MODELLING AND PREDICTING THE REAL MONEY DEMAND IN ROMANIA

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Abstract

The main aim of this article is to model the quarterly real money demand in Romania and to make short-run forecasts for 2014:Q1-2015:Q1. A vector-autoregressive model (VAR(1)) was built for stationary data series of real money demand, real GDP and spread between active and pasive interest rate of the credit institutions over the period from 2000:Q1 to 2013:Q4. In the first period the variations in the double differentiated real money demand are exclusivly generated by the changes in this variable.The short-term forecasts based on this model indicated a slow variation in the rate of real money demand. For the first quarter of 2014 the comparison of the forecast with the actual value is made and an error of 0.94 percentage point was obtained. Starting with the second quarter of 2014, a slow decrease is anticpated for the rate of real money demand.

Keywords: money demand, VAR model, spread, forecasts

JEL classification: C51, C53

Introduction

Most of the emirical studies regarding the money demand are related to developped countries. However, for countries like Romania few studies were made for explaining the evolution of this indicator. The instability of money demand is not specific to transition economies, being observed also in well developed countries. The main objective of this study is to model and predict the quarterly evolution of real money demand M2 in Romania. Therefore, the vector-autoregression approach will be used as forecasting method. The money demand is better correlated to the spread between active and pasive interest rate of the credit institutions and the real GDP during 2000-2013. Starting with the second quarter of 2014 a slow decrease in the rate of real money demand is anticipated.

Literature review

The expansion of monetary aggregates is an essential process that is attentively monitored by authorities of monetary policy. There are economic programs where some performance criteria are fixed by taking into account the boundaries of monetary aggregates. In this approach, the estimation of money demand becomes essential, but this process is based on the examination of the relationships between money demand and other relevant economic variables.

Econometric models based on empirical approach for money demand entered in researchers attention since the 1970s. The utility of using these models is multiple: forecasting, inference, establishing the policy, parameter consistency. Moreover, it was observed the failure of many equations in predicting the money demand during periods with explosion in M1, missing money or decline in great velocity. Scutaru and Pelinescu (2001, p.35) have used a vector error correction model to explain the real money demand using as indepedent variables the index of consumer prices and industrial production index. The monthly prediction of money demand were made over the period from December 1999 to December 2000. Mutluer and Barlas (2002, p. 60) built an error correction model for money demand in Turkey using as explanatory variables in long run equation: real GDP, inflation rate, interest rate on deposits, real exchange rate and interest rate on government securities. The authors observed a significant influence of inflation rate and real exchange rate on money demand in Turkey during 1987-2001.

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The monetary agregate in broad sens (M2) includes the net M1, the private savings and the unauthorized and non-personal deposits from accredited banks. It provides useful information regarding the money savings and the inflation trend. Pelinescu (2012, p. 7) showed that M2 could serve as leading indicator for the economic activity.

Beyer(2009, p. 4) proposed an empirically stabel model for money demand in the euro zone that was used in making predictions. The author showed that housing wealth captured in the first decade of the actual century a major part from trending money behaviour. Giese and Tuxen, (2008, p. 8) showed that the relationship between prices and money supply was quite low in the past 10 years. Setzer and Wolf (2012, p. 300) drew attention that since 2001 the money demand specification for the euro zone were unstable. This instability is not caused by altered standard factors that generate preference for holding money.

Bahmani-Oskooee, Kutan and Xi (2013, p. 3280) obtained a stable and correctly specified money demand in many countries from Central and Eastern Europe, showing that policy based monetary targeting can continue to be used despite large monetary uncertainty.

Jawadi and Sousa (2013, p. 509) modeled the money demand for euro zone, England and USA using quantile regressions and smooth-transition models. They obtained that the sensitivity of money demand relative to inflation rate becomes higher when the money holdings are very low. A double variation, across the countries and because of the regime, was observed for money demand elasticity with respect to GDP, inflation rate, interest rate and exchange rate.

Dreger and Wolters (2014a, p. 307) analyzed the prediction performances of M3 comparing these with the spread of interest rate. Even if the data from recent financial crisis period are includes, M3 has an evolution in line with money demand. Recently, a heterogeneous-agent model was built by Ragot (2014, p. 100) who proved that 78% of the variation in money demand are explained by financial friction in France.

Dreger and Wolters (2014b, p. 5) have shown the lack of utility given by co-integration methods for explaining the correlation between money demand in time and other economic indicators. They built a stable long-term money demand function for euro zone and USA. Money balances proved to be useful tools in monetary policy mostly in cases when nominal interest rates have limits lower than zero.

Methodology and results

A first determinant of money demand is a variable that measures the level of economic activity like an income or a wealth variable. The money demand is directly proportional to income. For income variables good proxies are the Gross Domestic product (GDP) and the Gross National Product (GNP). The money demand is inversly correlated to market interest rate. If there are large changes in prices, the impact of inflation and exchange rate of money demand is significant. The cost of holding money increases if the inflation grows, fact that explains the inverse relationship between real money demand and inflation rate. In developing countries like Romania the inflation elasticity on long term should be high because of the limitation of the range of financial instruments excepting money. Moreover, a major part of government portofolio is represented by real assets. The negative correlation between foreign exchange rate and moneey demand is explained by the fact that an increase in the deposit holders' foreign currencies demand will determine a decrease in domestic currency.

The following variables have been chosen, quarterly data being collected over the period 2000:Q1-2013:Q4: real money demand, real GDP, index of consumer prices, reference interest rate, spread of active-passive interest. The data are provided by the National Institute of Statistics and National Bank of Romania. The data are seasonally adjusted using moving average method for GDP and spread and Tramo/Seats methos for the rest of the variables.

The matrix of correlation for all the variables that have been included in the study with seasonally adjusted data was computed. The objective is to determine the variables that are more correlated with the money demand. In Romania M2 is weak correlated with the interest rate of monetary policy, a strong relationship being observed between M2 and the spread.

Table 1

Correlation matrix of different economic variables during 2000:Q1-2013:Q4

Variable	M2_SA	GDP_SA	CPI_SA	IR_SA	SPREAD_SA
M2_SA	1.000.000	0.947076	-0.761455	0.347259	-0.949659
GDP_SA	**0.947076**	1.000.000	-0.842278	0.382600	-0.978191
CPI_SA	**-0.761455**	-0.842278	1.000.000	-0.533567	0.837677
SPREAD_SA	**-0.949659**	-0.978191	0.837677	-0.385508	1.000.000

Source: authors' computations

The negative correlation between money demand and inflation rate, which is contrary to macroeconomic theory, might be explained by the negative correlation between inflation and growth rate for foreign currency since there is a direct correlation between inflation and broad money of domestic currency.

The data were not stationary, being transformed as it follows: for the consumer price index and interest rate the logharitm was applied, while a diferentiation of order one was applied for real GDP (D_GDP) and spread (D_SPREAD) and of order two for real money demand (D2_M2). A valid model of order 1 (VAR(1)) was estimated, considering as variables D2_M2, D_GDP and D_SPREAD.

D2_M2 = - 0.400100650369*D2_M2(-1) - 0.267401372295*D_GDP(-1) - 82.0134442876*D_SPREAD(-1) + 86.7593928012 (1)

D_GDP = 0.0330315518259*D2_M2(-1) + 0.513712933465*D_GDP(-1) - 55.8950430331*D_SPREAD(-1) + 96.3147719644 (2)

D_SPREAD = 0.000165398746575*D2_M2(-1) - 0.0008414006748*D_GDP(-1) + 0.152288913244*D_SPREAD(-1) - 0.0326983298156 (3)

It is surprising that the coefficient of real GDP is negative, contrary to the theory. A possible explanation for this was given by W. Gavin (2005) "If we are in an era of relative price stability, then we expect to see the effects of shifts in money demand. We should not be surprised to see M2 and GDP growing in different directions much of the time."

Almost all the lag criteria (LR, FPE, SC, AIC) indicated that the lag should be 1. For this model all the tests were checked, resulting that the errors are independent, homoskedastic, following a normal distribution. The model satisfies the stability condition. The results of the tests are presented in Appendix 1.

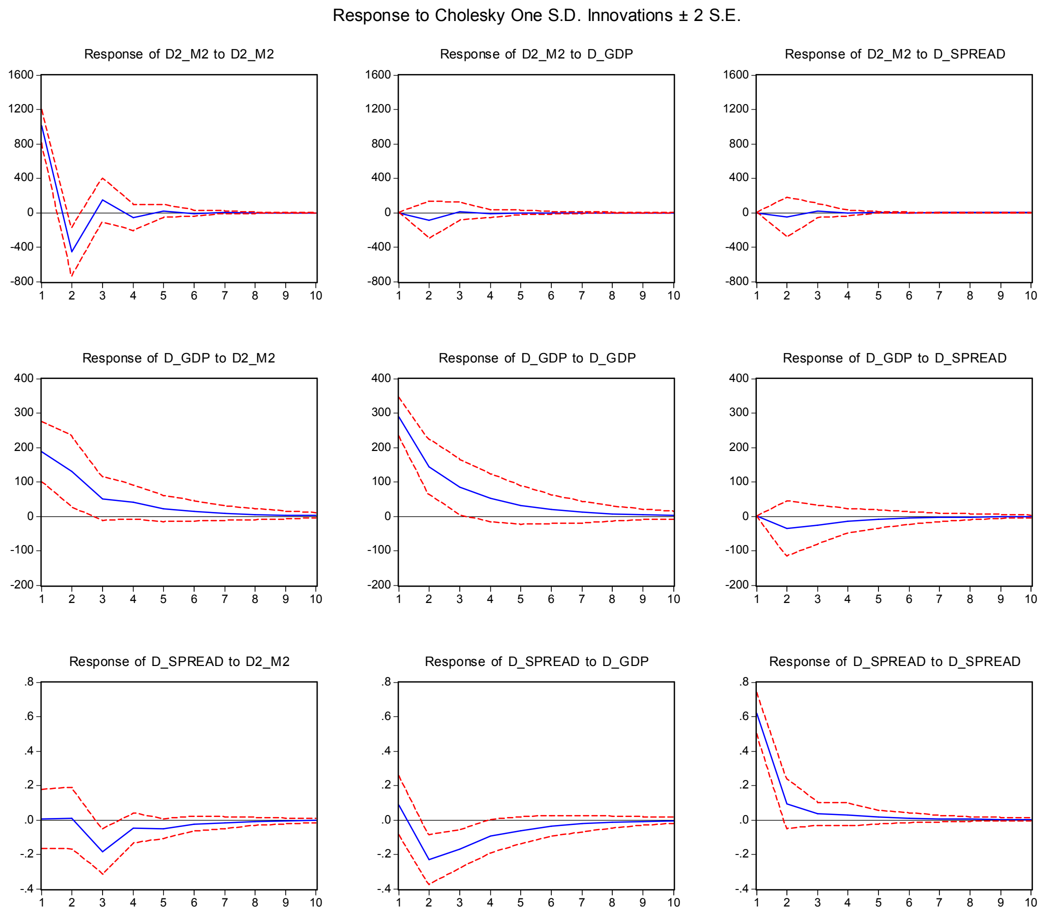

Figure 1. Impulse-response function in the VAR(1) model

Source: authors' graph

The variation of D2_M2 in the first period is due only to the changes in this variable. In the second period, 0.577% of the variation in D2_M2 is due to the changes in D_GDP and only 0.211% to the modifications in D_SPREAD. The impact of these variables increases in time, but the contribution of the monetary demand to its own changes is more than 99%.

Table 2

Variance decomposition of D2_M2

Period	S.E.	D2_M2	D_GDP	D_SPREAD
1	1007.708	100.0000	0.000000	0.000000
2	1109.617	99.21269	0.576755	0.210559
3	1119.509	99.17231	0.582574	0.245111
4	1121.069	99.15662	0.596945	0.246432
5	1121.184	99.15588	0.596875	0.247247
6	1121.216	99.15510	0.597667	0.247235
7	1121.218	99.15498	0.597752	0.247268
8	1121.219	99.15491	0.597824	0.247269
9	1121.219	99.15489	0.597842	0.247271
10	1121.219	99.15488	0.597851	0.247272

Source:authors' computations

Starting from this VAR model some predictions were made for money demand on the horizon 2014:Q1-2015:Q1. The forecasts are consider under some assumptions related to the values of spread and real GDP growth.

Table 3

Forecasts of money demand (horizon: 2014:Q1-2015:Q1)

Quarter	Forecast for rate of real money demand (%)	Value of spread (assumption)	Value of real GDP rate (%) (assumption)
2014:Q1	3.29	5.25*	0.953*
2014:Q2	3.31	5.25	0.93
2014:Q3	3.2	5.15	1.030
2014:Q4	3.15	5.15	1.035
2015:Q1	3.08	5	0.98

Source:authors' computations;* data reported by the INSSE and NBR

For the first quarter of 2014 the comparison of the forecast with the actual value (4.23%) is made and an error of 0.94 percentage point was obtained. Starting with the second quarter of 2014, a slow decrease is anticpated for the rate of real money demand.

Conclusions

The VAR model have been frequently used lately in modelling monetary indicators, being atheoretical models that correspond to the lack of enought information regarding the economic mechanisms that determined a certain evolution of financial variables. In this study, a VAR model of order 1 has been constructed for money demand in Romania. The forecasts based on this model anticipated a slow decrease in the rate of real money demand.

A future research might continue with the estimation of a structural VAR for money demand, when more economic variables are employed.

Roots of Characteristic Polynomial
Endogenous variables: D2_M2 D_GDP D_SPREAD
Exogenous variables: C
Lag specification: 1 1

Root	Modulus
0.614084	0.614084
-0.345444	0.345444
-0.002738	0.002738

No root lies outside the unit circle. VAR satisfies the stability condition.

VAR Lag Order Selection Criteria
Endogenous variables: D2_M2 D_GDP D_SPREAD
Exogenous variables: C
Sample: 2000Q1 2013Q4

Lag	LogL	LR	FPE	AIC	SC
0	-821.9867	NA	8.44e+10	33.67293	33.78875
1	-789.1899	60.23907*	3.20e+10*	32.70163*	33.16493*
2	-786.1850	5.151257	4.11e+10	32.94633	33.75711
3	-777.8008	13.34623	4.26e+10	32.97146	34.12972
4	-769.1720	12.67914	4.42e+10	32.98661	34.49235
5	-758.8722	13.87325	4.34e+10	32.93356	34.78677

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Residual Portmanteau Tests for Autocorrelations
Null Hypothesis: no residual autocorrelations up to lag h
Sample: 2000Q1 2013Q4
Included observations: 53

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	1.678095	NA*	1.710366	NA*	NA*
2	5.143124	0.8217	5.311279	0.8064	9
3	13.46605	0.7632	14.13358	0.7203	18
4	45.02160	0.0162	48.26509	0.0072	27
5	47.63767	0.0929	51.15367	0.0485	36
6	49.73256	0.2904	53.51600	0.1799	45
7	52.93113	0.5156	57.20130	0.3572	54
8	58.29204	0.6445	63.51526	0.4581	63
9	70.27230	0.5356	77.94603	0.2954	72
10	77.45302	0.5911	86.79668	0.3096	81
11	88.28808	0.5313	100.4695	0.2115	90
12	92.10277	0.6752	105.4007	0.3112	99

*The test is valid only for lags larger than the VAR lag order.
df is degrees of freedom for (approximate) chi-square distribution

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Sample: 2000Q1 2013Q4
Included observations: 53

Joint test:

Chi-sq	df	Prob.
41.95981	36	0.2283

Individual components:

Dependent	R-squared	F(6,46)	Prob.	Chi-sq(6)	Prob.
res1*res1	0.131465	1.160462	0.3438	6.967666	0.3238
res2*res2	0.190007	1.798441	0.1204	10.07040	0.1217
res3*res3	0.194543	1.851744	0.1099	10.31080	0.1122
res2*res1	0.239286	2.411589	0.0414	12.68217	0.0484
res3*res1	0.071001	0.585942	0.7397	3.763047	0.7087
res3*res2	0.095382	0.808363	0.5688	5.055233	0.5367

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 08/11/14 Time: 19:52
Sample: 2000Q1 2013Q4
Included observations: 53

Component	Skewness	Chi-sq	df	Prob.
1	0.067832	0.040643	1	0.8402
2	-0.099945	0.088236	1	0.7664
3	0.239903	0.508389	1	0.4758
Joint		0.637268	3	0.8879

Component	Kurtosis	Chi-sq	df	Prob.
1	3.726007	1.163982	1	0.2806
2	3.818855	1.480740	1	0.2237
3	4.025267	2.321340	1	0.1276
Joint		4.966063	3	0.1743

Component	Jarque-Bera	df	Prob.
1	1.204626	2	0.5475
2	1.568976	2	0.4564
3	2.829729	2	0.2430
Joint	5.603331	6	0.4691

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