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**CREDIT-TO-GDP GAP:
LOCAL VERSUS FOREIGN CURRENCY CREDIT**

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Abstract

The credit-to-GDP gap is a fundamental indicator used to identify credit bubbles. Currently, the indicator takes into account aggregate credit as a ratio of GDP, without distinguishing between local and foreign currency. In the Albanian financial system, foreign currency loans comprise about fifty percent of the total credit. Due to the large share of foreign currency loans, this paper evaluates the credit-to-GDP gap by local (Albanian lek) and foreign (Euro and US dollar) currency to assess their performance in identifying credit bubbles. This study concludes that using a modified version of credit-to-GDP gap, which extracts foreign currency fluctuations, provides a better overall performance than the standard approach. In addition, a split credit-to-GDP gap according to local and foreign currency provides similar performance to the standard and modified approach, but offers a more structure-based approach.

JEL Code: E44, G01, G18

Keywords: credit-to-GDP gap, foreign currency credit, countercyclical capital buffer.

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1. INTRODUCTION

This paper explores the possibility of using alternative approaches when calculating credit-to-GDP gaps. It provides a modified credit-to-GDP gap that extracts foreign exchange effects, as well as considers a split currencies approach by calculating credit-to-GDP gaps for local and foreign currency portfolios. Each of these alternatives provides additional flexibility to policy makers by allowing for an approach based on the currency structure in the financial system.

After the global financial crisis of 2008 (GFC), multiple studies have analyzed the driving factors of the crisis as well as attempted to identify early warning indicators that would help prevent a similar situation. Defining a credit bubble can be complicated, as is establishing proper indicators and thresholds. The Basel Committee on Banking Supervision has identified the credit-to-GDP gap as an important early warning indicator and a useful tool for implementing countercyclical capital buffer requirements.

Several authors, such as Geršl and Seidler (2011), have recognized that early warning indicators have shortcomings and need to be adapted to the economic characteristics of each country. One important characteristic is the composition of domestic credit between local and foreign currency. This is particularly important in a country like Albania, characterized by a considerable share of credit in foreign currency. In this context, I compute a modified credit-to-GDP gap, as well as separate credit gaps for local and foreign currency lending. My results show that their accuracy is overall better when compared to the standard approach in the Albanian case.

The modified approach and the split currencies approach outperform the standard approach. This indicates that it is important to take into account currency exchange fluctuations when measuring the credit-to-GDP gap.

My study is organized as follows: I start with a literature review; followed by a short description of the data used in this study; offer some background information on the Albanian financial system; outline the different methodologies I propose in regard to calculating credit-to-GPD gap according

to the total, local currency and foreign currency; and finally, I evaluate the signaling performance of each approach as well as provide their countercyclical capital buffer requirements.

2. LITRATURE REVIEW

The study of Macroprudential Policy has seen major developments in the last decade, with a significant increase in the number of studies on its main instruments. Countercyclical capital buffers are one of the main macroprudential instruments available to supervisory authorities to address imbalances before they threaten the financial stability. One of the key early warning indicators discussed is the credit-to-GDP gap.

After the global financial crisis of 2008, the Basel Committee on Banking Supervision (BCBS) published *Guidance for national authorities operating the countercyclical capital buffer*, which sets the credit-to-GDP gap as the main indicator for the countercyclical capital buffer. This guidance document provides a detailed methodology on how to calculate the credit-to-GDP gap, define its components, set thresholds, measure the long-term trend, as well as relate the credit-to-GDP gaps with corresponding countercyclical capital buffers. (BCBS, 2010)

The Basel Committee recommends using the Hodrick-Prescott (HP) filter to measure the long-term trend of credit-to-GDP. The mathematical technique at the basis of the HP filter was introduced by the British mathematician Edmund T. Whittaker in 1923 in a paper entitled “On a New Method of Graduation”. However, the method was made popular by Robert J. Hodrick and Edward C. Prescott in a 1997 paper titled: "Postwar U.S. Business Cycles: An Empirical Investigation". Since then, this filtering methodology has been widely used in macroeconomics and finance to identify economic, financial and business cycles. The filter allows for the removal of the cyclical component of a raw data series.

Prior to BCBS publishing its guidance document for national authorities, numerous studies had been conducted to evaluate the significance and importance of the credit-to-GDP gap to anticipate credit bubbles. Drehman et al. (2010) explored several options when setting countercyclical capital buffers. The paper concludes that a system-wide countercyclical capital buffer is preferred, as

opposed to a bank-by-bank buffer requirement, because idiosyncratic components appear to have a major impact in a bank-by-bank scenario. Drehman et al. (2010) also determine that the credit-to-GDP gap provides the best result compared to other indicators such as credit growth, GDP growth, property prices, profit before taxes, credit losses, and credit spreads.

Numerous studies have also discussed the shortcoming of the credit-to-GDP gap as an early warning indicator. Hansen and Sulla (2013) examine credit growth in Latin America and highlight that credit growth differs according to currency and country financial structure in regard to dollarization level. In addition, Galan (2019) provides a general view of countries making adaptations to the credit-to-GDP gap in order to reflect the financial structure of the respective countries. Galan provides example of several instances where countries have implemented modifications to the credit-to-GDP gap indicator to better reflect the economic characteristics of each country. Brazil and Russia have adapted their calculations to reflect currency fluctuations. According to Geršl and Seidler (2011), credit-to-GDP is not necessarily the right indicator to capture the credit conditions of economies that use multiple currencies. Currency fluctuations make the foreign currency portfolio appear small in good times when the currency is strong, while it increases the outstanding loans in bad times when the currency depreciates. In addition, Niepmann and Schmidt-Eisenlohr (2017) show that companies that borrow in foreign currency are more likely to be past due with their payments, since they do not fully hedge the foreign exchange risks.

Other studies have questioned the statistical shortcomings of the HP filter. Hamilton (2017) argues that the HP filter has spurious dynamics, the ends of the filtered time series differ from those in the middle, and it stands at odds with its statistical foundations. As a solution, Hamilton suggests using a linear projection. In response to Hamilton et al. (2018) acknowledge the weakness of the HP filter, but argue that by using the one-sided HP filter, it is possible to achieve better results than with other detrending methods. Other studies have tried to address the purely statistical credit-to-GDP gap calculation, by adding a semi-structural economic model to provide a theory-based credit gap. For instance, Lang and Welz (2018) provide the means to combining economic theory and the credit gap for higher predictive and explanatory results in regard to households' credit-to-GDP

gap. Lang et al. (2019) propose adding complementary indicators that provide policymakers with additional domestic economic specifications, thus compensating for the shortcomings.

3. DATA

To study the differences between credit bubbles in local versus foreign currency, I use quarterly data aggregated on a total financial system level, which includes bank credit, non-banking financial institutions (NBFI), as well as savings and loans associations (SLA) for the period 2000:Q1-2019:Q4. Total credit is defined as total lending from banks and shadow banks after we deduct lending to financial institutions, lending to the Government and non-residents.

I use the following data: total credit to the economy, local and foreign currency; credit growth; GDP growth; inflation rate; nominal and real exchange rate relative to euro and United States dollar.

The data are sourced from the Bank of Albania (BoA), the National Institute of Statistics of Albania (INSTAT), the European Central Bank (ECB), Eurostat and the US Federal Reserve.

All the credit indicators and the currency exchange rates are taken from the Bank of Albania website. On the other hand, Gross Domestic Product (GDP) and Consumer Price Index (CPI) are from INSTAT. The European Central Bank and the Federal Reserve provide credit-to-GDP gap and the underlying indicators for the respective economic area. Eurostat data is also used for the GDP and inflation in the European Union.

4. EVOLUTION OF CREDIT COMPOSITION IN ALBANIA

Albania is a small economy intertwined with the Euro Area, in particular with Italy and Greece. Historically, Albania's financial system has been dollarized and later eurorized. Dollarization/Euroization has been present in the Albanian economy since the transition to an open market economy in the early 1990s. Manjani (2015) studies some of the drivers of dollarization and, later, euroization of the banking system deposits. Some of these drivers are similar to other

emerging economies in southeastern Europe. In the 1990s, as the economy opened up, the Albanian lek (ALL) suffered high volatility, followed by high inflation and currency devaluation. The instability of the currency led depositors to store their saving in foreign currency.

Moreover, in 1997, Albania suffered a deep financial crisis which led to widespread skepticism towards the value of the local currency. Public distrust and resentment were high and many people preferred storing their savings in currencies that were perceived as more secure and value-preserving. The demand for foreign currency was high and most of the loans were denominated in foreign currency.

The privatization of the banking system during the early 2000s also played a major role in accelerating the euroization of the financial system. Large state-owned banks were bought by foreign banks, mainly from the Eurozone.

During 2000 – 2008 Albania experienced accelerated credit growth, with foreign currency loans driving most of the growth. After the global financial crisis of 2008, foreign currency loans suffered a large decline. During the seven years following the crisis, the local currency depreciated with respect to the United States dollar (USD) and the euro (EUR).

Table 1 provides the annual growth rate and the period average for some of the key indicators used in this study. It shows the annual growth rate for GDP, private credit as defined by the Basel Committee, bank credit, non-banking financial institutions (NBFI) credit, savings and loans associations (SLA) credit, as well as the currency exchange rate for the two main foreign currencies used in the Albanian financial system.

I have selected years before and after the global financial crisis to illustrate the change in growth rates for the period under review. The earlier years of 2000s are characterized by higher growth rates due to the low level of the private credit portfolio and the privatization process. In the second half of the years 2000s there was robust credit growth, especially in foreign currency. After the global financial crisis there was a slowdown and later decline in foreign currency lending. Since 2015 there has been an acceleration in credit growth, with local currency credit leading the trend.

Table 1: Annual growth performance by financial institutions and currency type.

Variable	2005 Q4	2008 Q4	2011 Q4	2013 Q4	2015 Q4	2019 Q4	Average 2001Q1 - 2019Q4
GDP Growth	8.5%	12.6%	2.5%	1.0%	2.2%	2.2%	6.1%
Standard Private Credit	73.3%	32.0%	10.4%	-1.4%	-3.7%	7.1%	20.7%
Modified Private Credit	67.2%	30.2%	9.0%	-1.2%	-2.6%	7.2%	21.8%
Local Currency	112.5%	29.0%	17.6%	1.7%	1.7%	11.1%	26.0%
Foreign Currency	53.8%	30.7%	4.8%	-3.0%	-5.6%	3.8%	22.1%
Bank Credit Growth	68.9%	30.6%	9.4%	-1.1%	-2.5%	6.3%	21.3%
Local Currency	139.6%	30.6%	19.7%	1.8%	1.6%	10.1%	25.1%
Foreign Currency	53.6%	30.6%	4.6%	-2.8%	-5.2%	3.2%	21.9%
NBFI Credit Growth	46.0%	22.4%	3.0%	-2.5%	-6.9%	23.1%	15.7%
Local Currency	41.3%	17.8%	-2.8%	3.8%	0.9%	24.2%	12.2%
Foreign Currency	103.2%	59.7%	10.9%	-10.4%	-20.0%	21.2%	44.2%
SLA Credit Growth	33.8%	14.6%	-0.5%	-10.3%	5.0%	11.7%	15.5%
Local Currency	33.8%	14.6%	-0.5%	-10.2%	5.0%	10.8%	15.5%
Foreign Currency		37.6%	39.0%	-23.5%	7.0%	104.0%	50.3%
1 EUR in ALL	122.58	123.80	138.93	140.20	137.28	121.77	132.12
1 USD in ALL	103.58	87.91	107.54	101.86	125.79	108.64	111.10

Note: This table shows the annual growth rate on a quarterly bases of selected indicators for the period 2001:Q1 – 2019:Q4. Due to the limited space, I have selected few years before and after the financial crisis to illustrate the impact of the global financial crisis.

Source: Bank of Albania; INSTAT; author's calculations.

After the global financial crisis, outstanding foreign currency loans decreased. According to the Bank of Albania's reports, most of the non-performing loans were in foreign currency. Therefore, when banks started writing off lost loans, the foreign currency portfolio was impacted the most. Local currency lending has been more volatile compared to foreign currency lending. This higher volatility in local currency loans is mainly caused by the early years of 2000s, when the largest publicly owned banks were privatized and large portions of their loan portfolio were restructured or written off.

Table 2 describes the main macroeconomic variables used in this study by providing the mean, standard deviation, the minimum, the maximum, and the number of observations for each component of the credit-to-GDP gap. Standard private credit refers to private credit as defined by the Basel Committee, without taking into account currency exchange fluctuations. The modified approach provides private credit after extracting foreign currency exchange fluctuations from the foreign currency credit portion of the portfolio. In addition, foreign currency credit is also computed after extracting currency exchange fluctuations.

Table 2: Key indicators and statistics for the periods 2000:Q1 – 2019:Q4.

Variable	Mean	Std. Dev.	Min.	Max.	No
GDP Growth	6.1%	3.9%	0.5%	13.4%	76
Standard Private Credit Growth	20.7%	23.4%	-7.0%	81.6%	76
Modified Private Credit Growth	21.8%	24.0%	-7.0%	79.2%	76
Local Currency Credit Growth	26.0%	42.2%	-66.7%	179.9%	76
Foreign Currency Credit Growth	22.1%	26.3%	-5.9%	91.6%	76
Local Currency Inflation	2.5%	1.1%	0.2%	7.5%	76
EUR Exchange Rate	132.12	7.05	120.73	141.41	80
ΔEUR Exchange Rate	-0.3%	4.5%	-9.3%	14.6%	76
USD Exchange Rate	111.10	17.12	77.17	148.58	80
ΔUSD Exchange Rate	-0.8%	10.3%	-20.3%	28.2%	76

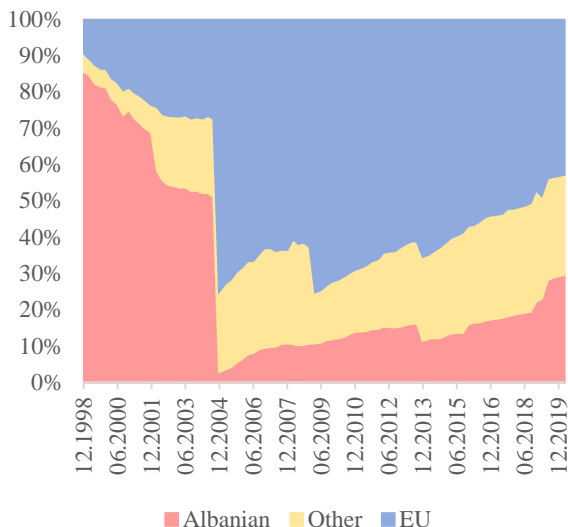
Note: The table provides the mean, the standard deviation, the minimum, the maximum and the number of observations for key indicators that are used in this study. It provides the annual change for each quarter for the periods between 2000:Q1 – 2019:Q4.

Source: Bank of Albania; INSTAT; author's calculations.

Following the 1997 financial crisis, the Albanian Parliament passed a number of reforms to reestablish public trust in the financial system and the Central Bank. In addition, in 1998 the Parliament adopted a strategy to privatize the largest banks, which at the time were publicly owned. (Ibrahimi, 2000) After the privatization process in 1999 of one of the largest publicly owned banks, public ownership decreased. Figures 1 and 2 show total asset control and banking system capital

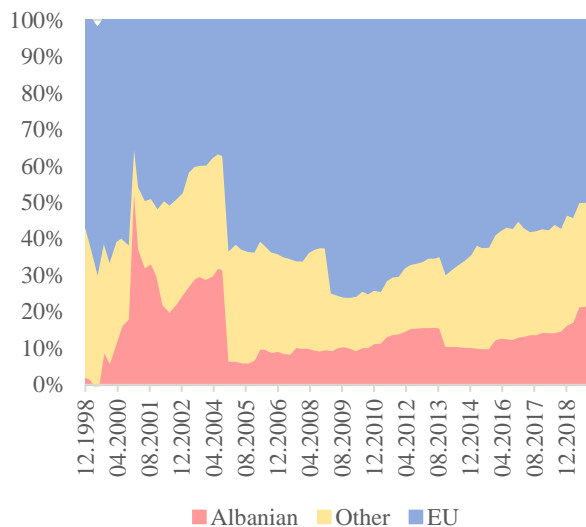
ownership over the last 20 years by the owners' origin, divided in three categories: Albanian; European Union; and others.

Figure 1. Share of total bank assets control according to the owners' origin.



Source: Bank of Albania; author's calculations.

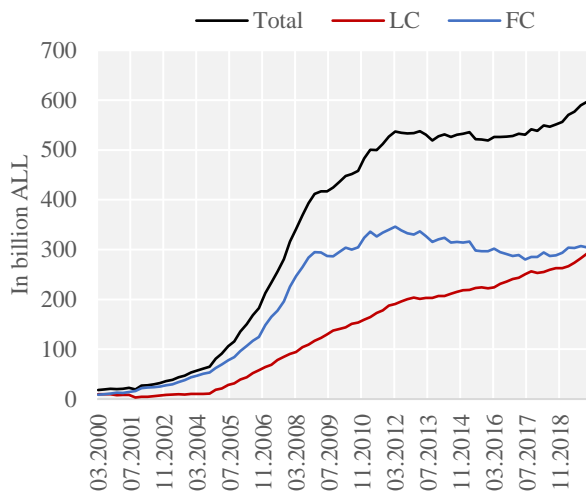
Figure 2. Share of bank capital ownership according to the owners' origin.



Source: Bank of Albania; author's calculations.

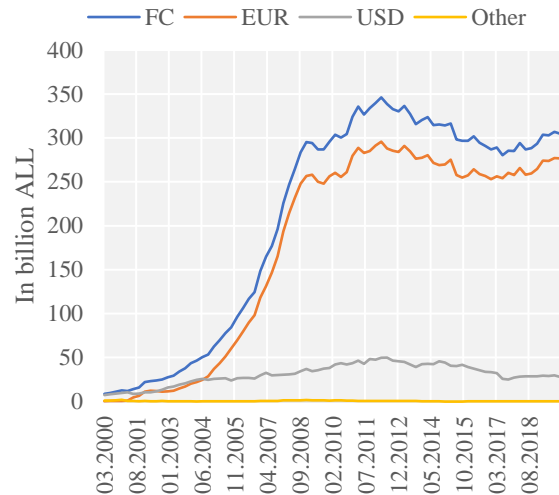
The privatization process started in 1999 and continued to 2004. The sharp drop in Albanian ownership in 2004 reflects the privatization by a European bank of the last and the largest bank that was publicly owned. The privatization process had a major impact on the further development of the Albanian banking system, but also amplified the use of foreign currency in the system. Over the recent years, the Albanian ownership share has been growing continuously, signaling a greater interest from local investors in the banking sector. However, over the past decade European financial institutions have seen a continuous decline in their share of ownership in the Albanian financial system. This is a reflection of less profitable and favorable business conditions following the global financial crisis. Higher credit risks and lower credit growth led to a fast decline of outstanding foreign currency credit, while local currency experienced a slowdown but was able to remain positive. Furthermore, within the foreign currency portfolio, we observe that the main driver is lending in euros that fueled the accelerated growth we observed during 2004 – 2008 period, as illustrated in Figure 3 and 4.

Figure 3. Total private credit according to local and foreign currency in million ALL.



Source: Bank of Albania; author’s calculations.

Figure 4. Foreign currency credit according to the main currencies in billion ALL.



Source: Bank of Albania; author’s calculations.

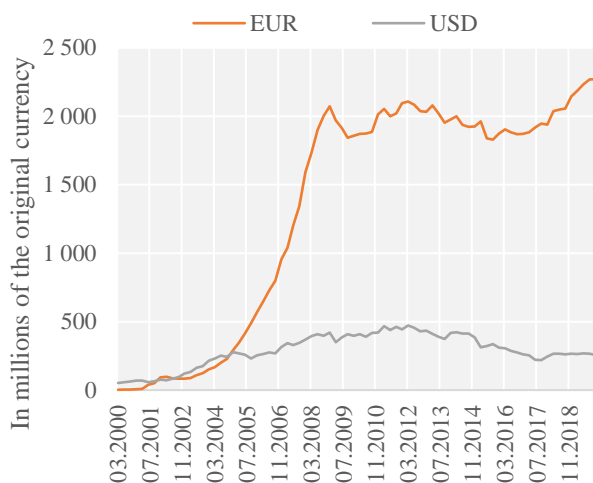
Figures 3 and 4 show that, after 2004, there was an acceleration in credit growth mainly driven by foreign currency lending. This accelerated credit growth corresponds with the financial system privatization, where we saw a considerable share acquired by foreign European banks. Moreover, most of the foreign currency credit growth was driven by lending in euros.

The data indicate that there is a significant difference in credit growth between local and foreign currency, and lending in euros experienced the fastest growth. Figures 5 and 6 also show that exchange rate fluctuations have provided a smoothing effect on outstanding foreign currency loans. During financial and economic crises, the local currency depreciated to stimulate the economy by providing support for exporting businesses, as well as increasing inflation in times of deflationary pressures. After the 2008 financial crisis, the Albanian Lek (ALL) lost strength against other major currencies. However, in the last two years there was a gradual strengthening of the ALL.

Figure 5 provides the total outstanding loans in the banking system, converted into the original currency. The graph shows the accelerated growth during the years 2004 – 2008. After the 2008 global financial crisis the exponential trend breaks, where we observe even a decrease in

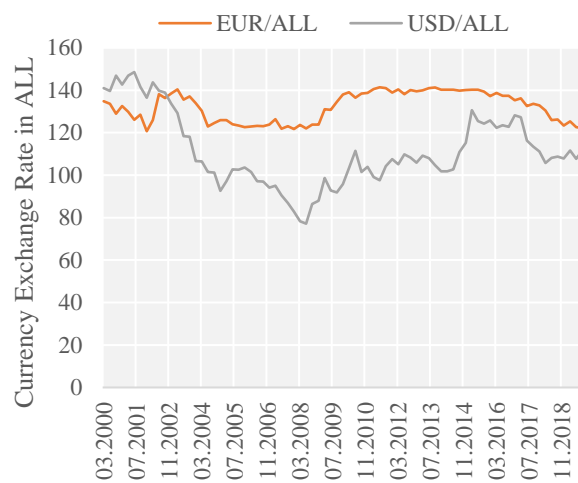
outstanding loans in euros. After 2008 outstanding loans in euros have shown fluctuations around similar levels. It is precisely these phenomena that are very specific to lending in foreign currency that are not captured by a total credit-to-GDP gap indicator, which this study attempts to distinguish and address.

Figure 5. Outstanding loans in EUR and USD denominated in the original currency.



Source: Bank of Albania; author's calculations.

Figure 6. Currency exchange rate for EUR and USD in ALL.



Source: Bank of Albania; author's calculations.

Figure 6 displays the exchange rate at the end of each quarter for the past 20 years, where we see the local currency appreciate in value before the crisis, yielding a smaller level of outstanding credit in foreign currency when converted into local currency, and a larger share after the crisis when the local currency decreases in value. Therefore, it is important to extract the foreign currency exchange fluctuations for the outstanding foreign currency credit portion of the portfolio, since the foreign exchange appears to amplify the cyclical effects.

5. EMPIRICAL ANALYSIS

The empirical analysis for this study is divided in two parts. The first part describes the methodology, the second part provides the results, followed by testing and the countercyclical capital buffer requirements according to each approach.

5.1. Methodology

This section provides the early warning properties of the credit-to-GDP gap using standard private credit compared to a modified private credit, as well as using a credit-to-GDP gap by local and foreign currency. The Basel Committee has recommended the Credit-to-GDP gap as an early warning indicator to identify credit bubbles and proposed equivalent capital buffers in reference to the size of the gap. Capital buffer requirements are recommended when the gap between the actual credit-to-GDP ratio and the one-sided Hodrick–Prescott (HP)-filtered trend grows above two percentage points. The buffer increases linearly up to a gap of ten percentage points with corresponding capital buffer requirements (BCBS, 2010).

The standard credit to GDP ratio is calculated as follows:

$$Ratio_t = \frac{Credit_t}{GDP_t} \quad (1)$$

Credit is defined as total private credit by residents and non-resident financial companies. Total private credit excludes lending to government and financial institutions. In addition, the private credit indicator excludes lending to state-owned companies, as these companies often reflect government risk rating and are not a reflection of credit conditions.

This study uses private credit from all financial institutions to the private sector. The main objective of this indicator is to capture credit bubbles in the economy by monitoring lending to the non-financial private sector. The credit data refers to the outstanding loans on a quarterly bases, therefore the GDP is quarterly as well, but annualized.

Following the quarterly calculation of credit-to-GDP, the trend is calculated by using a one-sided HP filter as illustrated below:

$$Trend = \min_{\{g_t\}_{t=-1}} \left\{ \sum_{t=1}^T (y_t - g_t)^2 + \lambda \sum_{t=1}^T [(g_t - g_{t-1}) - (g_{t-1} - g_{t-2})]^2 \right\} \quad (2)$$

where, y denotes the original time series (in this case, the ratio defined in equation 1), g refers to the trend of the time series and λ represents the positive smoothing parameter that reduces cyclicity in the trend. The first part of formula (2) addresses the variance of the cyclical component, while the second part addresses the smoothness in the trend component. We use the one-sided HP filter to base our measures only on the data that we currently have available, thus using only historical values and not forward-looking estimations that are incorporated in the two-sided HP filter. (Drehman et al, 2010)

An important choice is lambda which reflects the smoothing parameter. Drehman et al (2010) assessed several options of lambda based on other studies to conclude on a value of 400,000 as the best performing alternative. This choice suggests that credit cycles are 4 times greater than business cycles. The gap between the historical value and the HP-filtered trend is defined as the credit-to-GDP gap:

$$\text{Credit to GDP gap} = \text{Ratio} - \text{Trend} \quad (3)$$

A large positive credit-to-GDP gaps signals a potential credit bubble, while large negative credit-to-GDP gaps signal can signal deteriorating credit condition.

As mentioned above, there are shortcomings with a standard credit to GDP gap when a financial system uses multiple currencies. In order to take into consideration the fact that the Albanian economy uses multiple currencies, I divide the standard credit-to-GDP gap formula into local (4) and foreign (5) currency:

$$\text{Ratio}_t^l = \frac{\text{Credit}_t^l}{\text{GDP}_t} \quad (4)$$

$$\text{Ratio}_t^f = \frac{\text{Credit}_t^f}{\text{GDP}_t} \quad (5)$$

The same approach is followed to measure the credit-to-GDP gap according to local and foreign currency, as illustrated below:

$$Credit\ to\ GDP\ gap^l = Ratio^l - Trend^l \quad (6)$$

$$Credit\ to\ GDP\ gap^f = Ratio^f - Trend^f \quad (7)$$

Once we build foreign currency gaps, we need to recognize that currency fluctuations can have a substantial impact on the value of outstanding foreign currency loans. As the local currency strengthens in good times, the foreign currency portfolio shrinks in importance. On the other hand, as the local currency weakens in bad times, the outstanding loans in foreign currency grows, thus influencing the credit-to-GDP gap.

In order to extract currency exchange volatility, I follow an approach proposed by Geršl and Mitterling (2020) and calculate the level of the nominal exchange rate implied by the real exchange rate trend as follows:

$$nominal\ ER_t = \frac{100}{\exp(trend_t)} \times \frac{P_t}{P_t^*} \times \frac{1}{RER_{2010}} \quad (8)$$

where, *nominal ER* represents the exchange rate after extracting the currency fluctuations at time *t*. I calculate the *real exchange rate (RER)* using the actual exchange rate, the local currency consumer price index (CPI) P_t , and P_t^* which represents the CPI of the foreign currency. Later, I calculate the real effective exchange rate (REER) and from its natural log I calculate the long-term *trend_t*.

Using Equation (8), I am able to calculate the exchange rate based on the long-term trend, RER_{2010} as the base period and the CPI for the local and foreign currency. I use these methods only for private credit in euros and in U.S. dollars. The rest of the foreign currency portfolio has had historically a very small share of the total portfolio (less than 0.5% since December 2002) and I use credit in other currencies at their nominal value.

Lastly, the credit-to-GDP gap is mapped into a corresponding capital buffer requirement as proposed by the Basel Committee guidelines (BCBS, 2010). For any gap above two percentage

points (pp) there will be a stepwise buffer requirement of 0.25 pp, with a maximum capital buffer requirement of 2.5 percent of total risk weighted assets, as illustrated in Table 3.

Table 3. Mapping Credit to GDP gap with Capital Buffer requirements.

Credit to GDP Gap BCBS Mapping	Credit to GDP Gap for LC and FC Adapted Mapping	Countercyclical Capital Buffer in Percentage Points
<2 pp	<1 pp	0
2 - 2.8	1 – 1.4	0.25
2.9 - 3.6	1.5 – 1.8	0.5
3.7 - 4.4	1.9 – 2.2	0.75
4.5 - 5.2	2.3 – 2.6	1
5.3 - 6	2.7 – 3	1.25
6.1 - 6.8	3.1 – 3.4	1.5
6.9 - 7.6	3.5 – 3.8	1.75
7.7 - 8.4	3.9 – 4.2	2
8.5 - 9.2	4.3 – 4.6	2.25
9.3 - 10 pp <	4.7 – 5	2.5
	5.1 – 5.4	2.75
	5.5 – 5.8	3
	5.9 – 6.2	3.25
	6.3 – 6.6	3.5
	6.7 – 7	3.75
	7.1 – 7.4	4
	7.5 – 7.8	4.25
	7.9 – 8.2	4.5
	8.3 – 8.6	4.75
	8.7 – 9 pp <	5

Note: The table provides the countercyclical capital buffer requirements using the Basel Committee recommendation for the standard and modified approaches, while adding the adapted mapping method for the local and foreign currency to calculate the split currencies approach. The lower limit is reduced to represent the structure of private credit, where about 50% is in local currency and 50% in foreign currency. The adapted approach also allows for a higher capital buffer according to each currency because the weighted average tends to find a middle level depending on the structure of the private credit portfolio.

While the recommended approach from the Basel Committee guidelines (BCBS, 2010) works for a single aggregate private credit requirement, it does not work for a split currencies approach. Therefore, I have adapted the recommended approach, by lowering the minimum level from 2 pp to 1 pp, given the fact that about half of private credit is in local currency. I also extended the upper limit to allow the weighted average to reach the level of 2.5 pp if an institution's risk exposure is particularly high for the local or foreign currency portfolio.

Although the adapted mapping method for countercyclical capital buffer requirements allows for the local or the foreign currency portfolio to reach buffers higher than 2.5 pp, the weighted average countercyclical buffer rate has a cap of 2.5 pp. The adapted method proposes a weighted average capital buffer requirement according to the local and foreign currency credit structure of each lending institution, in order to set a single capital buffer requirement. Nevertheless, the adapted mapping does not attempt to evaluate the risk of local and foreign currency lending: it simply requires financial institutions to accumulate additional capital reserves according to their exposure when there is a potential of a credit bubble in local or foreign currency.

The following formula provides the adapted method for mapping local and foreign credit-to-GDP gap with the corresponding countercyclical capital buffer:

$$CCyB_t^w = CCyB_t^l \times \omega_{ti}^l + CCyB_t^f \times \omega_{ti}^f \quad (9)$$

where, $CCyB_t^w$ represents the weighted average of the countercyclical capital buffer requirement at time t , which derives from the countercyclical capital buffer requirement for local currency $CCyB_t^l$, and foreign currency $CCyB_t^f$. On the other hand, ω_{ti}^l and ω_{ti}^f represent the respective weight of local and foreign currency credit for a particular financial institution i . Furthermore, $CCyB_t^w$ is rounded up or down to the nearest multiple of 0.25 pp, with a maximum value of 2.5 pp.

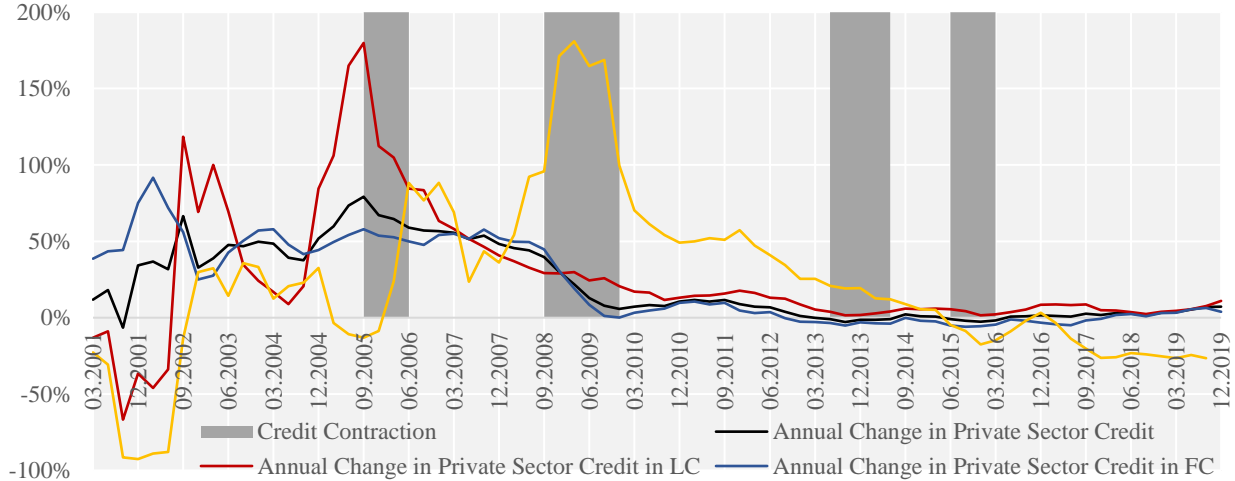
With the standard and modified approaches, each bank applies the countercyclical capital buffer requirement in the same way. On the other hand, the split currencies approach requires the same

capital buffer across the financial system according to local and foreign credit, which are applied by each lending institution based on their portfolio weight of local and foreign currency credit structure. This approach allows for system-level capital requirement, which is adapted to the institutions' credit structure.

5.2. Results

This section provides the results of the different approaches, starting with the standard approach proposed by the Basel Committee (BCBS 2010), followed by the modified approach that extracts the currency fluctuation from the foreign currency portfolio, and lastly the split currencies approach. To compare the signaling effectiveness for each approach, I follow the same methodology used by Drehmann et al (2010) to set the criteria to identify bad times: banking system credit contractions and losses.

Figure 7. Annual change for private credit growth, bank provisions and credit contractions.



Note: The graph provides the historical annual change for total private credit, local currency credit, foreign currency credit, and outstanding banking system provisions. I have also removed the currency exchange rate in the private credit numbers, to provide more accurate credit conditions. There are three periods of credit contractions that are highlighted with darker gray areas.

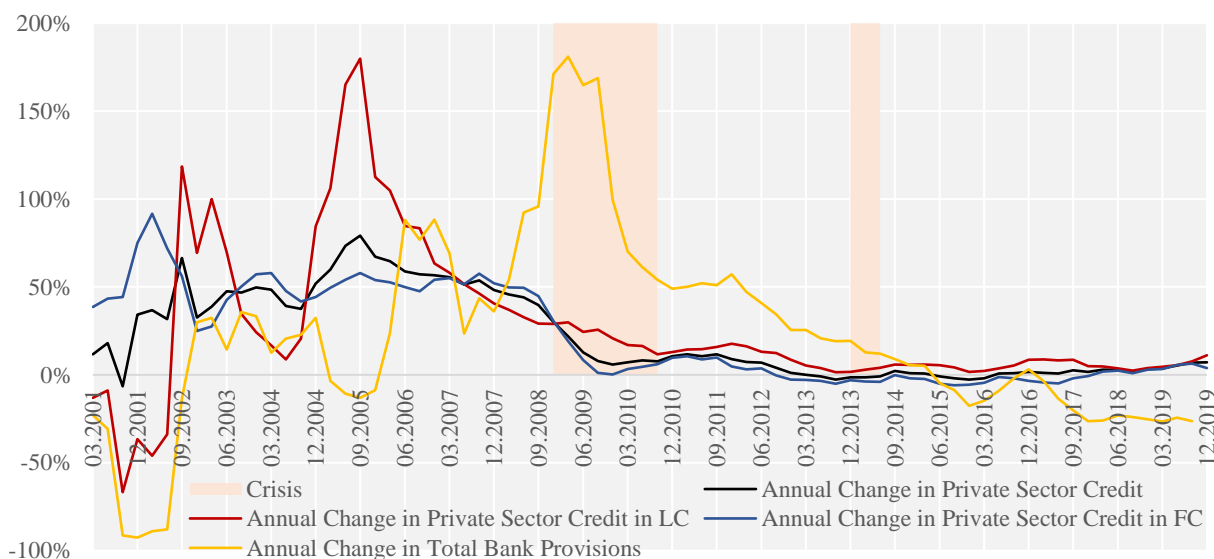
Source: Bank of Albania; author's calculations.

I have highlighted in gray the periods with a sharp decline in credit, negative credit growth, and a sharp growth in accumulated provisions. Sharp declines in credit show credit contraction and the

increase of provisions by banks indicates higher anticipated losses. In a bad period the countercyclical capital buffer that was accumulated during good periods should be released to provide additional support to the financial system in providing credit to the economy.

Not all credit contractions, or sharp decreases in credit growth, are followed by a financial or economic crisis. According to the Bank of Albania’s (2019) *Financial Stability Report*, as illustrated by the Financial Stress Index (FSI)², out of the four periods shown on Figure 7, two of them are followed by financial system distress: 2008:Q4 – 2010:Q3 and 2013:Q4 – 2014:Q2.

Figure 8. Annual change for private credit growth, bank provisions and financial crisis.



Note: The graph highlights periods defined as financial crisis. The first highlighted area, which is also the longest period, shows the crisis following the global financial crisis of the year 2008. The second crisis represents the period following the Greek debt crisis.

Source: Bank of Albania; author’s calculations.

Each of the approaches is tested according to how well they perform in identifying crisis periods using the Area Under the Receiver Operating Characteristic (AUROC). AUROC has become an important instrument to evaluate early warning indicators. The testing method evaluates the conditional probabilities of a true positive rate (TPR) that is known as the sensitivity, and the false

² The methodology used to build the Financial Strss Index (FSI) is based on a study by Kota, V. and Saqe, A., (2013). *A Financial Systemic Stress Index for Albania*, Bank of Albania Working Paper, No 03 (42) 2013.

positive rate (FPR) that is known as a false alarm. An AUROC value of 1 indicate perfect identification of TPR and has no FPR, a 0.5 value shows a performance equal to flipping a coin, and any value less than 0.5 indicate a performance that is worse than simple chance.

Table 4 describes the performance results according to each approach using up to eight quarters time lag respectively.

Table 4. AUROC results for each approach and different time lags.

Crisis Lag	Standard Credit to GDP Gap	Modified Credit to GDP Gap	LC Credit to GDP GAP	FC Credit to GDP Gap
Crisis t-0	0.639	0.458	0.652	0.482
Crisis t-1	0.700*	0.598	0.675	0.576
Crisis t-2	0.737*	0.655	0.698	0.631
Crisis t-3	0.764*	0.709*	0.723*	0.688
Crisis t-4	0.793*	0.766*	0.767*	0.747*
Crisis t-5	0.814**	0.806**	0.816**	0.796*
Crisis t-6	0.831**	0.827**	0.869**	0.833**
Crisis t-7	0.841**	0.842**	0.897**	0.843**
Crisis t-8	0.846**	0.846**	0.920***	0.842**

Note: The table provides AUC results according to each approach using quarterly time lags of up to eight quarters. An AUC value of more than 0.7 and up to 0.8 is considered to perform fair (*), 0.8 up to 0.9 is considered good (**), and 0.9 and above is considered excellent (***).

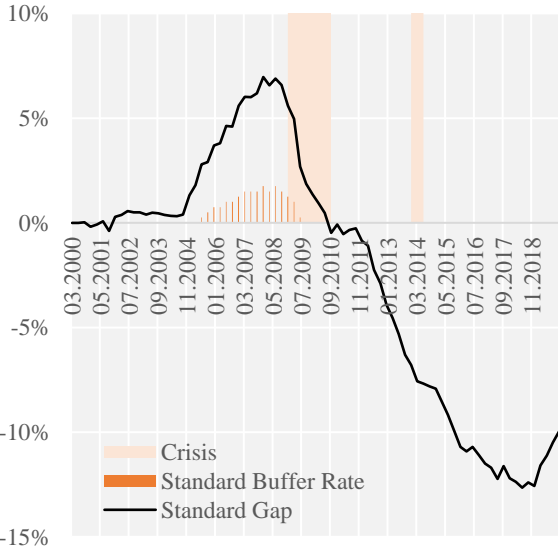
Based on the results of Table 4, we conclude that the performance is the highest with an eight quarters lag for the crisis events, which provides the highest value for AUROC. In addition, each approach provides very similar performance, with the local currency credit-to-GDP gap outperforming due to its credit growth consistency. Therefore, using the modified or the split approach yields equal, or in some cases better, signaling performance than the standard approach. However, the advantage of using the modified or the split approach is that currency structural considerations are integrated.

The most notable difference between the approaches is their respective countercyclical capital buffer requirement. Thus, it is important to evaluate each approach performance not only using AUROC, but also its ability to differentiate between local and foreign currency portfolio, as well as its ability to provide timely and proper capital buffer requirements prior to a financial crisis.

The two new approaches I propose are able to capture credit bubbles by utilizing the credit structure of the financial system. Therefore, they provide an additional instrument for policy makers to address credit bubbles by targeting the source and adapting countercyclical capital buffer requirements according to the financial system structure.

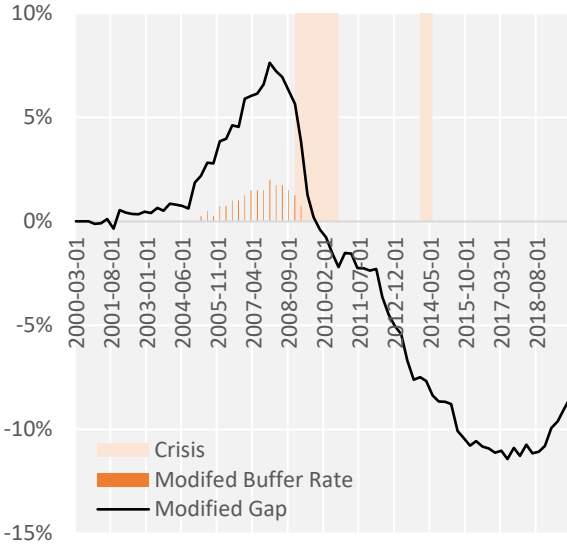
Figure 9 and 10 provide a comparison between the standard approach and the modified approach when setting countercyclical capital buffers. Their performance is similar, however, the modified approach provides buffer requirements earlier, higher at its peak, and releases it sooner than the standard approach.

Figure 9. Standard Credit-to-GDP Gap



Source: Author’s calculations.

Figure 10. Modified Credit-to-GDP Gap



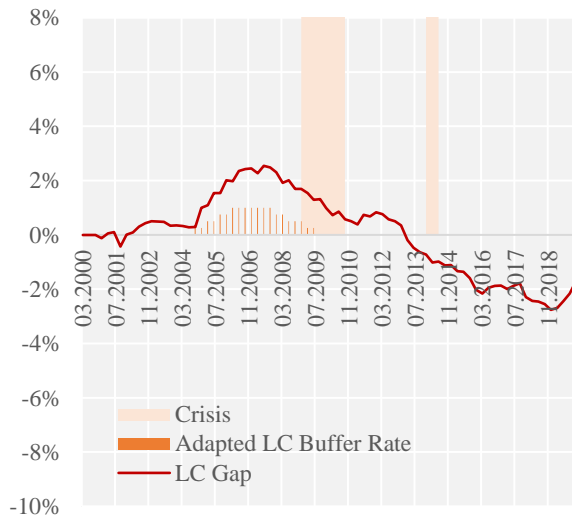
Source: Author’s calculations.

The main difference between the Standard and the Modified approach is the sensitivity and size of the countercyclical buffer. As illustrated in Figure 10, the modified approach requires countercyclical capital buffers sooner with capital requirements reaching higher, as well as a faster

release in times of crises. From a policymaker’s perspective, the modified approach is more responsive before, during and after a crisis, thus making it a better early warning indicator.

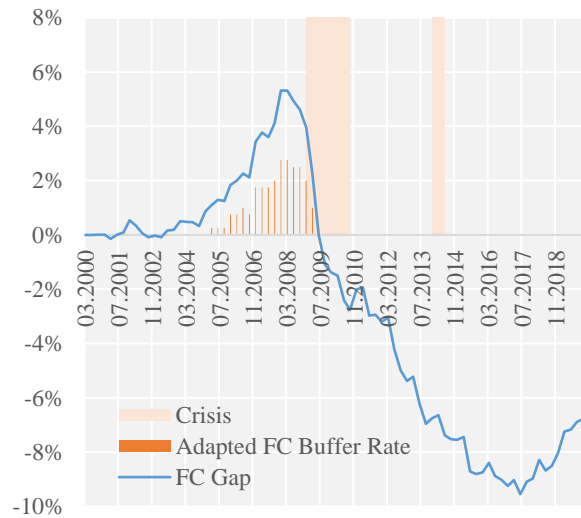
In regard to the split currencies approach, the countercyclical capital buffer requires modifications to mapping the gap. In this paper I provide a weighted average method that yields comparable results with the standard and the modified approach. Figure 11 and 12 show the credit toGDP-gap with the corresponding countercyclical capital buffer requirement according to the local and foreign currency credit. Due to the faster growth in foreign currency credit during the period before the global financial crisis, the capital buffer requirements would have been higher than the local currency credit, which has shown a more consistent growth rate. The split approach would require a lower level of countercyclical capital buffer for an institution that operates predominantly in local currency and would require a higher rate for institutions that operate in foreign currency. This approach is dependent on the private credit structure of each lending institution, the credit-to-GDP gap for the local and foreign currency.

Figure 11. LC Credit to GDP Gap



Source: Author’s calculations.

Figure 12. FC Credit to GDP Gap

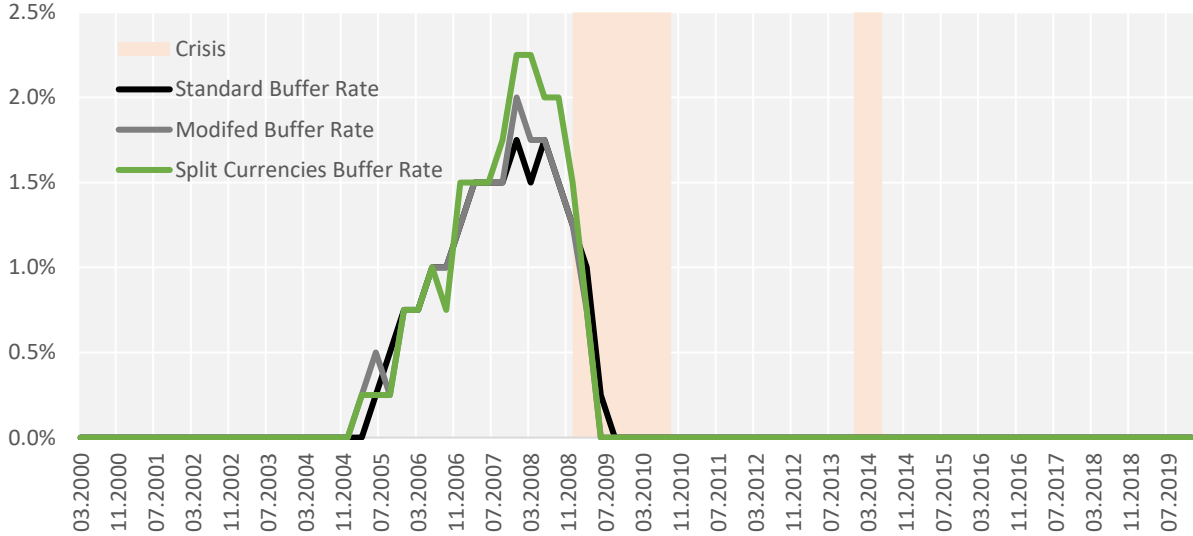


Source: Author’s calculations.

For a more detailed illustration of how the split currencies approach would impact different financial instructions according to their credit structure, please refer to Annex 2.

Figure 13 compares the countercyclical capital buffer requirements according to each approach. Overall, the performance of all three alternatives is very similar and requires capital accumulation in good times and release it in crisis periods. However, the split currencies approach provides the best performance when considering the accumulated countercyclical capital buffer requirement before the global financial crisis of 2008. The Modified approach and the Split approach start the buffer requirement one quarter earlier, reach a higher capital buffer at its peak, and releases the accumulated buffer one quarter sooner than the standard approach. The poorest performing approach is the standard approach, which reacts slower, creates the smallest buffer, and releases it later than the proposed alternatives.

Figure 13. Countercyclical buffer rate requirement according to each approach.



Note: The graph provides countercyclical capital buffer requirements according to the standard approach, the modified and the split currencies approach before, during and after the financial crisis.

Source: Author’s calculations.

When selecting a particular approach, policymakers consider not only the early warning properties of an indicator, but also its performance when combined with an instrument, such as the countercyclical capital buffer requirement. Moreover, the new split currencies approach provides additional flexibility for policymakers to target the driving factors of the credit bubble, rather than using a broad approach that penalizes all credit regardless of currency.

6. CONCLUSIONS

Since the fall of communism, the Albanian financial system has historically been dollarized and later eurorized. Currently, about fifty percent of the deposits and loans are denominated in foreign currency, mainly in euros and U.S. dollars. The rate of credit growth has been different for local and foreign currency credit. In fact, after the conclusion of the privatization process in 2004, credit in foreign currency experienced large growth, especially private credit denominated in euros.

Numerous studies have shown that the standard credit-to-GDP gap as proposed by the Basel Committee has limitations as it does not take into account the financial structure of a particular country. This paper attempts to address these issues by offering two alternatives to the standard approach that could provide a more flexible approach with similar, or even better, signaling performance for countries that, like Albania, have a large share of foreign currency loans. The new proposed approaches require capital buffers sooner and at a greater level before the crisis than the standard approach.

This study shows that the modified and split currencies approaches provide just as accurate signaling properties as the standard approach, but offer a lot more flexibility in implementing the countercyclical capital buffers. It is possible to make the credit-to-GDP gap more adaptable to the financial structure without reducing its accuracy. In fact, for local currency credit, the accuracy shows higher signaling performance than the other approaches.

The fundamental objective of the credit-to GDP-gap indicator is to build up excess capital in good times and release it in bad times. The sooner financial institutions accumulate their excess capital in good times, the most likely they are to remain resilient during crisis periods. Both of the new approaches I propose offer a more responsive countercyclical capital requirement by asking for buffers earlier, of a larger amount at its peak, and faster release than the standard approach in bad times.

The new approaches also have some weaknesses. They do require a currency by currency credit portfolio data in order to extract the currency exchange effects from the foreign currency credit. In addition, combining the split countercyclical capital buffer requirement becomes more complicated as there are numerous alternatives as to how to add the two requirements. Also, instead of using an alternative mapping method, a simple sum using the Basel Committee mapping guidelines would provide slightly different results. However, these approaches do not provide the flexibility to adapt countercyclical capital buffer requirements according to the institution's private credit structure.

The topic of macro-prudential policy instruments is relatively new and there are numerous studies exploring possible improvements in order to achieve the intermediary objectives set by the Basel Committee. This is a continuous process that strives to improve the monitoring indicators and the corresponding instruments that are used to address potential imbalances. In this context, this paper attempts to push our understanding in regard to countercyclical capital buffer by providing a more flexible approach that takes into account the currency structure of the financial system.

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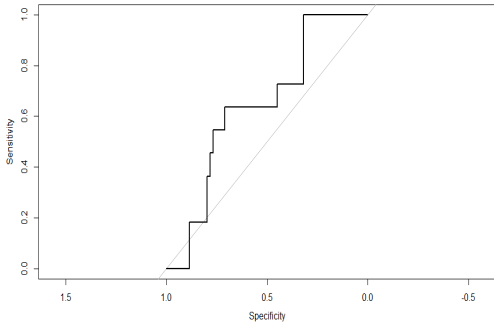
Manjani O. (2015). Estimating the Determinants of Financial Euroization in Albania. Graduate Institute of International and Development Studies, International Economics Department, Working Paper N IHEIDWP07-2015.

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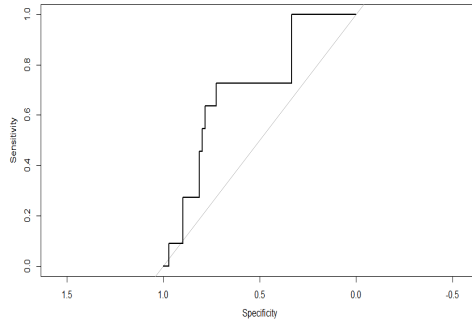
ANNEX 1: RECEIVER OPERATING CHARACTERISTIC (ROC) CURVE

Figure 14. ROC Curve for the Standard Approach

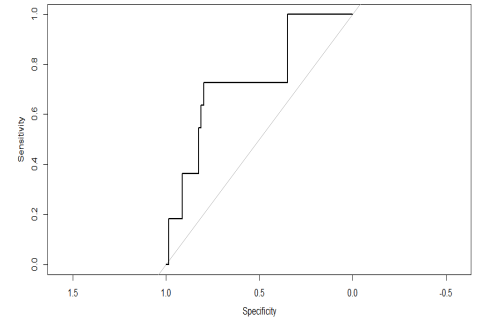
Standard Approach – Lag 0



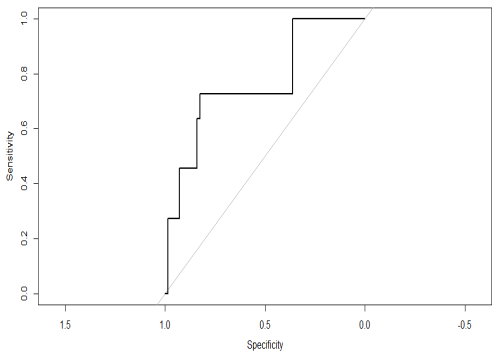
Standard Approach – Lag 1



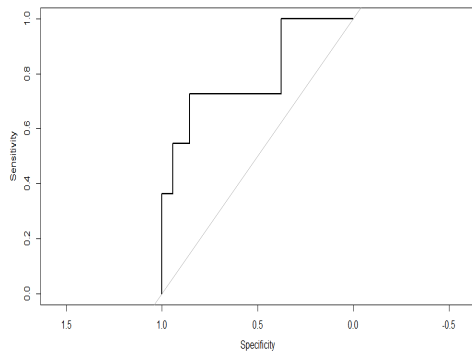
Standard Approach – Lag 2



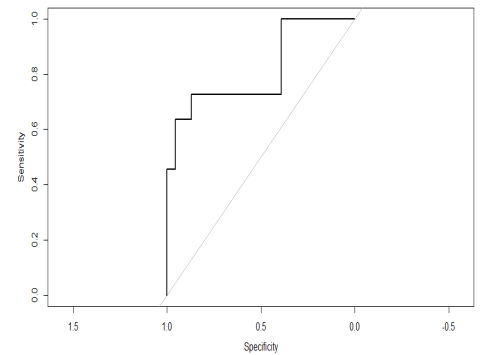
Standard Approach – Lag 3



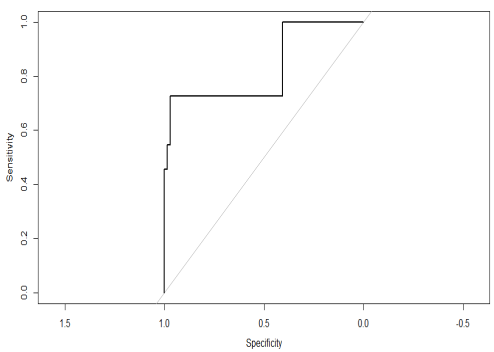
Standard Approach – Lag 4



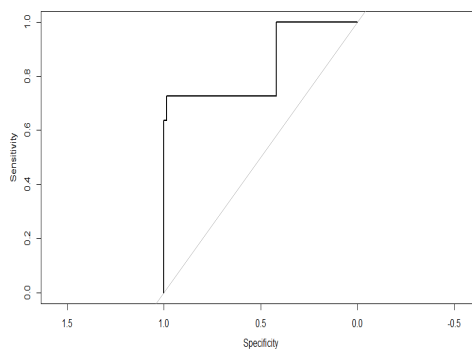
Standard Approach – Lag 5



Standard Approach – Lag 6



Standard Approach – Lag 7



Standard Approach – Lag 8

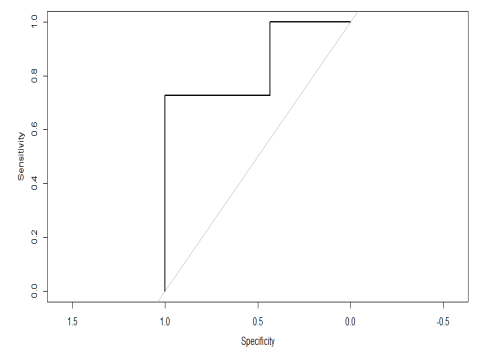
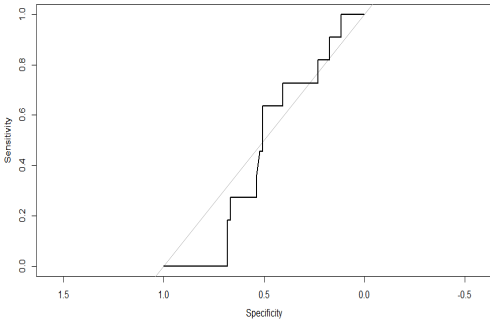
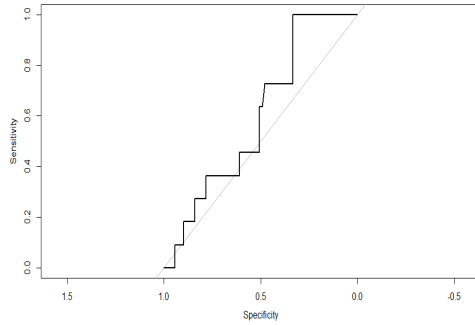


Figure 15. ROC Curve for the Modified Approach

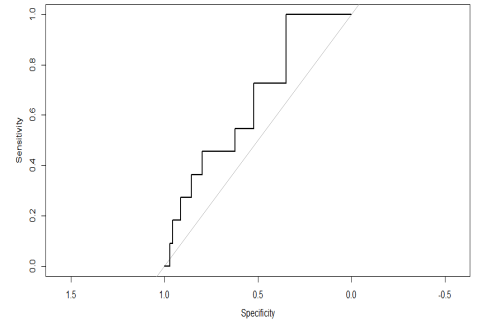
Modified Approach – Lag 0



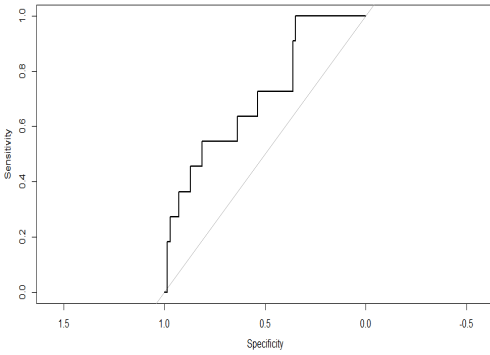
Modified Approach – Lag 1



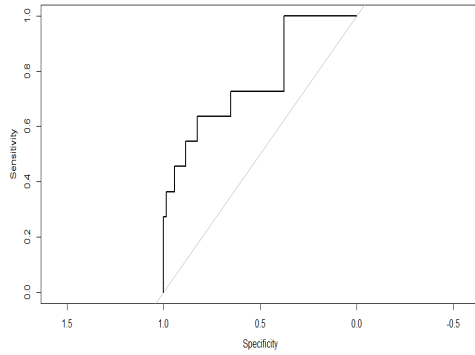
Modified Approach – Lag 2



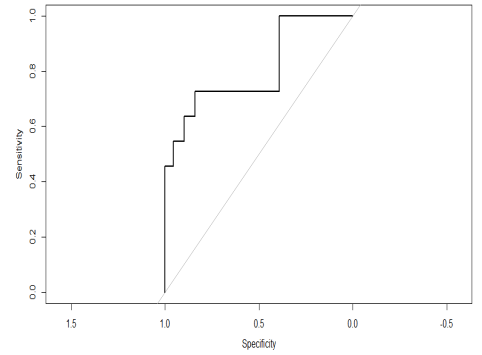
Modified Approach – Lag 3



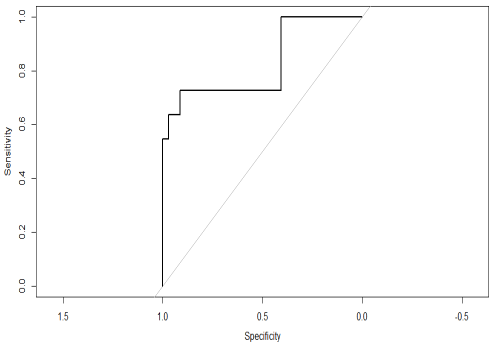
Modified Approach – Lag 4



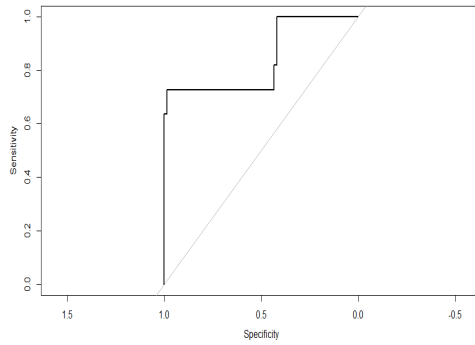
Modified Approach – Lag 5



Modified Approach – Lag 6



Modified Approach – Lag 7



Modified Approach – Lag 8

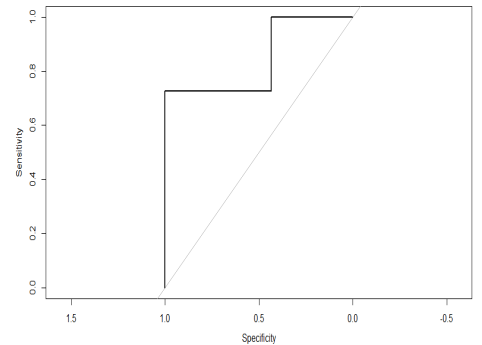
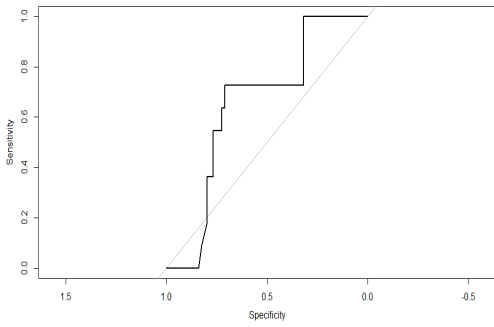
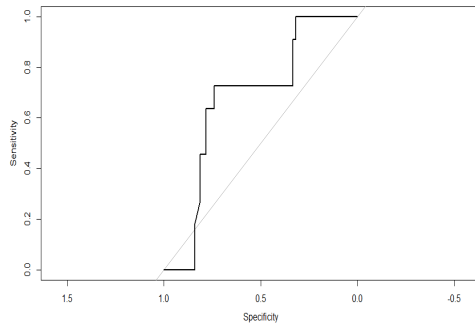


Figure 16. ROC Curve for the Split Currencies Approach: Local Currency

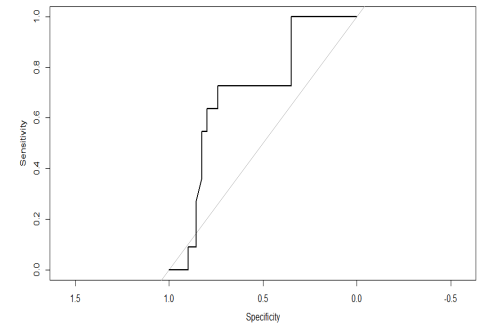
Local Currency – Lag 0



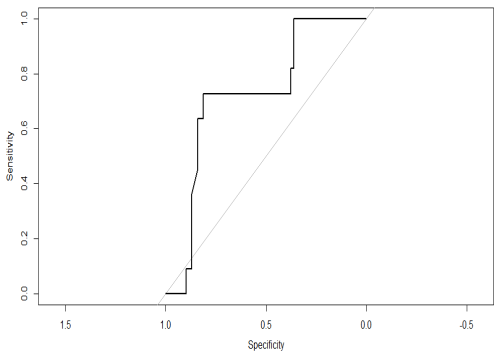
Local Currency – Lag 1



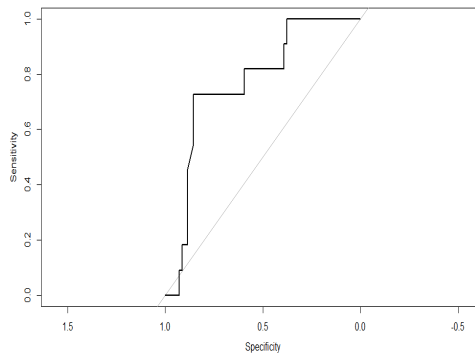
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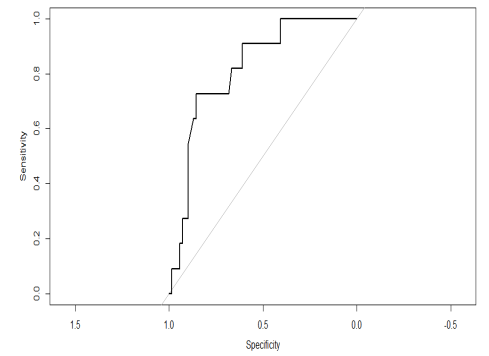
Local Currency – Lag 3



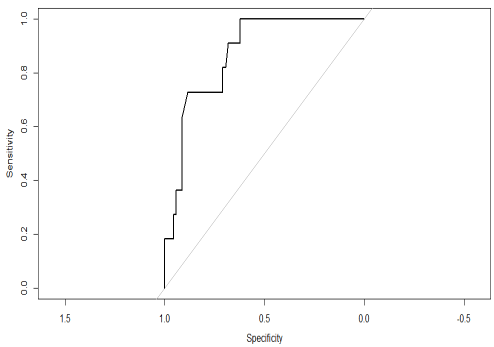
Local Currency – Lag 4



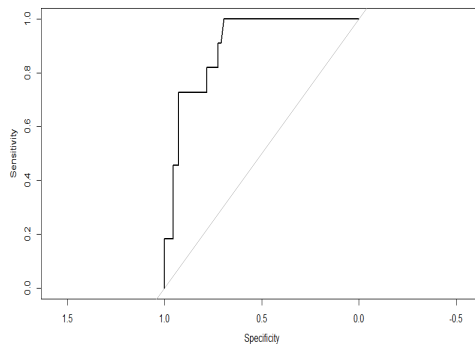
Local Currency – Lag 5



Local Currency – Lag 6



Local Currency – Lag 7



Local Currency – Lag 8

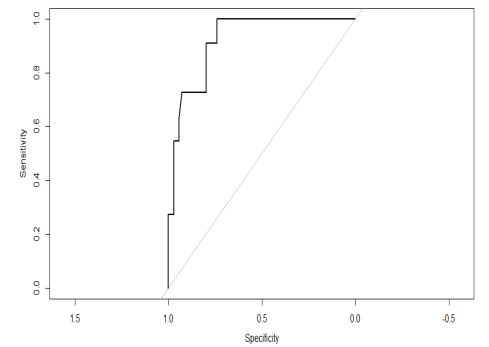
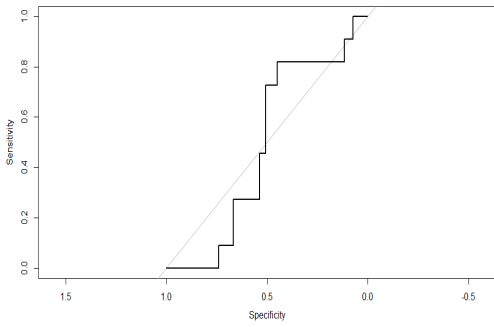
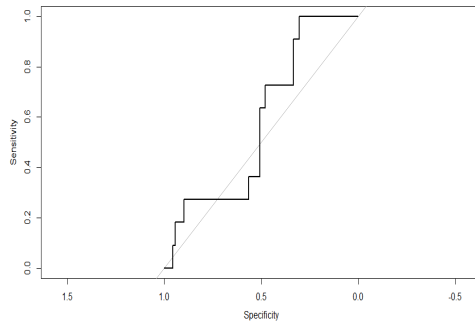


Figure 17. ROC Curve for the Split Currencies Approach: Foreign Currency

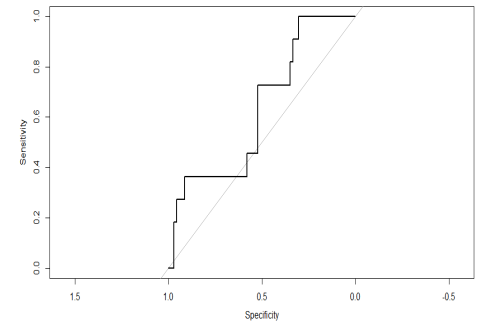
Foreign Currency – Lag 0



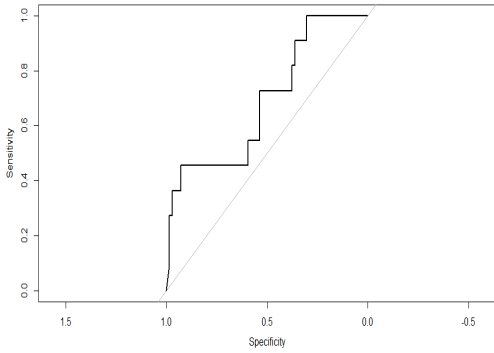
Foreign Currency – Lag 1



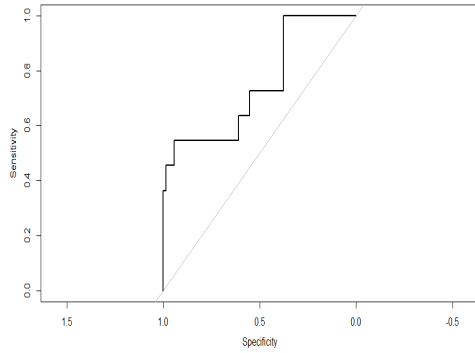
Foreign Currency – Lag 2



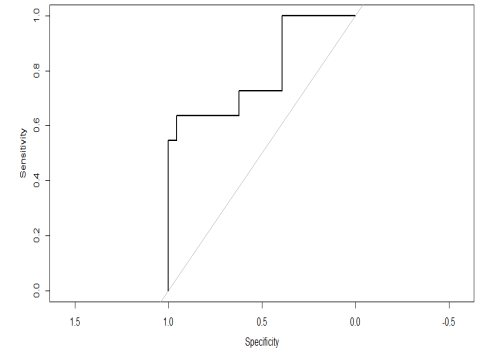
Foreign Currency – Lag 3



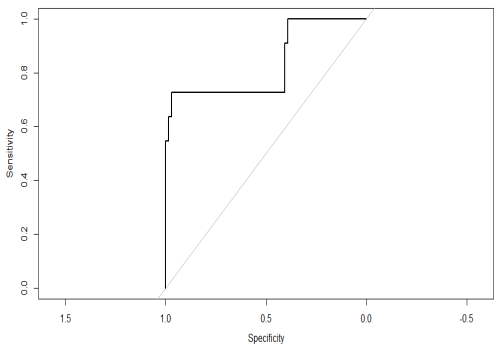
Foreign Currency – Lag 4



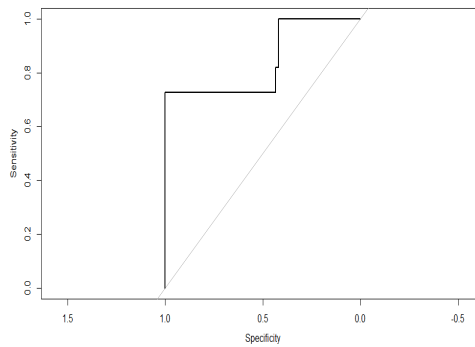
Foreign Currency – Lag 5



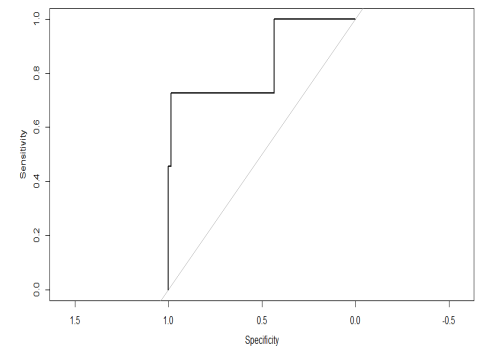
Foreign Currency – Lag 6



Foreign Currency – Lag 7



Foreign Currency – Lag 8

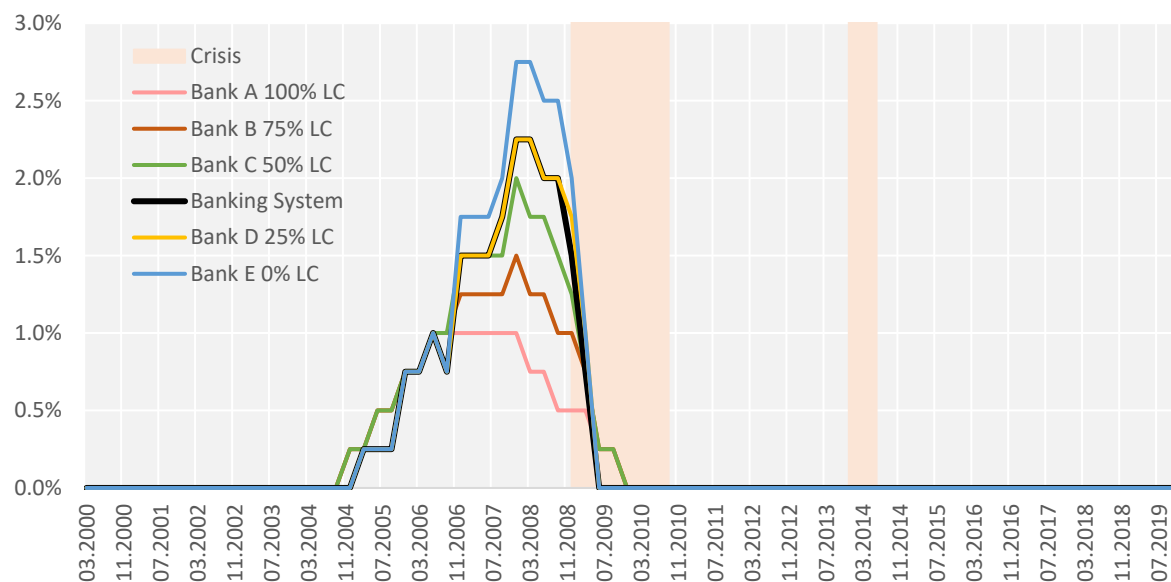


ANNEX 2: ILLUSTRATING THE SPLIT CURRENCIES APPROACH

According to the split currencies approach, the countercyclical capital buffer requirements are set according to the local and foreign currency, which are later implemented by financial institutions according to their share of private credit in local currency and foreign currency. This new approach attempts to maintain the advantages of establishing countercyclical capital buffer requirements based on the macro trends, while allowing enough flexibility that its implementation be done according to the currency structure of a particular institution.

To simulate my results, I have utilized the countercyclical capital buffers computed using the split approach, which I apply to five imaginary banks that have the following share of private credit in local currency: Bank A with 100% in local currency; Bank B with 75%; Bank C with 50%; Bank D with 25%; and Bank E with 0%. Figure 18 provides the countercyclical capital buffer requirement that are illustrated in Figure 11 and 12 when applied to the five imaginary banks that have different currency structure of their private credit portfolio.

Figure 18. Examples of countercyclical capital buffer implementation.



Note: The graph provides five different examples of financial institution implementing the countercyclical capital buffer according to the split currencies approach based on their private credit currency composition.

Source: Author's calculations.