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A Theoretical Analysis of Money Supply for Libya

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دالة عرض النقود في ليبيا: دراسة تحليلية

المستخلص

هذه الدراسة تهدف إلى إجراء دراسة تطبيقية حول إمكانية وقدرة دالة عرض النقود التقليدية على تفسير التطورات التي حصلت في عرض النقود في الاقتصاد الليبي خلال الفترة ما بعد 2013، وتهدف الدراسة أيضا على البحث عن صياغة بديلة لدالة عرض النقود تضم العوامل الرئيسية المؤثرة في عرض النقود في ليبيا.

أعتمدت الدراسة في وصف وتوصيف وصياغة دالة عرض النقود الخاص بالحالة الليبية على ثلاثة فرضيات أساسية وتوصلت إلى أن دالة عرض النقود في ليبيا تختلف عن دالة عرض النقود المشار إليها في الأدبيات الاقتصادية، ولعل السببين الرئيسيين لذلك الاختلاف هما: قانون إلغاء سعر الفائدة والذي أدى إلى إلغاء دور المصارف التجارية في عملية خلق النقود، والسبب الثاني الازمة المالية التي تمر بها الحكومة والتي أدت إلى أن قرارات المصرف المركزي في التوسع في القاعدة النقدية كان لخدمة أهداف السياسات المالية وليس النقدية

وأوضحت نتائج التحليل البياني والاحصائي بأن التغير في عرض النقود ناجم عن التغير في القاعدة النقدية ولا يوجد دور واضح للمصارف التجارية في عملية خلق النقود، وإن العلاقة بين قرارات المصرف المركزي في التوسع في عرض النقود مرتبطة بالسياسات المالية وليس بالسياسات النقدية، وبعبارة أخرى إن قوة العلاقة بين التوسع في عرض النقود والمديونية الحكومية تحدد استقلالية وتبعية السياسة النقدية، أي أنه كلما كانت العلاقة بين المتغيرين أقوى كانت دور السياسة النقدية تابع للسياسة المالية، حيث جاءت تلك النتائج مؤيد لفرضيات التحليل النظري التي أعتمدت عليها الدراسة في صياغة دالة عرض النقود في ليبيا.

وفي الختام أوصت الدراسة على ضرورة إجراء دراسة تطبيقية يتم من خلالها تقدير نموذج قياسي يضم دالة عرض النقود في ليبيا بصيغتها الجديدة ويقاس قوة العلاقة بين متغير المديونية الحكومية من المصرف المركزي وقرارات الاخير في التوسع في عرض النقود.

الكلمات الدالة: عرض النقود، دالة جديدة، ليبيا

A Theoretical Analysis of Money Supply for Libya

Abstract

This study aims to conduct a theoretical analysis on the potential and ability of the traditional money supply function to explain the money supply developments in the Libyan economy post-2013, and the study also aims to search for an alternative formula that has ability to describe the factors affecting the money supply in Libya.

The descriptive analysis method, mathematical equations and simple charts with statistical tests was used to examine three principle hypotheses proving the inability of the traditional formula to explain the economic variables affecting the Libyan money supply and found that the money supply function in Libya differs from the money supply function mentioned in the literature, and two main reasons for that difference are: the interest rate abolition, law No 1 (2013), and the financial crisis that the Libya is going through during study period .

The money supply function for Libya illustrates that the change in money supply resulted from the change in the monetary base (MB) and no role for commercial banks in creating money process and the nominal money supply (MS) is related to a positive relationship with the central bank credit to government (COG) and a negative relationship to the exchange rate of LYD in the black market

The results also showed that the relationship between the central bank's decisions to expand money supply is linked to fiscal policies, not to monetary policies, in other words, the strong relation between COG and MS means that the monetary policy is dependent on fiscal policy.

Keywords: Money Supply, New-function, Libya

1- Introduction:

The importance of this study is developing a new formula embodying the main factors affecting the money supply in the Libyan economy after confirming the results of many previous studies the inability of the traditional formula on the interpretation of the monetary reality in the Libyan economy.

The study examined three principle hypotheses; i) there is no effective role for Libyan commercial banks in influencing the money supply, ii) the main motivation behind the central bank expanding basic of money supply is to finance the public budget deficit, iii) there is an inverse relationship between the nominal money supply and the exchange rate of the Libyan dinar in the black market.

The study relied on the Keynesian analysis and the subsequent developments that were conducted on the Keynesian model, in achieving the object of the study, which is to prove the inability of that model to explain the economic reality, and to search for an alternative model that expresses the Libyan case.

The study aims to formulate a new money supply function that includes the set of main macroeconomic variables controlling the money supply in the Libyan economy, which helps decision-makers to make sound economic decisions and policies. Pulse the study provides economic literature with an economic model that used by academics interested in conducting empirical studies about Libyan economy such as econometric studies, as the new money supply formula is the first real attempt to create a bridge between the academic efforts and the needs of the decision-makers for research advices when making macroeconomic decisions.

Based on the researcher's information, this study is considered the first attempt to present a money supply function that identifies the main determinants affecting the money supply in the Libyan economy, where, the previous studies based on function that reproduced from previous studies conducted on countries that enjoy a kind of economic stability different from the Libyan economy.

Since the study conducting a theoretical analysis, the descriptive analysis method applying charts and mathematical equations was used in developing the Libyan money supply function, considering that the MS formula is a set of economic variables relationships that describe the MS function; it can be expressed in words, tables, charts and mathematical equations.

2- The previous studies:

This part of this study is focusing on some previous studies conducted on the Libyan economy and used money supply in its economic models during the post-2011 period. These studies can be divided according to their objectives into three types: Studies aimed to measure the impact of money supply as a tool of monetary policy on some macroeconomic variables, and other studies applied Pairwise Granger Causality Test between nominal money supply and other economic variables, while the third type aimed to estimate the money supply multiplier formula. The following is a review of the most important findings of previous studies:

Study conducted by Al-Maghribi (2018), “The effect of money supply on inflation, GDP, and the exchange rate in the Libyan economy during the period (2003-2018)”. The study used descriptive approach in analysing the economic relationships between money supply and some macroeconomic variables rather an economic model.

The most important finding is that monetary policy was floundering and the central bank was unable to influence the exchange rate of the Libyan dinar on the black market in the period 2011-2017, as the difference between the official and unofficial exchange rate was very large during that period.

Study conducted by Al-Jaroushi and Aburawi (2017), “Analysis of the monetary stability and its impact on inflation in the Libyan economy during the period (1962-2014)” The study also did not use an economic model, but rather it was satisfied with using some mathematical indicators and some measures provided by economic theory, such as velocity of money circulation, the monetary stability and the inflationary gap.

The study found that all the results of monetary stability indicators indicate the existence of monetary instability due to the mismatch between money supply and real GDP growth, which was clearly reflected in the general price level and inflation in the Libyan economy.

There is another study conducted by Al-Lahdi and Abukrish (2018) aimed to analyse the effect of the exchange rate, money supply and inflation on the rates of economic growth in Libya during the period (1980-2014). This study used a simple model relies on the assumption that there is a relationship between money supply, inflation, exchange rates, and economic crises and real GDP as dependent variable.

The study concluded that the Libyan economy suffered from instability and emerging a severe financial crisis led to a decline in the value of production and an increase in the amount of money supply in the post 2010, and thus the rise in prices and the deterioration of the Libyan dinar value against other foregone currencies.

Study conducted by Hamida and Mahfouz (2019) “The effect of money supply and the exchange rate on the real GDP (an applied study on the Libyan economy 1990-2017)” The study examines the impact of the economic policy using an economic model in the logarithmic form of equation. The model attempted to provide an explanation of the relationship between GDP as an indicator of economic growth in the Libyan economy, the simple model based on the hypothesis that the Libyan economy is greatly affected by money supply, the exchange rate and the general level of consumer prices.

The results of the study, using the Pairwise Granger Causality Test, revealed the existence of a bi-directional (two-way causality) moving from the exchange rate to the money supply (MS), meaning that the exchange rate affects the money supply. The results also indicated the existence of a one-way causal relationship moving from MS towards the general level of consumer prices, meaning that the money supply affects the general level of consumer prices.

There is another study conducted before Hamida and Mahfouz study that confirmed the causal relationship between the exchange rate and the money supply. This study was conducted by Nooruddin (2013), aimed to test the causal relationship between the official exchange rate and money supply and concluded that there is uni-directional (one-way causality) between the official exchange rate of the Libyan dinar and broad money supply.

Note-taking on both previous studies is: the studies did not explain theoretically the effect of the exchange rate on the money supply, but rather they were satisfied with establishing the causal relationship statistically without clarifying the mechanisms of the relationship according to economic theory.

Study conducted by Bazinah (2020), this study is considered the important previous study and the main motivation for seeking for another the money supply formula that expresses

the Libyan MS function. Bazinah's study aimed to estimate the money supply multiplier formula in the Libya during the period (2008-2018) and study's results are the best proof of the necessity for looking for a new MS formula that explains the economic phenomena that the Libyan economy is going through.

There are few notes taking on Bazinah's study: in the one hand the study based on model that reproduced from previous studies conducted on countries that enjoy a kind of economic stability different from the Libyan economy (for example, a study on the Saudi economy by (Rasas et al., 2016), a study on the Algerian economy by Mohamed, and Mukhtar (2017) and a study on the Kenyan economy by Susan (2018)), on the other hand, the results of the study described that the model was unstable due to the critical situation that Libya is going through.

Furthermore, the study's results found that the money supply multiplier is < 1 during most of the study period and the large percentage of demand deposits go to the currency in circulating and commercial banks' excess reserves, which reduces their ability for creating money.

All that notes open the way for doubts about the validity of the formula of MS function for Libya and open also the way for seeking for another formula has the ability to express the Libyan MS function and this study is an extension of literature review and does not complement to previous studies, nor deny or confirm the findings of the studies that have been interesting in studying money supply in Libya.

3- Definition of money and money supply:

The study attempts not to expand on the theoretical issues of money supply and focus on its main goal of providing economists with a new formula of money supply function that is suitable and capable of explaining economic phenomena and helps to understand the monetary situation in the Libyan economy, but it is useful in a short way explain some theoretical concepts that will be covered in the analysis part of the study, especially the study's model depends on the Keynesian theory and post Keynesians developments.

It was mentioned in the economic literature that money consistently has three functions: store of value, unit of account, and medium of exchange (Edgmand, 1983). The function of money as a unit of account is important in conducting accounts, keeping records and making decisions, and money performs its function as a store of value where families keep all or part of their savings in the form of cash. Saving can take various forms, such as bonds, stocks, and land. Therefore, money is not the only store of value, especially inflation reduces the value of a currency's purchasing power and it does not fulfil its role as a store of value satisfactorily.

However, the function of money as a medium of exchange distinguishes it from previous two functions is called quasi-money, since money can be used to buy goods and services and settle debts. The most common definition of money is that it is any object that obtains general acceptance and used as a final means of paying for goods and services and settling debts (Edgmand, 1983).

According to that definition, coins and currency in circulation (CC) are considered money, and demand deposits (DD) are also considered money and this money is called Narrow definition money (M1) because they are accepted as a medium for trading. However, time deposits and savings deposits (TD) are not considered money in M1 definition because they are not accepted as a medium for trading and should be converted

into demand deposits or any other form of money, therefore are called quasi money and it is included in broad definition of money (M2) (Edgmand, 1983).

The money supply is determined in currency and demand deposits that are kept by the non-banking public. The currency that is kept in banks is excluded because it is not in circulation and may cause double my account if it is taken into account, and in order to achieve the objectives of this study, it will adopt the definition of money supply used by the Central Bank of Libya (CBL), which is Narrow definition M1 and broad definition M2:

$$M1 = C + D \quad \& \quad M2 = M1 + TD$$

The central bank is the only one responsible for currency issuance operations, it can control the nominal supply of money MS, and the central bank can control also the money supply with three basic tools such as open market operations, changes in the reserve requirements ratio and changes in the discount rates, These three tools enable the central bank to change the money supply.

The Commercial banks (Co Banks) also have a great role in determining the money supply by increasing demand deposits by granting credit, and any changing in reserve requirements ratio by the central bank has an impact on the commercial banking system, considering demand deposits (DD) as part of the money supply (MS), the successive increase caused by commercial banks in DD through the use excess reserves from required reserves in granting credit is considered a successive increase in MS.

As mentioned, the study does not aim to expand the theoretical topics that mentioned in the economic literature, the study aims to provide economists with a money supply function that has the ability to explain the economic situation in Libya, and thus leaves delving into the details of money creation processes and focusing on the variables affecting in Co Banks' ability to create money.

4- Key determinants of money supply:

When the central bank buys bonds from government or gives government good loan fund, the reserves rise and excess reserves rise by same amount as a result of the initial increase caused by that central bank action, and based on two assumptions: 1) The commercial banks do not maintain the excess reserves, 2) the public does not add to their cash holdings (CC) or time deposits (TD) to their accounts. The increase in DD continues until the excess reserves disappear, and as a result, the initial change in reserve (ΔIR) eventually becomes the change in required reserve (ΔR) and so on:

$$\Delta IR = \Delta R$$

Accordingly, the change in required reserve R is equivalent to required reserve ratio of demand deposits, r, multiplied by the total change in demand deposits DD, and substituting that into the previous equation to obtain:

$$\Delta R = r\Delta D$$

Dividing both sides of the equation by r and rearranging the equation to get:

$$\Delta DD = \Delta IR/r \quad \longrightarrow \quad (1)$$

(ΔDD) proxy for the total change in demand deposits (checkable deposit), (ΔIR) the initial change in Banks' reserves, and (r) the ratio of legal required reserve to DD, since demand deposits are considered part of the money supply, and based on the previous two

assumptions, the total change in money supply is equal to the change in demand deposits.

The increase in money supply that was mentioned in equation (1) represents the maximum possible amount in creating deposits. It is assumed that Co Banks do not maintain excess reserves and individuals do not add to their CC or TD during the expansion process. The assumptions are not usually fulfilled on the ground, since Co Banks keep a percentage of the DD as the excess reserve and public also keep cash in their possession and their time deposits. Consequently, the previous equation needs to be developed in case the two previous assumptions are not available:

4-1- In case the Co Banks maintain excess reserves: Co Banks feel that the reserve requirement is insufficient to compensate for their expected losses from deposits, and accordingly, they maintain additional reserves to provide liquidity, and this option is considered encouraging when the interest rate (i) is low, considering the cost of maintaining the excess reserve is Less.

When Co Banks maintain excess reserves, they lend less money, and thus the opportunity for increasing in DD is also less. Therefore, the large amount of excess reserve represents a leakage from the bank system. If banks maintain a constant percentage of excess reserves (e) from demand deposits, the leakage equals $e\Delta DD$, eventually initial change in reserves ΔIR will be divided into the change in reserve requirement ΔR and excess reserve $e\Delta DD$, and the equation becomes as follows:

$$\Delta IR = \Delta R + e\Delta DD$$

Since the change in reserve requirement ΔR equals $r\Delta D$, then by substituting it can be obtained:

$$\Delta IR = r\Delta DD + e\Delta DD$$

4-2- In a case, the individuals hold cash and time deposits during the expansion process of creating deposits, and thus banks lose their reserves, that lead to limit the amount of loans granted by Co Banks and lose the opportunity to increase in demand deposits. Thus, the individuals hold cash represents a leakage from the bank system, and if individuals maintain a constant ratio between cash in hand (CC) and their demand deposits (DD), then the leakage or withdrawal is equivalent to $c\Delta DD$, i.e. the ratio multiplied by the change in DD, Consequently, the initial change in reserves will be divided into the change in the required reserves and excess reserves, and the currency held by the public outside banks:

$$\Delta IR = r\Delta D + e\Delta D + c\Delta D$$

In case, the individuals add to their time deposits (TD) during the process of expanding deposits, and according to this assumption, Co Banks will not lose their reserves, because banks must maintain reserves to cover TD as well as demand deposits, then a fraction of IR be used as a reserve for TD, then there will be less reserves to cover required reserves for demand deposits, and there will be less increase in DD.

So the increase in TD represents a leakage from the money creation process. If the individuals keep their TD in the form of (t) percentage of their DD, and if (r) represents the required reserve ratio for TD then the leakage is equal to $rt\Delta DD$, i.e. legal required reserve (r) multiplied by the change in time deposits $t\Delta DD$, and so the initial change in reserves IR, it will finally be divided into the change in the required reserves for demand deposits $r\Delta DD$, the excesses reserves $e\Delta DD$, the cash holding by individuals $c\Delta DD$, and the required reserves for time deposits $rt\Delta DD$, the equation is as follows:

$$\Delta IR = r\Delta DD + e\Delta DD + c\Delta DD + rt\Delta DD$$

In order to determine the change in demand deposits ΔD , which corresponds to the initial change in reserves ΔIR , rearrange the factors by dividing both sides of the equation by $(r + e + c + rt)$, to obtain the following equation:

$$\Delta DD = \frac{\Delta IR}{r + e + c + rt} \longrightarrow (2)$$

Equation (2) illustrates that the change in demand deposits is a function of the initial change in reserves (related to DD & TD), and the ratio of both (excess reserves, cash with the public, and time deposits) to demand deposits.

Since the money supply $MS1$ includes those monies that are very liquid such as cash held by the non-banking public and demand deposits, so the change in money supply $\Delta MS1$ equals the change in demand deposits ΔDD plus the change in the money balance or:

$$\Delta Ms = \Delta D + c\Delta D \longrightarrow \Delta Ms = (1 + c) \Delta D \quad (\Delta CC = c\Delta D)$$

Substituting the value of ΔD , the equation (2) would be:

$$\Delta Ms = \frac{(1 + c) \Delta IR}{r + e + c + rt} \longrightarrow (3)$$

In principle, the change IR represents the change in reserves R , but if the non-banking public added to the currency in its possession during the expansion period in creating deposits, then fraction of the reserves would leak out from the banks system, and since the increase in the currency held by the public is fraction of the money supply, IR can be interpreted as the change in the monetary base MB . All principles level textbooks prefer to define the monetary base is the sum of total currency in circulation and the amount held by banks as reserves, and thus equation (3) can be reformulated as follows:

$$\Delta Ms = \frac{(1 + c)}{r + e + c + rt} \Delta MB \longrightarrow (4)$$

Where Ms is the narrow money supply, MB is the monetary base, and equation (4) represents the money supply formula, and the change in money supply is positively related to the change in the monetary base, and is inversely related to other factors.

5- The role of the banking system in determining the money supply

The equation 4 shows that the central bank can change the money supply by changing the monetary base MB , using open market operations, the discount rate and required reserve ratio (r). The money supply can be influenced also through the decisions of Co Banks and the public, if Co Banks decide to increase their excess reserves, or if the public decides to increase their cash and TD, then the money supply will decrease, and vice versa.

Using a multiplier, the equation (4) would be:

$$\Delta Ms = mm \Delta MB \longrightarrow (5)$$

Where:

$$mm = \frac{(1 + c)}{r + e + c + rt}$$

Where mm is the money supply multiplier and equation 5 represents the money supply formula by multiplier.

Since the ratios of: excess reserves, currency in circulation, and time deposits to demand deposits change with the interest rate (i), so the money supply multiplier changes with the interest rate, and this relation helps in determining the effectiveness of the banking system's role in influencing the money supply.

$$Ms = f(MB, i)$$

Once the relation between i and MS is stronger, the monetary policy is more effective, and therefore it is important to determine the strength of the relationship between nominal money supply and the interest rate.

6- The theoretical formula for money supply and explanation the Libyan case

After describing and analyzing the theoretical formula for money supply, and the role of the banking system in influencing the money supply, this part of the study is concerned with evaluating the effectiveness of applying the theoretical formula to the Libyan case and the effectiveness of the Libyan banking system in affecting the money supply.

The role of commercial banks in money supply expansion processes:

To test the efficiency of the theoretical formula in explaining the evolution of the money supply in the Libyan money market, it must analyze the monetary variables in the Libyan economy that affect the money supply function, and their effectiveness in proving the theoretical relationships mentioned in the previous section of the study

According to the previous money supply formula, the central bank can influence the money supply through a change in the monetary base MB, and also by changing the value of the money supply multiplier by changing the legal reserve ratio for deposits r, and the public can also influence the money supply multiplier through an increase or decrease in: holding the currency outside Co Banks and their time deposit balances.

All of these factors affect the ability of Co Banks to expand the creation of money supply, basing on theory that the money supply multiplier depends on the commercial banks granting loans such as mortgages, auto loans, business loans, and personal loans and banks make profit from making loans by charging interest as the latter is directly related to the expansion of banks in creating money, and this relation has been clarified in the previous part of the study.

Since the interest rate is the main determinant of the profits of banks resulting from lending operations, and it is also the main determinant for cost banks to maintain excesses reserves from deposits and thus expand the creation of money. Maintaining excesses deposits resulting from the processes of changing the monetary base, which means cancelling the role of commercial banks in money creation processes. Again, banks would not need to grant loans and destroy money. In effect, creating money supply is determined

by increases (or decreases) in qualified loan supply with the surplus of reserves. But the banks in the system are unwished to grant new loans with zero interest rate, so the money expansion process stops, there is no “multiplier.” Ennis and Weinberg (2007), and undermining the role of the central bank in influencing the money supply by losing the tool of influence on multiplier by changing the required reserve ratio of deposits, the following are the factors affecting the decisions of commercial banks for a change in the money supply multiplier according to the money supply function in Libya:

6-1- The interest rate on loans granted by commercial banks (i) is equal to zero by Law No. (1) 2013:

- In practice:

- ✓ The efficiency of the tool for changing the required reserve ratio of deposits (r) is zero.
- ✓ The cost of commercial banks maintaining excesses reserves (ER) is zero.
- ✓ The cost of holding the currency in circulation (c) is zero.
- ✓ The change in reserves required on time deposits (RRT) is zero.
- ✓ The public holding time deposits to demand deposits is zero.

6-2- The inability of Co Banks to provide liquidity to the public:

- In practice:

- ✓ Increasing in demand deposits with commercial banks (DD).
- ✓ Increasing in the ratio of private companies to hold currency in circulation to deposits (c).
- ✓ Decreasing in the ratio of individuals' currency holdings in circulation to deposits (c).
- ✓ Maintaining Co Banks large excesses reserves (ER).

The effect of the inability of commercial banks to provide liquidity on (c) is unclear, as the theoretical relationship is still ambiguous and requires practical evidence, and this ambiguity has arisen that the lack of liquidity in commercial banks cause to prevent the individuals and private companies to deposit their money in banks and prefer keeping them out-bank system.

Accordingly, the effect of the lack of liquidity on the ratio of the public's holding of currency to demand deposits is positive, simultaneously, the lack of liquidity leads to prevent the individuals and companies, who work for public sector, to obtain their incomes in cash, so the impact of the lack of liquidity on the public's holding of currency to demand deposits would be negative in this case.

In practice it may be more likely the relationship is negative and the hypothesis that (c) is very small ($c \approx 0$), due to the large size of the public sector in Libya, where the total balances are transferring to the bank accounts of individuals and companies reach more 2.5 billion Libyan dinars per month in the form of wages, salaries, bonuses for workers and non-workers, as well as payments for companies that provide operational services for the public sector.

$$(e \approx 1) \ \& \ (rt = 0) \ \& \ (c \approx 0) \ \& \ (\Delta RRT = 0) \quad \longrightarrow \quad (i = 0)$$

As the traditional formulation of the money multiplier according to the theoretical formula is expressed by equation (5):

$$\Delta Ms = mm \Delta MB \longrightarrow$$

Since Co Banks in Libya stopped lending operations as a result of cancelling the interest rate, the money supply formula can be expressed in the following equation:

$$\Delta Ms = \Delta MB \longrightarrow \Delta MB = \Delta CC + \Delta RR + \Delta ER$$

This means that any change in the money supply is the result of a change in the monetary base, through increase or decrease in deposit reserves or through issue new currency, and that there is no role for Co Banks to multiply the initial change in the monetary base, and this equation can be proven mathematically by assuming r is ineffective as follows:

$$mm = \frac{(1 + c)}{r + e + c + rt} = 1 \quad (i = 0) \longrightarrow (e \approx 1) \& (rt = 0) \& (c \approx 0)$$

If it cannot be proved trend of the relation between illiquidity and the public holding of currency to deposits, negative or positive, the equation can be expressed mathematically as follows:

$$mm = \frac{(1 + c)}{r + e + c + rt} = \frac{(1 + c)}{(1 + c)} = 1 \quad (i = 0) \longrightarrow (e \approx 1) \& (rt = 0)$$

7- The role of the central bank of Libya in the money expansion process:

The money multiplier equals one ($mm = 1$) that expresses the neutrality of Co Banks in the processes of expanding money supply by creating deposits, and that means any change in money supply is a result of the central bank changes in MB^1 . This is not the only difference between the formula of theoretical MS function and formula of the Libyan MS function, as there is another fundamental difference, which is the determinants affecting the central bank's decisions regarding the increase or decrease MB to influence MS , and these determinants can be determined in the following:

7-1- Money supply is used as a tool of fiscal policy, not monetary policy:

- In practice:

- ✓ The expansion of the money supply came to finance the public budget deficit (BDD).
- ✓ The change in demand deposits ΔDD is the initial change in Co Banks deposit reserves with the Central Bank of Libya (ΔDR).
- ✓ The expansion in money supply takes place through the change in MB .
- ✓ The expansion in the money supply results from an increase in claims on government with the Central Bank (COG).

7-2- The exchange rate of the Libyan dinar in the black market (exch) and the Central Bank's decisions to increase MB:

- In practice:

¹ Study conducted by Bazinah (2020), also found that, the commercial banks do not have an effective role in MB , the study proved that the money supply multiplier <1 , this finding confirms that the results of the study are insignificant.

- ✓ (exch) has negative relation with the public holding currency (CC).
- ✓ (exch) has negative relation with currency issuance decisions (CI).

8- Formula of money supply function for Libya:

It can be concluded from the previous discussion that the decisions of CBL to expand MB for the purpose of increasing MS came in order to mitigate the negative effects resulting from the financial crisis that country is going through and not to serve the macroeconomic goals according to the economic literature. So it is obvious that the theoretical MS function does not fully express the reality of money supply in the Libyan economy.

This judgment came from the inability of theoretical formula of MS function to explain the economic situation, since judging models based on their ability to achieve the goal of explaining economic phenomena and events, if the model helps to understand reality then it is appropriate model, and if the model leads to misunderstanding then it is an inappropriate model, so alternative models must be sought (Edgmand, 1983).

Base on the previous assumptions, the appropriate formula can express the money supply function for Libya; it can be expressed in mathematical way as follows:

$$\begin{aligned} \Delta DD &= \Delta DR \quad \& \quad \Delta PR = \Delta DR + \Delta CV \\ \Delta Ms &= \Delta R + \Delta CC \quad \& \quad \Delta Ms = \Delta MB \quad \longrightarrow \quad \Delta MB = \Delta PR + \Delta CC \\ \Delta MB &= \Delta DR + \Delta CV + \Delta CI - \Delta CV \quad \longrightarrow \quad (\Delta R = \Delta DR + \Delta CV \quad \& \quad \Delta CC = \Delta CI - \Delta CV) \\ & \quad \Delta MB = \Delta DR + \Delta CI \quad \longrightarrow \quad (1) \end{aligned}$$

DD is demand deposits with Co Banks.

R is reserves of Co Banks with the Central Bank.

DR is demand deposits of Co Banks with the Central Bank.

CV is cash in vault with Co Banks.

MB is monetary base.

MS is narrow money supply.

CC is currency in circulation.

CI is currency out bank system.

It can be analyzed the components of definitional equation 1, that any change in DD is caused by a change in the reserves of Co Banks, and not by the expansion of Co Banks in the process of creating money. The change in MS equals the change in the reserves of Co Banks with CBL plus the change in CC, (the change in the MB, and there is no effective role for CO Banks in affecting MS). The change in MB is equal to the sum of the change in the total issued currency (CI) and the change in demand deposits commercial banks at the Bank of Libya Central (DR).

It can be conclude that the monetary base is equal to the currency issued by the Central Bank of Libya minus the currency in banking operations plus demand deposits of Co Banks with CBL.

$$MB = DR + CI \quad \longrightarrow \quad (2)$$

8-1- Monetary base and claims on government with CBL:

Based on the hypotheses that, the main motive behind the central bank's expansion in the money supply is to finance the public budget deficit (BDD) and the increase or decrease in the MB results from the change in the balance of the claims on government with the CBL (COG), and thus, the change in the balance of commercial banks' reserves with CBL results from depositing the advances in DD of public enterprises' deposits with Co Bank. So, it can be concluded, that the change in the COG is the main determinant of the change in MB through changing DR (deposits of Co Banks with the CBL), or:

$$DR = f(\text{COG})$$

8-2- Monetary base and exchange rate in black market:

The assumption saying that, there is correlation between the nominal money supply and the exchange rate of the Libyan dinar in the black market (exch) is distinguishing study's model (of MS function). The interpretation of this assumption is that, the decrease in exch leads to a rise in the general level of prices, which increases the individuals adding the currency in their possession as a result of the increase in the values of transactions and also the increase of their desire to hold the currency as a result of the expectation of a rise in exchange rate in the black market in near future. In light of the inability of Co Banks to provide cash liquidity, large cash balances are kept out- banking system, which pushes the CBL to take decision to print more currency to meet the increasing demanded currency by individuals, which will lead to an increase in MB through the issuance of a new currency CI and then the increase in the money supply MS.

$$CI = f(\text{exch})$$

It can be confirmed that COG and exch are among the most important determinants MB, considering that COG is equal to the loans granted by the central bank to the government, and the change in this variable is the main effect on the change in the Net Domestic Assets of the central bank (NDA). In addition, the Net Foreign Assets of the central bank (NFA) are also considered one of the most important determinants affecting its ability to influence the exch. Therefore, it can be confirmed that the factors affecting MB are NDA & NFA through the following definitional equation:

$$MB = NDA + NFA$$

To assure the importance of COG and exch in determining monetary base, and then in the money supply in equation (2), the money supply function in the Libyan economy is written as follows:

$$Ms = f(\text{COG}, \text{exch}) \longrightarrow Ms = MB$$

According to the money supply function of the Libyan economy, the nominal money supply is related to a positive relationship with the central bank credit to government and a negative relationship to the exchange rate of the dinar in the black market. This relationship shows the expansion in MS is linked to financial policy not to monetary policy, in other words, if the relation between COG and MS is strong, it means that monetary policy is less effective and dependent on financial policy. Therefore, it is important to identify the power of the relation between COG and nominal money supply in the Libyan economy.

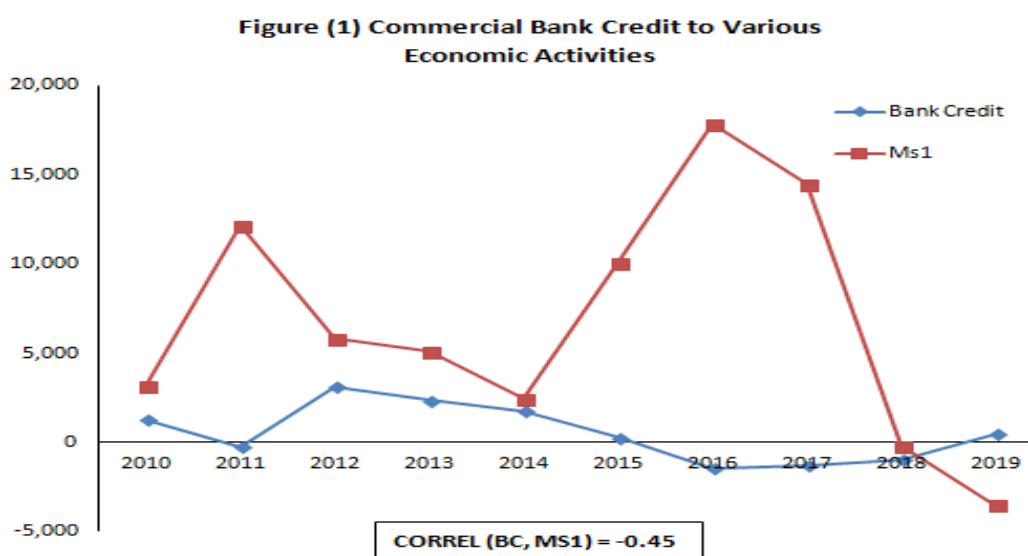
9- Evaluate the ability of study's formula for representing MS function in Libya:

The ability of the function to identify the economic variables that make up the money supply is tested by measuring the economic relations between the variables affecting the money supply, by tracking and analyzing the behaviour and changes that occur on the variables and measuring their impact on the nominal money supply. The following are the results of diagrams and statistical analysis to prove hypotheses on which the function is based:

9-1- The change in demand (DD) results from the change in MB and not the expansion of Co Banks in the creating money process, (test hypothesis 1):

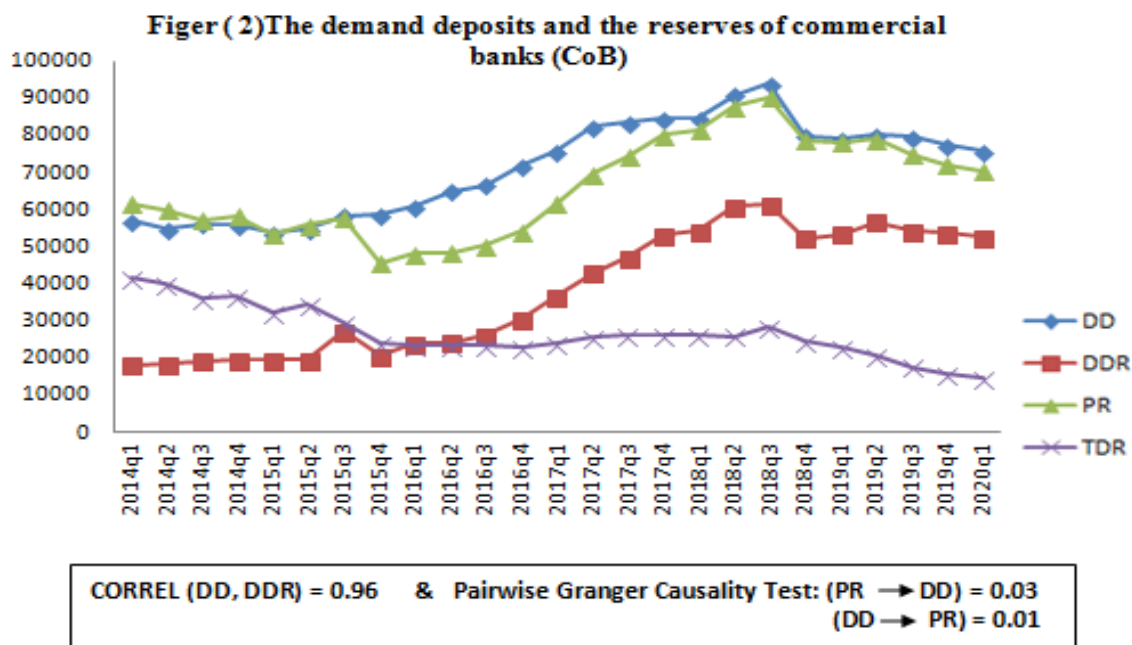
It was also mentioned in the previous part of this study that the role of Co Banks in influencing the money supply through the multiplier has been limited after the issuance of the law abolishing the interest rate on banking credit to various economic activities in the years post 2013.

The decline of commercial banks in granting loans to economic activities and the growing balances of their excess reserves is an indication of the decrease in the effectiveness of their role in creating money. The coefficient correlation was negative, and this single is contradicting the nature relationship between bank credit and money supply and indicates its insignificance.



Source: Central Bank of Libya, economic bulletins, various issues

Figure (2) shows the changing in demand deposits (DD) and the reserves of commercial banks with the Central Bank of Libya (PR) through (2014q1- 2020q1), it can be concluded that there is a strong relation between DD and (PR), which reinforces this relation by the value of the coefficient of correlation between the two variables, which amounted to 96%, and this result confirms the first study's hypothesis that the change in demand deposits is caused by a change in the monetary base and not in the money supply multiplier. It is worth noting that time reserve deposits (TDR) declined during the same period as a result of the issuance of the law no (1) for 2013, regarding abolishing interest rate dealings in Libyan banks.



Source: Central Bank of Libya, economic bulletins, various issues

The relation between DD and PR may seem strong, but this is not sufficient to prove that the causal relationship between them is according to the hypothesis of the study that “the change in demand deposits results from the change in the monetary base through the change in the reserves of commercial banks at the Central Bank of Libya not the other way around”. As the theoretical definitional relationship says that any change in demand deposits leads to change in Co Banks' reserves with the central bank and not vice versa, and to prove the existence of an inverse causal trend relationship in the Libyan economy, a causal relationship test between the two variables has been tested. (Granger Causality Test)².

The results of the Causality Test show that the hypothesis that the change in the reserves of commercial banks with CBL causes a change in the demand deposits is accepted at a significant level (0.03), and the results show also that the hypothesis that the change in (DD) causes changes in (PR) is accepted at a level of significance (0.01). So, it can be concluded that, there is a two-way relationship between the change in the monetary base and the change in demand deposits with commercial banks. So when choosing a method for estimating the money supply function, it must be taken into account that there is a causal relationship in two directions between MS & MB³

It can be confirmed that the validity of the hypothesis that “the change in money supply is caused by the change in the monetary base and there is no effective role for commercial banks in influencing the money supply”.

2 The AFD test was conducted to ensure the stability of the time series and the variables were stationary at the first deference. The Granger test lagged years were selected according to the VAR lag order selection criteria.

3 In other words, if there is endogeneity between MS and MB, then all econometric estimations ignoring this endogeneity will produce wrong and misleading results; in this case, the GMM method is preferable.

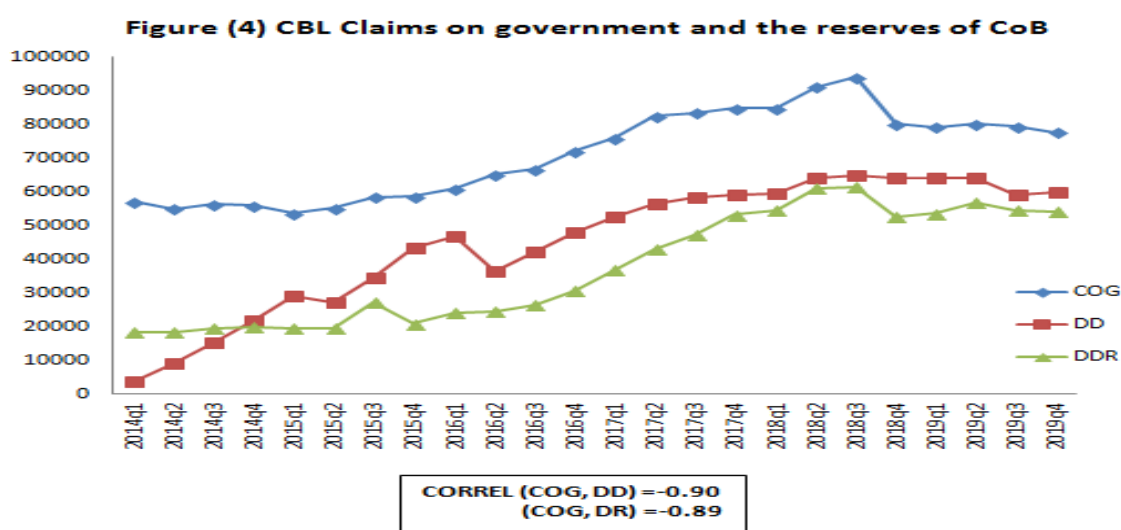
9-2- The increase or decrease in demand deposits (DD) is due to the change in the balance of the claims of government to the Central Bank (COG), (test hypothesis 2):

As was explained in the previous part of this study, there is a definitional relationship between COG and MB, as net domestic assets (NDA) and net foreign assets (NFA) are the factors affecting MB, since calculating the net of domestic credit, the value of COG is actually subtracted from government deposits with CBL, which is the net of domestic assets of central bank (NDA). the theory states that, the mechanisms of the relationship between (COG) and MS is that any change in COG leads to change in NDA and then expanding in MB, where the central bank can expand MS by increasing its net worth of domestic and (or) foreign assets.

The theoretical mechanisms may differ from the empirical mechanisms of the relationship between COG and MS in the Libyan case, where the central bank does not aim to expand the money supply, but rather that the monetary evaluation of the macroeconomic situation is inconsistent with injecting more money supply. The operations of expanding the monetary base came to serve the public finances by granting advances and loans to the government in order to cover the fiscal deficit in the public budget.

The second study’s hypothesis says that the change in the balance of commercial banks’ reserves with the central bank results from depositing the advances and loans in demand deposit accounts of governmental agencies at commercial banks and then governmental agencies transfer the money for its account to the benefit of individuals and institutions working for government, and on that basis, the change in COG is the main determinant of the change in the balance of commercial bank deposit reserves (DDR) and then the balances of demand deposits (DD). The diagrams and correlation coefficient (sign and value) below came in support of the hypothesis, reaching 90% and 89% for the relationship (COG, DD) and (COG, DR), respectively.

It can be confirmed the hypothesis that claim of government is the main influence on the change in the reserves of Co Banks and then the change in the balance of demand deposits with Co Banks.



Source: Central Bank of Libya, economic bulletins, various issues

9-3- The decrease in the exchange rate of the Libyan dinar in the black market (exch) has an impact on decisions to expand the monetary base through the issuance of a new currency (CI), (test hypothesis 3):

Before conducting statistical tests on above hypothesis, it must be clarified that this hypothesis is characteristic of the study, as it was not in the previous studies that were applied money supply function for Libya adopting a function includes the free exchange rate (meaning free is the price determined by the power of demand and supply in the foreign exchange market), although there are some applied studies that dealt with investigating the existence of a causal relationship between the official exchange rate (not the free) and nominal money supply in Libya, such as the study presented by (Noureddine 2013 & Hamida and Mahfouz 2019), which did not build a special model for the Libyan case that reflects the nature of the relationship between the two variables, but rather reproduced the model from some previous studies conducted on other countries.

The mechanism of the effect exch on MS is different from what was mentioned in the economic literature, as the nominal money supply is independent and negatively affects the value of the domestic currency, and this has been proven in many previous studies such as (Bakhit and Meznan 2006) and (Shendi 2006).

However, the study’s hypothesis (3) is completely different from the models of MS function covered by previous studies, as the model relied on the assumption that exch influences the MS and not the other way around and the decrease in the value of the Libyan dinar leads to an increase in the money supply by influencing the decisions of the Central Bank of Libya by pushing them to print a new currency (CI), this philosophy makes the money supply function in Libya different from other functions and the reproduction of models from previous studies is neither applicable nor does it express the Libyan case.

It can be found from Figure (5), that there is an inverse relation between the balances of the issued currency (CI) and the exchange rate of the dinar in the black market (exch), the sign and value of the correlation coefficient confirmed that relationship, which amounted to (-0.78). However the direction of the relation between two variables must be determined to find out which one affects the other by performing a causal relationship test, (Pairwise Granger Causality Test)⁴

The results of causality test in the short term show that accepting the hypothesis that the change in exch causes a change in CI at a significant level (0.04). As for the result of testing the hypothesis of a causal relation moving from (CI) to (exch), the results show that we reject the hypothesis at a significant level (0.27).

The results of the statistical tests came to reinforce the assumptions that were adopted in building a special formula for the money supply function in Libya, which was proven in the previous part of the study by theoretical analysis of the mechanisms of action of COG & exch and their impact on MB:

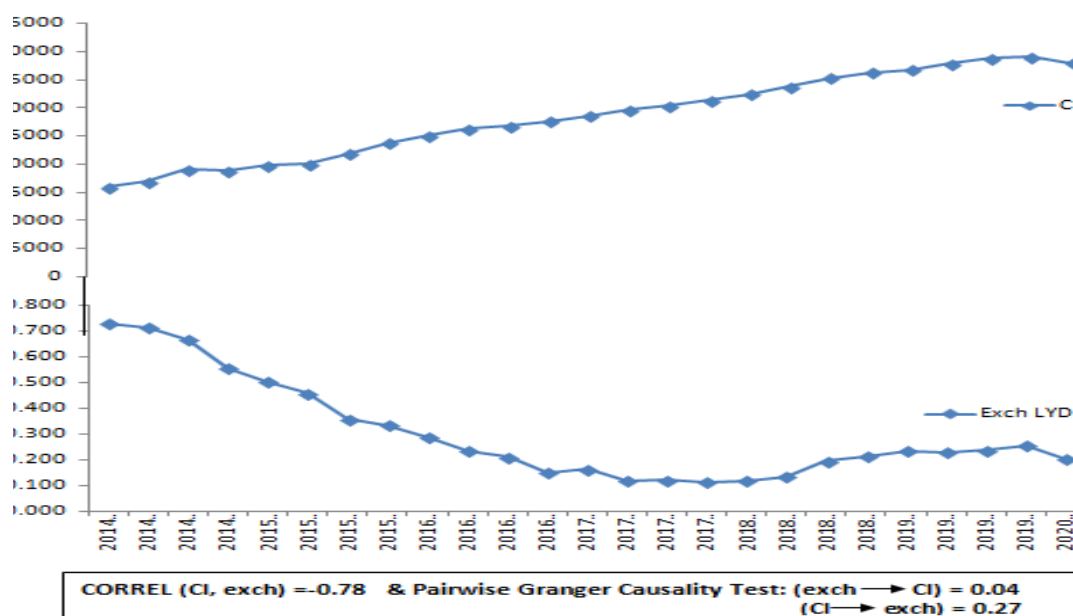
$$MB = DR + CI \quad \longrightarrow \quad \{Ms = MB \quad \& \quad CI = f(exch) \quad \& \quad DR = f(COG)\}$$

$$Ms = f(COG, exch)$$

4 The 4 lagged-years Granger test score was selected according to the VAR lag order selection criteria.

Finally, it can be concluded that the money supply function for Libya can be formulated by the following function:

Figure (5) Issued currency and exchange rate in black market



Source: Central Bank of Libya, economic bulletins, various issues

10- Conclusion and recommendations:

The study concluded that the formula of money supply function in Libya differs from the theoretical formula referred to in the literature, and perhaps the two main reasons for that difference are: The interest rate abolition law No 1 (2013), which led to the abolition of the role of commercial banks in the process of creating money, and the second reason is the financial crisis that the government is going through during study period, led to the Central Bank’s decision to expand the monetary base to serve the objectives of financial policies, not monetary policy, and the following are the most differences:

- ✓ There is no effective role for commercial banks in affecting the money supply, and therefore there is no multiplier for the money supply in the Libyan economy.
- ✓ The role of the Central Bank of Libya in influencing the money supply came within the framework of financing the public finance deficit and serving the objectives of the fiscal policy.
- ✓ The role of the public in influencing the money supply did not come in the context of influencing the decisions of commercial banks to increase the money supply multiplier as mentioned in the literature, but rather to influence the central bank’s decisions to expand the monetary base.
- ✓ The exchange rate of the Libyan dinar in the black market directly affects the decisions to expand the issuance of the currency and then expand the monetary base, and this was not mentioned in the applied studies conducted on the money supply in the Libyan economy.

Finally, this study presented an appropriate model capable of explaining economic manner and assisting to understand the Libyan money supply function over the next few

years, and thus it is recommended to conduct applied studies that estimate function (is called Hasen's money supply formula) taking into consideration the two-way relationship between the exchange rate and money supply when determining the method of estimation.

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