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VELOCITY OF MONEY IN PAKISTAN: TIME SERIES ANALYSIS

The study identifies the determinants of velocity of money (VM) in Pakistan by using cointegration technique. The analysis covers narrow money (M2). The cointegration results support a positive relationship between VM and economic growth in Pakistan. Financial development and inflation also affect VM positively. Having an increasing relationship of VM with these variables, the adverse impact of expansionary monetary policy is not likely to be small in Pakistan.

Keywords: *financial development; velocity of money; monetary policy.*

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ОБОРОТНІСТЬ ГРОШЕЙ В ПАКИСТАНІ: АНАЛІЗ ЧАСОВИХ РЯДІВ

У статті за допомогою технології коінтеграції визначено чинники оборотності грошей (ОГ) у Пакистані. Аналіз проведено на т. зв. "вузьких грошах" (М2). Результати коінтеграції підтвердили позитивний зв'язок між ОГ і економічним зростанням у Пакистані. Фінансовий розвиток і інфляція також позитивно впливають на ОГ. У разі підвищення залежності між ОГ і цими змінними несприятливий вплив фінансової політики в Пакистані навряд чи буде зведено до мінімуму.

Ключові слова: *фінансовий розвиток; оборотність грошей; фінансова політика.*

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ОБОРАЧИВАЕМОСТЬ ДЕНЕГ В ПАКИСТАНЕ: АНАЛИЗ ВРЕМЕННЫХ РЯДОВ

В статье с помощью технологии коинтеграции определены факторы оборачиваемости денег (ОД) в Пакистане. Анализ проведен на т. н. "узких деньгах" (М2). Результаты коинтеграции подтвердили позитивную связь между ОД и экономическим ростом в Пакистане. Финансовое развитие и инфляция также положительно влияют на ОД. В случае повышения зависимости между ОД и этими переменными неблагоприятное влияние стимулирующей финансовой политики в Пакистане вряд ли будет сведено к минимуму.

Ключевые слова: *финансовое развитие; оборачиваемость денег; финансовая политика.*

1. Introduction. The money supply in an economy is determined by the quantity of money and the rate of circulation of money that is velocity of money (VM). To determine the optimal amount of money in an economy the numerical value of VM and its determining factors are equally important to total quantity of money. So, for the purpose of setting credible monetary policy programs the understanding of behavior of VM and its determining factors are crucially significant, particularly for in an economy like Pakistan where annual economic growth fluctuates frequently.

To formulate efficient monetary policy, the reliable estimates of VM and its forecasts are necessary. If VM is unpredictable, the demand for money remains unstable, that makes the standard relationship between GDP, inflation, and money supply

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uncertain. It results in inefficiency of monetary policy. The critical concern of monetary authorities is to ensure adequate supply of money to spur economic growth without causing inflation. This goal cannot be achieved if VM remains unstable. In recent years, VM has gained much importance to analyze the efficiency of monetary policy all over the world. Pakistan adopted monetary targeting policy during the heydays of monetarism. Even in the mid 1990s, when there was a decline in the role of money in macroeconomic models all around the world, Pakistan remained unrelenting with this policy. The acknowledged perception for monetary authorities was beset by monetarists' doctrine which believes in stability of money velocity.

In 1990s and early 2000s substantial institutional changes, especially in the financial sector, occurred in Pakistan that probably changed the standard relationship between VM and other macroeconomic variables. This paper examines whether these changes have any effect on VM. If VM changes with the change in macroeconomic variables like real GDP, interest rate, and inflation, the monetary authorities have to be careful for explanatory monetary policy by issuing money.

2. Financial Development and Velocity of Money in Pakistan. In the recent decades Pakistan has gone through a series of significant reforms in the financial sector that have changed the saving and deposit behavior of people along with lending and borrowing tendencies of financial institutions. Under this scenario the assumption that VM remains constant seems not to be realistic. Some other factors like real income, foreign investment and exchange rate may be added to affect the VM and its movement. Pakistan embarked on financial liberalization and reforms in 1990s.

In the 1950s — the early years of the country, the financial sector was comparatively less developed. However, developmental financial institutions like Pakistan Investment and Credit Corporation (PICIC) and Pakistan Industrial Development Corporation (PIDC) were operating to finance public sector industrial units. They performed a vital role in the establishment of industrial base in Pakistan. During this period State Bank of Pakistan (SBP) used modest and indirect control of monetary policy. Private sector was intensively facilitated in the 1960s.

Institutional credits were made available to the private sector. Reserve requirement and marginal requirement became the main instruments to control supply of money by SBP. Credit quota system was also introduced in this decade (Meenai, 2001). In the 1950-60s open market operation (OMO) was pursued by SBP but remained limited due to weak security market in the economy. In the early 1970s, due to the nationalization of financial institutions by Government of Pakistan, the structure of the financial sector changed. Annual credit plan was introduced to channel credits into previously neglected sectors. The National Credit Consultative Council (NCCC) and Pakistan Banking Council (PBC) were established to provide institutional mechanism for direct control. In 1980s the framework of monetary policy was not dismantled. Since 1988, Pakistan pursued the policy of financial liberalization following a worldwide wave of liberalization. A number of institutional changes like the economic prudential and structural regulations have been taken place till today and many are under way. For example, the nationalization and then denationalization of financial institutions, institutional strengthening like the autonomy of State Bank of Pakistan, Basel Accord, CAMELS framework, dealing with the non-performing loans in the form of establishment of banking courts, debt management reforms,

monetary management measures, exchange and payment reforms, capital market reforms etc. It is essential to investigate the effects of these institutional changes on velocity of money.

3. Literature Review. In the literature on developed economies the empirical findings regarding the trends of income velocity of money are adequate. On the other hand, for developing economies sufficient evidences are non-existent to draw the consensus. For Pakistan the determinants of money velocity are explained by various research in different perspectives. The findings are very different. The reasons for such results may be economic and institutional factors, different time periods along with diverse estimation techniques. For Pakistan, Bilquees and Rauf (1994) examined the functional relationship between money velocity and macroeconomic variables for the period 1975-1992. The results explored that per-capita income, interest rate, inflation and institutional factors like payment mechanism and spending habits are the major determinants of money velocity in the country.

Akhtaruzzaman (2008) examined the determinants of income velocity of money in Bangladesh for both M1 and M2, for the period 1973-2007. The study found a negative relationship of VM with economic growth indicating a declining VM over time in Bangladesh. The study further established that financial development affects VM negatively.

4. Theoretical Background and Model Specifications. According to modern quantity theory of money, money velocity depends on income and inflation. The growth of institutions, especially in the banking sector affects the way people perform economic transactions. Financial development may be included in the velocity of money. Interest rate is the cost of holding money that is also relevant with money velocity. In this section we will discuss the theoretical aspects of relationship between these variables and money velocity as well as the overlapping relationship like, the velocity of money and rate of interest in the presence of inflation. However, through theoretical and empirical support we have formulated the velocity of money function as:

$$VM = f(FDEV, GDP, I, INF), \quad (1)$$

where FDEV = financial development, GDP = real income, I = interest rate, INF = inflation.

The velocity of money is usually defined as the proportion of nominal GDP to money supply (GDP/M). A broader definition of money supply is assumed more suitable than the narrow money in both developed and developing countries. We have used broader definition of money M2 for measuring the money velocity.

There is a variety of proxies for financial development, like growth of financial institutions, financial innovation, demand deposit and currency ratio (DD/C), time deposit and currency ratio (TD/C) and demand deposit and time deposit ratio (DD/TD). We have used DD/TD as a measure of financial development. Due to dearth of other financial assets in developing countries like Pakistan, people substitute demand deposits against time deposits as income increase. That is why we have used DD/TD measures of financial development.

Financial development decreases transaction costs of transferring funds between demand and time deposits. The decreased transaction cost augments the share of total savings held in the form of time deposits. Financial development increases time

deposits (TD) at a higher rate than demand deposits (DD) implying change in DD/TD. So, the sign of DD/TD may be positive or negative in the velocity function. As financial development occurs people are likely to have more money in time deposits that results in velocity sliding down showing inverse relation of velocity of money with DD/TD.

Real income is represented by per capita real GDP. The way per capita income affects velocity depends upon income elasticity of demand for money. If it exceeds one, there will be negative impact of per capita income on money velocity and vice versa. For Pakistan, the studies have shown that increase in per capita income increases money demand by more than proportionate, i.e. income elasticity of demand for money is greater than one (Akhtar, 1994). However, over the time the income elasticity of demand for money is found to be declining around one (Khan, 1994). The empirical studies have also shown that VM is a negative function of per capita income, although it contradicts the quantity theory of money.

According to Fry (1988) the sign of association between VM and per capita income depends on the stage of economic development, particularly the financial development. At the earlier stage of economic development the velocity may fall with higher growth of income but at a later stage it may become positively correlated with income growth. The reason may be that at the initial stage of economic development there is increasing monetization, spread of banking system and relatively fast expansion of monetary transactions that contribute to higher demand for money making money velocity fall down. At the advanced stage of development characterized by transaction efficiency, financial innovation and technological progress that guarantee the accessibility and use of money substitutes and provide a variety of money substitutes reduce the demand for money which makes VM boost up. It is also empirically evidenced that there may be a U-shaped velocity of money function with respect to economic growth.

Interest rate in an economy also determines the money velocity. An increase in interest rate leads to a decrease in demand for money which make the velocity of money increase. It is more likely under inflation. Furthermore, interest rate represents the opportunity cost of holding money, when this cost increases, money holders likely to hold less amount of money which makes the velocity of money to increase. Within the economies characterized by increasingly developing financial market, interest rate is expected to play an important role for substitution between money and financial assets. Hence, interest rate proxied by call money rate as a determinant of money velocity has been included in the model to see its impact on money velocity in Pakistan.

The inflation in the model has been measured by consumer price index. In the times of increasing inflation people prefer to hold real assets over monetary assets. Money is spent as soon as received so velocity of money increases. Rising inflation effects money velocity similar to rising interest. In Pakistan and other developing economies, although a number of newly introduced financial assets exist at financial markets, they are not enough to serve as a substitute to money. Furthermore, interest rate is not completely determined by market forces, so asset choice by wealth holders becomes partially restricted to money or real assets.

The functional form of the model is:

$$VM = \beta_0 + \beta_1 FDEV + \beta_2 LGDP + \beta_3 I + \beta_4 INF, \quad (2)$$

where VM = income velocity of money per capita;

FDEV = financial development (DD/TD ratio);

LGDP = log of GDP per capita;

I = interest rate (call money rate);

INF = consumer prices index (CPI).

5. Data and Model Estimation. The annual time series data for 1978-2010 has been taken from Pakistan Economic Survey (various issues) by Government of Pakistan (GOV), Annual Reports (various issues) by State Bank of Pakistan (SBP) and Banking Statistics (various issues) by SBP.

The stationarity of the data has been tested with unit root tests. The hypothesis of a unit root in the series is tested with augmented Dickey-Fuller (ADF) test and Phillips-Peron tests. The ADF test check the presence of a unit root in an autoregressive model yt = ayt-1 + et, where *yt* is the variable studied, *t* is the time period, *a* is a coefficient, and *et* is a error term. The model may also be written as: yt = (a - 1) yt-1 + et = d yt-1 + et, where *d* is the first difference operative. So here, testing for a unit root is the same as to testing d = 0. One of the shortcomings of the ADF test is that it assumes that the error term is statistically independent and has an invariable variance. This assumption may not hold for every type of data so, Phillip-Peron (PP) test has also been used to settle down this overassumption. PP test allows the error term to be distributed heterogeneously. This can be presented mathematically by yt= a0 + a1 yt-1 + at {t- T/2} + et. If a time series is not stationary and becomes stationary when it is differenced one time, then series is said to be integrated of the order one I (1) and if two series are integrated of the same order, there may exist a linear combination stationary at level. If such type of combination exists then these series are considered cointegrated. The cointegration tests are of two broader categories: (1) residual-based tests, and (2) maximum likelihood-based tests. Engle-Granger (1987) tests are residual-based tests while Johansen (1988, 1991) and Johansen-Juselius (1990) tests are maximum likelihood-based tests. In this study, we are using Johansen and Juselius cointegration test to check the presence of cointegration in the series. Johansen and Juselius test is based on vector autoregressive (VAR) approach that assumes all the variables in the model endogenous. This test is most appropriate in cases of multivariate time series, especially when they are integrated of same order. The null hypothesis of the test is that there is no cointegration among the series. Johansen and Juselius include two likelihood ratio tests for the determination of number of co-integrated vectors, maximal eigen value and trace statistic test. The lag length of the test is selected by using Akaike information criterion (AIC). If there is cointegration in the long run then the system of equations is restructured by inserting an error correction term to arrest short-run deviation of variables from their long-run equilibrium values. This is essential because the impact of financial development on other variables is generally more evident in the short run and disappears in the long run as the economy matures. Thus, evidence of cointegration among the variables produce base for error correction model (ECM). We have also used variance decomposition analysis that presents the accurate breakup of the change in the variable in a

period which results from the changes in the same variable due to other variables in the previous periods.

6. Results and Discussion. The first step is to test the stationary of the variables. For this purpose, the ADF test for checking unit roots in the series has been used at level and first difference. The results of the ADF test clearly indicate that the time series is not stationary at level but becomes stationary at first differences of the logarithmic transformations of the series. So the series are integrated of order one (1). The results of Phillips-Perron test were also in line with the results of the ADF test. So we can conclude that the series are integrated of order (1). When the series are integrated of the same order, the maximum likelihood-based Johansen (1988, 1991) test and Johansen-Juselius (1990) procedure is appropriate to find the existence of cointegrating equations in a set of time series. Optimal lag length for the test has been selected by AIC. Table 2 exhibits the results of the multivariate cointegration test for the whole sample period. According to the results of the Johanson cointegration test, there is a long-run cointegration relationship among the variables.

Table 2 presents the results of Johansen cointegration test. In the test linear deterministic trend has been assumed. While the lags interval (in first differences) is 1 to 1.

According to the results of cointegration equation real GDP per capita (LGDP) has a significant positive sign with velocity of money (VM) that is in line with the quantity theory of money. Fry (1988) indicated that the sign of association between money velocity and real income (negative or positive) depends upon the stages of economic development in an economy especially the stage of financial development. At the early stage, velocity should fall with the growth of income but at a later stage, velocity and income become positively correlated. The positive sign in our study indicates that the economy of Pakistan is working at later stage of financial development. The coefficient of financial development has also significant positive sign. It also suggests that the economy of Pakistan is working at later stage of financial development. Financial development is likely to increase the collection of time deposits (TD) at a higher rate than (DD) implying declining DD/TD ratio that affects the velocity of money positively, implying that lower the value of proxy variable (DD/TD), the greater the level of financial development and higher the money velocity.

Interest rate as proxied by call money rate has also shown positive sign. The increase in interest rate leads to a decrease in demand of money and increase in velocity of money. The coefficient of CPI has also positive sign. In the times of inflation, money velocity rises as the payment pattern and spending habits alter.

Variance decomposition analysis explains the contribution of every source of innovation to forecast error variance for each variable. So we have used a variance decomposition analysis to measure the degree to which shocks to money velocity are explained by GDP per capita, financial development, interest rate and inflation. It also helps to identify the pattern of response transmission over time. Table 4 exhibits the decomposition of forecast error variance for the money velocity explained by other variables.

Variance decomposition analysis suggests that GDP per capita, financial development and inflation are substantial sources of instability of money velocity. The contribution of financial development to variation in velocity of money ranges from 6.2

to 8%. In the same way the contribution of inflation to variation in money velocity ranges from 3.6 to 13%. The GDP per capita has significant portion of variation in velocity of money ranging from 11.7 to 15% and interest rate changes have 4.8 to 5.4% contribution to variation in money velocity.

7. Conclusion. The estimates we presented above allow us conclude that interest rate, economic growth, inflation and financial development in Pakistan significantly affect the money velocity. The monetary authorities for estimating the optimal amount of money for monetary policy should take into consideration the crucial role of these variables. Particularly, the monetary authorities should be careful with expansionary monetary policy issuing money. Furthermore, Pakistan has gone through a series of financial sector reforms and still a number of reforms are in pipeline. The financial development impacts the velocity of money. The financial reforms are the objectives of the authorities and the process is likely to continue. In the presence of financial reforms the monetary policy is required to boot the economic growth. Similarly, inflation rate has a significant contribution in influencing money velocity so the policies containing inflation should be dealt carefully.

Table 1. **Results of the ADF and PPP Tests**

Variables	Lag length	ADF (level)	ADF (First Difference)	PPP (Level)	PPP (First Difference)
VM	2	-2.535	-7.637	-2.430	-7.872
FDEV	1	-1.854	-4.662	-1.9445	-6.543
LGDP	2	-1.0595	-5.345	-1.023	-5.023
I	5	-2.078	-3.1484	2.034	-7.543
INF	2	-2.391	-5.0078	-2.198	-4.994
1 % critc value		-4.0363	-4.0363	-4.0363	-4.0363
5%critc value		-3.4477	-3.4477	-3.4477	-3.4477
10%critc value		-3.1489	-3.1489	-3.1489	-3.1489

Table 2. **Unrestricted Cointegration Rank Test (Trace)**

Hypothesized No. of CE (s)	Eigen Value	Trace Statistics	0.05 Critical Value	Prob.**
None*	0.615951	74.80434	69.81889	0.0189
At most 1	0.534703	44.18082	47.85613	0.1062
At most 2	0.354328	19.69831	29.79707	0.4435
At most 3	0.159184	5.699456	15.49471	0.7307
At most 4	0.004714	0.151204	3.841466	0.6974

Trace test indicates 1 cointegrating eqn. (s) at the 0.05 level
*denotes the rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug Mechelis (1999) p-values

Table 3. **Standardized Cointegrating Vector of Coefficient (or Eigen vectors)**
(Negative signs are considered positive in a cointegration vector)

1 Co integration Equation(s): Log likelyhood = -147.7272				
Normalized cointegrating coefficients				
VM	FDEV	LGDP	I	INF
1.000000	-.05454	-.068840	-.181864	-0.003754
standard error	(3.36660)	(0.87222)	(0.22653)	(0.00198)
t-Statistic	-2.97223	-2.36045	-5.2175	-1.85959

Table 4. **Variance Decomposition Analysis**

Periods	SE	VM	FDEV	LGDP	I	INF
1	0.08	100.00	.000	.0000	.000	.000
2	0.09	80.83	6.20	11.69	0.32	0.95
3	0.11	72.97	7.39	11.13	4.87	3.63
4	0.10	68.77	6.05	13.22	4.94	7.02
5	0.11	65.94	7.44	13.67	5.57	7.37
6	0.11	64.70	7.17	12.89	5.69	9.54
7	0.12	63.39	7.45	13.92	5.41	9.82
8	0.12	60.09	6.12	16.48	5.66	11.64
9	0.13	61.29	7.99	14.43	5.76	10.51
10	0.13	58.04	7.98	15.19	5.44	13.33

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