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Sustainability of the Currency Board in Bosnia and Herzegovina in the Conditions of a Negative Interest Rate on the Reserve Currency

Abstract: The Currency Board in Bosnia and Herzegovina (BiH) uses the euro as a reserve currency in the conditions of a negative nominal interest rate on deposits with the ECB. In this paper, we investigated the impact of negative interest rates on deposits and negative yields on bonds denominated in euro on the general advantages of the currency board and the consequences for the functioning of the currency board in BiH. The impact of negative interest rates was measured by the currency board coverage index (IC). A negative nominal interest rate on the reserve currency creates a negative seigniorage in the country of the currency board, increases the costs of issuing domestic money and reduces the competitiveness of the economy. The monetary policy of the ECB in the conditions of the COVID-19 crisis generates negative influences on the functioning of the currency board. The COVID-19 crisis poses a threat to currency board coverage in BiH. Technically, a currency board can also function in terms of negative interest on the invested reserve currency as long as it can cover the costs of its business.

Keywords: currency board, negative nominal interest rate, currency board coverage index, reserve currency, seigniorage.

JEL Classification: E42, E49, E50

1. Introduction

We live in a time that is rapidly writing new pages of economic history. They will certainly contain the first case of a negative oil price (Irwin, 2020), but also a negative nominal interest rate on deposits and bonds denominated in the reserve currency in which the currency board keeps foreign exchange reserves. Changes in the modern economy are strongly influenced by the consequences of the financial crisis of 2008 and the impact of the coronavirus pandemic on the world economy in 2020 (COVID-19 crisis). The consequences of both shocks blended during 2020 into a single system of economic disruption that requires a series of forced measures of short-term economic policy, but also long-term strategic solutions. This is primarily reflected in the monetary sphere. The 2008 crisis affected the attitude of economists about the role of public debt and its emergence. Due to the growth of the state budget deficit, the monetization of the budget deficit was accepted by the central banks through the creation of new money and the purchase of government bonds, which resulted in increased indebtedness, change in debt structure, reduction of interest rates, and change in exchange rates. Although the monetization of the budget deficit is contrary to the basic principles of the constitution of the European Union (EU) and the anti-inflationary consistency of the European Central Bank (ECB), after the failure of the austerity policy, it has become the most important policy of mitigating the crisis¹. After the outbreak of the COVID-19 crisis, the monetization of government deficits became an almost generally accepted measure to mitigate the effects of the crisis². Economic policy measures aimed at addressing the causes of the 2008 crisis can no longer be distinguished from measures to mitigate the effects of the COVID-19 crisis.

From the first institutionalized form of interest, originated in the Babylonian legislation more than four millenniums ago (Laws of Eshnunna), until the second

¹ For the first time since the establishment of the euro area, the ECB directly repurchased government bonds in 2010 through the program: Securities Market Program - SMP. Two years later, the new government bond repurchase program followed: Outright Monetary Transactions. By a decision of the Governing Council of the ECB of 22 January 2015 (ECB, 2015a), the ECB launched the largest quantitative easing (QE) program: The Expanded Asset Purchase Program (EAPP) or the Public Sector Purchase Program (PSPP). It is implemented as a supplement to the ECB's Asset-Backed Securities and Covered Bonds Purchase Programs (ABSPP and CBPP3), (ECB, 2015b).

² On 24 March 2020, the ECB adopted the Pandemic Emergency Purchase Program (PEPP) in the amount of 750 billion euros as a non-standard monetary policy measure. The value of PEPP was increased to 1,350 billion on 4 June 2020, and to 1,850 billion euros on 10 December 2020. The duration of the program has been extended until March 2022, while the initial deadline was June 2021 (ECB, 2020c).

decade of the 21st century, nominal interest rates were mostly positive (Haksar and Kopp, 2020). In the late 19th century, the German economist Silvio Gasell was the first proponent of the idea of a negative nominal interest rate, which was never adopted as a form of money taxation. At the time of the crisis in the early 20th century, his idea was also appealing by very influential economists such as Irving Fisher and John Maynard Keynes (Ilgmann and Menner, 2011). After the onset of the financial crisis in 2008, the idea of a negative interest rate was reaffirmed by Mankiw, thinking of it as a trick to prevent a recession (Mankiw, 2009). In order to encourage banks to invest money, some central banks have started to apply a negative nominal interest rate (ECB, Central Banks of Japan, Denmark, Sweden, Switzerland, etc.) or to keep it close to zero (Bank of England, FED, etc.). On the other hand, all theories about the interest rate, the banking system, investments and savings, and the regulatory systems of countries, are based on the assumption of a positive interest rate.

The negative interest rate creates special challenges for countries that have a currency board based on the reserve currency whose issuing bank has introduced a negative interest rate on deposits. The positive nominal interest rate on reserve currency deposits was maintained from the creation of the first currency board (British Indian Ocean colony of Mauritius, 1849) until 11 June 2014, when the ECB introduced a negative interest rate on euro deposits of - 0.1%. This decision of the ECB created a new business environment for the central banks of Lithuania, Bulgaria and Bosnia and Herzegovina (BiH), which used the euro as a reserve currency. Lithuania has been a member of the euro area since the beginning of 2015, and Bulgaria has been on the path to joining the euro area (ERM II)³ since July 2020, so BiH is the only country that is simultaneously experiencing the temptations of the currency board in terms of negative interest rates on the reserve currency and the COVID-19 crisis.

There is significant heterogeneity in the purpose, design, and operational specificity of negative interest rates and significant differences in the implications for effective interest rates and money market financing conditions (Angrick and Nemoto, 2017). In this paper, on the example of BiH, we will try to provide answers to some of the key questions that arise in the circumstances of the negative

³ As of 13 July 2020, the Bulgarian lev has been included in the exchange rate mechanism (ERM II). The middle exchange rate of the Bulgarian lev is 1.95583 leva = 1 euro. ERM II allows a standard fluctuation rate around this rate of plus or minus 15%. Although Bulgaria still has a currency board, by joining EMR II its rigidity is reduced as the exchange rate may fluctuate (ECB, 2020a). This was preceded by an agreement between the ECB and the Bulgarian National Bank (22 April 2020) on the establishment of a € 2 billion swap line to provide euro liquidity. The agreement is valid until the end of 2020 (if not extended) (ECB, 2020b).

interest rate on the reserve currency of the currency board and the disturbance of the world economy under the impact of the COVID-19 crisis resulting in the negative interest rate. Can the emergence of a negative interest rate on deposits in a currency used in other countries as a reserve currency change the attitude of countries towards the currency board as a form of organization of the monetary system? What is the economic position of the country of the currency board by introducing a negative interest rate on the reserve currency in conditions when the COVID-19 crisis requires monetary intervention? Can the currency board help make the consequences of the COVID-19 crisis easier to bear? Does the negative interest rate jeopardize the advantages that the currency board has compared to the classic central bank? Is and under what terms the currency board sustainable in the conditions of a negative interest rate on the reserve currency and in the conditions of a decline in production and exports under the influence of the COVID-19 crisis?

2. Literature review

In light of the new challenges the currency board functioning is facing, it is confirmed that Meltzer was right when he stated that economic theory does not allow us to say that the currency board is always the optimal arrangement, but neither to say when it was not. No one has described the conditions under which the currency board is the optimal way of organizing the monetary system (Meltzer, 1993).

The goals of our research include consulting the literature on the currency board, quantitative easing (QE) in the euro area and monetary policy measures in the context of the COVID-19 crisis.

There is an extensive literature on the currency board, which, according to the subject of analysis, can be grouped into several sections: (a) the papers that simultaneously describe, compare and argue the advantages and disadvantages of the currency board (e.g. Greaves, 1954; Birnbaum, 1957; Ow, 1985; Schuler, 1992, 1996; Williamson, 1995; Avramov, 2000; Rodriguez, 2000; Berger and Fraassen, 2001; Haan, 2001; Hanke and Schuler, 2015). In these papers, especially favourite topics are the advantage of the currency board in ensuring the stability of prices and exchange rates of the domestic currency, and the profitability of investing the reserve currency. (b) Papers that analyse and prove the shortcomings of the currency board (e.g.: Clauson, 1944; Mars, 1948; Hazlewood, 1952; Newlyn and Rowan, 1954; Nevin, 1961; Narsey, 2016; Boger, 2018). The main topics of these papers are unnecessarily high foreign exchange reserves, the absence of discre-

tionary monetary policy, the absence of the lender of last resort function and the depreciation of the domestic currency. (c) Papers explaining experiences of currency board operations in different countries and in different circumstances (e.g.: Greenwood, 1981, 1984, 2008; Jao, 1990, 1998; Silajdzic 2005; Ponsot, 2006; Kamhi and Dehejia, 2006; Genberg, He and Leung 2007; Gedeon 2009, 2010; Hong Kong Monetary Authority, 2013). Although the literature on the currency board is extensive, there are few papers investigating interest rates on deposits and bonds denominated in the reserve currency (e.g. Hazlewood, 1952; Greenwood, 1984; Schuler, 1992; Narsey, 2016, Boger, 2018). These papers mainly deal with differences in interest rates and effects on yields in the country of the currency board and the country of the reserve currency. At the same time, nominal interest rates are positive in both countries. There are no published scientific papers that investigate the functioning of the currency board and the sustainability of its advantages in terms of negative nominal interest rates on deposits and bonds denominated in the reserve currency. A positive nominal interest rate has always been implied when choosing a reserve currency.

One part of the currency board critique, especially active in the 1940s and 1950s, (Clauson, 1944, Mars 1948, Hazlewood, 1952, Newlyn and Rowan, 1954, Nevin, 1961) considers that the currency board unnecessarily holds excess foreign exchange reserves, issuing domestic currency based on 100% coverage in the reserve currency, and very often for 5 to 10% higher (Schuler, 1992). Critics of the currency board start from the fact that, in reality, there is always a minimum of domestic money that will not be exchanged for a reserve currency, so unnecessary reserves that would be available for importing goods in the classical central bank system are unnecessarily kept. Supporters of the Monetary Committee reject this remark, pointing out that once spent foreign exchange reserves for the import of goods do not bring new income, while foreign exchange reserves held by the currency board bring interest (seigniorage) because they are invested in bonds denominated in the reserve currency (Hanke and Schuler, 2015). In doing so, it may happen that the risk-adjusted return on domestic assets is higher than the risk-adjusted return on foreign assets, which is a consequence of the difference in risk (Schuler, 1992). A similar answer could be given to the recent criticism of the currency board in the British colonies. Narsey (2016) argues, based on an analysis of several currency boards and their assets, that Britain organized currency boards in the colonies in the late 19th and early 20th centuries to help itself to the detriment of the colonies. One argument he highlights for the above claim is the currency board's obligation to hold in London a 10% surplus of reserves in gold and pounds sterling and a 10% reserve in the Depreciation Fund. This idea was tested by Boger (2018) using the original annual data on securities and assets of currency boards of Palestine, East Africa and West Africa. His analysis

confirmed that currency boards in the analysed colonies enabled Britain to manipulate the monetary systems of its colonies to its advantage. Both Narsey's and Boger's studies were conducted based on the state of assets and the difference in returns on assets. They do not include an analysis of the differences in investment risks in the colonies and Britain.

Currency board in BiH attracted the attention of researchers primarily because of the challenges of its functioning in the post-war economy, high balance of payments deficit, high inflation and a number of currencies used in BiH. One of the first domestic authors to deal with the currency board (Silajdzic, 2005) sought to assess which advantages of the currency board will come to the fore in BiH, how much and under what conditions it will contribute to macroeconomic stability, low inflation, strengthening confidence in domestic currency, reducing operating costs and investment growth. The author concludes that the currency board in BiH was a good initial solution in the post-war period, but that its abandonment should be considered due to high socio-economic costs that may jeopardize its sustainability. Ponsot (2006) analysed the abilities of European currency boards (Estonia, Lithuania, Bulgaria and Bosnia and Herzegovina) to contribute to the monetary credibility of the transition, i.e., monetary stability. He is inclined to conclude that the rigidity of the currency board forces commercial banks to develop their own strategies and influence the adjustment of the currency board, which undermines its credibility. Therefore, he concludes that for these countries, including BiH, the best solution is integration into the EMU. Kamhi and Dehejia (2006) came to the identical conclusion by analysing the currency board in BiH. The possibility of credit expansion in BiH in the conditions of the currency board, i.e., the absence of the lender of last resort function, and the permanent trade deficit was analysed by Gedeon (2009). The analysis showed that the free operation of the market can establish a lender of last resort function through lending between domestic and foreign banks. In his paper published a year later, Gedeon (2010), on the example of the currency board in BiH, deals with the influence of foreign ownership of commercial banks on the functioning of the currency board. He concludes that, with the introduction of the currency board, monetary policy has not been abandoned, but that it has been decentralized and privatized, which is crucial for maintaining the financial stability of the currency board. However, in the conditions of sudden changes in the global financial market, when there is not enough time for spontaneous market adjustment, as Tomas (2012) warns, the BiH economy is exposed to unhindered and uncontrolled influences because the Central Bank of Bosnia and Herzegovina (CBBH) has no possibility to intervene. In their report published at the end of 2019, the IMF staff provides recommendations to the CBBH on adjusting the manner of reserve management in the face of negative ECB nominal interest rate

(IMF, 2019). The study does not investigate the general conditions for the survival of the currency board in terms of the negative deposit interest rate of the bank of the reserve currency issuer. It was made at the request of the CBBH and oriented towards finding possibilities for more efficient functioning of the CBBH in the existing conditions. However, the study clearly pointed out that in conditions of lower returns on foreign exchange reserves and reduced inflows of foreign capital, there had been a gradual and constant erosion of currency board coverage.

Quantitative concessions were implemented by central banks after the 2008 crisis (Klyuev, Imus, and Srinivasan, 2009) and continued during the COVID-19 crisis in 2020 in order to prevent or mitigate the recession. In doing so, they did not assume any responsibility for the consequences of quantitative easing (QE) in countries that use their currency as the reserve currency of the currency board. By adopting the QE program, the ECB began to follow the example of the FED, the Bank of England, and the Bank of Japan (Claeys, Leandro and Mandra, 2015). Although this program was not revolutionary (Coeuré, 2015) in terms of scale, risk allocation and form of implementation, it left strong consequences for the EU economy and monetary systems of countries that use the euro as a reserve currency. The QE program is focused on supporting the real economy with the expectation that investment and consumption growth will outweigh its cost effects (Draghi, 2015). Some authors think that the purchase of private property can also be used as a part of the quantitative easing program (Michael and Osaulenko, 2021). However, QE is implemented through financial markets (Irwin, 2014), so the actual effects will only be subsequently verified. An integral part of these effects will be the consequences for the monetary systems of countries that have a currency board with the euro as their reserve currency.

The institutional structure of the ECB is based on the theory of consistency (Kydland and Prescott, Barro and Gordon) from the 70s and 80s of the last century. According to the theory of consistency, central banks should respect monetary rules and not pursue discretionary monetary policy (Della Posta, 2020). Younger followers of consistency theories acknowledge the legitimacy of “case and coincidence” which led to its evolution and to the synchronization of the positions of the theory of chance and the theory of the optimal monetary area. This made it clear that, if production was hit by an unexpected asymmetric shock, as in the case of the COVID-19 virus pandemic, compliance with monetary rules could not be more acceptable than discretionary monetary policy. Therefore, Della Posta argued that in the current situation, the ECB cannot lose its anti-inflationary credibility by purchasing government bonds in the primary market and by crediting the citizens.

After the sudden onset of the COVID-19 crisis, leading European economists have become almost united in supporting the monetization of budget deficits. Thus, Giavazzi and Tabellini (2020) call the blow to the economy caused by the COVID-19 pandemic a war shock that will require great fiscal support. These costs should be spread over several generations and they would be covered by Eurobonds that would have to be repurchased by the ECB in order to keep the funding burden low. Blanchard and Pisani-Ferry (2020) argue that monetization does not have to end in uncontrolled inflation if the monetizing central banks do not give up the obligation to ensure price stability. De Grauwe and Ji (2020), supporting the monetization of government deficits, are of the opinion that when uncertainty is extreme, cautious central banks should decide on the basis of what is seen and not on the basis of unreliable forecasts. Miles (2020) is of the opinion that redemption of government bonds can be useful in stabilizing the economy in conditions of low interest rates because it enables states to issue long-term bonds, have low short-term effective costs and avoid unstable financial markets.

The proponents of government deficit monetization argue that purchasing government bonds using central bank reserves only changes the structure of total government liabilities by maturity and issuer because changes in the size of the central bank's balance sheet, up or down, are neutral due to the nature of central bank reserves (Reis, 2016). The fact that the central bank has a monopoly in setting the nominal interest rate and holding reserves gives it control over the timing of inflation and the effective maturity of government liabilities. These are the reasons why the monetization of the state budget deficit does not have to end in inflation. Blanchard and Pisani-Ferry (2020) explain that at a nominal central bank interest rate equal to zero, the monetization of the state budget deficit does not affect the dynamics of public debt, because it only replaces at zero interest rate the assets called "debt" by the assets called "money". Comparing the Fed's financial stabilization measures with those of the ECB, Schnabl and Sonnenberg (2020) concluded that the Fed's measures are more conducive to stabilizing the financial sector because they involved removing bad assets from the banking sector and indirectly recapitalizing banks. In contrast, the ECB measures are aimed at monetizing sovereign debts, leaving bad assets in banks and further weakening banks by charging them negative interest on their excess reserves. However, if the COVID-19 crisis continues for a long time and therefore government debt accumulates so much that governments cannot repay it from regular revenues, central banks will have to choose between inflation, debt restructuring, financial repression and wealth expropriation (Blanchard and Pisani-Ferry, 2020). Excess reserves after quantitative easing can generate an unwanted increase in the money supply, which turns into inflationary pressure (Tanaka, 2020). Therefore,

inflation as a consequence of the monetization of government deficits during the COVID-19 crisis was not ruled out as a possibility in the future.

3. Hypotheses

The positive nominal interest rate on deposits with the reserve currency issuer's bank and on bonds denominated in the reserve currency has never been highlighted in the literature as an important factor for the establishment and functioning of the currency board. However, it was usually assumed when highlighting the good sides and when defending the currency board from criticism. The negative nominal interest rate on deposits with the bank of the issuer of the reserve currency and bonds in the reserve currency eliminate the acquisition of seigniorage solely on the basis of interest, which is one of the most important advantages of the currency board over the classic central bank. The loss of this advantage can shake confidence in the currency board especially in circumstances similar to the time of the COVID-19 crisis. Which country would choose a currency board if it knew in advance that it would invest its foreign exchange reserves in a reserve currency in the country at a negative nominal interest rate? The decrease in invested foreign exchange reserves due to the negative nominal interest rate cannot be explained in the same way as in the case of the difference in the rate of return on domestic and foreign assets. Investing a reserve currency in foreign bonds with a negative nominal interest rate is not an iteration in the arbitrage process of equalizing yields on the domestic and foreign markets. Each unit of the reserve currency had to be earned on the foreign market before being placed in the currency board reserves. During the COVID-19 crisis, the inflow of foreign money into the country of the currency board decreases due to reduced exports, interest income of the currency board, remittances and foreign investments, and the negative interest rate on the reserve currency implies the outflow of foreign money from the currency board country. It is a paradox that can seriously jeopardize the currency board. Once paid, a negative interest rate is a permanent loss of already held value.

We will try to achieve the basic goals of this paper through research in which we will test the following basic hypotheses:

H_0 : If the nominal interest rate on deposits and bonds in the reserve currency of the currency board is negative, assuming 100% coverage of the domestic currency, investing in the reserve currency will reduce the existing amount of foreign exchange reserves, i.e., negative seigniorage occurs, thus losing one of the main advantages of currency board.

H_1 : The currency board is sustainable even in the conditions of negative seigniorage as long as it is able to cover the costs of its operation without spending the coverage of issued domestic money.

H_2 : A country with a rigid currency board does not follow the monetization of the government deficit in the conditions of the COVID-19 crisis, but it can be exposed to its harmful consequences through the reserve currency.

We will try to prove these hypotheses on the example of the currency board in BiH because it is the only currency board in the world that operates during the COVID-19 crisis in terms of negative interest rates on deposits with the bank issuing the reserve currency and negative yield on bonds denominated in the reserve currency. True, Bulgaria also has a currency board with a fixed exchange rate of the lev to the euro (Kozínska, 2022), but the lev is included in ERM II with an allowed fluctuation of plus or minus 15% around the fixed exchange rate, and at the same time an agreement with the ECB on a € 2 billion swap line that the National Bank of Bulgaria can use as needed to maintain liquidity. It is certain that the consequences of the monetization of inevitable state deficits in the conditions of the COVID-19 crisis are not the same in BiH and Bulgaria.

4. Method of analysis

The Central Bank of BiH functions as a currency board that issues the domestic currency convertible mark (BAM) based on a fixed exchange rate against the euro as a reserve currency. The fixed exchange rate is determined by the Law on the CBBH, according to which 1 euro is converted to 1.95583 BAM. The amount of monetary liabilities is linked to the amount of net foreign exchange reserves. At the end of November 2020 (CBBH, 2020a), the net foreign exchange reserves of the CBBH amounted to more than 6.9 billion euros, of which the CBBH used more than 6.4 billion euros for BAM issuance, and kept 453.7 million euros as net foreign assets (general reserve, "excess reserves"). The general reserve should amount to 5% of the total amount of cash liabilities.

According to the CBBH Law (Law on the CBBH, 2007), the CBBH cannot perform any form of lending to any entity in the country and abroad, cannot print domestic currency without providing coverage in the reserve currency, cannot hold deposits denominated in the currency of BiH, cannot buy securities of BiH and its entities, cannot buy shares of any company or have a share in. The law specifies that the CBBH can only "invest foreign assets in accordance with the principles and practice of sound investment" in liquid securities guaranteed by

the government or the central bank of the country in whose currency the securities are denominated. Based on Article 34 of the Law, the CBBH invests over 95% of the foreign exchange reserves of BiH in financial instruments denominated in euros.

Negative interest rate on deposits with the ECB and on bonds denominated in euros, on the one hand, and reduced foreign exchange inflows due to the COVID-19 crisis, on the other hand, may undermine the stability of the currency board. We will measure the stability of the currency board by the currency board coverage index (I_C) that we constructed by modifying the general reserve rate, including in the index the amount of negative interest and the legal rate of the general reserve:

$$I_C = \frac{A_F + C_S - N_R}{M_L} - G_R \quad (1)$$

where A_F is the net foreign assets (general reserve); C_S the currency board founding capital; N_R the amount of negative interest on deposits and bonds in reserve currency; M_L monetary liabilities and G_R legal rate of general reserve (lower limit of index value).

The specific values of I_C are:

$I_C = 0$, the current coverage of monetary liabilities is exactly at the level of the legally prescribed minimum coverage. The currency board is stable and fulfils its legal obligation. In the case of BiH, if $I_C = 0$, monetary liabilities are covered by the reserve currency with 105%.

$|G_R| > |I_C| < 0$, the current coverage of monetary liabilities is less than prescribed by law because the general reserve is less than the amount prescribed by law, but, due to $|G_R| > |I_C|$, monetary liabilities are fully covered by the reserve currency but not at the level of the legal G_R rate. The currency board would be exposed to risk in such conditions, but it would still function stably and fulfil its legal obligations. If the described case were to occur in BiH, it would mean that the issued BAMs are completely covered by euros (even a few percent more), but that the general reserve is less than 5% and higher than zero.

$I_C = -G_R$, the current coverage of monetary liabilities is 100%, but there is no prescribed general reserve at the G_R rate. The currency board can function in these conditions as well, but it is very sensitive to market disturbances. All issued domestic money is 100% covered by the reserve currency. In the example of BiH, this would mean that $I_C = -0.05$, i.e., that there are no "excess reserves".

$|G_R| < |I_C| < 0$, the current coverage of monetary liabilities is below 100%, i.e., foreign exchange reserves are less than the volume of domestic money issued. With this situation, the currency board would violate the basic principles of its functioning and would not be sustainable in the long run. Such a situation could arise if the effects of a negative interest rate on the invested reserve currency were greater than the general reserve of the currency board.

From the previous analysis of the value of I_C we can conclude that the currency board will be able to perform its issuance function with 100% coverage of domestic currency by reserve currency if $I_C > -G_R$. However, the preferred value is $I_C \geq 0$. Then the issue of domestic money is covered by the reserve currency at least to the minimum prescribed by law. In the example of BiH, this would mean that, if the I_C is in the interval $(-0.05; 0)$, the currency board will issue BAM with full coverage in euros, but with no general reserve or with a general reserve less than the legal minimum.

Using the regression analysis of annual data, we will determine the dependence of the I_C value and the degree of its sensitivity to changes in these variables, i.e., the degree of stability or vulnerability of the currency board depending on changes in general reserves, negative interest rates and monetary liabilities.

5. Data and calculation

The value of IC is affected by: net foreign assets, founding capital, negative interest, monetary liabilities and the legal rate of general reserves. We have a series of annual data on these parameters from the establishment of the currency board in BiH (1997) until today. The IC values for BiH will be calculated on the basis of data taken from the CBBH database (http://statistics.cbbh.ba/Panorama/novaview/SimpleLogin_bs.html.aspx) and data from annual reports (Table 1).

Table 1: Currency Board Coverage Index in BiH

Date	Coverage Index (I_C)	Monetary Liabilities (in millions of BAM)	Net Foreign Assets (in millions of BAM)	Founding Capital (in millions of BAM)	Negative Interest (in millions of BAM)*
12/1997	0.005	160,3	-16,1	25,0	0,0
12/1998	0.164	253,9	29,4	25,0	0,0
12/1999	0.016	836,7	30,3	25,0	0,0
12/2000	0.031	973,2	54,1	25,0	0,0
12/2001	-0.007	2.591,6	86,8	25,0	0,0
12/2002	0.019	2.345,2	137,7	25,0	0,0
12/2003	0.022	2.627,7	164,1	25,0	0,0
12/2004	0.010	3.303,6	174,4	25,0	0,0
12/2005	0.009	4.010,1	213,4	25,0	0,0
12/2006	0.007	5.182,6	268,1	25,0	0,0
12/2007	0.016	6.303,9	393,7	25,0	0,0
12/2008	0.053	5.727,5	567,3	25,0	0,0
12/2009	0.043	5.705,5	505,7	25,0	0,0
12/2010	0.036	5.969,6	486,8	25,0	0,0
12/2011	0.040	5.915,1	507,4	25,0	0,0
12/2012	0.041	5.987,0	520,4	25,0	0,0
12/2013	0.015	6.659,2	408,1	25,0	0,0
12/2014	0.026	7.293,1	531,4	25,0	0,0
12/2015	0.020	8.064,6	540,4	25,0	1,1
12/2016	0.019	8.926,3	602,6	25,0	8,6
12/2017	0.009	9.977,1	577,8	25,0	11,5
12/2018	0.008	10.983,3	638,1	25,0	24,4
12/2019	0.015	11.824,2	771,2	25,0	26,4
11/2020	0.020	12.630,4	887,4	25,0	28,3

* Author's estimate for November 2020

Sources: http://statistics.cbbh.ba/Panorama/novaview/SimpleLogin_bs_html.aspx and the CBBH Annual Report

The obtained I_C values show its stable movement in the entire analysed period (1997-2020). The value never fell below the lower limit of -0.05. A negative value was recorded only in 2001, but significantly lower than the lower limit, so the currency board provided a full coverage of the domestic currency that year as well.

Given that the data for L_M and A_F are expressed in millions and hence the former variable's values were increasing almost exponentially from 1997 until 2020, the observed values were linearized by taking the natural logarithm. As the analysis

includes time series, Augmented Dickey-Fuller (ADF) for unit-root stationarity including trend for L_{M^P} given the clear upward trend, has been applied. Using the original, non-linearized values of variables, the null hypothesis of a unit root the ADF test could not be rejected at all common significance levels. Applying the natural logarithm to the values of L_M and A_P , the null hypothesis of the ADF test is rejected at 1% significance level.

Table 2: Overview of the regression model specifications

Variables	Index	t-test	P> t
In (Monetary Liabilities)	-0.113*** (0.00681)	-16.65	0.000
In (Net Foreign Assets)	0.0882*** (0.00626)	14.11	0.000
Negative Interest	-0.000615** (0.000225)	-2.73	0.013
Constant	0.478*** (0.0259)	18.42	0.000
Observations	23		
F-statistic	105.67		
Prob.(F-statistic)	0.000		
R-squared	0.943		
R-squared Adjusted	0.935		
Root MSE	0.008		

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

It can be concluded from Table 2 that the variation in the I_C is very well explained by the variations in the logarithm of L_{M^P} , logarithm of A_P and N_R , yielding an R^2 of 94.3%. Looking at the value of the F-statistic, all the three variables are jointly statistically significant in explaining the variation of the I_C .

The estimated model's primary goal is not to forecast the index's value based on the values of the three included variables, hence the autoregressive terms are not included in the model. Based on the time series regression the following regression model is formed:

$$I_{C_t} = 0.478 - 0.113 \ln L_{M_t} + 0.0882 \ln A_{P_t} - 0.000615 N_{R_t}$$

The obtained coefficients can be interpreted as follows. A 1% change in L_M , is associated with a negative change in the I_C of 0.00113 (-0.113×0.01). Similarly, a 1% change in A_P , results in a change of the I_C by 0.000882 (0.0882×0.01). On the other hand, change in the negative interest by 1 million BAM translates to a change of -0.000615 in the I_C . Although this result is statistically significant at 5%, very low coefficient indicates that the Negative Interest is relatively less important in determining the level of the I_C , compared to the L_M and A_P , both of which are statistically significant at 1%, implying no economic significance. This finding is probably a consequence of the observed negative interest paid only after 2015, with all the observations before being zero. Should the negative interest environment persist in the future, it could be the case that this relationship becomes statistically insignificant.

6. Discussion

By choosing the euro as its reserve currency, BiH has left it to the ECB to conduct discretionary monetary policy. The ECB conducts monetary policy in the interest of the euro area member states. Therefore, the objectives of monetary policy in the euro area can coincide with the objectives of the BiH economy only to the extent that the interests of the BiH economy and the economies of the euro area member states coincide. The implementation of the QE program and the Pandemic Emergency Purchase Program (PEPP), which is directly aimed at helping countries combat the consequences of the COVID-19 pandemic, did not create any obligations for the ECB towards countries that use the euro as a reserve currency.

The negative interest rate on deposits with the ECB and the negative yield on euro bonds influenced the generation of negative seigniorage, which reduced the efficiency of the currency board in BiH. The weighted average interest rate on the foreign exchange reserves of the CBBH has been declining since 2008, when it reached a maximum of 4.2%, and in 2019 it fell to 0.11%. This is a weighted rate, which means that certain deposits and bonds do not generate yields or interest is paid for holding reserves in those bonds. For bonds denominated in euros with a maturity of up to two years a “negative interest rate” (reserve holding fee) was paid of -0.04% in 2015, -0.32% in 2016, -0.39% in 2017, -0.13% in 2018, and -0.27% in 2019, and on bonds with a maturity of up to three years -0.25% in 2016, -0.24% in 2017, $+0.08\%$ in 2018, and -0.18% in 2019 (CBBH, 2020). In 2019, a negative interest rate of 0.02% was recorded on bonds in euros with a maturity of up to 5 years. During 2018, the CBBH paid 12.5 million euros on the basis of negative interest rates. The growth of interest expenses based on the negative interest rate

on bonds in euros continued in 2019 and amounted to 13.5 million euros. That amount is expected to be over 14 million euros by the end of 2020. From 2014 to the end of 2019, the CBBH paid or reduced seigniorage by over 40 million euros on behalf of the negative interest rate on bonds in euros.

Statistical analysis showed that the negative interest rate has the effect of reducing the value of the I_C , but that it still does not jeopardize the coverage of the currency board. According to the provisions of the Law on the CBBH, the CBBH invests over 95 % of BiH foreign exchange reserves in financial instruments denominated in euro, which is why the CBBH “has to accept negative and low market yields on government debt securities and negative interest rates on foreign currency deposits with foreign banks” (CBBH, 2018:43). The CBBH interest income decreased from the maximum of 140.4 million euros in 2008 to 12.7 million euros in 2019. The decrease in the net profit of the CBBH was faster than the decrease in interest income because the amount of net profit, in addition to interest on bonds, is also affected by the negative interest rate. From 2008 to 2018, the net profit of the CBBH decreased by about 24 times, from 102 million euros to 4.3 million euros. In order to preserve the coverage of the currency board, the CBBH stopped paying part of the profit into the BiH budget from 2018. Further, since 2016, the CBBH interest income includes the effects of the deposit facility rate on deposits of domestic commercial banks, which is currently -0.5%. On that basis, in the period from 2016 to 2019, the CBBH collected about 12 million euros from commercial banks.

Thus, a negative interest rate reduces seigniorage and increases the cost of maintaining a currency board. In order to ensure the coverage of the currency board, the CBBH reduces the payment of profits to the state budget and imposes on commercial banks the obligation to pay interest on excess reserves. Owing to these measures, the impact of negative interest rates on I_C trends has been reduced. All this proves that seigniorage on the basis of interest income, as one of the main advantages of the currency board, loses its significance in the conditions of negative interest on the invested reserve currency. Negative seigniorage increases the risk of currency board coverage and imposes the need to find other income that will compensate for losses due to negative interest rates. This proves hypothesis H_0 .

The negative interest rate on the reserve currency reduces the profitability of the currency board. The statistical analysis of I_C movements confirms that the currency board is sustainable even in the conditions of a negative interest rate on the reserve currency. The limit of its sustainability is determined by the sum of net foreign assets and the founding capital of the currency board. So as long as

their sum is greater than the negative interest rate, the currency board has full coverage and is sustainable. The movement of the IC values for BiH confirms this because BiH has been paying negative interest on a part of the reserve currency placement since 2015. This also proves our hypothesis H1. However, it should be borne in mind that the sustainability of the currency board in terms of negative interest rates on reserve currency placements is paid by reducing the already reached value of the total capital of the currency board, and that it is limited in time. In the long run, the currency board would become economically meaningless in terms of investing total foreign exchange reserves at a negative interest rate. In reality, the sustainability and stability of the currency board can be improved by changing the structure of reserve currency investments (avoiding placements with negative interest rates), changing the currency structure of commercial banks' required reserves, reducing the currency board's operating costs and by charging for the services it performs for banks and society. In addition, the negative interest rate on deposits with the ECB and on euro-denominated bonds should be seen as transient, resulting from the 2008 crisis, which intensified due to the outbreak of the COVID-19 crisis.

The COVID-19 crisis has established a completely new environment for the functioning of the economy. All the principles of economic freedom, on which economic science is based, have been suspended in whole or in part indefinitely. The area of economic freedom has been narrowed, and business uncertainty has increased for most activities. The functioning of the market no longer yields the usual and expected outcomes. Regulatory institutions also face operating restrictions. Rational choice comes down to doing what is possible in the current conditions. Expectations from the state have become higher than expectations from the market. These are the circumstances that influenced the sudden change in the attitude of economists, politicians and central bank administrations towards the monetization of state deficits. However, there is no complete agreement on this. There are serious warnings that the monetization of government deficits during the COVID-19 crisis could cause inflation in the post-crisis period, then that it is "helicopter money", and that the PEPP may affect the change in relations among euro area members. The currency board cannot monetize the government deficit, but the economy in which it operates may be exposed to the effects of inflation from the reserve currency economy.

Since the outbreak of the COVID-19 crisis, the CBBH has not introduced any new monetary measures or changed the reserve requirement rate for commercial banks or the negative interest rate on the excess reserves of commercial banks. In BiH, no institution is responsible for the stability of the financial sector. The CBBH does not have the possibility to protect the liquidity of banks by credit-

ing, which is why they are more cautious and avoid risky placements, and keep the excess reserves with the CBBH above the required reserves (over 1.5 billion euros at the end of 2020, which is at the level of 2019), paying negative interest rate that is higher than in 2019. Commercial banks, in the conditions of unstable economy, prefer a smaller volume of well-secured placements with a higher interest rate, than vice versa, even in the conditions when they pay a negative interest rate of the CBBH on excess reserves. The stability of the financial sector in BiH is maintained at the expense of slow economic development. It is uncertain how long the COVID-19 crisis will last and how much damage it will cause to the BiH economy. Also, it is uncertain how much the BiH entities (Federation of BiH and Republic of Srpska) will have to borrow, where, from whom and under what conditions in order to ensure some kind of social and economic stability. Government bonds in the euro area are "redeemed" at an interest rate equal to zero, while the effective interest rate on entity bonds is around 3%⁴. Further, it is uncertain in which condition the BiH economy will be at the end of the crisis and at what pace it will recover in the post-crisis period. Is BiH's fiscal capacity going to be able to cover the consolidated government's budget expenditures after the crisis? For now, it is only certain that budget deficits will increase, that the indebtedness of the entities will grow, and that public revenues will decrease. If inflation occurs in the eurozone, it will be transferred to BiH through exchange.

The competitiveness of the BiH economy on the market of the most important foreign trade partners of BiH depends on the exchange rate of the euro against the national currencies of the countries of the most important foreign trade partners of BiH. By choosing the euro as its reserve currency, BiH has left the ECB's monetary influence on the foreign competitiveness of the domestic economy. Thus, a difficult and uncertain way of conducting the competitiveness policy of the domestic economy was chosen (Tomas, 2021). Exports are the basis for the formation of foreign exchange reserves, which includes the currency board. However, BiH continues to have a high current account deficit. The current account deficit affects the appreciation of the REER (Real Effective Exchange Rate) in relation to the equilibrium exchange rate. This tendency stimulates imports and discourages exports. In the conditions of the currency board, a paradoxical situation arises: without exports there is no sustainability of foreign exchange reserves, and exporters are discouraged from exporting. The aggravation of the economic crisis, which is taking place under the influence of the COVID-19 crisis, is having an impact on reducing the inflow of money from abroad due to the reduction of exports, foreign investments and remittances. All this can jeopardize BiH's foreign

⁴ On 14 April 2020, 141,670 five-year bonds of Republic of Srpska were sold on the Banja Luka Stock Exchange at the effective interest rate of 3%.

exchange reserves. In the conditions of the COVID-19 crisis, BiH is powerless to influence the inflow of money from abroad, except for borrowing abroad. Prior to the COVID-19 crisis, BiH had the opportunity to influence the adjustment of REER and the equilibrium exchange rate through commodity prices and wages in the domestic market and thus encourage the competitiveness of the domestic economy (Tomas, 2012). However, during the COVID-19 crisis, this measure also has a very limited scope, because the decline in cash inflows from abroad is not caused by low competitiveness of the domestic economy, but by a sharp decline in economic activity (demand) abroad although “countries such as BiH, Serbia and Northern Macedonia, whose exports are part of the global supply chain to Western Europe, registered a slightly milder decline in economic activity” (Žunić, Kozarić, and Žunić Dželihodžić, 2021).

The QE in the euro area and the COVID-19 crisis have created another threat to the stability of the currency board in BiH. Foreigners are the dominant owners of capital in commercial banks in the country. By equating the fee on excess reserves with the CBBH above the required reserves with the deposit rate of the ECB, the CBBH equated the price of keeping excess money of commercial banks in BiH with the price in the euro area. Thus, by keeping surplus money above the required reserve, commercial banks in BiH were no longer profitable for foreigners. In the first quarter of 2020, there was a restructuring of foreign assets and a significant reduction in foreign liabilities. Deposits of non-residents were decreased by BAM 256.9 million, and loans from non-residents by BAM 9.5 million (CBBH, 2020). The trend continued in the second quarter of 2020. It is obvious that the owners of foreign capital estimate that it is more profitable and safer to keep the surplus money, whose storage costs the same as in the euro area, outside BiH, because they expect the recovery of the euro area economy after the COVID-19 crisis to be faster.

Thus, changes in the monetary sphere of the euro area during the COVID-19 crisis may jeopardize the functioning of the currency board that uses the euro as a reserve currency through several influences over which the country of the currency board has no influence: (a) the reduction in the inflow of foreign money due to a decline in economic activity; (b) the ineffectiveness of economic policy measures that encourage foreign competitiveness; (c) the accumulation of sovereign debt in the euro area that may cause inflation in the post-crisis period; and (d) the withdrawal of non-residents' money from domestic commercial banks. These tendencies confirm our hypothesis H_2 .

7. Conclusion

The negative nominal interest rate on deposits and bonds in the reserve currency represents an additional cost of issuing domestic currency in the conditions of the currency board. This means that the money we invest in bonds is worth more if we don't invest it that way. Further, this means that the domestic currency, issued on the basis of which we pay a negative nominal interest rate, at the time of issuance relatively loses its value in the amount of the negative nominal interest rate. This is not a good environment for gaining confidence in the currency board and is not a guarantee of its long-term sustainability.

Currency board in BiH is also maintained in conditions of negative nominal interest on ECB deposits and bonds in euros owing to the coverage of issued BAM with reserve currency above 100%, even higher inflow of interest income from interest expenses, which can be attributed to the introduction of deposit facility rate. Technically, the currency board in BiH can function in the existing conditions, but the aspect of its economic justification and profitability is seriously endangered. The BAM exchange rate is legally fixed against the euro and it will probably remain sustainable until the CBBH Law has changed, especially if we keep in mind that the Law regulates the coverage of CBBH losses, including those that would occur due to the payment of negative interest on the reserve currency.

The COVID-19 crisis has reduced the inflow of foreign money into BiH due to reduced exports, reduced interest income from the reserve currency, reduced remittances, reduced foreign investment and the withdrawal of non-residents' money. Reducing the inflow of money from abroad may jeopardize the coverage of the currency board in BiH. The nature of the COVID-19 crisis, due to the sudden cessation of the economy, makes ineffective all measures to encourage the competitiveness of the domestic economy in foreign markets. Therefore, the threat of currency board coverage in BiH is inevitable as long as there is a COVID-19 crisis. In order to increase the country's stability during the COVID-19 crisis, it would be useful to make changes in the maturity structure of negative yield bonds, reduce CBBH operating costs, as well as create institutional opportunities for using reserve currency to regulate the business framework of commercial banks.

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