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Behavioral Pattern of Income Velocity of Money and Estimation of Its Function (The case of Iran)

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Abstract

Based on the "Aggregate Demand" theory, monetary policies are designed with the aim of achieving desirable level of macroeconomic goals through affecting the stock of money supply and income velocity of money. Thus, the velocity (V)-as well as money supply - has significant impact, particularly on rate of inflation through expansionary or contractionary monetary policy. To focus on the velocity from a theoretical point of view, the classical theories of demand for money considered this variable as a stable, due to negligible changes in structures and real variables of the economy. On the other hand, the contemporary theories of New-classical and New-Keynesian schools believed in the effectiveness of anticipated and even unanticipated policies on the fluctuations, or stability of income velocity.

However in regards to the fluctuations of this variable in the Iranian economy, it has been observed that from the 1340's (1960's) until the beginning of the First Five Year Development Plan, in 1368 (covering 1989/90-1993/94 period) it has diminished and then until recent years, it has an upward trend, showing a "U" shape pattern, same as that in the European and American economies. Thus, to find a specific behavioral pattern for this variable, we can estimate and predict its impacts on macro-economic variables, i.e, on inflation rate, etc. In this paper, an attempt is made to survey the stability of this variable, and then the long run or the equilibrium function of income velocity shall be estimated, using the co-integration method. Finally, we analyse the short run adjustment of this variable to predict its long-run equilibrium value, by applying the impulse response function, variance decomposition and error correction model (ECM).

Keyword: Monetary policy, money supply, (income) velocity of money (liquidity), inflation, demand for money, classical theory, New - classical theory, New Keynesian school, (un) anticipated policy, stability of velocity.

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1- Introduction

In the process of designing economic policies and particularly monetary policy, diagnosing the fluctuations and significant factors affecting velocity is very important. Thus, if the fluctuations of velocity have a specific behavioral pattern, or if the fluctuations are predictable, then monetary authorities can produce anticipated changes in the GNP by using monetary aggregates.

From the theoretical point of view, the economic literature is full of controversial issues. The classical school, which in a broad prospect – including the Newclassics and New classical school – believes in the independence of income velocity of money from government active policies and considers it as a function of real as well as institutional variables with negligible fluctuations in the short-run. However, contemporary theorists, particularly the Neoclassic, have neglected the effectiveness of the government's anticipated policies on real variables including velocity of money. Thus, they have assumed the velocity as a stable variable which can be influenced, only by unanticipated policies in the short-run. However, from the Keynesian views, velocity has been considered as a highly fluctuating variable and its changes are significantly influenced by economic policies. In the meantime, changes of "V" are they nullify such that it nullifies the effects of monetary policies. Although, the New Keynesians, who believe in inefficiencies and failure of market mechanism, pointed out that even anticipated policies have certain effects on velocity (same as real variable).Thus "V" is considered as a highly fluctuating variable.

Further studies on stability of velocity which were attempted in late 1980's in the European countries by M. Bordo and L.Jonung (1987) indicated evidence that the income velocity of money displayed a "U" shaped pattern from the 1870's to the 1970's, which throws doubts upon the stability of "V" theorem, envisaged in traditional theories.

In other words, in this theory, "V" follows significant fluctuations in the short-and long-run. Its non-stationary behavior will be affected by specific relevant variables which influence money demand [such as current (permanent) income, inflation rate, anticipated rate of inflation and interest rate]. It will also be fully affected by institutional factors in money and capital markets such as increase in technical efficiency of the payment system in the financial sector, emergence of assets with high a degree of liquidity, technical innovations in

money transfer, and development of money in the banking sector, which in general are totally considered as factors affecting the volatile behavior of "V".

Other studies which were accomplished by Hamilton (1989), Siklos (1993) and Baldev (1995) produced significant results in support of the latter theory, and have become famous as monetary institutionalism.

Finally, given the "U" shape behavior of the velocity of money (liquidity) in Iran which occurred since the 1340's (1960's) until now (during the First and Second Five Year Development Plans), we have observed the turning point of the trend of "V". Moreover, a survey of "V" function and the specific variables affecting it indicates that in their level they are non-stationary; and as it will be proved in this paper, the variables specified in the "V" function are non-stationary or have a unit root. Therefore, using conventional econometric models will end with spurious regression results. After reviewing the theoretical issues of velocity in section 2, we will study its trend during the past 4 decades i.e 1340-1379 (1960-2000) in section 3. In section 4, the long- run equilibrium function of "V" and its explanatory variables shall be estimated using co-integration method. Then, through error correction model, variance decomposition, and impulse-response functions, short-run adjustments of the model and their performance in obtaining the long-run equilibrium shall be studied. Finally, the concluding remarks and policy guidelines are proposed.

2- Review of the Literature

2-1- Classical School

Classical economists, in explaining monetary inflation (which in the economic literature is known as Quantity Theory of Money) and being propounded by economists such as Steuwart Mill, Ricardo and Fisher, have attempted to analyze the relationship between volume of money and inflation (value of money); which in turn is considered to be the basis of their thoughts about the velocity of money. Their theory in the framework of Irving Fisher's (1960s) equation of exchange is as follows:

$$MV+M'V'=PT \qquad (1)$$

Where M and M' are nominal stock of money (active) and bank deposits, respectively. V and V' indicate transaction velocity of money and deposits. P shows general price level and T is volume of transactions.

In another interpretation of Fisher equation, with regards to the complexity of computation of volume of transactions due to the significant developments in financial markets, and to analyze the impacts of velocity on inflation and national income, we have:

$$mv = p.y \Rightarrow V = \frac{py}{m} \qquad (2)$$

In which M, represents the volume of active money and *"V"* is "Income velocity of money" indicating time intervals (period) which each unit of money is spent by the economic agents for final goods. Considering the fluctuating behavior of "V" according to Classical School, velocity is a function of choice and preferences of people and real factors, and structures of the society – i.e. receipts and payment systems, invention of new instruments as substitute for money, (particularly development of banking systems), and it is generally independent from government economic policies, and especially from demand management policies. Thus, because of negligible changes of those factors and structures, "V" is considered as a stationary variable in both the short-and long run; so that, despite existence of slow and slight changes and fluctuations in the said factors, their aggregate impacts on this variable are neutral in the short-run. In addition, the long-run fluctuations of "V" shall be easily predictable.

2-2- Cash Balance School

A new interpretation of the Quantity Theory of Money was proposed by Marshall and Pigou from Cambridge University as Cash Balance Approach. On this basis, the demand function for real cash balance is as follows:

$$m = KpY \qquad (3)$$

$$k = \frac{1}{v} \qquad (4)$$

Where, K, or cash ratio, represents part of income of the society, whit the public demand for their cash transactions. Based on this approach, study of "V"

behavior is, thus, study of money demand function from another angle. According to Neoclassical, although "K" may show significant changes in the short-run, it is a constant in the long–run in different societies. They, same as classical, believe that "V" is an independent variable from economic policies, while its behavioral pattern, like "K" is predictable.

2-3- Chicago School (Monetarists)

The advocates of Chicago school led by Friedman, (based on the assumptions of inherent stability of the private sector and flexibility of prices), believe that any distortion in an economic system-provided no government intervention-shall be automatically corrected, and the system benefits from a long-run stable equilibrium. Monetarists, by incorporating the concept of long-run period in their economic analysis and by utilization of Cagan's Adaptive Expectations Theory, believe that monetary policies have merely significant effects on production in the short run. In the long-term (and in the medium-term), increase in the volume of money leads only to inflation. Thus, through rejecting adoption of discretionary monetary policy of the Central Bank, they recommend adoption of constant money growth policy (Friedman, 1959). According to the Monetarist School, due to dependency of velocity to economic policies, it bears high fluctuations in the short-run. Therefore, its behavior is less predictable. However, its changes in the long-run, because of fluctuations of real factors and structures of the society, keeps a smooth path-which increases its stability and predictability.

Considering various factors affecting velocity of money, Friedman, by assuming money as consumer goods in the utility function of consumers and given the assumptions of non-existence of money illusion and the stability of public's preferences, the demand for money is function of return of alternative assets for money. Additionally, by assuming that money demand function homogeneity of degree one to income, and after specifying the rates of return of two major alternatives to money, i.e. r, rate of return on financial assets, and p, as rate of expected inflation as proxy for rate of return on non-financial or durable consumer goods and y, real income as proxy variable for wealth, then we have:

$$M/P = m^d = m(y,r,P) \qquad m_1 > 0 \qquad m_2 < 0 \qquad m_3 < 0 \qquad (5)$$

$$M/P=m^d=K(r,P).\ y \rightarrow m^d/y=k(r,p) \quad k_1<0 \qquad k_2<0 \tag{6}$$

Equation 6 can be transformed as follows:

$$V=y/m^d=\frac{1}{K(r,p)}=V(r,p) \Rightarrow V_1>0 \qquad V_2>0 \tag{7}$$

Thus, velocity can be considered as a stable function of rates of return on different financial and physical assets.

2-4- Keynesian School

In brief, the fundamental basis of Keynesian approach is as follows:

With the rigidity of money wages (downward) and money illusion existed on the part of laborers, the Neo-classical equilibrium associated with full employment in the labor market does not exist. Thus, considering the excess supply of labor and low interest elasticity of IS function in the commodity market and shortage of aggregate demand for goods and services, the condition of disequilibrium IS caused. Moreover, since the money market tends to be in a liquidity trap situation, it generally leads the economy to depression; and because of inefficiency of monetary policy, they emphasize the role of fiscal policy for remedy. From the Keynesian viewpoints, velocity of money is severely affected by demand management policies. Therefore, it is considered as a non-stationary variable, and its fluctuations are opposite to the movement of money supply-which, due to its relative severe instability, controlling and predicting the behavioral pattern of "V" seems to be difficult for policy making purposes. Interest rate is also considered as a variable influencing on "V", and particularly, because of severe fluctuations of (r) during the business cycles, the velocity will be also affected by this unstable condition.

2-5- New - Classical School

With the aim of renewing the viewpoints of neoclassical approach, a new generation of monetary economists found the New-Classical school in the 1970's. The basic tenet of this school which was founded by Lucas (1973), Sargent and Walace (1975) and significant theoretical contribution of Barro

(1977-78) and is now considered to be an important contemporary macroeconomic school is composed of the two axioms i.e. complete flexibility of wages and prices and rational expectations. They believe that monetary policy may have a temporary impact on the output level, if the public has not anticipated it properly. According to "Sargent and Wallace", the Phillips curve is vertical even in the short-run. The New Classical is of the opinion that the velocity of money (due to the stability of money demand function) is a stationary variable in the long run. Since monetary policies are fully predictable for the public, only the unanticipated policies of the government can inflict the fluctuations on "V" in the short-run; while in the long-run, the impact of these policies on "V" is neutral due to correction of expectations on the part of people.

2-6- New-Keynesian School

New-Keynesians generally reject the New-Classical theory of explaining economic fluctuations based upon the market clearing principle. By integrating rational expectations with the assumptions of the rigidity of wages and prices, they believe that in the short-run, the aggregate demand for production is the main stimulant for levels of output and income, and the aggregate supply curve is not vertical. Meanwhile, Mishkin (1982) has propounded that "even the anticipated monetary policy can also have a significant impact on the output" [1].

The New-Keynesians believe that in the Keynesian tradition prior to 1980's, price and wage rigidity were either assumed directly, or wage rigidity was the result of considering the long-term employment contracts between worker unions and employers, i.e, Fisher (1977) and Taylor (1979-80). They try to explain inflexibility of prices as rational behavior, while tending toward using micro-foundation of price rigidities through applying asymmetric information model. So that, famous New Keynesian theoreticians such as Mankiw (1970) and Ball, and Romer (1986) presented Menu Costs theory and believe that negligible costs (such as publishing and change of price menus), and asymmetric distribution of information cause" even anticipated policies to be effective in the economy.

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1 - Mishkin, F. (1982) "Does Anticipated Monetary Policy Matter" An Econometric Investigation", J.P.E. Vol. 90, PP. 22-51.

In the case of velocity behavior, they emphasise the fact that "V" is affected by the active economic policies; while, with regards to the market failure and inefficiencies, the behavioral pattern of "V" is considered by them as a function of anticipated and unanticipated policies and its high fluctuations are also a function of these policies.

2-7- Monetary Institutionalists theory on the Trend and Factors Affecting "V" Behavior

Regarding the causes of fluctuations of velocity, M.Bordo and L.Jonung (1987), found that since late 19th century until the World war II, "V" has kept a downward trend in five industrialized countries namely USA, England, Canada, Sweden, and Norway; while it experienced an upward trend in post war period. In other words, it shows a "U" shape pattern for a century, which refutes conventional theories of "V" stationary hypothesis. Bordo and Jonung have expounded that the long-run, behavior of "V" and its fluctuations are the result of institutional developments in the money and capital markets, particularly that of broader-based banking system expansion, technical progress in financial sector of different countries, and changes in fiscal and monetary policy decision making.

According to them, technical progress in financial sector has kept two different effects on "V" trend in industrialized countries. Thus, because of monetization of the economy in the initial period of industrial development, the growth of demand for real money balances has been faster than rise in national income. Therefore, "V" faces a downward trend. However, in the next stage, due to further stability and economic security, growth of international trade, emergence of highly liquid securities and technical progress in transfer of funds through utilizing credit cards and ATM's have altogether optimized the desirable volume of demand for real balances for economic agents. These developments, are thus, considered by Bordo-Jonung as cause of persistent increase in "V" (upward trend) during the second half of the last century.

3- Review on the pattern of "V" in Iran, during 1338-79

Studies done on Income velocity of liquidity[1] trend in Iran, indicate that "V_2" has faced two general trends into three distinguished phases during the past four decades.

In this regard "V_2" registered a decreasing trend from its initial amount of 5.7 in 1338 until 1359 coincided with the Iraqi war, at which time it reached its lowest level of 1.47 showing a downward trend for 22 years period with an average of 3.63 (during this period, except in 1352-53, with respective amounts of 3.35 and 3.73 which it reached its relative peak due to the rise in crude oil revenue).

In the second period, which synchronized with the war era, "V_2" kept an almost linear trend of 1.47-1.42 and average of 1.61, which showed negligible fluctuations and could be considered as a turning point from a downward trend to an upward one. The third period, covering post-war era until 1379-80, "V_2" experienced an upward trend, rising with a smooth slope, by 1.48 since 1368 was the year of inception of the First Five Year Economic Development Plan, and maintained its trend at the end of the plan period by 1.94.

From 1373 it was still increasing (by 2.07) and in 1379 with an amount of 2.3, the increasing trend of "V_2" continued. During the period 1374-78, the average of "V_2", with 2.1 higher than the average of the previous period,(1368 - 72) reached 1.72.

Taking the period which coincided with war as a turning point, the behavioral pattern of "V" in Iran has a "U" shape trend. Its downward slope started in 1339 and continued until 1359 with average of 3.63. The upward trend of "V" started in 1360 and kept its path until 1379 and its average reached 1.8. Which conceived certain policy outcomes, so that the starting point of upward slope of "V_2" indicates technical efficiency of payment system and steps taken by the country's capital market?

Study of stability coefficient (dispersion index)[2] of velocity of liquidity also indicates both partial and total instability of this variable. Thus, stability

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1 - Based on M2 monetary aggregate (V2).

2 - This coefficient which is known as Pearson's coefficient is defined as, $V=\frac{\sigma}{\mu}$.

coefficient was 0.35, during its downward trend (1339-1359), 0.13 during its upward slope and 0.3 for the whole period of the study (1338-1379). Hence based on the statistical results, the stability or stationary hypothesis of "V_2" is not confirmed both in the long-and short-run.

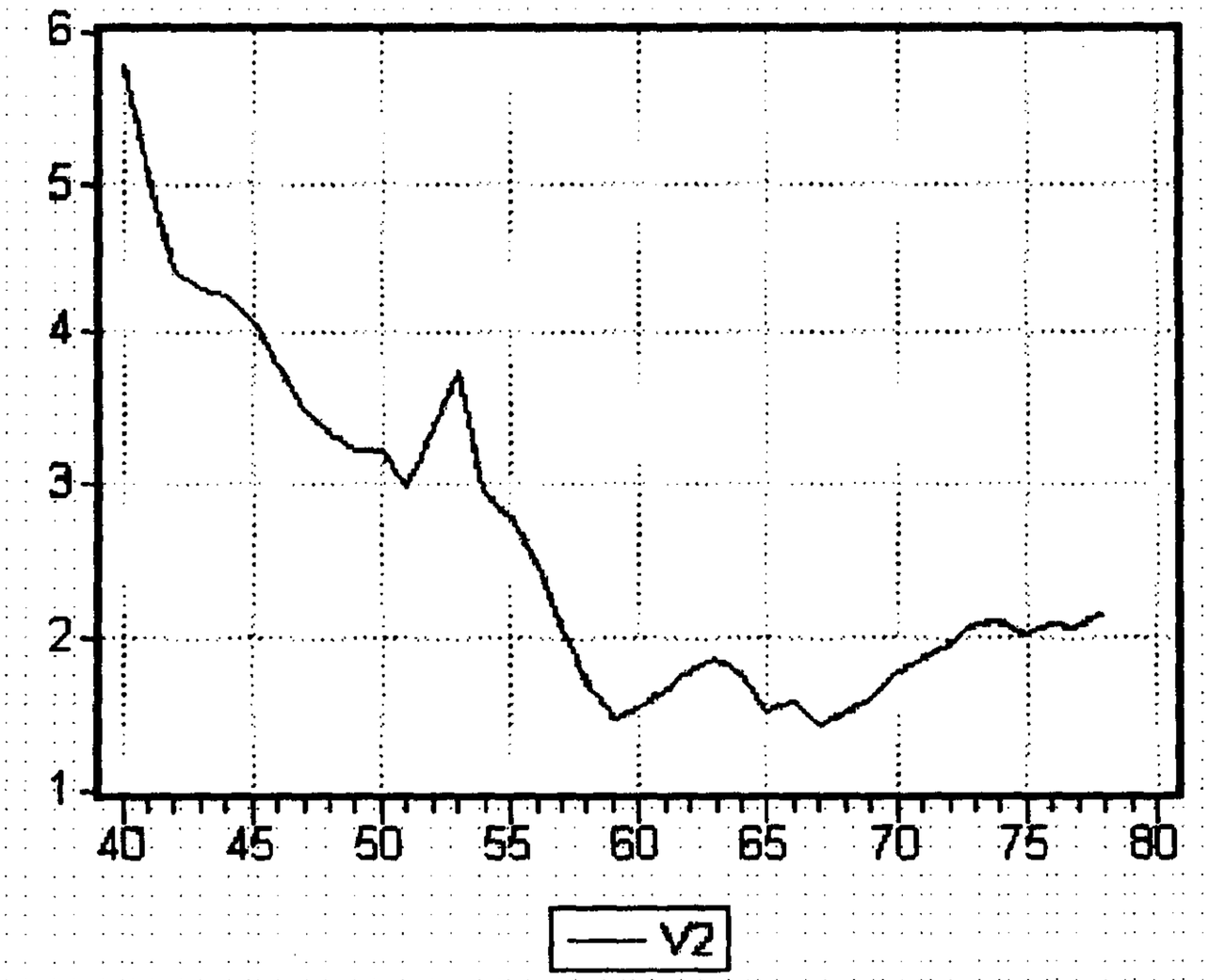

Figure (1): Pattern and Trend of Income Velocity of Liquidity (V_2) in Iran (1359-1379)

4- Estimating Income Velocity of Money (Liquidity) Function in Iran

4-1-Model and Methodology

The mathematical model presented here, is based on studies done by economists supporting institutional hypothesis in financial sector regarding "U" shape of "V" trend, and it generally includes applied researches of Hamilton (1989), Siklos (1989a-b), and Raj-Siklos (1988). From the theoretical point of view, the research works of founders of monetary institutionalism's hypothesis i.e. Bordo and Jonung has been considered as the core of our study. Hence, estimation of "V" function is performed by two models, indicating velocity of liquidity "V_2 and velocity of money "V_1 as follows:

$$V_2 = \beta_0 + \beta_i \Phi_1 + \beta_k \Omega_t + \varepsilon_{0t} \qquad (8)$$

$$V_1 = \beta_0 + \beta_i \Phi_1 + \beta_k \Omega_t + \varepsilon_{1t} \qquad (9)$$

A- In the above models, vector Φ_t *includes* variables that originate from real money balances, which in turn comes from variables indicating conventional theories of demand for money function such as:

Φ_t =[YCAPR, RTL,RSS, INF]

where: YCAPR= real per capita income (Gross domestic product at constant 1361 factor prices)

RTL= weighted average rate of return on long-term investment deposits of one year and more in the banking system (at current prices)

RSS = rate of return on savings and short-term deposits in the banking system.

INF= Inflation rate (percentage change of annual increase in consumer price index)

B - The Ω_t vector include variables indicating sophistications in the country's financial institutions (monetary and banking), which is presented as:

$$\Omega_t = [MQM_1\ M_2M_1, CM_1, M_1M_2, RER, BAY, VAG]$$

where:

MQM_1 = Ratio of quasi money to money.

$M_2\ M_1$ = Ratio of liquidity to money.

CM_1 = Ratio of notes and coins to money.

M_1M_2 = Ratio of money to liquidity.

These four variables have been entered in the model as variables, which measure the degree of monetization of the society or degree of financial deepening.

RER= real exchange rate in the Iranian economy and is obtained through the following equation:

$$RER = FRER\left(\frac{P_{us}}{P_{IR}}\right) \qquad (10)$$

FRER= Parity rate of each U.S. dollar against Rial in unofficial exchange market, P_{IR} and P_{us}, represent consumer price indices in Iran and U.S.A, respectively, at constant 1985 prices.

BAY= Ratio of commercial and specialized banks' assets to GDP (at market prices) and is considered as an index for broader-based banking services rendered and the extent of development of banking sector.

VAG = Ratio of value-added in agriculture sector to GDP, at constant 1361 prices. This variable has been added to the model with the aim of attempting to increase the predictability of functions; on the basis of few studies done in the area of "money demand function"[1], in countries where the agriculture sector dominates and contributes a significant share to GDP, omission of this variable in demand function may lead to specification error in the estimation of functions.

The time-series applied in this study covers the period of 1340 – 1379. All variables in the model are measured in logarithmic form except for rate of return on short and long-term deposits and inflation (where logarithmic conversion for variables indicating rate or ratio are not recommended), (Fair 1981).

In the case of estimation of models for income velocity of money (liquidity), we observe that: considering the nature of the components of the functions which are generally non-stationary in level, estimation methods using level of variables leads to pseudo regression results, so that the variables entered the present functions are non-stationary and have a single unit root. Disregarding the above fact, adoption of suitable methods of estimation may result in certain outcomes for policymaking. Therefore, if "V" has unit root, the possible shocks may deviate the "V" time series from its previous pattern, in the long-term, and it is not clear which mechanism can reverse it to its former trend. As a result, in this study, we have applied co-integration method based upon maximum likelihood technique, Johansen (1988) and Johansen & Juselius

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1 - See also Driscol and Lahiri (1983) in which they surveyed money demand for 12 developing countries with agricultural-based structures. It should be added that Goldfeld (1976) has also pointed out the different behavior of real money balance.

(1990) procedure. Moreover, Error Correction Model, which indicates the short-run and long- run relationship between the models, is also applied.

Furthermore, the dynamic effects of short- run model, which leads to long-run and stationary equilibrium, will be analyzed through variance decomposition and impulse response functions.

4-2- More explanations on the Variables Determining the Velocity of Money ("V_1") and Liquidity ("V_2") Function

4-2-1-Dependent Variable (Velocity of money and liquidity)

Since velocity of money and liquidity have been selected as dependent variables, therefore, having a proper and precise definition of money and liquidity from which V_1 and V_2 are derived is of significant importance. As time series data on "money" and "liquidity" (both monthly and quarterly), have indicated fluctuations due to the habits, preferences and consumption behavior of the public and the payment system in the economy, and in particular the role of government in the Iranian economy.

To achieve the stationary equilibrium function of velocity, the monthly smoothening of M_1 and M_2 time-series are inevitable. For this purpose time series data on the stock of money, M_1 (notes, coins and sight deposits) and liquidity (M_2) (money and quasi-money) were adjusted and smoothed in various methods, including: Monthly Multiplicative Smoothing, Holt-Winters Multiplicative, and Hedrick Prescott Filter.

In the following tables the degree of stability of adjusted M_1 and M_2 time series (Monthly) data in three said methods are compared with each other. Where in the tables;

M_1SAD and M_2SAD indicate growth rate of adjusted M_1 and M_2 in Monthly Multiplicative smoothing method. M_1SMD and M_2SMD presented growth rate of adjusted M1 and M_2 in Holt-winters method and finally HP03D and HP01D are growth rate of adjusted M_1 and M_2 in Hodrick –Prescott filter.

As is shown in the tables 1 and 2, among the three methods, the Hodrick-Prescot method according to statistical criteria, particularly of stability Index (Pearson's dispersion Index) proved to be the most stable time series.

In tables 3 and 4 the stability Index of time series (in growth rate) of money Stock and liquidity (according to the officially released data) of M_1D and M_2D are compared with adjusted of them, M_1AD and M_2AD,(on the basis of Horick–

Table (1) : Comparison of Degree of Stability of Adjusted M_1 Growth Rate

Monetary Variable / Statistical Index	HP03D	M_1SAD	M_1SMD
Mean	181.91	175.32	195.59
Standard deviation	321.51	769.98	963.65
Stability Index	1.76	4.39	4.93

Table (2) : Comparison of Degree of Stability of Adjusted M_2 Growth Rate

Monetary Variable / Statistical Index	HP01D	M_2SAD	M_2SMD
Mean	408.45	397.4	458.53
Standard deviation	730.12	1168.22	2250.93
Stability Index	1.78	2.93	4.9

Table (3) : Comparison of Degree of Stability of Adjusted M_1 and M_2 Growth Rate

Monetary Variable / Statistical Index	M_1 D Money Growth Official Statistics	M_1AD Money Growth (Adjusted)	M_2 D Liquidity Growth Official	M_2AD Liquidity Growth Adjusted
Mean	22.96	17.96	24.26	24.11
Standard deviation	13.25	7.34	10.3	8.5
Stability Index	0.57	0.4	0.42	0.35

Table (4): Comparison of Degree of Stability of Time-Series for Income Velocity of Money and Liquidity(V_1 and V_2)

Monetary Variable / Statistical Index	V_1 Velocity of Money	V_1A Adjusted) (V_1)	V_2 Velocity of Liquidity	V_2A (adjusted) (V_2)
Mean	5.42	5.68	2.63	2.72
Standard deviation	2.28	2.19	1.13	1.15
Stability Index	0.42	0.38	0.43	0.42

Prescott filter) and as is shown in those tables, the adjusted data has least deviation or the highest degree of stability. On this basis, V_1 and V_2 (according to the officially released data) are compared with adjusted V1A and V2A (velocity of money and liquidity), and thus the adjusted data show the most stationary trend.

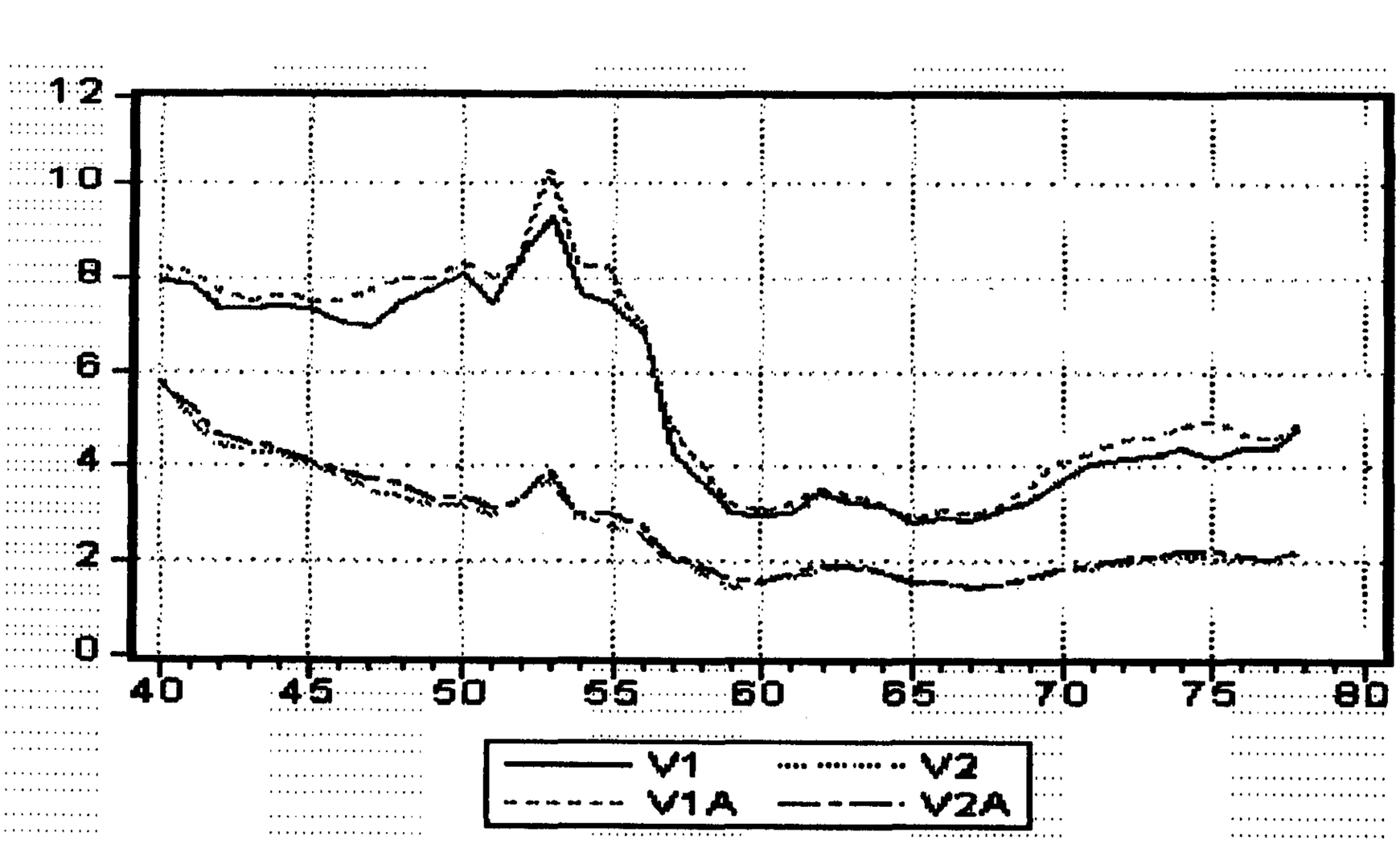

Figure (2): Income Velocity of Liquidity (V_2) & Adjusted V_2 (V_2A) Income Velocity of Money (V_1) and (V_1A)

Therefore, LV_1A and LV_2A, as logarithm of adjusted velocity of money and liquidity [ratio of income (GDP) at market prices to annually adjust money stock and liquidity] are appeared in the model as dependent variables.

4-2-2- Scale Variable

As is prevalent in similar studies, to construct a stationary function of demand for money (velocity), the logarithmic form of real per capita income has been used in the function, as a proxy of volume of transactions in the economy, to indicate the economic growth, and distribution of income and wealth.

According to Friedman, the scale variable should be entered in the money demand functions as a variable, which represents both physical and human wealth. In a research done by Bahmani Oskooei, (1991) for estimation of money demand function in UK, the real income variable has been used as a proxy for wealth. Other economists, Arestis and Demetriadis (1991) have introduced two variables i.e, per capita income and per capita expenditure in the estimation of money demand function for Cyprus.

Overall, in developing countries where accurate time series data for physical wealth do not exist for a long period, usually GDP data are used as scale variable, we may refer to a study done by Kiyani (1997) in Iran. Therefore, the GDP data are used as scaled variable in the present study, too.

4-2-3- Variables Representing Opportunity Cost of Money

There is no common consensus for selection of the rate of return on competing assets as alternative for money; while some researchers believe that interest rate on securities with long-run maturity can be an appropriate variable, others have used rate of return on bonds with short-run maturity, proposing that financial assets with short-run maturity are a better alternative for money. Friedman (1956) has expounded that: "rates of return on domestic and foreign shares can be regarded as alternative variables", which may be entered in the proposed money demand function along with rate of return on bonds. On the other hand, rate of inflation and anticipated rate of inflation have also been used in various studies as return on non-financial assets as opportunity cost of holding money. In this regard, Aghevli and Mohsin Khan (1979), Darat (1991), and Bahmani-oskooei and Malixi (1991) have utilized inflation and anticipated rate of inflation which bears a negative relation with real money balances, believing

that since well developed financial markets do not exist in developing countries, and due to administrative controls of interest rate, physical durable goods are considered as a better alternative for money. In this research, we have used rate of return on short-run and savings deposits (less than one year-RSS) and also weighted average of rate of return on one year and above deposits (RTL) as return on financial assets and rate of current inflation (INF) in non-logarithmic form, as opportunity cost of holding money and quasi-money in the Iranian economy. Although the RSS variable has not created any improvement from statistical and theoretical points of view in the pilot study and thus is omitted, it is expected that the other two variables put negative impact on money demand and are therefore positively related to velocity.

4-2-4- Introducing Proxy Variables for institutional Changes in Iran's Money and Banking Sector

Among the variables which have significant impact on the trend of "V" according to institutionalists theory are: degree of monetization, development of banking system, degree of financial deepening and the like. i.e. LMQMA, LM_2M_1A, LCMA and LM_1M_2A which in logarithmic form have been used in this model. (These were defined in equations (8) and (9)).

The monetization of the economy, i.e. higher use of cash funds to settle transactions and increasing the ratio of money to liquidity, will cause "V" to reduce in the absence of appropriate alternatives of money, Thus, as a result of development in financial and banking sector, increased economic security and higher degree of financial deepening, the ratio of quasi-money to the liquidity (the volume of money) will rise, which in turn cause "V" to rise through reduction in the demand for money balances. In our study, we have used LMQMA (log ratio of adjusted quasi-money to money) in the model, which can represent degree of maturity or institutional developments in the money and banking sector, and financial deepening which is expected to put positive effect on "V".

Another factor, the LBAY (log ratio of banking system assets to GDP), has been used in the model to measure the endogenous expansion of banking system to render banking services, particularly for transaction of funds, and as a variable for testing technical efficiency of money. Thus, this variable has been considered significant, and improves the ability of the model.

The variable LVAG, (log ratio of the value-added in agriculture sector to GDP), has also been specified in the model to measure the effect of financial operations of agriculture sector in the economy. The share of this sector in Iran has been 22% of GDP, on the average. Given the income elasticity of money in agriculture sector which is usually higher than the urban areas, we tried to test the presence of banking system in non-urban and rural areas by using this variable[1].

However, in pilot studies, incorporation of this variable not only caused distortions in the sign and co-efficient of other variables, but it was also statistically insignificant and its' sign was against the theory in the sample model, thus this variable has not been applied in the final model.

4-2-5- Effect of Exchange Rate on Velocity

Essentially, the existence of a relationship between exchange rate and demand for money was advocated by Mundell in 1963. According to Mundell, demand for domestic money with the aim of maintaining desired and scheduled level of commitments and payments for transactions will increase because of depreciation of domestic money against foreign exchange. In the case of countries with severe foreign exchange restrictions, public sector and contractors require more funds for their payments. The manufacturing sector is also affected in the same way for financing the imports of primary, intermediate and capital goods. Thus, there exists a direct relationship between demand for money and degree of depreciation of domestic currency. (It also implies an inverse relation between "V" and depreciation of domestic currency).

On the other hand, considering the substitution effect and opportunity cost of money, some economists believe that along with depreciation of domestic currency the public will tend to substitute foreign currency for domestic currency, which in turn put a direct and positive effect on the velocity as the demand for domestic money is diminishing. In a study done by two economists, Arango and Nadiri (1987), it has been stated that there is a positive and direct

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1 - Considering the relative share of production of Agro-industry units in the GDP, use of this variable may weaken the results of similar studies in other countries.

relation between depreciation of domestic currency and demand for money and argued that devaluation of domestic currency resembles the increase in price of foreign securities available in the economy. Thus, with the increase of monetary base, the interest rate will reduce and the demand for money will increase.

In another study for Iran done by Bahmani-Oskooei (1991), a positive relationship has been observed between changes of exchange rate and demand for money. Kiyani also reached the same and similar results in his study in 1997.

In the present study, to investigate the above case, LRER or log of real exchange rate has been used for this purpose. The parity rate of U.S. dollar against Iranian Rial (in unofficial market) has been adjusted with the domestic consumer price index in terms of consumer price index of U.S.A, indicating the degree of devaluation of domestic money and an index of economic risk(1). Considering its impressive impact on the model, determination of its sign was subjected to the dynamic process of estimation of model-through maximum likelihood co-integration method of Johansen –Juselius.

4-3- Estimation of the Model and Report of Final Results

Based on the theoretical findings raised so far and various empirical studies, the adjusted velocity of liquidity (LV2A) and money (LV1A) functions were estimated by applying co-integration method for the period 1359-1378 with the following models, by utilizing the EVIEWS- 3 program.

$$LV_2A = f\,[LYCAPR, LMQMA, LRER, RTL, INF, LBAY] \qquad (11)$$

$$LV_1A = f\,[LYCAPR, LMQMA, LRER, RTL, INF, LBAY] \qquad (12)$$

The above models are in log linear form, and all variables except RTL (weighted average of deposit's rates of return) and INF (inflation rate) are log based, while L indicates the natural log operator.

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1 - Considering introduction of foreign exchange certificate of deposit (in the TSE) and foreign exchange interbank market, part of fluctuations and risks existed in this index has been adjusted during recent years.

4-3-1- Stationary Tests of Variables

According to the results of studies done since the 1980's, application of the conventional econometric models in the empirical studies is based on stationary assumption of variables. Since most of the time series data for macroeconomic variables are non-stationary in level, and taking into account that in our designated estimation method the co-integration condition of order one of endogenous variables of the model is necessary, we have applied the unit root test, through Augmented Dicky-Foller method (ADF) [1].

The results of this test at levels and first differences of time series of variables of the model are shown in table 5. According to this table, all variables have not been rejected at %5 and %10 significance level, and are non-stationary, or have unit root. However in the case of first difference of variables, we observe that all variables after one order differentiating rejects non-stationary hypothesis, at least at the former significant levels, and are then stationary. Thus, all selected variables are integrated of order one and are specified in LV_1A and LV_2A functions.

4-3-2- Co-integration Test and Derivation of Maximum Likelihood Estimators of Johansen and Juselius

In this method, by using the maximal eigen value (λ_{max}) and Trace Test (λ_{trace}), which realizes the diagnostic of integrated vectors, after identifying the integration vectors and their normalization based upon the maximum likelihood procedure, the significance of co-efficient are observed. Finally, based on the theoretical underpinning that explained earlier, only selection of final variables in LV_1A and LV_2A are mentioned.

According to the method envisaged by Harris (1995), appropriate model has a restricted constant term without any trend. Thus, a decision was made on the basis of the significance of coefficients of LR (likelihood Ratio) statistics

1 - In this research auto-correlation and correlogram function are used for measuring the stationary of variables. Finally, the results of ADF are reported at the end of this paper. In addition, Perron's test has also approved the result of the present study.

and the critical level of 2.5 % of the X^2 test. Introducing the Dummy variables of Du 53 and Du 72 as proxy for effects of increase in foreign exchange revenues and exchange rate unification, respectively, proved to be statistically significant. However, in the case of the impact of the Islamic revolution and implementation of usury-free banking operations and outbreak of the Iraqi war against Iran, they did not show any significant impact in the model and as a result they were not entered in the proposed functions.

Table (5): ADF Test Results

Test variables	ADF statistics	First difference of variables	ADF statistics	Mackinon 5% confidence level	Mackinon 5% first difference
LV_1A	-1.46	DLV_1A	-2.95*	-2.94	-2.95
LV_2A	-2	DLV_2A	-3.17	-2.94	-2.94
LYCAPR	-1.93	DLYCAPR	-2.7 *	-2.94	-2.94
LMQMA	-2.16	DLMQMA	-3.56	-2.94	-2.94
LCMA	-0.83	DLCMA	-2.81*	-3.53	-2.94
LM_1M_2A	-3.39*	DLM_1M_2A	-3.04	-2.94	-2.94
LM_2M_1A	-3.4 *	DLM_2M_1A	-3.04	-2.94	-2.94
RTL	-1.58	DRTL	-3.17	-3.55	-2.95
RSS	-2.21	DRSS	-3.07	-2.95	-2.95
LRER	-2.21	DLRER	-4.29	-3.53	-2.94
INF	-2.51	DINF	-6.63	-2.94	-2.94
LBAY	-2.51	DLBAY	-4.24	-2.94	-2.94
LVAG	-1.76	DLVAG	-2.96	-2.94	-2.94

* At 10% level of significance.

On this basis, results of co integration test through Johansen and Juselius procedure for LV2A is presented in table 7. Taking into consideration that the confidence levels for X^2 test related to LR statistics has come in EVIEWS-3, which is not applicable to be compared with λ_{max}, therefore, as suggested by K. Patterson (2000), table 14.4, p. 630, suitable statistics at 95% and 99% levels have been derived, which for LV_2A or velocity of liquidity (adjusted) two vectors at 95% level in Maximal Eigen value test, and three vectors in trace test

are confirmed at 99% level. Because of the results of λmax, existence of two integrated vectors at minimum level of 5% was confirmed and selected. Thus, based on the significance of co-efficient of LR test and from point of theoretical expectations, after normalization of co integration vectors, the first vector is selected, which indicate a long run stable equilibrium relationship between LV_2A and variables affecting on it. The result for long run function of adjusted income velocity of liquidity is as follows:

$$LV2A = 0.11(LYCAPR) + 0.18(LMQMA) - 0.09(LRER) + 0.66(RTL) + 0.01(INF) - 1.47(LBAY) - 0.28MA \quad (13)$$

In this equation, real per capita income establishes a positive and direct relation with velocity of liquidity. This variable, which is also an index of volume of transactions in the economy, indicates that the velocity will increase by 0.11 percent as per capita income (volume of transactions) increases by one percent (taking other variables constant).

The sign of proxy for financial deepening also corresponds to theoretical expectations. Since with the development of financial markets the growth of demand for cash will decline and through expansion and strengthening of capital market and emergence of new financial instruments, as substitutes for money, and appropriate monetary derivatives, the financial deepening will face noticeable improvement. Thus, the ratio of quasi-money to the money (LMQMA) will increase, which due to reduction of demand for cash, the income velocity of money increases.

Co-efficient of proxies for opportunity cost of holding money; i.e. inflation rate and bank deposit rates also showed positive signs, and do correspond to expectations. This fact is an indicator that demand for money is negatively affected from rate of return on physical and financial assets, on the one hand, and indicating positive effects of these variables (RTL, INF) on LV_2A, on the other. The fact which is noteworthy in this research is the highest effect of RTL variable as compared to rate of inflation on velocity, so that the velocity will rise by 6.6 percent if the rate of return on deposits increases by 10 percent, while the co-efficient of inflation rate is almost 0. 01.

Table (6): Co-integration Test Results for LV_1

λ trace	λ max	λ characteristics root	Alternative hypothesis	Null hypothesis
218.58	87.7	0.924	r =1	r =0
130.88	44.77	0.732	r =2	r ≤1
86.11	32.28	0.666	r =3	r ≤2
53.83	25.38	0.526	r =4	r ≤3
28.45	17.14	0.396	r =5	r ≤4
11.32	11.31	0.283	r =6	r ≤5
0.0068	0.0068	0.0002	r =7	r ≤6

Table (7): Co-integration Test Results for LV_2

λ trace	λ max	λ characteristics root	Alternative hypothesis	Null hypothesis
224.05	79.67	0.904	r =1	r =0
144.38	45.8	0.74	r =2	r ≤1
98.58	39.06	0.683	r =3	r≤ 2
59.52	32.27	0.613	r =4	r≤ 3
27.5	16.75	0.389	r =5	r≤ 4
10.75	10.74	0.271	r =6	r≤ 5
0.0068	0.0068	0.0002	r =7	r≤ 6

Considering the effect of RER, i.e. the degree of depreciation of national currency and its relationship with the velocity which has been specified in the model with a negative sign, this factor shows the positive relation of national currency depreciation with the demand for domestic money (*indicating wealth* effect in the Iranian economy), and sina qua non indicates the negative relation with the velocity of liquidity (V_2).

However, LBAY, which is representing monetary sector development and expansion of banking activities in the economy, had an adverse effect (against the theoretical expectations) on the velocity. In other words, despite expansion of banking services (at nominal prices), which are mainly originated from movements of exchange rates parity, and undesired expansion of assets, (particularly their composition of fixed and current assets), undue interference of monetary and fiscal policies with each other, and increasing size of the government, these facts have caused the demand for real money balances to rise, and led to reduce the velocity.

The results of test of the co-integration between velocity of money (adjusted) LV_1A and the variables affecting on it are represented in Table 6. We observed that the results of Maximal Eigen value test indicate the existence of two vectors; and for Trace Test, three integrated vectors which are confirmed at least at 5% level. Thus on the basis of power of Maximal Eigen value Test, the existence of two integrated vectors is confirmed, and after normalization of integrated vectors, the first vector, is selected as follows:

$$LV_1A = 0.13(LYCAPR) + 0.64\,(LMQMA) - 0.1(LRER) + 0.98(RTL)$$
$$+ 0.01(INF) - 1.4\,(LBAY) + 0.4MA \qquad (14)$$

like the estimated LV_2A function, the adjusted velocity of money function indicates a stable and long run equilibrium-relationship among all variables, and the sign of coefficients on LV_1A function is similar to LV_2A function.

The per capita income and ratio of quasi-money to money and proxies for opportunity cost of money again had a positive impact on LV_1A while the real exchange rate and LBAY as substitute for degree of banking sector development put a negative impact on the velocity of money.

The reason for such results are mentioned above, i.e.: for the effect of LBAY on LV_1A, we can conclude that the development of banking sector is due to interference and dominance of fiscal policies over monetary policies and also the negative sign of the coefficient of RER also indicates the "wealth effect".

4-4- Short-run Dynamics

4-4-1- Error Correction Model

Co-integration between set of economic variables provide the statistical basis for using the error correction model (ECM). These mechanisms relate the short-term fluctuations of variables to long-term equilibrium level. In this research, to construct ECM's for LV_1A and LV_2A, we initially estimate parameters related to the long-term mechanism using data pertained to the level of variables through OLS. In the next step, error correction term (E.C.T) shall be estimated as an explanatory variable along with the first difference of other variables in ECM. The ECT coefficient represents the speed of adjustment toward equilibrium in the mechanisms. The ECM for velocity of money and liquidity has been computed and the results are as follows:

$$\begin{aligned} DLV_2A = {} & -0.01 + 0.17(DLYCAPR) + 0.24(DLMQMA) - 0.03(DLRER) \\ & + 0.084(DRTL) + 0.0009(DINF) - 0.83(DLBAY) - 0.004(DU\ 53) \\ & + 0.18(DU\ 72) - 0.52(ECT) \end{aligned}$$

$$F=25.97 \qquad D.W=1.41 \qquad \overline{R}^2 = 0.90 \qquad (15)$$

In this model, the $\overline{R}^2 = 0.90$ is indicative of high explanatory power of the model and the ECT coefficient (which is estimated at (–0.52) shows that almost half i.e (0.52) percent of disequilibrium in the velocity of liquidity in each period is adjusted annually over the next period. In other words, the speed of adjustment to long-run equilibrium is fast and significant.

Table (8): Impulse Response to one S D Innovation

Response of L V 2 A							
Peiod	**LV2A**	**LYCAPR**	**LMQMA**	**LRER**	**RTL**	**INF**	**LBAY**
1	0 061322	0 000000	0 000000	0 000000	0 000000	0 000000	0 0000000
2	0 077456	0 001625	-0 008812	-0 001151	0 001337	0 005141	0 004480
3	0 071288	-0 013071	0 00 3479	-0 001814	-0 012730	0 011774	0 006959
4	0 054523	-0 025224	-0 002415	-0 004285	-0 021749	0 007967	0 005049
5	0 36210	-0 047097	-0 012174	0 001497	-0 023311	-0 007984	0 000577
6	0 020362	-0 061253	-0 012686	-2 40E-05	-0 017377	-0 015723	-1 73E-06
7	0 0 06814	-0 065976	-0 026456	-0 009955	-0 010424	-0 017922	0 00 1843
8	0 001882	-0 068416	-0 053664	-0 022769	-0 006182	-0 022998	0 004359
9	0 006360	-0 067834	-0 079919	-0 030843	-0 006920	-0 026395	0 006150
10	0 007625	-0 062599	-0 094766	-0 035011	-0 015853	-0 025482	0 006283
11	0 003827	-0 058719	-0 101259	-0 032017	-0 026068	-0 022488	0 006007
12	-0 007475	-0 060611	-0 103806	-0 022871	-0 033314	-0 021133	0 004875

Table (9): Impulse Response to one S D Innovations

Response of LV1A							
Peiod	**LV1A**	**LYCAPR**	**LMQMA**	**LRER**	**RTL**	**INF**	**LBAY**
1	0 083431	0 000000	0 000000	0 000000	0 000000	0 000000	0 000000
2	0 099931	-0 030572	0 002464	0 003391	0 001170	-0 001025	0 018280
3	0 103523	-0 061849	0 003516	0 008409	0 001771	-0 002516	0 022610
4	0 098894	-0 091124	0 006851	0 009702	-0 000809	-0 004495	0 024199
5	0 091506	-0 117664	0 006360	0 014629	-0 002426	-0 008235	0 029793
6	0 083128	-0 139022	0 004348	0 018074	-0 002306	-0 010998	0 032483
7	0 076626	-0 155208	0 004020	0 019427	-0 002824	-0 013003	0 033042
8	0 071241	-0 168221	0 003253	0 021463	-0 003412	-0 015070	0 035123
9	0 066685	-0 178218	0 001978	0 023133	-0 003304	-0 016620	0 036553
10	0 063349	-0 165542	0 001496	0 023804	-0 003569	-0 017615	0 036859
11	0 060863	-0 191216	0 001147	0 024586	-0 003593	-0 018521	0 037595
12	0 058839	-0 195575	0 000588	0 025331	-0 003574	-0 019230	0 038276
13	0 057349	-0 198756	0 000306	0 025666	-0 003566	-0 019679	0 038456
14	0 056270	-0 201177	0 000163	0 025963	-0 003651	-0 020055	0 033712
15	0 055409	-0 203045	-5 94E-05	0 06281	-0 003660	-0 020364	0 039011
16	0 054762	-0 204416	-0 000201	0 026444	-0 003649	-0 020564	0 039115
17	0 054298	-0 205446	-0 000263	0 026561	-0 003679	-0 020719	0 039205
18	0 053934	-0 206243	-0 000334	0 026692	-0 003689	-0 020851	0 039330
19	0 053650	-0 206833	-0 000414	0 026770	-0 003684	-0 020939	0 039886
20	0 053456	-0 206833	-0 000475	0 026817	-0 003694	-0 021004	0 039420
21	0 053302	-0 207611	-0 00 0504	0 026870	-0 003700	-0 021060	0 039470
22	0 053183	-0 207864	-0 000504	0 026906	-0 003698	-0 021099	0 039498
23	0 053096	-0 206052	0 000518	0 026927	-0 003701	-0 021126	0 039512
24	0 053081	-0 206190	-0 000331	0 020946	-0 003704	-0 021150	0 039531
25	0 052980	-0 2068305	-0 000543	-0 026964	-0 003704	-0 021167	0 039545

Table (10): Variance Decomposition

Variance Decomposition of LV2A							
Period	**SE**	**LV2A**	**LYCAPR**	**LMQMA**	**LRER**	**RTL**	**INF**
1	0.061322	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.099447	98.68642	0.026716	0.785168	0.013394	0.018065	0.267261
3	0.124528	95.70989	1.118877	0.578812	0.029770	1.056535	1.064349
4	0.140365	90.41899	4.109919	0.485172	0.116613	3.232323	1.159910
5	0.154886	79.72546	12.62180	1.016287	0.105113	4.919779	1.218366
6	0.169901	67.69308	23.48704	1.402108	0.087357	5.134680	1.868969
7	0.185736	56.77726	32.27055	3.202115	0.360382	4.611460	2.494956
8	0.207765	45.38347	36.63342	9.230507	1.489038	3.773929	3.219242
9	0.236493	35.09963	36.50122	1854400	2.850138	2.998372	3.730318
10	0.266557	27.71043	34.24702	27.23675	3.968666	2.713862	3.850199
11	0.294983	22.64392	31.92706	34.02383	4.418720	2.996962	3.725077
12	0.321906	19.06854	30.35512	38.96946	4.215272	3.587633	3.559002
13	0.348336	16.72756	29.43872	42.20781	3.814466	4.082095	3.514954
14	0.374708	15.21017	28.83223	44.52622	3.423073	4.153873	3.668165
15	0.400299	14.01917	28.18658	46.66272	3.149348	3.920091	3.897885
16	0.424724	12.85800	27.20338	49.05893	3.076007	3.616747	4.035662
17	0.448453	11.66365	25.87783	51.74792	3.153445	3.364787	4.044200
18	0.470826	10.60231	24.51526	54.29374	3.227331	3.252515	3.959356
19	0.490516	9.775494	23.41391	50.27145	3.205998	3.343507	3.841327
20	0.507329	9.167710	22.69487	57.57849	3.093678	3.578196	3.743927

Tabe (11) : Variance Decomposition

Variance Decomposition of LV1A							
Period	**SE**	**LV1A**	**LYCAPR**	**LMQMA**	**LRER**	**RTL**	**INF**
1	0.083431	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.135040	92.93263	5.15248	0.033305	0.063039	0.007508	0.005760
3	0.182707	82.87137	14.25911	0.055234	0.246240	0.013502	0.022106
4	0.228501	71.71412	25.01963	0.125226	0.337703	0.009886	0.052829
5	0.275059	60.55892	35.57225	0.139877	0.523723	0.014804	0.126667
6	0.321593	50.98304	44.71028	0.120607	0.699002	0.015826	0.209197
7	0.367485	43.39223	52.07856	0.104330	0.8147795	0.018024	0.285407
8	0.412750	37.37588	57.89298	0.088912	0.916291	0.021123	0.359548
9	0.456874	32.63561	62.46702	0.074442	1.004225	0.022470	0.425780
10	0.499421	28.92072	66.07910	0.063196	1.067574	0.023356	0.480737
11	0.540430	25.96645	68.95019	0.054419	1.118676	0.024365	0.527990
12	0.579884	23.58280	71.26167	0.047369	1.162455	0.024961	0.568557
13	0.617735	21.64323	73.14865	0.041766	1.196989	0.025328	0.602503
14	0.654082	20.04477	74.70488	0.037260	1.225213	0.025707	0.631414
15	0.689029	18.70970	76.00284	0.033577	1.249558	0.025986	0.656335
16	0.722642	17.58392	77.09864	0.030533	1.269928	0.026175	0.677672
17	0.755019	16.62537	78.03237	0.07983	1.287104	0.026352	0.696104
18	0.786261	15.80094	78.83491	0.025823	1.302093	0.026501	0.712210
19	0.816446	15.08604	79.53106	0.023975	1.315097	0.026614	0.726296
20	0.845655	14.46149	80.13955	0.022374	1.326386	0.026715	0.738683
21	0.873964	13.91177	80.67500	0.020978	1.336377	0.026805	0.749671
22	0.901439	13.42473	81.14941	0.019750	1.345248	0.026879	0.759452
23	0.928140	12.99069	81.57231	0.018661	1.353129	0.026945	0.768196
24	0.954123	12.00170	81.95130	0.017690	1.300203	0.027005	0.770001
25	0.979440	12.25127	82.29271	0.016818	1.366587	0.027057	0.783164
26	1.004133	11.93411	82.60174	0.016031	1.372357	0.027104	0.789603
27	1.028246	11.64579	82.88268	0.015317	1.377604	0.027147	0.795466
28	1.051815	11.38262	83.13910	0.014666	1.382398	0.027185	0.800825
29	1.074873	11.14151	83.37404	0.014071	1.388788	0.027221	0.800738
30	1.097451	10.91984	83.59004	0.013525	1.390852	0.027253	0.810259

In addition, by applying the error correction model, for the velocity of money we estimated the following function:

$$DLV_1A = -0.01 + 0.2(DLYCAPR) + 0.58(DLMQMA) - 0.05\,(DLRER) + 1.89(DRTL) + 0.0007(DINF) - 0.82(DLBAY) - 0.0006(DU\,53) + 0.15(DU\,72) - 0.72(ECT)$$

$$F=38.45 \qquad D.W=1.6 \qquad \bar{R}^2 = 0.93 \qquad (16)$$

In this model, the ECT co-efficient equals –0.72, which is even higher than the adjustment co-efficient in the former model, indicating faster speed of adjustment of velocity of money in the short-run toward long-run equilibrium. Overall, these facts are evidence for confirmation of the reason that due to prevailing socio-economic uncertainties, and lack of symmetric information in financial markets in the developing countries- the probability of occurrence of risks in the markets- is very high, as a result, the insights and approaches of economic agents are focused in the short-run and myopic. Therefore, decisions are adopted in an unstable condition.

4-4-2 Impulse Response Function

Based on the results of our study as is shown in the table 8, the effect of a shock of standard deviation of each variable in the model i.e LYCAPR, LMQMA and others, shall be reflected on LV_2A, on itself and other variables. For instance, a shock of one standard deviation from LV_2A in the first phase raises the velocity of liquidity by 0.06. In the second phase, this increase will reach 0.07, and this trend keeps on until the 10th or 11th year. However, in the 12th year, the direction will become reverse and negative. In the second column, the effect of one standard deviation shock in the logarithm of per capita GDP has no impact on the velocity of liquidity; in the second phase the shock raises it by 0.001, while in the following years reduces the trend of this variable as it affects in negatively. Similar to such reasoning would be derived and applied to impact of shocks by each variable of the model on other variables.

In the case of LV_1A function, according to the response function as is shown in the table 9, a shock of one standard deviation in the logarithm of velocity of money raises it by 0.08 in the first phase and keeps an upward trend

until 4th and 5th year. It peaks up in the 5th year with a coefficient of 0.09, and gradually its impact tends toward 0.05 through the time span. For instance, occurrence of a shock of one standard deviation from LRER (degree of money depreciation) put no effect on LV_1A in the first phase, while its impact reaches almost 0.02 within the second to seventh phase. The effect of shock between the 7th to 14th periods increases to 0.025, and fixes at 0.027 levels (on LV_1A) until 25th period. Thus, we can observe the effects of shocks originated from each variable on (logarithm) of velocity of money and liquidity. Similarly, we are able to estimate the ultimate effect of these variables on the other macroeconomic variables, provided it is supported by designing the appropriate monetary policy after forecasting the fluctuations of behavioral pattern of LV_1A and LV_2A.

4-4-3- Variance Decomposition

Applying variance decomposition method help analyses and estimation of the effects of shock in a variable on the time series innovation of other variables in the model. On the basis of results of variance decomposition table for LV_2A (table 10),during a 25 year period, the standard error of forecast for one period ahead is 0.06, for two periods ahead is 0.09, till it reaches 0.5 in the 20th period. These errors originate from changes in the current and future quantities of a variable or an unexpected initial shock.

Overall, it is observed that in the medium and long-term periods, the share of changes in LV_2A on itself is gradually declining, while the share of degree of financial deepening (LMQMA) is increasing; so that it reached %57.5 in the 20th period. The share of real per capita income reached 22.7% and those of degree of depreciation of domestic currency (LRER) and deposit rates (RTL) and inflation rate (INF) constitute 3 to 4 percent and bear the same weight in changes of LV_2A. However, the share of LBAY has been reduced to 0.14. The similar analytical results can be deducted from the share of explanatory variables on LV_1A,(table 11) which put certain effects on changes of adjusted velocity of money at the same sequence but with different values.

5- Summary and Concluding Remarks

Based on aggregate demand theory, monetary policy put significant impact on ultimate objectives of macroeconomic policies through change in volume of

money stock and income velocity of money. On these grounds, "V" also plays a pivotal role through aggravating or weakening of this process. Thus, the monetary policy-maker, by gaining insight and predicting the fluctuations and the behavioral pattern of velocity, is able to make more precise forecasting of national income and inflation, through desirable changes in the monetary aggregates.

As is evident in the theoretical concepts, the classical schools (Neoclassicals and Newclassicals) are believing in independence of velocity of Money from government active policies and consider the velocity as a function of real variables and socio-economic institutions. However, regarding their slow movement, "V" is also assumed to be a stationary variable. Yet, Newclassical theorists who advocate the rational expectations theorem explain that only unanticipated monetary policies are able to produce short-run fluctuations.

According to Keynesian economists, velocity is considered as a severely fluctuating variable, with er, changes which are significantly influenced by economic policies. Howevbased on new Keynesians, believing in inefficiencies and market failure, this variable is influenced by anticipated policies as well.

Review of fluctuations of income velocity of money and liquidity, V_1 and V_2 in the case of Iran, indicate the "U" shape pattern of these variables; so that, from the beginning of the 1340's (1960's) until the beginning of the war 1359(1980), it kept a downward trend and later on faced an upward trend with slight and smooth fluctuation during the 1359-68 (1980-1989) period, and maintained a mild increasing slope (same as in the industrial countries), since 1369 (1990). Considering the present status of "V" with an upward slope, it indicates a positive movement in money and capital markets through financial deepening, innovations of new instruments as substitutes for money in transactions, which ultimately may indicate the improvement in payment system. Although the slowly declining trend of this variable has offset the effects of expansionary monetary policy in the recent years to some extent, the particular concern of the monetary policy-maker to its future trend will help to estimate the component of the aggregate demand and better assess the efficiency of monetary policies. As regards to the fluctuations of this variable, we observe that it is not a stationary variable in both short-and long run periods, though its stability index indicates that V_2 was more stable in its upward trend than the downward one.

Implications of the Results

First: In this research, an attempt is made to diagnose the factors affecting the trend of velocity of money (and the velocity of liquidity) in order to estimate their long-run equilibrium functions. The results of the study indicate a positive and significant impact of per capita income and financial deepening on behavioral pattern of "V".

In other words, with the expansion of an ATM system, availability of credit cards and introduction of the highly liquid assets and deposits in recent years and the positive impact of these developments on the upward trend of "V" which leads to changes in macroeconomic target variables.

Second: The positive effect of deposit rates of return on "V", can promptly provoke the attention of the policy makers to introduce flexibility in bank rates and remove the administrative mechanism.

Third: As regards to the direct effects of inflation on the trend of "V", we suggest that curbing of inflation is the pivotal step and it should be taken into account by the monetary authority. Although we observed that the inflationary process had been curbed in recent years, due to persued financial discipline, it may rise following the transition to unified exchange rate from the beginning of 1381 (March 21, 2002); hence focusing on the future trend of inflation and its impact on the increasing trend of velocity requires attention to be paid to monetary aggregates.

Fourth: Findings of the estimated models for V_1 and V_2 indicate the negative effect (opposite to the theoretical expectations) of degree of broader-based developments of banking system on the velocity, which can be due to the lack of endogenous expansion of the country's banking system as a result of increase in the public demand for banking services. Thus, nominal expansion of banking operations after the Islamic revolution era has generally been due to the changes of exchange rates parity, significant outstanding claims of banks on governments, and on the whole, the undue dominance of fiscal policies over monetary policies. However, as a remedy, the privatization and deregularization of the banking system is recommended.

Fifth: Considering the adverse effect of depreciation of national currency on the velocity, indicates the presence of the wealth effect. In other words, adoption of any policy, which results to the depreciation of national currency, raises the demand for domestic money, which in turn reduces the velocity.

The finding of the error correction models indicate that the speed of adjustment in the velocity of both money and liquidity are very fast and the horizon for decision making of the economic agents is short. This fact indicates per se the lack of public confidence on the credibility of the adopted economic policies.

No doubt, adoption of any economic policy in an unstable condition, regardless of the socio - politico economic conjecture of Iran, may aggravate the disequilibrium in macro economic relations and the *velocity of money and liquidity*.

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