

# Quantity of money in Croatia – a transactional approach

## Summary

This paper proposes a new calculation of monetary aggregate M4 and the quantity of money in Croatia. The existing methodology used by the central bank uses foreign currency as part of monetary aggregate M4 this methodology inflates the quantity of money. This paper takes the foreign currency out of the calculation of monetary aggregates and provides a different quantity of monetary approach to be used. The definition is based on the quantity of money used for transactions the so-called transactional approach. As an additional point of research, the paper investigates the velocity of money using a new aggregate with a special focus on the great recession and post-recession period.

Key words: quantity of money, monetary aggregates, central bank, monetary policy, M4

JEL codes: E41, E51, E52, E58

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## 1. Introduction

The quantity of money is the central variable for both monetary policy and monetary theory. Monetary multiplication is the result of credit activity which should be tied to investing activity. Because of the relationship of monetary variables to the real economic variables, it is fundamental, for a clear understanding of what is happening in the economy, to have reliable and correct data for higher-level monetary aggregates like M3 or M4. Higher-level monetary aggregates represent the quantity of money and the velocity of money reflects economic activity. Economic activity is conducted through transactions between participants in the economy using money.

It is the main contention of this paper that the monetary aggregate M4 in Croatia, as calculated and presented by the Croatian National Bank, is calculated using an inappropriate methodology. The existing methodology of calculating M4 is thus leading to conclusions and econometric testing which gives incorrect interpretations. Incorrect data leads to policy mistakes. The aim of this paper is to investigate the structure of M4 and to provide a new analysis of the quantity of money in the Croatian economy based on the transactional approach to the quantity of money as discussed in Ćirović (1987) and Dimitrijević (1981).

The implications of the quantity of money in the economy have been reintroduced to modern economic research by Milton Friedman. In a series of papers on money and monetary policy Friedman (1976) has pointed out that monetary policy's purpose is not to keep the interest rates low but to provide economic stability. Economic stability was especially important in view of the natural rate which Friedman advocated. The effects of monetary policy on real economic variables were temporary and distortionary because the monetary policy can only cause oscillation around the natural rate, but not the permanent change in the natural rate. For a permanent change in the natural rate, a real economic shock is required. This approach later led to monetary neutrality proposed by Lucas (1972).

In his 1968 American economic association presidential address, Friedman (1968) points out that the relationship of money to real economic variables as presented by the Philips curve can be misleading. Friedman points out that there is no one to one relationship between inflation and unemployment ie. two percent inflation is not always 5% unemployment. Friedman points out that the connection might be in the change of inflation. Thus increasing inflation can temporarily create a rise in employment, but the solution to low unemployment is not perpetually rising inflation because such inflation would lead to economic instability. This point was further shown by Lucas (1973) clearly pointing out that rising inflation does not lead to decreasing unemployment in several countries. A further critique of the models used is now known as the Lucas critique as explained in Lucas (1975). Friedman pointed out that monetary policy is important and relevant but not almighty when it comes to the relationship between monetary and real variables. Friedman was more oriented towards investigating the value of the natural rate of unemployment and not the inflation-output trade-off presented by the Philips curve. Most of his analysis Friedman based on his investigation into the quantity of money.

The relationship of the quantity of money to the rest of economic variables has been a major research topic and as the understanding of monetary policy has changed over time so has the role of the central bank. But regardless of the economic theory, one might prescribe to, the fundamental

fact remains. The central bank controls the quantity of money and any actions to change the quantity of money have to be executed on a transactional level by the central bank. Regardless of the central bank is the conduct of monetary policy an increase or decrease in the quantity of money the balance sheet of the central bank has to reflect the policy and will change depending on the type of the transaction executed. The operations of the central bank and the structure of the monetary system has created a very stable approach to lower level monetary aggregates like M0 and M1.

Credible monetary policy has to be conducted (backed by) actual transactions of the central bank any changes in the balance sheet of the central bank will have effects on the quantity of money and change in the quantity of money will have effects on the price of money leading to changes in economic decisions of economic participants and consequently having real economic effects. The problem with the change in the quantity of money and the conduct of the monetary policy is the determination of how the real variables will be affected when the quantity of money changes.

In order to measure the effects of monetary policy on the economy, we have to have correct data on the quantity of money. This is particularly important in the case of a small open economy with a stable exchange rate like Croatia where the central bank conducts monetary policy via FX transactions. Without the correct data, it is impossible to determine the effects of the monetary policy or to simulate alternative policies to determine the optimal policy given economic conditions.

This brings us to the state of monetary policy in Croatia. After the period of hyperinflation which ended in 1994<sup>1</sup>. the central bank has chosen a nominal currency anchor as the main policy variable. Croatian National Bank has maintained a monetary policy of exchange rate stability ever since Croatian Kuna was introduced in 1994. The monetary policy in Croatia assumes a stable exchange rate leads to low inflation. From the start, there were two problems with this approach. One theoretical and one practical.

The theoretical problem was the implicit implication the exchange rate instability is the only source of inflation. This approach completely disregards other sources of inflation like wage inflation, commodities induced inflation, or inflation caused by expectations. If changes in the exchange rate was the only cause of inflation all small open economies in the world would have stable exchange rates and inflation close to 0. But since there are other sources of inflation, tying monetary policy to just one variable has removed the central bank's ability to act when other sources of inflation emerge. As was seen in Croatia in 2007 when, in spite of the stable exchange rate, the inflation rate went to over 7% primarily caused by the rise in the prices of commodities.

The practical problem is the fact CNB has never developed any other monetary transactions except the FX transactions with the banks. CNB will execute transactions either buying or selling FX when the FX rate changes, these transactions will change the quantity of money in the Croatian economy. This is the reason why CNB does not distinguish between the quantity of HRK and quantities of foreign currency in the Croatian economy. This was pointed out by Vidaković (2016)

The operational problem remains on the demand side of money. When the central bank performs the FX transactions it usually responds to changes in the exchange rate. The change in the exchange rate can be caused by a multitude of factors. The transaction to either buy foreign currency (increase the quantity of kuna in the economy) or sell foreign currency reserves (decrease the quantity of kuna in the economy) will change the quantity of HRK in the Croatian economy, regardless of the actual money demand when the transaction has occurred.

The central bank conducts monetary policy in complete separation from the actual economy and the money demand in the Croatian economy. The central bank does not have an endogenous policy function, but an exogenous policy function. This leads to wild swings in the domestic interest rates as it has occurred in 2009. Because of the monetary arrangement in Croatia, Croatia central bank has never conducted monetary policy focused on domestic demand for money.

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<sup>1</sup> As described in a seminal book Rohatinski et. al (1995).

The standard approach to the quantity of money is to look at money through monetary aggregates. The definition of aggregates varies. For a comprehensive study of definitions of monetary aggregates see Lim and Sriram (2003). The definition used by CNB is focused on both domestic and foreign currency. This approach does not differentiate the two separate markets for money. The domestic demand for domestic money and domestic demand for foreign money. While foreign money is used for international transactions and savings in Croatia, domestic money is used for domestic transactions which are part of the economic activity.

This lack of separation of domestic money HRK and foreign money<sup>2</sup> leads to a misunderstanding regarding the monetary policy conducted in Croatia and effects of monetary policy on the Croatian economy. Precisely because of this fundamental economic analysis in the vein of Friedman and Lucas is hard to perform in Croatia.

The objective of this paper is to determine the quantity of domestic money in the economy and consequently propose a new approach to M4 and provide new data set for economic analysis.

The paper is structured as follows. In part two we are going to investigate the theoretical difference between traditional M4 calculation and the transactional M4. Part three calculates transactional M4. Part four investigates the monetary multiplier and part five investigates the velocity of money. Part six is the discussion of the main finding of the paper. Part seven concludes.

## **2. Theory of what is money in the economy**

Before we go into deep analysis it is important to have a truly clear understanding of what the paper is focused on. This paper focuses on the broadest money in the economy, which is known as M4 monetary aggregate in Croatia. The lower order monetary aggregates are not part of the investigation in this paper since there is a consensus on what M0 and M1 are.

Apart from the mentioned Lim and Sriram (2003) other authors have investigated monetary aggregates and what should be included in monetary aggregates. Walter (1989) provides how the monetary aggregates have changed over time in the USA: Yueh-Yun (2006) provides a comprehensive overview of the aggregates across countries. The discussion of what should be included in monetary aggregates is not limited to USA. For example Khan ul Hasanm, and Fida (2005) provide an investigation of what should be appropriate monetary aggregates in Pakistan.

There are two ways to approach the quantity of money in the economy. The first one is focused on liquid financial assets that have related to other economic variables like income. The second approach is to focus on the money used for transactions in the economy.

The first approach is based on Friedman and Meilseman (1963) the paper which provides what is known as the F-M framework. The approach used by F-M focused on higher-order monetary aggregates as high liquid financial assets. Over the years the definition of higher-order monetary aggregates was also supplemented with assets like treasury bills, money market funds. This approach was criticized by Ando and Modigliani (1965). In another investigation of money Friedman and Schwartz (1970) book investigate what can be used as money over and what are the implications of the quantity of money in the USA over a long period of time. In Croatia, F-M approach was investigated by Svilikos (2012).

The second approach is focused on money as a means of transaction. Money is used for transactional purposes in the economy: to buy or sell goods or services. This is the approach used in Ćirović (1987) and Dimitrijević (1981). This approach views money as a means to conduct the actual economy in the economy. There are two views to look at Dimitrijević and Ćirović approach

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<sup>2</sup> The foreign money in Croatia was traditionally Deutsche Mark and now it is Euro.

(D-Ć approach). The first is to use actual money used for transactions. In this case, money is the currency in circulation and checking deposits owned by all economic participants. Since actual payments are done through money or CNB regulated payment system. We can call this the “narrow” approach to transactional money. The second approach is to determine other assets can be used as money for transactions. This encompasses all HRK in the economy.

It is the main point of this paper that the D-Ć transactional approach to the investigation into the quantity of money is more suitable in the case of Croatia. Using the second approach to higher-order monetary aggregates leads to interesting implications for both monetary and real variables some of which are investigated in this paper.

Ćirović (1987) points out that transactional money is hard to define and should be narrower than the total money in the economy. This is the approach we also take. The definition of M4 as provided by the Croatian national bank is:

*Broadest money (M4) comprises money (M1), savings and time deposits, foreign currency deposits as well as bonds and money market instruments and money market funds' shares/units (all components are taken over from the Consolidated balance sheet of monetary financial institutions<sup>3</sup>.*

Following the reasoning of Ćirović (1987) in this paper we are going to define transactional money as CNB M4 minus foreign currency in the Consolidated balance sheet of monetary financial institutions. So we are taking out the FC component of the CNB M4 and defining the remaining quantity as the transactional M4 or quantity of HRK in the Croatian economy.

Before we move on it should be clearly stated that using foreign currency in M4 is not unusual and exceptional for Croatia. As Yueh-Yun (2006) points out foreign currency is part of M4 in countries like Canada, a large economy, and Island, a small open economy. There is also a middle ground. Mexico uses USD deposits as part of monetary aggregates, but not other foreign currencies.

Using the approach or the F-M framework it is completely understandable CNB used foreign currency deposits in the M4, however using the second approach of the money as a way to conduct transactions in the economy, foreign currency deposits should be excluded from the definition. The explanation of why foreign currency should be excluded from M4 is given in the next chapter.

## **2.1. Quantity of kuna in the economy**

It can be seen from the definition Croatian national bank uses foreign currency deposits as a definition of quantity of money in Croatia. This definition is not suitable for the Croatian economy and using the D-Ć approach is much more appropriate. What is especially important is that using the D-Ć approach paints a different picture of monetary policy in Croatia.

The existence of significant amounts of Euro in the Croatian economy cannot be denied. There is a long-standing tradition of Croatians save in foreign currency. First the Deutsche Mark and now in Euro. FC currency can be found in the aggregate bank's balance sheet. FC deposits are 53%% of all deposits<sup>4</sup>. The fact retail deposits are in Euro is not itself the reason to use FC deposits in the M4 monetary aggregate. Euro is not domestic money and should not be included in the monetary aggregate. The explanation follows because of several reasons.

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<sup>3</sup> <https://www.hnb.hr/en/statistics/statistical-data/financial-sector/monetary-and-credit-aggregates>

<sup>4</sup> Data as of 31.12.2019.

First of all, the Euro is not used for payments in Croatia. Domestic transactions in Croatia are conducted in domestic currency. Although some prices like tourist apartments and prices of housing are listed in Euro. Housing prices in Croatia are prices in Euros (apartment might cost 2000 € per square meter). Some used cars are also sometimes priced in Euros. The third category is the tourist apartments. But all of the above transactions legally have to be performed in the domestic currency.

The second reason is the fact that most banking loans are not in foreign currency. The loans are mostly in HRK or with foreign currency clause, but not in actual foreign currency. This is simple to verify through data. At the end of July 2020 loans to corporations and households were 77% of total banking loans. Out of this only, 7,72% were loans in foreign currency. If we include the government as well total lending to these three sectors are 95,7% of loans and the percentage of loans in foreign currency is still only 7,4%. So the data clearly confirms that the lending in FC is an almost insignificant part of the total lending activity.

The lending mechanism of the foreign currency clause is especially important to understand. How does a foreign currency clause loan work in terms of actual liquidity impact on the bank? This type of loan is denominated in foreign currency for the purpose of accounting. Once the bank issues a loan, the loan is booked as the amount of euros converted to HRK using the middle exchange rate as defined by the Croatian national bank. From a foreign currency risk point of view, the loan is in foreign currency. Changes in the value of euro vs. HRK will change the value of the loan on the bank's balance sheet. However, in terms of the actual liquidity when the loan is paid out to the customer, the loan is paid out in domestic currency. The bank pays out the loan in HRK and when the annuities are paid back the annuities are stated in foreign currency, but the actual payments are in done in domestic currency. From the perspective of the bank's liquidity foreign currency clause loans are loans in HRK. This duality is a strong reason why to use the D-C approach to the quantity of money: most lending in Croatia in terms of liquidity is in the local currency, not foreign currency.

The above case strongly points to the fact the FC in a bank's liabilities can not be counted as money because of the simple fact the FC from the bank's liabilities is not much used in banks for lending at a transactional level. HRK is used for lending and FC is used for accounting purposes. If the case was reversed the whole point of this paper would be moot.

The third reason why foreign currency deposits cannot be equated with domestic money in terms of the monetary aggregates is the fact that a loan might or might not have an impact on the bank's liquidity. As described in Gregurek and Vidaković (2013) it is important to understand that not all loans have an impact on a bank's liquidity.

Let us look at the case when a customer has an account with the bank. The accounting process of a loan in a foreign currency clause goes like this: when the bank gives out a loan to the customer, on the assets side the bank increases the number of loans; on the liabilities side it increases the amount of money in the client's checking account. This process is the process of monetary multiplication, as we can see in this example the quantity of loans and the quantity of money has increased, but there was no impact on the bank's liquidity. Since the foreign currency clause loans are paid out in HRK the increase in the customer's account will be on his account in HRK. The change in the bank's liquidity will occur when the client uses the loaned funds.

The above reasoning is connected to the second reason for not including FC in M4. As shown in the above paragraph the monetary multiplication is done in HRK, not in FC in the case when the loans are in foreign currency clause.

The fourth reason why euro deposits cannot be used as money for monetary aggregates, calculation lies in the bank's liabilities. We already mentioned Croatians save in euro, but in case a saver wants to use the money for purchases, the euros will have to be converted into HRK since payments in Croatia are done in domestic, not in foreign currency.

The fifth reason is the most important one and it involves the monetary operations of the Croatian national bank. CNB conducts monetary operations only when there is a change in the exchange rate of HRK vs. EUR. Monetary operations might be caused by the inflow of foreign currency (increase in foreign currency deposits in banks) but not all increases in the foreign currency deposits are sterilized by the monetary operations. Also, the change in the foreign currency deposits might or might not create a reason for the monetary operation of the central bank. The actual monetary operations are caused by multiple reasons and are not connected with the changes in foreign currency deposits in the banks. This will be analyzed much more in the chapter on the velocity of money.

The sixth reason why foreign currency should not be used in the calculation for M4 is simple: there is no money multiplication. Croatian central bank cannot produce euros. However, even if we disregard this fact the foreign currency does not get multiplied in the Croatian banking system, once the foreign currency deposits do enter the bank's balance sheet it stays there as we have explained in reason number four. The counterpart of deposits in euros in the assets is not a loan in foreign currency, but a loan in foreign currency clause which is paid out in domestic currency. For money to be money it has to be multiplied through the banking system and only then reflected in the monetary aggregates. Croatian central bank does not create euros in M0 and since the loans are not paid out in foreign currency, but in the domestic currency, Euros cannot multiply through the credit process.

There is a possible explanation why foreign currency deposits should be included in M4 and it goes something like this: since FC deposits are not used for lending and HRK for the banks to be able to lend HRK while indexing in foreign currency, the Central bank has to buy the FC from domestic banks. Because of this, the central bank must purchase FC from the bank which was obtained from deposits. So eventually those FC deposits do get converted into HRK. This argument does not hold. The amount of total foreign currency interventions from 2000<sup>5</sup> is only 44,3 billion HRK net while the total growth of foreign currency deposits is 179 billion HRK. Even if we adjust the number here for the regulation, and monetary multiplication since a portion of regulation is held in FC the number still does not come close to justifying the inclusion of FC deposits in M4.

Another argument why not use the transactional approach and that is the fact that transactional and currency approach leads to the same results in terms of quantity of money. Croatian kuna is used for transactions in Croatia and Euro is not. But Euros can be freely and at any time converted into HRK, therefore Euro can also be included in M4 using the transactional methodology proposed by this paper. This is an appealing argument but it has a serious structural flaw. Foreign currency deposits held by corporations should be mostly used for international transactions. It is hard to determine how much of the net FC corporate deposits will be converted into HRK to be used for domestic transactions. And how much HRK will be converted into FC for international transactions? As for the FC households deposits, their microstructure is exceptionally diverse and choice of conversion depends on a single household's need for money not the aggregate households' demand for domestic money. They could be converted into HRK for transactions, but savings by definition represent wealth put aside not to be spent. Therefore from a theoretical point of view, FC retail savings could be converted into HRK and used for transactions, but from a practical point of view that is hard to interpret since savings in banks are steadily increasing over time even during the times of recession.

Therefore the calculation of the quantity of money in terms of M4 in Croatia has to be recalculated to exclude foreign currency deposits in order to obtain a new variable: the transactional quantity of money. This will be done in the next chapter.

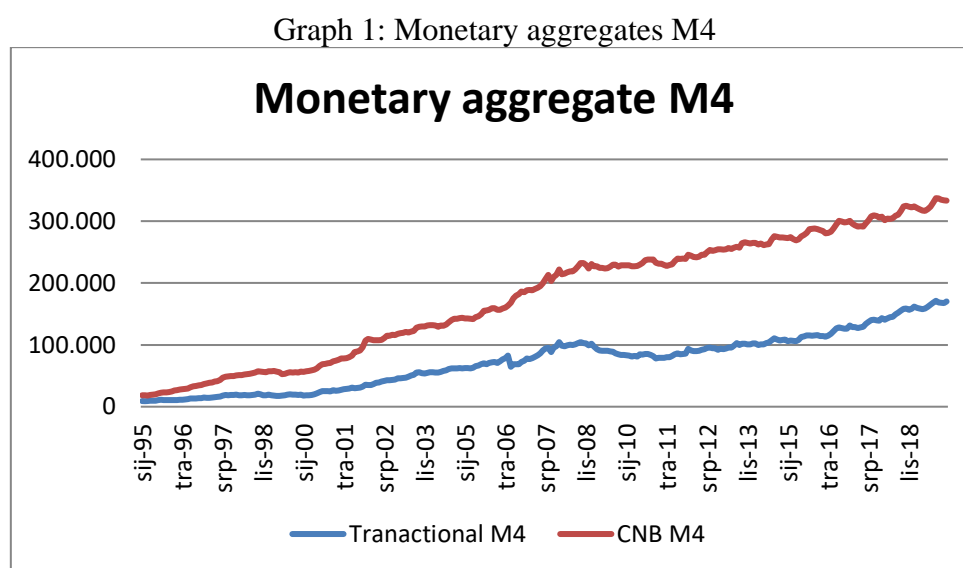
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<sup>5</sup> Since the data is available

### 3. Monetary aggregate based on transactional money

In this part of the paper, we are going to investigate the size and the implication of monetary aggregates as presented by the CNB's official calculation and the ones used in this paper which will be calculated using the transactional approach.

CNB publishes data on monetary aggregates. In order to obtain the HRK component of M4 or as this paper will define it "the transactional M4" the foreign currency is subtracted from CNB M4 data using the methodology we have described. Because we have subtracted the foreign currency from the M4 we now get pure domestic currency quantity of money in the Croatian economy. The graph below shows us the CNB M4 and the transactional M4.



Source: Author's calculation and CNB

From the graph, we can now see two completely different pictures of the quantity of money in the Croatian economy. Both series are increasing but at different rates. It is also important to look at the changes in the quantity of money during the period of the great recession.

Table 1: quantity of money during great recession

	2008	2009	2010	2011	2012	2013	2014
<b>CNB M4</b>	223.456,7	226.745,6	232.092,8	234.820,2	248.245,6	259.781,1	268.216,6
<b>Transactional M4</b>	100.779,5	89.060,1	82.762,0	83.236,7	92.688,5	98.853,1	105.014,5
<b>GDP growth rates</b>	1,76%	-7,36%	-1,50%	-0,31%	-2,24%	-0,55%	-0,10%

Source: author's calculation, CNB and Croatian Statistical institute<sup>6</sup>

What we can see are two completely different pictures of monetary policy during the great recession. If we look just at the CNB M4 we can see that the quantity of money in the economy during the great recession is increasing. From this, it is easy to conclude the monetary policy

<sup>6</sup> Monetary aggregates data is in million HRK and annual averages.



conducted by the CNB during the recession was expansionary since M4 is constantly increasing. But if we look at the transactional M4, which is focused only on HRK in the Croatian economy we see monetary policy was contractionary in terms of HRK. During the worst global recession in decades, CNB has actually decreased the quantity of HRK in the Croatian economy.

It is true that CNB has conducted expansionary monetary policy by decreasing regulation, but the decrease in regulation was focused on regulation for foreign currency, not for domestic currency. This can be clearly seen by the overall increase in the quantity of money, but that increase is driven by an increase in the foreign currency component of M4, while transactional M4 is decreasing. This data paints a different picture of monetary policy in Croatia during the great recession.

#### 4. Monetary multiplier

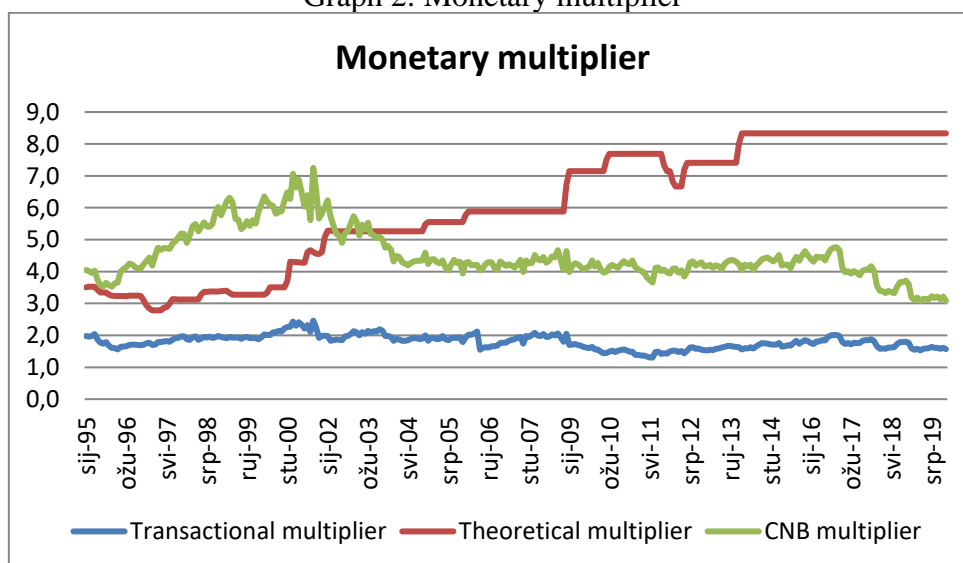
We are going to use three categories of the monetary multiplier. The first one is a straight textbook multiplier  $1/RR$ . The data for this is taken from the CNB's website. The category is called the "CNB average reserve requirement" since the number represents the average reserve requirement for the month. The data used is average because there were frequent changes in the reserve requirement from month to month. The second data is the CNB M4 divided by M0. In theory the calculation of  $1/RR \approx M4/M0$ .

The two monetary multipliers can be put into relation. The first ratio ( $1/RR$ ) is the theoretical amount of how much money there should be in the economy and the second ratio is the actual quantity of money in the economy. If the monetary structure of the economy is normal and monetary multiplication is occurring through normal transaction the close equivalent of the ratios should hold.

The third monetary multiplier calculation is the transactional M4 which we calculated in this paper divided by M0. This ratio will give us the true amount of how much HRK is multiplied in the economy.

As we can see from the graph below there is a considerable difference between the theoretical and real monetary multipliers.

Graph 2: Monetary multiplier



Source: Author's calculation

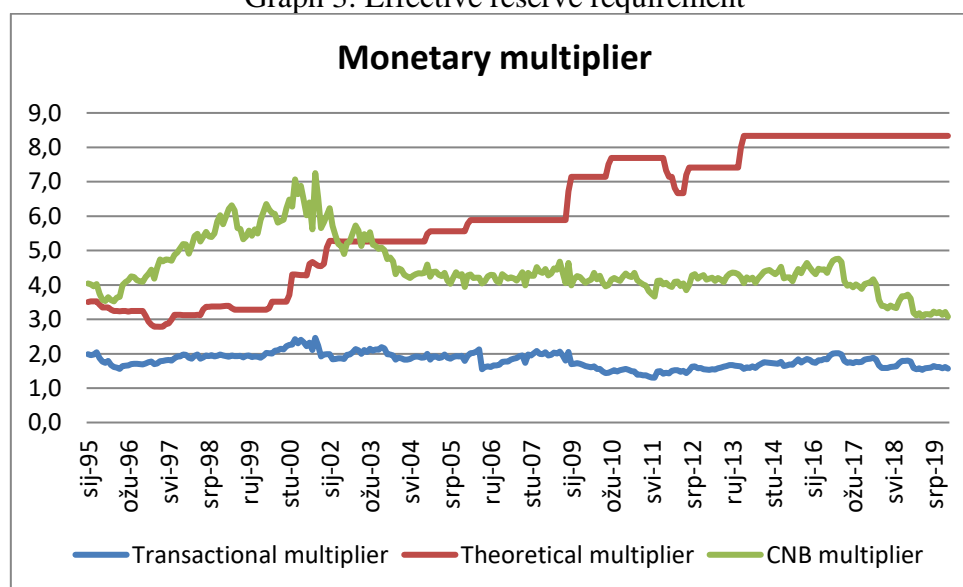
The simple question is: why there is such a difference between the real data and theoretical foundations for both transactional and CNB multiplier? The calculation of the monetary multiplier is simple. In the long run, the theoretical and monetary multiplier should be approximately the same, however, in Croatia, they are vastly different. The main reason for the difference is the currency structure of the reserve requirement in Croatia. CNB has the same reserve requirement for both domestic currency and foreign currency in terms of the actual percentage of the reserve requirement. However, the actual reserve requirement currency is the same as the bank's liabilities currency used to calculate the required reserve requirement. In the case of HRK liabilities, 100% of the reserve requirement is paid in domestic currency. In the case of foreign currency, 75% of the reserve requirement is paid in foreign currency, while the rest is paid in domestic currency<sup>7</sup>. This effectively means that the reserve requirement for HRK is higher because HRK is used to pay reserve requirements for both bank's liabilities in local and foreign currency. This regulation makes the reserve requirement on domestic currency much higher than the theoretical value.

#### 4.1. Monetary multiplier with new aggregates

We can now focus on the third category in graph 2, the transactional monetary multiplier and the real reserve requirement in Croatia on HRK liabilities. We can see that the transactional monetary multiplier on HRK is exceptionally low. It has been around 2 for the whole period of observation.

We will now use reverse engineering. Using the transactional monetary multiplier from graph 2 we are going to use the theoretical calculation of  $1/RR$  to obtain the effective reserve requirement of Croatian kuna. This calculation is shown in the graph below together with the official reserve requirement.

Graph 3: Effective reserve requirement



Source: Author's calculation and CNB

From the graph, we clearly see the reserve requirement on HRK is on average around 50% in the data period. The natural question is: why is that?

<sup>7</sup> <https://www.hnb.hr/temeljne-funkcije/monetarna-politika/instrumenti/obvezna-pricuva>

The explanation is three-fold. The first explanation has already been given. The part of reserve requirement on foreign currency funds in the bank's balance sheet is paid in domestic currency. This immobilizes a significant portion of domestic currency thus effectively increasing the actual reserve requirement on the domestic currency. The second explanation is that HRK is used for payments in the economy, so the banks have to maintain a portion of their balance sheet in cash and liquidity reserves above the theoretical reserve requirement. Also as we have already explained most of the lending is in domestic currency so the banks have to keep excess liquidity reserves in domestic currency in order to be able to lend loans with foreign currency clause. This causes the difference between the real and theoretical monetary multiplier since the banks can not lend all of the funds they have received from their deposits. The third reason is connected with the second one and it relates to the actual conduct of monetary policy in Croatia. Until the COVID crisis, CNB has conducted monetary policy exclusively through foreign currency interventions. Since the banks do not know when the next intervention is going to occur, they are forced to maintain another liquidity cushion in domestic currency in order to have enough HRK liquidity after the CNB interventions.

From the three explanations we have provided we can see that there are in fact three sets of liquidity reserves the banks in Croatia has to maintain. The first one is standard liquidity in any given currency. This liquidity is used for the buffer in case there is a decrease in the payments inflow into the bank. The second liquidity is lending liquidity. The banks have to maintain enough liquidity for lending because foreign currency loans are paid out in HRK. The third liquidity buffer we can call CNB intervention liquidity. All three of these liquidity sets in act block a significant portion of domestic currency thus making the monetary multiplier so low.

## 5. Velocity of money

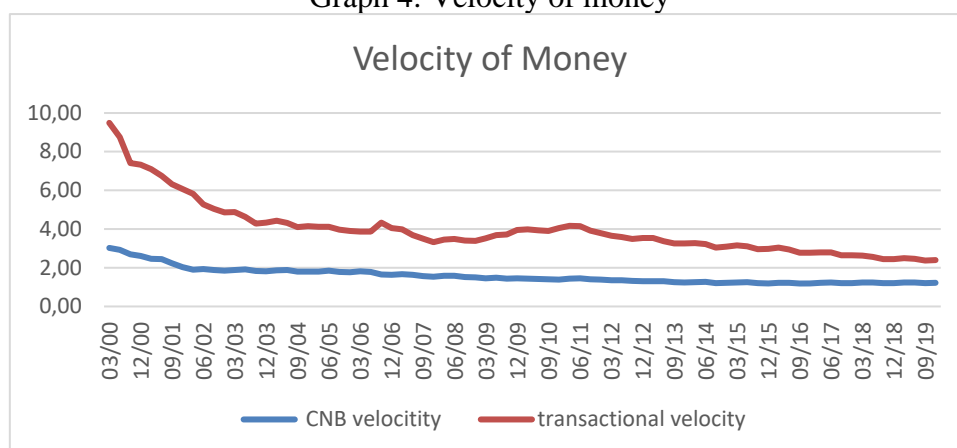
Following the theoretical construct proposed by Dimitrijević (1981) in this chapter we are going to focus on the velocity of money. Dimitrijević proposed that the central bank should focus on the number of transactions in the economy in order to determine the conduct of monetary policy. In case there is an increase in the number of transactions in the economy the central bank should interpret this increase in the amount of transaction as a sign there is an increase in the economic activity. An increase in real economic activity should be followed by an increase in the quantity of money up to the point when inflation does not increase. A decrease in the number of transactions should be interpreted as a decrease in economic activity and deflationary. To a decrease in the number of transactions, the central bank should respond by an increase in the quantity of money in order to facilitate the number of payments in the economy.

Dimitrijević's reasoning is completely at odds with Friedman. While Friedman argued the velocity of money is constant, Dimitrijević takes the opposite view, the velocity of money is always changing and monetary policy should be adjusted depending on the changes in the velocity of money at the current state of the economy. This approach actually makes the velocity of money a part of the central bank's policy function.

Although this line of conduct of monetary policy has not been pursued in either theory or practice of monetary policy it is useful for us. In order to follow this line of research in the future, the initial point of reference has to be the velocity of money as defined by quantitative equation  $MV=PQ$  where  $V=PQ/M$ . In our case, we are going to investigate the velocity of money using the M4 monetary aggregates which we have used in this paper.

The methodology used is as follows. Seasonally adjusted quarterly data for GDP is divided by the average amount of money in a quarter. The seasonally adjusted quarterly GDP is divided by both CNB M4 and the transactional M4. The change of velocity of money over time is provided in the graph below.

Graph 4: Velocity of money



Source: Author's calculation

What we can see from both series the velocity of money is decreasing over time which clearly points to the decrease in overall economic activity. It is not surprising that real velocity is higher for the CNB M4 velocity this is for the transactional M4. This is understandable since transactional M4 is smaller than CNB M4. What is important is the decreasing trend in the velocity of money.

The two data sets point to two different interpretations of the quantity of money theory. It would be extremely interesting to see the repeat of the research done on the velocity of money by Benazić and Tomić (2020) using two data sets from this paper.

## 6. Implications of the analysis

This paper has opened the topic of research which has been fundamentally neglected in Croatian: quantity of money. There has been significant research on money demand and on the changes in the money supply in Croatia, but the fundamental definitions were missing.

Previously in the paper, it has been demonstrated foreign currency deposits should not be part of the money in Croatia and are not part of the monetary multiplication process, consequently they should be excluded from the M4 aggregate, especially for policy analysis. Foreign currency deposits are part of the bank's balance sheet but are not domestic money since FC is not used for domestic economic activity.

The transactional methodology has provided us with an alternative data set which can be used to interpret the effects of monetary policy in Croatia. The focus of the paper was on two main monetary variables: monetary multiplier and velocity of money.

The transactional monetary multiplier shows an exceptionally restrictive monetary policy on the domestic currency. From the data calculated the effective reserve requirement on the domestic currency in Croatia is around 50% from 1995 on. From the moment the anti-inflationary program in Croatia was implemented the CNB has conducted an exceptional restrictive domestic currency monetary policy.

The implications of such a high reserve requirement are multiple. The high reserve requirement is the answer to why domestic currency lending never took off, the answer is simple. The cost of domestic currency funds was simply too high for banks to lend. At the same time, the monetary framework has made HRK precious to banks. In order to preserve HRK liquidity, the banks have focused their lending on quazy foreign currency lending while maintaining ample domestic currency liquidity reserves.

This line of reasoning points to another direction and that is the Central bank lend euroization. Because the reserve requirement on domestic currency was so high banking balance sheet euroization is a by-product of a reverse reserve requirement policy. High reserve requirement on foreign currency and lower reserve requirement on domestic currency would have decreased banking euroization in Croatia and led to the opposite effect. This is an important topic for future research.

The Paper also investigates the velocity of money an exceptionally neglected topic of research among Croatian economists. Clearly, the velocity of money is not constant regardless of what monetary aggregate we use, but the implications of changes in the velocity of money over time have not been researched. Significant progress in the right direction has been made by Benazić and Tomić (2020).

The paper shows a different quantity of money and paints a different picture of the monetary policy in Croatia, particularly during the period of the great recession. While CNB has maintained the position, monetary policy was highly accommodative during the great recession we can see that was not the case. The quantity of Croatian Kuna during the recession years has decreased causing a prolonged period of decrease in GDP. This is another important research topic that requires further econometric testing.

Using the approach proposed in this paper it would be interesting to see the results of papers like Kotarski, and Deskar-Škrbić Milan (2016). Jakšić (2008). Mance, Mance, and Žiković (2015). Bošnjak, Novak, Krišto, (2018). If testing from these papers yields the same results using CNB M4 and transactional M4, then the main point of this paper will be null and void.

The fundamental point is the fact that CNB uses foreign currency for the calculation of the quantity of money in Croatia. This is shown to be incorrect. The paper then provides new calculations and paints a different picture of the monetary policy and has different calculations of the quantity of money in the economy over a long period of time. The data from this paper and future research requires significant investigation into the nature of monetary policy in Croatia.

With the data set provided by the author, there is an ample opportunity for new research. The next step would be to use the data for both econometric and mathematical models of effects of monetary policy on real and monetary economic variables for the larger time periods and run regressions using both CNB M4 and the transactional M4 provided in this paper. The research point would be an in-depth econometric investigation of monetary policy during the Great recession with special investigation into the relationship of the quantity of money with real economic like GDP, employment, and other monetary variables like inflation and real exchange rate. On the policy front, the new data set provides an opportunity to develop new mechanisms of financial transactions for the central bank to use during the crisis period. This will be done in future papers by me and my coauthors.

Another line of investigation is monetary policy during the COVID crisis using real M4 and the new transactions implemented by the CNB to decrease the negative effects of the crisis. Because of the nature of the investigation of monetary policy in this paper the COVID data was deliberately left out. The explanation is simple, this period requires a separate paper in order to investigate monetary policy in 2020.

Lastly, an important point is to address the overall monetary policy conducted by the CNB. For decades the CNB has maintained three firm postulates. First Croatia is a highly euroized country. Second, the interest rates channel of monetary policy does not work. Third, there is nothing that can be done to change the first two postulates. This paper shows the main reason why the CNB has maintained such postulates is a complete lack of understanding of monetary variables in the Croatian economy. Incorrect data in the form of the wrong methodology to calculate M4 has obscured the monetary relationships in Croatia. CNB saw nothing wrong with the monetary policy

because it was using the wrong data. By looking at their M4 aggregates the monetary policy was expansionary, this paper has clearly shown it was not.

The data from this paper can be used to completely reassess the quality of monetary policy in Croatia, especially when it comes to the so-called macro-prudential regulation. While there is a myriad of a regulation which CNB has imposed over the years, from this paper it is clear the central theme of the monetary policy was to make domestic currency expensive and decrease the overall economic activity which can be seen from the decrease in the velocity of money.

Even from this small overview, it is clear the data provided from this paper offers a new view of the monetary policy in Croatia and a new fruitful field of research for the future.

## 7. Conclusion

As we have seen in this paper the quantity of money as presented by the Croatian central bank is vastly different from the calculation presented in this paper. The main thesis of the paper is that foreign currency deposits cannot be used for the calculation of M4 monetary aggregates. The paper presents logical proof of why this methodology is wrong. Instead of the standard F-M framework for the calculation of monetary aggregates, this paper proposes a new D-C framework to calculate M4 focused on domestic money used for transactions, not the whole money in the economy which also includes foreign currency.

Using the new methodology for the monetary aggregate M4 the paper calculates transactional M4 which only has a domestic currency component. Using transactional M4, monetary multiplier, and the velocity of money is calculated. The new data sets give a new perspective of monetary policy and the effects of monetary policy in Croatia.

The paper also implies that there are significant changes in the behavior of economic participants and state of the economic during different phases of the business cycle as can be viewed in the velocity of money which is clearly not constant over time.

The new data set provided by this paper also leads to new possibilities for research because with the new data effects of the monetary policy on the real economy can now be evaluated.

## Bibliography

Ando, A., & Modigliani, F. (1965). The Relative Stability of Monetary Velocity and the Investment Multiplier *The American Economic Review* 55(4), 693-728

Benazić, M., & Rami, J. (2016). Monetary policy and unemployment in Croatia. *Economic research - Ekonomska istraživanja* 29(1), 1038-1049

Benazić, M, & Tomić, D. (2020). Testing the Stability of Money Multipliers for Croatia, unpublished manuscript

Bošnjak, M., Novak, I., & Krišto, I. (2018). Monetary and absorption approach to explain the Croatian current account *Zbornik radova Ekonomskog fakulteta u Rijeci* 36(2), 929-946.

Broaddus, A. (1975). "Aggregating the Monetary Aggregates: Concepts and Issues", *Economic Review*, Federal Reserve Bank of Richmond (November/December) pp 3-12.

Ćirović, M. (1987) *Monetarna ekonomija* European centre for peace and development University for Peace, Beograd 367 pages

- Dimitrijević, D. (1981). *Monetarna analiza* Institut Edvard Kardelj Niš 499 pages
- Friedman M. (1968). The Role of Monetary Policy. *American Economic Review* 58(1), 1–17
- Friedman M. (1969). *The Optimum Quantity of Money*. Chicago: Aldine Publishing 296 str.
- Friedman, M. & Meiselman, D. (1963). "The Relative Stability of Monetary Velocity and the Investment Multiplier in the United State, 1897-1958" in Commission on *Money and Credit, Stabilization Policies*, Englewood Cliffs 1963.
- Friedman, M., & Schwartz, A. (1970). "Monetary Statistics of United States: Estimates, Sources, Methods", National Bureau of Economic Research, New York.
- Gregurek, M. & Vidaković N. (2013). *Bankarsko poslovanje Effectus* Zagreb, 600 pages
- Jakšić, S. (2008) "Utjecaj monetarnog agregata M4 i kamatnih stopa na CROBEX." *Zbornik Ekonomskog fakulteta u Zagrebu* 6I(1), 131-139
- Khan ul Hasanm, M., & Hussain, F. (2005). "Monetary Aggregates in Pakistan: Theoretical and Empirical Underpinnings," SBP Working Paper Series 07, State Bank of Pakistan, Research Department.
- Kotarski, K., & Deskar-Škrbić M. (2016). Transcending the new macroeconomic orthodoxy in the Eurozone: a Post-Keynesian view." *Zbornik radova Ekonomskog fakulteta u Rijeci* 34(2), 419-441.
- Lim, E.-G. & Sriram, S. (2003). Factors Underlying the Definition of Broad Money: An Examination of Recent U.S. Monetary Statistics and Practices of Other Countries. International Monetary Fund, IMF Working Papers. 03.
- Lucas, R. (1972). Expectations and the neutrality of money *Journal of Economic Theory* 42 103-124
- Lucas, R. (1973). Some International Evidence on Output-Inflation Tradeoffs. *American Economic Review* 63(3), 326-345
- Lucas, R. (1975). Econometric Policy Evaluation: A Critique, in K. Brunner and A. Meltzer, eds., *The Phillips Curve and Labor Markets*, North-Holland,
- Mance, D., Mance D., & Žiković S. (2015). Econometric Analysis of Croatia's Proclaimed Foreign Exchange Rate *South East European Journal of Economics and Business*, 10(1), 7-17,.
- Rohatinski Ž., Anušić Z., & Šonje, V. (1995). Put u nisku inflaciju Hrvatska 1993-1994. Vlada Republike Hrvatske , Zagreb 171 pages
- Svilokos, T. (2012). Determinants of Croatian Money Supply // 1st International M-sphere conference for Multidisciplinarity in Science and Business Dubrovnik, 2012. str. 549-561
- Vidaković, N. (2016) *Monetary and credit analysis Effectus*, Zagreb, 568 pages.
- Walter, J. (1989). Monetary aggregates: a user's guide *Economic Review*, Federal Reserve Bank of Richmond, vol. 75(Jan). pages 20-28.
- O'Brien, Y-Y. C. (2006). "Measurement of monetary aggregates across countries," Finance and Economics Discussion Series 2007-02, Board of Governors of the Federal Reserve System (U.S.)