IMPACT OF EXCHANGE RATE REGIMES AND EURO AREA MEMBERSHIP ON THE ECONOMIC GROWTH OF THE NEW MEMBER STATES FROM CENTRAL AND EASTERN EUROPE

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Abstract

The goal of this paper is to study the effects of exchange rate arrangements and euro area (EA) membership on the economic growth of ten new member states (NMS) from Central and Eastern Europe (CEE), which joined the European Union (EU) in 2004 and 2007 – the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Bulgaria and Romania. Croatia is excluded from the analysis since it became a EU member relatively late - in 2013. A vector autoregression (VAR) of annual data for the period 2007-2017 is employed. The empirical results provide statistical evidence that flexible exchange rates and EA membership favor the economic growth of the NMS from CEE.

Key words: new member states, economic growth, exchange rate regimes, euro area membership

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1. Introduction

The influence of exchange rates arrangements and currency union membership on economic growth has been heavily debated in economic literature

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for decades but no agreement has been reached among academics and practitioners on this important topic. This issue is of utmost significance for the NMS from CEE, which joined the EU in 2004, 2007 and 2013 - the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Bulgaria, Romania and Croatia, since according to their EU accession treaties, these countries are obliged to introduce the euro after they meet the Maastricht convergence criteria for a EA membership. Five of these NMS already adopted the euro – Slovenia in 2007, Slovakia in 2009, Estonia in 2011, Latvia in 2014 and Lithuania in 2015, while six of them are still out of the EA – the Czech Republic, Hungary, Poland, Bulgaria, Romania and Croatia.

An exchange rate regime (including a currency union membership) may positively or negatively affect economic growth (Eichengreen, 2007; Obstfeld and Rogoff, 1995). After their accession to the EU, the separate NMS pursued different exchange rate strategies. Slovenia, Estonia, Latvia and Lithuania used pegs to the euro till their EA entry because they wanted to introduce the euro as fast as possible. The Bulgarian lev is also fixed to the euro and Bulgaria is expected to enter the EA "waiting room" – the Exchange Rate Mechanism II (ERM II), in 2020. Slovakia was the first NMS with a floating exchange rate to join the EA in 2009. Hungary, Poland, the Czech Republic, Romania and Croatia implement flexible exchange rate policies to absorb external shocks and are reluctant to enter the ERM II and the EA.

The objective of this article is to study the impact of exchange rate arrangements and EA membership on the economic growth of NMS-10 (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Bulgaria and Romania) via a vector autoregression (VAR) of annual data for the period 2007-2017. The objective of the article has been achieved by the fulfilment of the following tasks:
➢ Review and systematize theoretical and empirical studies on the relationship between exchange rate arrangements and economic growth (Section 1);
➢ Empirically investigate the effects of exchange rate regimes and euro area membership on the economic growth of NMS-10 (Section 2);
➢ Formulate advisable exchange rate strategies for the NMS, which has not adopted the euro yet (Conclusion section).

Croatia has been excluded from the analysis since it accessed the EU relatively late (in 2013) in comparison with NMS-10, which joined the EU in 2007 and 2010.

For the purpose of this research, the exchange rate regimes of the NMS have been separated into two groups: fixed (pegged) and floating (flexible) on the basis of the De Facto Classification of Exchange Rate Regimes and Monetary Policy Framework of the International Monetary Fund (IMF). The group of the fixed regimes in this study includes the hard and soft pegs categories in the IMF

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classification, while the group of the flexible arrangements is comprised of the floating regimes and residual categories in the IMF classification.

2. Review and systematization of the theoretical and empirical studies on the nexus between exchange rate regime and economic growth

The choice of exchange rate regimes and their impact on growth are a matter of permanent interest in macroeconomic theory and practice. The adequacy of exchange rate regimes is one of the key issues discussed at international economic forums. One aspect of this debate is the suggestion that in a world of increasing international capital mobility, only polar arrangements (hard pegs or free floats) are likely to be sustainable (Eichengreen, 2007; Obstfeld and Rogoff, 1998). This hypothesis is controversial. Its opponents believe that intermediate regimes are and will continue to be an acceptable option for macroeconomic strategists (Williamson, 2000).

Economic theory assumes that the type of exchange rate regime affects not the long-run equilibrium value of real variables (Helpman, 1981; Lucas, 1982), but the process of economic adjustment (Mundell, 1968). The real exchange rate returns to its long-run equilibrium after a shock under any exchange rate regime but the type of the regime influences the way the equilibrium is restored. According to one view (Caporale and Pittis, 1995, etc.), if prices and wages are rigid, a smoother transition to a new equilibrium can be expected under a more flexible exchange rate regime. A more flexible regime is less likely to lead to long-lasting imbalances and an economic crisis. A second viewpoint is that flexible exchange rates tend to be unstable and provoke imbalances (Baxter and Stockman, 1989; Flood and Rose, 1995, etc.). Exchange rate shocks associated with flexible regimes may influence resource allocation decisions. Countries with underdeveloped or weak financial systems may not be able to adjust to strong exchange rate fluctuations under flexible regimes. The type of exchange rate regime is likely to influence economic growth through its effects on the adjustment process.

The relationship between exchange rate regimes and economic growth is an important and contradictory problem in macroeconomics. Despite the extensive literature on the topic, it is not clear which regime is the most favorable for growth. Empirical studies lead to two main conclusions: first, fixed exchange rates provide lower inflation; second, flexible exchange rates generate lower output fluctuations (Bordo and Scharwtz, 1999; Mills and Wood, 1993; Ghosh et al., 1996).

On the one hand, the lack of adjustment of the exchange rate under fixed regimes and the rigidity of prices and wages cause price disproportions and higher output fluctuation in the event of real shocks. In open capital markets, targeting the exchange rate leads to loss of independent monetary policy and inability to respond to shocks, which encourages fluctuations in aggregate income (Levy-Yeyati and Sturzenegger, 2003).

On the other hand, fixed regimes act as a nominal anchor, which, while ensuring the soundness of monetary policy, guarantees long-term price stability by restricting money supply growth and by increasing demand for money. Internal price stability is accompanied by high vulnerability to external shocks. With wage and price rigidity, these shocks can cause serious fluctuations in GDP and employment (Bordo and Scharwtz, 1999).

Flexible exchange rate regimes are better suited to isolate the economy from external shocks, so economic fluctuations should be (and actually are) less of a serious problem (Mussa, 1986; Baxter and Stockman, 1989; Ghosh et al., 1997; Bordo and Schwartz, 1999; Broda, 2001). In case of price and wage rigidities, flexible regimes can absorb economic shocks (Bailliu et al., 2003). However, empirical evidence suggests that more flexible exchange rates are associated with higher inflation (Bordo and Schwartz, 1999).

An advantage of fixed exchange rates is the higher price stability, while a merit of floating exchange rates is the lower volatility of aggregate income. A number of studies show that price and output volatility hinder economic growth (De Gregorio, 1992; Barro, 1997; Ramey and Ramey, 1995). A question arises: what is more detrimental to growth – the higher inflation under floating exchange rates or the higher output fluctuations under fixed exchange rates? This problem became popular in the literature after various factual methodologies for classifying exchange rate regimes were elaborated. The increasing interest in assessing the impact of different exchange rate regimes on economic growth stems mainly from the fact that empirical studies based on the de jure classification (exchange rate regimes officially announced by the central banks of) show rather unsatisfactory results, since there is no consensus on whether exchange rates affect key real macroeconomic variables and through which channels.

The empirical evidence is not clear as to which regime is better for stimulating economic growth. One group of empirical studies implies an advantage of fixed over floating exchange rates in terms of growth. Mundell (1995) argued that industrial economies grew faster under the Bretton Woods fixed-rate system than under the subsequent Jamaican floating exchange rate system. According to Mac Donald (2000), fixed exchange rates stimulate good economic performance because they eliminate the negative effects of exchange rate fluctuations on trade and investment. Ghosh et al. (2000) showed that currency boards are associated with higher economic growth. A second set of empirical studies suggested that flexible regimes favor economic growth more than fixed ones (Rolnick and Weber, 1997; Larrain and Velazco, 2000 etc.).

According to a third group of authors, interim exchange rate regimes are unsuitable for the current conditions of globalization and capital mobility, as they are vulnerable to speculative attacks (Eichengreen, 1994; Fischer, 2001). Ghosh et al. (1997) found that some countries with regimes formally reported as pegs often

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devalued their currencies in order to maintain or enhance their competitiveness. Calvo and Reinhart (2002) examined a group of countries with regimes classified as flexible under the de jure classification and found that these economies exhibited the so-called "fear of floating": in countries with high degree of financial dollarization, the monetary authorities had strong incentives to intervene in the foreign exchange market to reduce exchange rate fluctuations.

Obsfeld and Rogoff (1995) argued that fixed exchange rate regimes last for an average of a few years only and are usually followed by a collapse in the exchange rate and a currency crisis. In countries with persistent inflation, fixing the nominal exchange rate often leads to an overvaluation of the real one. This turns out to be unsustainable in the medium term as it makes the regime vulnerable to speculative attacks. Therefore, Williamson (2000) recommended that hard pegs be made more flexible by introducing crawling bands tied to currency baskets. According to Reinhart (2000), floating exchange rates are more misleading than fixed rates for the simple reason that they do not exist. Looking at a large sample of countries, she demonstrated that no emerging country actually allowed its exchange rate to float, as the governments of those countries suffer what Calvo and Reinhart (2002) called "fear of floating".

Alagidede and Ibrahim (2016) examined the effects of exchange rate fluctuations on the Ghanaian economy. They found that in the short term exchange rate changes caused negative shocks in consumption, investment and the aggregate product, which were overcome slowly and painfully in the long term.

Ashour and Yong (2018) studied the relationship between exchange rate regimes and economic growth in sixteen developing countries from 1974 to 2006. The results of the study indicated that at a fixed exchange rate, the rate of growth was 1.2% higher than at a floating exchange rate. These results were explained by the lack of a well-functioning financial sector in developing countries, which prevented them from reaping the benefits of flexible exchange rates.

Rao (2019) analyzed the impact of exchange rate regimes on the growth of BRICS (Brazil, Russia, India, China and South Africa) over the period 1970-2012. He found that growth in the BRICS over the study period was 81% lower at a fixed exchange rate than at a floating exchange rate.

Bailliu et al. (2010) estimated the impact of exchange rate regime type on growth by regressing panel data for twenty-five emerging market economies for the period from 1973 till 1998. The authors made two conclusions: first, flexible exchange rates are associated with higher economic growth than fixed rates, but only in the presence of free movement of capital and well-developed financial markets; second, a change in the exchange rate regime causes a temporary slowdown in growth till the country's economy adjusts to the new monetary conditions.

Barguellil et al. (2018) investigated the impact of exchange rate fluctuations on the economic growth of forty-five developing countries over the period 1985-2015. The results show that the volatility of the exchange rate has a negative impact on the economic growth of emerging markets, especially under floating exchange rates and free movement of capital.

Basirat et al. (2014) ascertained a negative impact of exchange rate fluctuations on the economic growth of eighteen developing countries for the period 1986-2010.

According to Bastourre et al. (2004) the more inflexible the exchange rate, the greater the short-term fluctuations in real GDP, which make it difficult to achieve sustainable long-term growth.

Bermudez and Dabus (2015) did not find a statistically significant relationship between the exchange rate regimes and the economic growth of Latin American countries for the period 1974-2004.

Chioma et al. (2016) discovered a positive effect of the floating exchange rate regime on Nigeria's economic growth for the period 1986-2015.

Coudert and Dubert (2004) assessed the relationship between exchange rate regimes and the growth of ten big Asian countries over the period 1990-2001. The results showed that fixed exchange rate regimes were associated with weaker growth than floating exchange rate regimes.

De Vita and Kyaw (2011) did not ascertain a statistically significant relationship between the exchange rate regimes and the long-term economic growth of seventy developing countries for the period 1981-2004.

Edwards and Levy-Yeyati (2003) empirically studied the impact of trade shocks on economic growth under alternative exchange rate regimes. They found evidence that countries with more flexible exchange rate regimes grew faster than countries with fixed exchange rates.

Beker (2006) analyzed from a theoretical perspective the advantages and disadvantages of fixed and floating exchange rate regimes. They concluded that there was no universal optimal exchange rate regime, and the choice of such should be tailored to the specificities of a particular country and a specific time period.

Bank of Canada (2017) empirically examined the impact of the exchange rate regime on economic growth in 60 countries over the period 1973-1998. Exchange rate regimes with a monetary anchor, no matter if they were fixed, intermediate or floating, had a positive impact on growth, while intermediate and floating arrangements without monetary anchor had a negative impact. The

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existence of a strong monetary policy framework is more important to economic growth than the type of exchange rate regime.

De Grauwe and Schnabl (2004) estimated the impact of the exchange rate regime on inflation and output in the CEE countries for the period 1994-2002. Evidence was found that exchange rate stability contributed to low inflation and had a positive effect on real GDP growth.

Combes and Veyrune (2002) investigated the effectiveness of currency boards via co-integration of panel data for different countries. The authors concluded that in some cases (such as bi-monetarism in Argentina), currency board may be ineffective.

Anastassova (1999) tested the hypothesis that the introduction of a currency board lead to lower inflation, lower nominal and real interest rates and higher economic growth. The hypothesis was confirmed, which may be seen as a surprise given the inability of monetary authorities to decisively intervene in the market and counteract the negative effects of various external shocks.

Frankel et al. (2019) built a new database of the actual exchange rate regimes of 145 countries throughout the period after Bretton Woods. With this new database, they studied the relationship between exchange rate regime and economic growth. The authors found that intermediate exchange rate regimes favored economic growth to the highest extent and that the choice of exchange rate regime was more important for low-income countries than for high-income countries.

Fristedt (2016) analyzed the theoretical arguments regarding the relationship between exchange rate regime choice and economic growth, and whether this relationship depended on the different level of development of various countries. They examined empirically whether there was an optimal exchange rate regime in terms of growth. Applying cross-sectional regression to 60 countries for the period 2000-2010, they discovered that the choice of exchange rate regime had no statistically significant impact on economic growth.

Guellil et al. (2017) explored the relationship between exchange rate regime and economic growth in 38 developing countries for the period 1980-2013. They concluded that fixed exchange rate generates the highest growth in developing countries.

Ihnatov and Capraru (2012) estimated the effects of exchange rate regimes on the economic growth of 16 Central and Eastern European countries. The results indicated that floating and intermediate exchange rate regimes favored higher growth than fixed ones.

Jakob (2016) ascertained a positive and statistically significant relationship between fixed exchange rate regimes and GDP growth in 74 countries in 2012.

Kassa and Lartey (2018) discovered that increasing exchange rate flexibility had a negative impact on GDP growth and total factor productivity in African countries. This negative impact weakened as the level of financial development and the degree of trade openness increased.

Kenny (2019) empirically studied the relationship between exchange rate regimes and economic growth in Nigeria during the period 1981-2015 and concluded that floating exchange rate is more favorable to the country's long-term economic growth than fixed one.

Levy-Yeyaty and Sturzenegger (2001) investigated the impact of exchange rate regimes on inflation, nominal money growth, real interest rates and GDP growth. The findings of the study showed that in non-industrialized economies "long-term" pegs (lasting five years or more) were associated with lower inflation rates and slower growth than floating exchange rates. A similar trade-off between inflation and growth was also observed under strictly fixed exchange rates (currency boards and economies without own currency), whose growth did not differ significantly from that of "long-term" pegs. The "short-term" pegs were characterized by lower growth and similar inflation in comparison with floating exchange rates.

Levy-Yeyaty and Sturzenegger (2003) examined the relationship between exchange rate regimes and economic growth for a sample of 183 countries in the post-Bretton Woods period. In developing countries, less flexible exchange rate regimes were associated with weaker growth and stronger output fluctuations. In industrialized countries, exchange rate regimes had no significant effect on growth.

Obi et al. (2016) explored the relationship between exchange rate regime and GDP growth in Nigeria over the period 1970-2014 and concluded that the Nigerian economy was growing faster at a floating rate than at a fixed exchange rate.

Okoye et al. (2019) evaluated the impact of two exchange rate regimes on Nigeria's economy - fixed (1970-1986) and floating (1987-2016). While the effect of the fixed exchange rate on growth was statistically insignificant and negative, that of the floating exchange rate was statistically significant and positive.

Applying the generalized method of moments on panel data for 169 countries in 1976-2006, Petreski (2009a) did not detect a statistically significant effect of exchange rate regime on economic growth.

Petreski (2009b) analyzed theoretical and empirical research on the relationship between exchange rate regime and economic growth. He concluded that clear and unambiguous inferences about the nature of this relationship cannot be made since individual authors express different and often opposing views.

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Schnabl (2007) found a negative impact of exchange rate volatility on the growth of 26 emerging market economies in Europe and East Asia for the period 1994-2005.

Selimi et al. (2017) discovered empirical evidence that fixed exchange rate regime encouraged economic growth in North Macedonia.

Umaru et al. (2018) found a negative effect of exchange rate fluctuations on economic growth in English-speaking countries in West Africa over the period 1980-2017.

Vujanic et al. (2017) examined the impact of the exchange rate regime on the internal balance of 10 European countries in the transition to a market economy in the period 2000-2014. The results of the study indicated that floating exchange rate regimes were advisable for more developed, but not for less developed European countries in transition. The implementation of floating exchange rate regimes in less developed countries in transition was associated with higher average inflation rate, which might be explained by their higher dependence on imports and the increase in domestic price levels as a result of currency depreciation.

The reviewed literature can be classified according to different criteria - research methods, territorial scope, results, conclusions and recommendations.

According to the research methods, the analyzed literary sources can be divided into two large groups - theoretical studies and empirical studies. The study of Petreski (2009b) occupies an intermediate place between these groups as it systematizes the theoretical and empirical literature on the relationship between exchange rate regimes and economic growth. The group of theoretical studies includes Fristedt (2016) and Zdravkovic et al. (2013). Empirical studies are those of Ashour and Yong (2018), Babu Rao (2019), Barguellil et al. (2018) Basirat et al. (2014), Chioma et al. (2016), Coudert and Dubert (2004), De Vita and Kyaw (2011), Edwards and Yeyati (2003), Frankel et al. (2019), Fristedt (2016), Guellil et al. (2017), Ihnatov and Capraru (2012), Jakob (2016), Kassa and Lartey (2018), Kenny (2019), Korkmaz (2013), Obi et. al. (2016), Umaru et al. (2018), Vujanić et al. (2017), Schnabl (2007), Tavlas et al. (2008), Habib et al. (2016), Ehigiamusoe and Lean (2019), Grandes and Reisen (2003), Razzaque et al. (2017), Levy-Yeyaty and Sturzenegger (2003), Alagidede and Ibrahim (2016), Bermudez and Dabus (2015) and Okoye et al. (2019).

According to the territorial scope, the literature reviewed can be divided into studies on one country and studies on many countries. The first group includes the research of Alagidede and Ibrahim (2016), Chioma et al. (2016), Ehigiamusoe and Lean (2019), Kenny (2019), Obi et al. (2016), Okoye et al. (2019), Razzaque et al. (2017) and Selimi et al. (2017). Authors who analyze more than one country are Fristedt (2016), Zdravkovic et al. (2013), Vujanic et al. (2017), Ashour and Yong (2018), Babu Rao (2019), Barguellil et al. (2018), Basirat et al. (2014), Coudert and Dubert (2004), De Vita and Kyaw (2011), Edwards and Levy-Yeyati (2003),

Frankel et al. (2019), Guellil et al. (2017), Ihnatov and Capraru (2012), Jakob (2016), Kassa and Lartey (2018), Korkmaz (2013), Umaru et al. (2018), Vujanic et al. (2017), Schnabl, (2007), Tavlas et al. (2008), Habib et al. (2016), Grandes and Reisen (2003), Levy-Yeyaty and Sturzenegger (2003) and Bermudez and Dabus (2015).

According to their results, the investigations can be grouped into:
- Literature, which suggests that fixed exchange rate regimes have the most favorable impact on economic growth. This may include the studies of Ashour and Yong (2018), Babu Rao (2019), Barguellil et al. (2018), Guellil et al. (2017), Jakob (2016), Levy-Yeyaty and Sturzenegger (2001) and Selimi et al. (2017).
- Studies that show greatest positive effect of floating exchange rate regimes on economic growth. This includes the studies of Bermudez and Dabus (2015), Coudert and Dubert (2004), Edwards and Yeyati (2003), Ihnatov and Capraru (2012), Kassa and Lartey (2018), Kenny (2019) and Vujanic et al. (2017).
- Research claiming that intermediate exchange rate regimes provide the highest economic growth - Frankel et al. (2019) and Ihnatov and Capraru (2012).
- Investigations implying that the type of exchange rate regime is not related to economic growth - Basirat et al. (2014), De Vita and Kyaw (2011), Fristedt (2016), Grandes and Reisen (2003), Schnabl (2007) and Umaru et al. (2018).

According to its conclusions and recommendations, the reviewed literature can be divided into:
- Studies that recommend a fixed exchange rate regime. This group includes the research of Ashour and Yong (2018), Babu Rao (2019), Guellil et al. (2017), Jakob (2016) and Selimi et al. (2017).
- Research which advocates for a flexible exchange rate regime - Chioma et al. (2016), Coudert and Dubert (2004), Edwards and Yeyati (2003), Ihnatov and Capraru (2012), Kenny (2019) and Okoye et al. (2019).
- Analyses that recommend intermediate exchange rate regimes - Frankel et al. (2019) and Ihnatov and Capraru (2012).

The following conclusions can be drawn from the analysis of the literature on the relationship between exchange rate regime and economic growth:
- There is no consensus in economic theory which type of exchange rate regime is the best (optimal) in terms of economic growth;
- Empirical studies on the impact of exchange rate regime on growth produce different, often conflicting results that vary depending on their methodology, territorial and temporal scope.

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3. Empirical analysis of the effects of exchange rate regimes and euro area membership on the economic growth of the new member states

3.1. Methodology

This research employs a vector autoregression (VAR) with the following variables: $GDPGR_{ij}$ – real GDP growth rate of country i in year j; EAM_{ij} – euro area membership of country i in year j; $FLOAT_{ij}$ – floating exchange rate regime of country i in year j; $INVR_{ij}$ – investment ratio (percentage share of gross capital formation in GDP) of country i in year j; $FISCB_{ij}$ – fiscal balance (percentage of GDP) of country i in year j; $POPGR_{ij}$ – population growth rate of country i in year j; $INFLR_{ij}$ – inflation rate of country i in year j; $TRADE_{ij}$ – trade openness (percentage ratio of exports and imports to GDP) of country i in year j; HDI_{ij} – human development index of country i in year j; $CORRUPT_{ij}$ – corruption perception index of country i in year j.

The target (dependent) variable is *GDPGR.* The independent (explanatory) variables of interest to interest to this research are *EAM* and *FLOAT.* Both of them are binary dummies with values *1* or *0*. If $EAM_{ij} = 1$, this means that country i is a euro area member in year j. If $EAM_{ij} = 0$, this means that country i is not a euro area member in year j. If $FLOAT_{ij} = 1$, this means that country i has a flexible exchange rate regime in year j. If $FLOAT_{ij} = 0$, this means that country i has a fixed exchange rate arrangement in year j.

The remaining variables are control variables. They reflect the influence of the following factors on economic growth:
➢ I*NVR* – accumulation of physical capital;
➢ *FISCB* – fiscal policy of the government;
➢ *POPGR* – changes in the number of population which can affect both the supply and the demand side of the economy;
➢ *INFLR* – monetary policy of the central bank;
➢ *TRADE* – international economic conditions;
➢ *HD*I – quality of human capital and living standard;
➢ *CORRUPT* – institutional environment.

3.2. Data

This study uses annual data on ten NMS - the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Bulgaria and Romania, for eleven years (the period 2007–2017). The number of observations is 110.

The data sources are as follows:
✓ The Eurostat website for the variables *GDPGR, INVR, FISCB, POPGR, INFLR* and *TRADE;*

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✓ The Convergence Reports of the European Central Bank (ECB) for the variable *EAM;*
✓ The Annual Reports on Exchange Arrangements and Exchange Restrictions of the International Monetary Fund (IMF) for the variable *FLOAT;*
✓ The United Nations (UN) Human Development Reports for the variable *HDI;*
✓ The Transparency International website for the variable *CORRUPT.*

3.3. Results

The Levin, Lin & Chu unit root tests show that all variables are stationary at level (see Table 1). This requires the application of unlimited VAR.

Table 1: Levin, Lin & Chu unit root test*

Variable	Statistic	Probability	Cross-sections	Observations
GDPGR	-26.0242	0.0000	10	90
INVR	-23.0975	0.0000	10	90
FISCB	20.3457	0.0000	10	90
POPGR	-2.28983	0.0110	10	90
INFLR	-5.96030	0.0000	10	90
TRADE	-10.2250	0.0000	10	90
HDI	-7.31277	0.0000	10	90
CORRUPT	-2.99060	0.0014	10	90

* Null: Unit root (assumes common unit root process)

Source: Prepared by the authors

The test for the optimal number of lags in the vector autoregression indicate that according to all criteria this number is one (see Table 2). The vector autoregression has been estimated with one lag.

Table 2: Optimal lag length in the VAR model

Number of lags	FPE	AIC	SC	HQ
0	3664.823	36.58529	36.88305	36.70467
1	3.58e-31*	-41.74440*	-38.46912*	-40.43125*
2	9.24e-31	-40.90331	-34.65049	-38.39638
3	2.58e-29	-37.87491	-28.64456	-34.17420

* Shows the optimal number of lags according to the respective criterion

Source: Prepared by the authors

The equation for the target variable in the VAR model *GDPGR* after the step-by-step removal of statistically insignificant variables is

(1) GDPGR = 27.19 + 0.18*GDPGR(-1) + 1.77*FLOAT(-1) + 1.64*EAM(-1) - 29.66*HDI(-1) - 0.99*INFLR(-1) - 0.11*POPGR(-1)

The standard errors, the t-statistics and the probabilities of the regression coefficients in Equation (1) are reported in Table 3.

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Table 3: Results from the econometric estimation of Equation (1)

Variable	Coefficient	Standard error	t-Statistic	Probability
C	27.18733	10.54779	2.577539	0.0115**
GDPGR(-1)	0.179504	0.062005	2.894972	0.0047***
FLOAT(-1)	1.773370	0.799148	2.219074	0.0289**
EAM(-1)	1.635563	0.960737	1.702405	0.0920*
HDI(-1)	-29.65773	12.56900	-2.359594	0.0204**
INFLR(-1)	-0.994870	0.096014	-10.36173	0.0000***
POPGR(-1)	-0.107464	0.054479	-1.972581	0.0515*

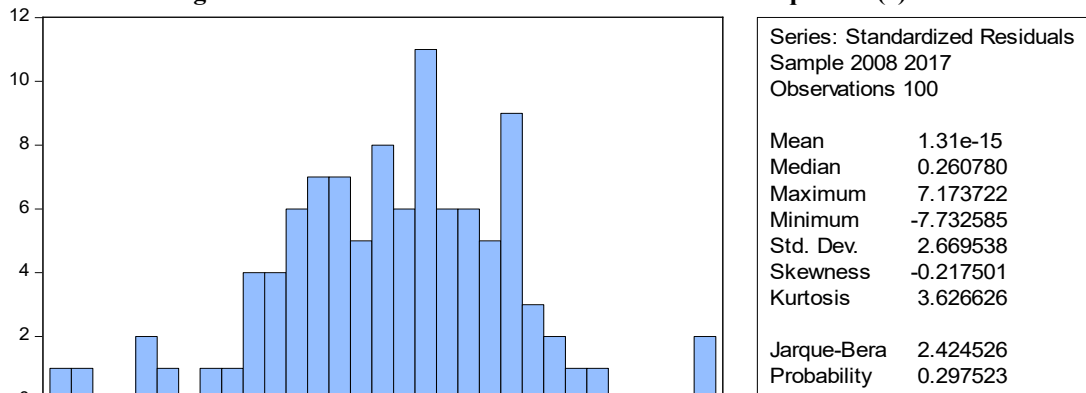$* \ p < 0.10, ** \ p < 0.05, *** \ p < 0.01$

Source: Prepared by the authors

The economic growth in NMS-10 is affected by its own past values, the type of the exchange rate regime, the EA membership and the lagged values of the human development index, the inflation rate and the population growth rate. The positive sign of the dummy *FLOAT* imply that flexible exchange arrangements are more favorable for economic growth than fixed exchange rates. The positive value of the dummy *EAM* suggests that the NMS in the EA enjoy better conditions for economic growth than the NMS outside the EA. The negative signs of *HDI* (a proxy for human capital) and *POPGR* (a proxy for labor) are in conflict with the theory of economic growth. They can be explained by the migration of highly qualified and productive workforce from NMS-10 to wealthier countries, which prevents the NMS-10 from taking full advantage of its human capital.

The value of the coefficient of determination (R-squared = 0.59) indicates that 59% of the variation of the NMS-10 real GDP growth can be explained by changes in the independent variables in Equation (1). The probability of the F-statistic (0,00) shows that the alternative hypothesis of adequacy of the model used is confirmed. It should be made clear that this does not mean that the model is the best possible but simply adequately reflects the relationship between the dependent and the independent variables.

The probability of Jarque-Bera statistics is 0.30 (see Figure 1), which justifies the acceptance of the null hypothesis of normal distribution of the residuals in Equation (1).

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Figure 1: Test for normal distribution of residual in Equation (1)

Series: Standardized Residuals	
Sample 2008 2017	
Observations 100	
Mean	1.31e-15
Median	0.260780
Maximum	7.173722
Minimum	-7.732585
Std. Dev.	2.669538
Skewness	-0.217501
Kurtosis	3.626626
Jarque-Bera	2.424526
Probability	0.297523

Source: Prepared by the authors

The results from the Pairwise Granger Causality Tests indicate that in the short term the economic growth of NMS-10 is Granger-caused by the inflation rate and the investment ratio (see Table 4).

The results from the Granger Causality / Block Exogeneity Wald Tests show that in the long run the human development index (human capital and living standard) and the inflation rate Granger-cause the real GDP growth rate in NMS-10 (see Table 5).

Table 4: Results from short-term causality tests

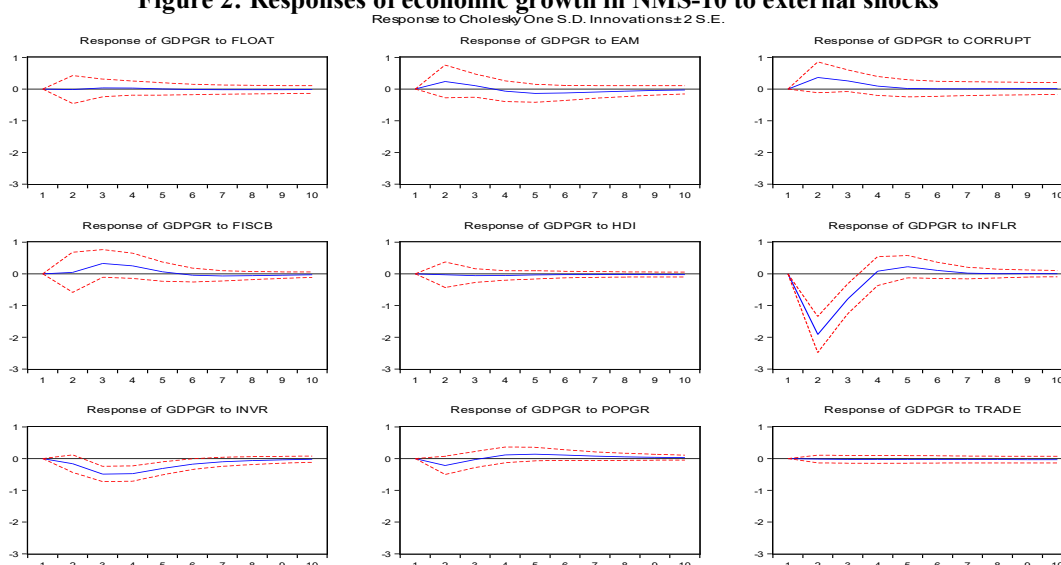| Independent variables	Probability
FLOAT	0.4505
EAM	0.3634
CORRUPT	0.9628
FISCB	0.7106
HDI	0.7670
INFLR	0.0000
INVR	0.0000
POPGR	0.4084
TRADE	0.8555

Source: Prepared by the authors

Table 5: Results from long-term causality tests

Independent variables	Probability
FLOAT	0.0509
EAM	0.1229
CORRUPT	0.4397
FISCB	0.8786
HDI	0.0343
INFLR	0.0000
INVR	0.2590
POPGR	0.1327
TRADE	0.8046

Source: Prepared by the authors

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Figure 2: Responses of economic growth in NMS-10 to external shocks

Response to Cholesky One S.D. Innovations± 2 S.E.

Source: Prepared by the authors

4. Conclusion

The following inferences can be drawn from the review and systematization of the literature (section two):

✓ Economists agree that the type of exchange rate regime may affect real economic growth in the short run but not in the long run;

✓ There are four hypotheses about the nexus "exchange rate regime - real economic growth" in the short term. The first hypothesis is that exchange rate regime does not influence short-term economic growth. The second, third and fourth hypotheses assume that the highest growth is achieved, respectively, under fixed, floating and intermediate exchange rate regime;

✓ The multiple attempts to empirically test the four hypotheses generate different and contradictory results that do not allow the unambiguous acceptance or rejection of any hypothesis.

The empirical results in this study indicate that floating exchange rates and euro area membership provide better conditions for economic growth in NMS-10 than fixed exchange rates and non-participation in the EA. However, exchange rate arrangements and euro area membership cause the real GDP growth in NMS-10 neither in the short term nor in the long run. On the basis of these results, two exchange rate strategies can be considered appropriate for the NMS from CEE:

1) Join the euro area;
2) Run a flexible exchange rate.

The main argument in favor of the first strategy (euro adoption) is the expansionary monetary policy of the European Central Bank, which encourages the economic growth in the euro area. The great merits of the second strategy (floating exchange rate) are that flexible exchange rates absorb external shocks and that

national currencies can be depreciated to in order to stimulate exports and growth in times of crisis.

The first exchange rate strategy was implemented by Slovenia in 2007, Slovakia in 2009, Estonia in 2011, Latvia in 2014 and Lithuania in 2015. The second strategy has been applied by the Czech Republic, Hungary, Poland, Romania and Croatia since their accession to the EU. The only NMS, which follows neither of these two successful exchange rate strategies, is Bulgaria, which is still out of the euro area and operates a currency board arrangement with a peg to the euro.

Bulgaria has the most unsuccessful exchange rate policy among all NMS in CEE. This statement is supported by the fact that in the beginning of 2020 Bulgaria does not use either of the two growth-enhancing exchange rate strategies - euro area membership and floating exchange rate. The stubborn adherence to the currency board for the purpose of a swift introduction of euro proved to be unjustified, since Bulgaria had not been accepted for a long time in ERM II for political reasons (ECB reluctance), despite the formal fulfillment of the Maastricht criteria.

It is time that Bulgaria reconsiders its exchange rate policy and if its membership in the EA is postponed again for reasons beyond its control, to shift to a floating exchange rate regime as a strategy, which is more auspicious for economic growth than the currency board.

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APPENDIX A

Table A. Classification of the reviewed literary sources

Literary source	Methodology	Territorial scope	Conclusions
Alagidede and Ibrahim (2016)	GARCH, GMM	Ghana	Excessive volatility is found to be detrimental to economic growth; however, this is only up to a point as growth-enhancing effect can also emanate from innovation, and more efficient resource allocation.
Anastassova (1999).	Pooled time series with cross-section analysis	22 countries with currency boards and other pegged exchange rate systems	The currency board countries exhibit almost 3% lower annual inflation differential when putting them against the other pegged exchange rate systems, and 1% point advantage over the countries similar to currency boards. On average, countries with currency boards showed higher economic growth.
Ashour and Yong (2018).	Fixed effects and pooled regression	Sixteen developing countries	The results indicated that as compared to flexible exchange regime, growth rate was higher by 1.2% when fixed exchange regime was adopted; and a growth rate of 0.64% was achieved under the intermediate regime when compared with the flexible regime.
Bailliu et al. (2003).	Cross-country growth regression on a panel-data set	Twenty-five emerging market economies	More flexible exchange rate arrangements are associated with higher economic growth, but only for countries that are relatively open to international capital flows and, to a lesser

			extent, that have well-developed financial markets.
Bank of Canada (2017)	Fixed-effect regressions	51 advanced and emerging market economies	Quantity elasticities are significantly below one, pass-through is incomplete and export prices react significantly to exchange rate changes. Despite low quantity elasticities, the trade balance reacts positively to a depreciation in all countries because export and import prices adjust.
Barguellil et al. (2018)	Generalized method of moments	45 developing and emerging countries	Nominal and real exchange rate volatility has a negative impact on economic growth. The effect of exchange rate volatility depends on the exchange rate regimes and financial openness, that is, volatility is more harmful when countries adopt flexible exchange rate regimes and financial openness...
Barro (1997)	Cross-sectional regression	Around 100 countries	Price and output volatility hinder economic growth.
Basirat et al. (2014)	Dynamic panel data regression	Eighteen developing countries	The effect of financial development on economic growth as well as the effect of exchange rate fluctuation on economic growth are negative and significant. The mutual effect of exchange rate fluctuations and financial development on economic growth is positive, but not

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			statistically significant.
Bastourre and Carrera (2004)	GMM	153 countries	The more rigid the regime is the grater real volatility will be. Countries with "fear of floating" or "inability of pegging" behavior exhibit lower volatility than consistent pegs.
Baxter and Stockman (1989)	Time-series regression	Forty-nine developed and developing countries.	Aside from greater variability of real exchange rates under flexible than under pegged nominal exchange rate systems, the authors find little evidence of systematic differences in the behavior of other macroeconomic aggregates or international trade flows under alternative exchange rate systems.
Beker (2006)	Theoretical comparison of exchange rate regimes	-	The advantages and disadvantages of fixed and flexible exchange rate regimes, which have been quite relativized from the conventional point of view, together with simultaneous, but not synchronized effects of structural and external factors, remain permanently questioned throughout a complex process of exchange rate regime decision making.
Bermudez and Dabus (2015)	GMM	Latin American countries	Exchange rate regimes are not significant to explain economic growth in Latin America. In this region flexible regimes appear to have more advantages in terms of the role of

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			the determinants of economic growth in relation to the other exchange regimes.
Bordo and Scharwtz (1999)	Historical analysis of exchange rate regimes	All monetary regimes in the world in the period 1880-1995	Fixed exchange rates provide lower inflation. Flexible exchange rates generate lower output fluctuations.
Broda (2001)	Descriptive and trend analysis of the post-Bretton-Woods exchange rate regimes	Seventy-four developing countries	Broda found support for the conventional wisdom regarding the insulating properties of flexible regimes to real shocks. Although this benefit comes at the expense of a more volatile real exchange rate, the magnitudes involved suggest that these insulating properties are, indeed, a powerful argument in favor of flexible regimes for countries that face mostly real shocks.
Calvo and Reinhart (2002)	Theoretical and empirical analysis	154 exchange rate arrangements in developed and developing countries	Countries that say they allow their exchange rate to float mostly do not--there seems to be an epidemic case of fear of floating.' Since countries that are classified as having a free or a managed float mostly resemble non-credible pegs--the so-called demise of fixed exchange rates' is a myth--the fear of floating is pervasive, even among some of the developed countries.
Caporale and Pittis (1995)	Principal components analysis	Alternative exchange rate regimes	If prices and wages are rigid, a smoother transition to a new equilibrium can be expected under a more flexible exchange rate regime. A more flexible

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			regime is less likely to lead to long-lasting imbalances and an economic crisis.
Chioma et al. (2016)	Ordinary Least Square Regression	Nigeria	Positive effect of the floating exchange rate regime on economic growth
Combes and Veyrune (2002)	Co-integration model adapted for panel data	Argentina, Bulgaria, Hong Kong, Estonia and Lithuania	The currency board regime permits a rapid convergence between base money and external account. In some situations, as Argentina bi-monetarism, the monetary policy could become inoperative.
Coudert and Dubert (2005)	Pooled regressions	Ten major Asian countries	Pegs are associated with weaker growth and lower inflation
De Grauwe and Schnabl (2004)	GMM	Ten Central and Eastern European countries	The estimations reveal a significant impact of exchange rate stability on low inflation as well as a highly significant positive impact of exchange stability on real growth.
De Gregorio (1992)	Endogenous growth model	A sample group of Latin American countries	An advantage of fixed exchange rates is the higher price stability, while a merit of floating exchange rates is the lower volatility of aggregate income. Price and output volatility hinder economic growth.
De Vita and Kyaw (2011)	Fixed effects panel estimation	Seventy developing countries	No robust relation between the choice of exchange rate regime and economic growth.
Edwards and Levy-Yeyati (2005)	Simultaneous equations model	One hundred and eighty-three developed and developing countries	Terms of trade shocks get amplified in countries that have more rigid exchange rate regimes. Countries with more flexible exchange rate regimes grow faster than countries with fixed exchange rates.

Ehigiamusoe and Lean (2019)	MG and PMG estimators	The West African region	Financial development has a long-term positive impact on economic growth, but this impact is weakened by real exchange rate and its volatility.
Eichengreen (2007)	Theoretical analysis	Alternative exchange rate regimes all over the world	In a world of increasing international capital mobility, only polar arrangements (hard pegs or free floats) are likely to be sustainable
Fischer (2001)	Descriptive and trend analysis	IMF's member countries	The bipolar view of exchange rates is exaggerated. For countries open to international capital flows, softly pegged exchange rates are crisis-prone and not sustainable over long periods. However, a wide variety of flexible rate arrangements remains possible.
Flood and Rose (1995)	Theoretical and empirical analysis	OECD countries	The volatility of macroeconomic variables such as money and output does not change very much across exchange rate regimes.
Frankel et al. (2019)	Cross-country analysis	One hundred and forty-five developed and developing countries	Intermediate exchange rate regimes are positively related to economic growth.
Fristedt (2016)	Cross-sectional regression estimation	Sixty developed and developing countries	Exchange rate regime has no statistically significant impact on economic growth.
Ghosh et al. (1996)	Descriptive and trend analysis	All IMF members countries	Fixed exchange rates provide lower inflation. Flexible exchange rates generate lower output fluctuations.
Grandes and Reisen (2003)	Inter-country comparison	Argentina, Brazil and Mexico	Failed attempts with hard pegs have been discontinued in favor

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			of more flexible exchange-rate arrangements.
Guellil et al. (2017)	Panel Fully Modified Least Squares	Thirty-eight developing countries	There is a positive relation between exchange rate regime and economic growth with a preference for fixed exchange rate regimes in achieving the highest growth rate.
Habib et al. (2017)	IV approach	One hundred and fifty developed and developing countries	A real appreciation (depreciation) reduces (raises) significantly annual real GDP growth in developing countries with pegs.
Helpman (1981)	Theoretical analysis		The type of exchange rate regime does not affect not the long-run equilibrium value of real variables.
Ihnatov and Capraru (2012)	OLS and GMM	16 Central and Eastern European countries	The results suggest superior effect on economic growth of the floating and intermediate regimes comparing to the fixed arrangements.
Jakob (2016)	Cross-sectional regression	74 countries	Positive and significant correlation between pegged exchange rates and economic growth
Kassa and Lartey (2018)	GMM	African countries	An increase in exchange rate flexibility has a negative impact on both GDP growth and the growth of total factor productivity.
Kenny (2019)	Augmented Dickey Fuller (ADF) Unit Root Test, Co-integration test, Fully Modified Ordinary Least Square (FMOLS) estimation technique and diagnostic tests	Nigeria	Sustained utilization of managed floating exchange rate regime in Nigeria would significantly improve economic growth.
Korkmaz (2013)	Panel Data Analysis	Nine randomly selected European countries	There is causality from exchange rate towards economic

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			growth for the nine European countries.
Larrain and Velazco (2001)	Theoretical and empirical analysis	Emerging market economies	Flexible exchange rate regimes favor economic growth of developing countries more than currency pegs.
Levy-Yeyati and Sturzenegger (2003)	Pooled regression	183 countries	For developing countries, less flexible exchange rate regimes are associated with slower growth, as well as with greater output volatility. For industrial countries, regimes do not appear to have any significant impact on growth.
Lucas (1982)	Theoretical analysis		The type of the exchange rate regime does not affect the long-run equilibrium value of real variables.
Mundell (1968)	Theoretical analysis		The type of the exchange rate regime affects the process of economic adjustment.
Mussa (1986)	Theoretical and empirical analysis	16 advanced industrial countries	Flexible exchange rate regimes are better suited to isolate the economy from external shocks, so economic fluctuations should be (and actually are) less of a serious problem.
Obi et al. (2016)	GMM	Nigeria	Fixed exchange rates constrain the performance of the Nigerian economy.
Obstfeld and Rogoff (1995)	Theoretical and empirical analysis	Countries with fixed exchange rates	Industrialized-country monetary authorities have the resources to defend exchange parities, but if this commitment lacks credibility with markets, the costs to the broader economy of defending an

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			exchange-rate peg can be very high.
Obstfeld and Rogoff (1998)	Theoretical analysis		In a world of increasing international capital mobility, only polar arrangements (hard pegs or free floats) are likely to be sustainable.
Okoye et al. (2019)	GARCH	Nigeria	For developing economies that rely on manufactured and industrial goods imports, exchange rate management should follow a gradual transition process from the fixed to the floating exchange rate policy so as to smoothen the transition-induced shocks.
Petreski (2009a)	GMM	One hundred and sixty-nine developed and developing countries	No statistically significant effect of exchange rate regime on economic growth was found.
Petreski (2009b)	Review of the Theoretical and Empirical Literature		Clear and unambiguous inferences about the nature of this relationship cannot be made since individual authors express different and often opposing views.
Ramey and Ramey (1995)	Fixed effects regression of panel data	A sample of 92 countries and a sample of OECD countries	Price and output volatility hinder economic growth.
Rao (2019)	Panel regression	BRICS countries – Brazil, Russia, India, China, Republic of South Africa	Pegged regimes have significantly (-81%) lower growth in BRICS countries.
Razzaque et al. (2017)	Co-integration techniques	Bangladesh	In the long run, a 10 per cent depreciation of the real exchange rate is associated with, on average, a 3.2 per cent rise in aggregate output. However, a contractionary effect is observed in the

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			short run so that the same magnitude of real depreciation would result in about a half per cent decline in GDP.
Reinhart (2000)	Theoretical and empirical analysis	Thirty-six countries in Africa, Asia, Europe, and the Western Hemisphere	Countries that say they allow their exchange rate to float mostly do not - there seems to be an epidemic case of "fear of floating".
Rolnick and Weber (1997)	Descriptive and trend analysis	15 countries	Flexible regimes favor economic growth more than fixed ones.
Schnabl (2007)	Cross country panel estimations	Twenty-six emerging market economies in Europe and East Asia	A negative impact of exchange rate volatility on growth both in Emerging Europe and East Asia.
Selimi and Selimi (2017)	OLS, VAR	North Macedonia	Real exchange rate positively affects economic growth. This is an argument in support of the fixed exchange rate regime, which ensures macroeconomic stability of the country.
Tavlas et al. (2008)	Critical analysis of the methodologies for de facto classifications of exchange rate regimes		There is a need of a more thorough investigation of the degree of monetary-policy independence.
Umaru et al. (2018)	Panel data regression analysis	West African English speaking countries	The independent variable (real exchange rate) is statistically significant and negatively related to the dependent variable (GDP).
Vujanic et al. (2017)	Descriptive and trend analysis	Ten European transition countries	The results of the research confirmed the justification of the application of the floating exchange rate regime in more developed, but not in less-developed, European transition countries.

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Williamson (2000)	Theoretical and empirical analysis	IMF member states	Intermediate regimes are and will continue to be an acceptable option for macroeconomic strategists
Zdravkovic et al. (2013)	Descriptive and trend analysis	Western Balkan Countries (WBC) and New Member States (NMS)	The countries with fixed exchange rate regimes experienced higher growth before the global crisis of 2008 and lower economic growth after the crisis in comparison with the states with flexible exchange rates.

Source: Prepared by the authors