Journal of Applied Economics and Business Research
JAEBR, 8(1): 24-37 (2018)

Econometric Analysis of Money Demand in A Dollarized Economy: The Case of Tajikistan

Maftuna F. Khakimova
Tajik National University, Tajikistan

Muhammad Ahad[1]
COMSATS Institute of Information Technology, Lahore Campus, Pakistan

Abstract
After gaining independence, Tajikistan undergoes explosive reform. However, applied analysis of the conducted macroeconomic policy was not carried per se. This paper is filling this gap by conducting quantitative analysis of money demand, which is instrument of economic development. The main objective of this paper is to estimate stability of the money demand function in Tajikistan and provide an empirical analysis of factors that influence money demand. This analysis has done on the base of standard approach such as the ARDL Bound Test approach and vector error-correction model with the main objective to determine the factors which, in both short- and long-term, influence its movements. The findings of ARDL bound testing confirms the long run relationship between all type of money demand, economic activities, exchange rate and price level. Further, we found instability of the money demand function under reviewed sample. The bidirectional causality between aggregated money demand, economic activity, exchange rate has been noticed. The empirical analysis suggests that the money demand is unstable, one of the reasons being the dynamic nature of changes in the financial system of Tajikistan and could not be used for the purpose of targeting monetary aggregates.

JEL code: C1, E41

Keywords: Money demand, cointegration, vector error-correction model, ARDL Bound Test, Tajikistan, Monetary policy, transition economy.

1. Introduction

The demand for money is one of the most researched problems in macroeconomics, as it creates the basis for the analysis of the effectiveness of monetary policy. Money demand is a crucial instrument of the economic development of any country. An increase in money demand leads to improve the situation of an economic in the country, as opposed to the falling of money demand, which indicates deterioration of economic situation. There are short-term and long-term aspects of money demand in the macroeconomic theory. In the short term, a decline in the rate of monetary circulation can cause an increase in money demand, regardless of the dynamics of real production. However, the continuous growth of the money supply, regardless of the trends in production, leads to stronger inflationary pressures. In return, transactional demand is higher as the larger is the national product, related to the long-run period, in the country. This means that the increased issue of money which is consistent with price stability may solely be achieved in the long-run period if it follows the growth of output. The Central bank influence on money demand by its instruments.

[1]Correspondence author Muhammad Ahad, Email: m.ahad68@yahoo.com

Increasing or decreasing interest rates result in decline or growth of money demand. Contrariwise, money demand gives huge effect to the economic activity, exchange rate stability, thereby creating background to apply transmission mechanism used to bring the monetary targets.

Over the last few decades, empirical analysis of the stability of money demand function in an economy has become greatest challenge for research that have attracted most attention of scientific researchers, economists and policy makers all over the world. A vast number of empirical works are devoted to the problems of demand for money in both developed and developing countries. This can be illustrated by the example of review papers by Fase (1993), Sriram (2001), and Knell and Stix (2006), which summarize the results of the modeling of money demand both for developed and developing countries. Due to the fact that a number of countries of Eastern Europe and the former USSR have undergone a transition period, also a number of empirical studies have appeared in the scientific literature that examine stability of the demand for money function in transition economies: Bolharyn and Babaian (1998) in Ukraine, Karla (1999) in Albania, Buch (2001) in Hungary and Poland, Payne (2003) In Croatia, Slavova (2003) in Bulgaria, Andronescu et al. (2004) in Romania, Bahmani-Oskooee and Barry (2000), Oomes and Ohnsorge (2005) and Drobyshevsky (2010) in Russia and other.

Nevertheless, until recently, there was limited empirical researches on money demand estimation in the context of Tajik economy. One earlier research done by Khaydarov (2001), where main conclusion about stability of money demand function made by Johansen cointegration approach covered the small sample, thus didn't cover main economic reforms and monetary measures. According to this, conclusions about stability of money demand looks unclear. Other researches Babadzhanov (2004) and Alidzhanova (2012), etc. devoted to qualitative analysis of various aspects of monetary policy and its instruments. Therefore, the main goal of this paper is to conduct empirical study of the money demand function of the Tajikistan, test its cointegration properties and its stability over time. The main prerequisite of this study is the implementation of monetary measures which are interesting to study empirically. This study presents analysis of money demand relative to economic activity in Tajikistan. Further research will be expanding to empirical analysis of transmission mechanism in Tajik economy.

This study contributes in existing applied literature in following ways: 1) We check the stability of money demand function in case of Tajikistan by using monthly time series data. 2) We applied newly developed Kim and Perron (2009) single structural break unit root test to identify single unknown structural shocks that are streaming into series. 3) The ARDL bound testing approach is used to find out cointegration relationship between money demand, price level, economic activities and exchange rate in the presence of identified structural shocks. 4) Further, we used OLS and ECM mechanism to find long and short run estimations. 5) VECM Granger causality is applied to discovery the direction of causality in short and long run.

Further, section 2 is organized as review of literature. Section 3 explains model specification, data collection and estimation strategy. The imperial estimation and results explanation is displayed in section 4. The conclusion and policy suggestion are representing in section 5.

2. Macroeconomic situation in Tajikistan

Monetary policy formation of the Tajikistan accomplished under difficulties of transition period. Implementation of an independent monetary policy in Tajikistan became possible only after introduction of the national currency (somoni) in 2000. Prior to this period, Tajikistan used first Soviet Union and later Russian Federation currency. Due to shortage of currency in economy in that period, debts on wages and pensions increased and financing of the economy has been stopped, which led to the hyperinflation. Annual CPI sharply increased by 1420% in 1992. Lack of national currency caused in deterioration of macroeconomic situation. The huge size of dollarization in

 ISSN 1927-033X

national economy of Tajikistan emanates from tight monetary policy, weak banking system infrastructure, national economy dependence from remittances and economic instability, as well as hyperinflation emerged in the initial period of independence. As a result, introduction of national currency created the ground for the implementation of independent government monetary policy aimed at harnessing inflation and maintaining a stable exchange rate. Its success in fighting inflation is reflected by continuous fall of annual inflation to 124,0% in 2000. The annual inflation rate was 6,1% in 2016.

Since 2000, Tajik economy has expanded, with an average growth rate of about 6-7% per annum. The main drivers of economic growth last years are remittances inflows, construction, industry, especially mining, processing and agriculture (9.9%). By June 2016, the current reserves of NBT is enough to cover 2.4 months of import, against 1.4 months in 2015. Share of investment and investment in fixed assets in GDP in 2015 was 10.44% and 20.14% correspondingly. Summarizing, since independence Tajikistan has made significant progress in reforming its economy towards a market-oriented economy. Under present economic, conditions it is pertinent to investigate the determinants of long-run money demand in Tajikistan. Our findings will point out whether money demand is stable in Tajikistan, as well as cointegration relationships will be revealed.

3. Review of Literature

Since estimation of money demand function is of crucial importance among economists and policy makers in pursuing an effective monetary policy, there are a vast number of studies devoted to this problem. First fundamental study on demand money function was Friedman (1956), where hypothesis on stability of money demand function have been taken. The demand for money function is considered as a tool for determining the values (for example, the level of money income, prices) that plays a key role in economic analysis. That is, the money supply serves as an intermediate goal of the ongoing economic policy for further influence, for example, on output and prices. Approaches to empirical analysis of the money demand function have changed significantly over time, but the purpose of research remained the same - finding a functional relationship between real money and main macroeconomic indicators characterizing economic activity and alternative cost of storing money. The first and most common method to estimate models of money demand was least-squares method. The popularity of this method is explained by the simplicity of its application. But consistent estimates of money demand function are crucial from the econometric side. In turn, consistency of OLS estimates can be achieved under erogeneity of explanatory variables. Otherwise, there is the problem of endogeneity, or the dependence of the explanatory variables on the shocks of the explained variable.

Particularly, inconsistent estimates of OLS takes place if lagged value of the explained variable given as explanatory variable and there is an autocorrelation in the residuals of the model. Investigations of the demand for money on quarterly data often include the lagged value of the money supply as a regressor in the equation. In this case, an accurate analysis of the residual structure of the model is necessary. One of the most famous examples of analyzing the demand for money on quarterly data is Goldfeld et al. (1973). Goldfeld investigated the demand for money in the USA for the 1952Q2 to 1972Q4 time period based on partial adjustment model. Goldfeld showed stability of the demand for money both in the short- and long-run period. Later, Robert Hall and Franco Modigliani criticized Goldfeld for using OLS approach, which by their opinion, could lead to incorrect results. Thus, the main method of demand for money estimation was subject of considerable criticism. The problem of endogeneity of regressors can be solved by usage of 2SLS approach, but it is associated with difficulties in choosing the correct and relevant instrumental variables. In turn, this method is preferably on a sufficiently large sample, which is not always possible due to the lack of data over a long period of time.

 ISSN 1927-033X

Sims (1972) criticized the use of partial adjustment models in case of short-term demand for money estimation. Sims shows that money is strictly exogenous in relation to the output in the short run based on the causality test. Thus, evaluation of the demand for money equation in this case is incorrect, since it assumes the erogeneity of income and interest rates in relation to the money supply. The same problem is investigated by Mehra (1978). He reveals that in the case of estimating demand for real money, explanatory variables are exogenous, and in the case of the demand for nominal money estimation, the money supply is exogenous. Teigen (1964) pointed another problem related to the endogenous nature of the money supply. Teigen says that researches devoted to monetary issues usually ignores the process of money supply by banking institutions. However, the fact that money supply is determined, for example, by interest rates, is beyond doubt. According to the author, investigation of money demand and supply is possible only in the scope of system of simultaneous equations, since this approach avoids the bias and inconsistency of estimates caused by the endogeneity of the money supply. As exogenous variables Teigen also suggests to use variables that the Federal reserve system can really control. In the process of estimation by Teigen biasness problem identified.

Modern econometrics of time series relies on the cointegration analysis and dynamic correcting models. Initially, cointegration analysis introduced by Engle and Granger (1987). Nelson and Plosser (1982) showed that most macroeconomic time series are nonstationary. Thus, methods of time series analysis, used previously, requires correction. Many empirical studies, conducted recently, show the existence of a stable function of the demand for money in most developed countries, as well as in a number of developing countries. These studies are based on modern methods of econometric analysis that allow analyzing long-term and short-term aspects of economic dynamics. For example, McNown and Wallace (1992) estimated the demand for money for United States by applying Johansen cointegration approach. The results showed that cointegrating relationship exist only when we use M1 as money demand. On contrary, Mehra (1993) revised money demand function for United States by testing data from 1953:1 to 1991:2 with ECM. He proved that real M2 and real GNP has cointegrating relationship, as well as money demand function is stable throughout the sample period.

Similarly, Arize and Shwiff (1993) analyzed money demand function using quarterly data from 1973:1 till 1988:4 for Japan by using CUSUM/CUSUMQ test. They have confirmed long-run relationship among real GNP, real wealth and real XR (exchange rate). Haug and Lucas (1996) probed the money demand function in case of Canada using time period 1953-1990 and 1968-1990. The results of this investigation vary depending on cointegration tests selected and combination of money aggregates and interest rates. However, stable long-run relationship is found among real M1, real GDP, and the 91-day T-bill rate. Another author, Lim (1993) estimated demand for money function for Australia using quarterly and monthly data for the period of 1977:4-1990:2 and 1976:8-1990:6 respectively. According to research, cointegrating relationship exist for both monthly and quarterly models for each money variable (without the 90-day bank bill rate). ECM shows some evidence for the significance of 90-day bank bill rate in influencing the short-run adjustments of the monetary aggregates. Chowdhury (1995) has confirmed instability of money demand without adding exchange rate for case of Switzerland by using Johansen cointegration test. For money demand estimation, real money base, real M1, real GDP, interest rates and NEER have been used for the period of 1973 to 1991.

The recent paper, Sharifi-Renani (2007) estimated the demand for money in Iran using the ARDL approach to cointegration analysis. The empirical results showed that there is a unique cointegrated and stable long-run relationship among M1 monetary aggregate, income, inflation and exchange rate. The study also found that the income elasticity and exchange rate coefficient are positive, while the inflation elasticity is negative. The results of study demand for money functions

 ISSN 1927-033X

in transition economies are ambiguous. Bahmani-Oskooee and Barry (2000) find that the demand for money in Russia which includes income, inflation rate and exchange rate variables was unstable in the 1990s. Later Drobyshevskiy (2010) reveal that money demand function for the period of 1quarter 1999 to 2quarter 2008 was stable. It has also proved that main factor of inflation in Russia was changes in exchange rate.

Ahad (2017) investigated impact of financial development on money demand by taking annual data from 1972-2012. The results of combine cointegration show the long run relationship between underlying variables. This study found stable money demand function in case of Pakistan. Buch (2001) finds that the long run elasticity values in the money demand function in Hungary and Poland have the expected sign and some evidence of stable demand for money functions. Cuthbertson and Bredin (2001) find that for the Czech Republic a predictable relationship exists between money balances, real income and inflation and that the coefficients have the expected signs. Payne (2003) finds a stable demand for money function for Croatia with the opportunity cost variables having expected signs. Slovova (2003) has shown that in Bulgaria in the aftermath of the hyperinflation, the currency board successfully stabilized the demand for money.

4. Model Specification, Data Collection, and Estimation Strategy

The purpose of this study is to examine stability of money demand in Tajikistan after the period of macroeconomic stabilization and economic development. For this purpose, the monthly frequency is used from 2000-2016. The macroeconomic approach to the study of money demand comes from the monetary theory, as well as from the assumption of sufficient price flexibility and the equality of supply and demand in the money market[2]. Thus, the basic equation of the demand for money has the following form:

$$\left(\frac{M}{P}\right)^{D} = f\left(Y, i\right), \tag{1}$$

where M is some monetary aggregate, i.e. amount of money in the economy; P - price level; Y - indicator of economic activity; i - alternative costs of storing money. According to the microeconomic foundations of demand for real monetary balances, the estimated econometric model will be presented in the form of the following relationship:

$$\ln M_t^D - \ln P_t = \alpha_0 + \alpha_1 \ln Y_t + \alpha_{3_j} \ln i_j + \varepsilon_t, \tag{2}$$

where i_j, $j = \overline{1, J}$ reflect the possibility of including several factors in the model that determine the alternative costs of holding money. We have used three types of money to check the robustness of our results. All estimated models are following:

$$\ln M_{0t}^D = \alpha_0 + \alpha_1 \ln Y_t + \alpha_{3_j} \ln i_j + \alpha_{4j} \ln P_t + \varepsilon_t \text{`} \quad \text{(Model-1)} \tag{3}$$

$$\ln M_{2t}^D = \beta_0 + \beta_1 \ln Y_t + \beta_{3_j} \ln i_j + \alpha_{4j} \ln P_t + \varepsilon_t \quad \text{(Model-2)} \tag{4}$$

$$\ln M_{4t}^D = \gamma_0 + \gamma_1 \ln Y_t + \gamma_{3_j} \ln i_j + \alpha_{4j} \ln P_t + \varepsilon_t, \quad \text{(Model-3)} \tag{5}$$

Here, ln M0 is a log of cash in circulation, ln M2 represents log of national currency, ln M4 is a natural log of broader money, ln P describes natural log of price level proxy by CPI, ln Y denotes natural log of economic activities proxy by GDP and ln i displays the natural log of exchange rate for the proxy of opportunity cost of holding money. Monetary aggregates M0, M2 and M4 have been chosen as proxy for amount of money in economy, where M0 stands for cash in circulation, M2 is cash added by deposits in national currency (money supply) and M4 (broad

[2]As known, on practice this equality on money market does not reach in the case of inflation.

 ISSN 1927-033X

money) is M2 added by deposits in foreign currency. As price level, base index (1999) of prices have been chosen. Real GDP stands as a proxy for economic activity, because of according to Friedman (1956), money demand is a function of real variables. In our opinion, GDP is the best possible approximation for representation of economic activity, since it is an aggregate indicator that characterizes behavior of the economy of the whole country. Exchange rate is used as an indicator of the alternative cost of holding money. Reason of choosing exchange rate as an indicator of the alternative cost of holding money is high level of dollarization in Tajikistan. This is proved also by 94% of correlation between exchange rate and money aggregates. All series related to money and exchange rate is collected from National Bank of Tajikistan (NBT[3]). The data series of GDP and CPI is collected from agency on statistics, Government of Tajikistan[4].

We follow the theoretical studies of the demand for money and start following the theoretical hypotheses in our analysis: 1) the demand for money in Tajikistan positively depends on the level of economic activity; 2) in the case of the existence of the dependence of the demand for money on the CPI, this dependence is negative; 3) with the growth of the somoni/dollar(euro) exchange rate, economic agents will aspire to convert their available somoni into dollars(euro), expecting the continuation of the rate growth (this assumption is based on the assumption of adaptive expectations).

4.1 ARDL Bound Testing Approach to Cointegration

In time series analysis, many cointegration approaches have been developed such as Engle and Granger, (1987) cointegration approach, Johansen (1990) Johansen test, Phillips and Ouliaris (1990) Phillips–Ouliaris cointegration test and Error Correction Model (ECM) based F-test of Boswijk (1994), and the ECM based t-test of Banerjee et al. (1998). These approaches are required series to be stationary at 1st difference. Later on, to enhance the power of cointegration relationship, Pesaran et al. (2001) introduced ARDL bound test approach that is flexible when same or mixed order of integration exist i.e. I(0) or I(1) or I(0)/I(1). But it is restricted that any series should not be integrated at 2nd difference, i.e. I(2). The estimated models for ARDL bound testing are following:

$$\Delta \ln M_{0t} = \alpha_1 + \alpha_T T + \alpha_{M0} \ln M_{0(t-1)} + \alpha_Y \ln Y_{t-1} + \alpha_i \ln i_{t-1} + \alpha_p \ln P_{t-1} + \sum_{j=0}^{q} \alpha_j \Delta \ln Y_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta \ln i_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta \ln P_{t-l} + \mu_t \quad (6)$$

$$\Delta \ln M_{2t} = \beta_1 + \beta_T T + \beta_{M2} \ln M2_{t-1} + \beta_Y \ln Y_{t-1} + \beta_i \ln i_{t-1} + \beta_P \ln P_{t-1} + \sum_{j=0}^{q} \beta_j \Delta \ln Y_{t-j} + \sum_{k=0}^{r} \beta_k \Delta \ln i_{t-k} + \sum_{l=0}^{s} \beta_l \Delta \ln P_{t-l} + \mu_t \quad (7)$$

$$\Delta \ln M_{4t} = \gamma_1 + \gamma_T T + \gamma_{M4} \ln M4_{t-1} + \gamma_Y \ln Y_{t-1} + \gamma_i \ln i_{t-1} + \gamma_P \ln P_{t-1} + \sum_{j=0}^{q} \gamma_j \Delta \ln Y_{t-j} + \sum_{k=0}^{r} \gamma_k \Delta \ln i_{t-k} + \sum_{l=0}^{s} \gamma_l \Delta \ln P_{t-l} + \mu_t \quad (8)$$

[3] http://www.nbt.tj/tj/
[4] http://www.stat.tj/

 ISSN 1927-033X

Here, The null hypothesis for all three models are $\alpha_{M0} = \alpha_{Y} = \alpha_{i} = \alpha_{P} = 0$, $\beta_{M2} = \beta_{Y} = \beta_{i} = \beta_{P} = 0$ and $\gamma_{M4} = \gamma_{Y} = \gamma_{i} = \gamma_{P} = 0$. Similarly, The alternative hypothesis are $\alpha_{M0} \neq \alpha_{Y} \neq \alpha_{i} \neq \alpha_{P} \neq 0$, $\beta_{M2} \neq \beta_{Y} \neq \beta_{i} \neq \beta_{P} \neq 0$ and $\gamma_{M4} \neq \gamma_{Y} \neq \gamma_{i} \neq \gamma_{P} \neq 0$. The null hypothesis shows that there is no cointegration between underlying variables. Likewise, alternative hypothesis shows that cointegration relationship exist. If the calculated F-statistics exceeds the UCB, we may reject the null of no cointegration, otherwise accept. However, if calculated F-statistics exist between lower critical bound (LCB) and upper critical bound (UCB), we may say that our results are inconclusive and uncertain.

4.2. VECM Granger Causality

After confirming the long run relationship between variables, we proceed to Granger causality approach because it is necessary to detect the direction of causality among aggregated money demand, economics activates, price level and exchange rate. Firstly, Engler and Granger (1987) introduced a method to detect causal linkages between different variables. Later on, this Granger causality approach has modified as VECM granger causality by dividing causality into short and long run. The estimated VECM models are listed below:

$$(1-L)\begin{bmatrix}\Delta \ln M_t^D \\ \Delta \ln P_t \\ \Delta \ln Y_t \\ \Delta \ln i_t\end{bmatrix} = \begin{bmatrix}a_1 \\ a_2 \\ a_3 \\ a_4\end{bmatrix} + \begin{bmatrix}b_{11i}b_{12i}b_{13i}b_{14i}b_{15i}b_{16i} \\ b_{21i}b_{22i}b_{23i}b_{24i}b_{25i}b_{26i} \\ b_{31i}b_{32i}b_{33i}b_{34i}b_{35i}b_{36i} \\ b_{41i}b_{42i}b_{43i}b_{44i}b_{45i}b_{46i}\end{bmatrix} \times \begin{bmatrix}\Delta \ln M_{t-1}^D \\ \Delta \ln P_{t-1} \\ \Delta \ln Y_{t-1} \\ \Delta \ln i_{t-1}\end{bmatrix} + \ldots + \begin{bmatrix}b_{11i}b_{12i}b_{13i}b_{14i}b_{15i}b_{16i} \\ b_{21i}b_{22i}b_{23i}b_{24i}b_{25i}b_{26i} \\ b_{31i}b_{32i}b_{33i}b_{34i}b_{35i}b_{36i} \\ b_{41i}b_{42i}b_{43i}b_{44i}b_{45i}b_{46i}\end{bmatrix}$$

$$\times \begin{bmatrix}\Delta \ln M_{t-1}^D \\ \Delta \ln P_{t-1} \\ \Delta \ln Y_{t-1} \\ \Delta \ln i_{t-1}\end{bmatrix} + \begin{bmatrix}\alpha \\ \beta \\ \gamma \\ \delta\end{bmatrix} \times ECT_{t-1} + \begin{bmatrix}\varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t}\end{bmatrix} \qquad (9)$$

Here, (1-L) is difference operator and the lagged correction term is ECM_{t-1}. Our conclusion about existence of long run causality can be drawn when the coefficients of lagged error correction term (ECM_{t-1}) are statistical significant. Similarly, the significance of first difference coefficients express short run causality.

5. Results and Discussion

The results of descriptive statistics and correlation for all three estimated models are displayed in table-1. The results predict that all underlying series are not correlated with each other. It shows that series are not correlated. In extend, market activities and exchange are positively correlated while price level is negatively correlated with all types of money. Similarly, exchange rate is also positively correlated while price level is negatively correlated with market activities.

In econometric literature, it is necessary to test the unit root properties of series that must be stationary at any level except 2nd difference. We used ADF unit root test introduced by Dickey and Fuller (1981) and PP unit root test by Phillips and Perron, (1988) as they are tradition unit root tests and provide authentic results for long frequency data. The results of unit root test are reported into table-2. The results of ADF test show that all series are stationary at 1st difference except price series. The PP test also verifies the findings of ADF test by providing same results. The stationarity shows that all data series have zero mean and constant variance over the period of time.

 ISSN 1927-033X

Table 1. Descriptive Statistics and Correlation Matrix

Variables	M_{0t}	M_{2t}	M_{4t}	Y_t	i_t	P_t
Mean	6.7235	7.0320	7.4830	8.3953	1.3152	100.95
Median	6.9751	7.2778	7.7790	8.4667	1.2361	100.60
Maximum	8.9253	9.2248	9.6045	10.878	2.0640	112.40
Minimum	3.9473	4.1102	4.4510	4.2934	0.4221	99.100
Std. Dev.	1.4265	1.4357	1.4259	1.4283	0.3515	1.4594
Skewness	-0.4805	-0.4514	-0.3804	-0.3891	-0.0216	4.0204
Kurtosis	1.9989	2.0102	1.9265	2.5352	3.0550	25.610
Jarque-Bera	16.371	15.255	14.715	6.9849	0.0416	4895.2
Prob.	0.0002	0.0004	0.0006	0.0304	0.9794	0.0000
M_{0t}	1.00					
M_{2t}	---	1.00				
M_{4t}	---	---	1.00			
Y_t	0.78	0.77	0.76	1.00		
i_t	0.94	0.94	0.95	0.68	1.00	
P_t	-0.26	-0.26	-0.25	-0.22	-0.30	1.00

For time series analysis, it might be possible that data has structural changes. So, it is necessary to identify unknown structural breaks because without these breaks, we cannot provide authentic results for policy makings. For this purpose, all traditional unit root tests remain fail. Now, we have to move for structural breaks unit root tests such as Perron and Volgelsang, (1992), Perron (1997), Clemente et al. (1998) and Zivot–Andrews, (2002).

Table 2. Traditional Unit Root Analysis

Variables	ADF Test		PP Test	
	Level	1st difference	Level	1st difference
ln M_{0t}	-1.755	-15.82*	-1.567	-16.064*
ln M_{2t}	-2.059	-16.069*	-1.754	-17.030*
ln M_{4t}	-2.571	-8.229*	-2.712	-19.117*
ln Y_t	-1.182	-3.548**	-1.435	-7.3274*
ln i_t	-2.730	-10.218*	-2.968	-10.859*
ln P_t	-7.870*	---	-7.859*	---

Note: * and ** show the significance at 1 % and 5 % level of significance.

Recently, Kim and perron (2009) introduced a structural break unit root test to check the level of integration by identifying single unknow structural break. We are also using this new test in our research. Table-3 represents the results of Kim and Perron (2009) single structural break unit root test and findings demonstrate that all series are not stationary at level except price level. But, these series seem to be stationary by taking 1st difference. Price level is stationary at level. It shows that mixed order of integration exists for our series. These findings are also consistent with the findings of ADF and PP unit root test.

As we mentioned above, there is high level of dollarization of national economy in Tajikistan. According to Table-1, there is 94-95% correlation between exchange rate and money aggregates, which specify high level of dollarization in Tajikistan. Due to this, national economy is vulnerable to external shocks. This shock caused in money aggregates and depreciation of national currency in early stage of stabilization, as well as recent years. This can be seen on table - 3. The Break periods of money aggregates in early years driven both by emission of national currency in order to cover cotton debts and sharp devaluation of national currency in 2008. This phenomenon also had impact on GDP. Should be mentioned, nowadays Tajikistan experienced deep devaluation of the national economy as well. Exchange rate of US dollar in Tajikistan has increased by 34.2% in 2015. For comparison, in 2014 devaluation of the national currency against the US dollar was 11.4%. The main reason of national currency depreciation emanated from

 ISSN 1927-033X

Russian crisis through remittances. Furthermore, there is a worsening of banking system situation. The Government of Tajikistan provided financial support through currency emission 2.1 bln. somoni in 2015 to four commercial banks of Tajikistan in order to improve their financial situation and rescue troubled banks from bankruptcy.

Table 3. Kim and Perron (2009) Structural Break Unit Root Test

Variables	Break Period	T-stat. Level	Prob.	Decision
ln M_{0t}	2003M08	-2.257	0.953	Not Stationary
ln M_{2t}	2016M02	-2.880	0.747	Not Stationary
ln M_{4t}	2015M04	-3.008	0.681	Not Stationary
ln Y_t	2005M11	-3.367	0.461	Not Stationary
ln i_t	2014M11	-4.0723	0.133	Not Stationary
ln P_t	2001M06	-8.9238*	0.000	Stationary
		1st difference		
ln M_{0t}	2005M01	-16.899*	0.000	Stationary
ln M_{2t}	2003M01	-16.368*	0.000	Stationary
ln M_{4t}	2008M02	-13.244*	0.000	Stationary
ln Y_t	2008M11	-14-343*	0.000	Stationary
ln i_t	2016M01	-13.050*	0.000	Stationary

Note: * shows the significance at 1 % level of significance

The mixed order of integration suggest us to move for ARDL bound testing approach because this approach has an advantage when data series have different integration order I(0)/I(1). The results of ARDL cointegration (equation 6,7,8) are reported into table-4. To accommodate structural break years of respective series, we introduce dummy of these series and estimate long run relationship. The empirics illustrate that calculated F-statistics are greater than Upper Critical bound (UCB). So, we may reject null of no cointegration which shows that long run relationship exists between underlying variables in the presence of structural break shocks for all three models.

Table 4. ARDL Bound Testing

Estimated models	Lag orders	Break Years	F-statistics	Cointegration
Model-1	(3,0,2,3,1)	2003M08	3.7254***	Exist
Model-2	(3,1,0,3,0)	2016M02	6.4864*	Exist
Model-3	(3,0,0,3,0)	2015M04	6.5766*	Exist
Significance level[5]	I(0) Bound	I(1) Bound		
1%	3.74	5.06		
5%	2.86	4.01		
10%	2.45	3.52		

Note: * and *** represent significant at 1 %, and 10 % level of significance. Lag length is based on minimum value of AIC.

After confirming the long run relationship between all type of money, economic activities, exchange rate and price level, we go to estimated long run parameters. The results of long run estimation (equation 3,4,5 for model-1, model-2, model-3 respectively) are reported into table-5. The findings show that economics activities and exchange have positive but significant, while, price level has negative but insignificant impact on aggregated money demand. The coefficients of economic activities are 0.21, 0.21 and 0.20 for M0, M2 and M4 respectively. It shows that when we increase 1 % in economic activities, money demand will increase approximately by 0.21 %. This is evidence of demonetization of national economy due to tough monetary policy. Similarly, coefficients of exchange rate are 3.06, 3.15 and 3.21 for M0, M2 and M4 respectively. It also predicts that 1 % increase in exchange rate leads to increase in money demand by 3.06 %, 3.15 % and 3.21 % for M0, M2 and M4 respectively. Concerning insignificance impact of price level to

[5] The values of upper and lower critical bounds are drawn from Pesaran et al. (2001)

 ISSN 1927-033X

money aggregates should be noted that price level has production nature. It means that share of price level of manufactured goods is very high, it is approximately 70 %. Our results predict that money demand function is not stable in case of Tajikistan because price level is not significant predictor of money demand. Further, Adjusted R square for M0, M2 and M4 are 0.89, 0.91 and 0.91 respectively. The value of adjusted R square shows that dependent variables of all three models are explaining 89 %, 91 % and 91 % by independent variables. Moreover, F-statistics confirms the significance of overall model for all three models.

Table 5. Long Run Analysis

Variables	Model-1		Model-2		Model-3	
	Coefficient	T-stat.	Coefficient	T-stat.	Coefficient	T-stat.
ln Y_t	0.2181*	6.0508	0.2100*	6.3127	0.2011*	6.2632
ln i_t	3.0680*	20.330	3.1505*	22.624	3.2175*	23.932
ln P_t	-0.0273	-1.130	-0.0321	-1.4394	0.0008	0.0370
Constant	3.6224	1.4465	4.3744***	1.8931	1.4811	0.6639
Adj R^2	0.8937		0.9106		0.9143	
F-stat.	560.59		679.57		723.01	
Prob.	0.0000		0.0000		0.0000	

Note: * and *** represent significant at 1 % and 10 % level of significance respectively

The results of short run analysis are presented in table-6. We find that economic activities have positive and significant impact on all types of money in short run. But, exchange has positive and significant impact on money demand only in case of Model-3. Similarly, price level is negative and significant only in case of M0 for short run. The lagged value of ECM is negative and significant for all types of money demand. The value of ECM shows the speed of adjustment from disequilibrium to equilibrium. The estimated values of ECM are -0.033, -0.035 and -0.029 for M0, M2 and M4 money respectively. This implies that deviations from short run towards long run are corrected by 3.3 %, 3.5 % and 2.9 % in each month and it will take almost 2.5, 2.3 and 2.8 years to reach the equilibrium path respectively.

Table 7. Short Run Analysis

Variables	Model-1		Model-2		Model-3	
	Coefficient	T-stat.	Coefficient	T-stat.	Coefficient	T-stat.
ΔY_t	0.0208*	3.8317	0.0283*	5.7210	0.0259*	4.1974
Δi_t	-0.3871	-1.4548	-0.1022	-0.4213	0.7181**	2.3747
ΔP_t	-0.0124*	-3.8483	-0.0113	-3.8336	-0.0036	-0.9839
Constant	0.0267*	5.5719	0.0248*	5.6836	0.0188*	3.4545
$ECM_{(t-1)}$	-0.0335*	-3.6173	-0.0357*	-3.8976	-0.0293**	-2.4749
Adj R^2	0.2199		0.2677		0.1075	
F-stat.	12.957*		18.100		5.9664	
Prob.	0.0000		0.0000		0.0000	

Note: *and ** represent significant at 1 % and 5 % level of significance respectively.

After confirming long run relationship, we move to identify the direction of causality. For this purpose, Enger and Granger (1987) introduced causality procedure. Table-7 shows the results of VECM granger causality (eq-9). VECM granger causality has an advantage over simple Granger causality because it divides simple Granger causality into long and short run causality. The results express that economic activities, exchange rate and price level cause M0 in long as well as short run. Moreover, bidirectional causality between economic activities and exchange rate, and price level and exchange rate in long as well as short run for M0 model. Similarly, bidirectional causality exists between economic activities, M2 and price level. We also find feedback effect between price level and exchange rate for model M2. Further, when we take M4 function of money, we find

 ISSN 1927-033X

bidirectional causality between M4, economic activities and exchange rate in long and short run as well. The price level also causes exchange rate and being affected by same variable.

Table 7. VECM Granger Causality

Variables	Short run				Long Run
			Model 1		
	ΔM0	ΔY	Δi	ΔP	ECM
ΔM0	---	7.7493*	3.4666**	16.1085*	-0.0263*
ΔY	12.2969*	---	10.4111*	0.7062	-0.4510*
Δi	2.9338***	15.1016*	---	4.9112*	---
ΔP	13.2875*	2.3177	6.4131*	---	-0.5046*
			Model-2		
	ΔM2	ΔY	ΔI	ΔP	ECM
ΔM2	---	19.7150*	1.6484	26.5988*	-0.0256*
ΔY	31..4510*	---	10.4853*	3.1484**	-0.4162*
Δi	0.9178	14.1411*	---	5.8824*	---
ΔP	14.0906*	3.3469**	6.9397*	---	-0.5035*
			Model 3		
	ΔM4	ΔY	Δi	ΔP	ECM
ΔM4	---	9.5127*	3.5884**	2.2117	-0.0246**
ΔY	12.7819*	---	19.5691*	0.1475	-0.4843*
Δi	3.1610**	25.6772*	---	6.5520*	---
ΔP	1.7203	0.4461	6.3174*	---	-0.5389*

Note: *, ** and ** show the significance at 1 %, 5 % and 10 % level of significance

6. Conclusion and Implications

This study has examined the stability of the demand for money function in Tajikistan over the monthly period of 2000-2016. The reason of taking this sample period was macroeconomic stabilization and further economic development of Tajikistan. The empirical analysis reveals that all three models for long- and short-term periods are well specified, but the money demand function was unstable throughout the observed period due to insignificance of price level as a predictor of money demand. The cointegration analysis is tested by ARDL cointegration procedure which confirms the existence of long-run relationship between the aggregated money demand, overall economic activity, price level, and exchange rates. The findings show that economic activities and exchange rate have positive and significant, while price level has negative and insignificant impact on all three types of money (M0, M2, M4). But short-run analysis shows that the money demand is affected by the exchange rate only in third model, i.e. in the case of broad money, this result is consistent with the economic theory.

The significance attached to the exchange rate variable in the long and short-term proves high level of dollarization of both balance sheet assets and liabilities. To a certain extent, the above facts cause the instruments of monetary policy to be less efficient. The instability of the money demand function points to the sensitivity of Tajik national economy to external shocks. In this context, the instable demand for money function means that it may not be forecasted in the long-run period based on the set of observed factors and, therefore, it may not be used for the monetary aggregate targeting, as also proved by the test results. In practice, the relation between the money demand and inflation rate proves much more complex than the results of our model suggest.

Monetary policy of the Republic of Tajikistan includes the process of regulation and management of the supply of money in the economy, the liquidity level of the banking system and short-term interest rates through the use of monetary policy instruments aimed primarily on achieving price stability and promoting real economic growth. Currently, the mechanism of the monetary policy of the National Bank of Tajikistan is based on the monetary targeting and holding stability of price level. Results of econometric estimation reveal instability of money demand function, which implies the inefficiency of monetary policy of the Tajikistan. In turn, the main reason of inefficiency of monetary policy in the Tajikistan are non-monetary factors, and foremost

 ISSN 1927-033X

on the external economic situation and pressures. Taking into account all of the above mentioned, it can be concluded that the money supply (money base) cannot be accepted as a targeting parameter of monetary policy in Tajikistan.

Reference

Ahad M. 2017. Financial Development and Money Demand Function: Cointegration, Causality and Variance Decomposition Approach for Pakistan. *Global Business Review* 18:4, 811-824.

Arize AC, Shwiff, SS. 1993. Cointegration, real exchange rate and modelling the demand for broad money in Japan. *Applied Economics* 25:6, 717-726.

Andronescu A, Mohammadi H, Payne JE. 2004. Long-run estimates of money demand in Romania. *Applied Economics Letters* 11:14, 861-864.

Bahmani-Oskooee, M, Barry MP. 2000. Stability of the demand for money in an unstable country: Russia. *Journal of Post Keynesian Economics* 22:4, 619-629.

Boswijk PH. 1994. Testing for Unstable Root in Conditional and Structural Error Correction Models. *Journal of Econometrics* 63:1, 37-60.

Banerjee A, Dolado J, Mestre R. 1998. Error-Correction Mechanism Tests for Cointegration in A single-Equation Framework. *Journal of Time Series Analysis*, 19:3, 267-283.

Bolharyn IV, Banaian K, Valliere RJ. 1998. Modeling money demand in the Ukrainian economy. *Russian and East European Finance and Trade* 34:3, 45-55.

Buch CM. 2001. Money Demand in Hungary and Poland. *Applied Economics* 33:8, 989-999.

Cuthbertson K, Bredin D. 2001. Money Demand in the Czech Republic since transition. *The Journal of Policy Reform 4*:4, 271-290.

Chowdhury AR. 1995. The demand for money in a small open economy: The case of Switzerland. *Open Economies Review* 6:2, 31-44.

Clemente J, Montanes A, Reyes M. 1998. Testing for a unit root in variables with a double change in the mean. *Economics Letters* 59:2, 175-182.

Dickey DA. Fuller WA. 1981. Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica,* 49:4, 1057-1079.

Engle RF, Granger CW. 1987. Co-integration and error correction: Representation, estimation and testing. *Econometrica: Journal of the Econometric Society* 55:2, 251–276.

Fase M. 1993. The stability of the demand for money in the G7 and EC countries: A survey. Research Memorandum WO&E Nr. 9321.

Friedman M. 1956. The Quantity Theory of Money, a Restatement, in Studies in the Quantity Theory of Money, ed. M. Friedman, Chicago, Ill.: University of Chicago Press.

Goldfeld SM, Duesenberry J, Poole W. 1973. The demand for money revisited. *Brookings Papers on Economic Activity 1973*:3, 577-646.

Haug AA, Lucas RF. 1996. Long-run money demand in Canada: in search of stability. *The review of Economics and Statistics* 78, 345-348.

Johansen S, Juselius K. 1990. Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and statistics*, 52:2, 169-210.

Kalra MS. 1998. Inflation and money demand in Albania *(No. 98-101)*. International Monetary Fund.

Knell M, Stix H. 2006. Three decades of money demand studies: Differences and similarities. *Applied Economics* 38:7, 805-818.

Kim D, Perron P. 2009. Unit root tests allowing for a break in the trend function at an unknown time under both the null and alternative hypotheses. *Journal of Econometrics* 148:1, 1-13.

 ISSN 1927-033X

Lim GC. 1993. The Demand for the Components of Broad Money: Error Correction and Generalized Asset Adjustment System. *Applied Economics* 25:8, 995-1004.

McNown R, Wallace MS. 1992. Cointegration tests of a long-run relation between money demand and the effective exchange rate. *Journal of International money and Finance* 11:1, 107-114.

Mehra, YP. 1993. The Stability of the M2 Money Demand Function: Evidence from an Error-Correction Model. *Journal of Money. Credit and Banking* 25:3, 455-460.

Mehra YP. 1978. Is money exogenous in money-demand equations. *Journal of Political Economy* 86:2, Part 1, 211-228.

Nelson CR, Plosser CR. 1982. Trends and random walks in macroeconomic time series: some evidence and implications. *Journal of monetary economics* 10:2, 139-162.

Oomes, N, Ohnsorge F. 2005. Money demand and inflation in dollarized economies: The case of Russia. *Journal of Comparative Economics* 33:3, 462-483.

Payne JE. 2003. Post stabilization estimates of money demand in Croatia: error correction model using the bounds testing approach. *Privredna kretanja i ekonomska politika*, *12*:93, 39-53.

Phillips PCB, Perron P. 1988. Testing for unit root in time series regression. *Biometrika* 75:2, 335-346.

Phillips PC, Ouliaris S. 1990. Asymptotic Properties of Residual Based Tests for Cointegration. *Econometrica: Journal of Econometric Society* 58:1, 165-193.

Perron P, Vogelsang TJ. 1992. Nonstationary and level shifts with an application to purchasing power parity. *Journal of Business & Economic Statistics*, 10:3, 301-320.

Perron P. 1997. Further evidence on breaking trend functions in macroeconomic variables. *Journal of econometrics* 80:2, 355-385.

Pesaran MH, Shin Y, Smith RJ. 2001. Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics* 16:3, 289-326.

Sharifi-Renani H. 2007. Demand for money in Iran: An ARDL approach. Munich Personal RePEc Archive, *MPRA Paper No*. 8224.

Sims CA. 1972. Money, income, and causality. *The American economic review*, *62*:4, 540-552.

Slavova S. 2003. Money demand during hyperinflation and stabilization: Bulgaria, 1991-2000. *Applied Economics*, 35:11, 1303-1316.

Sriram SS. 2001. A Survey of Recent Empirical Money Demand Studies. *IMF Staff Papers* 47:3, 334-365.

Teigen RL. 1964. Demand and supply functions for money in the United States: Some structural estimates. *Econometrica: Journal of the Econometric Society* 32:4, 476-509.

Zivot E, Andrews DWK. 2002. Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis. *Journal of business & economic statistics 20*:1, 25-44.

Алиджанова СА. 2013. Меры адаптации денежно-кредитной политики к макроэкономическим условиям переходной экономики Республики Таджикистан. *Вестник ТГУПБП*, 146-154. // Measures for adapting monetary policy to the macroeconomic conditions of the transition economy of the Republic of Tajikistan.

Бабаджанов ДП. 2001. Некоторые аспекты денежно-кредитной системы Таджикистана. *Экономика Таджикистана: Стратегия развития* 1, 74-89. //Babadzhanov DP. Some approaches of monetary system of the Tajikistan.

Дробышевский СМ. [и др.]. 2010. Моделирование спроса на деньги в российской экономике в 1999-2008 гг. Научные труды //*Ин-т экономики переходного периода* 136Р, 144. //Drobyshevskij SM. et al. Modelling demand for money in Russian economy of the 1999-2008.

 ISSN 1927-033X

Хайдаров АК. 2001. Политико-экономические последствия феномена валютного замешения. Сб.: Переходный период: тенденции социального и *экономического развития Таджикистана*, 2, 41-46. //Khaydarov AK. Political and economic consequences of the currency exchange phenomenon.

http://www.nbt.tj/tj/

http://www.stat.tj/

 ISSN 1927-033X