

THE EURO'S EFFECT ON TRADE

The aim of the present paper is to study the effects of euro adoption on the trade of goods and services. For this purpose, a panel regression model is estimated for the seven euro area Member States from Central, Eastern and Southern Europe that have most recently adopted the single currency. The studied period covers the years from 2003 to 2018. The results indicate that euro area membership led to an increase in both the exports (by 3.3%) and the imports (by 2.8%) of the selected countries and for the chosen time period. This paper contributes to the existing literature by empirically examining the effect of euro area membership on trade, by covering the newly joined Member States.

JEL: E52; F14; F45

Keywords: Euro area; euro; trade; exports; imports

The accession to a currency union¹ is one of the highest forms of integration and it may influence the exports and imports of its member states. A common currency eliminates the exchange rate uncertainty and transaction costs associated with operations in different currencies, hence, reducing the risks linked to trade and respectively fostering trade. Moreover, a single currency ensures price transparency, which boosts competition among companies, while simultaneously decreasing the mark-up and increasing trade.

The Economic and Monetary Union (EMU) is the result of progressive economic integration in the European Union. It comprises a common monetary policy, the coordination of economic and fiscal policies and the euro – the common currency. According to Eun & Resnick (2012), the euro must be seen as a product of historical development towards the ever-deepening integration of Europe, beginning with the creation of the European Economic Community in 1958. The euro was founded with the aim of bringing the European countries together and achieving closer economic integration, which would in turn lead to faster economic growth and would guarantee a peaceful Europe (Stiglitz, 2016, p. 34).

The European single currency – the euro, was launched as an accounting currency in January 1999, substituting the former European Currency Union. Three years later, on 1 January 2002, the physical euro banknotes and coins entered into circulation. The common currency was established with the provisions of the

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¹ An exchange rate regime, where several countries share a common currency is known as a monetary (currency) union. Simeonov (2017, p. 16) points out that the term "monetary union" means the union of two or more countries that share a common currency or have irrevocably fixed the exchange rates of their national currencies.

Maastricht Treaty of 1992, defining the specific criteria for joining the Eurozone (more details on this will be given in the following section). Currently, the euro area consists of 19 of the 27 current Member States of the European Union (EU): Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain (see the Appendix). As members of the EU, the other eight countries have committed to introducing the euro (with the exception of Denmark, for which the EU Treaties foresee an "opt-out" clause²). The official financial authority of the EMU is the European Central Bank (ECB). The ECB and the national central banks constitute the Euro system; whose main goal is to safeguard price stability by protecting the value of the euro.

It is interesting to observe how participating in a monetary union affects the group of countries that have most recently joined the union. Therefore, the main focus of the present paper is to study if and how the adoption of the euro affects trade in the selected sample of Member States.

Some of the obvious positives of having countries share a single currency are the lower transaction and administrative costs and the price transparency, as everything is priced in the same currency. The euro allows for a free and easy movement of goods, capital and labour within the euro area, and it also permits an integration of economic activities from different countries (Mursa, 2014). Usually, with the accession to the euro area, the credit rating of the country is being increased, and thereby, the long-term interest rates tend to be lower. The single currency provides greater certainty for business organisations and encourages inward investments. The euro implies a greater presence of the Union in the global economy. Moreover, one of the main benefits of the euro is that it is expected to stimulate trade.

The aim of the present paper is to examine the impact of the introduction of a single currency on trade in seven euro area Member States. Although there are multiple studies on the effect of a single currency on trade in specific Member States and regarding other currency unions, the research on a group of Member States remains limited. The paper opens with a presentation of the theoretical background which examines the history of the Economic and Monetary Union (EMU) and the euro, as well as the convergence criteria for adopting a single currency. Previous studies related to trade and sharing a common currency are reviewed. The concept of trade integration in the EU context is then presented.

Afterwards, the main methodology of the study – a panel data regression and the descriptive statistics of the indicators: gross domestic product, exports of goods and services and imports of goods and services, are presented. The empirical study examines two linear regressions on panel data on the impact of the euro on the exports and imports of goods and services, respectively. The hypotheses on whether the adoption of the euro, the GDP and the Great Recession affect the exports and

² The other non-euro area countries are Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania and Sweden.

imports of goods and services for the sample of Member States, are tested. The paper concludes with the main deductions reached from the obtained results.

Theoretical background

Economic and monetary union

Mundell (1961) started the discussions on the benefits of a monetary union. A common currency enables closer integration of capital markets and encourages trade. The EU Member States decided to examine the possibilities of developing an economic and monetary union (EMU). The chairman of the committee of experts set up for this purpose was Pierre Werner (Prime Minister and Finance Minister of Luxembourg). The work of the committee resulted in the Werner Report (1970), providing a definition of the EMU with the ultimate goal of achieving an irrevocable fixing of exchange rates, liberalisation of capital movements and replacing national currencies with a common one. The other two key documents related to the establishment of the EMU are the Delors Report (1989) and the Maastricht Treaty or the Treaty on European Union (1992).

A committee mandated by the European Council was set up to explore and propose concrete stages for the establishment of the EMU in 1988. Its chairman was Jacques Delors, the President of the European Commission at the time. The report set out the three stages for the creation of the EMU and the required measures for their achievement³.

The third important document is the Maastricht Treaty of 1992. To join the euro area, EU Member States need to comply with the convergence criteria laid out in this Treaty. These economic and legal conditions ensure that the individual Member State is ready to join the euro area, without creating risks for the economy of the country itself, but also for the euro area as a whole.

Table 1

Maastricht Criteria for convergence

Economic objective	Indicator	Criteria
Sound and sustainable public finances	Government debt	< 60% of the GDP
	Budget deficit	< 3% of the GDP
Price stability	Harmonised index of consumer prices (HICP)	< 1.5% above the three best performing Member States
Durability of the convergence	Long-term interest rates	< 2% above the rate of the three best performing Member States in terms of price stability
Exchange-rate stability	Deviation from a certain level	Participation in the Exchange Rate Mechanism II (ERM II) for at least 2 years without severe tensions

Source. Treaty on the Functioning of the European Union, 2008. pp. 281-282.

³ <https://www.ecb.europa.eu/ecb/history/emu/html/index.en.html>

The Euro's effect on trade

In order to monitor the process of convergence of economic dynamics in the Member States related to the European Monetary System (EMS), the European Commission and the European Central Bank monitor the Maastricht criteria (Gerunov, 2016).

These convergence criteria have the following economic purposes: price stability; sound and sustainable public finances; exchange rate stability and long-term interest rates. There is also a legal convergence whereby the candidate country must ensure that its national laws regulate the independence of the central bank and that its statutes are in line with the provisions of the Treaties and are compatible with the Statute of the ECB and the ESCB.

Under the EU Treaty, the bonds used to calculate the convergence criterion relating to long-term interest rates should be long-term government bonds or similar securities with a maturity of 10 years. The Exchange Rate Mechanism was first introduced in 1979 as a means to curtail exchange rate variability and to attain monetary stability, before the adoption of the euro. After the introduction of the single currency in Europe, the Exchange Rate Mechanism II (ERM II) was set up and its purpose was to link the currencies of Member States outside the Eurozone to the euro as an anchor. It represents a way of evaluation and preparation for potential members of the euro area. At the moment, only Denmark takes part in ERM II with a fluctuation band of +/- 2.25%, while the official fluctuation margin is +/- 15%. Bulgaria and Croatia joined the ERM II in July 2020. The convergence criteria are listed in Table 1.

As defined in article 140 of the Treaty on the Functioning of the European Union, the Commission and the European Central Bank must report on the fulfilment of the convergence criteria by the Member States. This examination is done at least once every two years or at the request of a Member State with a derogation.

Being part of the EMU could bring about both advantages and challenges. Thus, the impact of euro introduction in the Member States must be thoroughly examined.

Single currency and trade

The literature that studies the euro's impact on trade is copious. Marin (1992) argues that an "outward looking" regime expands the productivity of developed countries, stimulating economic growth.

Rose (2000) initiated the empirical overview of the currency unions' effect on trade and estimated an exceptionally large positive effect. In this paper, Rose shows that a common currency fosters trade three times greater compared to countries with different currencies. For this purpose, the employed gravity model was based on panel data for a sample of 186 countries over the period 1970-1990. The data contains over a hundred pairs of countries that share the same currency. Rose concludes that two countries with a single currency trade three times as much as they would with different currencies. Therefore, currency unions such as the EMU may lead to a boost in international trade. A later research by Rose (2001), based

on panel data enveloping the formation and dissolution of currency unions since 1948, reached even better results. Afterwards, Glick & Rose (2002) proposed a slightly modified model that spanned over a longer term (1948-1997) and covered a larger number of countries, which were part of different currency unions. They estimated a lower yet still considerable effect – that countries which share a common currency trade two times as much as the ones with different currencies. In a recent paper Glick & Rose (2016) separated the EMU from other currency unions and a panel approach was used to show that the EMU has fostered a 50% increase in exports. It should be noted that different currency unions are affected by various factors that can also influence trade.

Subsequently, the impact of a shared currency on trade has been extensively studied, and for the most part it is considered as being positive. The different studies apply different econometric techniques, time periods and country samples, hence, suggesting a great variety of results. Early researchers report significantly higher effects of the euro on trade (Rose, 2000), while more recent ones, employing improved methodologies, state that trade increases moderately – by between 5% and 40% (Baldwin & Di Nino, 2006; Eicher & Henn, 2011).

For instance, Flam & Nordström (2003) apply a gravity model to study the effect of euro adoption in 1999 on exports. They study the period 1989-2002, including both aggregate data and data on nine economic sectors, including: machinery and transport equipment, beverages and tobacco, mineral fuels, lubricants and related materials, etc. The research covered ten euro area countries: Austria, Belgium-Luxembourg (treated as one country in trade statistics), Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal and Spain. The ten non-euro area countries included in their research were Australia, Canada, Denmark, Japan, New Zealand, Norway, Sweden, Switzerland, the United Kingdom and the United States. Flam & Nordström (2003) stated that the euro boosted intra-euro area trade by 15% on average for the period 1998-2002 compared to the benchmark. Exports from euro area to non-euro area countries increased by 8%, while those from non-euro area countries to Member States increased by 7.5%. Year effects were applied, which reveal a very clear increasing trend starting in 1998.

Four years later Flam & Nordström (2007a) suggested that the euro boosted trade within the euro area by approximately 26% and outside trade by 12% on average for the period 2002-2005 in comparison to 1995-1998. More precisely, the impact was observed with emphasis on finished and semi-finished goods (i.e. machinery, pharmaceuticals). In a subsequent research, Flam & Nordström (2007b) demonstrated a slight increase in the results. The trade among euro area Member States was enhanced by 28%, while trade between the euro area and outsiders grew by about 12-14% in 2002-2006 with reference to 1995-1998.

A critical examination of the literature on the matter was made by Baldwin (2006a, 2006b, cited in Flam & Nordström, 2007b, p. 2.), who claimed that the analyses of Rose have methodological deficiencies, as they are based on non-European data, but rather include countries with peculiar characteristics, referring

to them as being “very small, very poor and very open”. Baldwin surveyed other studies utilizing data for the EMU and asserted that they report a smaller impact of the currency on trade, from very insignificant to exceeding 30%.

Trade among the member states of a currency union grows due to the elimination of exchange rate variability, reduced transaction costs and price transparency and comparability. According to Badinger & Turkcan (2014), the effects may vary based on the type of product traded. However, various factors except for the euro adoption also have an influence on foreign trade, among the latter are globalization, European integration and foreign trade liberalization.

One of the first contributions related to the EMU was that of Micco et al. (2003). Their study is based on panel data on the bilateral trade of a group of European countries from 1992 to 2002. During this period, 12 European countries officially joined the monetary union. Micco et al. (2003) denote that euro area Member States experience an increase in bilateral trade. Taking into consideration a host of other factors, they found that euro area participation stimulates trade integration between the Member States and that this positive effect grows over time, ranging from 4% to 16%.

Faruquée (2004) demonstrated that trade performance depends on the country-specific effects of the single currency, caused by primary conditions and structural characteristics of the country in question. In particular, he found that more open economies, Member States with higher intra-trade shares and the ones with greater exchange rate volatility would benefit more.

Similarly, De Nardis & Vicarelli (2003) fit a dynamic panel model for the period 1980-2000 considering the levels of trade with and without the single currency. They estimate a euro impact on trade within the ranges of 9-10% in the short-run and 16-19% in the long-run. Another panel data study conducted by Chintrakarn (2008) concludes that the single currency increased intra-euro area trade by between 9 and 14%. On the other hand, as Havranek (2010) points out, the results of these early publications are strongly influenced by their econometric design, suggesting that the actual effect could be lower. More recent studies take into account some methodological shortcomings and reach different conclusions. Camarero (2013; 2014) found a much smaller but still positive effect of the single currency on trade flows within the EMU.

Saia (2017) reported that the introduction of the euro led to growth in intra-European trade flows of between 19% and 55%. The paper estimated that the aggregate trade flows between the UK and the euro area Member States would have been 16% greater if the euro had been introduced in Britain.

The findings of Murphy & Siedschlag (2011) suggest that the euro had a significant and positive impact on Irish exports to the other Member States compared to the rest of its trading partners since 2000. Moreover, they analyse the export flows across 21 industries over the years 1993-2004 and point out the heterogeneous effects of the euro across the different industries. On the other hand, Dwane et al. (2010) also studied Ireland and 21 of its major trading partners (EU15, Australia, Canada, New Zealand, Norway, Switzerland, and the USA) from 1950 to 2004. They examined

the long-term relationship between trade and various independent variables, among which dummy variables for the participation in a monetary union. Dwane et al. (2010) concluded that there is no significant impact of the euro on Irish trade.

A recent research by Felbermayr & Steininger (2019) found that the “EMU has been successful in increasing trade between its members, but that the effects differ quite a bit across sectors, country pairs, and direction”. Evidence was obtained for the “positive welfare effects from the transaction cost savings generated by the creation of the EMU”.

Trade integration

Over the last several decades, trade integration within the global economy has intensified rapidly. EU trade integration is the percentage of a country's gross domestic product (GDP) which is composed by its trade with EU Member States (imports and exports of goods and services).

Mann (2015) studied the effect of European integration (measured as trade with other EU Member States as a proportion of the total trade) on economic growth for 10 Central Eastern European countries. The findings showed that European integration is favourable to Member States. Moreover, a research conducted by Barr et al. (2003) revealed that the trade effects of the EMU were statistically significant and overall trade would have been more substantial if countries outside of the union had ascended to the euro area.

The concept of a single market is at the heart of the EU project. A single market would stimulate competition and trade. The European Commission (EC) evaluates the level of trade integration of the Member States using the so-called Single Market Scoreboard. This in-depth analysis presents an overview of the state of implementation of the Single Market rules in the EU. The higher the value, the more open and integrated the economy of the particular Member State is in relation to the size of its economy. The most recent available data are based on the years 2016-2017. The evaluation in the scoreboard is made on the basis of two indicators:

- EU trade integration: percentage of a Member State's GDP, which constitutes trade with EU countries (both exports and imports).
- Value of the total imports and exports of goods and services (inside or outside the EU, from and to any country) as a share of the GDP.

In general, the best performing Member States among the chosen sample of countries from Central, Southern and Eastern Europe are Slovakia and Lithuania, while the countries having average or below average scores for the indicators are Estonia and Malta. The EC's report states that Slovenia and Lithuania are among the Member States with the fastest raise in levels of trade integration (European Commission, 2019).

The indicators (see Table 2) for which the countries in question achieved predominantly above average results are the levels of EU trade integration in goods and services and the degree of openness to imports of goods (see Table 3).

The Euro's effect on trade

In order to increase trade integration, it is recommended to initiate structural reforms⁴, both on the EU and the national levels, and to strengthen EU integration. One way of doing this is through monetary integration by being part of the euro area.

Table 2

Trade integration indicators (in %)

N	Indicator	Above average	Average	Below average
1	EU trade integration in goods (levels)	> 26.2	13.1 - 26.2	< 13.1
2	EU trade integration in goods (change)	> 2.7	0 - 2.7	< 0
3	EU trade integration in services (levels)	> 9.5	4.7 - 9.5	< 4.7
4	EU trade integration in services (change)	> 3.4	0 - 3.4	< 0
5	Openness to imports of goods (levels)	> 41.2	20.6 - 41.2	< 20.6
6	Openness to imports of goods (change)	> 3.9	0 - 3.9	< 0
7	Openness to imports of services (levels)	> 14.6	7.4 - 14.6	< 7.4
8	Openness to imports of services (change)	> 1.6	0 - 1.6	< 0

* Trade integration and market openness to imports are reflected in relation to the overall GDP and change in 2016-2017.

Source. Data adopted from the European Commission chart (see European Commission, 2019).

Table 3

Trade integration performance, by Member State (2016-2017)

Indicator	Member State						
	Cyprus	Estonia	Latvia	Lithuania	Malta	Slovenia	Slovakia
1	\bar{x}	> \bar{x}	> \bar{x}	> \bar{x}	\bar{x}	> \bar{x}	> \bar{x}
2	< \bar{x}	< \bar{x}	\bar{x}	> \bar{x}	\bar{x}	> \bar{x}	\bar{x}
3	> \bar{x}	> \bar{x}	\bar{x}	> \bar{x}	> \bar{x}	> \bar{x}	\bar{x}
4	> \bar{x}	\bar{x}	\bar{x}	> \bar{x}	< \bar{x}	> \bar{x}	\bar{x}
5	\bar{x}	> \bar{x}	> \bar{x}	> \bar{x}	\bar{x}	> \bar{x}	> \bar{x}
6	> \bar{x}	< \bar{x}	> \bar{x}	> \bar{x}	< \bar{x}	> \bar{x}	\bar{x}
7	> \bar{x}	> \bar{x}	\bar{x}	\bar{x}	> \bar{x}	\bar{x}	\bar{x}
8	> \bar{x}	< \bar{x}	\bar{x}	> \bar{x}	< \bar{x}	\bar{x}	\bar{x}

* " \bar{x} " – average level, "< \bar{x} " below average, "> \bar{x} " above average.

Source. Data adopted from the European Commission chart (see European Commission, 2019).

⁴ Regulation (EU) № 1303/2013 defines the concept of 'structural reforms' as reforms identified in the European Semester process in accordance with Article 2-a of Council Regulation (EC) No 1466/97 of 7 July 1997 on the strengthening of the surveillance of budgetary positions and the surveillance and coordination of economic policies.

According to the ECB, structural reforms are measures that change the structure of an economy, the regulatory and institutional framework. Structural reforms can be targeted at specific sectors.

Methodology

The applied statistical method in this paper is a panel data analysis, which was used in order to combine both cross-section data and time series.⁵ In the present study, these are the annual data on the exports of the selected group of euro area Member States. There are several advantages to applying a panel regression model, namely, that the panel data substantially enlarge the sample size, they are appropriate for investigating the dynamics of change and they facilitate the analysis of more complicated behavioural models (Gujarati, 2003). Panel data analysis has its limitations, among which are data collection issues, i.e. the sampling design and coverage (see Torres-Reyna, 2007).

The analysis is focused on the Member States, which have most recently joined the euro area. The latter comprises seven countries from Central, Eastern and South Europe, namely: Cyprus, Estonia, Latvia, Lithuania, Malta, Slovenia and Slovakia. The data are collected from the official statistics of the European Union (2019)⁶, i.e. Eurostat, and were extracted on 23.08.2019. The data consist of yearly observations of the variables for a 16-year period from 2003 to 2018.

The dependent variable in the first panel model is the exports of goods and services in current prices (in EUR million), while in the second panel regression it is the imports of goods and services in current prices (in EUR million).⁷

In both models the explanatory variables are the same: the logarithm of the GDP at market prices and two dummy variables for euro adoption and economic crisis. The GDP at market prices is defined by Eurostat as an indicator for the economic situation of a country, “it reflects the total value of all goods and services produced less the value of goods and services used for intermediate consumption in their production”.

The selected time range covers both the pre-accession and post-accession periods. The dummy variable concerning the single currency equals 1 when the respective country is already a Member State of the euro area and 0 when it is not.⁸ The second dummy variable represents the Great Recession and takes the value of 1 in 2008, 2009, 2010, indicating the years of the crisis and 0 for the rest of the period.

Descriptive statistics

Descriptive statistics of the data were conducted in order to investigate the sample characteristics. Figures 1, 2 and 3 reveal the tendencies of the exports, imports

⁵ Murphy & Siedschlag (2011) employed a similar methodology – they compiled a panel of cross-country industry data covering the period from 1993 to 2004 and studied the euro’s impact on Irish exports towards its trading partners.

⁶ <https://ec.europa.eu/eurostat/>

⁷ According to Eurostat, “Imports and exports of goods occur when economic ownership of goods changes between residents and non-residents. This applies irrespective of corresponding physical movements of goods across frontiers”.

⁸ Similarly, Chen (2019) applies a dummy variable to the euro when studying its impact on exports. Moreover, Polyak (2016) uses a dummy variable to denote the accession to the euro area in order to study the effect of the euro on Slovakia’s exports.

The Euro's effect on trade

and GDP, respectively, for the seven Member States (Cyprus, Estonia, Latvia, Lithuania, Malta, Slovenia and Slovakia) for the period 2003-2018. On every individual graph, the vertical line corresponds to the relevant year of euro adoption.

Figure 1

Exports by new Member States

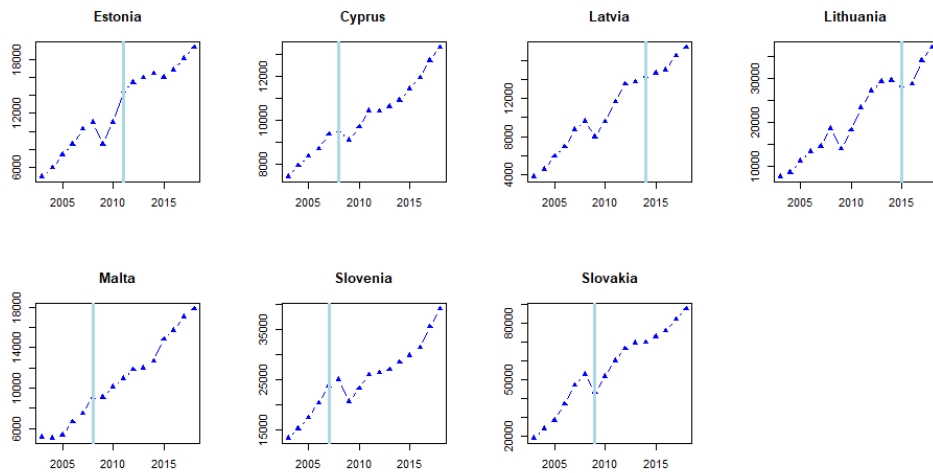


Figure 2

Imports by new Member States

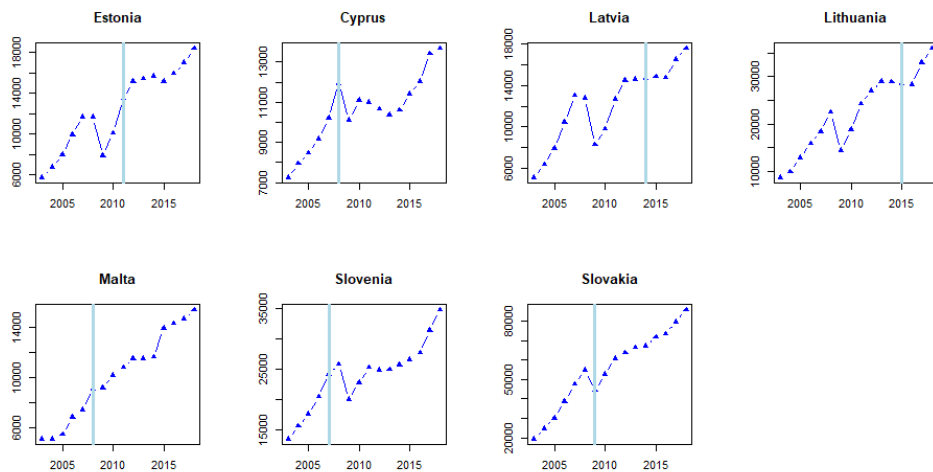
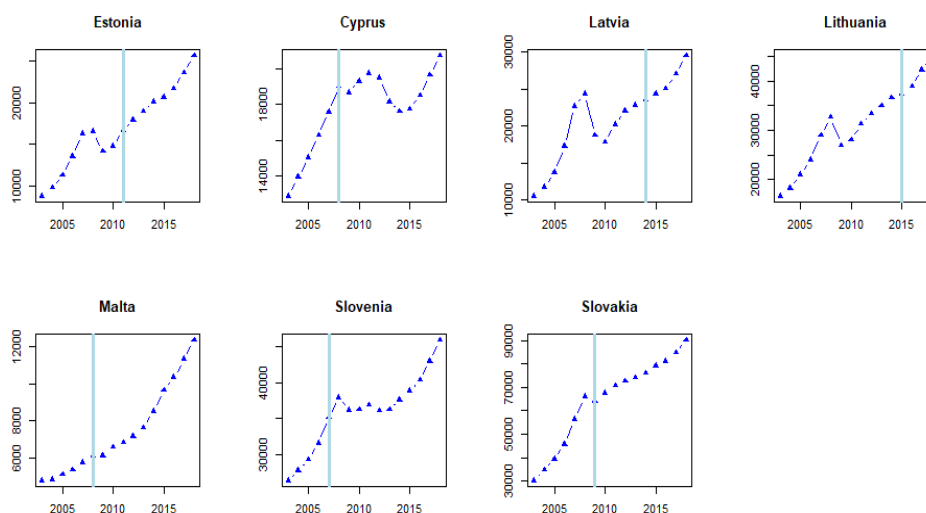


Figure 3

Gross domestic product by new Member States



Overall, all three variables presented in Figures 1, 2, and 3 show an increase during this particular time frame. The latter is consistent with the information provided by Kristjanpoller & Olson (2014). In their research, they demonstrate that an expansion in exports entails a higher growth in GDP. As can be seen, all three of the indicators continue to increase once the single currency is introduced, except for the countries whose year of adoption coincides with the economic and financial crisis (2008). The direction in which the variables are developing might be explained by the trend towards globalisation. That is why, a more profound study of the euro's impact on exports and imports is needed.

The descriptive statistics of the indicators are presented in Tables 4 and 5, and provide information concerning: the mean, the minimum and maximum values and the median.

The minimum values of the exports of goods and services correspond to the beginning of the period – 2003, except for Malta, which has a minimum value of 103.5% of the GDP in 2004. In general, Malta is the country with the highest levels of exports compared to its GDP (from the selected sample of countries). Similarly, the maximum values of exports for all seven of the countries are observed in the final year of the study – 2018. Slovakia is the country with the highest level of exports, EUR 55 456 million on average (95.6% as a share of GDP). Malta has the highest exports of goods and services as a share of the GDP – 165.3%. Latvia is the Member State with the lowest exports compared to its GDP, with a mean of 51.1%. The highest

The Euro's effect on trade

increase of exports as a percentage of the GDP one year after joining the euro area was reported in Malta – 18.9% (from 129.5% in 2007 to 148.5% in 2008).

Table 4

Descriptive statistics on the exports of goods and services (as % of the GDP)

Country	Indicator			
	Min.	Mean	Median	Max.
Estonia	57.4	72.5	75.3	86.7
Cyprus	48.7	59.6	56.3	74.5
Latvia	36.1	51.1	55.7	61.6
Lithuania	46.2	63.4	65.8	78.9
Malta	103.5	140.6	148.7	165.3
Slovenia	50.9	69.0	69.2	85.0
Slovakia	62.5	83.4	84.6	95.6

Source. Author's calculations based on <https://ec.europa.eu/eurostat/>.

Table 5 presents data on the imports as a percentage of the GDP of the sample of countries. Malta has the highest level of imports, equal to 136% of the GDP on average, suggesting that Malta's economy is highly open. On the contrary, Latvia's imports are the lowest, with a minimum value of 44% of the GDP, a maximum value of 66% of the GDP and a mean of 58% of the GDP. The other Member States' imports are, on average: 73% of the GDP in Estonia, 59% of the GDP in Cyprus, 70% of the GDP in Lithuania, 66% of the GDP in Slovenia and 83% of the GDP in Slovakia for the period 2003-2018. The distribution of the minimum and maximum level of imports of goods and services in the sample of countries is similar, with Cyprus, Estonia and Slovenia having minimum values of imports ranging from 52 to 56%. Moreover, Malta experienced the most significant boost in imports one year after introducing the euro – 20%. As can be seen from Table 2, Malta has above average results for the level of openness to the imports of services (2016-2017). Estonia's imports grow by 12% with the adoption of the euro, while, on the other hand, Slovakia's imports decline by 14%, expressed as a percentage of the GDP, from 2008 to 2009 – the years marked by the Great Recession.

Table 5

Descriptive statistics on the imports of goods and services (as % of the GDP)

Country	Indicator			
	Min.	Mean	Median	Max.
Estonia	56	73	72	84
Cyprus	54	59	57	68
Latvia	44	58	59	66
Lithuania	52	70	71	83
Malta	105	136	137	161
Slovenia	52	66	68	76
Slovakia	64	83	85	95

Source. Author's calculations based on <https://ec.europa.eu/eurostat/>.

Empirical study

In an attempt to assess the impact of euro adoption on trade, two panel regression models were constructed. The covered period of time spans from 2003 to 2018 ($T=16$), while the cross-sectional units are seven ($n=7$), including the euro area Member States Cyprus, Estonia, Latvia, Lithuania, Malta, Slovenia and Slovakia, hence, the number of observations is $N=112$.

As was reported in the Methodology section, the response variable Y in the first regression model denotes the exports of goods and services in logarithm form, while in the second one it denotes the imports of goods and services, also in logarithm form. The explanatory variables are the logarithm of the GDP, the global economic and financial crisis and the adoption of the euro.

The paper seeks to examine if the euro's introduction has had an impact on trade, as well as the direction of its influence. Thus, the hypotheses and their alternatives are defined, as follows:

$H_1: \beta_i=0$; the euro adoption, the GDP, and the Great Recession do not influence exports.

$H_{A1}: \beta_i \neq 0$; the euro adoption, the GDP, and the Great Recession influence exports.

$H_2: \beta_i=0$; the euro adoption, the GDP, and the Great Recession do not influence imports.

$H_{A2}: \beta_i \neq 0$; the euro adoption, the GDP, and the Great Recession influence imports.

There are two main possible approaches to the regression model with panel data – a fixed effects / “within” model and a random effects model. A Hausman test (1978) was performed to determine which model is most appropriate for each of the two panel regressions. From the data in Table 6, it can be seen that the p-value of exports is below the reference value of 0.05, hence, the applied model for exports is the “within” model. Whereas the p-value of imports is 0.06, which is above the threshold, and thus, the random effects model is applied in the second panel regression.

Table 6

Hausman test

Y	Exports	Imports
chisq	18.943	7.3694
p-value	0.00028	0.06101
model	Within	Random

Source. Author's calculations obtained using R Studio.

Panel regression 1

The first panel regression model tests the relationship between trade in terms of exports and economic growth, the global financial crisis and the adoption of the euro. The regression equation of the fixed effects model panel data is written, as follows:

The Euro's effect on trade

$$(1) \log(\text{Exports}) = \beta_1 \times \text{Euro} + \beta_2 \times \log(\text{GDP}) + \beta_3 \times \text{Crisis} + u_{it} + \alpha_i$$

where α_i ($i=1\dots n$) is the unknown intercept for each country; and u_{it} is the error term.

When we substitute the results in equation (1), we obtain:

$$(2) \log(\text{Exports}) = 0.033 \times \text{Euro} + 1.331 \times \log(\text{GDP}) + (-0.039) \times \text{Crisis}.$$

The fixed effects model, or “within” model, uses the ordinary least square principle and presumes that the differences between the cross sections can be assimilated from a different intercept. Table 7 presents the fixed effects by Member State. The overall intercept or weighted mean of the fixed effects for the “within model is -1.589 with a standard error equal to 0.239.

Table 7

Fixed effects

Country	Cyprus	Estonia	Latvia	Lithuania	Malta	Slovakia	Slovenia
α_i	-1.545	-1.666	-1.728	-1.668	-1.145	-1.689	-1.680

Source. Author's calculations.

Table 8 illustrates the estimated coefficients from the “within” model. At the 1% of significance, there is convincing evidence that the alternative hypothesis is true and that the euro's adoption, the logGDP and the economic and financial crisis have an impact on exports. Approximately 92.3% of variance in exports could be explained by the model.

Table 8

Exports – panel regression 1

Coefficients*				
	Estimate	Std. Error	t-value	Pr(> t)
Euro	0.033	0.014	2.425	0.017087*
logGDP	1.331	0.056	23.708	< 2.2e-16***
Crisis	-0.039	0.011	-3.422	0.000897***

*p-value < 2.22e-16, Adj. R-Squared: 0.92327.

Source. Author's calculations.

Furthermore, the estimated results indicate that euro area accession has a strong positive effect on exports. Introducing the euro would yield a 3.35% increase in exports, holding all other variable predictors constant. The latter appear consistent with prior research conducted by Baldwin et al. (2005), based on the idea that the abolition of exchange rate risk results in expanded export activity, particularly owing to a greater number of exporters and an extended volume of sales of existing exporters. Moreover, the findings are in line with previous results reported by Bun & Klaassen (2007), who point out that the euro adoption's impact on trade is 3%.

The results show that for any 10% increase in the GDP, increase in exports by about 13.5% is expected. This is consistent with the studies related to the relationship

between exports, imports and economic growth, which were conducted by Khan et al. (2012) on Pakistan for the period 1972-2009; by Muhammad Adnan Hye (2012) on China for the period 1978-2009; by Sahoo et al. (2014) on India, for the period 1981-2010, etc.

Overall, the results suggest that the introduction of the single currency – the euro, positively affects trade in the context of the exports of goods and services. This is consistent with the outcome of previous studies in this scientific field (Baldwin et al., 2005; Bun & Klaassen, 2007; Polyak 2016).

Panel regression 2

The second panel regression studies trade in terms of the imports of goods and services for the same period for the group of seven Member States. It is a random effects model, having as an outcome variable the logarithm of the imports of goods and services, and the equation is rewritten, as follows:

$$(3) \log(Imports) = \beta_0 + \beta_1 \times Euro + \beta_2 \times \log(GDP) + \beta_3 \times Crisis + e_{it} + u_{it}$$

where e_{it} is the residual – a combination of time series and cross section/idiosyncratic error; and u_{it} is the individual/ between-entity error.

When we substitute the results in equation (3), we obtain:

$$(4) \log(Imports) = -0.825 + 0.028 \times Euro + 1.158 \times \log(GDP) + (-0.028) \times Crisis.$$

This model is also called the “Error component model” and suggests that variables may be interconnected between individuals and between time. Hence, the intercept is a random variable. The random effect model applies the generalized least square technique or the principle of maximum likelihood. In this panel regression θ (theta) is closer to 1 (0.9234) signifying that the composite error is predominantly made up of an individual error (u_{it}). The random effects of the model are displayed in Table 9.

Table 9

Random effects

Country	Cyprus	Estonia	Latvia	Lithuania	Malta	Slovakia	Slovenia
α_i	0.012	-0.085	-0.096	-0.044	0.330	-0.093	-0.024

Source. Author's calculations

Table 9 outlines the estimated coefficients from the random model. At the 1% of significance, it could be concluded that the alternative hypothesis is true and that the euro's introduction, the logGDP and the Great Recession crisis affect the imports of goods and services. Around 92.9% of the variance in exports could be explained by the panel regression.

From equation (4), the following key results emerge: the imports of goods and services of a country are 2.83% higher when it is part of the euro area, holding other variables constant. Overall, these findings are in accordance with the results reported by Bukovšak et al. (2017), who argued that the impact of the EMU might be

The Euro's effect on trade

positive in the context of Croatian investments and international trade. Moreover, they concluded that trade might rise due to “lower transaction costs, easier price comparison and currency risk elimination, which might increase the price competitiveness of Croatian companies”.

A similar conclusion was reached by Cieřlik (2012), who found that the euro's introduction would expand exports as well as the volume of trade of the countries from Central and Eastern Europe (the studied period was 1993-2007). Furthermore, he suggested that euro area participation stimulates imports from outside of the EMU countries and contracts exports to these countries.

For any 10% increase in the GDP, imports are expected to raise by 11.7%. A similar direction of the relationship between economic growth and imports was obtained in the paper by Bun & Klaassen (2007).

The Great Recession of 2008, as anticipated, has had a negative impact on trade – affecting both the exports and imports of goods and services. A similar conclusion was reached by the World Bank (2011), according to which “trade flows collapsed across all the regions of the world”. Furthermore, the results are in line with the ideas of Shelburne (2010), showing that the crisis negatively impacted world economies.

The present findings confirm a positive impact of euro adoption on trade in terms of the imports of goods and services. The results provide a basis for analyses and reflection for the future euro area candidate Member States.

Table 10

Imports – panel regression 2

Coefficients*				
	Estimate	Std. Error	z-value	Pr(> t)
Intercept	-0.825	0.199	23.592	3.495e-05***
Euro	0.028	0.011	15.850	0.014534*
log GDP	1.158	0.045	-1.460	< 2.2e-16***
Crisis	-0.028	0.010	-3.031	0.004

*p-value < 2.22e-16, Adj. R-Squared: 0.92988.

Source: Author's calculations obtained using R Studio

Conclusion

The EMU is the most substantial achievement in the European integration process. Twenty years after its introduction, the euro became the world's second international currency.

An interesting aspect of the common currency is the question of whether the decrease of transaction costs and currency risks triggers an increase in trade between the Member States of the monetary union. The literature offers a great variety of studies on this topic, presenting diverse results depending on the applied econometric model, the analysed period and the specific country or group of countries. Rose's estimations were the starting point for further investigations on the matter. However,

in this field of research there are various publications that have reached different conclusions, based on the methodologies used, the scope, and the period of analysis.

The present research focuses on the trade effects of the introduction of the euro in seven euro area Member States. The study argues that euro area accession leads to an increase of around 3% in terms of both exports and imports. Thus, the results suggest that a single currency provides stimulus to trade. These findings support the notion that the euro might restrict transaction costs, leading to more profitable and easier trade within the Union, while at the same time eliminating exchange rate fluctuation risk and thus stimulating international trade. Moreover, the single currency triggers price transparency, which facilitates consumers and allows them to easily compare prices in a timely manner, which also boosts trade in the EMU.

It is a question of future investigations to explore the potential effects of euro adoption in candidate countries, as well as the impact on other economic and industrial indicators.

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Appendix

EMU accession by Date*

Date	Country/Countries
January 1, 1999	Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain
January 1, 2001	Greece
January 1, 2007	Slovenia
January 1, 2008	Cyprus, Malta
January 1, 2009	Slovakia
January 1, 2011	Estonia
January 1, 2014	Latvia
January 1, 2015	Lithuania

* EU Member States that are not in the EMU are: Bulgaria, Croatia, the Czech Republic, Denmark, Hungary, Poland, Romania, and Sweden.

Source. European Commission, www.ec.europa.eu

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