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THE EXPORT PERFORMANCE AND COMPETITIVENESS OF THE EURO AREA'S PERIPHERY

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This paper examines the impact of the selected factors on the real exports of goods and services in the several euro area (the eurozone) peripheral economies. There are five countries in the sample (Italy, Spain, Portugal, Ireland, and Greece). The time period from 2000 to 2019 is considered. The research is aimed at providing robust estimates of the long-term relationship between the real exports of these countries and the selected explanatory variables using panel data analysis. The coefficients of the cointegration export equation were estimated using the FMOLS and DOLS estimators. Using the FMOLS estimator, the estimated coefficient of the real effective exchange rate is negative (-0.80) and of the variable foreign demand is positive (2.25). The coefficient of the real effective exchange rate confirms the fact that, from the point of view of the eurozone peripheral members, the overestimated real value of the euro has a disincentive effect on their real exports. The estimated coefficient of foreign demand suggests that the real export of goods and services (volumes) of the eurozone peripheral members increases by 2.25% when the real Gross Domestic Product (GDP) of the EU increases by 1%. The real export elasticity of the eurozone periphery countries is higher for foreign demand (income elasticity) than for relative price changes (price elasticity). Reductions in wages and prices in peripheral countries have led to redistributive effects in favor of the core.

Keywords: export, real effective exchange rate, foreign demand, net FDI inflow, cointegration, exports equation

JEL Classification: E32, F32, F41, F44

INTRODUCTION

The eurozone members are economically interconnected. According to the convention, the peripheral members of the eurozone include Italy, Spain, Portugal, Ireland and Greece (the countries that geographically belong to the periphery of the eurozone). On the other hand, there is Germany in the center of the Eurozone "core". A dynamic approach to classifying the eurozone countries into those "core" and/or those "peripheral" was developed by P. De Grauwe (2018) and F. N. Campos and C. Macchiarelli (2021). There is an economic rationale for the classification of these countries into the two blocs. The empirical research shows that there is a large gap formed between

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these two blocs with respect to competitiveness and external imbalance during the upswing phase of the economy and in terms of the degree of instability in the government bond market and the downward slope of the business cycle as well. The lower productivity and competitiveness of their economy compared to the core of the eurozone are a common characteristic of the peripheral members. Therefore, the asymmetric effects of external shocks occur between these two groups of countries, with the burden of adjustment falling on the countries with a current account deficit. The peripheral members of the eurozone are in the center of our research study. These countries generated big trade deficits in the period before the outbreak of the global financial crisis. Through empirical research, the paper aims to check how these countries solved the problem of external imbalance in the circumstances of external shocks and how that affected their competitiveness. Since all the members of the eurozone renounced the exchange rate as an instrument of the economic policy, the economically weaker members (in our case the peripheral members) are exposed to greater pressure due to external shocks. If the same research were conducted on a sample of the core countries of the eurozone, different results could be expected because these countries are stronger and more competitive economies compared to the peripheral members.

After the global financial crisis of 2008-2009, the European economies were shaken by the sovereign debt crisis. The current account imbalances in the Eurozone periphery (hereinafter referred to as the "periphery countries") are at the heart of the European sovereign debt crisis. The growing eurozone current account imbalances were subjected to the adjustment process in the post-crisis period after 2009. The increase in the exports of the deficit countries was an important channel of this adjustment. The periphery and the core of the eurozone had differed from each other by unit labor costs since the creation of the monetary union. As a result, there are also differences in price competitiveness. In the current account rebalancing process, the eurozone periphery countries had to suppress the growth of inflation and labor costs below the average of the eurozone in order to restore price competitiveness. In the literature, production structural reforms have been proposed in order to achieve this goal. P. R. Lane and G. M. Milesi-Ferretti (2012) show that the global imbalances correction after the crisis of 2008 was mainly due to a reduction in consumption. More recently, attention has been drawn to the other factors in addition to price competitiveness, which has all led to current account imbalances. One of them is the export structure due to the fact that the peripheral eurozone countries have been hit by the competition coming from low-cost countries (Chen, Milesi-Ferretti & Tressel, 2012). In the literature, there is an opinion that the growth of domestic demand in the peripheral countries is a more important cause of the current account deficit than price competitiveness (Wyplosz, 2013). In this case, certain authors see the increase in unit labor costs as an accompanying effect of domestic demand growth, not as the main factor causing the current account deficit (Gabrisch & Staehr, 2012). According to some other authors, the higher growth of unit labor costs in the periphery compared to the core countries reduced the export competitiveness of the peripheral countries and increased demand for products from the core countries, so that the deepened differences in price competitiveness led to current account imbalances (Sinn, 2014; Storm & Naastepad, 2015). In the high-tech goods exporting countries, the impact of this factor on competitiveness is less pronounced.

K. Efstathiou and G. B. Wolff (2017) show that the current account adjustment of the peripheral countries in a ten-year period from 2007 to 2016 was achieved through exports, whereas imports remained at an earlier level or but slightly increased. According to these findings, the trade balances in Spain and Portugal were adjusted to around 8.5 percentage points of the Gross Domestic Product (GDP), with the export contribution being 8 and 11 percentage points (pp) and the import contribution simultaneously being 0.5 and -2.5 (an increase in imports), respectively. Despite the strong adjustment of the current account balance, the Spanish economy is characterized by high gross external indebtedness, which amounted to 169.3% of the GDP at the end of 2019 (Delgado-Télez, Moral-Benito & Viani, 2020). The authors who came to these findings point out the fact that, due to such high external indebtedness, the country's financial stability could be disrupted if the external financing conditions deteriorated.

As the members of the eurozone, the peripheral countries were able to access a deeper financial market. At the same time, however, these countries gave up the exchange rate as a valuable corrective mechanism in the times of crisis. A higher degree of financial integration eased external borrowing, which led to deterioration in the external position of these countries. The economic growth of Greece and Ireland during the early 2000s was based on the expansion of consumer credit and borrowing abroad. Private consumption accounted for almost three-quarters of Greece's GDP growth and was financed by bank loans. A part of consumer credit was spent on imported products, which, along with moderate exports, led to a current account deficit. The real effective exchange rate appreciated in Ireland during the boom led to a reduction in export shares, so the current account shifted to a deficit in 2005 (Dooley, 2018). The global financial crisis of 2008 and the eurozone debt crisis in the period from 2010 to 2012 imposed the adjustment process which led to a reduction in the current account deficit of the peripheral members. In order to restore competitiveness and adjust the real exchange rate in the short run, these countries were forced to undertake an internal depreciation of the euro (a weaker real effective exchange rate of the euro), which was achieved by a downward adjustment in nominal wages and prices relative to major trading partners, which led to a slowdown in economic growth, a rise in unemployment, and an increase in the fear of potential recession[1]. Thanks to the structural reforms, the peripheral countries have managed to restore some of the lost macroeconomic competitiveness in recent years. However, the external shock of Covid-19 led to a large decline in the economic activity in all the members of the eurozone, so that the peripheral members are facing a reduction in export demand, which on its part can undermine the sustainability of the current account of these countries. At the same time, it will be difficult for the periphery to continue to depreciate the real exchange rate as a measure to boost exports because it could further disrupt economic growth, increasing the budget deficit and the public debt. It is, therefore, necessary to establish a redistributive industrial policy in order to support an adequate level of aggregate demand in all the euro area member states. As pointed out by C. Gräbner, Ph. Heimberger, J. Kepeller and B. Schüz (2020), strengthening the technological catch-up process in the periphery countries is a precondition to reducing the divergence between the periphery and the center of the eurozone. These are the reasons for examining the export performance of the peripheral euro area members in more detail.

The Covid-19 pandemic caused a great shock in the European economy. Some peripheral eurozone members have suffered a serious blow (Spain and Italy), so their economy is severely affected by this crisis. In the other countries, the shock caused by Covid-19 was followed by a slowdown in economic growth and trade. If the Covid-19 crisis continues to last for long, it can be expected that EU consumers will cut expenditures on manufacturing goods. It will lead to trade-to-GDP elasticity greater than the one in the eurozone periphery (the reduction in manufacturing exports of these countries will be considerably larger than the reduction in the EU's GDP). That is the reason why it is extremely important for the peripheral members of the eurozone to quickly return to the path of export growth so as to avoid the worsening of the current account. To achieve that, it is necessary that the impact of the relevant factors on the real exports of the peripheral eurozone members should be reexamined.

The subject matter of the research conducted in this paper implies the examination of the role of the exchange rate and foreign demand in shaping the export performance and competitiveness of the peripheral members of the eurozone. The paper is aimed at investigating the relative role of price competitiveness and foreign demand as the factors that affect real exports and therefore the current account of the eurozone periphery countries. Starting from the subject matter and the goal of the research study, the following research hypotheses are tested in the paper:

H1: Price competitiveness is an important export factor of the peripheral members.

H2: The export demand of the other European Union members significantly affects the export of its peripheral members.

The panel model of the real export of the five peripheral eurozone members most affected by the sovereign and banking crisis in Europe (namely Italy, Spain, Portugal, Ireland, and Greece) will be estimated. The real effective exchange rate was used as a measure of price competitiveness, while the real GDP of the EU was used as an indicator of foreign import demand, i.e. an indicator of the income elasticity of demand for the exports of the peripheral countries. The export equation in this study includes the EU28 import demand variable since the EU28 market was the most important export destination for the peripheral eurozone members in the period covered by our panel analysis.

The rest of the paper is structured as follows: Section 2 provides an overview of the literature; in Section 3, the methodology applied and the data used in the research are presented in detail; in. Section 4, the empirical results of the research study are presented, while Section 5 ultimately provides the concluding remarks.

LITERATURE REVIEW

The earlier empirical studies that analyzed the causes of the current account deficit in the eurozone peripheral members examined the effects of price competitiveness on exports (Harmsen, Turunen & Bayoumi, 2011; ECB, 2012; Tressel & Wang, 2014; Storm & Naastepad, 2015). Thus, some authors emphasize the fact that the rebalancing of the peripheral eurozone members is not only an internal process, because a significant part of these countries' exports is realized outside the eurozone (Darvas, 2012). It is pointed out that exporters from the peripheral countries are confronted with the intense competition of the countries with abundant cheap labor. The exchange rate is one of the factors influencing exports in different ways (Chen *et al*, 2012). The systematic studies of the link between eurozone exports and various cost and price competitiveness indicators do not show compliance with the "ideal indicator" for measuring international cost and price competitiveness. In an effort to answer this question from an empirical point of view, M. Ca' Zorzi and B. Schnatz (2007) evaluated the alternative export equations that included the various real effective exchange rates of the eurozone. The obtained results are quite consistent with previous findings. The authors estimated that the improvement of cost and price competitiveness by 1% was associated with an increase in the volume of exports ranging from 0.3% to 0.4% for the largest number of the indicators used to measure cost and price competitiveness. In their study on the export performance of the eurozone, R. Harmsen *et al* (2011) estimated the impact of foreign demand on exports. They found that the elasticity of exports on foreign aggregate demand was positive and statistically significant, but the price competitiveness coefficient varied considerably depending on which indicator was used as a proxy for price competitiveness. In their recent work, S. Christodoulopoulou and O. Tkačevs (2014) assessed export and import equations for some eurozone countries, and their research findings show that price competitiveness is a significant factor that affects exports.

The findings in the literature indicate the fact that the value of the exports of the peripheral members is significantly influenced by the exports structure. Countries with a greater share of high-tech products in total exports have a greater export growth, so the foreign income elasticity of export demand is greater (Wierts, van Kerkhoff & de Haan, 2014). U. Baumann and F. di Mauro (2007) analyzed how the specialization of trade in the euro area had changed due to globalization and found that the specialization of this zone had increased in those high-tech sectors in which there was a high productivity growth with strong growth in demand, e.g. pharmaceuticals.

Some authors (Matthes, 2014) found that current rebalancing in some peripheral members was mainly the consequence of the business cycle phenomenon that could be reversed in the other direction. They argued that rebalancing was not a structural phenomenon and that, due to the growth of the economic activity, imports would be greater than exports.

Our empirical strategy is also related to the literature that analyzes resource reallocation in the periphery countries. For instance, T. Tressel and Sh. Wang (2014)

analyzed the effects of the external rebalancing of the eurozone deficit countries. These authors did not provide strong evidence for resource reallocation from the non-tradable sector to the tradable sector, but they did conclude that an improved export performance still depended on external demand in the rest of the world.

Many recent papers have focused on internal demand as an important factor of the current account deterioration. One conclusion found in this literature is that rebalancing in the current account of the periphery countries is possible by redirecting exports to non-EU countries (Éltető, 2018). This author investigated the effects of trade in goods and services in the Iberian, Baltic, and Visegrád countries after the crisis. The analysis concluded that the exports of these countries had increased due to a decline in domestic demand. The results of this study show that the reorientation of trade towards non-EU countries was temporary, and the product structure of exports remained largely the same as before the crisis. G. Gaulier and V. Vicard (2012) analyzed the causes of the current account deficit in the peripheral Eurozone members and concluded that, until the outbreak of the crisis, the accumulated deficits had been mainly due to relatively dynamic domestic demand. They also noted the fact that the exports of the peripheral eurozone members had often grown despite the rising unit labor costs. These authors concluded that the financial integration in the eurozone had allowed capital inflows in the non-tradable sectors of the periphery countries, thus resulting in an increased import demand, as well as a rise in the price of non-tradable goods and services. E. Bobeica, E. P. Soares, A. Rua and K. Staehr (2014) investigated the link between domestic demand pressure and exports by using the error correction dynamic panel model for the 11 euro area countries over the two decades. The findings of that study suggest that there is a statistically significant substitution effect between domestic and foreign demand. At the same time, the link is much stronger when domestic demand decreases than when it increases, according to the authors' estimation.

Finally, some recent papers have used dynamic equilibrium models in the current account analysis of the peripheral eurozone countries. Ch. Zwick (2018) analyzed the sources of the current account deficit in Greece, Ireland, Portugal, and Spain after the introduction of the euro. The DSGE model with a diversified exports sector structure was applied in the research and estimates were given for each peripheral country individually. The model exhibited a solid performance and was used to quantitatively estimate the different explanatory variables that explain the origin of the deficit. The results indicate the fact that the interest convergence played an important role in the decline of the net-exports-to-GDP ratios in the eurozone periphery.

DATA AND METHODOLOGY

Data

Our empirical analysis of the dynamics in the exports of the peripheral eurozone countries is based on the annual time series for five countries (Ireland, Italy, Spain, Portugal, and Greece) in the period from 2000 to 2019. The source of the data for all the variables was the EUROSTAT statistical database, with the exception of the data for the net inflow of the FDI variable for the period from 2000 to 2019, and the unit value of exports for the years 2000 and 2001, which were downloaded from the World Bank database[2]. The export of goods and services is the dependent variable in the model. The explanatory variables were selected according to the conventional construction of the export equation in the literature. All the variables in the model are natural logarithms. The panel is balanced.

The variables in the export equation are as follows:

The export of goods and services (the label in the export equation is *EXPORT*). The data on the exports of goods and services are chain-linked volumes, index 2010 = 100. The export of goods and services is a dependent variable, but with a time lag of one period, it also appears as an explanatory variable. The other indicators represent the explanatory variables.

The Real Effective Exchange Rate (the label in the export equation is the *REER*). *REER* is the real effective exchange rate (the deflator: the consumer price index - 42 trading partners - industrial countries), index 2010 = 100[3]. A rise in this index means a loss of competitiveness. *REER* is calculated using tradable and non-tradable prices separately, in which way the effects of price competitiveness can be better understood according to the approach set by C. Wyplosz (2013). *REER* for internal goods is calculated by dividing *REER* (calculated using the GDP as the deflator) by *REER* (obtained using the export prices as the deflator) (the decomposition according to Ruscher & Wolff, 2009). The label for this *REER* in the export equation is *REERINTERNAL*. This variable is used to test the robustness of the model.

Foreign demand (the label in the export equation is *FD*). As an indicator of foreign demand, the data for the EU28 GDP at market prices (the chain-linked volumes, index 2010 = 100) were used. The EU's GDP was taken as the indicator of foreign demand because the predominant part of the export of the peripheral countries is realized on the EU market.

The Net FDI Inflow (the label in the export equation is *FDI*). Different *FDI* categories have a different impact on trade and competitiveness. In our panel, Ireland is an example of a country with a link between the large net *FDI* inflows and a strong export-led economic growth during 1990[4]. A significant part of the *FDI* inflow was realized in the intra-euro area in the form of mergers and acquisitions (M&A), so its impact on competitiveness and trade seems to be irrelevant. Hence, the transfer of technology associated with M&As between the euro area countries is rather limited. The largest inward *FDI* stock in terms of their GDP was recorded in Ireland (244% in 2018). Italy and Greece did not form a significant stock of *FDI*, while important investments by German companies in Spain and Portugal from the beginning of 1990 were later redirected towards new EU member states.

Export Prices (the label in the export equation is *EXPORTPRICE*). The export prices were approximated by the unit value of the exports. The unit values were calculated by dividing the trade value by the quantity. The unit values obtained in this way were divided by the average unit value of the previous year in order to obtain the basic indices of the unit value. The outliers were removed from these indices. The indices of the basic unit values were aggregated across countries and commodities. Finally, the unit value indices were chained back to the reference year (2010 = 100) and were used in this paper to approximate the import and export price movements.

The Dummy (the label in the export equation is *DUMMY*). The period from 2009 to 2019 is a crisis period because the peripheral eurozone members were forced to implement the current account adjustments. This dummy variable serves to show that the financial crisis affected the periphery countries. The dummy variable is equal to 1 from 2009 to 2019, being 0 otherwise.

Methodology

Regression model specification

Following M. Comunale and J. Hessel (2014) in our research study, the model of aggregate exports is applied, in which the panel series of the exports volumes of goods and services is a dependent variable, the independent variables being as follows: 1) the real effective exchange rate as a substitute for price competitiveness; 2) foreign demand, proxied by the EU28 growth GDP; 3) net foreign investments, as multinational enterprises represent significant exporters from the peripheral countries; 4) export prices. All the variables are natural logarithms.

The dependent variable is also a one-lag regressor and the independent variables are at the level and with one lag. The Akaike information criterion (AIC) and the Bayesian information criterion (BIC) were applied for the lag length selection. Different combinations of the variable lag lengths were used in our export equation and the differences between them were negligible. Finally, a decision was made to use all the variables with one lag length as the simplest option. The model follows the typical structure of a dynamic panel model, which includes a dependent variable

with a lag. The introduction of the variables with a lag is important for controlling the dynamics of the process. The selection of the variables in the model is similar to the analysis of the eurozone's export performance provided by R. Harmsen *et al* (2011).

The model can be expressed as:

$$LogEXPORT_{i,t} = \delta_i LogEXPORT_{1,t-1} + \alpha_{10i} LogREER_{i,t} + \alpha_{11i} LogREER_{i,t-1} + \alpha_{20i} LogFD_{i,t} + \alpha_{21i} LogFD_{i,t-1} + \alpha_{30i} LogFDI_{i,t} + \alpha_{31i} LogFDI_{i,t-1} + \alpha_{40i} LogEXPORTPRICE_{i,t} + \varepsilon_{it} \quad (1)$$

The robustness of the obtained results was checked by an extended regression equation:

$$LogEXPORT_{i,t} = \delta_i LogEXPORT_{1,t-1} + \alpha_{10i} LogREER_{i,t} + \alpha_{11i} LogREER_{i,t-1} + \alpha_{20i} LogFD_{i,t} + \alpha_{21i} LogFD_{i,t-1} + \alpha_{30i} LogFDI_{i,t} + \alpha_{31i} LogFDI_{i,t-1} + \alpha_{40i} LogEXPORTPRICE_{i,t} + \alpha_{40i} DUMMY_{i,t} + \alpha_{40i} LogREERINTERNAL_{i,t} + \varepsilon_{it} \quad (2)$$

The choice of the variables included in the export equation was motivated by the literature on external competitiveness. The estimated export equation provides an opportunity to see the impact of the selected explanatory variables on the real exports of the countries included in the panel. The panel regression in this study implies that the estimated elasticities for foreign demand and the real effective exchange rate are common across the sample of the observed countries. However, in reality, foreign trade structure differs across the periphery countries, which means that the individually calculated coefficients of elasticity will differ across countries.

The estimation strategy

The first step in the study is to check the stationarity of time series. The literature (Harmsen *et al*, 2011) suggests that aggregate trade panels are stationary (I(1)) and cointegrated. Testing for the stationarity of the time series in the panel here will be carried out using the following tests: 1. the A. Levin, Ch. F. Lin and Ch. Ch. J. Chu (2002) test (LLC), 2. the K. S. Im, M. Pesaran and Y. Shin (2003) test (IPS), 3. the J. Breitung (2000) test, 4. the Fisher -ADF and Fisher-PP tests (Maddala & Wu, 1999; Choi, 2001) and 5. the K. Hadri (2000) test. It should be pointed out that the LLC, Breitung, and Hadri tests assume that there is a common process of the unit root, whereas the the IPS and Fisher-ADF, and Fisher-PP tests are based on the assumption that there is an individual process of the unit root.

In order to investigate the possibility of cointegration in this panel, the following cointegration tests are applied: the P. Pedroni (1999; 2001; 2004) test, the C. Kao (1999) test, and the Johansen-Fisher (Johansen, 1991) Panel Cointegration Test. The Pedroni and Kao tests are based on R. F. Engle and C. F. J. Granger's (1987) two-step (residual-based) cointegration tests. The Fisher test is a combined Johansen test. The cointegration equation in this panel is estimated by the FMOLS (Fully Modified OLS) and DOLS (Dynamic OLS) estimators (Phillips & Hansen, 1990).

The pooled FMOLS estimator defined by P. C. B. Phillips and R. H. Moon (1999) is an extended version of the standard estimator established by P. C. B. Phillips and B. E. Hansen (1990). Having defined a modified dependent variable and the serial correlation correction terms, the panel pooled FMOLS estimator for the coefficient β is given as follows:

$$\hat{\beta}_{FP} = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \bar{X}_{it} X_{it}^{'} \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} \left(\bar{X}_{it} Y_{it}^{+} - \hat{\lambda}_{12}^{+'} \right) \quad (3)$$

where $\bar{y}_{it}^{+} = \bar{y}_{it} - \hat{\omega}_{12} \hat{\Omega}_{22}^{-1} \hat{u}_2$ is the modified dependent variable which corrects endogenously and $\hat{\lambda}_{12}^{+} = \hat{\lambda}_{12} - \hat{\omega}_{12} \hat{\Omega}_{22}^{-1} \hat{\Lambda}_{22}$ is the modified serial correlation correction term.

Instead of directly estimating the asymptotic variance, P. Pedroni (2001) and N. C. Mark and D. Sul (2003) defined the consistent estimator by using the regressor moments:

$$\hat{V}_{FP} = \hat{w}_{1.2} \hat{M}_{FB}^{-1} \quad (4)$$

where

$$\hat{M}_{FP} = \frac{1}{N} \sum_{i=1}^{N} \left(\frac{1}{T^2} \sum_{t=1}^{T} X_{it} X_{it'} \right) \quad (5)$$

In their paper, N. C. Mark and D. Sul (2003) propose the sandwich form of this estimator, which allows for heterogeneous variances:

$$\hat{V}_{FP} = \hat{M}_{FP}^{-1}\hat{D}_{FP}\hat{M}_{FP}^{-1} \tag{6}$$

where

$$\hat{D}_{FP} = \frac{1}{N}\sum_{i=1}^{N}\left(\hat{w}_{1.2i}\frac{1}{T^2}\sum_{t=1}^{T}X_{it}X_{it'}\right) \tag{7}$$

and the long-term variance $\hat{w}_{1.2i} = \hat{w}_{11i} - \hat{w}_{12i}\hat{\Omega}_{22i}^{-1}\hat{w}_{21i}$ is calculated for each cross-section. For $\hat{w}_{1.2}$ and $\hat{w}_{1.2i}$ it is possible to correct the degree of freedom for comparability with the standard regression standard error of the regression estimators.

The dynamic OLS (DOLS) method for estimating the panel cointegration equation can be applied by augmenting the cointegrating regression with the lead and lag of the regressors. The following regression equation can be used (Pooled DOLS):

$$y_{it} = X_t^{'}\beta + D_{1t}^{'}\gamma_1 + \sum_{j=-q}^{r}\Delta X_{t+j}^{'}\delta + \vartheta_{1t} \tag{8}$$

The model allows for the short-term dynamic coefficients δ to be cross-section specific.

P. Pedroni (2001) proposed the augmentation of the J. H. Stock and M. Watson (1993) DOLS estimator on the panel structure. The panel DOLS includes an extended panel cointegration regression equation with specific cross-section lags and leads ΔX_{it} to the exclusion of asymptotic endogeneity and a serial correlation.

C. Kao and M. H. Chiang (2000) described the pooled DOLS estimator using ordinary least squares to estimate an augmented cointegrating regression equation as follows:

$$\tilde{y}_{it} = \tilde{X}_{it}^{'}\beta + \sum_{j=-q_i}^{r_i}\Delta\tilde{X}_{it} + {}^{'}{}_{j}\,\delta_i - \tilde{v}_{1it} \tag{9}$$

where $\tilde{y}_{it}$ and $\tilde{X}_{it}$ are the data without individual deterministic trends. The short-term dynamic coefficients δ_i can be cross-section specific.

Suppose that $\tilde{Z}_{it}$ represents a regressor created by the interaction of the $\Delta\tilde{X}_{it} + j$ terms with the cross-section dummy variables and denote $\tilde{W}_{it}^{'} = \left(\tilde{X}_{it}^{'}, \tilde{Z}_{it}^{'}\right)^{'}$.

Thereafter, the pooled DOLS estimator can be written as follows:

$$\begin{bmatrix}\hat{\beta}_{DP}\\ \hat{\gamma}_{\gamma DP}\end{bmatrix} = \left(\sum_{i=1}^{N}\sum_{t=1}^{T}\tilde{W}_{it}\tilde{W}_{it}{}'\right)^{-1}\left(\sum_{i=1}^{N}\sum_{t=1}^{T}\tilde{W}_{it}\tilde{y}_{it}{}'\right) \tag{10}$$

C. Kao and M. H. Chiang (2000) show that the DOLS and pooled FMOLS estimators have the same asymptotic distribution. Therefore (Kao & Chiang, 2000) the asymptotic covariance matrix of the $\hat{\beta}_{DP}$ can be estimated using the corresponding sub-matrix of:

$$\hat{V}_{DP} = \hat{w}_{1.2}\hat{M}_{DP}^{-1} \tag{11}$$

where

$$\hat{M}_{DP} = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{1}{T^2}\sum_{t=1}^{T}\tilde{W}_{it}\tilde{W}_{it}{}'\right) \tag{12}$$

and $\hat{w}_{1.2}$ is an estimator of the long-term residual variance.

In this paper, the Granger-Causality relationship will be checked among the panel time series. Granger Causality can be calculated using bivariate regressions, the bivariate regressions in a panel context taking the following form:

$$\begin{aligned} y_{i,t} =& \propto_{0,i} + \propto_{1,i} y_{i,t-1} + \ldots + \propto_{k,i} y_{i,t-k} + \\ &+\beta_{1,i}x_{i,t-1} + \ldots + \beta_{k,i}x_{i,t-k} + \varepsilon_{i,t} \end{aligned} \tag{13}$$

$$x_{i,t} = \propto_{0,i} + \propto_{1,i} x_{i,t-1} + ... + \propto_{k,i} x_{i,t-k} + \\ + \beta_{1,i} y_{i,t-1} + ... + \beta_{k,i} y_{i,t-k} + \varepsilon_{i,t} \quad (14)$$

where t represents the time dimension of the panel, and i shows the cross-sectional dimension.

Here, the panel causality test that treats panel data as one large, stacked set of data are used and the standard Granger Causality test is applied then. This method is based on the assumption that all the coefficients are the same across all the cross-sections, i.e.:

$$\propto_{0,i} = \propto_{0,j} \propto_{1,i} = \propto_{1,j}, ..., \propto_{l,i} = \propto_{l,j}, \dot{A}\forall_{i,j} \quad (15)$$

$$\beta_{1,i} = \beta_{1,j}, ..., \beta_{l,i} = \beta_{l,j} \dot{A}\forall_{i,j} \quad (16).$$

Quantile regression is also applied in order to assess the impact of the real effective exchange rate and foreign demand at the different quantiles of the conditional real export distribution in the peripheral eurozone member countries. While most regression models relate to the analysis of the conditional mean of the dependent variable, quantile regression models the quantiles of the dependent variable given a set of explanatory variables. The original version of this model was formulated by R. Koenker and Jr. G. Bassett (1978). Based on this version, using quantile regression, the relationship between the LogREER and LogGDPEU regressors and the specified quantile of the LogEXPORT dependent variable is estimated.

The Empirical Results and Discussion

The results of the empirical research are presented in this section. The descriptive statistics of the variables used in this research are given in Table 1.

Table 1 shows that all the variables have a positive value of the mean. The FDI net inflow has the highest standard deviation (1.77), which means that this variable has the highest dispersion of the time series. Based on the Jarque-Bera statistics for the EXPORT and FDI variables, the null hypothesis reading that these series are normally distributed is rejected with a significance of 1%, as well as for the REERINTERNAL variable at a significance level of 5%. The skewness values, except for the EXPORT variable, are less than zero, so their empirical distribution is asymmetric to the left. The systematic growth of the exports over time makes the empirical distribution of this variable asymmetric to the right. The asymmetry to

Table 1 The descriptive statistics of the used variables

	EXPORT	REER	GDPEU	FDI	EXPORTPRICES	REERINTERNAL
Mean	4.653465	4.577004	4.606658	0.79379	4.588338	4.574414
Median	4.62791	4.58272	4.62055	0.869926	4.59482	4.60151
Maximum	5.456602	4.695925	4.74232	4.391867	4.836537	4.758505
Minimum	4.102643	4.435567	4.467057	-6.52287	4.341205	4.349174
Std. Dev.	0.234566	0.051025	0.076002	1.771955	0.119709	0.104331
Skewness	0.789082	-0.52615	-0.07498	-1.6292	-0.26081	-0.45401
Kurtosis	4.26359	2.962443	2.27243	8.121833	2.14309	2.21485
Jarque-Bera	17.03025	4.619845	2.299356	153.5428	4.193246	6.003994
Probability	0.0002*	0.099269	0.316739	0.000000*	0.122871	0.049688**
Sum	465.3465	457.7004	460.6658	79.37897	458.8338	457.4414
Sum Sq. Dev.	5.447095	0.257754	0.571853	310.8428	1.418684	1.077606
Observations	100	100	100	100	100	100

Note:*p<1%; **p<5%. The descriptive statistics of each variable are calculated based on the logarithmic values of all the variables.

Source: Author

the left suggests that the rest of the time series exhibit a downward trend over time. The kurtosis for the EXPORT and FDI variables has a value greater than 3, which makes it possible to conclude that the tails of the empirical distribution of these variables are heavier than the tails of the normal distribution. The heavy tails are the result of the extreme disturbances in the movement of the time series, such as the global financial crisis of 2007-2009. The kurtosis for the other variables is less than 3, so the tails of the distribution of these variables are lighter than the tails of the normal distribution (the series are platykurtic).

In order to check the degree of the integration of the panel variables, the following first-generation unit root tests, namely the LLC, IPS, ADF-Fisher Chi-square, PP-Fisher Chi-square, and Hadri tests were applied. The data for all the variables cover the period from 2000 to 2019. As the time horizon in this study (20) is rather short, multiple unit-root tests were applied so as to avoid the weaknesses that arise due to the shorter time horizon of the panel time series. For all the tests, two options are included: the constant and the constant with the trend. The equation for testing was applied to the level and the first differential of each variable in the model.

The applied unit-root tests showed the presence of the unit root for the level of the variable in most panel time series at a significance level of 5%. Then, the integrity check at the first differential was carried out, and all the series were found to be stationary, that is their integrity was of the order one (Xt~I(1)). The exception were several variables whose stationarity of the first difference was not confirmed by the Hadri test. There was no surprise given the lack of the Hadri test because, in the shorter time series, it overly rejects the null hypothesis that a time series is stationary.

Since the biggest number of the unit root tests showed that the model variables were integrated of the order one, the existence of the cointegration between the exports and the explanatory variables in the model was subjected to examination. The Pedroni Cointegration Test was used, and to test the robustness of the conclusions the Kao Cointegration Test and the Johansen Fisher Panel Cointegration Test were done. The null hypothesis of the Pedroni and Kao test reads that the residuals of the estimated cointegration equations are nonstationary, i.e. they have a unit root. In case variables are co-integrated, residuals are stationary. Four of the 11 calculated test statistics of the Pedroni test (without the deterministic component in the model) indicate the existence of cointegration, whereas the other statistics of the same test do not confirm this finding.

Table 2 reports the results of the Kao Residual Panel Cointegration tests, which rejected the null hypothesis of no cointegration for the export of goods and services of the peripheral countries and the other variables at the 5% significance level, so there is cointegration.

Table 2 The Kao Residual Cointegration test results

	t-Statistic*	Prob.
ADF	-1.789289**	0.0368

Notes: The ADF is residual-based ADF statistics. The null hypothesis is no cointegration. ** It means that the estimated parameters are significant at a 5% level. The automatic lag length selection based on SIC with the max lag of 2, the Newey-West automatic bandwidth selection, and the Bartlett kernel.

Source: Author

The result of the Johansen-Fisher Panel Cointegration Test summarized in Table 3 allows us to see that there is a cointegration relationship among the five variables at the 1% significance level. Based on the results of the panel cointegration tests, it can be concluded that there is a panel long-term equilibrium relationship among the export of goods and services, foreign demand, the real effective exchange rate, foreign direct investment, and the exporting process. In contrast to the Kao and Johansen-Fisher panel cointegration test, most statistics (i.e. seven of 11, without the deterministic component in the model) do not reject the null hypothesis of no cointegration at the conventional size of 0.05 in the Pedroni test for the period from 2000 to 2019.

Since the largest number of the tests confirmed the existence of cointegration, the next step was to

estimate cointegration vector coefficients. Using the FMOLS and DOLS estimators, the long-term relationship between the variables of the starting model was estimated. The cointegration vector was estimated using country fixed-effects regressions (Table 4).

The largest number of the coefficients from the estimated equation are statistically significant at the level of 1%. The coefficient of the export volumes with a lag taken as an independent variable has a high value, which indicates a high degree of inertia in the movement of the exports of goods and services of the peripheral countries. The results obtained in this study are consistent with the findings in the economics literature (Harmsen *et al*, 2011). The diagnostic check shows that the residuals of the estimated equation do not have autocorrelation and are mostly normally distributed.

As expected, the real effective exchange rate significantly influences the exports and has the expected negative sign. The estimated coefficient of the

Table 3 The Johansen-Fisher panel cointegration test (the unrestricted cointegration rank test; the trace and the maximum eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	182.8**	0.0000	126.3**	0.0000
At most 1	87.19**	0.0000	57.38**	0.0000
At most 2	39.91**	0.0000	33.31**	0.0002
At most 3	16.80	0.0766	18.86***	0.0421
At most 4	6.285	0.7908	6.285	0.7908

Notes: * The probabilities (asymptotic p-values) are computed using the asymptotic Chi-square distribution. ** The test statistics are significant at the 1% level. *** The test statistics are significant at the 5% level. The linear deterministic trend is included.

Source: Author

Table 4 The export equation of the peripheral eurozone - the FMOLS and DOLS estimates, for the period from 2000 to 2019 and the subperiod from 2009 to 2019

	2000–2019		2009–2019	
	FMOLS	DOLS	FMOLS	DOLS
Export volume - *LogEXPORT*(-1)	0.96(0.00)	0.96(0.00)	0.84(0.00)	0.84(0.00)
Real effective exchange rate (*LogREER*)	-0.80(0.00)	-0.78(0.00)	-0.85(0.00)	-0.87(0.02)
Real effective exchange rate (*LogREER*)(-1)	0.60(0.00)	0.61(0.00)	0.39(0.00)	0.40(0.24)
Foreign demand (*LogGDPEU*)	2.25(0.00)	2.26(0.00)	2.09(0.00)	2.07(0.00)
Foreign demand (*LogGDPEU*)(-1)	-2.30(0.00)	-2.33(0.00)	-1.93(0.00)	-1.92(0.00)
Net FDI inflow (*LogFDI*)	0.00(0.00)	0.01(0.02)	0.00(0.00)	0.00(0.53)
Net FDI inflow (*LogFDI*)(-1)	0.00 (0.04)	0.00(0.48)	-0.00(0.62)	-0.00(0.04)
Export prices (*LogEXPORTPRICES*)	0.11(0.00)	0.12(0.13)	0.16(0.00)	0.16(0.00)

Notes: In parentheses, there is the p value. For the period from 2000 to 2019, the sample is adjusted to 2002-2019 for the FMOLS estimation and to 2001-2019 for the DOLS. The cointegration equation estimation method: the panel FMOLS; the panel method: pooled estimation; the cointegration equation deterministic: the constant (C); the first-stage residuals use heterogeneous long-term coefficients; the coefficient covariance computed using the default method; the long-term covariance estimates (the Bartlett kernel, the Newey-West fixed bandwidth); the p-values are given in parentheses. The cointegration equation estimation method: the panel DOLS; the cointegration equation deterministic: the constant (C); the long-term variance (the Bartlett kernel, the Newey-West fixed bandwidth) are used for coefficient covariances.

Source: Author

real effective exchange rate confirmed the theoretical view that the overvalued currency will discourage export. Therefore, the estimated value of that coefficient suggests that the potential improvement of competitiveness can significantly contribute to an increase in real exports. The overestimated real value of the euro from the position of the peripheral countries shows that the cost efficiency of these countries is reduced due to wage and domestic price growth. Given the fact that the exchange rate is an exogenous variable for all eurozone members, the growth of wages and prices in the peripheral countries relative to the EU average reduces their competitiveness. This price competitiveness indicator means that the exports of the periphery countries are largely dependent on prices and less on the product quality. However, the opposite conclusion is reached based on the estimated value of the coefficient for the export prices. According to the quantitative value, this coefficient is less significant compared to the estimated value of the coefficient for the real effective exchange rate, whereas according to the FMOLS, it is statistically significant, almost the same as the coefficient for the exchange rate. Given the fact that the coefficient for export prices has a positive sign, this would mean that the growth of export prices does not adversely affect the real exports of goods and services from the peripheral countries. In other words, the export of the peripheral member states is more influenced by high-quality goods with high value added (VA) than prices themselves. This coefficient suggests that, in the process of the current account adjustment in the countries included in our panel, structural adjustment programs would imply a greater export share of higher-VA products in their total exports.

However, the data on the share of high-tech products in the total exports of the peripheral countries show that, for most of them, this share is still low (except for Ireland). As a share of the total exports for 2018, high-technology exports in Ireland were 34.7%, in Italy 7.8%, in Portugal 4.0%, in Spain 5.5%, and in Greece 4.5% According to Eurostat (SITC Rev.4), high-technology products include the following products: the aerospace, computers-office machines, electronics-telecommunications, pharmacy, scientific instruments, electrical machinery, chemistry, non-electrical machinery, and armament. The total exports for the EU do not include intra-EU trade.) The data were retrieved May 6, 2021, from https://ec.europa.eu/eurostat/web/products-datasets/-/tin00140. As the share of these products in exports increases, a smaller impact of price on exports can be expected (Wierts *et al*, 2014). At the same time, the share of domestic VA in the total exports for the periphery countries is considerably higher than the share of high-tech products in the total export[5], which means that the biggest portion of the exports of the eurozone peripheral member countries are the products of lower VA whose export demand is sensitive to both quality and prices. It means that price and income elasticities are important for a significant portion of the exports of the periphery countries[6]. However, increasing countries' involvement in global value chains (GVCs) reduces the price and income elasticity of exports[7]. The 2008-2009 global financial crisis had a strong negative effect on GVCs participation for the periphery countries (WTO, 2019), and a similar effect can be expected after the Covid-19 crisis. Namely, the crisis caused by Covid-19 led to a disruption in GVCs deliveries, so the resumption of trade flows within GVCs depends on the recovery of the world economy and the behavior of countries in terms of the principles of open trade. Shortening supply chains can reduce countries' ability to specialize according to available comparative advantages. Besides, the strengthening of trade protectionism would lead to a further reduction in trade flows within GVCs.

The estimated coefficient for the GDPEU variable, which is a proxy for foreign demand, shows that the impact of the EU demand is a very important factor for the exports of the countries included in our panel. Since the time series are expressed in logarithms, the estimated coefficient implies that the real exports of goods and services (the volumes) of the peripheral countries will increase by 2.25% when the real GDP in the EU grows by 1%. The estimated coefficient for this independent variable is statistically significant at the 1% level, both according to the FMOLS estimator and according to the DOLS estimator for the whole period from 2000 to 2019, as well as the subperiod from 2009 to 2019. This confirms the fact that the real exports of goods and services in the peripheral eurozone member countries are strongly influenced

by the EU demand, according to which findings a conclusion can be drawn that the growth of demand in the eurozone core in the post-Covid-19 period encouraged by fiscal loosening in those countries would have a positive effect on the exports of the peripheral member countries. This would alleviate the burden of the fiscal adjustment and the balance of payments adjustment in the peripheral countries.

The estimates of the coefficient for the net FDI inflow variable are negligible. Based on this coefficient, it can be concluded that the net FDI inflow had almost no impact on the export of goods and services in the peripheral members. The reason for this low impact may lie in the fact that the prevailing part of the net FDI inflow into these countries is achieved through M&A, which does not lead to an increase in exports.

Once the export equation had been estimated, the residuals were tested. The same tests were applied for the unit root test in the panel time series. Based on all the tests, it can be concluded that the obtained residuals are stationary. It is important to point out the fact that the tests where the constant could be excluded (LLC, ADF Fisher, and PP Fisher) confirmed the fact that the residuals were stationary at the significance level of 1% in the case of the omitted constant. This procedure is common in testing residuals for stationarity. The obtained results confirmed the fact that the variables in the panel were cointegrated. Therefore, the applied model confirmed the fact that the selected variables had a significant impact on the exports of goods and services in the peripheral eurozone members.

In order to check the robustness of the estimated coefficients, two new variables were introduced in the cointegration equation, namely the dummy variable (*DUMMY*) and the real effective exchange rate for domestic goods (*LogREERINTERNAL*) variable. Table 5 accounts for the estimated coefficients in the extended export equation. The estimates were obtained using the FMOLS and DOLS estimators.

The cointegration equation estimates with the FMOLS and DOLS panel cointegration estimators are accounted for in Column 1 of Table 5. The export

Table 5 The robustness checks of the model for the period from 2000 to 2019 - the coefficients estimated using the FMOLS and DOLS estimators

Variables		1	2	3
Export volume - *LogEXPORT*(-1)	FMOLS	0.96***	0.96***	0.95***
	DOLS	0.96***	0.96***	0.95***
Real effective exchange rate (*LogREER*)	FMOLS	-0.80***	-0.77***	-0.81***
	DOLS	-0.78**	-0.75**	-0.80***
Real effective exchange rate (*LogREER*)(-1)	FMOLS	0.60***	0.61***	0.58***
	DOLS	0.61**	0.60***	0.60***
Foreign demand (*LogGDPEU*)	FMOLS	2.25***	2.31***	2.35***
	DOLS	2.26***	2.30***	2.34***
Foreign demand (*LogGDPEU*)(-1)	FMOLS	-2.30***	-2.39***	-2.36***
	DOLS	-2.33***	-2.37***	-2.33***
Net FDI inflow (*LogFDI*)	FMOLS	0.01***	0.01***	0.01***
	DOLS	0.01**	0.01**	0.01**
Net FDI inflow (*LogFDI*)(-1)	FMOLS	0.00**	0.00***	-0.00***
	DOLS	0.00****	0.02****	0.00****
Export prices (*LogEXPORTPRICES*)	FMOLS	0.11***	0.11***	-0.02****
	DOLS	0.11****	0.11****	-0.01****
DUMMY	FMOLS		0.00****	-0.01****
	DOLS		0.00****	0.01****
REER for internal goods (*LogREERINTERNAL*)	FMOLS			0.12****
				0.10****

Note: *** The significance level of 1%, ** the significance level of 5%, * the significance level of 10%. **** The coefficient is not statistically significant. The panel method: pooled estimation.

Source: Author

equation then includes the additional two variables, namely the *DUMMY* and *REER* variables, for internal goods. The estimates of the export equation with the two additional variables included are given in the columns 2 and 3 of Table 5. The introduction of the two new variables should check the adequacy of the estimated model. Almost all the coefficients estimated by the FMOLS estimator are statistically significant, generally at the level of 1%. The coefficient with the *REER* for internal goods variable estimated using the FMOLS and DOLS estimators was not statistically significant. Based on the estimated export equation, after the introduction of the additional variables, the adequacy of the starting model was confirmed.

It should be noted that there is a relationship between the real effective exchange rate that relates to the internal goods and the real exports of the countries included in the panel, which is indicated by the Granger causality test (Table 6).

Table 6 shows the Granger one-way causality from *LogREERINTERNAL* to *LogEXPORT*. This result indicates a possibility of increasing exports in the peripheral countries by increasing competitiveness. In fact, with an increase in competitiveness, there is a growing possibility that a part of the products sold in the domestic market of the peripheral countries would be redirected to exports, which could positively affect the current account of these countries.

Table 6 The peripheral eurozone countries pairwise Granger causality test, sample 2000-2019

Null hypothesis	Obs.	Lags	F-Statist-	Ver. p
LogREERINTERNAL does not Granger-cause LogEXPORT	90	2	2.78117	0.0676
LogEXPORT does not Granger-cause LogREERINTERNAL	90	2	0.23230	0.7932

Source: Author

Using the panel data quantile regression approach, the impact of the real effective exchange rate and foreign demand at different points along with the conditional distribution of the real exports of goods and services as the dependent variable was estimated for the period from 2000 to 2019 (Table 7). The impact of *logREER* and *logGDPEU* on *logEXPORT* varies along with the conditional distribution of the export volumes. The estimated coefficients are statistically significant, except for the 0.10 and 0.25 quantiles for *logREER*.

In the empirical model shown in Table 7, the relationship between the exports, *LogREER*, and *LogGDPEU* were first estimated using the Panel LS. The results are reported in the first column of Table 7. Applying the least square method, the relationship between the real exports as the dependent variables and the *LogREER* and *LogGDPEU* variables as the independent is estimated. The estimate is not related to the corresponding distribution point along with the dependent variable. The obtained coefficients are statistically significant and of a high value. In order to examine the impact of the independent variables on different points along with the conditional distribution of the exports as the dependent variable, quantile regression was applied at five quantiles, that is at the 0.10, 0.25, 0.50, 0.75, and 0.90 quantiles. The results are presented in the columns 2 to 6 of Table 7.

The values of the estimated coefficients vary depending on the selected quantile. All the coefficients estimated using the Panel LS are statistically significant at the level of 1%. In the quantile regression, the statistical significance of the estimated coefficients broadly differs across the regressions for various quantiles. The estimated *LogREER* coefficients are statistically significant at the level of 1% for the very top quantiles: 0.5 and 0.90, whereas the *LogGDPEU* coefficients are statistically significant at the level of 1% for all the quantiles. The negative value of the estimated coefficients for *LogREER* increases towards the higher levels of the distribution of the exports as the dependent variables, which demonstrates the increasing impact of this variable on the exports at the higher points of the conditional distribution of the exports.

Table 7 The estimation results for the export - quantile regression (2000-2019)

Independent Variables	Panel Least Square estimates	Quantile Regression Estimates				
		0.10	0.25	0.50	0.75	0.90
	(1)	(2)	(3)	(4)	(5)	(6)
C	-3.437(0.002)	-6.955 (0.000)	-4.364 (0.006)	-3.264 (0.024)	-1.671 (0.512)	1.158 (0.601)
LogREDK	-1.021 (0.000)	-0.144 (0.5668)	-0.337 (0.2344)	-1.024 (0.010)	-1.443 (0.016)	-2.077 (0.000)
LogBDPEU	2.771 (0.000)	2.635 (0.000)	2.2784 (0.000)	2.733 (0.000)	2.819 (0.000)	2.849 (0.000)
Number of cases	100	100	100	100	100	100
R^2	0.808					
Pseudo R^2		0.5692	0.581	0.582	0.596	0.655

Notes: 1) The prob-values reported in parentheses; 2) The quantile regression includes: the Huber Sandwich Standard Errors and Covariance; the sparsity method: Kernel (Epanechnikov) using residuals; the bandwidth method: Hall-Sheather, (bw=0.074542 for tau 0,1; 0.14497 for tau 0.25; 0.20932 for the median; the estimation successfully identifies the unique optimal solution.

Source: Author

The numerical value of the estimated coefficient for *LogGDPEU* is high and varies across the quantiles of the exports. According to these estimates, the impact of foreign demand on the real exports of the countries included in our panel is constantly strong regardless of the conditional distribution of the exports. In the case of the foreign exchange rate, this effect rises from the lowest to the highest quantiles, simultaneously showing that the real overvalued euro increases the adverse effect on the exports as they increase. The appreciation of the real effective exchange rate occurs when the growth of the prices in one member of the euro area is greater than the growth of the prices in the other members (inflation differentials), In which case the export of the member with higher inflation may be more expensive than the export of the other members, which on its part leads to a loss of export competitiveness. This confirms the findings in the literature that the euro, as the common currency of the peripheral countries with weaker competitiveness and the core ones with stronger performance, has led to an overvalued exchange rate for the peripheral countries and an undervalued exchange rate for the core countries. As a result, redistributive effects arise in trade between the eurozone members (Perotti & Soons, 2019). Thus, the findings of our quantile analysis confirm the early estimates derived from the panel analysis of the export vector of the peripheral countries.

CONCLUSION

This paper examined the connection between the exports of goods and services of the eurozone periphery countries and the real effective exchange rate, foreign demand, foreign direct investment, and export prices. Based on the empirical research, the initial hypothesis that price competitiveness is an important export factor of the peripheral members of the eurozone is confirmed. The findings of this paper *de facto* confirm the thesis that the overestimated real effective exchange rate of the peripheral countries reduces their competitiveness due to the growth of wages and prices in them (these countries cannot affect the nominal value of the euro because they renounced the autonomy of the exchange rate policy

by accepting the euro as the common currency), which directly reflects on commodity exports, for the reason of which fact they had to access the adjustment process in order to reduce their trade and current account deficits and bring them to a sustainable level.

The empirical findings in the paper also confirm a strong impact of demand in the other EU member states on the real exports of goods and services from the peripheral countries. The estimated coefficient shows that the real export of the peripheral member states increases by about 2.25% when the EU GDP increases by 1%, which on its part confirms the importance of economic growth in the EU for the export of the peripheral members. The revival of the economic activity across the EU opens up possibilities for the dynamic growth of the real exports of goods and services in the peripheral member countries, which confirms the initial research hypothesis saying that the export demand of the other EU members significantly affects the export of the peripheral member countries.

The impact of export prices on the exports of the peripheral member countries is also estimated in the paper. The estimated coefficient for this variable bears the unexpected positive sign, which in fact means that a rise in the prices of such exported goods is accompanied by an increase in exports. Although this is contrary to the usual theoretical assumption, according to which an increase in export prices in a foreign currency leads to a reduction in export competitiveness and to a fall in export volumes, the obtained findings require an analysis of the export structure. Namely, these findings can be linked to the changes in the export commodity structure of the peripheral member states, which occurred in their current account adjustment process over the period following the outbreak of the financial crisis in 2008. These changes are characterized by an increase in the share of higher-VA products in the total export, although this share is still small. An increase in the export volumes of these products is more influenced by the growth of foreign demand than the prices of these products (income elasticity is higher than price elasticity). A labor market reform (a reduction in nominal wages, the redirection of labor to the export sectors), an increase in the flexibility of wages and prices, as well as structural changes in exports towards increasing the share of technologically intensive products, can all contribute to an increase in the real exports of the peripheral member states. The resource reallocation from non-tradable to tradable sectors involves a reduction in unit labor costs due to a decline in domestic demand and an increase in unemployment. In order to achieve an increase in exports, wages in tradable sectors must be reduced. These products are then cheaper compared to competitors' prices on the world market. The eurozone countries with large current account deficits have significantly reduced unit labor costs in comparison to the main trade partners in the process of the current account adjustment after the financial crisis of 2008. Due to higher profit margins, relative prices have been reduced less than unit labor costs (Kang & Shambaugh, 2014). Reducing the trade deficit in the future is a desirable channel for reducing the current account deficit.

Based on the estimated export equation, it is concluded that price competitiveness is still a significant factor of export for the peripheral member countries, but that the impact of this factor decreases with an increase in the share of high technology exports in total exports. However, the export performance of the peripheral countries is also affected by the export demand of the other EU members, and this factor is more important than price competitiveness. These results confirm the findings of P. Wierts *et al* (2014) that the export structure has a significant impact on the value of exports.

The most significant results of the empirical research carried out in this paper are as follows:

- The growth of demand at the EU level is a strong driver of the exports of the eurozone peripheral member states. The slowdown in economic growth reduces the export opportunities not only of the eurozone peripheral member countries, but also of the other exporters to the EU market. This finding also applies to the countries which the EU is the largest trade partner for, as is the case of the Republic of Serbia. Global supply chains can act as shock absorbers in the event of a drop in global demand in major trading partners.

- The appreciation of the real effective exchange rate of the peripheral member countries has a disincentive effect on their exports. The peripheral member countries have reached an overvalued exchange rate due to the increase in domestic prices and wages compared to the core members of the eurozone. This finding is consistent with the theoretical assumptions about the impact of the real effective exchange rate appreciation on exports. The obtained result is particularly significant for the Western Balkan countries, where the price elasticity of export demand is also important.
- The positive impact of the growth of the export prices on the exports of the peripheral member countries shows that the increase in the share of the products of greater value added (VA) in exports leads to a real increase in exports. Demand for these products, especially when they are represented in global supply chains, is more stable and makes it easier for a country to achieve its current account balance. This finding is also significant for economic policymakers in the Republic of Serbia, because it carries the message that it is necessary to direct FDI towards those sectors where higher VA is produced for exports. A greater integration into regional value chains opens up opportunities for smaller fluctuation in real exports.

The analysis made in this paper is limited in that it covers a short-time horizon which reduces the quality of the econometric estimates. Additionally, the analysis is focused on the behavior of aggregate exports. This approach is relevant to macroeconomic analysis (such as the response of the total exports to changes in the real effective exchange rate), but it is inconvenient for the analysis of the behavior of individual sectors in an economy. In addition to that, the consumer price index used for calculating the real effective exchange rate includes the prices of the goods that are not the subject of trade. The nominal effective exchange rate adjusted to change in the prices of export goods would allow for a more accurate analysis of the impact of the real effective exchange rate on the export of the peripheral member states. Additional research efforts should also focus on separating the impact of the export factors on higher VA exports from the impact on lower VA exports.

ENDNOTES

1 The decline in the real effective exchange rate of Ireland and Greece in the period after 2008 was greater than in the other peripheral members (according to the EUROSTAT). By reducing wages and prices, the two countries have significantly improved their respective export competitiveness and reduced the current account deficit.

2 The databases were accessed on 5th February 2021.

3 The panel of 42 countries includes the EU-28 Member States and 14 other industrial countries - Australia, Canada, the United States, Japan, Norway, New Zealand, Mexico, Switzerland, Turkey, Russia, China, Brazil, South Korea, and Hong Kong.

4 The foreign-owned firms in Ireland had a high export orientation and were mainly located in high-technology sectors. For a more detailed analysis of FDI in Ireland, see F. Barry and J. Bradley (1997).

5 The share of domestic VA in the total exports for the periphery countries in 2016 was as follows: Ireland-58%, Portugal-72%, Greece-76%, Spain-77%, and Italy-78%. Retrieved May 6, 2021, from https://data.oecd.org/trade/domestic-value-added-in-gross-exports.htm)

6 Trade elasticity (the exports to the GDP) is significantly affected by the changes in the structure of import demand and cyclical factors.

7 Ireland's participation in GVCs measured as a percent share of the domestic VA sent to GVCs and foreign VA from GVCs in the total gross exports in 2015 reached 52.4% (40.2% is the backward participation and 12.3% is the forward participation); in Italy, it was 40.8%, in Greece 40.3%, in Portugal 43.9%, and in Spain 40.3%. Retrieved May 6, 2021, from https://vvv.vto.org/english/res_e/statis_e/mivi_e/countriprofiles_e.htm

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