LUND UNIVERSITY
School of Economics and Management

Analyzing the Effect of Internal Devaluation Policies on European Export Demand – A Panel Analysis on Industry Level

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October 2015

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Abstract

After the outbreak of the financial crisis in Europe in 2008, the strategies to antagonize its consequences, involved the implementation of internal devaluation policies such as nominal wage suppressions. The effectiveness of these policies has undergone various studies with rather negative criticism and evaluation. To produce further research and perform an empirical analysis in this field, this paper investigates the effect of unit labour costs on export demand of seven European countries on a specific industry basis between 2005 and 2014. Exports of twenty-one manufacturing industries, characterised by the International Standard Industrial Classification of all Economic Activities revision 4 (ISIC, rev. 4), have been analysed in a gravity model. Also the relationship has been investigated, excluding data for a representative crisis period (2008 - 2010) and for a reduced country group to depict the effects of GIIPS countries relative to European core countries. The research finds a statistically significant effect between exports and unit labour costs as well as the anticipated negative sign. The effects increase in the reduced time frame and decrease in the restricted country group, indicating that the crisis had major effect on the performance of unit labour cost cuts and that the GIIPS countries show rather small improvements relative to the European centrum.

Keywords: Internal devaluation, export demand, unit labour costs, industry level, gravity model.

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1. Introduction

Since 2008 the European Union (EU) and especially the Eurozone, has been battling a severe economic crisis resulting in insecurities throughout the financial markets, among politicians and the European population. In the process of finding explanations for its outbreak, various authors name a lack of competitiveness and long-lasting current account deficits, in connection with trade unbalances before 2008 to be main problems (Armingeon & Baccaro, 2012; Dodig & Herr, 2015; Stockhammer & Sotiropoulos, 2014). The implemented strategy to antagonize the consequences of the financial crisis involved a group of austerity policies, which according to Alexiou and Nellis (2013) decrease national government deficits by a mixture of cutting public spending and raising taxes. Especially in the so-called GIIPS-countries (Greece, Italy, Ireland, Portugal and Spain) these types of policies were utilized in an extensive manner according to Blyth (2013), to reduce their debts and stimulate economic activity. Taking a closer look, Dodig and Herr (2015) identify internal devaluation, next to structural reforms and fiscal strengthening, to be one of the measures, introduced by the EU, to stabilize the financially troubled countries.

Alexiou and Nellis (2013) describe internal devaluation as a process of stimulating the national price competitiveness and, through that, a rise in aggregate and export demand by suppressing real or nominal salaries. Further, they argue that, under particular circumstances the possible results would be a higher amount of production as well as a reduction of current account deficits. The idea behind this policy is the composition of the current account. Since the current account displays the net exports of goods and services of a country, increased exports and lower imports, due to reduces wages and a lower income, contribute to settle the balance of payments by reducing the current account deficit (Obstfeld & Rogoff, 1996). In addition, internal devaluation appears to be beneficial for Eurozone countries, since they are not able to depreciate their currency on their own to increase price competitiveness of their goods and services (Dodig & Herr, 2015). Therefore this strategy is used in the post crises period in Europe.

To answer the question of how effective internal devaluation policies perform in antagonizing the crisis and its existing problems, a variety of research has dedicated itself to it (Armingeon & Baccaro, 2012; Wood, 2013; Dodig & Herr, 2015; Stockhammer & Sotiropoulos, 2014). According to Wood (2013), price and wage rigidities prevent salaries and domestic demand to fall in the favoured way. Therefore unemployment increases while the desired competitiveness increase does not take place (Wood, 2013). So in his opinion, internal devaluation is failing to improve the situation in the EU. Also Dodig and Herr (2015) concluded that even though the crisis-countries were able to improve their current account balances slightly, they suffered from higher unemployment developments and too high decreasing output numbers. Further, comparing central Europe with the GIIPS-countries, Armingeon and Baccaro (2012) reason that the southern European countries were not able to reinstall their competitiveness relatively to the central European states and therefore maintained larger current account deficits. Stockhammer and Sotiropoulos (2014) performed an analysis of the effect of unit labour costs on the current accounts of the GIIPS countries and find that the lowering of domestic demand is of large amounts to rebalance the current account. Since exports are one of the most important constituent parts of the current account (Obstfeld & Rogoff, 1996), of further interest appears the paper by Sertić, Vučković and Perić (2015), who formulate an export demand model for manufacturing goods of European countries between the years 2000 and 2011 and include unit labour costs as one of the explanatory variables. However, they find no statistical significance of the variable and do not further discuss it with respect to possible implications of internal devaluation policies on exports. So from these results, the strong intuition arises, that internal devaluation has failed in achieving its desired goals.

Despite this overall negative impression of internal devaluation policies, curiosity arose to the author of this thesis, whether this effect of unit labour cost suppression on exports can also be accredited when looking on a more disaggregated level of data compared to the work of Sertić, Vučković and Perić (2015). These authors use grouped manufacturing export data for each country in their analysis, categorized by the classification system SITC (Standard International Trade Classification). Furthermore, could it be stated that internal devaluation policies have a rebalancing effect on the current account when the effect of wage cuts on exports of particular manufacturing industries is investigated? In addition, the questions

are asked how GIIPS countries perform relatively to European core countries of the magnitude of Germany or France and which consequences the crisis had on exports on an industry basis when specifically unit labour cost developments are of central interest in their explanation. Out of these queries, the main research question of this thesis is verbalised as: "does internal devaluation, by means of unit labour cost cuts, have a statistically significant effect on exports on an industry basis, when looking at an intra-European trade setup?" In answering this question, this paper will investigate whether this effect provides justification for the utilization of internal devaluation. In doing so, the author wants to contribute further analysis to the evaluation of internal devaluation in the context of the financial crisis in Europe and perform an analysis on a further disaggregated data level.

To answer these questions, an export demand function is analysed using a panel data set on country-industry level, which is then estimated by the Least Square Dummy Variable Approach to incorporated fixed effects. To the knowledge of the author, the utilization of industry data for this approach is rather rarely utilized. The analysis of Sertić, Vučković and Perić (2015) is therefore one of the main influences to conduct the performed investigation. The literature on export demand functions displays two major groups for its analysis. The first group uses panel data sets consisting of country-level data on GDP, exchange rates between traders and relative price data (Coşar, 2002; Camarero & Tamarit, 2004) and the second group can be characterized by the gravity equation models, which additionally include geographical distance measures between the trading partners as well as trade barriers or other important factors like the spoken language or the population size (Martinez-Zarzoso & Nowak-Lehman, 2003; Kimura & Lee, 2006; Egger & Pfaffermeyer, 2003). The upcoming literature review presents the major influences out of these fields that contributed to the thesis's analysis.

The performed analysis finally shows significant effects of unit labour costs on export demand on the industry level, which objects the findings of the previous research presented above. Throughout the majority of implemented model specifications of the demand function, it can be said that increasing unit labour costs have a negative effect on export amounts for the chosen country group within the according time frame. This presents justification for the utilisation of internal devaluation. Further, the analysis determines that the

years after the actual outbreak of the crisis, 2008 until 2010, have major influence on the unit labour cost effect since their exclusion causes it to increase. The results show overall significant results for unit labour costs. For this reason, it can be concluded that the financial crisis created worse conditions for the effectiveness of internal devaluation. Furthermore, the performance of the models including only GIIPS representatives (in this thesis only Italy and Spain) and two of the most important "European core" countries, Germany and France, shows decreased influence of unit labour costs on exports. This finding represents proof for the statement made by Armingeon and Baccaro (2012), that relative to the European core the country group around Italy and Spain was not able to reinstall their competitiveness.

To give an overview of how these results were obtained, the thesis is structured as follows: the next section dedicates itself to a literature review about research concerning internal devaluation, its empirical analysis and literature on export demand estimation with a special focus on gravity equation models. Section 3 discusses the data used to test the hypothesis of this essay. Section 4 outlines the methodology in describing the econometrical model. Section 5 presents the empirical results, followed by statistical and economical robustness checks in section 6. Section 7 discusses the findings and finally, concluding remarks and a critical view on the results are presented in section 8.

2. Literature Review

To the knowledge of the author, the paper by Sertić, Vučković and Perić (2015) is one of the rare researches that include unit labour cost in the explanation of export demand. However, one analytical paper appears to be not the broadest theoretical base to motivate the purpose of this thesis. For this reason, the literature review embodies two parts to establish a solid foundation. First, research on a different way of investigating the performance of internal devaluation (Stockhammer & Sotiropoulos, 2014) as well as a problem orientated approach by Armingeon and Baccaro (2012) are depicted. This shall give the first motivation for the conduction of this thesis and a presentation of reasons for the implementation of internal devaluation policies and empirical ways how to estimate it. Second, the estimation for export demand functions is examined from different points of view to give reasoning for the

structure of the investigated regression models. Therefore, the underlying problems of estimating demand functions (Verbeek, 2013), the general econometrical set-up of export demand (Coşar, 2002; Kimura & Lee, 2006) and approaches to control for possible heterogeneities between the trading partners (Cheng & Wall, 1999) are discussed. Furthermore, the analysis of Sertić, Vučković and Perić (2015) is explained in this context and contrasted to the empirical approach of this thesis.

In order to touch upon initial research within the field of internal devaluation research in context of the European financial crisis, the paper by Stockhammer and Sotiropoulos (2014) was the first influence even though its approach is not pursued further in this thesis. In trying to capture the whole extent of the consequences of internal devaluation policies in the Euro area, these two authors confront the issue from three sides. Their primary interest lies in the question of how much a country is supposed to reduce its domestic demand, in order to rebalance its current account. They investigate the time period from 1999 until 2011 for a group of Euro area countries. First, they formulate a basic current account equation where real GDP and unit labour costs serve as capital components since these variables are supposed to explain growth and price changes to the current account. From this structure, inspiration has been taken to conduct the empirical research. However, the original intuition for the purpose of this thesis was to investigate internal devaluation on a more disaggregated level to obtain a deeper insight on its influence. Therefore the choice of investigating one of the most important constituent parts and not the current account itself was made. Despite that, Stockhammer and Sotiropoulos (2014) further present indirect effects of internal devaluation on unemployment developments, represented by a Philips curve, and growth evolvements analysed by an Okun's Law equation. This conducts additional ground for future research and an expansion of this thesis.

Before even building up an empirical analysis of the effectiveness of internal devaluation by means of unit labour cost suppression, the researcher is first of all confronted with the underlying problems of the main crisis countries (GIIPS) and their adjustment to the strict imposed policies. Armingeon and Baccaro (2012) give an overview of the development of the GIIPS-countries after the crisis outbreak and highlight their performance under internal devaluation policies. This paper mainly influenced the choice of the country group as well as

the time period for the collection of the data. According to these authors, the GIIPS countries lacked in competitiveness compared to bigger European players like Germany, resulting in high current account deficits. During a period before the crisis, where Germany kept nominal unit labour costs nearly constant, these countries increased their salaries significantly. On the other hand, Germany was able to raise productivity and increase growth rates relatively to, for example Greece, Spain or Italy. For these reasons, Armingeon and Baccaro (2012) conclude that simply suppressing nominal unit labour costs may not lead to the desired effects of regaining competitiveness. Using these findings, two points for an empirical research seem to be of great importance. First, a time period before the outbreak of the crisis has an influence on the estimation outcome. Therefore the chosen time period for the analysis includes the years from 2005 until 2014. Second, when deconstructing internal devaluation on accounts of GIIPS countries, for example, it is important to measure these findings in relation to European core countries. Thus, the analysed country group of trading partners includes several countries of the GIIPS cluster but also bigger European players. Armingeon and Baccaro (2012) further engage with problems of the non-existence of the lender of last resort for the GIIPS countries and several alternatives and scenarios for the solution of the financial crisis, which leads to their conclusion that internal devaluation has rather worsening effects when antagonizing the current crisis. However, of major interest for the conducted empirical work are the two points mentioned above.

Before exploring the recent literature on the empirical analysis of export demand, there is one underlying problem, which is presented at first, to give an intuition why export demand functions have been expanded over the years. In standard macroeconomic theory, the demand for a good is usually described by the price. However, for a market equilibrium to be established, the demanded amount has to equate the supplied amount for the specific good, which is also dependent on the price (Verbeek, 2013). Verbeek (2013) argues for this case, that one is facing a system of simultaneous equations, in which it is not clear whether prices are explained by quantities or vice versa. He further amplifies, that the result is the so-called reverse causality, which explains the simultaneous equation bias that could distort the obtained estimation results. In consequence, all other factors disturbing this equilibrium condition have to be modelled accordingly to reduce this bias.

There are two groups of approaches to overcome and control for this bias. The first group describes a more basic way of constructing such a demand function using fixed effects and three main components, namely the GDPs of the trading partners, exchange rates and price levels for (Coşar, 2002; Camarero & Tamarit, 2004). Coşar (2002) investigates exports from Turkey, to a group of major trading partners by using this proceeding. He includes the real exchange rates of Turkey to the other countries, a volume index of the Gross Domestic Product (GDP) to represent foreign demand and prices are modelled trough the real exchange rate between the countries, where domestic price levels are divided by the nominal exchange rate multiplied by the producer price index of the foreign country. The so-called gravity models on the other hand describe the second group (Kimura & Lee, 2006; Mátyás, 1997; Egger & Pfaffermeyer, 2003). Gravity equations describe absolute distance measures in connection to the estimation of export demand functions (Kimura & Lee, 2006). Kimura and Lee (2006) explain the importance of considering the absolute as well as the relative distance between trading partners to analyse exports. The relative distance refers to increased trade volumes among countries, which are far away to the rest of the world but very close to each other (Kimura & Lee, 2006). So by incorporating distance measurements, they argue that trade flows become heavily dependent on transport costs and by the particular size of exporters and their trade partners. Comparing these two groups and their approaches with respect to the findings before about the selection of data of the respective countries, the medium of gravity equations has been chosen to establish the empirical research.

With regard of the choice of implementing gravity equation models for the research, of further interest is the work by Cheng and Wall (1999), who investigate heterogeneity among countries in gravity equation models. After a short introduction of the topic, they identify different strategies how to construct and estimate heterogeneity between exporting and importing countries within the model. Of special interest for this essay is the analysis of the specification by Cheng and Wall (1999) and Mátyás (1997). While the first approach describes a fixed-effects model with a country-pair fixed effect to control for heterogeneity, the latter implements one fixed-effect for the exporting country and another one for countries being importers (Cheng & Wall, 1999). According to these two authors, both methods are able to account for differences among countries and to overcome the problems in finding an appropriate measure of distance between traders. Furthermore, they state that all

other factors (for example language, historical background, cultural differences), which should stay constant over time, are also accounted for when using fixed effects estimation. In their opinion, the introduction of terms accounting for heterogeneity has significant effects on the estimated model; however, they favour the implementation of a country-pair effect rather than single fixed effects for either exporters or importers. In this thesis, both specifications will be investigated and compared but also expanded. Since exports are analysed on a more disaggregated level, it is expected that heterogeneity between the different industries of the chosen countries is present. For this reason, industry fixed effects will also be used in some of the estimated models, as well as exporter-industry and importer-industry fixed effects, to account for influences of the origin and the destination of the product.

As mentioned in the introduction before, of special interest and major motivation for the hypothesis of this essay is the work by Sertić, Vučković and Perić (2015) who investigate exports on a manufacturing industry level (total and high tech manufacturing goods) for European Union countries. For this reason, their analysis will be described in more detail and compared to the approach of this thesis to explain its main intentions. These three authors use determinants such as domestic and foreign demand, unit labour costs, industrial performance or a representative crisis term in their model. For a panel of 27 EU countries, they estimate export demand data, which are deflated by country individual consumer prices and are classified by the Standard International Trade Classification system (SITC). These export data display grouped industry amounts of several manufacturing industries for each country (Sertić, Vučković & Perić, 2015). To analyse exports on a more disaggregated level, export data for a selection of separate industry classes of the manufacturing sector, identified by the International Standard Industrial Classification system (ISIC rev.4), were collected to perform the empirical investigation of this thesis. That means, instead of two dimensions used of Sertić, Vučković and Perić (2015) the constructed panel data set for the performed estimation consists of four different dimensions. For a well-specified gravity equation according to Cheng and Wall (1999) and the additional industry level, the exports are displayed from exporter *i* to importer *j* from industry *f* at time *t*. The same dimensional structure is taken by the collected unit labour cost data and the representative price data for deflationary purposes. This also contrasts Sertić, Vučković and Perić (2015) who use a percentage change on the previous period labour cost index to measure the effect of labour cost on export de-

mand. However, in accordance to them, the estimated coefficients of unit labour cost on exports are expected to be negative since increasing wages would increase product prices and trigger a reduction of exports. A statistically significant effect however, would provide evidence in favour of the stated hypothesis of this essay. This would contradict the findings of these three authors since according to their estimation results the impact of labour costs appears to be insignificant, which declines their role in explaining particular exports of the manufacturing sector. Although, they show a significant contribution of the standard explanatory variables domestic demand as well as foreign demand in explaining exports. Thus, also in this thesis these effects are expected. In summary, the purpose of this thesis is to test the stated hypothesis by means of a gravity equation approach for the constructed country group using country-industry data to look on a more disaggregated level. For possible heterogeneity between the countries, two estimation strategies are implemented and adjusted to the increased number of panel dimensions.

3. Data

With the purpose of estimating export demand on a disaggregated level for separate industries, the research is confronted with limited data availability. As alluded before, Sertić, Vučković and Perić (2015) used grouped manufacturing export data, classified by the Standard International Trade Classification system (SITC), to conduct their research. However, according to the hypothesis and purpose of this thesis, further fractioned data is needed to analyse the performance of separated industry exports. For this reason, different industry classification systems were considered to find first of all export and unit labour cost data, which are classified by the same or comparable systems to satisfy the objective of the intended research. Besides GDP data that display control variables on the country level and are more common to find, industry data for example for exports, unit labour cost, prices or the control variable employment rate constitute a harder challenge. Furthermore, with respect to the presented findings in the literature review, these data have to be available for a representative time period since the periods preceding and succeeding the financial crisis play an undeniable role as well as the chosen country group that should contain the GIIPS countries and representative countries of the European core (Armingeon & Baccaro, 2012).

The two main variables, i.e. export and unit labour costs, were obtained from different sources but are characterized by the same system. The export data were obtained from the OECD STAN-data base for bilateral trade in goods by industry and end-use (OECD, 2015). For the time period of 2005 until 2014, the yearly observations are classified by ISIC rev. 4 (International Standard Industrial Classification of all Economic Activities, revision 4), which defines several economic good classes or categories that can be used to collect data according to them (United Nations, 2008). According to the latest revision of this classification system, the industry characteristics reach from for example "Agriculture, forestry and fishing" (United Nations, 2008, p.43) until "Activities of extraterritorial organizations and bodies" (United Nations, 2008, p.43). The manufacturing industries are to be found in section C of the revision, which embodies twenty-three subcategories of manufacturing activities (United Nations, 2008). To find comparable results to Sertić, Vučković and Perić (2015), for the first twenty-one of these manufacturing subcategories, export and unit labour cost data could be obtained. The unit labour cost data on basis of ISIC rev. 4, were obtained from the website of the Conference Board and are indexed at the year 2002 and displayed in national currency (The Conference Board, 2015). A detailed list of the twenty-one manufacturing activities can be found in the appendix of this thesis.

However, price data characterised by ISIC rev. 4, for deflating purposes could not be obtained. Nevertheless, producer price index data, classified by a different system called Classification of economic activities in the European Community, abbreviated NACE rev. 2, according to its French translation *nomenclature statistique des activités économiques dans la Communauté européenne* (Eurostat, 2015a), were obtained from the online database of Eurostat (Eurostat, 2015d). Since the ISIC rev.4 and NACE rev. 2 have the same structure and product categories (United Nations, 2008), the obtained price data can be matched to the according export and unit labour cost data for the different industry classes, to control for price changes during the chosen time frame of the analysis. The variables real exports and real unit labour costs were then obtained by dividing the respective observations by the producer prices indices. Furthermore, data for the employment rate could also be obtained from the online database of Eurostat (Eurostat, 2015c). The employment rates are for the working force between age fifteen and sixty-four for both sexes and are also categorized by

NACE rev. 2. This data were only available from 2008 until 2014. Therefore the first three observations for each country and industry are considered as missing.

To introduce control variables on the country level into the regression, real GDP data were obtained from the online database of Eurostat for the time frame of 2005 until 2014 (Eurostat, 2015b). The data are indexed at 2005 and are introduced in the model for the exporting as well as for the importing countries according to Kimura and Lee (2006). Finalising the data description, the "chosen" country group has to be presented. The word chosen is set in quotation marks here, because the unit labour cost data could not be obtained for any country desired for this analysis. However, the evaluated country group consists of seven Euro countries including Belgium, Finland, France, Germany, Italy, the Netherlands and Spain. This group includes two of the GIIPS countries (Italy and Spain) and five respective European "core" countries (Belgium, Finland, France, Germany and the Netherlands). In this sense, the argument made by Armingeon and Baccaro (2012) of the comparison between GIIPS and the core is controlled for. Admittedly, the obtained results for this country group have to be interpreted carefully, since it only investigates intra-European trade between these seven countries. Consequently, the cut of unit labour cost in one country might increase the exports of that country to one of these seven, but it could also have an effect on the exports to a different country or other countries' exports, not included in the sample. In that sense, the obtained results for these seven countries might be biased since further important trading partners have not been included in the regression. In summary, the constructed panel for the empirical analysis consists of data of seven Euro countries for which exports of twenty-one manufacturing industries between the years 2005 and 2014 are analysed and explained by the GDP of the exporting and the importing country as well as employment rates and unit labour cost. The following table 1 displays a summary of the data, their sources and classification systems. A table with summary statistics for the variables constructed out of these data is presented in section 4.

Table 1: Table of data, their source and system of classification

Data	Source	Classification by
Exports by industry	OECD STAN database	ISIC rev.4
Unit labour cost by industry	Conference Board	ISIC rev. 4
Real GDP	Eurostat	
Producer price index	Eurostat	NACE rev. 2
Employment rate	Eurostat	NACE rev. 2

Table 1: Obtained data with source and classification system

4. Methodology

This fourth section of the thesis occupies itself with the description of the estimated regression models and the method of estimation. As presented above, a gravity equation approach is used to establish the basis for the evaluation of the thesis' hypothesis. The effect of unit labour costs on exports, when looking at separate industry classes, is of major interest here and will be tested in four different models, distinguished by the specification of fixed effects to control for heterogeneity. The fixed effects constellations are motivated by the approaches of Cheng and Wall (1999) and Mátyás (1997), where not only single exporter and importer or country-pair effects are investigated, but also industry dummies and combinations of exporter-industry and importer-industry effects are implemented in the structure of the regression models.

The fundamental set-up for the regression models involves the dependent variable, real exports and the independent variables real GDP of the exporter, real GDP of the importer, real unit labour costs of the exporting country and the employment rate of the exporter. The control variables on the country level (real GDPs) are expected to have a positive influence and go along with the estimation structure of Kimura and Lee (2006) accordingly. To introduce a control variable on the industry level, the employment rate of the exporting country

was chosen to add a time changing variable in the regression structure that cannot be captured by fixed effects. The first regression model described by equation (1), is motivated by Mátyás (1997) with single exporter and importer as well as single industry and time fixed effects:

$$\log(rexp_{ijft}) = \alpha_0 + \beta_1 * \log(gdp_{it}) + \beta_2 * \log(gdp_{jt}) + \beta_3 * \log(rulc_{ift}) + \beta_4 * \log(empl_{ift}) + \alpha_i + \gamma_j + \delta_f + \lambda_t + \varepsilon_{ijft} \quad (1)$$

Here, $\log(rexp_{ijft})$ is the logarithm of real exports from country *i* to country *j* of industry *f* at time *t*; $\log(gdp_{it})$ is the logarithm of real GDP of the exporting country displaying domestic demand; $\log(gdp_{jt})$ is the logarithm of real GDP of the importer and simulates foreign demand; $\log(rulc_{ift})$ is the logarithm of real unit labour costs in country *i* of industry *f* at time *t*; $\log(empl_{ift})$ is the logarithm of the employment rate of the exporting country; α_0 is an intercept term; α_i describes the exporter fixed effect; γ_j is the importer fixed effect; δ_f is the industry fixed effect; λ_t describes the time fixed effect and ε_{ijft} depicts the disturbance term. The coefficient β_1, β_2 and β_4 are expected to have a positive sign. β_3 on the other hand is expected to have a negative sign since an increase of unit labour cost would lead to higher product prices and therefore to decreasing export numbers. As all other models, this regression is estimated by the Least Square Dummy Variable Approach (LSDVA) with robust standard errors to account for possible autocorrelations and heteroskedasticity.

The second model is motivated by the work of Cheng and Wall (1999) and their special country-pair fixed effect to deal with heterogeneity within the panel. The model is built up identically to the previous but the single exporter and importer fixed effects are replaced by one country-pair effect α_{ij}. Equation (2) illustrates the second model:

$$\log(rexp_{ijft}) = \alpha_0 + \beta_1 * \log(gdp_{it}) + \beta_2 * \log(gdp_{jt}) + \beta_3 * \log(rulc_{ift}) + \beta_4 * \log(empl_{ift}) + \alpha_{ij} + \delta_f + \lambda_t + \varepsilon_{ijft} \quad (2)$$

As the single exporter and importer fixed effects are supposed to capture all influences that stay constant over time regarding the countries in the model before, α_{ij} represents this task

in model (2) (Cheng & Wall, 1999). Regarding the heterogeneity between the trading partners, these are the two approaches that will be standing in comparison to each other in this essay. Factors concerning national culture, language, distance or transport costs are represented by these terms and should control for them.

However, regarding the industry fixed effects only a single fixed effect is implemented in the first two models so far. For this reason, two more model specifications are estimated, to compare the results to models (1) and (2). In a similar fashion of model (2), exporter-industry and importer-industry effects are introduced in models (3) and (4) respectively. This model structure should control for possible heterogeneities between various industries and their products with respect to the origin of production and its destination. With this approach the regressions should control for probable product specialisation of countries. Model (3) is presented below:

$$\log(rexp_{ijft}) = \alpha_0 + \beta_1 * \log(gdp_{it}) + \beta_2 * \log(gdp_{jt}) + \beta_3 * \log(rulc_{ift}) + \beta_4 * \log(empl_{ift}) + \delta_{if} + \gamma_j + \lambda_t + \varepsilon_{ijft} \quad (3)$$

The term δ_{if} represents the paired exporter-industry fixed effect, which is constructed in the manner of Cheng and Wall (1999) as before for an exporter-importer pair. It shall give more insight into whether the origin of manufactured goods plays a significant role in the determination of export demand and adds additional explanatory power to the model. To control for factors regarding the importing country, a single importer fixed effect γ_j is implemented again as well as time effects λ_t. Finally, the last specification is constructed in similar style as the one before, modelled in equation (3), but with a paired importer-industry fixed effect, δ_{jf}. With a single fixed effect for the exporting country, α_i, the model is displayed in equation (4). Below, a detailed list and a summary of important statistics of the constructed variables are displayed in tables 2 and 3 respectively.

$$\log(rexp_{ijft}) = \alpha_0 + \beta_1 * \log(gdp_{it}) + \beta_2 * \log(gdp_{jt}) + \beta_3 * \log(rulc_{ift}) + \beta_4 * \log(empl_{ift}) + \delta_{jf} + \alpha_i + \lambda_t + \varepsilon_{ijft} \quad (4)$$

Table 2: Variable list

Variable	Abbreviation	Expected sign
Real exports	$rexp_{ijft}$	
Real GDP of exporter	gdp_{it}	+
Real GDP of importer	gdp_{jt}	+
Real unit labour cost of exporter	$rulc_{ift}$	-
Employment rate of exporter	$empl_{ift}$	+
Exporter fixed effect	α_i	
Importer fixed effect	γ_j	
Industry fixed effect	δ_f	
Time fixed effect	λ_t	
Exporter-importer pair	α_{ij}	
Exporter-industry pair	δ_{if}	
Importer-industry pair	δ_{jf}	

Table 2: Descriptive list of variables; expected signs for dummy variables are omitted since they are controlling for a large numbers of factors, making their interpretation difficult

Table 3: Summary statistics for the constructed variables

Variable	Mean	Standard deviation
Real exports	7.366966	2.554225
Real GDP of exporter	4.681361	0.0457886
Real GDP of importer	4.681361	4.681361
Real unit labour cost of exporter	0.0489439	0.2469079
Employment rate of exporter	3.746188	1.481792

Table 3: Mean and standard deviation of all implemented variables in logarithmic form

5. Empirical results

The main empirical results for all four models are presented in table 4. Since the Least Square Dummy Variable approach has been chosen to estimate these models and due to the chosen structure of the data, a significant amount of dummy variables have been implemented in the regressions. Because of these amounts of effects, only the coefficients of the four main explanatory variables, goodness of fit measurements and model selection criteria are displayed in this section. However, since these fixed effects show great significance in the estimation, their statistical contribution to the models cannot be denied and will be referred to in the text at a later stage. Anticipatory, econometrical robustness checks are performed later on to evaluate the role of the amount of fixed effects.

Table 4 depicts the most important estimation results for the models of the analysis. The estimation was performed with robust standard errors to control for possible heterosekdasticity or autocorrelations. The estimated coefficients are presented with respective standard errors in brackets underneath. The according significance level of each coefficient is adduced beside it. Furthermore, the values of R^2 and adjusted R^2 are included in the table to give an indication of the goodness of fit. Due to the high amount of explanatory variables, the value of the adjusted R^2 is of more interest. In addition, the selection criteria AIC and BIC in brack-

ets underneath are displayed to give an intuition of model specification. Finally, the number of observations of the panel is depicted.

The second and third columns of table 4 present the results for models (1) and (2), that represent the approaches influenced by Mátyás (1997) and Cheng and Wall (1999) respectively. In these fixed effect structures, heterogeneity is controlled for by first a single effect for each exporter and importer and in the second by a country pair fixed effect. As can be seen, both models deliver highly significant results for almost all four coefficients of the main variables. In both models, the effect of real unit labour cost on real exports shows the expected negative sign and is significant on the one per cent level. Consistent with the previously stated expectations, foreign demand in the form of the importer's GDP and the employment rate shows positive signs and would increase ceteris paribus real export by over one per cent. In the case of the importer's GDP the effect is over three per cent. An unexpected result is obtained from the coefficient of the exporter's GDP. In both models, the coefficient shows a highly significant negative result. However, for both models the goodness of fit in the form of the adjusted R^2 is very high, in fact over eighty per cent in model (1) and over ninety per cent in model (2) respectively.

Compared to these first two models, the last two columns of table 4 present the estimation results for models (3) and (4), in which country industry fixed effects were applied. Comparing these two to the previous models, both models show rather similar results. In (3), the effect of real unit labour cost on real exports is still significant at the one per cent level and shows the expected negative sign but it is decreased to -0.48 per cent. The employment rate shows no significance anymore and the exporter's GDP coefficients show significance on the ten per cent level. Model (4) however, displays the same significance results as model (1) and the coefficients are also about the same size. The goodness of fit is again obtained at a very high level of over ninety per cent. According to the selection criteria, model (3) should be preferred since AIC and BIC show the lowest value. Nevertheless, the models (1), (2) and (4) seem to explain the dependent variable in a more significant way and are therefore of more interest to the researcher. Out of these three, model (2) performs best according to the AIC.

Table 4: Main estimation results for all four models

	Least Square Dummy Variable Approach			
	Model (1)	Model (2)	Model (3)	Model (4)
Log(GDP_exporter)	-4.308217*** (1.589035)	-4.514167*** (1.458514)	-2.464531* (1.452004)	-4.284623*** (1.42996)
Log(GDP_importer)	3.139507** (1.555105)	1.90381 (1.395905)	3.139507** (1.34538)	3.260044** (1.413387)
Log(rulc)	-0.7714544*** (0.0976374)	-0.7714544*** (0.0902613)	-0.4784775*** (0.150875)	-0.7742346*** (0.0861766)
Log(empl)	1.469724*** (0.049108)	1.469724*** (0.0447366)	0.0096355 (0.1699401)	1.470259*** (0.0459479)
R^2	0.8999	0.9209	0.9295	0.9217
Adj-R^2	0.89834121	0.91876373	0.92693426	0.91714008
AIC (BIC)	6101.798 (6342.349)	5544.849 (5955.546)	5289.478 (5829.252)	5667.331 (6512.194)
Obs.	2610	2610	2610	2610

Table 4: Normal R^2 & Adj-R^2 in the models (1), (2), (3) and (4), p-values are given by p<0.01=*; p<0.05=**; p<0.1=*; Robust standard errors are given in respective brackets.**

Since the four estimated regression models only differ in the structure and constellation of fixed effects, their contribution in explaining real exports is undeniable and shall be described as follows. Model (1) shows particular significant results in the industry fixed effects creating the conclusion that these effects control for time invariant factors, which have an impact on the dependent variable. Exporter and importer effects show mixed significant results, however the importer effects are in majority significant on the one per cent level. Solely the time fixed effects do not show similar results as those before. Fixed effects in model (2) show on average the same results for their coefficients. The country pair effects increase the amount of dummies significantly compared to the model before. However, the results are similar to the single fixed effects for exporters and importers. Model (3) presents a frequent result of significance of the exporter-industry effects as well as for the importer dummies. Time fixed effects on the other hand show an overall insignificant behaviour. Fi-

nally, estimation results for model (4) depict similar results to model (3). The importer-industry effects are in majority significant as well as the implemented exporter effects. The time fixed effects do not exhibit this behaviour.

6. Diagnostic & Robustness Checks

The diagnostics check section is divided into two parts. first the economic robustness is discussed, by re-estimating all four models, for a time period excluding the years 2008, 2009 and 2010 to factor out the direct impact of the outbreak of the financial crisis and second, the exporter group is reduced to only four countries, France, Germany, Italy and Spain to evaluate the results of the models in the comparison of the European core and the representatives of the GIIPS countries. The second part of this section involves several econometrical checks for heteroskedasticity, functional misspecification and joint inclusion of the different fixed effects.

The estimation results for the reduced time frame, excluding the crisis period from 2008 to 2010, are displayed in table 5. The presentation structure is the same as in the empirical results section with the estimated coefficients of all models with their respective standard errors, combined with measures of goodness of fit and model specification. The first significant result is that as before, domestic exporter's GDP has still a negative effect on real exports. By excluding the crisis years out of the sample, the sign could not be corrected, indicating that the crisis did have a serious effect on domestic output. The importer's GDP shows in neither of the models significant results but has the expected positive sign. The most important variable, real unit labour costs, depicts highly significant results and a negative effect on export volumes. With the exeption of model (3), all estimated coefficients have increased compared to the estimation with the entire time frame. So from these results, unit labour cost suppression has a larger influence on exports than with the inclusion of the crisis. This draws the intuition that the crisis left some "scorched earth" for policy makers in the sense that internal devaluation policies do not find the best conditions within the Eurozone to work effectively. The control variable employment rate shows very significant results and similar mag-

nitudes of the coefficients. The goodness of fit measures for all four models have slightly increased to before.

Table 5: Estimation results for all four models excluding the crisis period from 2008 to 2010

	Least Square Dummy Variable Approach			
	Model (1)	Model (2)	Model (3)	Model (4)
Log(GDP_exporter)	-0.1776816 (4.42187)	-0.7096354 (4.112899)	-0.4041765 (4.210951)	-0.1973949 (3.67572)
Log(GDP_importer)	4.443998 (3.597555)	1.252276 (3.134081)	4.443998 (3.1242)	4.890006 (3.25379)
Log(rulc)	-0.9181442*** (0.1405392)	-0.9181442 *** (0.1294961)	-0.2875817 (0.3870676)	-0.90402*** (0.1203663)
Log(empl)	1.522419*** (0.0705094)	1.522419*** (0.0649934)	-0.0228793 (0.2813546)	1.512804*** (0.0696059)
R^2	0.9023	0.9233	0.9304	0.9277
Adj-R^2	0.89934728	0.91899497	0.92509647	0.91802508
AIC (BIC)	2944.144 (3139.057)	2700.847 (3044.51)	2623.648 (3080.156)	2765.426 (3463.011)
Obs.	1248	1248	1248	1248

Table 5: Normal R^2 & Adj-R^2 in the models (1), (2), (3) and (4), p-values are given by p<0.01=*; p<0.05=**; p<0.1=*; Robust standard errors are given in respective brackets**

For the reduced country group, the estimation results are depicted in table 6. These results show the effects of all variables in explaining real export amounts of the four countries Germany, France, Italy and Spain when trading with themselves and the rest of the country group. This is intended to reduce omitted variable biases, since the trade of one country to another could influence exports or imports of countries, not included in the sample. The main purpose of this re-estimation however, is to compare the representatives of the GIIPS countries to the biggest European core countries Germany and France. The outcome of this procedure displays first of all the change in sign of exporter's GDP. Even though the results are insignificant, the expected positive sign shows up. The importer's GDP coefficients come close to the ten per cent significant level and show a positive sign as well as the employment

rate, which is significant in three of the models. The unit labour costs show a very interesting result. The coefficients are still negative and, with the exception of model (3), highly significant but their effect on real exports are decreased compared to the main results. This finding relates positively to the statement by Armingeon and Baccaro (2012) that GIIPS countries were not able to keep high competitiveness compared to the European centre. So for the time period of 2005 until 2014, the unit labour cost developments do not show high improvements of competitiveness relative to Germany and France for the countries Italy and Spain.

Table 6: Estimation results for all four models including only export demand of Germany, France, Italy and Spain

	Least Square Dummy Variable Approach			
	Model (1)	Model (2)	Model (3)	Model (4)
Log(GDP_exporter)	0.199134 (2.105792)	0.0567454 (1.889976)	1.000053 (2.24338)	0.1312978 (1.810016)
Log(GDP_importer)	1.70102 (1.537771)	0.846688 (1.395088)	1.70102 (1.47463)	0.6317461 (1.271122)
Log(rulc)	-0.4658089*** (0.0960294)	-0.4658089*** (0.0874155)	-0.159079 (0.198771)	-0.4868098*** (0.0872722)
Log(empl)	0.7541047*** (0.081397)	0.7541047*** (0.0678413)	0.3289668 (0.2245893)	0.7338533*** (0.0722506)
R^2	0.9323	0.9486	0.9431	0.9588
Adj-R^2	0.93053711	0.94661414	0.94058891	0.95489288
AIC (BIC)	2010.038 (2179.621)	1691.888 (1933.415)	1833.334 (2110.833)	1539.273 (2109.687)
Obs.	1260	1260	1260	1260

Table 6: Normal R^2 & Adj-R^2 in the models (1), (2), (3) and (4), p-values are given by p<0.01=*; p<0.05=**; p<0.1=*; Robust standard errors are given in respective brackets**

After these two economical robustness checks, the econometrical robustness of the main estimation models is investigated and is presented in the following part. Tests for heteroskedasticity, autocorrelation and model misspecification are utilised on all four models.

First of all, models (1) to (4) have been re-estimated without robust standard errors, to evaluate their application. Table 7 shows the Breusch-Pagan test results for heteroskedasticity with the LM-test statistic and its according p-values. As can be seen, all test statistics for the four models indicate high significant results at the one per cent level so the null hypothesis of a constant variance in the models has to be rejected in all four cases. In this sense, the utilization of robust standard errors in the Least Square Dummy Variable Approach was justified to estimate the different equations.

Table 7: Breusch-Pagan test for heteroskedasticity

	LM-statistic	p-value
Model (1)	741.26***	0.0000
Model (2)	1223.58***	0.0000
Model (3)	875.66***	0.0000
Model (4)	391.76***	0.0000

Table 7: Breusch-Pagan test results for heteroskedasticity; H0: Constant variance;

p-values are given by p<0.01=*; p<0.05=**; p<0.1=***

After establishing proof for the implementation of robust standard errors, the model specification is supposed to be analysed. Table 8 present test results for the model specification RESET test. It is designed to evaluate whether additional non-linear terms are missing in the estimated version of the models. According to the F-statistics and their respective p-values, the null hypothesis of no omitted variables has to be rejected in all four cases. That means in terms of non-linear model specification, the applied model structures could be improved and extended. This test may also give reasoning why the Breusch-Pagan tests showed evidence for heteroskedasticity, since omitted variables could be correlated with the explanatory variables. However, the more interesting issue for these diagnostic checks is whether the different fixed effect set-ups in the analysed models are justified or not.

Table 8: RESET tests for omitted variables

	F-statistic	p-value
Model (1)	37.13***	0.0000
Model (2)	35.85***	0.0000
Model (3)	11.65***	0.0000
Model (4)	67.89***	0.0000

Table 8: RESET test results; H0: model has no omitted variables;

p-values are given by p<0.01=*; p<0.05=**; p<0.1=***

To evaluate the necessity of various fixed effects, Wald-tests for joint restriction testing are performed. Their task is to evaluate if specific fixed effects are jointly equal to zero and do not play an important role in explaining the dependent variable, real export demand. To have a separated look, first of all, time fixed effects are described in an individual table. Second, industry, exporter, importer and pair fixed effects are tested and presented in a joint table. Therefore, table 9 displays the Wald test results for the implemented time dummies. According to the representative F-statistics and their p-values, the null hypothesis of joint insignificance can only be rejected for model (3). In all other models, time fixed effects seem to not play an important role in explaining real exports and could be excluded from the models.

Table 9: Wald tests on time fixed effects

	F-statistic	p-value
Model (1)	0.88	0.5071
Model (2)	1.48	0.1799
Model (3)	2.64**	0.0005
Model (4)	1.07	0.3754

Table 9: Wald test results; H0: Time fixed effects are jointly equal to 0;

p-values are given by p<0.01=*; p<0.05=**; p<0.1=***

After checking whether time fixed effects play a significant role in the estimated model, the different dummy variables displaying single industry, exporter or importer fixed effects as well as the country-industry-pair effects are also checked on their contribution to their model. Applying Wald-test, to investigate their joint significance, one can draw conclusions on whether their implementation was performed in the desired fashion. The relevant test results are presented in table 10, which is divided into four sections, regarding the individual effects. The first part displays single industry fixed effects in models (1) and (2), which show significance at the one per cent level, according to their F-statistics and their p-values. In this case, the null hypothesis, of all estimated industry dummy coefficients being equal to zero, has to be rejected, concluding that they add explanatory power. The next section states the test results for single exporter effects for models (1) and (4). Similar to the industry fixed effects they show highly significant F-statistics, which leads to a rejection of the null. The third part shows the results for single importer fixed effects for the models (1) and (3) that display relatively high F-statistics, compared to the two tests before. Also in their case, the according p-values show significant results at the one per cent level, leading to a dismissing of the null in their case. Finally the country-pair, exporter-industry and importer-industry effects of the respective models (2), (3) and (4) are tested on joint significance. The last part of table 10 displays their results, indicating that also in their case the null hypothesis does not hold. From these results, it is suggested to leave the estimated dummy variables in the model, since they jointly add explanatory power to the models.

Table 10: Wald tests on industry, exporter, importer & pair fixed effects

	Industry fixed effects	
	F-statistic	p-value
Model (1)	252.84***	0.0000
Model (2)	366.89***	0.0000
	Exporter fixed effects	
	F-statistic	p-value
Model (1)	469.92***	0.0000
Model (4)	520.65***	0.0000

	Importer fixed effects	
	F-statistic	p-value
Model (1)	485.78***	0.0000
Model (3)	698.93***	0.0000
	Pair fixed effects	
	F-statistic	p-value
Model (2)	255.41***	0.0000
Model (3)	304.06***	0.0000
Model (4)	173.97***	0.0000

Table 10: Wald test results for industry, exporter, importer & pair fixed effects; H0: Individual fixed effects are jointly equal to 0; p-values are given by p<0.01=*; p<0.05=**; p<0.1=***

7. Discussion

The presented results in the last two sections are now to be discussed on their economical interpretation and their findings. First of all, the main results undergo critical thoughts and analysis with respect to their economical outcome. Subsequently those findings are compared to the later performed diagnostic checks and their consequences for the empirical analysis. Finally, the econometrical robustness is discussed by means of model improvement and expansion.

When looking at the main results in section 5, it can be stated that unit labour cost developments in the manufacturing industry could show significant effects on real exports of the selected country group in the time frame between 2005 and 2014. In all four models the effect of unit labour costs is negative, which confirms the previously made expectations. This means further increases of labour cost would ceteris paribus decrease exports and counteract the re-instalment of competitiveness within the European Union. For this reason, the research hypothesis can be acknowledged in the sense that unit labour costs do have a statistically significant effect in the explanation of trade and in addition show the desired sign

for internal devaluation to work. However, these results have to be handled with care. First of all the inclusion of only seven countries in the sample due of data unavailability, displays a clear limitation to the analysis. Data for Greece, Portugal or Ireland could indeed add additional power to the results. Second of all, as can be seen also for the restricted estimations in the robustness section, the coefficient of real unit labour cost never exceeds the one per cent barrier. That means the increase of wages by one per cent decreases exports by less than one. Thus, the export decrease is lower than the wage increase, which means that the possible wage cut might have a lower outcome for the price that has to be paid, which is a counterargument for the implementation of internal devaluation. The hypothesis of this thesis could be justified but cannot deny the fact that its effect on exports is not strong enough to reinstall competitiveness on a larger scale, as also Dodig and Herr (2015) presented.

The results of the restricted models show additional insights into the behaviour of unit labour costs on exports. For the restricted time period, excluding the closest years to the outbreak of the crisis, the estimation results still show negative signs of exporter's GDP and even higher effects of internal devaluation in the form of unit labour cost developments on exports. Thus, in addition to direct consequences of the crisis, i.e. liquidity problems, high debt and unemployment (Dodig & Herr, 2015), also indirect effects are present which worsen the conditions for financial policies to antagonise the crisis. In this estimation, the coefficients of unit labour cost come closest to the breaking point of a one per cent change in export triggered by a one per cent increase of wages. As a result, the improvement of competitiveness for this time period might be higher than for the full time frame.

The comparing estimation of the reduced European core to the representatives of the GIIPS group showed additional evidence in favour of the presented literature and the displayed problems of the crisis countries (Armingeon & Baccaro, 2012). The relatively reduced effect of unit labour cost on exports in these estimation results, show the weak improvements of Spain and Italy compared to Germany and France. This suggests that just salary suppression is not enough to reinstall competitiveness in these countries compared to bigger trading partners. Despite these interpretations, the inclusion of a limited number of countries is of course not efficient. A comparison of the entire GIIPS group could produce more reliable results. The exclusion of more trading partners clearly represents a bias in the estimation

results since the effects of unit labour cost cuts in one country might trigger different results in not included countries.

However, the performed analysis is just focused on a selection of manufacturing industries and not on various export branches, which could give a better insight into the effect of wage suppression on total exports of a particular country. In addition, the analysis does not take into account the different export specialisations of the chosen countries. Analysing the effect of internal devaluation on the favourite export industry for the different countries could be the interest of further research. Although, according to these results, decreasing the salary to boost competitiveness can be acknowledged when looking on a specific manufacturing industry. That arises the question of whether these kinds of policies could be implemented on a country's export sectors, which show enough price sensitivity, relative to their trading partners' goods, to obtain higher competitiveness, while other export industries stay protected from wage cuts. The ethnical consequences of this question on equal treatment of workers are not discussed in this thesis.

The robustness checks on the analysis, presented in section 6, first of all gave justification for the use of heteroskedasticity and autocorrelation robust standard errors in all four executed estimations, since their Breusch-Pagan test results showed significant results, in favour of the alternative hypothesis of a non-constant variance. Furthermore, the performed RESET tests gave indication of model misspecifications in terms of missing non-linear terms within the regression. In all four cases the obtained F-statistics are too high to keep the null hypothesis of no omitted variables. As mentioned before, these could be the trigger for heteroskedasticity. However, it has to be mentioned that in the gravity equation approach other very important variables such as price differentials, language and distance, were either excluded or captured by fixed effects respectively. Therefore these RESET test and Breusch-Pagan test results could be caused by their absence.

The performed Wald tests on joint significance, to evaluate the performance of the different fixed effects, on the other hand showed evidence in favour of the model specifications. With the exception of the time fixed effects, the results state that the inclusion of the various fixed effects is justified and the null hypothesis of joint insignificance does not hold for any

of the tested fixed effect groups. Although it has to be mentioned that according to Verbeek (2013) the Least Square Dummy Variable estimation is not the most favourable way from a numerical point of view to simulate the different panel dimensions. However, since the amount of observations with over 2000 in the main estimation models is of a larger scale, this estimation method was chosen.

8. Conclusion

The response to the financial crisis of European politics was internal devaluation measurements, especially applied to the GIIPS-countries since the main reasons for the crisis to be of high impact in these countries were large and consistent current account deficits which lead to decreasing competitiveness (Blyth, 2013; Dodig & Herr, 2015; Armingeon & Baccaro, 2012). According to Alexiou and Nellis (2013), nominal wage cuts should decrease the export prices in a manner, that exports become relatively cheaper to their competitors and trigger the current account deficits to dissolve. However, the desired results of these austerity strategies could not be achieved according to various researches (Wood, 2013; Dodig & Herr, 2015; Armingeon & Baccaro, 2012). To conduct further research in this field, the work of Sertić, Vučković and Perić (2015) became of major interest since these authors established a manufacturing export analysis, incorporating measurement of unit labour costs. Their results displayed an insignificant effect of unit labour cost on exports. However, with the one of the major constituent parts of the current account, the question arose whether the analysis of more disaggregated data for manufacturing industries could depict different results on this estimation and establish a significant connection between exports and internal devaluation.

The introduced research question was formulated in the following way: “does internal devaluation, by means of unit labour cost cuts, have a statistically significant effect on exports on an industry basis when looking at an intra-European trade setup and will this effect provide justification for the utilization of internal devaluation?” To evaluate this question, the Least Square Dummy Variable Approach was applied to estimate an export demand function, depending on national and foreign GDP, local employment rates and unit labour costs. The basis of this analysis was the four dimensional panel, displaying exports by exporter to importer of a specific industry at a given point in time. The utilized data set consists of a

country group of seven Euro-member states in the time period of 2005 until 2014. The chosen manufacturing industries are classified by ISIC rev. 4, which is one of many industry characterization systems (United Nations, 2008). In total, twenty-one industries were used to estimate the models. However, to control for possible heterogeneities among the chosen countries, different fixed effects were introduced with reference to the work of Cheng and Wall (1999) and Mátyás (1997). This approach contrasts with the set-up of Sertić, Vučković and Perić (2015), who used grouped industry data on the country level. By using this more disaggregated data, it was attempted to account for possible biases in the relationship of exports to unit labour costs and detect evidence for the effectiveness of internal devaluation policies to increase exports and rebalance the current account.

The main results established a significant connection between the dependent variable real exports and real unit labour costs, indicating that on a more disaggregated level wage suppression plays an important role in explaining exports. This result could be shown in all four model-specifications. To check the economical robustness of these models, two restrictions were introduced to evaluate their performance for two important cases. First, the crisis period was excluded from the model (2008-2010) to see, what kind of influence the crisis created. The results displayed even higher coefficients for unit labour costs, stating that the crisis worsened the conditions for the implementations of policies to antagonize it. Second, the country group was reduced to only four exporting countries (France, Germany, Italy and Spain) with the usual amount of trading partner countries (importers). In this approach the statement of Armingeon and Baccaro (2012), that the GIIPS countries were not able to establish competitiveness relative to the European core, was assessed. The estimation results displayed decreased effects of unit labour cost on exports, indicating that this statement has to be approved and the representatives of the GIIPS countries in this thesis showed rather non-improving developments.

Despite these empirical results, their outcome has to be handled with care. Due to data limitations, especially for unit labour costs on this level, the possibility of estimation biases cannot be denied. Data for Greece, Ireland or Portugal for example could have additional explanatory power to all results. Also the country group depicts a problem for the robustness of the analysis. Since wage cuts might improve the trade between two partners but also af-

fects exporting or importing behaviour of other countries, the exclusion of further traders might not be beneficial. Moreover, the used gravity equation model could further be expanded in the style of Kimura and Lee (2006) to add more explanatory power. Finally the estimation method of Least Square Dummy Variables is according to Verbeek (2013) not the most desired one since it produces a lot of variables and increased the number of degrees of freedom significantly, which leads to a loss of observations. However, due to the large number of observations, this approach was utilized to model the different fixed effects.

The purpose of this thesis primarily was to contribute further analysis on the effectiveness of internal devaluation policies within the European Union after the financial crisis. By means of export demand, the performance of unit labour cost cuts was to be evaluated on the task of rebalancing the current account. Even though data limitations displayed a major problem, the approach was able to establish significant results for this relationship. Obtaining larger data amounts and a more expanded analysis could shed more light on the effectiveness of the implemented European strategies to antagonize the crisis. Of particular interest appears the performance of wage cuts on the industry level, when price sensitivity measurements of the particular product groups are introduced and rigidities in the various markets are taken into account. However, this matter left for future research.

9. References

Alexiou, C. & Nellis, J. P. (2013). Challenging the *Raison d'etre* of Internal Devaluation in the Context of the Greek Economy, *Panoeconomicus*, vol. 60, no. 6, pp. 813-836.

Armingeon, K. & Baccaro, L. (2012). Political Economy of the Sovereign Debt Crisis: The Limits of Internal Devaluation, *Industrial Law Journal*, vol. 41, no. 3, pp. 254-275, Available Online: http://ilj.oxfordjournals.org/content/41/3/254.full.pdf+html [Accessed 22 August 2015]

Blyth, M. (2013). Austerity: The History of a Dangerous Idea, New York: Oxford University Press.

Camarero, M. & Tamarit, C. (2004). Estimating Exports and Imports Demand for Manufactured Goods: The role of FDI, *Review of World Economics*, vol. 140, issue 3, pp. 347-375.

Cheng, I. & Wall, H. J. (1999). Controlling for Heterogeneity in Gravity Models of Trade and Integration, Research Division, working paper, 1999-01E, Federal Reserve Bank of St. Louis, Available Online: http://core.ac.uk/download/pdf/6608139.pdf [Accessed 4 September 2015]

Coşar, E. E. (2002). Price and Income Elasticities of Turkish Export Demand: A Panel Data Application, *Central Bank Review 2*, pp. 19-53, Available Online: https://www3.tcmb.gov.tr/cbr/index.php/cbreview/article/view/320/280 [Accessed 26 August 2015]

Dodig, N. & Herr, H. (2015). EU Policies Addressing Current Account Imbalances in the EMU: An Assessment, Institute for International Political Economy Berlin, working paper, no. 46/2015, Berlin School of Economics and Law.

Egger, P. & Pfaffermayer, M. (2003). The Proper Panel Econometric Specification of the Gravity Equation: A three-way Model with Bilateral Interaction Effects, *Empirical Economics*, vol. 28, issue 3, pp. 571-580.

Eurostat (2015a). Glossary: Statistical Classification of Economic Activities in the European Community (NACE), Available Online: http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Statistical_classification_of_economic_activities_in_the_European_Community_(NACE) [Accessed 8 September 2015]

Kimura, F. & Lee, H. (2006). The Gravity Equation in International Trade in Services, *Review of World Economics*, vol. 142, issue 1, pp. 92-121.

Martinez-Zarzoso, I. & Nowak-Lehman, F. (2003). Augmented Gravity Model: An Empirical Application to Mercosur-European Union Trade Flows, *Journal of Applied Economics*, vol. 6, no. 2, pp. 291-316.

Mátyás, L. (1997). Proper Econometric Specification of the Gravity Model, *The World Economy*, vol. 20, no. 3, pp. 363-368.

Obstfeld, M. & Rogoff, K. (1996). Foundations of International Macroeconomics, Cambridge, Massachusetts: MIT Press.

Sertić, M. B., Vučković, V. & Perić, B. S. (2015). Determinants of Manufacturing Industry Exports in European Union Member States: A Panel Data Analysis, *Economic Research-Ekonomska Istraživanja*, vol. 28, no. 1, pp. 384-397.

Stockhammer, E. & Sotiropoulos, D. P. (2014). Rebalancing the Euro Area: The Cost of Internal Devaluation, *Review of Political Economy*, vol. 26, no. 2, pp. 210-233, Available Online: http://dx.doi.org/10.1080/09538259.2014.881011 [Accessed 22 August 2015]

United Nations (2008). International Standard Industrial Classification of all Economic Activities - Revision 4, Department of Economic and Social Affairs, statistical paper, no.4, rev. 4, United Nations, Available Online: http://unstats.un.org/unsd/publication/seriesM/seriesm_4rev4e.pdf [Accessed 7 September 2015]

Verbeek, M. (2013). A Guide to Modern Econometrics, 4th edn, West Sussex: John Wiley & Sons, Ltd.

Wood, R. (2013). Europe: The Failure of Internal Devaluation, web blog post available at: http://www.economonitor.com/blog/2013/11/europe-the-failure-of-internal-devaluation/ [Accessed 22 August 2015]

10. Data Sources

The Conference Board (2015). International Comparisons of Manufacturing Productivity & Labour Costs Trends, available at: https://www.conference-board.org/ilcprogram/index.cfm?id=30139 [Accessed 14 July 2015]

Eurostat (2015b). GDP and main components (output, expenditure and income), available at: http://ec.europa.eu/eurostat/web/national-accounts/data/database [Accessed 1 October 2015]

Eurostat (2015c). Employment by sex, age and detailed economic activity (from 2008 onwards, NACE Rev. 2 two digit level), available at: http://ec.europa.eu/eurostat/web/lfs/data/database [Accessed 26 September 2015]

Eurostat (2015d). Producer prices in industry, total - annual data (2010 = 100), available at: http://appsso.eurostat.ec.europa.eu/nui/show.do

[Accessed 14 July 2015]

OECD (2015). STAN Bilateral Trade Database by Industry and End-use Category, available at: https://stats.oecd.org/Index.aspx?DataSetCode=BTDIXE

[Accessed 16 July 2015]

11. Appendix

Table 11: List of industries with ISIC rev. 4 codes

Code	Industry name
C10	Food Products
C11	Beverages
C12	Tobacco products
C13	Textiles
C14	Wearing apparel
C15	Leather and related products
C16	Wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
C17	Paper and paper products
C18	Printing and reproduction of recorded media
C19	Coke and refined petroleum products
C20	Chemicals and chemical products
C21	Basic pharmaceutical products and pharmaceutical preparations
C22	Rubber and plastics products
C23	Other non-metallic mineral products
C24	Basic metals
C25	Fabricated metal products, except machinery and equipment
C26	Computer, electronic and optical products

C27	Electrical equipment
C28	Machinery and equipment n.e.c.
C29	Motor vehicles, trailers and semi-trailers
C30	Other transport equipment

Table 11: List of industries with ISIC rev. 4 codes