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INTERNATIONAL TRADE AND EXCHANGE RATE REGIMES IN NEW EU COUNTRIES

ABSTRACT

The aim of this paper is to investigate whether different foreign exchange rate regimes affect export rate (i.e. the ratio of exports in GDP). The comparative analysis showed that countries with flexible exchange rate are more engaged in the international trade and these differences stem from differences in the export rates. These differences disappear (or became lesser) after 2008 as a primarily consequence of the lesser differences in the goods exports. The results showed that nominal depreciation in the crisis times can boost the price competitiveness and stimulate exports. These results should not ignore the fact that exchange rate is not the only determinant of exports. Therefore, it is realistic to expect that before the recent crisis the exports is dominantly influenced by non-price competitiveness factors, while the impact of price components (that also include the exchange rate) is more limited to the period of the recent crisis.

Key words*: exports and imports, exchange rate regimes, descriptive statistics, regression analysis*

1. Introduction

The determinants of international trade are among the most interesting topics for economists especially in small open economies (such as new EU members). Its significance on domestic employment, creation of human capital and overall economic activity is emphasized. The importance of international trade on domestic activity is usually measured by export rate (the share of exports in GDP) as well as import rate (the share of imports in GDP) which are showed in Figures 1 and 2 for new EU members (*i.e.* post-socialist countries that joined EU from 2004 onwards). The overall international trade is shown in Figure 3.

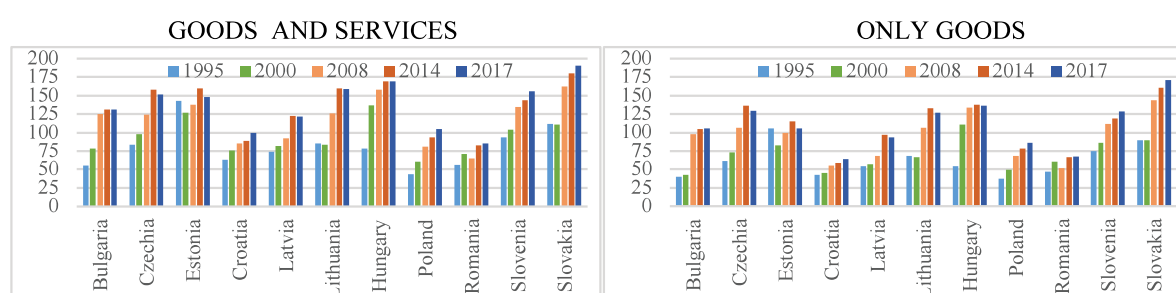**Figure 1:** *Exports of goods and services among new EU countries (% GDP)*
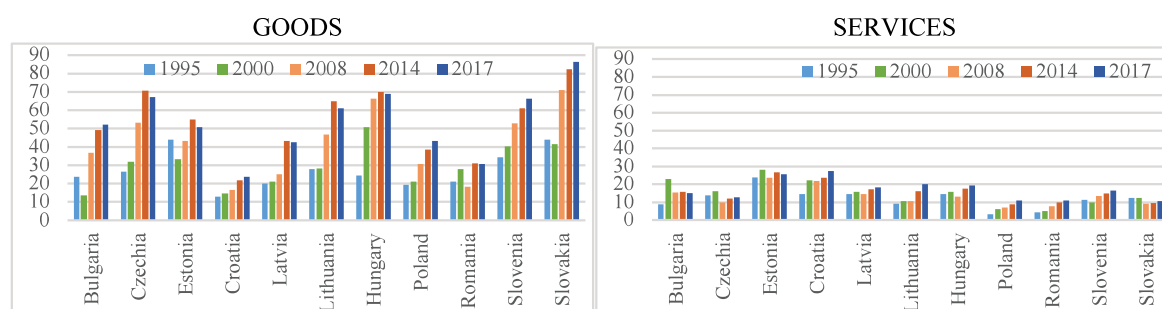
SOURCE: Eurostat (2019).

Figure 2: *Imports of goods and services among new EU countries (% GDP)*
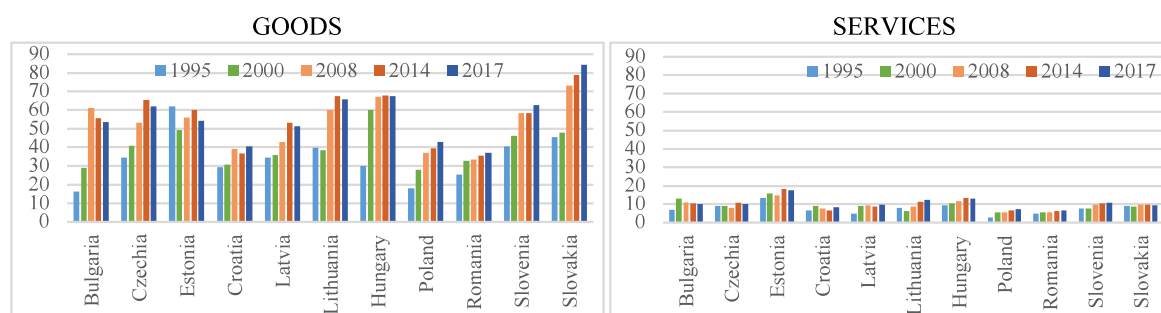
GOODS | SERVICES

SOURCE: Eurostat (2019).

Figure 3: *International trade of goods and services among new EU countries (% GDP)*

GOODS AND SERVICES | ONLY GOODS

NOTE: The volume of foreign trade is defined as the sum of exports and imports. This graph reflects the sum of the content on the previous graphs.
SOURCE: Eurostat (2019).

The latest among these figures compares the external trade of new EU members for 1995, 2000, 2008, 2014 and 2017 since SNA data according to SNA 2010 methodology is available between 1995 and 2017. 2008 was the last year before the Great Recession in 2009 when all EU countries except Poland recorded negative growth rates. 2014 is the last year of recession in Croatia and the first year of EU membership. The conclusions for foreign trade according to Figure 3 are as follows[1]:

1. All countries increased the share of foreign trade in GDP in the observed period.
2. The dynamics of the increase differ between countries. The strong increase in Hungary was recorded between 1995 and 2000 and it continued between 2000 and 2008. Stronger increase in this share between 2000 and 2008 was recorded in Slovakia, Slovenia, Lithuania, Bulgaria and the Czech Republic.
3. In the remaining countries the dynamics are slower. However, it intensified in Latvia after 2008 while in Croatia it is similar to that in Poland and Romania which are (based on the number of inhabitant) relatively large economies *i.e.* with population higher than 20 million. Although it is a small country, Croatia is relatively weakly engaged in exports as well as in imports.

Regardless of the Figure 3, it is not the same, whether the growth of foreign trade share is dominated by the growth of the share of exports or imports. Comparison of Figures 1 and 2 clearly shows that a country with a high share of exports usually has a high share of imports (in particular commodities). However, majority of countries are experiencing a deficit in

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[1]More than ¾ of foreign trade refers to the merchandise trade and in Figure 3 the trade of services is not shown. The growth rates of exports and imports are available in the Tables 2 and 3 in the Appendix.

merchandise trade compensated by the surplus in trade in services. The magnitude of the merchandise trade deficit differs between countries, so in 2008 was particularly high in Bulgaria (24%), Croatia (22%), Latvia (17%), Romania (15%), Lithuania (13%) and Estonia (12%). In some of the countries, foreign trade balance in goods became positive after 2008 (Czech Republic, Hungary, Slovenia and Slovakia).

In the study of foreign trade balance, greater importance should be on the side of export factors. According to the Figures 1 and 3 the higher share of foreign trade is associated with an increased share of exports. There is no doubt that EU accession (Romania and Bulgaria in 2007, Croatia in 2013 and others in 2004) contributed to it (especially as a consequence of fact that "old EU countries" are their main trading partners). Nevertheless, the dynamics of exports between them differ. Slovakia, Hungary, Czech Republic and Slovenia became the first four exporters among post-socialist economies. Unlike them the slowest dynamics of commodity exports were in Croatia with 13% of GDP in 1995 and 23.8% in 2017. However, export of services compensates for the weak Croatian performances in foreign trade of goods. Regardless, the entire Croatian exports in 2017 were 51% of GDP, making Croatia the weakest exporting economy among new EU members. There are some indications that EU accession also stimulated Croatian exports but to a lesser extent (compared with the previous accession of other members).

In basic econometric models exports are usually set as a function of foreign demand and real effective exchange rate. Given the foreign demand, real depreciation is needed to improve exports and one of the ways to achieve this is nominal depreciation. In accordance with the simplest interpretations, depreciation makes foreign goods and services relatively more expensive but domestic relatively cheaper and promote exports. But in the fixed exchange rate regime such a policy is disabled. Some of post-socialist countries have accepted this regime, but some economies with a flexible exchange rate in the first stage of transition (such as Slovakia, Hungary, Czech Republic and Slovenia) have become the largest exporters among new EU members. Also, countries with the fixed exchange rate regime before the recent crisis have achieved the biggest trade deficit in the goods. These facts impose following research questions in analysis: Does nature of the exchange rate regime affect trade balance and export performances in emerging EU countries? If answer is yes, can these differences be explained by exchange rate policies (and different exchange rate regimes)? The answers on these questions are given by testing the following hypotheses:

H1: *New EU members with a flexible exchange rate regime have a higher export rate before the recent crisis.*

H2: *The greater involvement of new EU members with a flexible exchange rate in foreign trade before the crisis stems from export orientation. There are no differences in the import rates before the crisis.*

H3: *The differences in export rates between groups of countries disappear after 2008. This is linked to a higher increase in the rate of export of services in countries with fixed foreign exchange rates.*

H4: *Differences in export rates may be to a lesser extent linked to changes in the nominal exchange rate than to a non-price competitiveness. However, the flexible exchange rate regime via nominal depreciation, helped to improve the export performance of new EU members in the recent crisis.*

H5: *In the recent crisis in the new EU member states with fixed exchange rates, the improvement in price competitiveness has more often achieved by cutting the relative unit labor costs and in the country with a flexible exchange rate by adjusting the nominal exchange rate.*

The formation of two different groups is explained in the empirical part of the paper.

The first and second hypothesis are accepted for export rates but the second hypothesis for import rates is accepted only if Romania and Poland are included in the sample of countries using flexible exchange rates. The third hypothesis is partially accepted, as reducing the difference in the export rate was more affected by the decrease in the difference in exports of goods. Since the results of the empirical analysis are mixed and the effects of the changes in nominal exchange rate changes are mostly limited to part of the period (crisis times), the fourth hypothesis is acceptable. Although a preliminary analysis has shown that the fifth hypothesis can be particularly accepted at the best case, the ultimate conclusion is that it can be fully accepted. Of all the observed countries, Croatia has achieved a minimal correction of the nominal exchange rate, but in return has also had the largest reduction in the relative unit labor costs. Other observed countries did not record a significant reduction in the unit labor costs. The empirical analysis of this paper confirms that the space to promote exports by exchange rate is small but exists.

The paper is organized as follows: in the second section literature examining export performance is presented. The third section presents the data and empirical model with results. Fourth (and the last) section concludes the findings of this paper.

2. Literature review

Economic researches resulted in a large number of papers investigating differences between exchange rate regimes. One of the most interesting topics is the influence of exchange rates on international trade. Arize, Malindretos and Igwe (2017) confirmed the existence of Marshall-Lerner condition in the long-run. Also, they showed that in the long-run the trade balance responds more strongly to real depreciations than appreciations but that nominal depreciation / devaluation can be successful in that period if it is linked to other appropriate policies. Other papers (*e.g.* Adam and Cobham, 2007; Qureshi and Tsangarides, 2010; Auboin and Ruta, 2013) suggest that reduced exchange rate volatility improves international trade which goes in favor of a fixed exchange rate. Also, there are some studies that confirm the flexible exchange rates accelerate the adjustment of the current account (Eguren-Martin, 2016) or this conclusion is valid in countries that are more open to trade (Romelli, Terra and Vasconcelos, 2018). However, Chinn and Wei (2013) did not find strong relationship between exchange rate regime flexibility and the rate of current account reversion even after accounting for the degree of economic development and trade and capital account openness.

Since the higher propensity to trade is traditionally associated with higher growth, the relationship between exchange rate regime and economic growth is being investigated in some papers. Some papers confirm that this relationship is positive in the fixed exchange rate (Jakob, 2016; Ashour and Chen, 2018; Guellil, Marouf and Benbouziane, 2017) or it is valid in developing countries but irrelevant for advanced European countries (Huang and Malhotra, 2004). Rodriguez (2017) showed that a higher degree of financial openness can mitigate the negative effect of exchange rate flexibility on growth. Investigating differences in exchange rate regimes are not just focused on international trade and growth rate. For example, Chowdhury, Bhattacharya, Mallick and Ulubasoglu (2016) displayed that a fixed exchange rate regime has better fiscal discipline at low levels of trade openness while a flexible regime produces a greater fiscal discipline above a certain level of trade openness.

Some papers are relevant due to orientation to European Union members. Esposito and Messori (2016) emphasized that all peripheral Eurozone countries had eliminated their current account

deficits by the end of 2014 but this is a result of the Great recession instead of a productivity increase in their economies. The determinants of Eurozone current account imbalances are also investigated in Cesaroni and DeSantis (2015) and the result is that financial integration helped to explain decline in Eurozone periphery current account balance, but business cycle also has important role while effects of competitiveness disappear over time. Herrmann (2009) confirms that in new EU members a more flexible exchange rate regime significantly enhances the rate of current account adjustment. The difficulty of adjusting when the change in the nominal exchange rate is disabled is appropriately described in Blanchard (2007) in the case of Portugal. However, Begović and Kreso (2017) confirmed that real depreciation deteriorates trade balance in European transition countries implying that policymakers in these countries should not use exchange rate policy to improve trade balance. DeGrauwe and Schnabl (2004) showed that exchange rate stability is connected with higher real growth rates in Central and Eastern Europe. D'Adamo and Rovelli (2013) presented that premature euro adoption may foster excess inflation. It is known from the standard macroeconomic analysis that this can cause real depreciation and deteriorate price competitiveness. Relevant researches on Croatian data suggest that price competitiveness remains an important determinant of overall competitiveness. However, for a significant increase in the share of domestic exports in the European market, it is necessary to improve non-price competitiveness (Cavallaro, Esposito, Matano and Mulino, 2012). Other papers already confirmed the shift from importance of price competitiveness to non-price competitiveness in the new EU members (Stojčić, 2012; Stojčić, Bečić and Vojinić, 2012; Tica, 2012).

Next question in this paper is: Could the differences between exchange rate regimes from these papers be confirmed in the new EU members? It can be said in advance that the answers are mixed but the countries must be classified according to the degree of flexibility of the nominal exchange rate before the presentation of these responses. This is left for the next part of the paper.

3. Empirical model and results

3.1. Country grouping

In the empirical papers foreign exchange rate regimes are classified in three categories – a peg, float and intermediate regimes[2]. The countries which follow hard and soft pegs in this paper are included among fixed exchange rate countries (termed FIXED) and those with float and intermediate regimes (with exception of Croatia[3]) are comprised in the flexible exchange rate group (termed FLEXIBLE). Markiewicz (2006) suggests that it is less likely that country would adopt fixed exchange rate regime unless it is small, its external trade is highly concentrated with the EU, inflation and/or deficit are higher or it is less financially developed. The formation of the groups was done according to the degree of flexibility of the nominal effective exchange

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[2] Float regime consists of an independent float having a market-determined exchange rate and an independent monetary policy and a managed float with no pre-announced path for the exchange rate. Intermediate regimes include exchange rate with crawling peg, crawling bands and a pegged exchange rate within horizontal bands at least ±1% (Markiewicz, 2006, str. 486). Also, in that paper soft peg and hard peg are differed. Soft peg is a fixed peg arrangement within a band of more than ±1% and hard peg refers to currency board arrangements (Markiewicz, 2006, str. 486).

[3] Officially, Croatia does not have fixed exchange rate, but the exchange rate stability requirement justifies its inclusion in the economies with a fixed exchange rate. A stable exchange rate between the kuna and the euro is the key anchor for price stability given the country's high import dependency but it is also important due to the high deposit and credit euroisation of the Croatian financial system.

rate (NEER) shown in Figure 4. Left figure (a) suggests that changes of the NEER in Bulgaria, Estonia, and Croatia are very small and therefore their inclusion in the fixed exchange rate group is understandable. Latvia and Lithuania are also included in this group, regardless of some changes in the NEER at the beginning of the period[4]. Other countries (Poland, Romania, Slovakia, Hungary, Czech Republic and Slovenia) are included in the group of flexible exchange rates. However, the strong depreciation of the NEER in Romania at the beginning of 2000s affects the average NEER in this group. Other countries were faced with appreciation (Czech Republic, Slovakia) or slight depreciation (Slovenia, Hungary) over the part of the observed period. Furthermore, Slovenia (from 2004) and Slovakia (from 2005) entered the ERM II mechanism before the final adoption of euro which *de facto* turned them in the fixed exchange rate regime. So it was questionable whether these two countries should enter the fixed exchange rate group after entering the ERM II mechanism and adoption the euro. Although it is justified, this was not done in the descriptive analysis of this paper. Even if their retaining in the FLEXIBLE group has drawbacks, this is reasonable by their higher inclination to exports achieved during the flexible exchange rate regime. Also, their inclusion into the fixed exchange rate group will artificially increase average values of the variables that indicate exports (*i.e.* EXPORT and EXPORT_GOODS) in the economies with fixed exchange rate. Furthermore, the number of observations in the second group will be halved. After forming the groups it is possible to carry out a descriptive analysis and monitor the differences between them before the recent crisis and after 2008.

Figure 4: *Nominal effective exchange rate (2010=100) in post-socialist countries between 1999 and 2018*
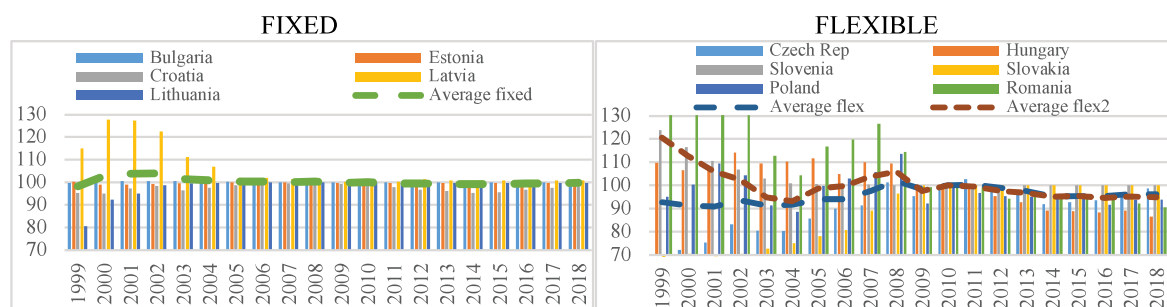
NOTE: The fall (rise) of NEER stands for the nominal depreciation (appreciation). The term "average" stands for the mean of the group where "flex2" means that the FLEXIBLE group includes Romania and Poland.
SOURCE: Eurostat (2019)

3.2. Descriptive analysis

The second step in the analysis is to define the variables used. Variables associated with international trade (EXPORT, EXPORT_GOODS, EXPORT_SERVICES, IMPORT, IMPORT_GOODS, IMPORT_SERVICES) are unavoidable in the further analysis and are expressed as % of GDP. It has already been emphasized that focus of this article will be on the price competitiveness which makes the real exchange rate a necessary indicator. It is calculated by deflating the nominal foreign exchange rate. Both foreign exchange rates are often used as

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[4] The regime in Latvia was float prior to 1994, then pegged to the SDR (1994-2005) or euro (2005-2013) before the final entrance in the monetary union (2014). Lithuania follows the currency board (from 1994) before the final adoption of the euro in 2015 (Twarowska, 2014, str. 116). While NEER in Latvia and Slovenia after 2005 is fixed, they are divided in different groups since Slovenia follows *de iure* float exchange rate regime (*de facto* intermediate) and Latvia soft peg (Markiewicz, 2006, str. 496-497; Twarowska, 2014, str. 116) before 2005.

effective exchange rates (*i.e.* the value of the domestic currency (good) in the terms of currency (goods) basket of our foreign trade partners). The number of partners and the deflator used is reflected in the value of the effective exchange rate index. According to Turner and Van't_dack (1993) and Klau and Fung (2006), the best price competitiveness indicator is obtained by deflating the nominal effective exchange rate (NEER) with unit labor on whole economy (termed REER_ULC) but deflating the NEER with consumer price index (REER) is also applied. In all cases the trade partners are members of the Eurozone. The rise of effective exchange rate stands for appreciation and *vice versa.* By dividing the REER and NEER variables the deflator ratio is obtained (relative unit labor costs (RULC) or relative prices (PRICE_REL)). This allows to monitor the differences in effective exchange rates and their components in two group of countries.

The differences in export rates also mean differences in the share of domestic demand in GDP (labeled DD). Stronger domestic market orientation is associated with a weaker orientation towards exports. Favorable financing conditions as well as fiscal policy of government can fuel domestic demand. Therefore, the fiscal policy indicators used in the descriptive analysis are net lending / borrowing, public depth (both as a share in GDP) as well as the share of general government investments in GDP (variable INVEST_PUBLIC). The economic characteristics analysis also included growth rates (variable GROWTH) and the deviation of current GDP from the potential GDP (YGAP - as % of potential GDP). Most of these variables were also used by Cesaroni and DeSantis (2015), Bogdan, Cota and Erjavec (2016), Cota, Erjavec and Bogdan (2017) and Bogdan, Cota and Erjavec (2017). Although the hypotheses of the proposed research are related to the exchange rate regimes, more involved variables will enhance the analysis. However, the results of the descriptive analysis are presented in relatively large tables (Table 4 and Table 5) and are shown in the Appendix of this paper. Table 6 provides variables and its sources.

Table 4 provides the summary statistics of each variable with respect to the economic cycle ("expansion" *i.e.* 1999-2008 vs. "crisis and post-crisis period" *i.e.* 2009-2017) and the exchange rate regime ("fixed" vs. "flexible"). Statistical *t*-test about equality of arithmetic means is used to confirm the first, second and third hypothesis. It was applied to examine whether the mean difference (column 7 in Table 4) is statistically significantly different from zero. The significant and positive values of this indicator are in favor of FLEXIBLE countries. However, the final conclusion can also be influenced by the inclusion of Romania and Poland (although relatively large countries) in the FLEXIBLE group. Therefore, the similar analysis is done in Table 5 if Romania and Poland are excluded from the analysis (marked as Option 2 that differs from the situation when all countries are analyzed – Option 1). Indeed, the descriptive analysis in Tables 4 and 5 points to the following conclusions:
   1. For most variables, differences in the averages of observed groups of countries in the analyzed period were confirmed. A significant positive difference in the pre-crisis period was recorded in variables EXPORT, EXPORT_GOODS and DEBT implying their higher value in the countries with flexible exchange rate[5]. Contrary to them, countries with fixed exchange rate have higher values of variables EXPORT_SERVICES, IMPORT_SERVICES, DD, GROWTH, BB and INVEST_PUBLIC. The difference in arithmetic mean is not significant only in the case of variables IMPORT, IMPORT_GOODS, YGAP and the components of real exchange rate.

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[5] Positive differences in the case of variables EXPORT and EXPORT_GOODS does not mean that differences are necessary derived from the foreign exchange rate since other factors (EU accession, business climate, complexity of goods, FDI in industrial sector and others) are also important.

Countries with fixed foreign exchange rates were more focused on the domestic market including public investments although at the same time they had a smaller share of the budget deficit and public debt in GDP. This is possible if the inflow of foreign capital increased aggregate private consumption and triggered a strong GDP growth[6] that was higher than the growth of the budget deficit and public debt[7]. Irrespective of the differences in DD, there is no difference in the variable IMPORT, but it does not reveal the structure of imports (it is possible that the share of imports of intermediate goods is higher in the countries with a flexible exchange rate corresponding to a higher share of final goods and services in the overall imports of the second group). However, these results could be influenced by the inclusion of Romania and Poland in a group of flexible exchange rate. As relatively large countries, these economies may be more oriented to the domestic market and less to the exports, which may be reflected in the conclusions on the impact of domestic demand. It would be useful to repeat the analysis when these two economies are excluded from the FLEXIBLE group.

2. Descriptive analysis without Romania and Poland in the pre-crisis period is presented in the left part of Table 5 (Option 2). Significant differences in the arithmetic means from Table 4 are also confirmed in Table 4 with a stronger magnitude (with the exception of the trade of services that is weaker). Now the significance of differences in arithmetic means in case of variables IMPORT, IMPORT_GOODS and components of real exchange rate has arisen. Although the macroeconomists do not care about the level of the real exchange rate (but the dynamics), the real exchange rate (REER) and its components (PRICE_REL, NEER) are smaller in countries with flexible foreign exchange rates. However, the RULC are higher so the mean difference in REER_ULC is insignificant.

3. Conclusions on the difference between the arithmetic means during the recent crisis and post-crisis period are mostly similar to those in point 2 (clearly, with different magnitudes since the whole sample is included). The difference is not valid only in cases of variables IMPORT, GROWTH, YGAP and INVEST_PUBLIC. However, it is questionable whether there is a significant difference for the variable EXPORT (p-value is 0.0992 which is marginally significant at 10%). Since Bogdan, Cota and Erjavec (2017) have already confirmed that this difference disappears in the crisis period (by 2014), it is convenient to test what happens with the difference between the averages of the EXPORT variable between 2014 and 2017. Regardless of whether the difference between the arithmetic means of the variable EXPORT is slightly diminished or completely insignificant, both are happened primarily due to a reduced difference for the variable EXPORT_GOODS (because the difference in EXPORT_SERVICE in favor of the FIXED group also decreases). But, it is more important to point out that all the average values of the components of the real exchange rate in countries with flexible foreign exchange rates have less value. This means that, on average, after 2008, the nominal effective exchange rate, relative price levels and relative unit labor costs have lower values in these economies. Also, the magnitude of other variables that are significant before the crisis ((except the variables INVEST_PUBLIC and DD) becomes weaker.

The average value of the variable DD is, as a results of the crisis, smaller in both groups of countries. Given the insignificance of the differences between the averages of the variable INVEST_PUBLIC, the reduction in aggregate private consumption was

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[6] Since there is no difference in import and the export rate is lower than the import rate, there is an inescapable deficit of the current account that is financed by capital inflows from abroad.

[7] The inclusion of Croatia in the FIXED group throughout the analysis period undermines the average of fiscal variables for these countries.

stronger in countries with a fixed foreign exchange rate. The results for the variable INVEST_PUBLIC, DEBT and the components of the real effective exchange rate point to the possibility that discretionary fiscal policy and price competitiveness are much more important in fighting the crisis in flexible exchange rate countries, but for the overall conclusion the dynamics of these variables is required.

4. These differences are slightly different if Poland and Romania are excluded from the analysis (Table 4 – Option 2). More pronounced differences after 2008 are noted in the cases of variables IMPORT, IMPORT_GOODS, DD, RULC, REER_ULC and DEBT. The big difference for the DEBT is related to the growth of Hungarian and Slovenian public debt in crisis and post-crisis times. Another significant result is the negative difference for the variables REER_ULC and RULC. The RULC dynamics in Figure 5 show in the fixed exchange rate countries the RULC have fallen more during times of crisis but also increased more in the post-crisis period.

The descriptive analysis from Tables 3 and 4 really confirms that the new EU members with a flexible exchange rate actually have a higher export rate before the recent crisis, so the H1 hypothesis can be accepted. There is also no significant difference in the import rate in the observed period, which means that the H2 hypothesis can also be accepted. However, it is questionable whether it can be concluded that differences in export rates disappear after 2008. The positive response is more likely but the average difference in EXPORT_SERVICE is slightly declining, which means that the difference in EXPORT should first be sought in the export of goods. So, H3 hypothesis is partially acceptable. The conclusion about the H4 and H5 hypotheses cannot be made solely with descriptive analysis, but a regression estimation is also needed. However, preliminary results show that the H5 hypothesis can be partially accepted, but the rejection cannot be completely excluded. The final answer will be given by regression analysis.

Before the regression estimation, it is necessary to know the dynamics of the variables (visible from Figure 6 in the Appendix) in which it will be carried out, as this enables us to create expectations about the possible link. Since there are no differences in imports (according to Table 3), international trade will be monitored through exports.

To understand the characteristics of both groups of countries, it is important to observe the movements of these variables. Variables EXPORT and IMPORT rise during the observed period with a strong drop in 2009 but the annual averages between two groups differ. In addition to Slovak, Hungary, Czech Republic and Slovenia (all from the FLEXIBLE group), more interesting cases are two countries from FIXED group – Estonia which is strongly engaged in exports (the export rates 61.5% in 2004, 83.1% in 2014 and 76.5 in 2017; the import rates: about 70% in 2008 and 72% in 2017) and Croatia with relatively small export and import rates (already highlighted in the introduction of paper). Overall export rate in Croatia was between 35 and 40% prior to the recent crisis but rose to 51% in 2017[8]. It was previously stressed that most of the countries before the recent crisis had a trade deficit that during the crisis declined or became positive. However, larger trade deficit was inherent to a countries with the fixed exchange rate.

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[8] It is worth remembering that the share of some variable in GDP can be increased in several ways. In addition to the usual faster growth of this variable compared to GDP, there are also:
- The lower decline of this variable in absolute terms compared to the GDP decline
- The greater or unchanged value of this variable under recession.

The current results of descriptive analysis point to the conclusion that in the analysis of foreign trade, greater emphasis should be placed on export performances that depend on price and non-price competitiveness. In this text, however, the emphasis is on price competitiveness that is captured by the real effective exchange rate and its components – the NEER and the RULC. The dynamic of NEER is already shown on Figure 4 but the dynamics of RULC are also required and presented in the Figure 5. Data show that both groups of countries were faced with an increase in RULC before the recent crisis but this was more pronounced in the fixed exchange rate group. Reducing the RULC during the crisis in the FLEXIBLE group was relatively negligible compared to the FIXED group which after 2012 recorded (with the exception of Croatia) a stronger increase in the RULC.

Figure 5: *Relative unit labor costs (2010=100) in post-socialist countries between 1999 and 2018*
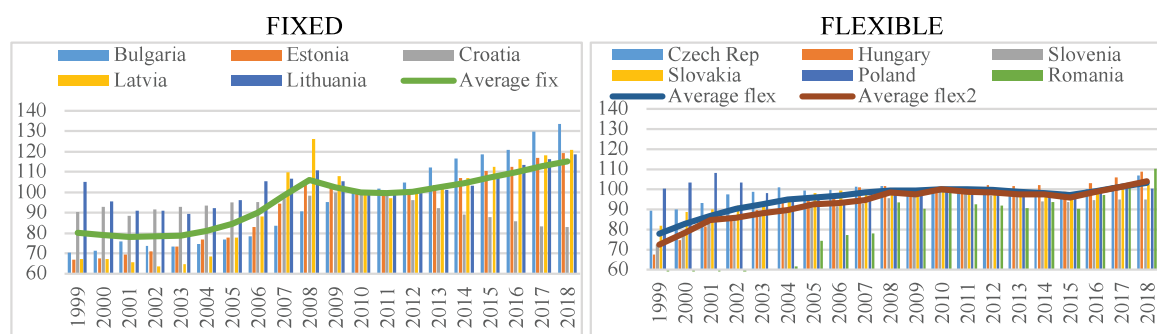
SOURCE: Own calculation using data from the Eurostat (2019).

If we summarize these results, it is apparent that in countries with a fixed exchange rate the inflow of debt capital stimulated domestic demand resulting in higher domestic unit labor costs and prices deteriorating export performances. The effects on the NEER disappear as a result of nature of the form of the exchange rate regime. However, real appreciation can be higher than nominal appreciation when a country follows a flexible exchange rate regime. Nevertheless, the dynamics of the NEER in these countries before the crisis was different implying depreciation in Slovenia (before entry into the ERM II mechanism), Romania (until 2004) and Hungary, appreciation in the Czech Republic and Slovakia and oscillations in Poland. In the crisis, countries with flexible exchange rate had nominal depreciation periods (except for Slovenia and Slovakia that introduced the euro) and it is questionable how much it contributed to their exports. To answer this question, a regression analysis is required in the next part of the paper.

3.3. Regression analysis

When a price competitiveness is an important determinant of exports, exports are usually defined as the function of the real exchange rate. Since the RULC dynamics of Figure 5 justify hypothesis H4, NEER can be used as a regressor *i.e.*:

$$EXPORT = f(NEER). \tag{1}$$

Additionally, the impact of RULC has already been explored in Bogdan (2018) for the FIXED group including Slovenia and Slovakia. The analysis was similar to this and showed that countries with fixed exchange rates reduced RULC but that the impact of non-price

competitiveness factors is still stronger. In the context of this paper the conclusions of Bogdan, Cota and Erjavec (2017) are important. These results have shown that real depreciation encouraged exports in the conditions of recent crisis, but these effects are associated with nominal depreciation. An analysis was made on the panel data, so analysis on individual countries could further confirm or reject this conclusion. Individual country analysis can incorporate the countries with change in the NEER *i.e.* Czech Republic, Poland, Hungary, Romania as well as Croatia but must use quarterly data which are seasonally adjusted. If the negative relationship between EXPORT and NEER is obtained, nominal depreciation can increase exports. The analysis also included time dummy variables to maintain the residual normality. The results of empirical analysis are summarized in Table 1.

Table 1: Summary of the empirical results

Country	Nominal effective exchange rate (NEER)	Results of analysis
Hungary	Continuous trend of depreciation with large oscillations by the end of 2011; cumulative yearly depreciation (2010 – 2018) about 14% or 1.8% *per annum*	Negative relationship between NEER and exports (analysis without the slope dummy)
Czech Republic	Continuous trend of appreciation with large oscillations by the beginning of 2011 and after the beginning of 2014; cumulative yearly depreciation from 2011 to 2014 about 11% or 3.7% *per annum;* possible negative relationship with exports between 2001 and 2003 and after 2010.	Unclear connection across the sample. The sub-samples confirmed the negative relationship in the mentioned periods (2001-03, 2010 -) which is not always related to depreciation.
Poland	Continuous trend of depreciation with large oscillations until the beginning of 2010 and a mild appreciation since the beginning of 2016; cumulative yearly depreciation from 2010 to 2016 about 8.4% or 1.5% *per annum*	A negative correlation between NEER and exports that is even stronger after 2010
Romania	Strong depreciation by the end of 2004. Slight depreciation again after 2008. cumulative yearly depreciation from 2010 to 2018 about 9.5% or 1.2 *per annum*	Negative relationship between NEER and exports in the crisis and post-crisis period.
Croatia	Stable exchange rate in the pre-crisis period with mild appreciation until 2008 which continues after 2014; cumulative yearly depreciation of 4.6% or 1.2% *per annum* between 2010 and 2014.	Limited weakening effects of nominal depreciation in the crisis period. The more important impact of reducing RULC.

SOURCE: Creation of the author according to Table 7 in the Appendix and dynamics of NEER and EXPORT.

According to the Table 1 the conclusions about the effects of nominal depreciation are mixed. In Poland, Romania and Hungary, nominal depreciation likely has a positive impact on exports. In the case of Czech Republic and Croatia, the caution is required when concluding. When the whole sample is analyzed, the connection between NEER and EXPORT was not verified in Czech Republic. When analysis is performed on two sub-samples, there are sub-periods in which this link is negative. The data overview shows the periods of simultaneous nominal appreciation and decrease of EXPORT as well as periods of simultaneous nominal depreciation and increase of EXPORT. This does not have to mean that the appreciation has adversely affected exports but may be a sign that the inflow of foreign capital simultaneously increased domestic demand and caused appreciation, so export growth could be slower than GDP growth. In the case of Croatia it has been shown that there are some indications that nominal depreciation could contribute to improve price competitiveness. But the conclusions are sensitive with respect to the specification of the link – in some specifications NEER is not significant in combination with RULC. Given the dynamics of NEER and RULC and the movement of EXPORT, it is reasonable to assume that the reduction of unit labor costs has more influenced the price competitiveness of Croatia.

4. Conclusion

The article explores the impact of exchange rate regimes on the international trade of new EU members. Differences in the international trade in pre-crisis times stem from differences in the export rates (acceptance of first and second hypothesis). These differences disappear (or became lesser) after 2008 as a primarily consequence of the lesser differences in the goods export. Hence, the article is oriented to price competitiveness of exports that can be improved by reducing relative labor costs and /or nominal depreciation. Data shows that countries with flexible exchange rates were not focused on reducing the relative unit labor costs, so the emphasis was on the nominal exchange rate. Although the results of the analysis are mixed, they show that nominal depreciation may still stimulate exports in the crisis times. However, the exchange rate cannot be the sole determinant of exports and that greater emphasis should be placed on non-price competitiveness for a significant increase in exports.

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Acknowledgments

Appendices

Figure 6: Annual averages of variables used in the analysis

EXPORT (% of GDP)

EXPORT_SERVICES (% of GDP)

IMPORT (% GDP)

DD (% GDP)

GROWTH (%)

REER_ULC (2010=100)

DEBT (% GDP)

BB (% of GDP)
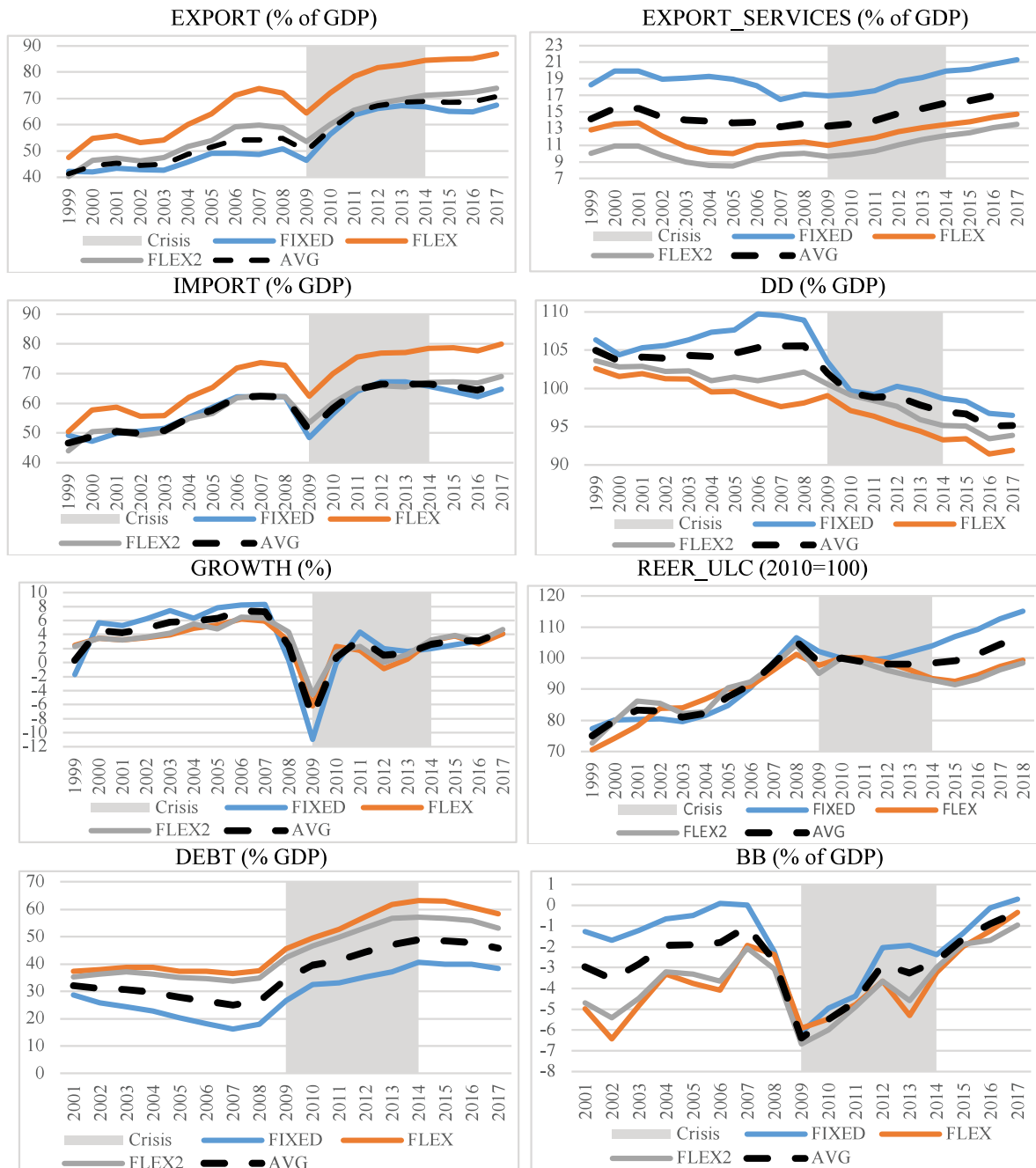
NOTE: Slovakia and Slovenia are included in the group of countries with flexible exchange rate. Graphs show annual averages on whole sample (AVG) and countries with flexible (termed FLEX2) (FLEX – the group FLEX2 without Romania and Poland) or fixed exchange rate regime (FIX).
SOURCE: Eurostat (2019).

Table 2 : *The average annual growth rates of exports of goods and services in the new EU member states*

	Average annual growth rate (goods)				Average annual growth rate (services)				Average annual growth rate (goods and services)			
	1995-1999	1999-2008	2008-2017	1995-2017	1995-1999	1999-2008	2008-2017	1995-2017	1995-1999	1999-2008	2008-2017	1995-2017
Bulgaria	-9.33	11.49	7.30	5.71	17.60	1.69	-1.49	3.07	-1.36	6.35	4.91	4.32
Czechia	6.74	15.82	4.86	9.56	5.23	1.10	3.91	2.99	6.30	12.10	4.71	7.97
Estonia	10.77	9.80	5.10	8.02	8.62	4.71	2.63	4.55	10.03	7.77	4.28	6.73
Croatia	0.06	9.02	4.42	5.46	10.20	5.85	0.97	4.59	5.98	7.07	2.52	4.99
Latvia	10.28	11.13	5.40	8.60	3.07	8.95	3.07	5.44	7.00	10.21	4.52	7.27
Lithuania	4.60	15.84	6.13	9.71	12.03	6.42	9.72	8.77	6.98	13.31	6.88	9.48
Hungary	20.40	15.21	2.94	10.91	3.57	5.01	6.80	5.48	14.72	13.06	3.67	9.41
Poland	7.57	10.43	5.62	7.92	14.44	8.91	9.48	10.13	8.56	10.17	6.36	8.31
Romania	6.43	12.78	10.19	10.54	8.87	12.01	4.65	8.38	6.86	12.70	8.81	10.02
Slovenia	7.90	10.06	3.58	6.98	-0.04	7.68	1.90	3.86	6.06	9.59	3.24	6.31
Slovakia	3.00	15.08	5.21	8.72	6.32	3.10	2.90	3.59	3.87	12.91	4.97	7.94
maximum	20.40	15.84	10.19	10.91	17.60	12.01	9.72	10.13	14.72	13.31	8.81	10.02
minimum	-9.33	9.02	2.94	5.46	-0.04	1.10	-1.49	2.99	-1.36	6.35	2.52	4.32

NOTE: Average annual growth rates are counted as geometric rates. If we denote this rate with G, then the formula $(1 + G)^{t-1}$ will get a cumulative rate of growth.
SOURCE: Author's calculation from Eurostat (2019) data.

Table 3: *The average annual growth rates of imports of goods and services in the new EU member states*

	Average annual growth rate (goods)				Average annual growth rate (services)				Average annual growth rate (goods and services)			
	1995-1999	1999-2008	2008-2017	1995-2017	1995-1999	1999-2008	2008-2017	1995-2017	1995-1999	1999-2008	2008-2017	1995-2017
Bulgaria	10.37	12.35	2.45	7.84	-19.38	8.39	-1.66	-1.30	2.85	11.57	1.78	5.88
Czechia	6.88	12.78	4.03	8.05	7.36	5.61	4.35	5.41	7.02	11.56	4.07	7.62
Estonia	9.55	10.72	2.86	7.23	13.31	8.01	4.53	7.50	10.39	10.13	3.21	7.29
Croatia	4.15	9.98	0.32	4.88	8.66	2.91	0.28	2.84	5.29	8.52	0.32	4.51
Latvia	8.11	10.69	2.14	6.65	22.13	9.77	-0.39	7.56	10.05	10.49	1.70	6.73
Lithuania	10.84	14.95	4.01	9.61	12.07	10.11	6.66	9.04	11.06	14.24	4.33	9.52
Hungary	19.00	12.07	2.88	9.40	7.09	10.54	3.47	6.97	16.52	11.84	2.95	8.93
Poland	16.36	8.98	4.19	8.28	17.73	6.99	6.74	8.77	16.58	8.70	4.55	8.35
Romania	9.60	19.94	5.30	11.87	-5.19	15.89	5.63	7.58	7.46	19.36	5.34	11.27
Slovenia	8.84	8.65	1.72	5.79	3.99	7.22	0.47	3.82	8.09	8.42	1.54	5.49
Slovakia	5.30	12.76	3.86	7.68	6.25	6.79	0.73	4.17	5.40	11.90	3.51	7.22
maximum	19.00	19.94	5.30	11.87	22.13	15.89	6.74	9.04	16.58	19.36	5.34	11.27
minimum	4.15	8.65	0.32	4.88	-19.38	2.91	-1.66	-1.30	2.85	8.42	0.32	4.51

NOTE: Average annual growth rates are counted as geometric rates. If we denote this rate with G, then the formula $(1 + G)^{t-1}$ will get a cumulative rate of growth.
SOURCE: Author's calculations from Eurostat (2019) data.

Table 4 *Summary statistics for the new EU members regarding the exchange rate regime and economic activity (1999-2017)*

Variable	Mean	Standard Deviation	Minimum	Maximum	Obs.	Mean Difference To 2008	Mean	Standard Deviation	Minimum	Maximum	Obs.
	Flexible exchange rates (1999 – 2008)						Fixed exchange rates (1999 – 2008)				
(1)	(2)	(3)	(4)	(5)	(6)	(7)=(2)-(8)	(8)	(9)	(10)	(11)	(12)
EXPORT	51.0900	16.4334	24.1000	83.3000	N=60	5.4220**	45.6680	10.6317	30.5000	70.2000	N=50
EXPORT_GOODS	41.3950	14.5095	17.2000	73.5000	N=60	14.3330**	27.0620	10.3006	10.9000	46.6000	N=50
EXPORT_SERVICES	9.6950	3.3188	4.0000	16.3000	N=60	-8.9190**	18.6140	5.3629	10.5000	28.4000	N=50
IMPORT	54.3000	14.7030	29.9000	85.0000	N=60	-0.5820	54.8820	10.9666	36.5000	74.6000	N=50
IMPORT_GOODS	46.6683	13.1294	25.6000	76.8000	N=60	2.1663	44.5020	9.4663	27.3000	61.2000	N=50
IMPORT_SERVICES	7.6667	1.9433	4.3000	11.7000	N=60	-2.7513**	10.3880	3.0035	6.1000	16.4000	N=50
DD	102.0950	4.4692	95.0000	118.1000	N=60	-5.0250**	107.1200	3.6487	101.1000	115.8000	N=50
GROWTH	4.4358	2.2409	-0.4637	10.8140	N=60	-0.9545*	5.3903	4.1045	-8.4211	11.8049	N=50
YGAP	0.9612	3.4459	-5.8374	8.1916	N=60	-0.6855	1.6467	4.5589	-7.2978	13.8097	N=48
BB	-3.9017	2.3794	-12.0000	-0.1000	N=60	-2.7871**	-1.1146	2.0877	-5.2000	2.9000	N=48
REER	86.4852	13.1658	50.5000	110.1900	N=60	-0.8022	87.2874	7.6600	64.1800	101.1200	N=50
PRICE_REL	90.7946	29.4341	34.4057	181.8602	N=60	2.2815	88.5131	11.2155	61.6790	121.1696	N=50
NEER	103.8458	30.6862	68.1300	257.4100	N=60	2.5600	101.2858	7.7063	80.7000	127.8700	N=50
RULC	87.8439	16.5666	22.7070	108.2511	N=60	2.4208	85.4231	14.5942	63.6416	126.0805	N=50
REER_ULC	87.3982	15.1868	55.7700	118.4700	N=60	1.4212	85.9770	12.8580	67.1000	127.1900	N=50
DEBT	35.2367	14.9950	11.9000	71.6000	N=60	12.0795**	23.1571	17.7636	3.7000	75.9000	N=49
INVEST_PUBLIC	3.9542	1.0466	1.6000	7.7000	N=60	-0.3978*	4.3521	1.3939	1.7000	7.3000	N=48
	Flexible exchange rates (2009 – 2017)					After 2008	Fixed exchange rates (2009 – 2017)				
EXPORT	67.3130	20.3167	26.0000	96.9000	N=54	4.6219**	62.6911	14.7464	34.5000	86.5000	N=45
EXPORT_GOODS	55.7630	18.4843	19.2000	86.4000	N=54	12.1274**	43.6356	14.9398	14.6000	68.6000	N=45
EXPORT_SERVICES	11.5444	3.4853	6.3000	19.4000	N=54	-7.5178**	19.0622	4.7453	10.9000	27.3000	N=45
IMPORT	64.4389	17.4234	32.4000	93.8000	N=54	2.2100	62.2289	13.5238	38.0000	84.4000	N=45
IMPORT_GOODS	55.4519	15.6432	26.4000	84.4000	N=54	3.7474*	51.7044	11.2770	31.1000	71.3000	N=45
IMPORT_SERVICES	8.9870	2.4328	5.1000	13.8000	N=54	-1.5330**	10.5200	3.6254	6.0000	18.7000	N=45
DD	96.5648	4.1952	88.6000	105.6000	N=54	-2.6108**	99.1756	3.2288	93.6000	107.6000	N=45
GROWTH	1.7061	3.2100	-7.7498	7.0074	N=54	0.7535	0.9526	5.0217	-14.8052	7.6000	N=45
YGAP	-1.7049	2.0001	-6.5263	1.8503	N=54	0.2888	-1.9937	3.7025	-12.5050	2.7127	N=45
BB	-3.7000	2.7113	-14.7000	1.5000	N=54	-1.1489**	-2.5511	3.1006	-9.1000	1.2000	N=45
REER	98.0013	3.2249	91.0400	102.6100	N=54	-2.2454**	100.2467	2.9431	94.6700	107.8100	N=45
PRICE_REL	95.0344	6.3428	81.4473	105.0617	N=54	-4.8235**	99.8578	3.7948	91.7275	107.7561	N=45
NEER	96.8757	3.6877	88.5200	102.7900	N=54	-2.7165**	99.5922	1.3798	95.4500	101.6400	N=45
RULC	98.3976	3.3078	90.1872	106.0572	N=54	-5.9499**	104.3475	9.7229	83.3692	129.6900	N=45
REER_ULC	95.2959	4.2724	85.7000	102.7400	N=54	-8.7048**	104.0007	10.5224	81.4100	129.6900	N=45
DEBT	52.3815	16.6583	22.1000	82.6000	N=54	16.4948**	35.8867	22.5220	6.1000	84.0000	N=45
INVEST_PUBLIC	4.3407	0.9450	2.6000	6.6000	N=54	0.0274	4.3133	1.0094	2.2000	6.6000	N=45

NOTE: Slovakia and Slovenia are included into the group of countries with flexible exchange rate. Column Mean Difference includes the point estimate of arithmetic mean differences before and after 2008 with positive (negative) values indicating the upper (lower) bound test. * denotes significance at 10% and ** at 5%.
SOURCE: Own calculations.

Table 5: *t-statistic in the testing of equality of arithmetic means*

	Time span (1999 – 2008)								Time span (2009 – 2017)							
	Option 1				Option 2				Option 1				Option 2			
Variable	Mean difference	Standard error	t-statistics	p-value	Mean difference	Standard error	t-statistics	p-value	Mean difference	Standard error	t-stat	p-value	Mean difference	Standard error	t-stat	p-value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
EXPORT	5.4220**	2.6237	2.0665	0.0207	15.0020**	2.3000	6.5227	0.0000	4.6219*	3.5680	1.2954	0.0992	17.3950**	2.7871	6.2412	0.0000
EXPORT_GOODS	14.3330**	2.3945	5.9858	0.0000	21.9430**	2.3460	9.3532	0.0000	12.1274***	3.3940	3.5732	0.0003	23.5144***	2.8188	8.3421	0.0000
EXPORT_SERVICES	-8.9190**	0.8796	-10.1402	0.0000	-6.9415**	0.8324	-8.3388	0.0000	-7.5178***	0.8608	-8.7336	0.0000	-6.1233***	0.9107	-6.7235	0.0000
IMPORT	-0.5820	2.4735	-0.2353	0.4072	7.4955**	2.3308	3.2158	0.0009	2.2100	3.1440	0.7029	0.2419	13.0100**	2.6044	4.9955	0.0000
IMPORT_GOODS	2.1663	2.1796	0.9939	0.1613	9.0480**	2.1320	4.2439	0.0000	3.7474*	2.7400	1.3677	0.0873	13.1761**	2.3369	5.6383	0.0000
IMPORT_SERVICES	-2.7513**	0.4981	-5.5235	0.0000	-1.5555**	0.4648	-3.3465	0.0007	-1.5330**	0.6406	-2.3930	0.0096	-0.1644	0.6200	-0.2652	0.3958
DD	-5.0250**	0.7812	-6.4326	0.0000	-6.9250**	0.6698	-10.3392	0.0000	-2.6108***	0.7543	-3.4610	0.0004	-4.4839**	0.7233	-6.1991	0.0000
GROWTH	-0.9545*	0.6549	-1.4574	0.0747	-1.1654**	0.6786	-1.7174	0.0450	0.7535	0.8761	0.8601	0.1963	0.3086	0.9367	0.3294	0.3714
YGAP	-0.6855	0.8022	-0.8546	0.1976	-0.3929	0.8008	-0.4907	0.3125	0.2888	0.6221	0.4642	0.3220	0.0594	0.6431	0.0923	0.4633
BB	-2.7871**	0.4344	-6.4162	0.0000	-3.0679**	0.5259	-5.8334	0.0000	-1.1489**	0.5977	-1.9223	0.0289	-0.9906*	0.6761	-1.4651	0.0735
REER	-0.8022	2.0336	-0.3945	0.3470	-3.4019*	2.4136	-1.4095	0.0820	-2.2454**	0.6270	-3.5813	0.0003	-1.9389***	0.7042	-2.7532	0.0037
PRICE_REL	2.2815	4.1535	0.5493	0.2922	-8.0441**	4.1124	-1.9561	0.0279	-4.8235***	1.0423	-4.6278	0.0000	-3.8689***	1.2825	-3.0167	0.0020
NEER	2.5600	4.1439	0.6178	0.2694	-7.3373**	2.8230	-2.5991	0.0061	-2.7165***	0.5476	-4.9608	0.0000	-2.0664**	0.7064	-2.9251	0.0028
RULC	2.4208	2.9997	0.8070	0.2107	6.1771**	2.4849	2.4859	0.0075	-5.9499***	1.5346	-3.8772	0.0001	-5.0880**	1.5284	-3.3289	0.0008
REER_ULC	1.4212	2.6987	0.5266	0.2998	-0.3713	2.9338	-0.1265	0.4498	-8.7048***	1.6914	-5.1465	0.0000	-7.2468**	1.6941	-4.2777	0.0000
DEBT	12.0795**	3.2226	3.7484	0.0002	14.2804**	3.5645	4.0063	0.0001	16.4948***	4.0944	4.0286	0.0001	20.9578**	4.5117	4.6452	0.0000
INVEST_PUBLIC	-0.3978*	0.2454	-1.6212	0.0543	-0.2121	0.2444	-0.8677	0.1941	0.0274	0.2000	0.1370	0.4457	-0.1300	0.2187	-0.5945	0.2770

NOTE: During all time horizons Slovenia and Slovakia are included as countries with flexible exchange rate regime. Option 2 excludes Romania and Poland (as relatively large countries) from the analysis. * denotes significance at 10% and ** at 5%.
SOURCE: Own calculations.

Table 6: *Data used in a descriptive analysis and sources of data*

Variable	Label	Value	Source
EXPORT, EXPORT_GOODS, EXPORT_SERVICES	Exports of goods and services (export rate) (overall, only goods, only services)	% of GDP	Eurostat
IMPORT, IMPORT_GOODS, IMPORT_SERVICES	Exports of goods (exports of_goods ratio)	% of GDP	Eurostat
DD	Domestic demand	% of GDP	Eurostat
GROWTH	Growth (change of GDP)	%	Eurostat
YGAP	Output gap (deviation from potential product)	% of potential GDP	AMECO
REER, REER_ULC	Real effective exchange rate – deflators: consumer price index and unit labor costs in the economy – 18 trading partners (Eurozone)	Index (2010=100)	Eurostat
NEER	Nominal effective exchange rate – 18 trading partners (Eurozone)	Index (2010=100)	Eurostat
PRICE_REL, RULC	*PRICE_REL = REER/NEER, RULC = REER_ULC/NEER*	Index (2010=100)	
BB	Budget balance: Net lending / borrowing	% of GDP	Eurostat
DEBT	General government debt	% of GDP	Eurostat
INVEST_PUBLIC	General government gross fixed capital formation	% of GDP	Eurostat

Table 7: *Empirical analysis*

	Hungary	Romania	Czechia			Poland	Croatia		
			All	Pre-crisis	Crisis	All	All	Crisis1	Crisis2
EXPORT_SA(-1)	0.507437**	-	0.943111**	0.892500**	-	-	-	-	0.665720**
NEER_SA	-0.283837**	-0.040900	0.016488	0.057231	-0.699047**	-0.123325**	-0.763328**	-0.303974	-0.306008*
DUMMY200714	-	19.37328**	-	-	-	-	-	-	-
DUMMY2001Q3	-	-	-	-	-	-	3.585513***	-	-
DUMMY2004Q2	-	-	10.55017**	9.360971**	-	-	-	-	-
DUMMY2008Q4	-	-	-	-	-7.428813**	-4.066876**	-	-	-
DUMMY2010Q1	-	-	-	-	-6.549946**	-	2.772773***	1.980737	-
DUMMY2009	-	-1.515486	-	-	-11.19055**	-5.976004**	-	-	-
DUMMY2010	-	-	-	-	-	-	-	-	2.238825**
DUMMY200103*NEER_SA				-0.024689**					
DUMMY200714*NEER_SA		-0.191150**							
DUMMY200914*NEER_SA							-0.045093**		
DUMMY201018*NEER_SA						-0.044897**			
DUMMY201118*NEER_SA					0.066519**				
RULC	-	-	0.011106	-	-	-	-	-	-0.280057**
@TREND	-	0.106606	-	-	-	0.452170**	0.210457***	0.448448**	-
Intercept	66.93342**	33.89513**	2.119604	2.226571	129.9026**	29.01676**	105.2473***	39.81306**	70.20484**
AR(1)	0.648515**	1.202988**	0.315277**	-	-	0.449628**	0.506101**	-	-
AR(2)	0.293302**	-0.233690	-	-	-	-	-	-	-
AR(3)	0.249469*	-0.024957	-	-	-	-	-	-	-
AR(4)	-0.319664**	-0.003759	-0.182820*	-	-	-0.319104**	-	-	-
Observations	80	80	80	36	44	80	75	40	40
R2	0.980734	0.964847	0.989226	0.985178	0.964717	0.995386	0.944992	0.952579	0.953237
F-stat	619.3417**	213.4794**	1117.118**	515.1108**	168.6116**	2219.049**	194.6982**	241.0509**	178.3651**
Durbin–Watson stat	1.863860	1.989107	1.842834	1.770082	1.539339	2.237870	1.960489	1.172750	2.044180
Breusch–Godfrey	4.978576	10.91778	7.452557	7.551824**	8.200917**	7.476962	1.018741	6.544724	1.417659
BPG test	0.206463	7.102494	2.351448	5.226386	16.49826	8.625413	1.243021	7.096135	15.21564
Jarque–Bera test	3.958080	0.884577	0.504308	-	-	0.068480	0.969529		

NOTE: Because of the size of the table, standard errors are not shown and significance is highlighted by the asterisks: * denotes significance at 10% and ** at 5%. Residual normality was tested by Jarque-Bera test, autocorrelation (4th order) with Breusch-Godfrey test and heteroscedasticity with Breusch-Pagan-Godfrey (BPG) test.
SOURCE: Own calculations.