

**Academy of Economic Studies  
Doctoral School of Finance and Banking**

**Transmission mechanisms of monetary policy**  
- English resume -

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## 1. Introduction.

In the first chapters of my study I present the objectives and the measures needed to achieve UE integration, at least the objectives and measures that were agreed by all decision maker in Romania. These decisions imply changes in monetary policy in all major aspects: a change in the type of policy used, changes in instruments used by the Central Bank, etc.

Presented in the paper are the instruments used in monetary policy and the link between the monetary policy and economic policy, with the distinctive features of each of the two important policies: the financial policy (fiscal and budgetary) and the monetary policy.

In determining the transmission mechanisms for each country a very important factor is considered the legal structure and the degree of intermediation in the financial sector. I present opinions of several specialists and a number of examples regarding the type of legal system in some countries. I present the link between the legal structure and the degree of financial intermediation and a few examples.

I also present each transmission mechanism; the causal relationships implied, from the theory's point of view, all this in order to establish a base for the empirical study on the Romanian economy.

Each transmission mechanism is presented with as many real life examples as I can find in theoretic and empirical literature covering this subject.

The channels of monetary policy transmission are:

- The traditional interest rate channel
- The other assets price channel with several sub channels
  - Stock market channel
    - The “Q” coefficient theory developed by Tobin
    - Wealth effects
    - The channel determined by the price of land and houses
  - Exchange rate channel
- The credit channel with several sub channels
  - Bank lending channel
  - Balance sheet channel
    - Traditional balance sheet channel
    - Cash flow channel
    - Unanticipated price level channel
  - Households liquidity effects

Some examples present the reality as being viewed by the central bankers in several countries (in the Central European region I could find examples only in the case of Hungary, Poland, Slovakia and Czech Republic).

In this English resume the theoretical part of the study is not presented because of limitation in the size of the study, and because the interest point and the original feature in this paper is the econometrical study of the Romanian economy.

## 1. Study on transmission mechanisms in Romania.

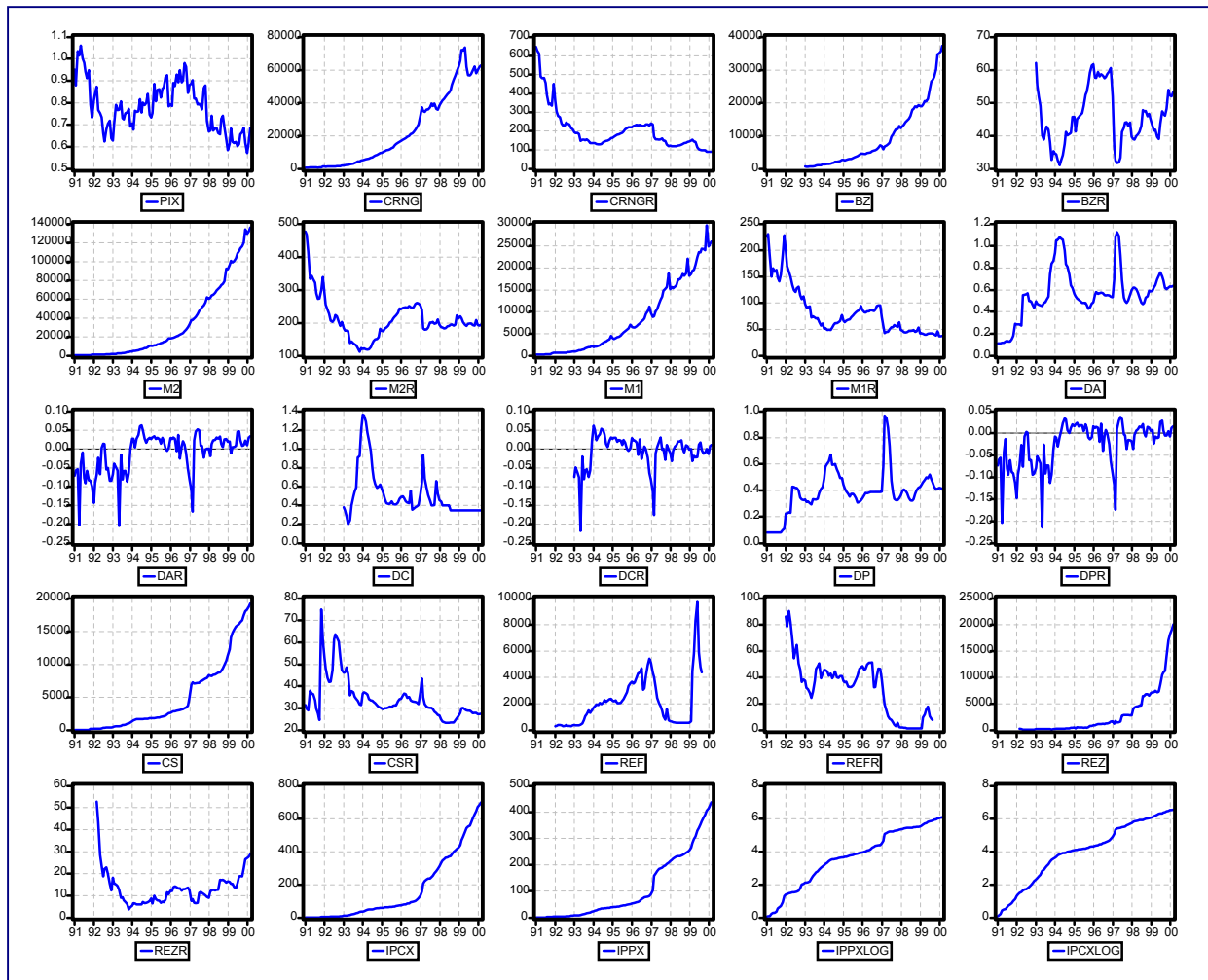
### 1.1. Time series utilized.

To realize an analysis of the mechanisms of monetary transmission, I used data from the National Bank of Romania, from the annual and monthly reports. The time series used are:

**Table 1 Time series used.**

Symbol	Descriere	Description
BZ	Baza monetară	Reserve Money
BZR	Baza monetară reală	Real BZ, CPI deflated, base 01:1991
CRNG	Creditul neguvernamental	Credit to Non-Governments
CRNGL	Creditul neguvernamental în lei	Credit to Non-Governments in lei
CRNGLR	Creditul neguvernamental în lei real	Real credit to Non-Governments in lei, CPI deflated, base 01:1991
CRNGR	Creditul neguvernamental real	Real credit to Non-Governments, CPI deflated, base 01:1991
CRNGV	Creditul neguvernamental în valută	Credit to Non-Governments in foreign currency
CRNGVR	Creditul neguvernamental în valută real	Real credit to Non-Governments in foreign currency, CPI deflated, base 01:1991
CS	Cursul de schimb	Exchange rate
CSR	Cursul de schimb real	Real exchange rate, CPI deflated, base 01:1991
CVB	Cvasibani	Cvasi-money
DA	Dobânda activă	Lending rate for non-bank customers
DAR	Dobânda activă reală	Real lending rate for non-bank customers
DC	Taxa scontului	Rescount tax
DCR	Taxa scontului reală	Real rescount tax
DP	Dobânda pasivă	Deposit rate non-bank customers
DPR	Dobânda pasivă reală	Real deposit rate non-bank customers
IPCL	Indicele prețurilor de consum	Inflation, CPI
IPCX	IPC cu baza în lanț	Inflation, CPI, chain, base 01:1991
IPCXLOG	Logaritm de IPC baza în lanț	Inflation, CPI, chain in logs
IPP	Indicele prețurilor producției industriale	PPI
IPPX	IPP cu baza în lanț	PPI chain, base 01:1991
IPPXLOG	Logaritm de IPP cu baza în lanț	PPI chain in logs
M1	Masa monetară în sens restrâns	M1
M1R	Masa monetară în sens restrâns reală	Real M1, CPI deflated, base 01:1991
M2	Masa monetară în sens larg	M2
M2R	Masa monetară în sens larg reală	Real M2, CPI deflated, base 01:1991
PI	Variația producției industriale	Industrial output variation rate
PIX	Variația PI cu baza în lanț	Industrial output chain
REF	Refinanțare de la BNR	Refinancing from NBR
REFR	Refinanțare de la BNR reală	Real refinancing from NBR
REZ	Rezerve la BNR	Reserves of banks at NBR
REZR	Rezerve la BNR reale	Real reserves of banks at NBR

Figure 1 Time series used.



The variables used in this econometric part of the paper are considered in real terms because only changes in the real level of a variable lead to changes in others. The variables are not used in their logarithmic form because this process creates a loss of information, which is not desirable, because the intention of this paper is to use VARs to investigate the response of industrial production to changes in other monetary variables.

### 1.2. Granger causality tests.

In order to establish the relationships between the variables used in this study, Granger tests were performed for all of them. The intention is to observe if links can be established between instruments used by the Central Bank (monetary base and discount rate) and the other variables, which in theory can be suspected to prove the existence of one or more channels of monetary policy transmission.

After conducting these tests the following conclusions proved to be relevant:

- There is a stable relationship between the real monetary base and the level of nongovernmental real credit, relationship from the monetary base towards the credit level.
- Between the real industrial production and the level of nongovernmental credit there is a causality relationship, but only on a short term basis, and the exogenous variable is nongovernmental credit leading to changes in industrial production.

- The link between the discount rate and the level of industrial production is not very clear and this case is similar with the relationship between the real lending rate and industrial production.
- The interest rates are caused, according to the test performed, by variations of the monetary.
- Some influence on the change in industrial production level is due to the changes in broad monetary, but this is not the case for narrow money.
- Also the change in broad money seems to be cause by changes in monetary base.

Table 2 Granger causality tests.

Pairwise Granger Causality Tests										
Sample: 1991:01 2000:03										
Lag(s)	1		2		3		6		12	
Null Hypothesis:	F-Stat.	Prob.	F-Stat.	Prob.	F-Stat.	Prob.	F-Statistic	Prob.	F-Statistic	Prob.
CRNGR does not Granger Cause BZR	2.16829	0.14467	0.03551	0.96513	0.19561	0.89909	0.60713	0.72372	0.79284	0.65543
BZR does not Granger Cause CRNGR	5.86547	0.01762	10.8557	6.70E-05	8.42261	6.60E-05	5.48425	0.00011	4.16724	0.00016
CRNGR does not Granger Cause PIX	6.03617	0.01562	4.35971	0.0152	1.47006	0.22722	2.02039	0.07073	1.60332	0.10922
PIX does not Granger Cause CRNGR	0.99074	0.32181	6.48156	0.00222	4.20344	0.00759	1.56963	0.16487	0.82835	0.62112
CSR does not Granger Cause CRNGR	2.15974	0.1446	41.5949	5.30E-14	33.7791	3.30E-15	23.2874	1.50E-16	2.66984	0.00493
CRNGR does not Granger Cause CSR	2.28312	0.13374	2.24777	0.11074	4.65949	0.00431	3.06014	0.00893	0.98214	0.47375
DAR does not Granger Cause CRNGR	2.43016	0.12197	1.98857	0.14206	1.11207	0.34786	1.5159	0.18166	1.72661	0.07806
CRNGR does not Granger Cause DAR	17.1495	6.90E-05	20.0078	4.50E-08	17.052	4.90E-09	7.83899	7.90E-07	4.55862	1.80E-05
DCR does not Granger Cause CRNGR	18.0917	5.50E-05	5.59059	0.00534	4.853	0.00381	3.37628	0.00567	2.41914	0.01462
CRNGR does not Granger Cause DCR	6.0348	0.01611	14.7998	3.40E-06	10.8311	5.10E-06	8.21518	1.10E-06	4.81828	3.40E-05
M1R does not Granger Cause CRNGR	2.17766	0.14296	18.835	1.00E-07	11.6071	1.30E-06	3.7882	0.00204	3.04314	0.0016
CRNGR does not Granger Cause M1R	0.1488	0.70045	5.94824	0.00358	3.65581	0.01502	2.66793	0.0197	0.60979	0.82731
M2R does not Granger Cause CRNGR	0.71793	0.39872	18.7411	1.10E-07	11.5254	1.50E-06	5.52253	6.40E-05	2.73006	0.00412
CRNGR does not Granger Cause M2R	4.23974	0.04192	6.7404	0.00177	4.39628	0.00597	1.83833	0.10016	0.40879	0.9558
DCR does not Granger Cause PIX	0.14382	0.70548	1.47268	0.23546	1.81698	0.15107	1.59357	0.16243	1.81047	0.07191
PIX does not Granger Cause DCR	0.29652	0.58753	0.19306	0.82482	0.42719	0.73408	1.46079	0.20488	0.91331	0.54069
DAR does not Granger Cause PIX	0.00506	0.94342	0.83639	0.43617	1.0049	0.39391	0.75912	0.60386	0.56377	0.86406
PIX does not Granger Cause DAR	1.71648	0.19295	0.61471	0.54275	0.5427	0.65417	0.7679	0.59705	0.48651	0.91654
M1R does not Granger Cause PIX	2.0661	0.15352	2.12315	0.12481	1.04322	0.37686	2.51365	0.02683	2.42783	0.01021
PIX does not Granger Cause M1R	4.67833	0.03277	3.14218	0.04732	1.77635	0.15647	1.65251	0.1417	3.1318	0.00122
M2R does not Granger Cause PIX	3.52518	0.06317	3.29092	0.04113	1.23776	0.30004	2.78208	0.01566	2.24674	0.01749
PIX does not Granger Cause M2R	2.06906	0.15323	2.6544	0.0751	1.37763	0.25396	0.50468	0.80337	1.98587	0.0375
DAR does not Granger Cause BZR	25.2554	2.80E-06	3.36582	0.03949	3.25456	0.02613	2.53228	0.02848	1.41929	0.18869
BZR does not Granger Cause DAR	5.37666	0.02287	4.99053	0.00907	3.38181	0.02238	4.72828	0.00044	2.65601	0.00781
DCR does not Granger Cause BZR	19.071	3.60E-05	1.84648	0.16445	1.71788	0.1703	1.66655	0.14265	0.89602	0.55683
BZR does not Granger Cause DCR	5.78594	0.01838	5.75586	0.00462	3.72709	0.01471	4.18896	0.00121	2.32344	0.01883
DPR does not Granger Cause BZR	27.4303	1.20E-06	3.98697	0.02236	3.79622	0.01353	2.79734	0.01717	1.52617	0.14619
BZR does not Granger Cause DPR	3.80979	0.05433	4.25199	0.01758	3.23922	0.02662	4.81896	0.00038	2.57766	0.00961
M1R does not Granger Cause BZR	2.14141	0.14715	2.96274	0.05737	1.86461	0.1426	1.90014	0.09335	2.15761	0.02917
BZR does not Granger Cause M1R	0.01995	0.88801	1.06569	0.34933	0.43913	0.72565	0.81946	0.55869	3.18013	0.00197
M2R does not Granger Cause BZR	0.24565	0.62147	0.22156	0.80176	0.31505	0.81445	0.86491	0.52526	1.01436	0.45044
BZR does not Granger Cause M2R	1.66392	0.20066	7.05672	0.0015	5.94862	0.00106	3.23554	0.00742	2.17807	0.02764
IPCXLOG does not Granger Cause BZR	3.22591	0.07612	3.41654	0.03769	3.33938	0.02356	3.07414	0.0101	1.43287	0.18276
BZR does not Granger Cause IPCXLOG	0.18522	0.66804	3.91132	0.02395	3.50767	0.0192	4.19248	0.00121	2.78404	0.00557

All the relationships presented early, point to a causal relationship between the real monetary base, nongovernmental real credit and real industrial production, in this order. Also a relationship between the discount rate and industrial production seems to surface, and this is

the case for real lending and borrowing rates, but only on a short-term basis. These findings indicate the existence of a weak traditional interest rate channel and a strong credit channel.

### *1.3. Variations in IP and the importance of the other variables.*

To assess the importance and the explanatory value of each variable, several regressions were realized, and two of them are presented. In order to segregate the meaningful variables from the others a regression with all the variables was performed.

**Table 3 Regression of IP over the other variables.**

Dependent Variable: PIX				
Method: Least Squares				
Sample(adjusted): 1993:01 1999:09				
Included observations: 81 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PIX(-1)	0.489244	0.127898	3.825260	0.0003
M2R	-0.002598	0.000761	-3.414441	0.0011
M1R	0.002955	0.002053	1.439214	0.1547
CSR	0.000642	0.001804	0.356118	0.7229
CRNGR	0.002407	0.000650	3.700757	0.0004
REFR	0.000202	0.000896	0.225692	0.8221
REZR	0.002690	0.004709	0.571270	0.5697
DAR	-1.623975	1.765003	-0.920098	0.3608
DPR	1.062441	1.413636	0.751567	0.4549
DCR	0.662187	0.703878	0.940769	0.3502
BZR	-0.001684	0.003814	-0.441609	0.6602
IPXLOG	0.174625	0.093545	1.866757	0.0662
IPCXLOG	-0.085785	0.080016	-1.072110	0.2875
R-squared	0.788758	Mean dependent var	0.773892	
Adjusted R-squared	0.751480	S.D. dependent var	0.096667	
S.E. of regression	0.048190	Akaike info criterion	-3.081283	
Sum squared resid	0.157915	Schwarz criterion	-2.696989	
Log likelihood	137.7920	Durbin-Watson stat	1.974078	

This regression leads to the conclusion that the variables that influence the changes in industrial production seem to be broad money and nongovernmental credit. This regression even plagued by so many non - explanatory variables has a high R – which indicate the presence of variables, which really explains the evolution of industrial production. The Durbin-Watson coefficient is in its normal interval (1,8 – 2,2) indicating the existence of a very weak autocorrelation between errors. The variables witch are not relevant for the regression had been removed in the following regression, choosing only the ones with a small probability of a 0 coefficient. This process was repeated till only the variables with very low probability remained. The new regression is presented in the next table.

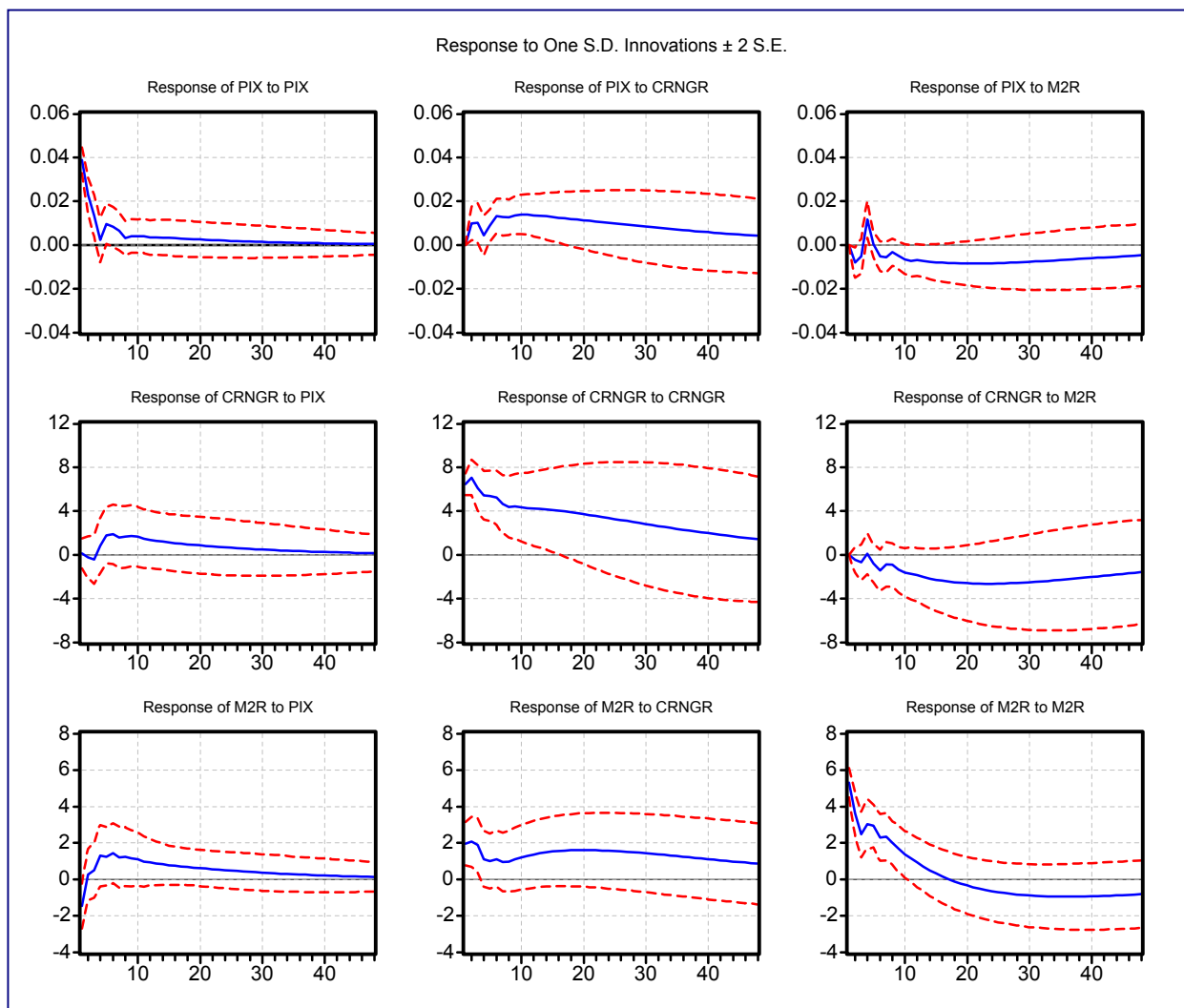
Dependent Variable: PIX				
Method: Least Squares				
Sample(adjusted): 1991:05 2000:03				
Included observations: 107 after adjusting endpoints				
Convergence achieved after 8 iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.685083	0.123218	5.559946	0.0000
M2R	-0.001457	0.000512	-2.848166	0.0053
M2R(-1)	-0.001369	0.000545	-2.510009	0.0137
M2R(-3)	0.001513	0.000321	4.713865	0.0000
CRNGR	0.000905	0.000360	2.511445	0.0136
CRNGR(-1)	0.001077	0.000359	2.998329	0.0034
AR(1)	0.875786	0.041235	21.23894	0.0000
R-squared	0.821838	Mean dependent var	0.773067	
Adjusted R-squared	0.811149	S.D. dependent var	0.106775	
S.E. of regression	0.046401	Akaike info criterion	-3.239795	
Sum squared resid	0.215308	Schwarz criterion	-3.064937	
Log likelihood	180.3290	F-statistic	76.88130	
Durbin-Watson stat	2.141751	Prob(F-statistic)	0.000000	
Inverted AR Roots	.88			

In this regression the explanatory terms are not surprising almost the same ones which appeared to be relevant in Granger causality tests, and a second observation is the high value of R – which demonstrate that over 80% of PIX variation can be explained using variations in broad money and nongovernmental credit. Also the unit roots are smaller than 1. The probabilities that the coefficients of the explanatory variables are 0 is very low, a good sign for the regression. This regression accentuates the hypothesis of a credit channel in the Romanian economy.

#### ***1.4. Response functions – unrestricted VAR.***

Following the path indicated by previous results, an unrestricted VAR has been realized using the significant variables. The following graph is the end result, showing very clear the reactions of industrial production, nongovernmental credit and broad money to a 1 standard error innovation in the other variable. The VAR is realized on four lags, using as endogenous variables industrial production, broad money, nongovernmental credit and as exogenous variables the discount rate, real lending and borrowing rates, the real exchange rate and the monetary base.

**Figure 2 Response functions of PI, M2, Crng.**

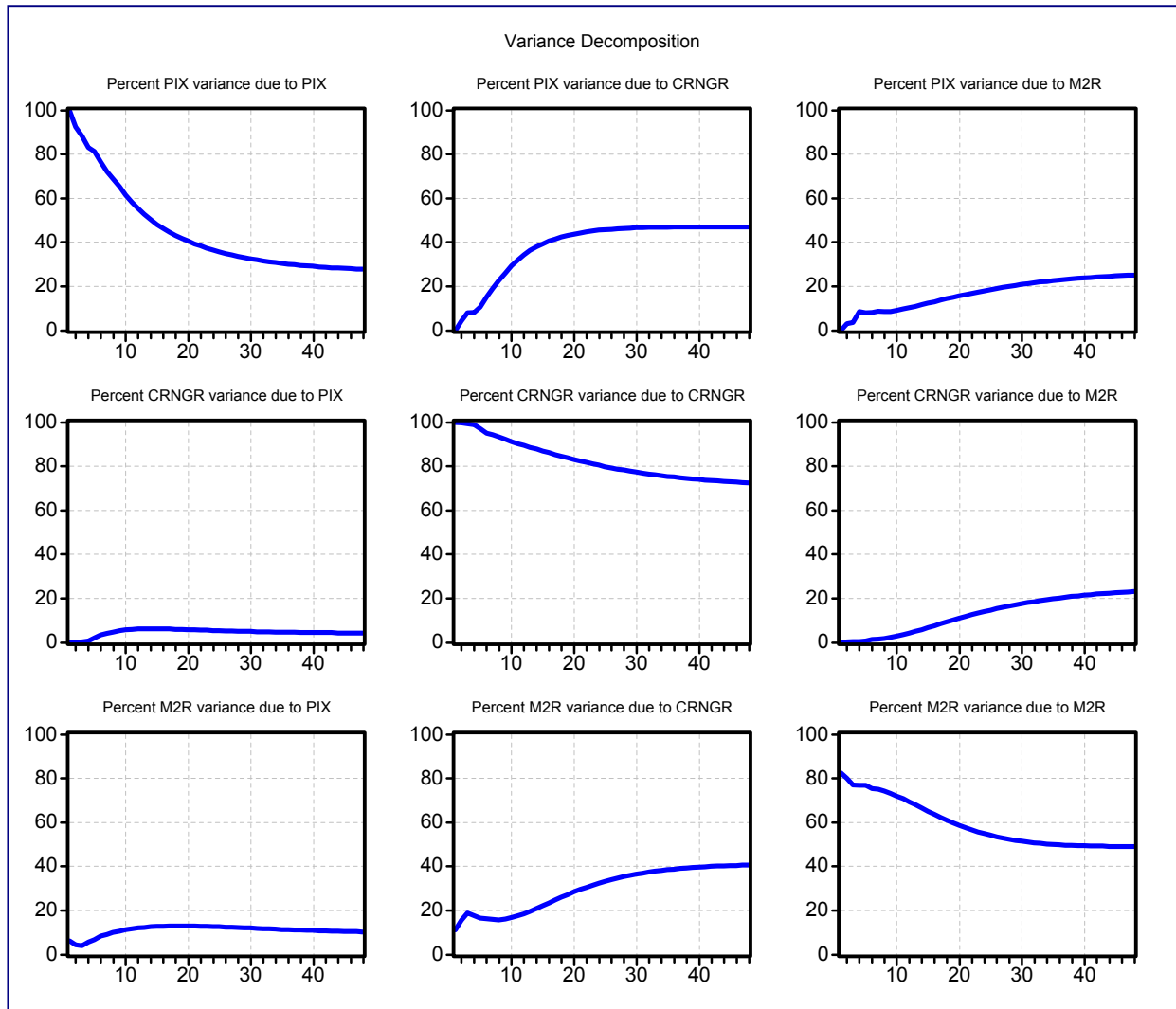


On the graph we can clearly see the strong reaction of industrial production at a variation of nongovernmental credit. Reaction of the industrial production at a standard variation in



broad money is controversial. The structure of the response is important, and in the next graph it is very clear that in the variation of the industrial production over 40% is generated by changes in nongovernmental credit. It is worth observing that broad money has a smaller contribution in the variation of industrial production. Another important fact is the autocorrelation with past values of nongovernmental credit.

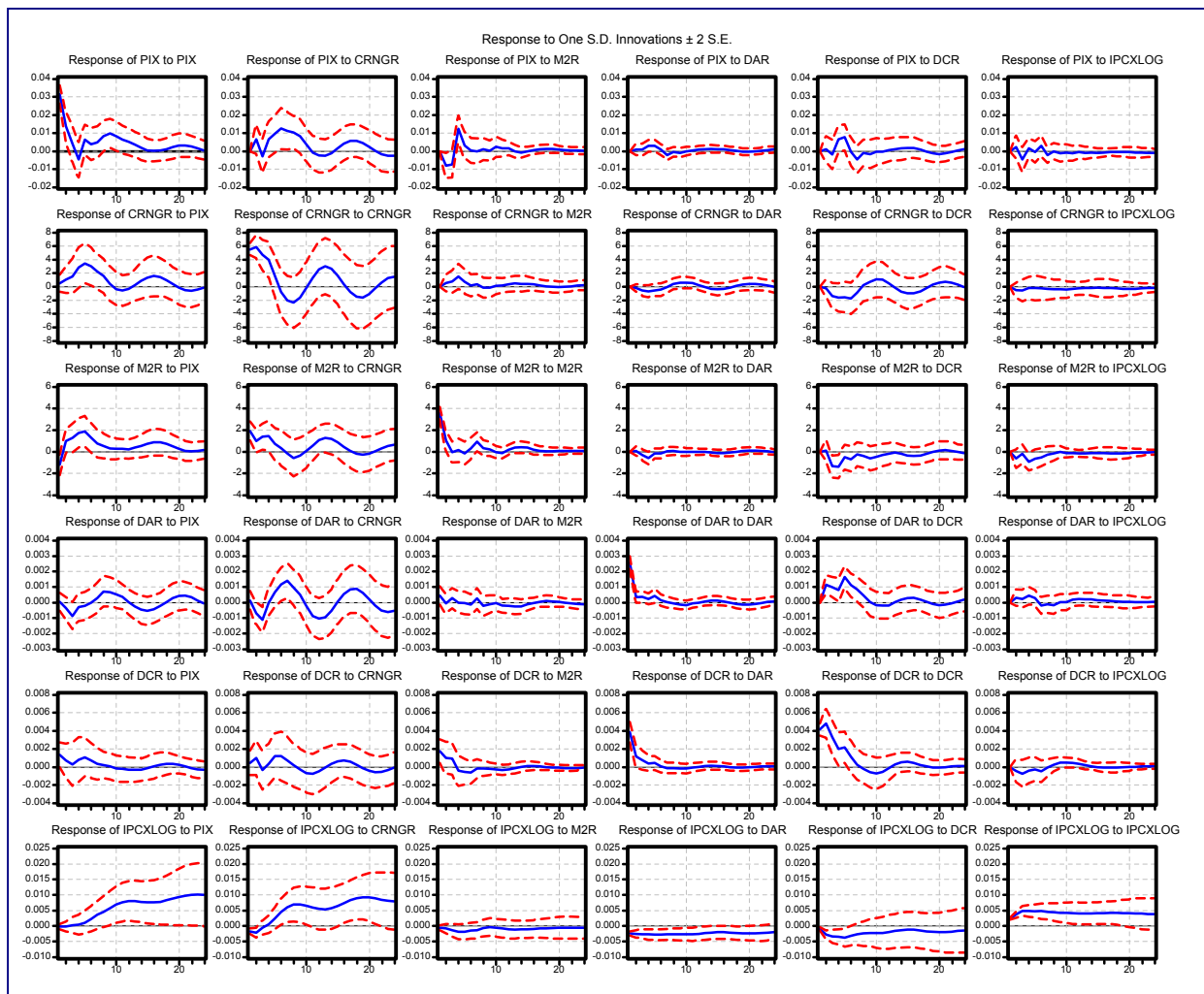
**Figure 3 Variance decomposition for PI, M2, Crng.**



A VAR with more variables has been developed. In this unrestricted VAR new endogenous variables have been introduced on top of the variables from the previous example. These variables are discount rate, real lending rate, the logarithm of consumer price index. As exogenous variables in this test are the real borrowing rate, the real exchange rate, the monetary base, the real reserves at NBR and real refinancing form NBR.

The effects of nongovernmental are very important and as a change the effects are pro cyclical. The response functions are relatively unchanged versus the previous results. Real lending rate has this VAR little effect on the industrial production. This is not very strange, because in a economy with no working capital, credit is taken at any interest rate, the alternative being the shut down of the firm.

Figure 4 Response functions for 6 variables.

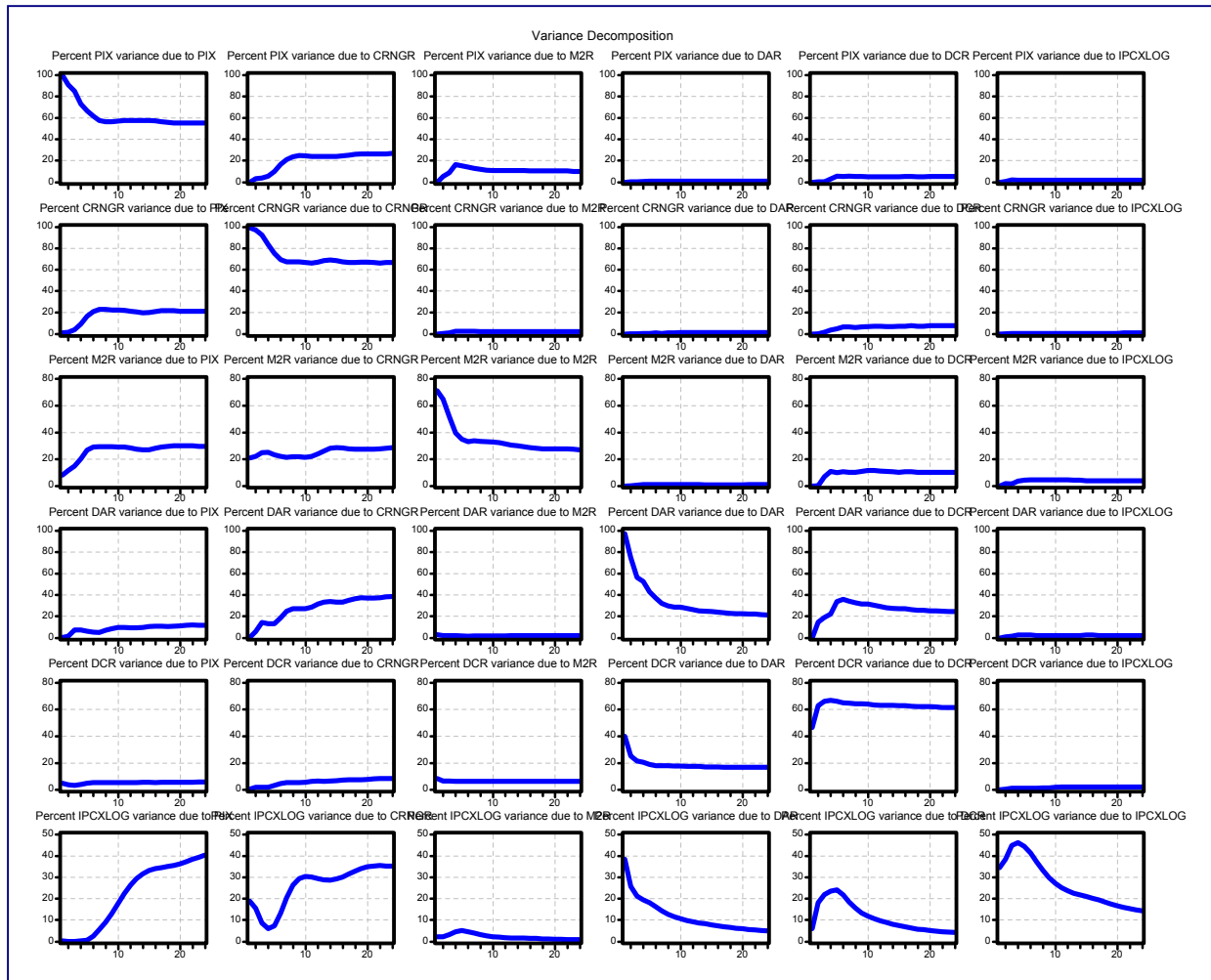


Decomposition of variance is important again to assess the importance of each variable in response by the other. Nongovernmental credit is again the main factor of influence for industrial production, and the second place is taken by broad money. Inflation rate has little consequences on variations of industrial production the same can be said about real lending rate and discount rate.

These findings are consistent with other results in this area (Popa C., 1996, PhD. Thesis, "Theoretical and Empirical Developments in modern Monetary Policy"). In the paper mentioned before the credit channel is an important mechanism of monetary policy transmission, in a close connection with the refinancing by the NBR.

The results are „orthodox” from the theory point of view, with few exceptions. The response of the variables at impulses is consistent with the hypothesis in the economic theory in direction and also in amplitude.

**Figure 5 Variance decomposition.**

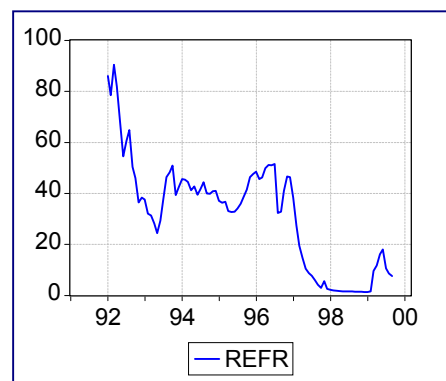


Several problems arise eventually in assessing the developments in Romania’s economy and in monetary policy.

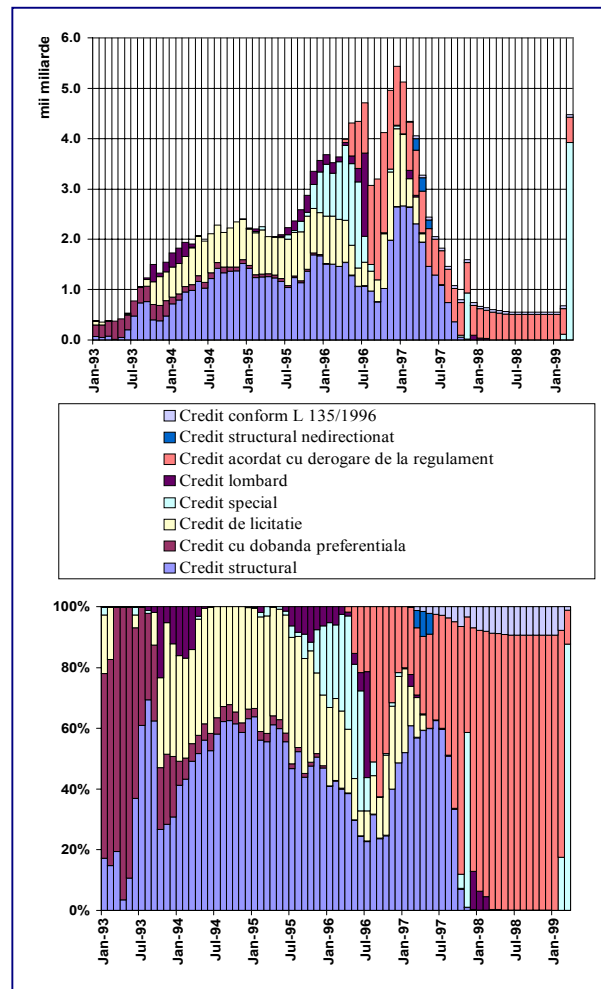
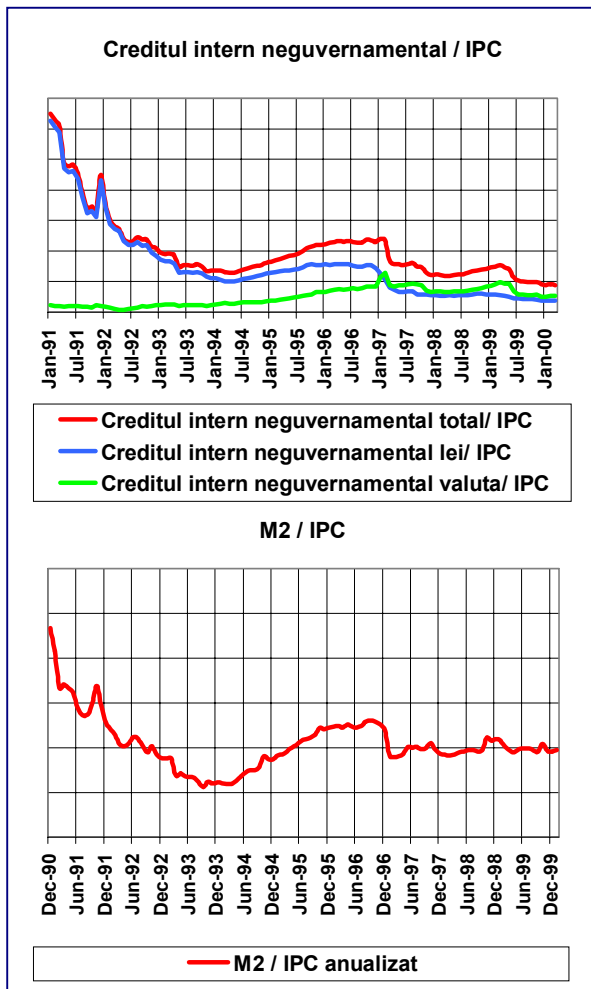
The first problem is the fast and wide variations in economic policy. Only in the last years the monetary policy has experienced dramatic changes, from an accommodative monetary policy towards a strict monetary policy, aiming for inflation control.

**Figure 6 Real refinancing level.**

Also the instrument of monetary policy had changed from refinancing credit to deposits attracted by the NBR. Refinancing credit was abandoned; the volume has dropped in nominal terms, and the change in real terms was more abrupt. Figure 8 Refinancing credits - volume and structure. is a short representation of refinancing credit in real terms having the start of 1991 as a mark. The change in the structure of refinancing credit is very significant, especially the drop in auctions credit and the raise of special credits, which are uses mainly to save bank in a poor financial situation.



**Figure 7 M2 and nongovernmental credit evolution.**



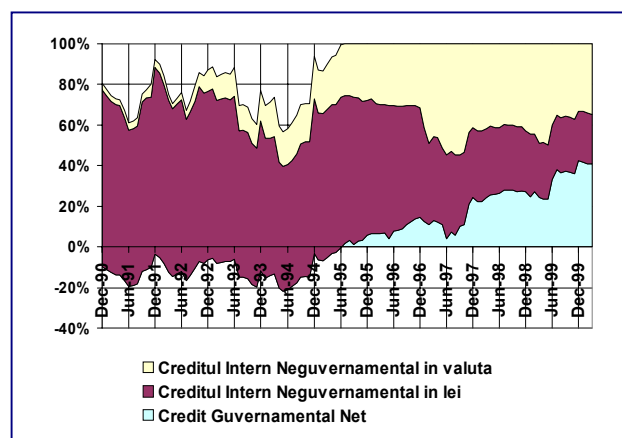
**Figure 8 Refinancing credits - volume and structure.**

The amplitude of variations in real broad money and in real nongovernmental credit is also significant for the dramatic changes that took place in Romania.

**Figure 9 The structure and volume of total internal credit.**

Another important element in the changes that has happened in Romania is the crowding-out effect, the substitution by the state of the private enterprises as borrowers. The next graph is very convincing in this problem.

All this dramatic changes in the Romanian fiscal and monetary policy could have an adverse effect on the VAR estimations. An alternative could be the use of structural VARs or the use of cointegration.



### 1.5. Tests of stationarity.

In order to cointegrate the variables mentioned in the previous part of this paper, it is essential to determine the integration order of each variable. In order to do this tests like Augmented Dickey Fuller or Phillips-Perron are needed. The results are centralized in the following table:

**Table 4 Order of integration.**

Trend ( T ) sau Constanta ( C ) Trend ( T ) or Constant ( C ) ADF = Augmented Dickey Fuller PP = Phillips-Perron	Variabila	Ordin de integrabilitate		Nivel de semnificație
	Variable	Order of Integration		Level of Significance
		ADF	PP	
	BZR	I(1) C	I(1) C	1%
	CRNGR	I(0) C	I(0) C	1%
	CSR	I(1) C	I(1) C	1%
	DAR	I(1) C	I(0) C	1%
	DPR	I(1) C	I(0) C	1%
	DCR	I(1) C	I(0) C	1%
	IPCXLOG	I(1) C T	I(0) C	1%
	IPPXLOG	I(1) C	I(1) C	1%
	M1R	I(1) C	I(1) C	1%
	M2R	I(1) C	I(0) C	1%
	PIX	I(1) C	I(1) C	1%
	REFR	I(1) C	I(1) C	1%
	REZR	I(1) C	I(1) C	1%

### 1.6. Cointegration relationships.

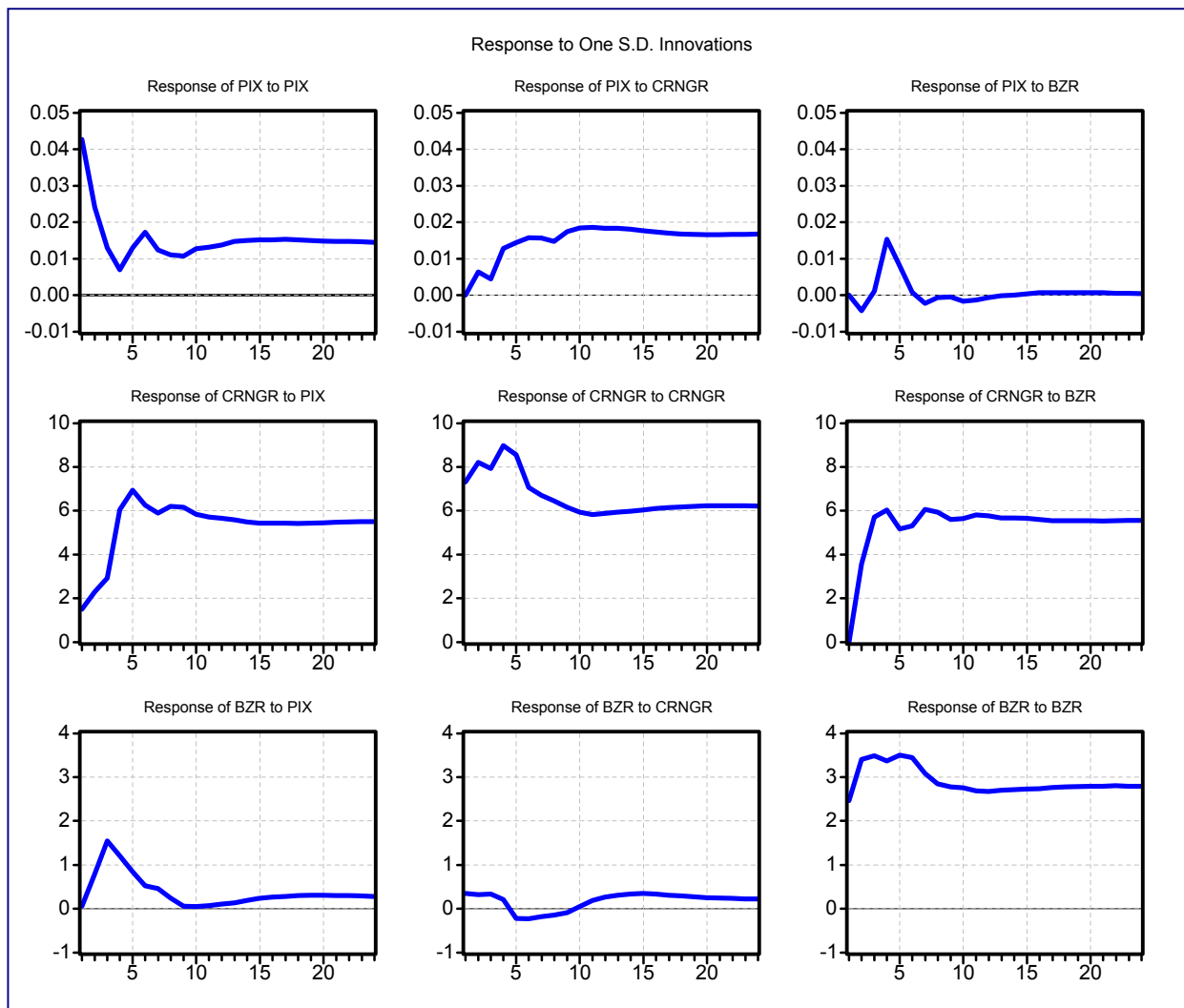
Even if the order of integration is different among variables, a test has been made to cointegrate just three of them. The result is presented in the next table:

**Table 5 Cointegration relations between Crngr, Bzr and Pix.**

Sample: 1991:01 2000:03				
Included observations: 82				
Test assumption: Linear deterministic trend in the data				
Series: CRNGR BZR PIX				
Lags interval: 1 to 4				
Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.141248	16.74811	29.68	35.65	None
0.046662	4.261584	15.41	20.04	At most 1
0.004176	0.343138	3.76	6.65	At most 2
*(**) denotes rejection of the hypothesis at 5%(1%) significance level				
L.R. rejects any cointegration at 5% significance level				
Unnormalized Cointegrating Coefficients:				
CRNGR	BZR	PIX		
-0.009086	0.017651	3.080779		
0.001203	0.011602	-0.077975		
0.002190	-0.015617	0.721536		
Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)				
CRNGR	BZR	PIX	C	
1.000000	-1.942703	-339.0798	188.4656	
	(0.53897)	(44.9828)		
Log likelihood	-327.7131			

Calculating the residuals from the relation presented above, a series with an integration order of  $I(0)$  has been obtained, using both ADF and PP at a significance level of 1%. Knowing that most of the variables in the equation are  $I(1)$  we can conclude that the variables are cointegrated. Using these variables a VAR with error correction was realized.

**Figure 10 VAR with error correction for Pix, Crngr, Bzr.**

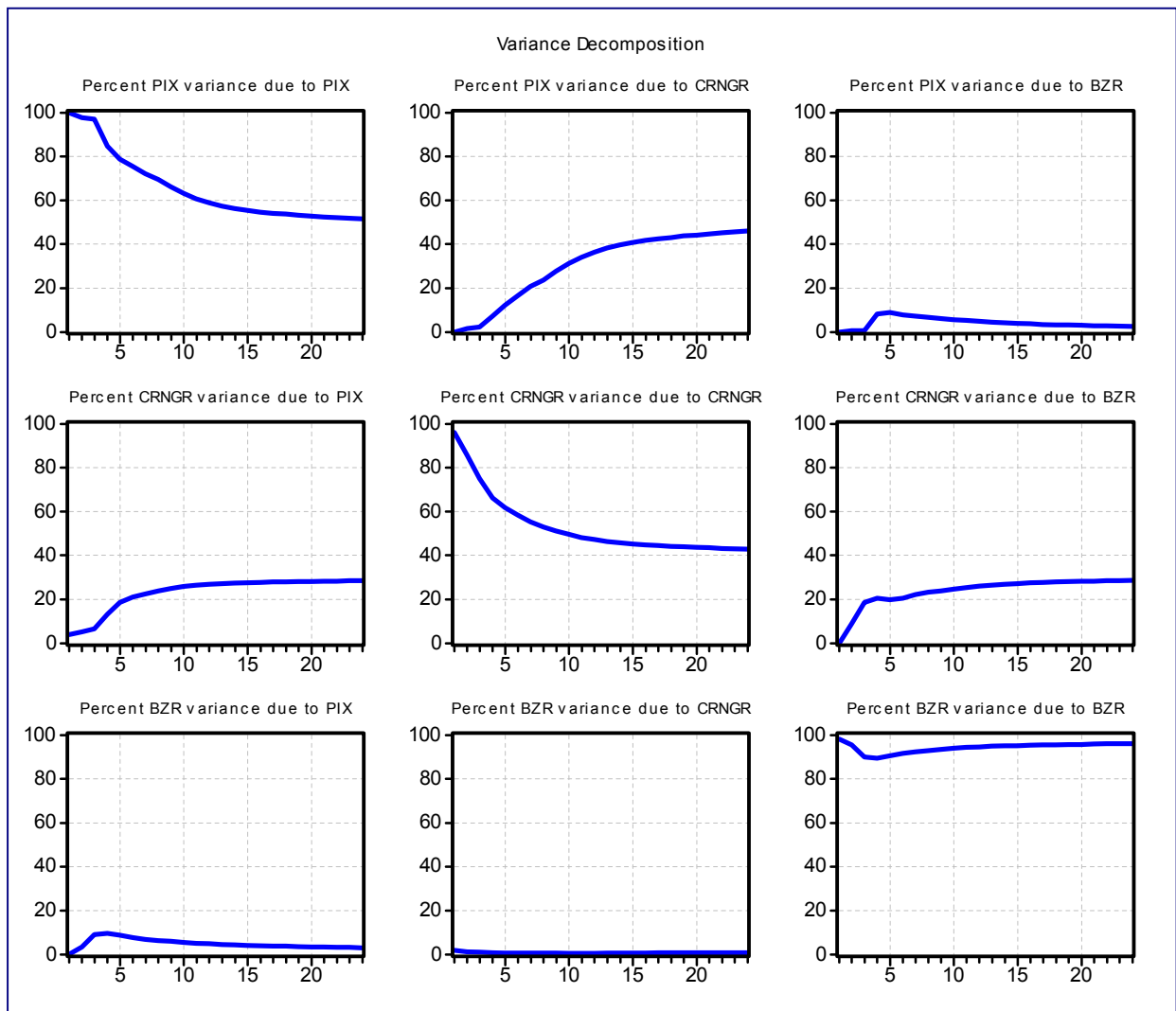


An immediately observation can be made about the similitude of the results with the results from the unrestricted VAR, at least in the direction of the changes in the response functions. The nongovernmental credit has a strong influence on industrial production and as a difference versus the unrestricted VAR the level achieved after the shock is not showing a gradual absorption of the shock, but a permanent change in the level of the endogenous variable. The same situation appears in the case of the response of the nongovernmental credit at the impulses generated by the monetary base, and also in the case of the responses of credit generated by a change in industrial production level.

Variance decomposition is presented in the next figure. The biggest factor in industrial production response is the change in the level of credit, and the other variables have a weak

impact. There is a link between the credit and monetary base but the causal relationship is only one way from the monetary base towards the credit.

**Figure 11 Variance decomposition.**



The relationship between variables is on a long-term basis, and an equilibrium level exists, each variable is drifting towards this level at a speed denoted by the coefficient of the cointegration equation. The coefficient is expressing the relation between variables, which are used in different forms, industrial production is an index versus the first month of the 1991, real credit is credit deflated with the CPI, so the values of the coefficients must be appreciated versus the significance and the measure of the variables.

A test had been made in order to cointegrate more variables (real nongovernmental credit, real money base, industrial production and broad money). The test has been a success, and the error vector has an integration order of  $I(0)$  at a significance level of 5% using the PP technique.

Using the same number of lags as in the cointegration equation a error correction VAR has been realized:

**Table 6 Cointegration equation between Crngr, Bzr, Pix, M2r.**

Date: 06/22/00 Time: 04:11				
Sample: 1991:01 2000:03				
Included observations: 82				
Test assumption: Linear deterministic trend in the data				
Series: CRNGR BZR PIX M2R				
Lags interval: 1 to 4				
Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.217910	40.97119	47.21	54.46	None
0.154215	20.81677	29.68	35.65	At most 1
0.049773	7.082612	15.41	20.04	At most 2
0.034703	2.896193	3.76	6.65	At most 3
*(**) denotes rejection of the hypothesis at 5%(1%) significance level				
L.R. rejects any cointegration at 5% significance level				
Unnormalized Cointegrating Coefficients:				
CRNGR	BZR	PIX	M2R	
0.008518	-0.028053	-2.283279	0.001221	
0.004520	0.018986	-1.347525	-0.005207	
0.001307	0.003603	-1.789109	0.001181	
0.000420	0.004142	0.309946	0.001559	
Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)				
CRNGR	BZR	PIX	M2R	C
1.000000	-3.293380	-268.0502	0.143359	167.4536
	(0.86499)	(36.9821)	(0.15043)	
Log likelihood	-557.8668			

The response function at impulses is very similar with the previous results, the credit continuing to influence heavily the industrial production. The change in the levels of the variables is permanent in this equation, very similar with previous results. Credit is again the leading factor in influencing industrial production, with almost 40%, so the existence of a credit channel is the obvious observation.

Broad money also responds by a permanent change at an impulse of the monetary base, and the monetary base is the most important factor in the variance of broad money.

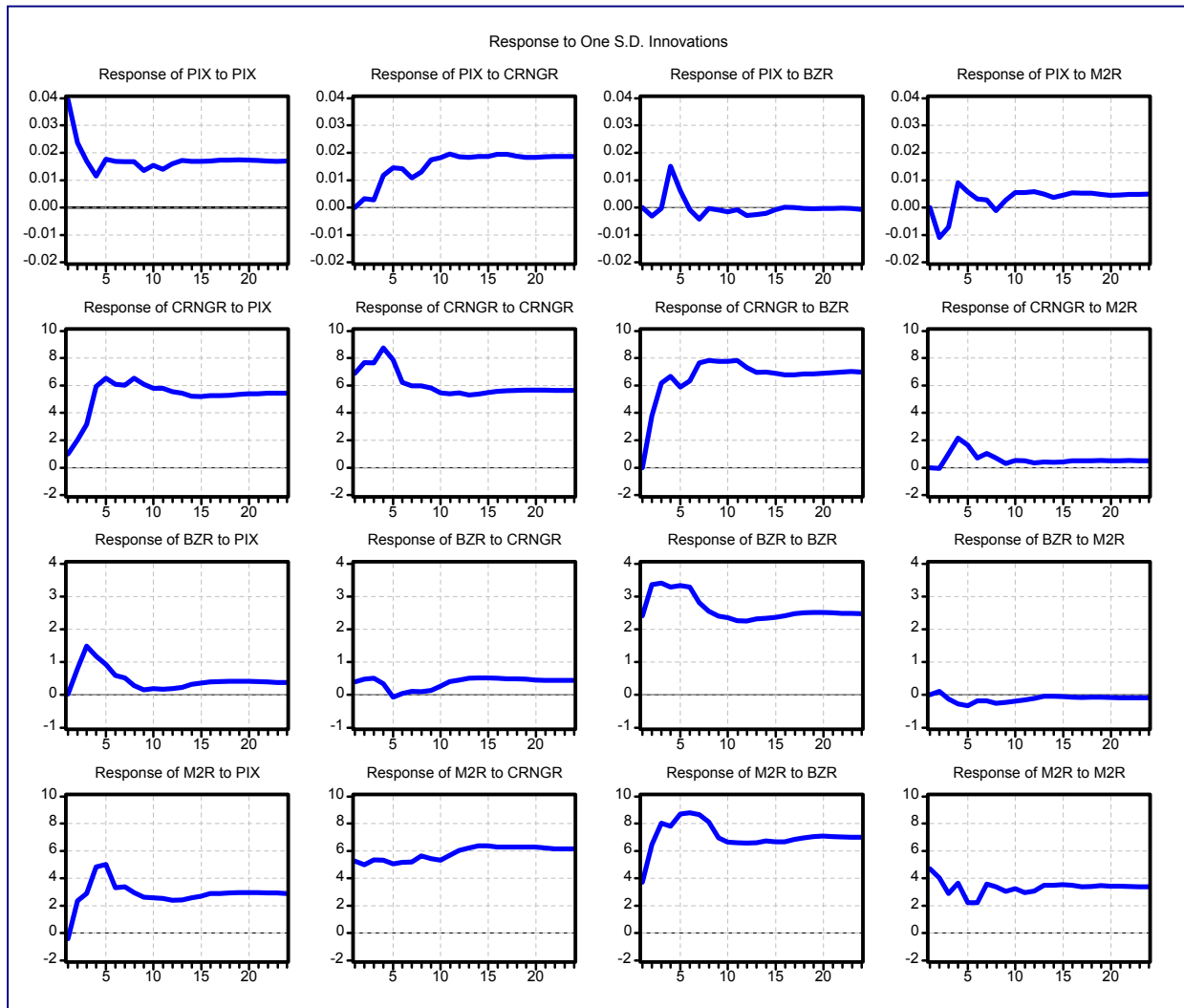
The influence of the Central Bank on the nongovernmental credit is also very visible, being suggested by the amplitude of the response at an impulse in the monetary base.

The result are robust the response in all four test being similar. This could be a sign of the relevance of the variables chosen, and of the correctitude of the representation realized using this methods.

The results are in all four cases “orthodox” from the theory point of view.



Figure 12 Response to innovations in a VAR with 4 variables.

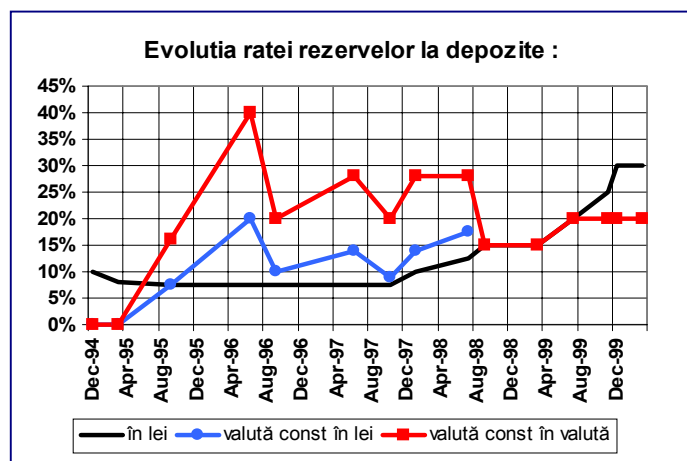


All the facts and data presented generate only one possible conclusion: the existence of a credit channel in the Romanian economy, channel with a powerful impact on the real variables of the economy.

Figure 13 Mandatory reserve requirements rates.

Knowing the degree of control of the monetary base by the NBR, the effect of each monetary instrument, we can assess the force and the implications of the instruments that can be used by the Central Bank.

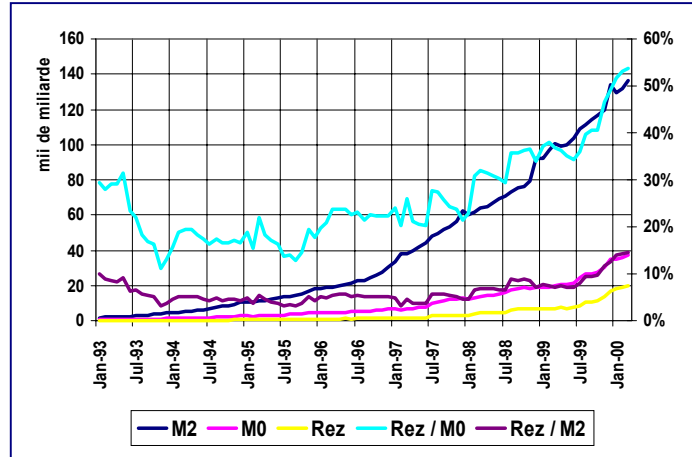
One instrument, very powerful and intimately linked with the credit channel is the mandatory reserve requirements. The frequent change in the rates of the mandatory reserves is another important proof in supporting the existence of a strong credit channel



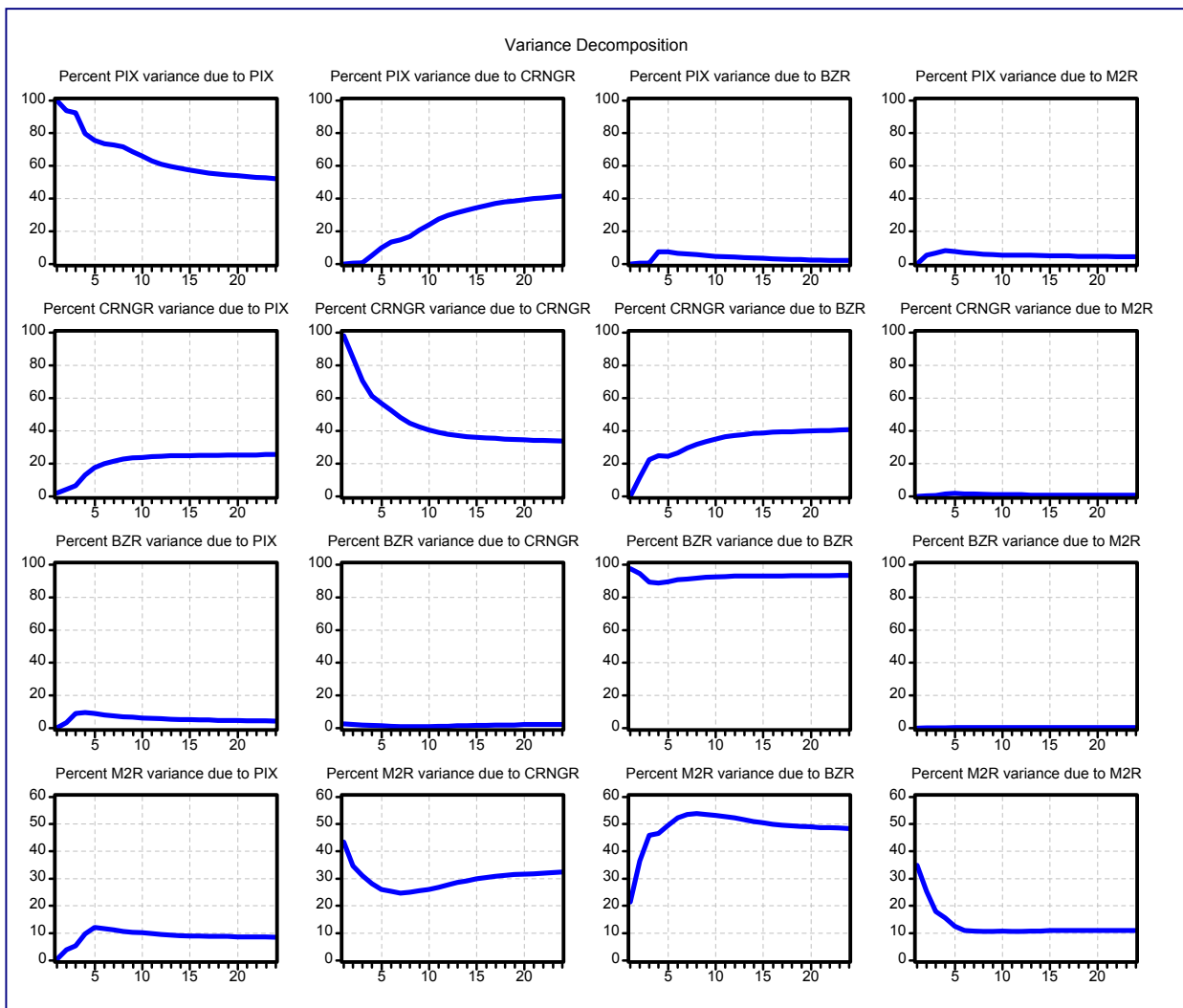
in Romania. The purpose of these changes is to influence the liquidity available to banks and the level of credit available to the economy. Because mandatory reserves are applied only on certain types of deposits, it may be important to calculate the evolution of the percent of reserves in money base and broad money.

**Figure 14 Mandatory reserves as percent of M0 and M2.**

It's important to notice that every change in reserve requirements has a powerful impact on the profit and loss account of the bank, and if the changes are very swift and very wide, the consequences could be a very difficult situation for the banking system, especially for the banks with less liquidity. So the use of reserve requirement must be gradual and combined with an increase of the interest rate used to remunerate the reserve requirements.



**Figure 15 Variance decomposition in a VAR(4).**



## 2. Conclusions.

The transmission mechanisms of monetary policy in Romania are heavily determined by the structure of the Romanian economy, by the structure of the financial system and by the legal framework. As a result of the study conducted in the previous chapter, and as a result of the study of other channels of monetary policy transmission, the following conclusions appeared:

- The traditional interest rate channel is one of the channels used in Romania, but the influence of this channel is very weak, a possible explication being the need for resources at any cost from the economic sector, as a result of chronic under capitalization. This is why an interest rate change leads to small changes in industrial production and another factor suggesting a relative small usage of this instrument is the stability of the real interest rates. The Central Bank's interventions are supposed to correct the rates towards positive values in real terms.
- The other assets price channel is also a mechanism of monetary policy transmission with little importance in Romania. There are several reasons why its importance is so small:
  - The stock market is poorly developed, the volume of stock market capitalization and the volume of transactions is very small as percent in GDP. Also de stock market is mainly used to privatize state enterprises, and less used to raise capital or to evaluate the financial situation of a firm.
  - The exchange rate channel has some influence on industrial production, but only on a short term, for several reasons. The first is the rigidity of Romania's exports; the rigidity of production for export at changes in exchange rate or foreign demand. Another reason, and a possible explanation for the first is the use of foreign materials to produce exported goods, so the cost of the exported products incorporate the exchange rate used to value the imported raw materials. An example of this situation is the textile industry, which represents 30% of both imports and exports, a clear indication of the use of lohn system. Another example is the petrochemical industry, etc. A change of the real exchange rate leads to a change of the industrial production volume and on a short term because the relative cheaper imported raw materials and the bigger price received are short lived, till the next import of raw materials. In the next period when the firm will need raw materials it will import them at the new exchange rate and the costs will be higher, and the prices will increase too. So the inflation will rise and the real exchange rare will return at the previous level. The time period in which an effect of the exchange rate devaluation will persist is proportional with the length of the average production process in sectors that realize exports, and the proportion of imported raw materials in the finished product.
- The credit channel is probably the most powerful mechanism of transmission. There are several reasons for this situation. The first the reliance of firms upon credit for replacing inexistent working capital. If firms cannot find a source for credit they cannot restart the production process. Another reason is the heavy reliance of the commercial banks upon the Central Bank at least for refinancing credit. For the firms, the interest rate is not a problem, the only problem being implicit quantitative restrictions in the credit supply, which are frequently

generated by Central Bank's policy. The use of the mandatory reserve requirements, the frequent change of this rates and the rapid change in methodological aspects in this domain, illustrate the importance of the credit channel. A separation between the various secondary channels, which compose the credit channel, is difficult, but adverse selection and moral hazard have an important role to play in an instable economy. The bank-lending channel is probably equally important. The large contribution of nongovernmental credit variations at changes in output has been demonstrated in this paper. On the other hand maybe the simultaneous reduction of real nongovernmental credit and industrial production in recent years is not a coincidence. A rise of the real money supply is an objective stated in the plan sent to UE – but a rise based on real assets. Eliminating the under capitalization of the firms and the small value of M2 in PIB are important objectives for the future, for the policy makers in Romania. Reform is needed in case of the firms that cannot be saved and restructuring is necessary for the others. The channel of the household's liquidity is also very weak considering the poor development of consumption credit and the continuous fall in the sales of durable goods.

Of course the present paper can be improved, the usage of VAR methods can be criticize in some respects, so future studies should use structural VARs, or another quantitative methods needed to offset the "Lucas critique".

In the following years one can expect the Central Bank to use monetary aggregates as intermediary objectives, moreover due to the ceilings on NDA and floors on NIR imposed by the agreements with the IMF.

In the long term the structural changes in the Romanian economy will lead to changes in monetary transmission mechanisms, as in other countries had already happened. The credit channel will decrease in role and other channels will take its place. Significant steps in this transformation will be a real liquid secondary market for bonds, a more efficient stock market, a smaller degree of dependence upon the Central Bank for the commercial banks, etc.

In order to achieve the ambitious objectives that Romania presented to the EU, the monetary policy will retain its importance, and the topic of the transmission mechanism will be a central problem, because only knowing the most efficient transmission mechanism the optimal decisions can be made and implemented. In order to understand the transmission mechanism a methodic and periodic study of this problem is needed, and in a rapidly changing economy the problem is more acute.

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