081)
Exporter EU	0.384***	-0.104	-0.065	0.328***	0.056	-0.062	-0.143**
	(0.115)	(0.440)	(0.076)	(0.089)	(0.105)	(0.056)	(0.056)
Both EU	0.784***	0.048	-0.061	0.554***	-0.011	-0.120*	-0.414***
	(0.141)	(0.355)	(0.081)	(0.118)	(0.151)	(0.071)	(0.080)
Importer EMU	-0.041	0.071	0.090**	0.202	-0.014	0.047	0.017
	(0.062)	(0.050)	(0.042)	(0.182)	(0.090)	(0.036)	(0.101)
Exporter EMU	0.279***	0.322	0.228***	0.115	-0.121*	-0.014	0.416
	(0.070)	(0.255)	(0.037)	(0.108)	(0.067)	(0.043)	(0.266)
Both EMU	0.343***	0.527*	0.219***	0.217	-0.199	0.079	0.124
	(0.073)	(0.293)	(0.043)	(0.202)	(0.124)	(0.057)	(0.164)
Log GDP per capita Origin	0.165***	0.373***	0.542***	0.534***	0.757***	0.513***	0.325***
	(0.063)	(0.101)	(0.033)	(0.094)	(0.115)	(0.033)	(0.068)
Log GDP per capita Destination	0.876***	0.657***	0.719***	0.024	0.556***	0.660***	1.172***
	(0.127)	(0.098)	(0.052)	(0.312)	(0.165)	(0.057)	(0.096)
Fixed Effects	Exporter-Importer (FE_{ij}), Year-Sector (FE_{kt})						
Obs.	38940	34364	40882	29293	27379	40832	39017
Pseudo R^2	0.971	0.975	0.993	0.937	0.866	0.992	0.970

Notes: Heteroskedasticity-robust std. errors clustered for the country pairs, reported in parenthesis (*** *p<0.01, ** p<0.05, * p<0.1).* The Constant is omitted.

Appendix B: Calculations for Value-Added Exports

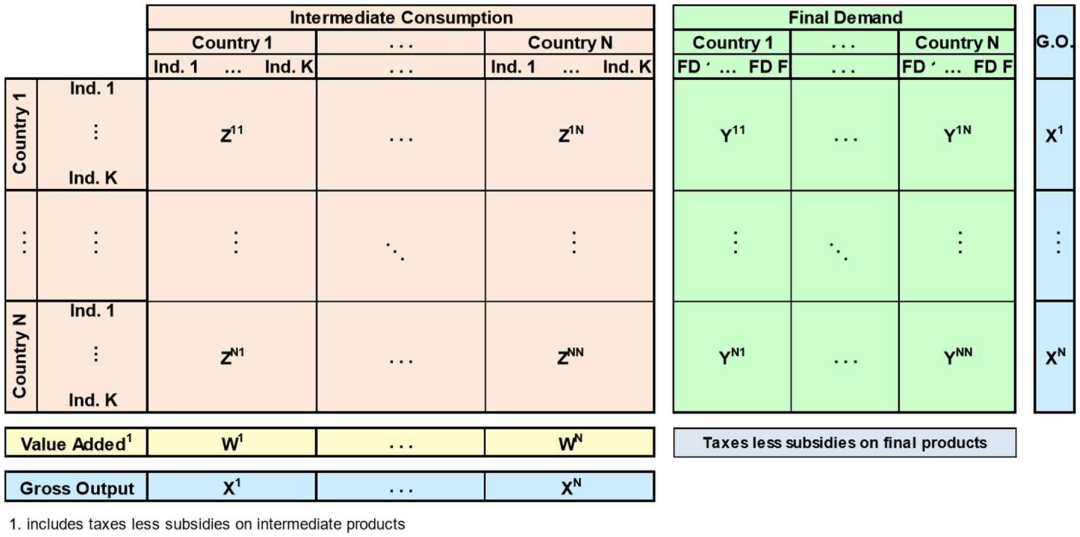

Figure 5 OECD's ICIO Basic Structure
Source: https://www.oecd.org/sti/ind/tiva/TiVA2018_Indicators_Guide.pdf

In order to gain more insights into the main dependent variable, value-added exports, the underlying calculations to the matrices used in the calculation of the measure will be presented.

Firstly, the diagonalized value-added share of production is specified as follows:

$$(5)\quad V_{ik} = \frac{Valu_{ck}}{Output_{ik}}$$

and indicates the domestic industry value-added content divided by gross output and shows a country's share of value-added embodied in trade and final demand. The size of the matrix is $1\ x\ (N\ x\ K)$. $Valu_{ck}$ is calculated by taking total production minus total intermediate input at basic prices (domestically).

Secondly, the Leontief inverse is of the following form and has a dimension of $NK\ x\ KK$:

$$(6)\quad B = (I - A)^{-1}$$

where B represents total domestic gross output required for a one unit increase of the demand of domestic goods and services. Further, $(I - A)$ resembles input minus the global input coefficients matrix.

Lastly, FD simply stands for the global final demand matrix, which can be observed from the Input-Output table. It demonstrates the demand for goods and services produced from home industries. No major calculations are necessary to derive this matrix.