# 2 THE DEMAND FOR MONEY IN TRANSITION ECONOMIES

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## Abstract

*This paper examines the long-run determinants of the demand for money in ten transition countries using panel data for the 1994-2005 period. Using panel unit root tests we rejected the the null hypothesis of the nonstationarity and employed the feasible generalized least squares (FGLS) model. Consistent with theoretical postulates, it is found that (a) the demand for money in the long-run positively responds to real GDP and inversely to the inflation and the real effective exchange rate and (b) the long-run income elasticity is about unity.*

**Key Words:** demand for money, transition economies, panel unit root test, feasible GLS
**JEL Classification**: E41, C33

## 1. Introduction

The importance of a well-specified demand for money to the implementation of monetary policy is of paramount importance in the existing literature. According to Goldfeld (1994), the relation between the demand for money and its main determinants is an important building block in macroeconomic theories and is a crucial component in the conduct of monetary policy. Therefore, the demand for money is one of the topical issues that have attracted the most attention in the literature both in developed and developing countries. In the context of developed countries it is argued that disequilibrium in the demand for money may affect the efficacy of interest rate policy in the long run via its impact on output gap and/or inflation. There are a number of studies that highlight the importance of the demand for money in developed

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countries because the "real money gap" (the resulting residuals from the money demand function) helps to forecast future changes in the output gap and/or inflation (see, Laidler, 1993, 1999; Gerlach and Svensson, 2004; Siklos and Barton, 2001).

As mentioned by Valadkhani (2006), a consensus among economists is emerging in support of the view that it is not a valid argument to focus exclusively on a single policy instrument and entirely neglect an important information variable because both the interest rate and monetary aggregates do matter in policy formation. Therefore, a well-specified money demand function is still important in this era of inflation targeting. It is essential to track both the interest rates and the money stock in order to assess precisely how monetary policy impacts upon the economy. Laidler (1999, p. 26) in the context of the OECD countries, which pursue inflation-targeting policy, posits that monetary aggregates should not be used "as the only target of monetary policy, but rather as a supplementary intermediate target variable in a regime whose principal anchor is an inflation goal".

A large number of studies tested for the stability of money demand functions using the single and multivariate cointegration techniques of the 1980s and 1990s. The results and implications of these studies clearly depend on the underlying variables, the econometric methods for stability tests, data frequency, and the development stage of a country. A few of recent examples for these studies are noted here. As far as the industrialized countries are concerned, one can refer to: McNown and Wallace (1992) for USA; Johansen (1992) for UK; Vega (1998) for Spain; Hamori and Hamori (1999) for Germany; Amano and Wirjanto (2000) for Japan; Karfakis and Sidiropoulos (2000) for Greece; and Bahmani-Oskooee and Chomsisengphet (2002) for 11 OECD countries.

A considerable body of literature has investigated the demand for money in developing countries. Some of these studies are: Wong (1977), Arize (1989), Gupta and Moazzami (1989), Bahmani-Oskooee and Malixi (1991), Agenor and Khan (1996), Arize *et al*. (1999) for 12 LDCs, Sriram (2000), Buch (2001) for Poland and Hungary, Pradhan and Subramanian (2003) for India, Nell (2003) for South Africa, Halicioglu and Ugur (2005) for Turkey, and Bahmani-Oskooee and Rehman (2005) for seven Asian countries. Bahmani-Oskooee and Malixi (1991) estimate the demand for money function in 13 developing countries as a function of inflation, real income and the real effective exchange rate. They conclude that, *ceteris paribus*, depreciation in real effective exchange rate results in a fall in the demand for domestic currency. Parametric estimates in many developed and developing countries look similar. In general, estimates of the income elasticities are close to unity and interest rate elasticities are small, negative and often insignificant in many developing countries (see Sriram, 1999 for a recent survey).

The demand for money in the literature (e.g. Ericsson, 1998; Coenen and Vega 2001) is conventionally specified as a function of real income, a long-run interest rate on substitutable non-money financial assets, a short-run rate of interest on money itself and the inflation rate. Mundell (1963, p.484) conjectured that in addition to the interest rates and the level of real income, the demand for money should be augmented by the exchange rate. Ewing and Payne (1999) have investigated the role of the exchange rate on the demand for narrow money in several developed countries. They utilise a standard cointegration technique to examine the relevance of the inclusion of the effective exchange rate in the money demand function. They suggest that "income

and interest rate are sufficient for the formulation of a long-run stable demand for money in Australia, Austria, Finland, rate should be incorporated".

A number of studies have considered the general process of financial asset substitution and justified the use of an exchange rate and a foreign interest rate in the analysis of the demand for money (e.g. Bahmani-Oskooee and Rhee, 1994; Chowdhury, 1995). All these studies are clearly in favour of both the currency substitution and capital mobility hypotheses. Therefore, it is very important to include the real effective exchange rate and a measure of the foreign real interest rate in the money demand function.

This paper examines the long-run determinants of the demand for money in ten transition countries, an important issue which has not been investigated by previous studies. Because there is a lack of internationally available literature on the analysis of money demand in transition countries. There are only several papers on money demand in transition countries, such as, Klacek and Šmídková (1995), Hanousek *et al*. (1995), Kozel (2000), Arlt et al. (2001), and Komarek and Melecky (2001). However, these studies are country specific studies not panel studies. Existing studies considered only one interest rate in the money demand equation. But this single interest rate does not adequately represent the opportunity cost of holding money, particularly in an era of financial deregulation and innovation. This paper also provides further empirical evidence that the rate of inflation and the real effective real exchange rate exert a negative impact on the demand for money.

The rest of this paper is structured as follows. Section 2 provides the model specification. The empirical econometric results for the long-run demand for money functions are presented in Section 3 and Section 4 concludes the paper.

## 2. Model Specification and Data

Following Bahmani-Oskooee and Rehman (2005), we assumed that the money demand function takes the following panel data form:

$$LnM_{it} = a + bLnY_{it} + c\pi_{it} + dLnREER_{it} + \varepsilon_{it} \quad (1)$$

where M is monetary aggregates in real term that is calculated as the ratio money and quasi money (M2) (current LCU) to consumer price index (2000 = 100), Y is a measure of real income as a scale variable that is calculated as the ratio GDP (current LCU) to consumer price index (2000 = 100). $\pi$ , is the rate of inflation that is taken as consumer prices (annual %) and *REER* is the real effective exchange rate (2000 = 100).

An estimate of *b* is expected to be positive. If *b=1*, the quantity theory applies; if *b=0.5*, the Baumol-Tobin inventory-theoretic approach is applicable; and if *b>1*, money can be considered a luxury. The inflation rate is considered as a proxy to measure the return on holdings of goods and an estimate of *c* is expected to be negative (*c<0*). The REER is considered as the currency substitution and an estimate of *d* is also expected to be negative.

The annual time series data are taken from the World Development Indicators (WDI) online for the period 1994-2005 in the form of balanced panel data. The sample includes ten transition countries: Bulgaria, Croatia, Czech Republic, Hungary,

Macedonia, Poland, Romania, Russian Federation, Slovak Republic and Ukraine. These countries are selected according to data availability.

## 3. Estimation Method and Empirical Results

### *3.1. Estimation Method*

Recent literature emphasizes that panel unit root tests have higher power than univariate unit root tests. Thus, panel unit tests are employed to test the stationarity of the variables in equation (1).

Levin *et al.* (2002) propose a more powerful panel root test (LLC – Levin, Lin and Chu test) than a separate unit root tests for each individual time series. The null hypothesis is that all indiviaduals have unit root ($H_0 : \beta = 0$) against the alternative that all individuals have stationary process ($H_0 : \beta < 0$). We can consider the following form of the ADF regression:

$$\Delta y_{it} = \alpha_i + \beta y_{i,t-1} + \sum_{j=1}^{k_i} c_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \text{ , } i=1,...N;\ t=1,...T \quad (2)$$

However, since $k_i$ is unknown, Levin *et al.* therefore suggests a three-step procedure to implement LLC test. In step 1, Levin *et al.* carry out separate Augmented Dickey–Fuller (ADF) regressions for each individual in the panel, and generate two orthogalized residuals. Step 2 requires estimating the ratio of long–run to short-run innovation standard deviation for each individual. In the final step, Levin *et al.* compute the pooled t-statistics.

Im *et al.* (2003) (IPS – Im, Pesaran and Shin test) developed a unit root test for dynamic heterogeneous panels based on the mean of individual unit root statistics. Im *et al.* proposes a standardized t-bar test based on the ADF statistics averaged across the groups. The stochastic process, $y_{it}$, is generated by the first-order autoregressive process:

$$y_{it} = (1-\phi_i)\mu_i + \phi_i y_{i,t-1} + \varepsilon_{it} \quad i=1,...N;\ t=1,...T \quad (3)$$

where initial values, $y_{i0}$, are given. In testing the null hypothesis of unit roots, $\phi_i = 1$ for all *i*. Equation (3) can be expressed:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \varepsilon_{it}, \quad (4)$$

The null hypothesis is that each individual series in the panel has a unit root and alternative hypothesis allows for $\alpha_i$ differing across groups:

$$H_0 : \beta_i = 0 \text{ for all i} \quad (5)$$

$$H_1 : \beta_i < 0,\ i = 1,2,...,N_1,\ \beta_i = 0,\ i = N_1 + 1, N_1 + 2,....,N \quad (6)$$

The modified standardized $t_{IPS}$ statistic below is distributed as N(0,1) when $T \to \infty$ followed $N \to \infty$ sequentially:

$$t_{IPS} = \frac{\sqrt{N}\left(\overline{t} - \frac{1}{N}\sum_{i=1}^{N} E[t_{iT} \mid \beta_i = 0]\right)}{\sqrt{\frac{1}{N}\sum_{i=1}^{N} \mathrm{var}[t_{iT} \mid \beta_i = 0]}} \tag{7}$$

As all the variables in equation (1) are stationary, we can apply the pooled ordinary least square (OLS) method. Under the geographic and historical proximity of countries, the error terms in the money demand are likely to be correlated between cross-sections at a given time. The slope coefficients (b, c and d) can be constistently but not efficiently estimated by OLS. Therefore, a pooled analysis of money demand data using the feasible generalized least squares (FGLS) estimation method is more efficient than applying OLS. The FGLS technique allows for integrating contemporaneous correlation by estimating the full variance-covariance matrix of the system's disturbance vector. The FGLS technique has two requirements: first, the panel must be balanced; second, T (time lenght) must be greater than N (number of countries), otherwise the FGLS estimator cannot be calculated (Greene, 2003, 322-326).

### *3.2. Empirical Results*

Table 1 presents the results from the panel unit root tests for the stationarity of the variables. The null hypothesis of LLC test and IPS test are that all individuals are nonstationary and each individual series is nonstationary respectively. Maximum lags are based on Schwarz information criterion (SIC); individual effects and individual linear trends are employed as exogenous variables. All results from the panel unit root tests reject the null hypothesis of the nonstationarity.

**Table 1**

**Results of Panel Unit Root Tests**

| Variables | LLC | IPS |
|---|---|---|
| M2 | -10.6134 (1) [0.0000]*** | -3.7162 (1) [0.0001]*** |
| Y | -5.6718 (1) [0.0000]*** | -1.5928 (1) [0.0556]* |
| $\pi$ | -61.3363 (1) [0.0000]*** | -31.8850 (1) [0.0000]*** |
| REER | -9.5281 (1) [0.0030]*** | -2.7437 (1) [0.0030]*** |

*Note: Maximum lags in ( ) & Probalities in [ ].*

** Significant at the 10% level.*

**** Significant at the 1% level.*

With the stationary variables, we employed the feasible generalized least squares (FLGS) method. The estimated coefficients of equation (1) presented in Table 2 are consistent with a priori expectations regarding sign and order of magnitude are statistically significiant. The coefficient of real GDP is positive (Y=0.938) and significiant. Thus, increase in real GDP (or real income) will also increase the demand for money. The coefficient of inflation is negative ($\pi$=-0.00019) and statistically significiant. The coefficient of real effective exchange rate is found negative (REER=-0.1473) and statistically significiant in the countries studied.

**Table 2**

**Cross-sectional time-series FGLS regression for the money demand**

| Variables | Coefficient | Std. Errors | z-Statistics | $P>\|z\|$ |
|---|---|---|---|---|
| Y | 0.93821 | 0.01152 | 81.44 | 0.000 |
| $\pi$ | -0.00019 | 0.00009 | -2.18 | 0.029 |
| REER | -0.14737 | 0.05827 | -2.53 | 0.011 |
| Constant | 1.13041 | 0.29781 | 3.80 | 0.000 |
| $H_0$: b=c=d=0 | $\chi^2$ (3) 7221.94 (0.0000) | | | |
| Log likelihood | 148.62 | | | |

*Note: The assumption of heteroskedastic with cross-sectional correlation (panel-specific AR(1)) are used in the estimation of the coefficients and z-statistics.*

The results show that the demand for money and quasi money (M2) is positively related to real GDP and negatively to inflation rate and real effective exchange rate. The estimated common long-run income elasticity for the ten transition economies is about unity. Compared with the inflation rate, the real effective exchange rate has a relatively higher long-run effect on real money balances.

## 4. Conclusions

The existence of a well-specified demand for money is important for the conduct of monetary policy, whether the central banks' major policy variable is the stock of money or the official interest rate or inflation. This paper examines the long-run determinants of the demand for real money balances in the ten transition countries for which consistent annual panel data were available for the period 1994-2005.

Consistent with theoretical postulates, this paper finds that the demand for money in the long run positively responds to an increase in real income and negatively to a rise in the rate of inflation and the real effective exchange rate. This means that real M2 is a predictable monetary aggregate. The estimated long-run income elasticity for all the countries is about unity. In the most of the transition economies, financial markets have been transforming substantial deregulation and dollarisation has been emerging. As the consequences of inflation and exchange rate depreciation risks, households keep deposits in dollars; thus the existing currency substitution can reduce the monetary independence of the transition economies. The further research may deeply analysis to take into consideration of inefficiency of the banking system, less financial instruments and the dynamics of exchange rates.

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