MUNDEL OPTIMALITY OF THE BULGARIAN ACCESSION TO THE EURO AREA

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Abstract

This paper analyses the level of economic convergence within the EU and in particular within EMU. The main purpose is to assess the level of business cycles synchronisation between Bulgaria and the Eurozone. The research is conducted with data for the period 1995–2019 divided in different subsamples in an attempt to find important turning points in the synchronicity levels. Business cycles are identified through detrending of GDP time series with two alternative techniques – Baxter-King and Hodrick-Prescott filters. The empirical results of this paper reveal that in the period 1995–2002 Bulgaria did not form Optimum Currency Area with any of the EMU members and possibly suffered severe negative effects from the introduction of the Currency Board in 1997. The findings also identify substantial increase in the synchronisation between Bulgaria and the EMU members, and within the Eurozone itself in the first decade of XXI century, followed by deterioration, signalling for potential problems with the stability of the Common currency in the future.

Key words:

business cycle
synchronisation, EU
integration, currency
unions, optimum
currency area.

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Introduction

European monetary union (EMU) is undoubtedly one of the most prominent accomplishments of the ongoing European economic integration and the development

of the European Union. The Euro area or Eurozone as it is also called is a currency and bank union consisting (currently) of 19 EU member-states, formally created with the signing of the Maastricht Treaty in 1992 (officially Treaty on the Functioning of the European Union). The Eurozone full membership is available only for member states of the European Union and all members are obliged to join the monetary union once they comply all requirements. Only Denmark and United Kingdom (UK) have negotiated an exclusion of this rule and UK is no longer a member of the EU. In addition to the full members of the EMU there are four non-EU states that have negotiated formal agreements to use the Euro as their official currency and issue their own coins but without representation in the European Central Bank (Andorra, Monaco, San Marino, and Vatican City) and also Kosovo and Montenegro have adopted the common currency as their legal tender without a formal agreement and, therefore, without issuing rights.

The admission of member-states in the Euro area is governed by the Maastricht Treaty through the so called euro convergence criteria (The Official Journal of the European Union , 2020). The five main criteria listed in the treaty are:

1. Inflation rate: Applicant countries should have inflation rate no more than 1.5 percentage points higher than the average of the three EU member states with the lowest inflation.

2. Long-term interest rate: The nominal long-term interest rate in the applicant countries must not be more than 2 percentage points higher than in the three lowest inflation member states.

3. Annual government deficit: The ratio of the annual government deficit to GDP must not exceed 3% at the end of the preceding fiscal year.

4. Government debt: The ratio of gross government debt to GDP must not exceed 60% at the end of the preceding fiscal year.

5. Exchange rate: Applicant countries should have joined the exchange-rate mechanism (ERM II) under the European monetary system (EMS) for two consecutive years and should not have devalued its currency during the period.

The nominal Maastricht criteria are set with the purpose of achieving price stability within the Eurozone and to ensure it was not negatively impacted when new member states accede. Due to the normative nature of the Maastricht Treaty, it does not provide measures to assess if the adoption of the Euro will be beneficial for an applicant country. The benefits and costs for a country joining a currency union can be assessed within the framework of the theory of Optimum Currency Areas (OCA) developed by Robert Mundell in the 1960's (Mundell, 1961). According to Mundell a Currency Area is a domain within all entities use a common currency or maintain

fixed exchange rates. Usually currency areas coincide with national borders but they also can be bigger or smaller than the national territory.

Mundell analyses two extreme examples: every person has their own currency and there is only one currency in the whole world. The first case is similar to barter economy and is generally viewed as not beneficial for any economy. The more currencies that exist, the more money will have to be exchanged in order to trade with others, thus increasing transaction costs. Also, the smaller the currency areas are, the more vulnerable each area becomes to speculation with its currency. If only transaction costs and speculation issues were to be considered, the whole world should have only one currency.

In the second case – only one currency for the whole world will not be beneficial either because it suggests uniform monetary policy for all entities. Monetary policy is used by governments as an anticyclical instrument – expansionary policy is used to combat unemployment and contractionary policy is employed to control inflation. Since the world is not homogeneous in terms of unemployment and inflation therefore a worldwide common currency implies an inability to react to shocks by adjusting exchange rates. If economic stability or adjustment to shocks is the only goal considered, as many areas as possible should trade with flexible exchange rates. The best decision in respect of both minimizing transaction costs and ability to adjust to cyclical shocks is to establish monetary unions within regions regardless national borders. In order to be optimal, Currency areas must meet the following requirements (i.e. OCA properties):

1. Labour mobility across the region – mobility of workforce equalises the level of unemployment within the area, which allows common policy.
2. Capital mobility across the region – foreign investments reduce the inflationary pressure and equalise prices within the region.
3. Entities within the region must have synchronised business cycle dynamics – allows uniform adjustment policy.

Some authors have suggested additional requirements for the optimality of currency unions. Ronald McKinnon (McKinnon, 1963) suggests price flexibility for goods and factors of production. Another contributor to the OCA theory is Peter Kenen (Kenen, 1969), who states that the participants in a currency union must have highly diversified economies (particularly external trade) because it would reduce the significance of random external shocks on exports.

Fulfilment of all these requirements suggests that the participation of a country in the monetary union will be beneficial due to reduced transactional costs and increase of mutual trade among the union members. When the OCA criteria are not

satisfied, idiosyncratic shocks cannot be adjusted with the instruments of monetary policy or the monetary policy itself may cause economic disturbances (inflation and unemployment).

Significant part of the fundamental European Union legislation is dedicated to the provision of factor mobility and price flexibility. Although the Rome Treaty and secondary legislation grant free movement of goods, capital and labour, in reality factor mobility within the Union is far from perfect. Capital is considered to be the more mobile factor among EU members, but its level is lower than the mobility within the US due to the different tax levels in EU countries (Wildasin, et al., 2000). The Rome treaty also postulates free movement of workforce but the mobility of labour is impeded by cultural and language barriers. All EU members are free market economies with negligible exclusions – in some of the members the price of electricity is regulated by the government and it is generally believed that there is no true wage flexibility (Sanz-de-Galdeano & Turunen, 2006). Since most of the OCA properties are not country specific due to the common European legislation, this paper is focused on the main Mundell criterion – business cycle synchronisation.

The objective of this paper is to assess if the accession of Bulgaria to the European Monetary Union will be beneficial or not. In order to achieve the goal of this paper, it is necessary to examine if the Bulgarian economy possesses the OCA properties.

The process of Bulgaria's accession to the European Union started in 1990 with the signing of the Convention on Trade, Business and Economic Relations and a resolution of the parliament expressing the desire of the Republic of Bulgaria to become a full member of the European Community. In 1999 the European Council decided to start accession negotiations with Bulgaria, and in January 1, 2007 Bulgaria acquired officially the status of full member of the EU. Another dimension of the Bulgarian integration into the EU is the introduction of a currency board in July 1, 1997. After several failed stabilisation attempts and a period of hyperinflation, the Bulgarian currency was pegged to the Deutsche Mark at a fixed rate and in 2002 when Germany adopted the Euro, it became the anchor currency for the Bulgarian Lev.

Now 14 years since the gaining of full member status, the Bulgarian integration in the EU economy is far from complete. Free trade and factor movement within the Union failed to provide economic convergence for Bulgaria. Despite the relatively high economic growth Bulgaria remains one of the poorest members of the EU with the lowest income per capita, the lowest labour productivity, relatively high unemployment, inflation and interest rates.

In Bulgaria there is an ongoing debate concerning the necessity and the benefits of the eventual adoption of the Euro. There is a growing body of research articles, trying to assess the institutional (Mihaylova-Borisova, 2014), nominal (Yorgova, 2009), (Simeonov, 2007) and fiscal (Marinova, 2016), (Petkov, 2014) preparedness of Bulgaria for the EMU accession. This debate even fuelled the idea for revaluation of the benefits of the currency board (Hristozov, 2017) with the argument that Bulgaria needs independent monetary policy in accordance with its own economic conditions.

According to the biannual Convergence reports of the European Central Bank, Bulgaria (ECB, 2020) does not comply to the Maastricht criteria because of breaching the long-term inflation requirement and is not nominally eligible for applying to the ERM II. Nevertheless, the Bulgarian Central Bank has been maintaining fixed exchange rate with the Euro since 2002 and the Bulgarian government states that the adoption of the Euro from Bulgaria is a real possibility.

In order to evaluate if the adoption of the Euro will be beneficial for Bulgaria it is required to assess the level of synchronisation of the Bulgarian business cycle with the cycle of the Eurozone and the individual cycles of the EMU members.

I. Methodology and Data

Measuring business cycle synchronisation is a complex task and is carried out in two separate iterations: cycle identification and synchronisation estimation.

The economic activity in open market economies inherently fluctuates with different frequency. These fluctuations are subjected to intensive scrutiny since the seminal works of Simonde de Sismondi from 1819 (Simonde de Sismondi, 1991), and Clement Juglar from 1860 (Legrand & Frobert, 2009), which led to the discovery of economic cycles with different length; from the shortest – Kitchin cycles with length between 1 and 3 years (Kitchin, 1923), to longest – Kondratieff waves between 45 and 60 years (Kondratieff & Stolper, 1935).

In this paper, for quantification purposes, the definition and length of the business cycle are derived from the interpretation of the National Bureau of Economic Research in the USA (Stock & Watson, 1993) of the definition of Burns and Mitchell: “Business cycles are a significant fluctuation found in the aggregate economic activity of nations...a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions” (Burns & Mitchell, 1947).

In this paper, GDP is selected as the most inclusive measure for economic activity and its dynamics may be considered as sufficient approximation of overall business cycle. The source of the data is the European Commission statistical database – Eurostat

(European Commission, 2020). We use quarterly data for the GDP of the 19 EMU countries and Bulgaria. The series are seasonally and calendar-day adjusted, because the non-adjusted data have cyclical properties and may distort the results. The timespan of the data is from the first quarter of 1995 to the last quarter of 2019. This period provides the longest possible sample from the given database, and includes data for most of the selected countries (Malta is reporting from the start of 2000 and Slovakia did not report quarterly data and is excluded from the sample).

1. Business Cycle Identification

Business cycle identification process usually requires a detrending procedure of the time series (Canova, 1998). The GDP data in this paper is detrended by filtering the time series with two different from theoretical point of view statistical transformations: Band-Pass Filter and Hodrick-Prescott Filter.

The Band-Pass Filter isolates the cyclical component of the time series by removing both low (which reflect the long term growth component) and high (which might be due to measurement errors and noise) frequency fluctuations from the data at a predefined level. The filtered series are computed as:

$$z_t = \sum_{c=1}^{q+1} w(1, c) y_{t+1-c} + \sum_{c=2}^{q+1} w(1, c) y_{t+c-1} \quad t = q+1, \dots, n-q$$

where:

z_t – filtered series

y_t – original series

q – lag length order

$w(1, c)$ – the corresponding element of the weight matrix

For the particular detrending procedure are used the “Ideal” settings of the Band-Pass filter recommended from Baxter and King (Baxter & King, 1999), with low band set at 6 lags and upper band set at 32 lags; the maximum lead/lag length of the filter is 10 lags. The Baxter-King Band-Pass Filter belongs to the category of the fixed length symmetric filters which share a well-known common deficiency – they significantly reduce the length of the filtered series (Christiano & Fitzgerald, 2003). These settings of the filter reduce the length of the time series with 10 lags at the beginning and additionally with 10 lags at the end of the series. Therefore, an alternative detrending technique is used, namely – Hodrick-Prescott filter.

The Hodrick-Prescott Filter is a smoothing method, which isolates the long-term trend component of time series (Hodrick & Prescott, 1997). The cyclical fluctuations

of the series are calculated as a difference between the trend component and the actual data. The Hodrick-Prescott filter is a two-sided linear filter that computes the smoothed series (s) by minimising the variance of actual series (y), subject to a penalty λ that constrains the second difference of the smoothed series. That is, the HP filter chooses (s) to minimise:

$$\sum_{t=1}^T (y_t - s_t)^2 + \lambda \sum_{t=2}^{T-1} ((s_{t+1} - s_t) - (s_t - s_{t-1}))^2 \rightarrow \min$$

The penalty or smoothing parameter is set at $\lambda = 1600$ according to the frequency power rule which is generally accepted in the literature (Ravn & Uhlig, 2002). Like the Band-Pass Filter the Hodrick-Prescott Filter also possesses some disadvantages, as pointed out from Baxter and King (Baxter & King, 1999) it is highly dependent from the sample length (samples with different length provide different results).

The Band-Pass Filter is preferable from a theoretical perspective (Stock & Watson, 1999), but its use on small sample series is questionable. Therefore, in order to increase the robustness of the results, both filtering techniques are applied independently and the produced two data sets are compared.

2. Estimation of Business Cycle Synchronization

Business Cycle Synchronisation between Bulgaria and EMU is measured with unconditional contemporaneous correlations. We compute correlation coefficients between the filtered series for Bulgaria and the EMU aggregate (independently for Band-Pass and Hodrick-Prescott filters). As a benchmark we calculate correlation coefficients between the EMU aggregate and every EMU member-state. Additional reference is provided from the bilateral correlation coefficients between Bulgaria and individual EMU members.

In order to study the development of the business cycle synchronisation over time, we divide the sample several overlapping sub-periods:

For the Hodrick-Prescott filter – five 8-year sub-periods overlapping at the fourth year, starting from the first quarter of 1995: 1995-2002; 1999-2006; 2003-2010; 2007-2014; 2011-2019.

For the Baxter-King band-pass filter because of the previously mentioned deficiencies of the technique – four 8-year sub-periods overlapping at the fourth year starting from the third quarter of 1997: 1997-2005, 2001-2009, 2005-2013, 2009-2017.

The length of the sub-periods has been chosen according the assumption of Baxter-King band-pass filter settings that the business cycle fluctuations are between 6 and 32 lags for quarterly data or between 1.5 and 8 years.

We are interested in the intertemporal comparison of the synchronisation because it shows the development of the European economic convergence over time, but also it allows us to test the assertion of Frankel and Rose for the endogeneity of the OCA criterion (Frankel & Rose, 1998). Using regression techniques, they found that the adoption of common currency itself causes synchronisation of the business cycle between the participating countries.

II. Results

The results from the described procedure are presented separately for the two filtering techniques for all sub-periods under investigation. The data obtained from the Hodrick-Prescott filter are displayed in three separate tables.

Table 1 includes the level of business cycle synchronisation between individual Eurozone members and EMU aggregate. Within the first sub-period – from 1995 to 2002, the overall level of synchronisation is low with 7 countries (Austria, Finland, France, Germany, Italy, Netherlands and Spain) scoring over 0.5 correlation with the EMU aggregate. The average synchronisation of all countries is 0.43 with highest score for Finland and Spain (0.85) and lowest for Greece (-0.18).

Table 1

Level of business cycle synchronisation between individual EMU members and EMU aggregate – Hodrick-Prescott filter

PERIOD	1995-2002	1999-2006	2003-2010	2007-2014	2011-2019
AUSTRIA	0.6239	0.8725	0.9559	0.9361	0.6456
BELGIUM	0.3961	0.7049	0.9150	0.9132	0.5184
BULGARIA	0.4562	0.6979	0.6270	0.5838	0.5628
CYPRUS	0.4241	0.5188	0.6647	0.5344	0.6900
ESTONIA	0.4976	0.8016	0.9428	0.8405	-0.1689
FINLAND	0.8513	0.7783	0.9547	0.9291	0.4688
FRANCE	0.8188	0.9430	0.9867	0.9557	0.5140
GERMANY	0.5403	0.9223	0.9659	0.9331	0.7285
GREECE	-0.1808	0.0873	0.3550	0.3043	0.6017
IRELAND	0.2783	0.5776	0.8673	0.7892	0.4925
ITALY	0.8168	0.8042	0.9655	0.9556	0.8818
LATVIA	0.3616	0.9339	0.9228	0.8119	-0.4106

LITHUANIA	0.3640	0.8044	0.9168	0.8267	-0.2417
LUXEMBURG	0.1409	0.7454	0.9176	0.8579	0.1940
MALTA	-	0.4364	0.6822	0.6243	0.5503
NETHERLANDS	0.8165	0.8968	0.9098	0.9221	0.5496
PORTUGAL	0.0600	0.8570	0.7073	0.6040	0.7690
SLOVENIA	-0.4306	0.6661	0.8157	0.8373	0.7608
SPAIN	0.8456	0.8552	0.9149	0.8387	0.8703
AVERAGE	0.4267	0.7318	0.8415	0.7894	0.4725

Source: Author's calculations.

This period represents the macroeconomic circumstances before the establishment of the EMU – first 11 members of the EMU fixed their exchange rates from January 1, 1999 and the Euro replaced the national currencies from the start of 2002. In regard to the synchronisation between EMU aggregate and the individual states, the results indicate definite idiosyncratic properties of the business cycle for most of the countries in the selection. This means that at the time of the formation of the EMU it probably did not form an optimal currency area. The creation of the Eurozone most probably caused significant economic problems for most of its members due to the lack of independent adjustment monetary policy. At the end of the XX century the EMU looks more like a political decision than an economically sound project.

In the next period, representing the actual entry into force of the EMU – from the 1999 to the end of 2006 the results are radically different. All countries in the selection significantly improved their level of synchronisation with the EMU aggregate. This notion holds true also for countries that are not members of the EMU nor even members of the EU. The average level of synchronisation of all countries to the EMU aggregate is 0.73 with as many as 13 states having synchronisation score of 0.7 or above. The high level of synchronisation between the business cycles of the selected countries with the EMU aggregate continues into the next period – 2003 to 2010, with average measure of synchronisation of 0.84 and 12 countries with correlation higher than 0.9. These results are very interesting and imply a possible proof of the claim from Frankel and Rose for the endogeneity of the OCA criterion (Frankel & Rose, 1998).

The high level of synchronisation between the individual countries business cycles and the EMU aggregate in the first decade of the XXI century (the two sub-periods: 1999-2006 and 2003-2010) signify that after the initial adjustment shock from its creation, the Eurozone was largely beneficial for its members. In the time of the establishment of the EMU it did not form an optimal currency area according to the Mundell criteria, but after the introduction of the single currency, it generated

positive effects in terms of increased trade, reduced transactional costs and risks without costs caused by lack of individual anticyclical policy.

The only country that stands out from the general trend of high synchronization is Greece. The level of synchronisation of the Greek business cycle is extremely low even negative in the first sub-period, even countries that are not members of the EU and the Eurozone demonstrate higher correlation with the EMU aggregate. This means that probably the Greek economy suffered severe economic problems from the accession to the Eurozone. The common monetary policy of the EMU was not optimal for the Greek economic circumstances and the Greek government probably had to compensate with other available policy instruments namely fiscal and government expenditure. This lack of synchronisation between Greek business cycle and the EMU aggregate could back the hypothesis that the adoption of the Euro is among the main causes of the Greek sovereign debt crisis from 2009.

The fourth sub-period (2007-2014) is described with radically different macroeconomic settings. The EMU accepted 7 new members and the world experienced the worst financial crisis since the Great Depression. During this period the overall level of synchronisation of selected countries with the EMU aggregate started to decrease slightly but maintained a relatively high value with average score of 0.79. But the last sub-period under investigation (2011-2019) shows substantial widespread deterioration of the individual level of synchronisation with the EMU aggregate. All countries in the selection decreased their correlation significantly lower than the respective highest scores in the previous sub-periods. The average overall level of synchronisation dropped to 0.47 – similar to the pre-Euro sub-period (1995-2002). The Baltic states are at the bottom of the list with negative synchronisation measure. The only exceptions are Cyprus and Greece, recording their highest synchronisation score for the period, respectively 0.69 for Cyprus and 0.6 for Greece.

This means that the Eurozone met the direct impact of the Global financial crisis relatively uniformly, but the long-term negative effects had severe idiosyncratic properties. The significant decrease of the level of business cycle synchronisation means that the Global financial crisis had radically differentiated effect on national economies in the selection or the anticyclical policy of the ECB and governments caused the individual countries' business cycles to drift apart. Obviously the Stability and Growth Pact failed to ensure its main goals – facilitate and maintain the stability of the EMU and to increase the economic convergence within the Union. These results may signal substantial problems with Mundell optimality of the Eurozone and cast doubt over the economic benefits of the single currency, therefore threatening the future stability of the EMU.

The significant decrease of the overall level of business cycle synchronisation within the EMU also has theoretical implications. According to the prominent economist Milton Friedman, business cycles are a result mainly from monetary policy and should not be called cycles at all (Friedman & Schwartz, 1963). The idiosyncratic cycles of the EMU members in the last decade emerged under a common monetary policy and could not be explained with purely monetary factors. Also the hypothesis of Frankel and Rose for the endogeneity of the OCA criterion (Frankel & Rose, 1998) could be questioned because of the drop in synchronicity under a single currency. At least it is possible to state that the synchronisation of the business cycles is not a unidirectional process and is reversible even under a common monetary policy.

During the investigated period Bulgaria followed the general trend in a moderate extend. In the first sub-period Bulgaria experienced severe economic problems with hyperinflation and negative economic growth, which led to the introduction of the currency board in July 1997 (Gulde, 1999). The low value of the correlation coefficient (0.46) indicates the lack of synchronisation between Bulgaria and EMU countries and probably an idiosyncratic nature of the cycle. In comparison with the EMU members Bulgaria's level of synchronisation higher than Belgium, Cyprus, Luxemburg and Portugal. The low level of synchronisation is natural and easy to explain – Bulgaria is not a member of the Eurozone and the EU, therefore its economy is not integrated yet into the Union.

The general conclusion for the observed sub-period is that Bulgaria does not meet the fundamental requirement for joining a currency union with the selected countries. Nevertheless, Bulgaria de facto entered a monetary union with Germany by introducing the Currency Board in 1997 and fixing its national currency to the German Mark. Table 2 presents the results for the level of business cycle synchronisation between individual EMU members and Bulgaria. The correlation between the Bulgarian and German business cycle is low and even negative (-0.0986). Therefore, we may assume that Bulgaria suffered substantial negative effects from the establishment of the Currency Board in 1997 due to the loss of the independent currency policy.

Table 2

**Level of business cycle synchronization between individual EMU members
and Bulgaria – Hodrick-Prescott filter**

PERIOD	1995-2002	1999-2006	2003-2010	2007-2014	2011-2019
AUSTRIA	0.2534	0.6356	0.6158	0.5687	0.6590
BELGIUM	0.0764	0.4514	0.3691	0.3967	0.4590

CYPRUS	-0.1831	0.5268	0.6758	0.6365	0.6678
ESTONIA	0.3371	0.3815	0.5943	0.3844	0.1010
FINLAND	0.5505	0.8156	0.6949	0.5524	0.4523
FRANCE	0.4759	0.6772	0.5843	0.4900	0.4942
GERMANY	-0.0986	0.7263	0.4740	0.3778	0.2398
GREECE	-0.7602	-0.1471	0.5928	0.3921	0.3193
IRELAND	0.3528	0.0147	0.4626	0.6134	0.0864
ITALY	0.6837	0.3351	0.4973	0.5640	0.5241
LATVIA	0.3831	0.7748	0.7657	0.4892	-0.2123
LITHUANIA	0.4415	0.7418	0.7528	0.4952	-0.0202
LUXEMBURG	0.0447	0.4319	0.3714	0.2756	0.1857
MALTA	-	0.5398	0.6006	0.4993	0.1763
NETHERLANDS	0.7282	0.8650	0.8075	0.6780	0.5606
PORTUGAL	0.5073	0.8399	0.5558	0.4144	0.4038
SLOVENIA	0.1517	0.8137	0.8979	0.7186	0.5002
SPAIN	0.4800	0.3750	0.7578	0.6845	0.4728
AVERAGE	0.2603	0.5444	0.6150	0.5128	0.3372

Source: Author's calculations.

Overall the level of synchronisation of Bulgaria with the EMU members across the selection may be defined as quite low (average value 0.26) even absent. The highest synchronization could be found with the business cycles of Italy (0.68) and Netherlands (0.73). From a theoretical perspective, Bulgaria should have chosen the Italian Lira or the Dutch Guilder as a base for the Currency Board, but that decision would prove meaningless because the ERM II mechanism started just 18 months later.

In the second sub-period – 1999 – 2006 Bulgaria increased the level of its business cycle synchronisation both with the EMU aggregate (0.70, Table 1) and the individual states in the selection (average 0.54, Table 2), indicating that the integration of Bulgaria to the EU economy has started even before the country joined the Union. The highest increase of the synchronisation measure is understandably with Germany (from -0.09.86 to 0.73).

The third sub-period – 2003-2010 is described with the accession of Bulgaria to the EU (January 1, 2007) and the first years of the Global financial crisis. Bulgaria increased its business cycle synchronization with individual EMU members to average measure of 0.62 and maintained a relatively strong correlation with the EMU aggregate at 0.63.

During the next two sub-periods Bulgaria followed the general trend of slight decrease in 2007-2014, and significant drop in 2011-2019 synchronisation both with EMU aggregate and individual member-states. In the last sub-period the average synchronisation of Bulgaria to other countries plummets to 0.34. The lowest synchronisation for Bulgaria for the entire period (1995-2019) is with the Baltic states, Ireland and surprisingly with Greece, which is a neighbouring country and one of the biggest trade partners of Bulgaria, therefore, is expected to be closely synchronised.

The general conclusions from the results under the Hodrick-Prescott filter for the entire period is that Bulgaria did not comply with the Mundell optimality requirements in the first sub-period – lacking labour and capital mobility with other countries and having very low level of synchronisation of the business cycle with them and with the EMU aggregate. Most probably Bulgaria suffered negative consequences of the introduction of the currency board in 1997. In the first decade of the XXI century Bulgaria significantly increased its synchronicity with the EMU aggregate and obtained EU member status, thus receiving capital and labour mobility within the Union. Probably the best point in time for Bulgaria to enter the Eurozone was around 2010. After this point the synchronisation of the Bulgarian business cycle with the EMU members and the aggregate measure started to decline, reaching at the end of the period values, suggesting that accession to the Eurozone might not be beneficial.

The results for the Baxter-King band pass filter are presented in similar manner in Table 3 and Table 4. As it was stated earlier the Baxter-King filter is theoretically different from the Hodrick-Prescott filter, and because of its peculiarities the sub-periods are defined slightly different.

Table 3

**Level of business cycle synchronisation between individual EMU members
and EMU aggregate – Baxter-King filter**

PERIOD	1997-2005	2001-2009	2005-2013	2009-2017
AUSTRIA	0.5745	0.9838	0.9580	0.8557
BELGIUM	0.0324	0.9406	0.9409	0.8846
BULGARIA	0.7955	0.5763	0.5801	0.6772
CYPRUS	-0.6083	0.8167	0.7081	0.5200
ESTONIA	0.6774	0.9821	0.9154	0.5939
FINLAND	0.4818	0.9563	0.9471	0.8498

FRANCE	0.7388	0.9946	0.9797	0.8791
GERMANY	0.9756	0.9665	0.9751	0.9290
GREECE	0.4640	0.6695	0.2328	-0.4359
IRELAND	0.6810	0.8671	0.8062	0.4340
ITALY	0.8558	0.9786	0.9723	0.9360
LATVIA	0.8711	0.9400	0.8399	0.4182
LITHUANIA	0.4776	0.9071	0.8684	0.5577
LUXEMBURG	0.8265	0.9306	0.9303	0.7575
MALTA	-	0.7958	0.6620	0.3849
NETHERLANDS	0.8035	0.9064	0.9313	0.8764
PORTUGAL	0.6457	0.9789	0.6373	0.2855
SLOVENIA	0.7780	0.8290	0.8378	0.7317
SPAIN	0.3636	0.9329	0.8916	0.6615
AVERAGE	0.5797	0.8923	0.8218	0.6209

Source: Author's calculations.

The result values of the level of synchronisation are slightly higher but the general dynamics are similar. In the first sub-period the average synchronisation between individual countries and the EMU aggregate is 0.58 – higher than the measure for the first sub-period for the Hodrick-Prescott filter. It is worth noting that under the Baxter-King filter a larger part of the sub-period covers the time, when the Euro already functions as an actual currency or as a system of mutually fixed exchange rates. In the next two sub-periods all countries in the selection, except Bulgaria increase their synchronicity with the EMU aggregate with average of 0.89 for 2001-2009 and 0.82 for 2005-2013. In the last sub-period there is a substantial decrease of the average synchronisation with the EMU aggregate to value of 0.62. The countries with lowest synchronisation measure for the entire period are Bulgaria, Cyprus, Portugal, and Greece.

Although the values and sub-periods are different, the general pattern is quite similar to the findings under the Hodrick-Prescott filter – relatively low synchronicity at the beginning of the period, rapid increase in the first decade of XXI century, followed from a decline in the last sub-period. This supports the initial conclusions from the previous procedure that at the time of its establishment, the Eurozone did not constitute an optimal currency area, but the synchronisation quickly increased to very high level of more than 0.90 for most of its members. At the end of the period there are obvious problems with the overall synchronicity, and therefore possibly with the Mundell optimality of the Eurozone, illustrated with the low correlation of Portugal

(0.29), Malta (0.38), Lithuania (0.56), Latvia (0.41), Ireland (0.43), Greece (-0.44), Estonia (0.59) and Cyprus (0.52).

The results for Bulgaria under the Baxter-King filter are different in comparison with the previous procedure. The first sub-period coincides with the establishment of the Currency Board in Bulgaria. During 1997-2005 Bulgaria scores its highest measure of synchronisation with the EMU average (0.80). In this sub-period Bulgaria has an average synchronicity to individual EMU members of 0.53 (Table 4), with highest individual scores to Austria (0.89), Germany (0.70), Ireland (0.90), Latvia (0.85), Netherlands (0.87), Slovenia (0.73), Portugal (0.91). The relatively high results from the first sub-period infer that the Bulgarian integration to the EU started earlier than suggested from the findings under the Hodrick-Prescott filter. In the second and third sub-periods Bulgaria retained a moderate synchronisation level (around 0.58) to the EMU aggregate. The values are not substantially different from the ones derived with the Hodrick-Prescott filter, but signal for earlier and more substantial problems with the Bulgarian economic convergence and integration into the EU.

Table 4

**Level of business cycle synchronisation between individual EMU members
and Bulgaria – Baxter-King filter**

PERIOD	1997-2005	2001-2009	2005-2013	2009-2017
AUSTRIA	0.8895	0.5923	0.6259	0.7657
BELGIUM	0.1015	0.3477	0.3776	0.6065
CYPRUS	-0.6175	0.8375	0.6792	0.6832
ESTONIA	0.6638	0.5877	0.5920	0.4548
FINLAND	0.5110	0.6989	0.7146	0.6006
FRANCE	0.6035	0.5752	0.5902	0.6043
GERMANY	0.6987	0.3965	0.5056	0.5315
GREECE	-0.0984	0.7927	0.1690	-0.2819
IRELAND	0.8957	0.2745	0.2787	0.2961
ITALY	0.4739	0.4344	0.5183	0.7009
LATVIA	0.8489	0.8056	0.6972	0.3025
LITHUANIA	0.6985	0.8181	0.7551	0.3619
LUXEMBURG	0.6738	0.3058	0.3306	0.3036
MALTA	-	0.6094	0.3090	0.1134
NETHERLANDS	0.8653	0.8062	0.7310	0.6264
PORTUGAL	0.9144	0.6018	0.2288	0.0653

SLOVENIA	0.7276	0.9120	0.8030	0.5187
SPAIN	0.6623	0.7362	0.5525	0.5331
AVERAGE	0.5285	0.6185	0.5255	0.4326

Source: Author's calculations.

In the last sub-period (2009-2017) the synchronisation level of the Bulgarian business cycle to the EMU aggregate increases to 0.68, which is around the median for the selection of countries – it is higher than the Baltic states, Greece, Cyprus, Ireland and Portugal, but significantly behind the values of the “core” Eurozone countries Austria, Belgium, France, Germany, Italy and Netherlands – all scoring synchronicity level around 0.9. In the same time the average synchronisation of the Bulgarian business cycle to individual EMU members declined to the lowest value (0.43) for the entire period of 1997-2017. This is explained with the closer synchronisation of Bulgaria with the “core” Eurozone countries, therefore higher correlation with the EMU aggregate and lower synchronisation with the rest of the members, causing lower average score.

The results obtained with the Baxter-King filter for the entire period show that although Bulgarian business cycle is more correlated with the EMU aggregate than half of its actual members. Nevertheless, the level of synchronisation is not sufficient to ensure Mundell optimality of the Bulgaria's accession to the Eurozone.

Conclusions

The main objective of this paper is to evaluate whether Bulgaria should join the EMU or it is more beneficial to abolish the existing currency board and have independent monetary policy. The empirical results show that at the time of the establishment of the Currency Board in 1997 Bulgarian business cycle was not synchronised with the German economy and probably Bulgaria suffered substantial negative effects loss of the independent currency policy.

In the first decade of XXI century, the Bulgarian economy quickly adjusted to the currency board and to the accession to the EU. At this point in time the level of synchronisation of the Bulgarian business cycle with the EMU aggregate was comparable with some of the actual members of the Eurozone. The results suggest that during this period Bulgaria benefited from the fixed exchange rate without damage from the lack of independent monetary policy.

Regrettably after the initial sharp increase, the Bulgarian economic convergence with the Euro area lost momentum and currently Bulgaria does not form an optimal currency area with the EMU. Also according to the last convergence report from the ECB, in 2020 for the first time in the last 10 years Bulgaria did not comply with the

nominal convergence criteria of the Maastricht Treaty. Bulgarian monetary policy is heavily influenced by the European Central Bank and the abolishment of the Currency Board is not a feasible option, therefore the Bulgarian government should increase the efforts to speed up the convergence with the Eurozone.

Although it was not within our tasks this paper gives some insight about the costs and benefits from the EMU for the member-states. Our results suggest that when the EMU was created the economies of the member-states were not synchronised and probably the introduction of the Euro caused severe economic disturbances at least for some of the members. Deprived of independent monetary policy they were forced to use only fiscal instruments to correct their problems, which probably led to the Euro sovereign debt crisis. Both filtering techniques in this paper show that after the initial adjustment shock the overall synchronisation within the EMU increased very fast, peaking at around 0.90 in 2010. In the last decade the synchronisation between the business cycles of the EMU members slowly deteriorates, reaching levels that pose a significant threat for the future stability of the Eurozone. No accession of a new member could be optimal if the Eurozone does not constitute an Optimal currency area. These results are signalling for the need of additional institutional reforms in the EMU, deeper economic integration within the EU and higher efficiency of the Stability and growth pact.

This research could be further improved by increasing the length of the observed time series because the applied procedures proved to be extremely sensitive to the selected length and scope of sub-periods. Also a causal investigation, identifying the main factors or hurdles of synchronisation, could be very valuable.

References

1. Baxter, M. & King, R., 1999. Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series. *The Review of Economics and Statistics*, 81(4), pp. 575-593.
2. Burns, A. F. & Mitchell, W. C., 1947. Measuring business cycles. *The Journal of Political Economy*, 55(4), p. 284.
3. Canova, F., 1998. Detrending and Business Cycle Facts. *Journal of Monetary Economics*, 41(3), pp. 475-512.
4. Christiano, L. & Fitzgerald, T., 2003. The Band Pass Filter". *International Economic Review*, 44(2), pp. 435-465.
5. ECB, 2020. *European Central Bank: Convergence reports*. [Online]
6. Available at: <https://www.ecb.europa.eu/pub/pdf/conrep/ecb.cr202006~9fefe8d4c0.en.pdf>

7. [Accessed 10 June 2020].
8. European Commission, 2020. *Eurostat*. [Online]
9. Available at: <https://ec.europa.eu/eurostat>
10. [Accessed 24 May 2020].
11. Frankel, J. & Rose, A., 1998. The Endogeneity of the Optimum Currency Area Criteria. *The Economic Journal*, 108(449), pp. 1009-1025.
12. Friedman, M. & Schwartz, A., 1963. *A Monetary History of the United States, 1867-1960*, s.l.: Princeton University Press.
13. Gulde, A., 1999. The Role of the Currency Board in Bulgaria's Stabilization. *Finance and Development*, September, 36(2).
14. Hodrick, R. & Prescott, E., 1997. Post-war U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit and Banking*, 29(1), pp. 1-16.
15. Hristozov, Y., 2017. Discussion on Keeping or Removal of the Currency Board in Bulgaria for the Past Twenty Years. Sofia, Monetary and Economic Research Center, pp. 107-123.
16. Kenen, P., 1969. The Theory of Optimum Currency Areas: An Eclectic View. In: R. A. Mundell & A. K. Swoboda, eds. *Monetary Problems in the International Economy*. Chicago: University of Chicago Press.
17. Kitchin, J., 1923. Cycles and Trends in Economic Factors. *The Review of Economics and Statistics*, 5(1), pp. 10-16.
18. Kondratieff, N. D. & Stolper, W. F., 1935. The Long Waves in Economic Life. *The Review of Economics and Statistics*, 17(6), pp. 105-115.
19. Legrand, M. D.-P. & Frobert, L., 2009. Some Preliminaries Options on Climent Juglar's Economic Writings. *Cahiers d'conomie politique / Papers in Political Economy*, pp. 175-196.
20. Marinova, T., 2016. Comparative Study on Monetary and Fiscal Policy in the Eurozone and Bulgaria. *Economic Alternatives*, Issue 3, 2016, pp. 367-378.
21. McKinnon, R. I., 1963. Optimum Currency Areas. *The American Economic Review*, 53(4), pp. 717-725.
22. Mihaylova-Borisova, G., 2014. Bank Efficiency in Bulgaria, International Financial Crisis and Eurozone Debt Crisis. *Ikonomiceski i Sotsialni Alternativi*, Issue 4, pp. 17-24.
23. Mundell, R., 1961. A Theory of Optimum Currency Areas. *The American Economic Review*, 51(4), pp. 657-665.
24. Petkov, V., 2014. Advantages and Disadvantages of Fiscal Discipline in Bulgaria in Times of Crisis. *Contemporary Economics*, 8(1), pp. 47-56.

25. Ravn, M. & Uhlig, H., 2002. On Adjusting the Hodrick-Prescott Filter for the Frequency of Observations. *Review of Economics and Statistics*, Volume 84, pp. 371-375.
26. Sanz-de-Galdeano, A. & Turunen, J., 2006. The Euro Area Wage Curve. *Economic letters* , 92(1), pp. 93-98.
27. Simeonov, K., 2007. Inflation Challenge to Bulgaria and Eurozone Membership. *Economic Thought*, Issue 1, pp. 80-98.
28. Simonde de Sismondi, . J. C. L., 1991. *New principles of political economy: of wealth in its relation to population*. New Jersey : Transaction Publishers.
29. Stock, J. H. & Watson, M. W., 1993. *Business Cycles, Indicators and Forecasting*.. Chicago: University of Chicago Press, National Bureau of Economic Research.
30. Stock, J. H. & Watson, M. W., 1999. Business Cycle Fluctuations in US Macroeconomic Time Series.. In: J. Tabor & M. Woodford , eds. *Handbook of Macroeconomics I*. s.l.:Elsevier Science B.V., pp. 3-64.
31. The Official Journal of the European Union , 2020. *Consolidated version of the Treaty on the Functioning of the European Union*. [Online]
32. Available at: http://data.europa.eu/eli/treaty/tfeu_2016/2020-03-01
33. [Accessed 7 june 2020].
34. Wildasin, D. E., Markusen, J. R. & Winters, L. A., 2000. Factor Mobility and Fiscal Policy in the EU: Policy Issues and Analytical Approaches. *Economic Policy*, 15(31), pp. 339-378.
35. Yorgova, N., 2009. Entering the Eurozone: Commitments and Challenges to Bulgaria in Terms of Financial Crisis. *Ikonomicheski Izsledvania*, Issue 1, pp. 172-180.