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The Role of Unbalanced Balance Sheet of Banking System in Creating the Puzzle of Interest Rate, Inflation and Liquidity Growth: Evidence from Iran

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The analysis of macroeconomic variables for current situation in Iran indicates a Conundrum. Solving this puzzle is vital for Central Bank of Iran in order to choose an appropriate approach for monetary policy and banking supervision. Increase in liquidity growth rate, significant decrease of inflation rate and interest rate rigidity are the three sides of this puzzle. This study designs an innovative model for connecting the microeconomy of banks with macroeconomy, indicating a solution for mentioned puzzle. Accumulation of fictitious and frozen assets in the assets side of banking system balance sheet makes an unsound flow of liquidity which is partly impacted by fictitious assets of banking system and it is called unsound Liquidity. This situation shows the reality that is financially and economically unbalanced balance sheet of banking system and if these balance sheets seem balanced, is just because deployment of false accounting methods. In fact, quality of liquidity is impacted by reduction of the quality of banking system assets and despite high liquidity growth, this lead to reduction of inflation rate and also caused banks to resist against the reduction of interest rate. The adjusted long run equation of quantity theory of money has estimated in a vector error correction model (1996-2016). The results confirm the direct effect of quality of liquidity on inflation.

Keywords: Unbalanced Balance Sheet, Liquidity, Interest Rate, Inflation and Accounting
JEL Classification: C32, E5, M4

1 Triangular Puzzle of Iran Economy: Liquidity Growth, Inflation and Bank Interest Rate

The analysis of current macroeconomic variables of Iran indicates that there is a triangular puzzle and increase in liquidity growth rate, significant decrease of inflation rate and interest rate rigidity are three sides of this puzzle (Figure 1). On the one hand, there is a divergence between liquidity growth rate and inflation rate in such a way that despite high liquidity growth, inflation rate

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has significantly been reduced. On the other hand, there is a divergence between nominal rate of interest and inflation rate in a way that despite significantly reduction of inflation rate in recent years, bank interest rates have not been purely reduced, on the contrary, they have been raised and consequently real bank interest rates are historically at the highest level. Real sector is also faced with credit crunch and stagnation pressures. Furthermore, liquidity growth rate and interest rate have been simultaneously increased while it is expected that higher liquidity growth rate reduces bank interest rates.

All mentioned cases imply that there is a puzzle which must be definitely resolved in order that Central Bank of Iran (CBI) can make a right approach for monetary policy and banking supervision paving the way for coping with current situation.

This study designs an innovative model for connecting the microeconomy of banks with macroeconomy, indicating a solution for mentioned puzzle. Financial statements are reflectors of microeconomy of banks. These statements and their items are evaluated according to the criteria and standards of accounting. So, the suggested model must present a method for connecting the concepts and techniques of accounting with economic concepts. The model must also connect the balance sheet statistics of banking system with the amounts of macroeconomic variables.

2 Reciprocal Relationship of Banking System Balance Sheet with Nominal and Real Sectors of Economy

Left side of banking system balance sheet contains the rights of shareholders (capital, cumulative dividend, etc.), debt to central bank, time deposits and demand deposits[1]. Time deposits in banking system act like quasi-money in macroeconomy. In this study and for analysis purposes, such deposits are divided into sound deposits (type1) and unsound deposits (type2).

Additionally, demand deposits in banking system plus notes and coins held by people act like money in macroeconomy. Finally, quasi-money and money together form liquidity (M2) in macroeconomy. Time deposits and demand deposits, as parts of liquidity, have some fluidity grades of liquidity and moving the banking system debts from time deposits to demand deposits raise the fluidity degree of liquidity in macroeconomy and vice versa.

[1] Time deposits which are cashable with the least or non penalty and they are decreasing or increasing by interest rate changes. Such deposits - currently common and almost exclusive to Iran banking system - play important role in this study.

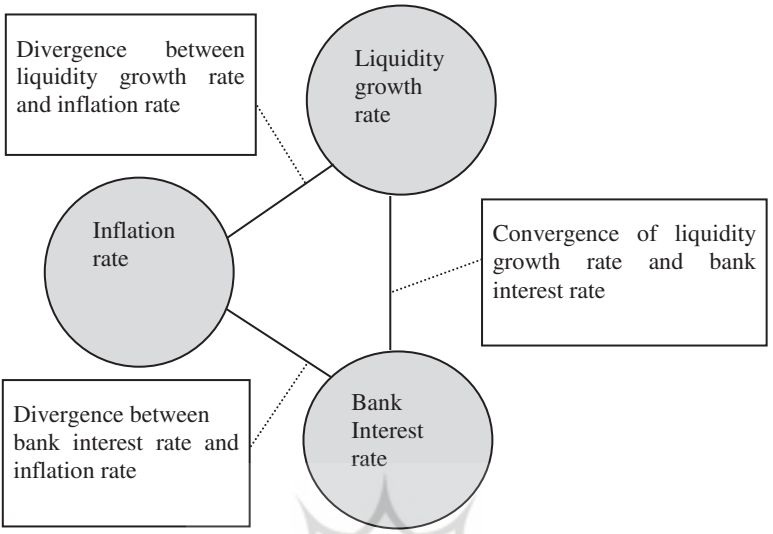

Figure 1. Triangular puzzle of Iran economy: liquidity growth, inflation and bank interest rate. *Source*: research findings.

Meanwhile, one must notice that banking system debts which form liquidity in economy are basically relied on the assets on the right side of banking system balance sheet. Assets of Iran banking system[1] are classified to: fixed assets (for banking operations), cash generating assets (including current loans[2] and productive investments), frozen assets[3] (including non-performing loans from government and non-cashable assets), fictitious assets[4] (including bad loans and identified cumulative profits which are basically fictitious like profits on fraudulent transactions of assets and also identified profits and compensations on doubtful loans), bank reserves and vault cash

[1] This classification is according to current financial situation of Iran banks and for this reason the classification may not be common in global banking system. For instance, fictitious asset amounts in many banking systems of the world are too different to compare with current situation of Iran banks due to professional management, careful supervisions of professional audits plus total, strict and consistent controls by regulators of banks in those countries.

[2] In Islamic banking for common term "Loans" there is an alternative word which is "financial (bank) facilities".

[3] Frozen assets are those that cannot be converted into cash in short time or forever.

[4] In many economic texts, a class of toxic assets is mentioned in bank balance sheets. This class is a total of frozen assets and fictitious assets. Though these two groups of assets have the same impacts on bank cash flows, but they are very different in essence and regarding some other features. Nevertheless, the groups must be differentiated for aims of this study.

(including banking system demand deposits in central bank plus currency and coins that are physically held in the banking system's vault).

At macro level, banking system assets and its changes are reflective of evolutions in real sector of economy and banking system debts and its changes are reflective of evolutions in monetary sector of economy. Changes of assets and debts in two sides of bank balance sheet actually reflect the reciprocal impacts of nominal and real sectors of economy.

3 Bank Balance Sheet Behavior and Liquidity Creation

3.1 Sound and Unsound Flow of Liquidity Creation in Banking System

Sound flow of liquidity creation denotes a flow in which growth of debt on the left side of banking system balance sheet are supported by expansion of sound assets (including assets producing cash flow, fixed assets and cash) on the right side of banking balance sheet. On the contrary, if some part of liquidity creation flow in left side of banking system balance sheet is synced with the creation and accumulation of unsound assets (especially fictitious ones) on the right side of banking system balance sheet, so this part of liquidity creation flow indicates an unsound flow which is creating unsound liquidity.

Different conditions for offering loans lead to unusual accumulation of fictitious assets in Iran banking system. On the one hand, interest rates of loans are not in accordance with credit ranking of borrowers due to lack of credit ranking system and the focus is mainly on collateral and its value. On the other hand, unlike universal banking systems, in Iran banking system nonperforming loans are not only write-off in balance sheet by gradual allowance, but also long term profits are counted on those debts without appropriated provision. Even if the existence of nonperforming loans is due to defaults by real sector, but unusual growth of nonperforming loans in Iran (rarely recorded in the world) is also resulted from using wrong accounting methods causing to fictitious cumulative assets in bank balance sheets. As a result and amid this time, increase in fictitious cumulative assets in the right side of banking system balance sheet equals with the increase in unsound deposits in the left side of banking system balance sheet. This makes an unbalanced balance sheet and consequently it causes to increase in unsound liquidity in macroeconomy.

Furthermore, it’s not necessary to assume no default and bad loans for having a sound liquidity flow in banking system. In fact if banking system is working soundly; its liquidity flow can bear defaults and write-offs caused by

real sector function and continue its normal cycle. This can be achieved using right accounting methods to write-off bad assets instead of hiding them in balance sheet.

Sound and unsound liquidity flows in banking system are respectively shown in tables 2 & 3. In this analysis, using the common theorizing method, hypotheses are as follows[1]:

- Bank plays no role except funds intermediary
- Incomes by providing financial services cover bank operating costs and the remainder of interest rate of loans and deposits make the profit margin of bank.
- Interest rate for deposits is 15% and for loans it is 18%
- 10% of deposits are considered as demand deposits
- Default rate of productive assets is 4%
- Freezing rate of productive assets is 2%
- 60% of dividends is distributed among bank shareholders
- Other assets, debts, incomes and costs are ignored

The comparison of two mentioned balance sheets in banking system indicates that:

1) As it shows, total of banking system balance sheet in condition A and at the end of tenth term equals with 46954 units lead to creation and adding 31810 units of new liquidity to economy raising liquidity from 9000 to 40810 (showing 16.3% annual liquidity growth)[2]. This case caused to accumulation of 15124 units of fictitious assets (equals with 32.2% of banking system assets) at the end of tenth term on the right side of banking system balance sheet showing the sever reduction of the quality of banking system assets. On the other hand, parallel with fictitious assets on the right side of banking system balance sheet, there is also a type of deposit on the left side of balance sheet which is called unsound deposit (type2) in this study. Besides, cumulative profits in shareholders' equity gained by the accumulation of fictitious assets would be fictitious too. In other words, equal with 15124 units of fictitious assets, 5144 units of fictitious cumulative dividend has been created and also 9979 units of unsound liquidity has been created and injected to economy.

[1] Hypotheses were brought into line with current real situation of banking system of Iran.
[2] Invariant monetary base is considered in this study

Table 1
Liquidity Creation in Condition A: Unsound Liquidity Flow Creation in Banking System When There is No Allowance for Nonperforming Loans

Banking sytem balance sheet in the beginning term (T0)			
Assets		Debts	
Cash generating assets	9800	900	Demand deposits
Frozen assets	0	8100	Time deposits (type 1)
Fictitious assets	0	0	Time deposits (type 2)
Cash	200	1000	Shareholders' equity
Total	10000	10000	Total
Banking sytem balance sheet at the end of first term (T1)			
Cash generating assets	10835	1054	Demand deposits
Frozen assets	231	9247	Time deposits (type 1)
Fictitious assets	463	243	Time deposits (type 2)
Cash	235	1220	Shareholders' equity
Total	11764	11764	Total
Banking sytem balance sheet at the end of tenth term (T10)			
Cash generating assets	23330	4082	Demand deposits
Frozen assets	7562	26748	Time deposits (type 1)
Fictitious assets	15124	9989	Time deposits (type 2)
Cash	939	6135	Shareholders' equity
Total	46954	46954	Total

Source: research findings.

2) As it shows, the difference between totals of banking system balance sheets in condition A and condition B at the end of tenth term is 13852 units. In other words, the accumulation of fictitious assets is prevented in condition B by 100% allowance regarding default loans or soon bad loans (means write off in balance sheet). Hence, liquidity growth has been decreased to 248% in condition B at the end of tenth term (13.3% annual growth) preventing the creation of unsound liquidity.
3) Banking system balance sheet in condition a shows that it is economically unbalanced despite the fact that banking system balance sheet at the end of tenth term is balanced from accounting point of view. This unbalance is rooted in fictitious assets in banking system balance sheet which have been accumulated due to using wrong accounting methods. If such assets are written off, then unbalancing of balance sheet will be clear which shows 15124 units (equals 32% of balance sheet) in the mentioned example in table 3.

Table 2
Liquidity Creation in Condition B: Sound Liquidity Flow Creation in Banking System When There is 100% Allowance for Nonperforming Loans

Banking sytem balance sheet in the beginning term (T0)			
Assets		Debts	
Cash generating assets	9800	900	Demand deposits
Frozen assets	0	8100	Time deposits (type 1)
Fictitious assets	0	0	Time deposits (type 2)
Cash	200	1000	Shareholders' equity
Total	10000	10000	Total
Banking sytem balance sheet at the end of first term (T1)			
Cash generating assets	10844	1027	Demand deposits
Frozen assets	231	9240	Time deposits (type1)
Fictitious assets	0	0	Time deposits (type2)
Cash	226	1035	Shareholders' equity
Total	11301	11301	Total
Banking sytem balance sheet at the end of tenth term (T10)			
Cash generating assets	24777	3137	Demand deposits
Frozen assets	7663	28236	Time deposits (type1)
Fictitious assets	0	0	Time deposits (type2)
Cash	662	1729	Shareholders' equity
Total	33102	33102	Total

Source: research findings.

In general, lack of allowance for nonperforming loans, causes the creation and injection of more liquidity in economy ending in liquidity creation flow in which some part of liquidity is impacted by fictitious assets of banking system, i.e. unsound money. In fact, a wrong accounting method (lack of adequate allowance and ignoring fictitious profit (condition B)) caused to expansion of banking system balance sheet and reflation. Therefore, accounting methods in banking system impact on nominal variable of macroeconomy and consequently on real variables of macroeconomy.

3.2 Vicious Cycle of the Accumulation of Fictitious Assets and Intensification of Unsound Liquidity Creation Flow in Banking system

By accumulation of fictitious assets on the right side of balance sheet and creation of unsound deposits on the left side of balance sheet causing liquidity creation and also under potential pressure of outflow cash, banks tries to control liquidity risk on one hand and to represent a perfect balance sheet on the other hand.

Table 3
Unbalancing in Real Banking Balance Sheet in Condition of Lack of Allowance for Nonperforming Loans

Balanced accounting balance sheet of banking system at the end of tenth term (T10)			
Assets		Debts	
Cash generating assets	23330	4082	Demand deposits
Fictitious assets	7562	26748	Time deposits (type1)
Frozen assets	15124	9989	Time deposits (type2)
Cash	939	6135	Shareholders' equity
Total	46954	46954	Total
Unbalanced economic-financial balance sheet of banking system at the end of tenth term (T10)			
Assets		Debts	
Cash generating assets	23330	4082	Demand deposits
Fictitious assets	-	26748	Time deposits (type1)
Frozen assets	7562	9989	Time deposits (type2)
Cash	939	6135	Shareholders' equity
Total	31830	46954	Total
Unbalancig value: equals with fictitious assets (15124 units and as much as 32% of balanace sheet)			

Source: research findings.

3.2.1 Identifying Profits by Fictitious Transactions, Accumulation of Fictitious Assets and Intensification of Unsound Liquidity Creation Flow in Banking System

By rising trend of the accumulation of fictitious assets and consequently with creation of unsound deposits and potential pressure by cash outflow, to arrange financial statements banks identify fictitious profits by fictitious transactions of real properties. As a result, trend of the accumulation of fictitious assets, damaging banking system balance sheet and consequently, unsound liquidity flow creation all are intensified.

3.2.2 Increase in Bank Interest Rate and its Impact on Assets and Debts Behavior in Banking System Balance Sheet

By accumulation of fictitious assets on the right side of balance sheet and then by creation of unsound deposits on the left side of balance sheet meaning liquidity creation, banks competitively try to save deposits, and under

potential pressure of cash outflow and also in absence of appropriate contrast structure for saving time deposits[1] they focus on higher interest rate.

Although, interest rate is impacted by several factors but undoubtedly changes in bank balance sheets and their competitions to absorb deposits are among the most important factors for increase in interest rate, especially increase in real interest rates. A review of the trend of real interest rates shows that real interest rates have experienced highest levels in recent years.

Bank interest rate have a mutual relationship with banking system balance sheet in such a way that beside the impact of banking system balance sheet on interest rate, bank interest rate is one of the most important variables in assets and debts behavior in two sides of balance sheet. If bank interest rate increases to more than natural rate[2] it causes a process of reduction of the quality of banking system assets on one hand and it leads to debts expansion plus changes in composition of banking system debts on the other hand. By increase in interest rate to higher than normal interest rate and through different mechanisms the process of accumulating fictitious assets lead to damaging banking system balance sheet and thus, the creation of unsound liquidity flow is intensified. The mechanism of this process will be explained afterward.

A) Increase in bank interest rate and assets behavior in bank balance sheets

In assets' side of banking system balance sheet, it is expected that increase in the interest rate of bank loans through increase in incomes by loans allocation causes to assets expansions of banking system. However, regarding outcomes by changing interest rate in macroeconomy, increase in interest rate to a level higher than natural rate can causes real deflation of banking system assets or causing increase in fictitious assets and frozen assets resulting in reduction of the quality of banking system assets.

A-1) increase in interest rate, recession and raising nonperforming loans

Basic models of transmission mechanism of monetary policy imply that an increase in interest rate to a level higher than natural rate causes increase in financial costs of firms and it results in decrease of supply by producers. On the other hand, increase in interest rate lead to delay consumption by

[1] In standard banking system, there are clear conventional borders between deposits regarding due date but in current situation of Iran banking system there is not such legal border between time and demand deposits and if there is any border it is very narrow. In Iran banking system, time deposits act indeed like demand deposits and this rarely recorded in standard global banking system.

[2] In standard approach of economy, natural interest rate is the one that holds the production on potential level and inflation rate on a targeted rate.

consumers resulting in demand reduction. Finally, increase in interest rate through supply and demand reduction in macroeconomy, causes production fall. Furthermore, increase in interest rate through reduction of production efficiency causes investment fall which have stagnation impacts in short run leading to cut tangible investments and production capacities in long run. As a result, raising interest rate to a level higher than natural rate through increase in financial costs of institutions and making recession outcomes in macroeconomy strengthens the risk of debt defaults of loans in banking system.

Thus, even when an increase of bank interest on loans through loans income growth is expected to cause an expansion in banking system assets, we will see that on the contrary it actually leads to more defaults. In case of sufficient allowance in banking system, such situation causes identification of the loss of bad loans and finally it results in contraction of banking system assets. On the contrary, in case of insufficient allowance in banking system, defaulted loans and identified profits of which in banking system balance sheet are converted into fictitious assets leading to reducing the quality of banking system assets.

A-2) increase in interest rate, depression of asset markets and fictitious and frozen assets growth

Interest rate as revenue paid on bank deposits compete with other asset like housing, stocks, foreign exchange and gold market. Therefore, regarding the substitution effect of bank deposits in asset portfolio of investors, increase in interest rate decreases the revenues from other assets. So, raising interest rate to an abnormal level can lead to depression in asset markets. Depression in asset markets causes reduction of fluidity degree of banking system assets resulting in increase of frozen assets in bank balance sheets and also reducing the quality of banking system assets. Moreover, depression in asset markets increases default risk of bank loans causing expansion of fictitious assets of banking system.

B) Increase in interest rate, debts expansion in banking balance sheet and liquidity combination

Regarding banking system debts and its function, increase in interest rate through increase of interest on time deposits causes to debts expansion in banking system.

Meanwhile, interest rate is one of the key variables in explanation of the behavior of people considering liquidity holding in banking system. Increase in interest rate motivates people to shift their deposits from demand to time

deposits for more interest. In macroeconomy level, this matter causes monetary contraction and quasi-money expansion.

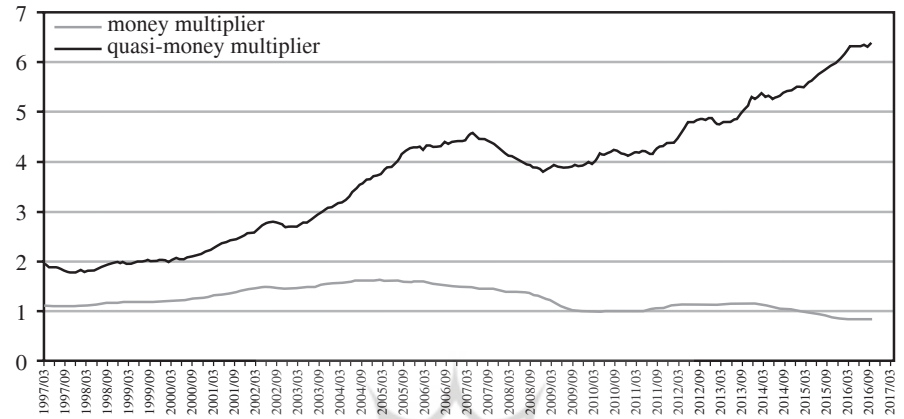

Figure 2. Quasi-money and money multiplier in Iran economy. *Source*: research findings.

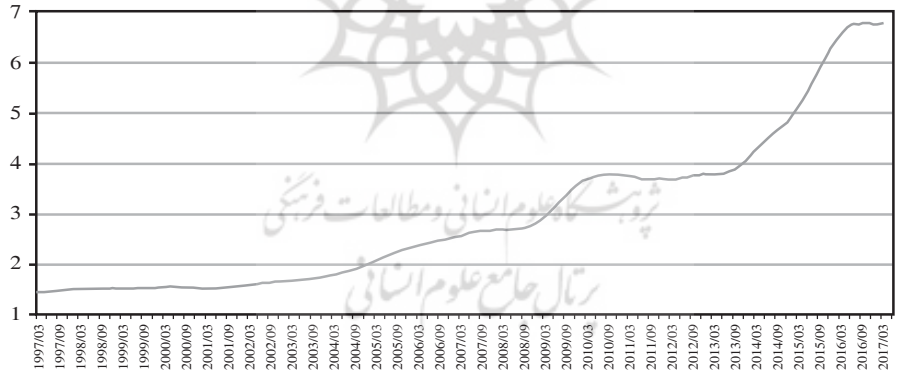

Figure 3. The ratio of quasi-money to money in Iran economy. *Source*: research findings.

3.3 Changes in Banking System Debts and Divergence of Monetary Variables in Iran Macroeconomy: Experimental Evidence

A study of quasi-money and money multiplier in Iran economy indicates a divergence between these two monetary variables in such a way that quasi-money multiplier rose from 2 in 1996 to 6 in 2016; at the same period money

multiplier was fluctuating above 1 and it fell into below 1 in 2016 (Figure2). This divergence is obviously visible in the ratio of quasi-money to money. In this case, the ratio of quasi-money to money rose from 1.5 in 1996 to 7 in 2016 (Figure3).

Upward trend of quasi-money multiplier and accordingly the ratio of quasi-money to money, mainly rooted in increasing trend of unbalancing in balance sheet of banking system resulting in paying high interest to time deposits; these interests are automatically deposited again. This process intensifies the unusual growth of time deposits or in other words, it promotes quasi-money. Regarding the unbalancing of banking system balance sheet due to accumulation of fictitious assets, such deposits are unsound ones.

4 A New Interpretation of Quantity Theory of Money: Puzzle of Liquidity Expansion, Increase in Interest rate and Inflation Decrease

Quantity theory of money is used in different approaches of macroeconomy for analyzing inflation and it states that general price level of goods and services is directly proportional to the amount of money supply in long run:

$$MV = PY \quad \rightarrow \quad \dot{P} = \dot{M} + \dot{V} - \dot{Y} \tag{1}$$

In fact, if velocity of money is stable in long run, then inflation rates equals with the rate of liquidity growth minus economic growth. Historical study of Iran economy shows that money velocity has been decreasing and not stable in recent 20 years falling from range of 3.5 in 1996 to range of below 1.5 in 2016 (Figuer4). Regarding downward trend of money velocity in more than two decades, a one-to-one relationship between liquidity growth and inflation rate is not expected in Iran economy even in long run.

Now, important question is about the reason of downward trend of money velocity in Iran economy. Money velocity is one of the key concepts of monetary economics that is theoretically and experimentally noticed by different economic approaches. In classical economics, money velocity is a function of real variables like financial system efficiency, social norms and salary payment method and it is not impacted by economic policies. In neoclassical economics, money velocity is stable in long run but it is variable and impacted by unexpected economic policies in short run. According to Friedman's approach, even if money velocity can be variable in short run but it remains stable in long run. However, in Keynesian economics and in new

Keynesian economics, money velocity is highly variable and impacted by economic policies, especially by demand policies.

There are several experimental studies about money velocity. Jonung (1983) and Bordo, Jonung and Siklos (1997) studied fluctuations of money velocity in USA, England, Canada, Sweden and Norway and their hypothesis on stability of money velocity was rejected. They believed that long run behavior of money velocity was impacted by monetary and real variables like deposit interests, margin of interest rate of deposit and loans, structural evolutions in money and capital market and banking system development. Owoye (1997) using Granger causality test studied the impact of factors on money velocity in 30 developing countries in 1961-1990 showed that for 21 countries; inflation and for 18 countries; GNP were key factors affecting money velocity. Bogdan and Altar (2002) studied factors impact on money velocity in Romania using vector error correction model and results showed that money velocity increases by increasing currency valuation. They also found out that money velocity is indifferent to production sector and it is highly sensitive to currency rate and to interest rate. According to a study by Faig and Jerez (2005), money velocity has been increased by upgrading IT, creation of credit cards and using telephone and electronic banking. Results of a study by Kim and Subramanian (2009) showed that monetary and fiscal shocks, interest rate and productivity of products impact on the fluctuations of money velocity. Results of a study by Okafor and others (2013) confirm a positive and statistically significant relationship between the growth of income and the velocity of money, which supports the quantity theory of money. Interest rate also has a positive and significant relationship with the income velocity of money.

Regarding experimental studies about Iran economy, Komeijani and Nazarian (2004) studied income velocity of money using error correction model and they argued that money velocity has been impacted (U form) by deposit interest rates, inflation rate, banking system development, currency rate and devaluation of currency. Moeini (1995) using Auto Regressive Distributed Lag (ARDL) argued that both GDP and inflation rate have positive and significant impact on money velocity. Najibi Ashkezari (2007) used also ARDL and argued that national income and inflation rate have significant impacts on money velocity; whereas, currency rate in free market and stock market volatility don't have significant impact on money velocity. Zeranezhad, Zare and Akaberi (2011) also used ARDL and they argued that real national income, interest rate, income distribution and banking system development are in a positive and significant relationship with money velocity

and liquidity; whereas, currency rate has negative and significant impact on liquidity velocity and it has no significant impact on money velocity. Besides, expect inflation rate have no significant impact on money velocity and liquidity velocity. Tayebnia and Taghimolaiee (2010) used also VAR and argued that money and inflation in Iran don't have a one by one relationship.

In general, although different factors like interest rate, production, exchange rate and technology in the banking system impact on the velocity of money. However, according to this study, changes in banking system balance sheet are considered as the key factor of downward trend of money velocity in Iran economy. Upward trend of fictitious and frozen cumulative assets and consequently downward trend of decreasing quality of the assets on the right side of banking balance sheet lead to increasing unsound liquidity (time deposits type2) and this causes downward trend of liquidity quality.

In this framework, liquidity quality in quantity theory of money is a key factor for measuring liquidity velocity. So, we have an adjusted value in below equation:

$$LP_t = \beta_1 LM2_t + \beta_2 LM2Quality_t + \beta_3 LY_t + \beta_4 + \psi_t^p \quad (2)$$

Liquidity quality is important in different components like unsound liquidity and quasi-money ratio to money in combination of liquidity. Considering the absence of real data on fictitious assets and unsound deposits, this study is mainly focused on quasi-money ratio to money as one of the components of liquidity quality[1].

Changing quasi-money ratio to money in combination of liquidity leads to changing fluidity degree of liquidity and also causes changes in liquidity quality. One point is that in standard banking system, there are clear conventional borders between deposits regarding due date but in current situation of Iran banking system, there is not such legal border between time and demand deposits and if there is any border, it is very narrow and time deposits can be converted to demand deposits by paying minimum penalty. In this frame, interest rate of deposits is the only factor that can save the border between time and demand deposits and in other word; it can save the border between money and quasi-money through impacting the behavior of economy participants for holding liquidity.

[1] In case of having data on time-series of fictitious assets growth in banking system, more significant statistical relationship is introduced.

4.1 Quasi-Money Ratio to Money, Liquidity Quality and Liquidity Velocity: Experimental Evidence

Study of historical trend of liquidity velocity and quasi-money ratio to money indicates that quasi-money ratio to money is a key variable for defining liquidity quality and also liquidity circulation velocity. Increase in quasi-money ratio to money that indicates decreasing fluidity of liquidity causes to decrease of the velocity of liquidity circulation and vice versa (Figure 4).

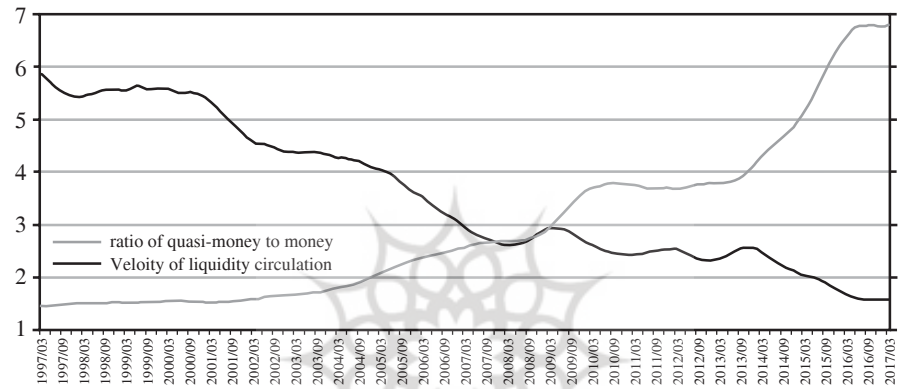

Figure 4. Quasi-money ratio to money and velocity of liquidity circulation in Iran economy. *Source*: research findings.

As explained above, upward trend of quasi-money multiplier and consequently quasi-money ratio to money is rooted in increasing trend of unbalancing balance sheet of banking system and also in paying high interest to time deposits and redepositing these interests. Hence, reducing liquidity velocity back to reduction of liquidity quality and increase in quasi-money ratio to money rooted in unbalanced balance sheet of banking system due to fictitious cumulative assets and creation of unsound liquidity.

Considering quasi-money ration to money as a key component of liquidity quality we have some adjusted in quantity theory of money in below equation:

$$LP_t = \beta_1 LM2_t + \beta_2 LQMM1_t + \beta_3 LY_t + \beta_4 + \psi_t^p \quad (3)$$

In this equation, LP_t is the logarithm of price index, $LM2_t$ is the logarithm of liquidity, $LQMM1_t$ is the logarithm of quasi-money ratio to money and LY_t is the logarithm of production in period t. Tests of Augmented Dickey Fuller (ADF) confirms that all four endogenous variables (including production,

price indexes, ear money ration to money and liquidity) have unit root and integrated (I (1)).

In this study, an econometric vector error correction model (VECM) was used to estimate the intended empirical relationship. This model consists of a set of long run relationships and a set of short run relationships. The former indicates the long run equilibrium, and the latter shows the dynamic transition processes of variables to long run values. The adjusted equation of quantity theory of money (Equation 3) forms the long run relationships of this model. Regarding short run relationships, there is the following equation:

$$\Delta Y_t = \alpha \psi_{t-1}^{p} + \sum_{i=1}^{s-1} \delta_i^{Y} \Delta Y_{t-i} + \gamma_1 \Delta LEr_t + \gamma_2 \Delta R_t + \varepsilon_t^{Y} \quad (4)$$

In this equation, ΔY_t indicates the growth rate of endogenous variables. ΔLEr_t, indicates growth rate of currency, ΔR_t indicates bank interest rate change an these two are considered as exogenous variables both are I(0).

For short run relationship of inflation we have:

$$Inf_t = d(LP_t) = A_1[\psi_{t-1}^{p}] + A_2 d(LP_{t-1}) + A_3 d(LM2_{t-1}) + A_4 dLQMM1_{t-1} + A_5 d(LY_{t-1}) + A_6 d(LEr_t) + A_7 (dR_t) + \varepsilon_t \quad (5)$$

Seasonal data related to time series of December, 1996-2016 were used in above mentioned VECM. According to co-integrated test and results from this model, the adjusted long run equation of quantity theory of money is accepted.

Results by estimated adjusted equation of quantity theory of money, indicates that every 1 percent increase in quasi-money ration to money in combination of liquidity cause to a 0.24% cut in general level of prices in long run:

$$LP_t = 1.008 LM2_t - .244 LQMM1_t - 1.733 LY_t + 14.94 + \psi_t^{p} \quad (6)$$

Short run realtionship of inflation shows that quasi-money ratio to money in combination of liquidity hass short run impacts and with minus multiplier of 0.1, it shows strong reverse impacts on inflation rate.

$$Inf_t = d(LP_t) = -.105^{*}[\psi_t^{p}] + .30^{*} d(LP_{t-1}) + .004 d(LM2_{t-1}) - .07^{*} dLQMM1_{t-1} - .017 d(LY_{t-1}) + .08^{*} d(LEr_t) - .0007(\Delta R_t) + 0.007 D - .022 + \varepsilon_t \quad (7)$$

Adjustment coefficient of 0.105 units shows a deviation of long run relationship indicating any deviation in adjusted long run equation of quantity

theory of money for different shocks is justified with a low speed (around 10 years).

Despite high growth of liquidity, reduction in liquidity quality impacted by decreasing quality of banking system assets has caused to increase in bank interest rates leading to credit crunch and reducing inflation rate is seen against liquidity growth. Moreover, high interest rate of banks is considered as the increase in liquidity growth resulted from paying high interest to bank deposits. An analysis of banking system balance sheet helps us on finding a convincible reason for paradoxes like increase in interest rate together with liquidity expansion, increase in interest rate despite sever reduction of inflation rate and reduction in inflation rate despite liquidity expansion.

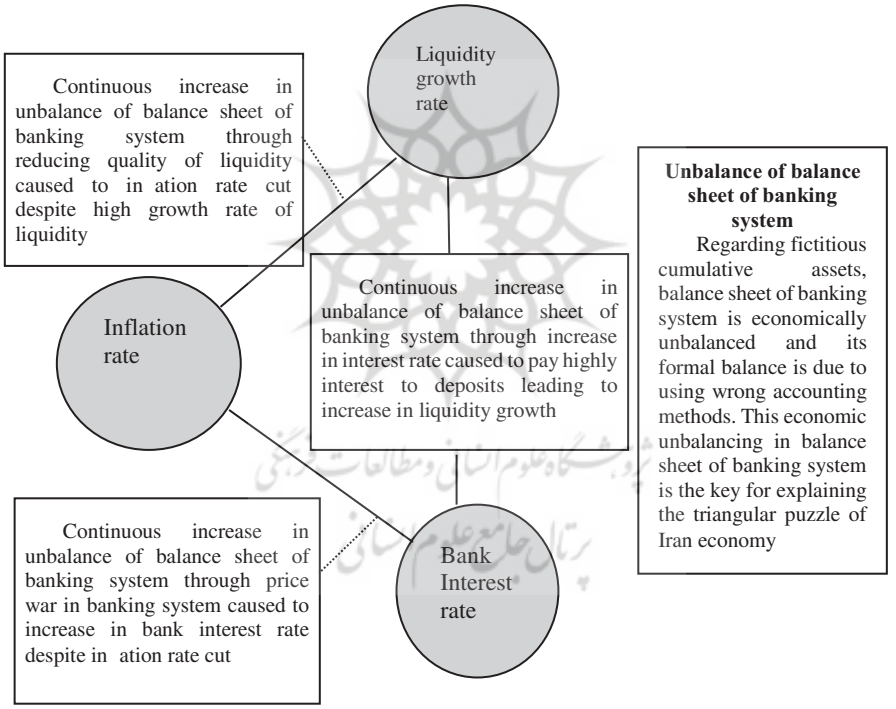

Figure 5. Unbalanced balance sheet of banking system is the key for explaining the puzzle of liquidity reflation, interest rate increase and inflation reduction. *Source*: Research findings.

5 Conclusion

This study explains a triangular puzzle disturbing Iran's economy in which the situation is: increase in liquidity growth, significant reduction of inflation rate and increase in bank interest rate. In suggested model of this study, we are connecting the microeconomy of banks to macroeconomy in order to show that from the macroeconomy point of view, the main reason that caused such puzzle is rooted in balance sheet of banking system. Most important findings of this study are as follows:

1) Decompositional analysis of assets and debts in balance sheet of banking system indicates that regarding the considerable accumulation of fictitious assets, balance sheet of banks are economically unbalanced and its formal balancing is due to using false accounting methods. This economical unbalancing in balance sheet of banking system is the key of explaining triangular puzzle of Iran's economy current situation.
2) The quality of banking system assets affects the quality of debts and consequently this affects the quality of liquidity. In fact, accumulation of fictitious and frozen assets on the right side of balance sheet of banking system caused an unsound liquidity flow creation in which some part of liquidity is impacted by fictitious assets in banking system that is called unsound liquidity in this study.
3) Huge amounts of fictitious and frozen assets in balance sheet of banking system has prevented available assets from making adequate cash flows in banking system leading to growth in liquidity demands and banks are inevitably trapped in a hard fight for saving deposits at any cost. This price war itself caused an increase in banking interest rate.
4) High interest paid to deposits due to accumulation of fictitious assets and unbalanced balance sheet lead to unusual growth of time deposits and this is the sequel of paying high interest to time deposits and redeposit of the interests. These all caused a simultaneous high rate of liquidity growth (which large portion of it is unsound) and high banking interest rates.
5) Persistent reduction in quality of banking system assets and the slope of unbalancing in banking system balance sheet through reduction of liquidity quality lead to credit crunch for firms despite high rate of liquidity growth alongside with inflation rate cut comparing to growth rate of liquidity. One of the components that changes the quality of liquidity is changing the quasi-money ratio to money in combination of liquidity which has clear impacts on the velocity of liquidity and its inflation outcomes. In this study, long run equation of quantity theory of money was adjusted by adding the variable of quasi-money ratio to money as one

of the components of liquidity quality. Estimation of this relationship in accordance with VECM indicated that every 1 percent increase in quasi-money ratio to money in combination of liquidity and consequently reduction of liquidity quality causes 0.24% reduction of general prices level in long term. Hence, considering these results, upward trend of quasi-money multiplier and consequently increase in quasi-money ratio to money are all affected by unbalanced balance sheet of banking system and also by unsound liquidity. This behavior shows that liquidity growth rate and inflation rate are not in sync especially in recent years.

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