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Monetary Conditions and GDP Evolution in Romania

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MONETARY CONDITIONS AND GDP EVOLUTION IN ROMANIA[1]

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Abstract: *We deal with the evolutions of monetary conditions in Romania before and during the economic crisis, and the extent to which GDP shocks are related to these conditions. The results confirmed the essential role of interest rate, credit and exchange rate in this respect, which underlines the importance of the monetary policy measures for stimulating the domestic/external demand. The exchange rate has an important weight, which shows the contribution of the currency depreciation to the pre-crisis increase of the domestic product. During the crisis (2008-2010), the reduction of GDP growth is more ample than the reduction of monetary conditions, revealing an important role of the real channel in transmitting shocks from abroad. The currency depreciation failed to stimulate the domestic product because of the low external demand, of similar devaluations of competitors' currencies, but also because of the increasing proportion of imports in the exported products. Under these conditions, the reduction in capital account had a substantially recessionistic effect. Since the end of 2010, the GDP oscillations have been restored around the monetary conditions, which have recovered the capacity to anticipate the macroeconomic evolution.*

Key-words: *monetary conditions index, GDP growth, Macro-financial linkages*

JEL Classification: *E44, E52, E32*

1. Introduction

The mechanisms by which financial conditions influence the real economy are a widely debated issue in literature. And this, because in the last decades the financialisation of economies has intensified and the equilibrium of the financial market has played an increasing role in macroeconomic performance. Moreover, the monetary policy transmission channels have become more complex and evolved in time, due to many financial innovations associated with the deregulation of financial markets. In this context, the start and the transmission of the global crisis through the financial channel have had unpredictable effects difficult to counteract, confirming the essential role of financial conditions in macroeconomic stability.

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Eastern European countries – highly dependent on foreign funding – have strongly felt the liquidity crisis in foreign financial markets. Although the banking system was not exposed to “toxic” assets in the USA, the increasing cost and diminishing funding amplified the existing bank balance sheet deterioration (high proportion of external assets, high leverage, high lending rate – non-performing assets). This combination of factors caused major problems to the banking systems of some countries, and government support was required. In Romania, the measures to temper lending taken by the NBR[3] before the crisis prevented such problems but it was not possible to avoid the financial instability contagion from abroad through external borrowing, exchange rate and asset price channels. Of course, there was a substantial transmission of recession through the real channel (export decline).

Considering the importance of the evolution of financial variables for the real economy stability, attempts have been made since the early 1990s to synthesize the national financial conditions as a composite index, cumulating the oscillations of the most representative financial indicators. First, it was the monetary condition index (MCI) set by the National Bank of Canada, which synthesized the modifications (shocks) of variables corresponding to the most important monetary policy transmission channels – interest rate and exchange rate – in relation to their trend. Gradually, the evolution of financial markets led to increasing importance of some transmission channels independent of the monetary policy. Therefore, other financial variables corresponding to various transmission channels were added, both of neoclassic type (interest rate measures and spreads; asset prices) and of non-neoclassic type (credit indicators). This resulted in financial condition indexes (FCI). Hatzius *et al.* (2010, pp. 9-10) provided a synthesis of the characterstics of the main MCIs used by financial institutions in developed countries (Deutsche Bank, Bloomberg, OCDE, etc.).

The MCI was initially used as an intermediate target of the central bank, placed somewhere between the monetary policy instruments and the final target (usually, inflation or aggregated demand). Because of its unsatisfactory outcome, the utilisation of the MCI gradually diminished, but it began to be used as an evaluation indicator of the monetary policy (restrictive or relaxed one). Precisely this assessment, in the case of Romania, is the topic of this paper. We are interested in how this index

[3] National Bank of Romania.

evolved during the financial crisis and, expecially, in the way the MCI evolution was correlated with GDP decline from the previous trend. This correlation can be considered a measure of how the growth rate was affected by monetary conditions.

2. The methodological framework

An MCI include any financial variable whose shock (deviation from the trend) significantly influences the state of the economy – revealed, as a rule, by various indicators of the real economy (domestic product, industrial production, etc.). The emergence of the theories regarding the monetary transmission mechanisms was followed by the occurrence of a multitude of variables with possible impact on the real economy. But the test results show that the most significant variables are those related to the interest rate, money supply, credit, exchange rate, and asset prices. The variables included in the MCI are weighted depending upon the importance of the related shocks for explaining the variation in the domestic product or the industrial production. The question of estimating such weights is vital for setting an MCI, as the weights determine the index performance.

In principle, there are four approaches to measuring the weights of variables X_j, components of on index of type MCI = Σj cj*Xj:

a) Determining the weights by means of an investment–saving (IS) equation, when the variation in a result indicator of the real economy (GDP or industrial production) is explained by previous values both of itself and of the financial variables, as follows:

$$\Delta Y_t = a_0 + \sum_{i=1}^{n} bi * \Delta Y_{t-i} + \sum_{j=1}^{m} \sum_{i=1}^{n} cji * X_{j,t-i} + e_t \qquad (1)$$

where: *ΔY* shows real economy changes, *Xj* = (*X1* ... *Xm)* are the financial variables that we want to include in the MCI; *n* is the number of lags included in equation; *m* is the number of financial variables; *e* is the error term. The coefficient of a financial variable in the future MCI results from the sum of the coefficients of this variable for all lags included in the IS equation.

b) Deducing the weights of MCI variables by means of an autoregressive vector (VAR) model of the following form:

$$Z_t = Ai + \sum_{i=1}^{n} Bi * Z_{t-i} + u_t, \qquad (2)$$

where: Z is a vector $mx1$ of all variables (including ΔYt), Ai is a vector $mx1$ of the intercepts, Bi is matrix mxm of the slope parameters. The weight of a variable in the MCI is determined by the average cumulated response of Yt to a shock of the errors of that variables, revealed by the *impulse-response function (IRF)* of the VAR model.

Unlike the previous variant, the IRF measures the impact of each variable on all the other variables. In a classic VAR model, built according to Christopher Sims (the author of VAR), all variables are considered to be endogenous, so that a shock to a financial variable implies both the direct effect and the indirect one through the other variables on the response variable.

c) Using complex structural models that should take into account the interactions among the main macroeconomic variables. This variant is suitable for the accurate quantification of the influence of financial variables, but it is a difficult attempt since it requires complex data on financial institutions, consumer behaviour and investments of households, as well as of companies, and others. But according to Gauthier *et al.* (2004, p. 6), some financial variables, such as asset price, play a limited role in macroeconomic models built by leading financial institutions. And this, because of the lack of consensus in literature regarding the mechanisms by which these indicators influence the aggregated demand and inflation.

d) Calculating the weights of MCI variables in relation to the capacity of various indicators and their combinations to predict the evolution of the domestic product and inflation. Stock and Watson (2002), English, Tsatsaronis and Zoli (2005) and others made such attempts and acquired important results, using a 1-2 year forecasting horizon.

Below, we use the VAR method to determine the weights of the MCI components.

3. An index of monetary conditions for Romania

In Annexes 1 and 2 we included a set of financial variables used for selection, with stationarity tests. The indicators include several measures of interest rate, money supply, private credit, bank deposits, and exchange rate indicators. The growth rate is computed in relation to the previous quarter, after the seasonal adjustment of data (as necessary) by the Census X12 method. We did not provide logarithms to the data series because this procedure means losing information, which is undesirable for building a VAR model (Cozmâncă, 2000, p. 30).

The modest size of data sample does not allow for using a large number of variables and lags, since the degree of freedom diminishes and cause big standard errors and very big confidence intervals of the coefficients. We opted for maximum 3 financial variables for building the MCI. To select the variables to be included, we computed in Annex 3 – for each factor *Xj* – the individual impact on domestic product growth rate, using the relation below. Because we use quarterly data, we select a lag n=4.

$$\Delta Y_t = a_0 + \sum_{i=1}^{n} bi * \Delta Y_{t-i} + \sum_{i=1}^{n} ci * X_{j,t-i} + e_t. \quad (3)$$

Considering the regression results shown in Annex 3 and Granger causality tests (Annex 4), the importance of the variables from an economic theory perspective, and the economic relevance of parameters in several forms of VAR models, we selected three financial variables:

- three-month inter-bank real interest rate (%), denoted by R_IR3;
- growth of real private credit over the previous quarter (%) denoted by ΔR_PCR ;
- growth of nominal exchange rate over the previous quarter (%), denoted by Δ_NEX;

to which we add the GDP real growth rate over the previous quarter, denoted by Δ_GDP.

In general, for setting an MCI, real variables are preferred, especially for long-term analyses, because it is assumed that economic agents take into account, for example, the real interest rate, not the nominal one, when they make decisions on consumption or investments. Therefore, although there are opinions favouring the influence of the "money illusion" on the above decisions, we opted for deflating the three variables by the consumer price index (CPI). To calculate the real variables, we used, in general, the CPI in relation to the previous quarter, except for several measures of the real interest rate, where we used the annual growth rate of prices, according to the following formula:

$$\Delta\_CP_{t\,annual}(\%) = \left[\left(\frac{CPI_t}{CPI_{t-1}}\right)^4 - 1\right] * 100 \quad (4)$$

where: *CPI t* is the index of quarterly consumer prices on a 2005=100 fixed basis.

Real increases in the indicator X were calculated by the following formula:

$$\Delta R\_X_t(\%) = \left[\frac{1+(\Delta\_X_t/100)}{1+(\Delta\_CP_t/100)} - 1\right] * 100, \quad (5)$$

Where $\Delta\_CP_t = ((CP_t/CP_{t-1})-1)*100$, except for the real interest rate, when we used $\Delta\ \_CP_{t\ annual}$.

The figures included in Annex 5 show the evolution of the three financial indicators selected, besides the evolution of the GDP growth rate, between 1998-2012. The charts show very high oscillations of the variables, especially the GDP, before 2000 as well as after 2007, when the global crisis began. Therefore, for calculating the weight of financial variables in the GDP, we used a sample corresponding to a period as monotonous as possible regarding the indicator evolution. The selected interval was Q3.1999 – Q2.2008.

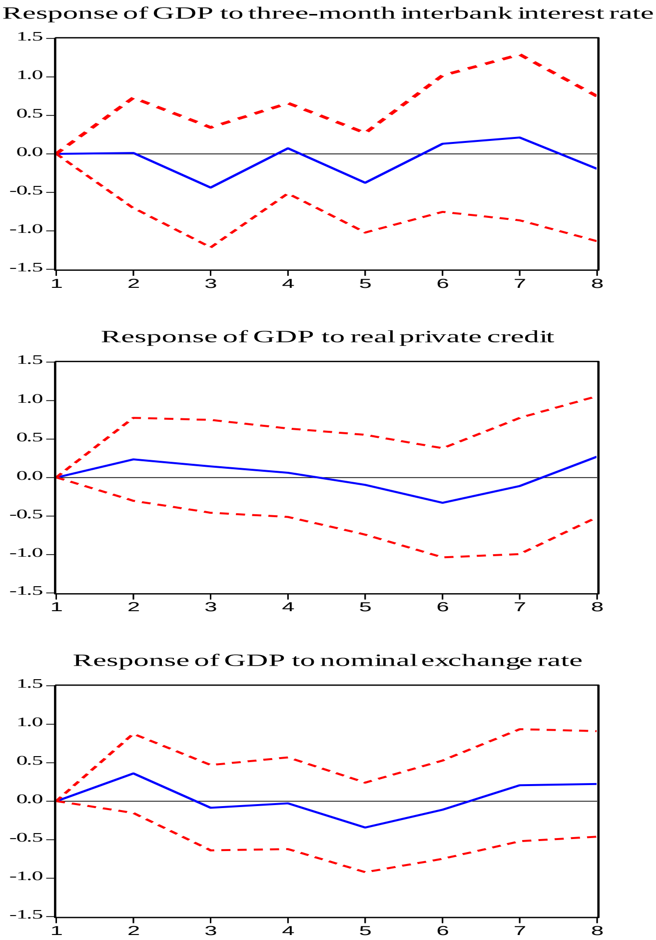
For the above-mentioned interval we built an unrestricted VAR model, using a four-period (quarterly data) lag, besides the impulse-response function (IRF) of the domestic product for a shock of each financial variable. We selected this lag – although too long if related to the sample size – considering both the lag lenght tests (FPE, AIC and HQ indicate this lag) and the "wrong" parameter signs (contrary to economic theory) in the IRF of VAR with 2 and 3 lags. Moreover, the IRF results for VAR4 are better – as regard the correlation of the MCI with Δ_GDP - than those produced by VAR2 and VAR3.

The IRF receives the impact of any X variable on the other ones of the VAR model, by changing by one unit the regression error of the equation corresponding to that variable. Therefore, according to Swiston (2008, p. 7), the coefficient of each financial variable revealed by the IRF is adequate for being used later in the MCI, because it is the response of the dependent variable (in our case, GDP) on a certain period t+k, to a shock of that financial factor, at time t.

The big issue when calculating the IRF is the error correlation between equations, and that is why the Cholesky procedure decomposes the residuals u_t in equation (2) into two parts: one caused by exogenous factors, and the other one caused by the other variables of the system. This process implies a complex set of algebraic transformations and ordering of the variables; the more correlated the residual variables are, the stronger the influence of ordering on results is – IRF coefficients (Brooks, 2008, p. 301). As a rule, variables are ordered by the length of the delay in responding to the variation in the other variables; it is considered that the last variable in that row reacts immediately to an impulse from the other ones. That is why we ussualy find the following order: GDP, inflation, interest rate, credit, and the alternative consisting in reversing the last two elements, as shown by Jääskela (2007, p. 13). The exchange rate is the last, after the interest rate, which implies a delayed answer of the monetary policy to an exchange rate shock (Bjørnland, 2008, p. 201). Of course, the order is determined by the specific characteristics of the analysed economy.

The charts in Figure 1 show the response of GDP growth rate to a shock of one standard deviation of the three financial variables, spanning eight quarters.

Figure 1: The response of GDP growth rate to a shock of one standard deviation of monetary variables, using the Cholesky decomposition (± 2 standard errors)



Source: Own calculations, based on data from IMF – International Statistics and Eurostat, using EViews.

For using the Cholesky decomposion of errors, we first ordered the variables as follows: GDP growth rate, three-month inter-bank real interest rate, real private crediting rate, nominal exchange rate variation; further other variables may be tested.

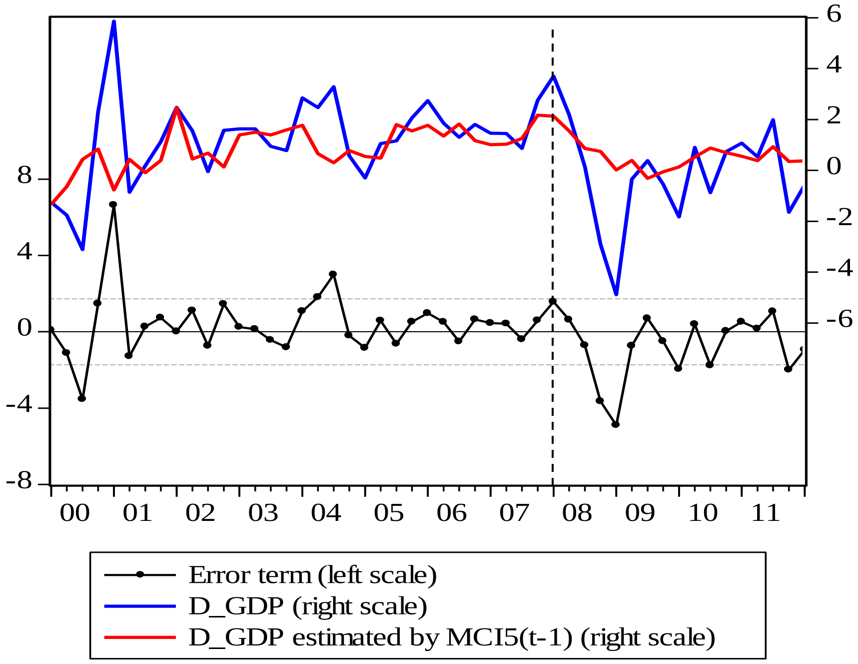
The charts show a negative reaction of GDP to an impulse of the interest rate, delayed for 3 quarters. Then, we see a positive initial response for Q2 and Q3 in the case of the real credit, and then the response oscillates. The response to an impulse of the exchange rate (devaluation) is also positive, but for a short period, and then it oscillates because of increasing domestic prices. We could say that the three responses are consistent with economic theory for a credible period of four quarters; the oscillations are caused by a relatively large number of lags (4).

By computing the averages of the IRF coefficients for three, four or five periods, and using three variable ordering variants, we obtained nine MCI, denoted by MCI1 - MCI9 (Annex 6). For ordering the variables we always kept the GDP as the first variable, because of the delay in response as against the other variables.

Testing the MCI performance is based on three criteria: the correspondence of the coefficient signs with economic theory; graphical examination of the MCI capacity to predict the evolution of the result indicator (industrial production, GDP, etc.) and especially to anticipate the inflexion points of the trend; the size of the correlation / determination coefficient between the MCI and the result indicator. The financial variable coefficients for the nine MCIs are presented in Annex 6, besides the regression results with Δ_GDP. The performances of the nine indexes are close, but the wights of the variables show considerable differences among the MCI variants, revealing substantial error correlation. According to the results, we selected MCI5(t-1) to be the most performing for predicting Δ_GDP(t) variation. Figure 2 (right scale) describes the evolution of the actual variation of GDP, compared with the GDP predicted by the MCI5 variation. The left scale shows the regression error.

The graph shows a relatively good capacity of the index to anticipate the GDP evolution up to 2007 (the period for which it was built). But what concerns us is the MCI evolution during the 2008-2011 financial crisis. The index anticipates the decerasing trend of the GDP growth rate between 2008-2009, but we also see a significant difference: the actual GDP trend is below the MCI predicted trend. This could mean a poor performance of the index or that it might be caused by a decisive role of the exchange rate (which increased significaly over that period) in MCI5 variation. But, in our opinion, the main reason is the influence of external factors, which affected the GDP, the first one being the export component (external demand) diminution. The second cause, which produced a negative shock to the GDP at the end of 2008, is a contraction of domestic absorption because of decreasing foreign capital inflows. The currency depreciation could not stimulate the domestic product growth because of the low external demand, the simultaneous devaluation of the competitor's currencies, as well as the increasing proportion of imports in exported products. In these circumstances, the capital account diminution had a substantial recessionistic effect. The simultaneous action of the two causes – export and foreign capital – does not allow for a distinction between their contributions. Starting with the end of 2010, the correlation of the two indicator trends occurred again.

Figure 2: Actual Δ GDP(t), and Δ GDP(t) estimated by MCI5(t-1), 2000 - 2011



Source: Own calculations, based on IMF and Eurostat data, using EViews.

The coefficients of the MCI component variables and the GDP response to shocks show the capacity of the financial conditions to predict the macroeconomic evolution. Thus, it confirms the essential role of interest rate, credit and exchange rate in this respect, which reveals the importance of monetary policy measures for stimulating domestic/external demand and preserving economic stability. The best performing MCI is that with a decisive contribution of the exchange rate (Annex 6), which confirms the contribution of depreciation to the GDP growth.

4. Conclusions

The monetary condition index computed in this chapter aimed to synthesize the actions of three monetary variables (interest rate, credit and exchange rate) on the GDP variation. Very often, such attempts fail, for several reasons. The first one is the multitude of financial variables affecting the output, having more and more indirect influence because of the increasing complexity of the financial market. An index incorporating only three variables cannot cover all financial shocks that deviate the GDP from the trend. The second reason is that the influence intensity of various financial indicators changes over time, and this dynamics cannot be revealed by an MCI. An ideal way is to adjust it periodically, and calibrated for as short periods of time as possible. The problem is that analyses based on a large number of variables in a short period of time are affected by inaccurate estimates. The third reason is that the financial variable shocks influence the domestic product at different speeds. Averaging one variable effects for a certain number of periods (quarters, etc.) in the IRF produce quite a distorted picture of the impact of that indicator. Finally, qualitative variables such as unrealistic positive expectations of future incomes (which cause overconsumption and speculative bubbles) or risk aversion (which significantly diminishes during “boom” periods) will never be quantified in mathematical formulas.

For EE countries, an important target of further research on the interaction of the financial economy and the real one is the inclusion of some variables able to capture external shocks. Also, comparative analyses of the financial variable influence by country could allow us to clearly define the role of external shocks as well as to identify the best monetary policy practice.

BIBLIOGRAPHY

1. Bjørnland, H.C. (2008) – "*Monetary Policy and Exchange Rate Interactions in a Small Open Economy"*, *The Scandinavian Journal of Economics* 110(1), p. 201.
2. Boivin, J., Kiley, M.T., Mishkin, F. (2010) – *How Has the Monetary Transmission Mechanisms Evolved over Time?* NBER Working paper15879, April, pp. 1-27.
3. Brooks, C. (2008) – *Introductory econometrics for Finance*, second edition, Cambridge University Press, pp. 301.
4. Codirlaşu, A. (2008) – *Econometrie aplicată utilizând EViews 5.1. Note de curs*, ASE – Catedra de Monedă, Octombrie, pp.1-124.
5. Cozmâncă, B.O. (2000) – "*Mecanisme de transmisie a politicii monetare*", lucrare de dizertaţie ASE, Şcoala Doctorală de Finanţe-Bănci (DOFIN), pp. 30.
6. Croitoru, L., Târhoacă, C. (2001) – "*Indicele condiţiilor monetare: un indicator al politicii monetare în România*", CEROPE, http://www.cerope.ro/pub/study32ro.htm.
7. Dumitru, I. (2002) – "*Cererea de bani în România*", lucrare de dizertaţie ASE, Şcoala Doctorală de Finanţe-Bănci (DOFIN), pp. 12-43.
8. English, W., Tsatsaronis, K., Zoli, E. (2005) – "*Assessing the predictive power of measures of financial conditions for macroeconomic variables*", BIS Working paper No. 22, April, pp. 228-252.
9. Gauthier, C., Graham, C., Liu, Y. (2004) – "*Financial Condition Indexes for Canada*", Bank of Canada Working Paper 2004-22, pp. 6.
10. Goodhart, C., Hofmann, B. (2001) – "*Asset Prices, Financial Conditions, and the Transmission of Monetary Policy*", Paper prepared for the conference on "Asset prices, Exchange Rates, and Monetary Policy", Stanford University, March 2-3, pp. 1-33.
11. Hatzius, J., Hooper P., Mishkin F. et al. (2010) – "*Financial Condition Index: A Fresh Look after the Financial Crisis*", NBER Working Paper 16150, July, pp. 9-10.
12. Jääskelä, J. (2007) - *More Potent Monetary Policy? Insights from a Threshold Model*, Reserve Bank of Australia, Research Discussion Paper No 2007-07, pp. 13.
13. Lu, C., Xin, Z. (2010) – *Impulse-Response function Analysis: An application to macroeconomic data of China*, D-Level Essay in Statistics for M.S. Degree, School of Economics and Social Sciences, Hoskolan Dalarna, pp. 1-18.
14. Osborne-Kinch, J., Holton, S. (2010) – *A Discussion of the Monetary Condition Index,* Central Bank of Ireland Quarterly Bulletin 01/ January, pp. 68-79.
15. Österholm, P. (2009) – *The Effect on the Swedish Real Economy of the Financial Crisis*, Working Paper No 110 of National Institute of Economic Research of Sweden, pp. 1-24.
16. Pecican, E. (2007) – *Econometria pentru ... economişti*, ediţia a treia, Editura Economică, Bucureşti, pp. 1-368.
17. Pelinescu, E. (2012) – *Transmission Mechanism of Monetary Policy in Romania. Insights into the Economic Crisis*, Romanian Journal of Economic Forecasting no.3, pp. 5-18.
18. Stock, J.H., Watson, M.W. (2002) – *Macroeconomic forecasting using diffusion indexes,* Journal of Business & Economic Statistics, 20(2), pp. 147-162.
19. Swiston, A. (2008) – *A U.S. Financial Condition Index: Putting Credit Where Credit is Due*, IMF Working Paper 161, July, pp. 7.
20. Ţepuş, A.M. (2012) – *Ipoteza Wagneriană din perspectiva economiei româneşti*, Economie Teoretică şi Aplicată nr.8, pp. 108-124.

Annex 1

Variables used during the selection process

Factor	Definition
Δ_GDP	Real GDP growth rate (%)
Δ_IR3	Three-month interbank interest rate, differentiated (% per year)
Δ_IR6	Six-month interbank interest rate, differentiated (% per year)
Δ_IR12	Twelve-month interbank interest rate, differentiated (% per year)
R_IR3	Real three-month interbank interest rate (% per year)
R_IR6	Real six-month interbank interest rate (% per year)
R_IR12	Real twelve-month interbank interest rate (% per year)
Δ_LR	Lending interest rate, differentiated (% per year)
Δ_DR	Deposit interest rate, differentiated (% per year)
R_LR	Real lending interest rate (% per year)
R_DR	Real deposit interest rate (% per year)
Δ_M1	M1 growth rate (%)
Δ_M2	M2 growth rate (%)
ΔR_M1	M1 real growth rate (%)
ΔR_M2	M2 real growth rate (%)
Δ_PCR	Domestic bank debt growth rate for the private sector (%)
ΔR_PCR	Real domestic bank debt growth rate for the private sector (%)
Δ_TD	Total deposit growth rate (%)
Δ_DD	Demand deposit growth rate (%)
Δ_TD	Term deposit growth rate (%)
ΔR_TD	Real total deposit growth rate (%)
ΔR_DD	Real demand deposit growth rate (%)
ΔR_DT	Real term deposit growth rate (%)
Δ_NEX	Nominal exchange rate growth (county currency / euro), %
Δ_ENEX	Effective nominal exchange rate growth (foreign/country currency), %
Δ_EREX	Real effective exchange rate growth (growth = appreciation), %

Annex 2

Stationarity tests, period: Q3.1999 – Q2.2008

Factor	ADF Test	Critical value (5%)	PP Test	Critical value (5%)	Constant (C), Trend (T)
Δ_GDP	-3.84	-2.95	-3.59	-2.95	C
Δ_IR3	-6.90	-2.95	-6.49	-2.95	C
Δ_IR6	-5.29	-2.95	-5.29	-2.95	C
Δ_IR12	-4.49	-2.95	-4.46	-2.95	C
R_IR3	-5.10	-3.56	-4.70	-3.54	C, T
R_IR6	-5.02	-3.56	-4.45	-3.54	C, T
R_IR12	-4.70	-3.56	-4.17	-3.54	C, T
Δ_LR	-6.43	-2.95	-6.42	-2.95	C
Δ_DR	-4.21	-2.95	-4.32	-2.95	C
R_LR	-3.48	-2.95	-3.55	-2.95	C
R_DR	-3.49	-2.96	-3.96	-2.95	C
Δ_M1	-6.28	-2.95	-6.41	-2.95	C
Δ_M2	-5.72	-2.95	-5.74	-2.95	C
ΔR_M1	-6.21	-3.60	-9.58	-3.55	C, T
ΔR_M2	-5.43	-3.54	-5.43	-3.54	C, T
Δ_PCR	-4.68	-3.54	-4.59	-3.54	C, T
ΔR_PCR	-3.91	-3.54	-3.75	-3.54	C, T
Δ_TD	-6.77	-2.95	-6.75	-2.95	C
Δ_DD	-5.32	-2.95	-5.60	-2.95	C
Δ_TD	-5.55	-2.95	-5.55	-2.95	C
ΔR_TD	-6.50	-3.54	-6.49	-3.54	C, T
ΔR_DD	-5.12	-3.54	-6.63	-3.54	C, T
ΔR_DT	-4.70	-2.95	-4.80	-2.95	C
Δ_NEX	-3.56	-2.95	-3.65	-2.95	C
Δ_ENEX	-4.43	-3.54	-4.43	-3.54	C, T
Δ_EREX	-4.50	-2.95	-4.48	-2.95	C

Source: Own calculation using EViews, based on IMF – International Financial Statistics and Eurostat.

Annex 3

Results of regression ΔYt in relation to financial variables for a lag n=4 (equation 3). Period: Q3.1999 – Q2.2008

Factor Xi	R^2	Adj. R^2	F	AIC	Obs.
Δ_IR3	0.51	0.33	2.88	2.66	31
Δ_IR6	0.51	0.33	2.82	2.67	31
Δ_IR12	0.44	0.23	2.12	2.81	31
R_IR3	0.41	0.19	1.88	2.86	31
R_IR6	0.43	0.22	2.07	2.82	31
R_IR12	0.42	0.21	1.98	2.83	31
Δ_LR	0.46	0.26	2.31	2.77	31
Δ_DR	0.46	0.26	2.30	2.77	31
R_LR	0.31	0.06	1.23	3.01	31
R_DR	0.33	0.09	1.36	2.97	31
Δ_M1	0.20	-0.10	0.67	3.16	31
Δ_M2	0.42	0.22	2.03	2.82	31
ΔR_M1	0.24	-0.04	0.85	3.11	31
ΔR_M2	0.25	-0.03	0.91	3.09	31
Δ_PCR	0.50	0.26	2.11	2.88	26
ΔR_PCR	0.62	0.44	3.48	2.60	26
Δ_TD	0.38	0.15	1.67	2.90	31
Δ_DD	0.21	-0.07	0.74	3.14	31
Δ_TD	0.46	0.26	2.31	2.77	31
ΔR_TD	0.21	-0.07	0.74	3.14	31
ΔR_DD	0.27	0.00	1.01	3.07	31
ΔR_DT	0.24	-0.03	0.89	3.10	31
Δ_NEX	0.22	-0.05	0.79	3.12	31
Δ_ENEX	0.26	-0.02	0.94	3.08	31
Δ_EREX	0.16	-0.14	0.53	3.20	31

Source: Own calculations using EViews, based on IMF – International Financial Statistics and Eurostat.

Annex 4

Granger causality tests. Dependent variable: ΔYt. Period: Q3.1999 – Q2.2008

	Lag = 1		Lag = 2		Lag = 3		Lag = 4		Lag = 5	
Factor	**F**	**p**	**F**	**p**	**F**	**p**	**F**	**p**	**F**	**p**
Δ_IR3	6.02868	**0.01988**	1.19653	0.31723	2.32896	0.09876	4.55551	**0.00784**	2.17938	0.09957
Δ_IR6	6.83118	**0.01370**	1.67666	0.20523	2.87988	0.05596	4.44705	**0.00874**	2.15938	0.10210
Δ_IR12	6.15885	**0.01870**	1.58276	0.22324	2.19628	0.11352	3.19531	**0.03269**	1.82523	0.15594
R_IR3	2.10352	0.15700	9.07464	**0.00092**	5.06268	**0.00708**	2.76718	0.05290	1.66638	0.19109
R_IR6	2.09942	0.15740	9.65356	**0.00065**	5.36408	**0.00544**	3.10152	**0.03628**	1.75579	0.17041
R_IR12	1.74854	0.19573	8.67043	**0.00117**	4.57257	**0.01098**	2.94371	**0.04330**	1.74404	0.17300
Δ_LR	8.95339	**0.00539**	0.51229	0.60463	3.88017	**0.02092**	3.53694	**0.02251**	1.76784	0.16781
Δ_DR	7.41988	**0.01050**	2.09523	0.14192	3.79931	**0.02260**	3.52102	**0.02290**	1.49799	0.23715
R_LR	0.68438	0.41441	4.33355	**0.02293**	2.42729	0.08912	1.59974	0.20976	3.15503	**0.03065**
R_DR	0.09655	0.75808	4.37982	**0.02213**	3.44561	**0.03183**	1.84572	0.15604	1.54686	0.22275
Δ_M1	1.55993	0.22102	0.45472	0.63923	0.41003	0.74718	0.60167	0.66542	1.31170	0.30088
Δ_M2	5.20150	**0.02960**	1.29011	0.29110	0.79086	0.51044	3.04024	**0.03885**	2.29300	0.08639
ΔR_M1	5.18696	**0.02981**	0.71298	0.49887	0.94951	0.43176	0.91907	0.47051	1.77812	0.16562
ΔR_M2	0.04386	0.83548	1.78585	0.18623	0.78829	0.51181	1.03069	0.41359	1.32439	0.29606
Δ_PCR	3.30250	**0.07952**	4.28091	**0.02519**	3.37875	**0.03744**	3.34433	**0.03414**	1.71720	0.19994
ΔR_PCR	5.57830	**0.02511**	3.81004	**0.03595**	3.16188	**0.04592**	5.80210	**0.00392**	2.06365	0.13580
Δ_TD	7.40720	**0.01056**	1.88688	0.17031	1.01583	0.40229	2.38299	0.08249	1.81699	0.15759
Δ_DD	3.63111	0.06602	0.98388	0.38641	0.71570	0.55189	0.73703	0.57668	1.63480	0.19899
Δ_TD	11.4558	**0.00195**	2.89181	0.07216	1.63781	0.20590	3.52515	**0.02280**	2.36700	0.07881
ΔR_TD	0.24108	0.62688	0.90575	0.41576	0.39987	0.75428	0.73889	0.57552	1.14749	0.37021
ΔR_DD	6.20920	**0.01827**	1.26908	0.29677	0.90982	0.45035	1.20387	0.33725	2.05156	0.11696
ΔR_DT	2.55156	0.12033	1.98371	0.15643	0.77442	0.51927	0.99099	0.43312	1.38156	0.27525
Δ_NEX	0.98330	0.32906	0.02667	0.97371	0.37078	0.77475	0.82404	0.52390	1.44845	0.25269
Δ_ENEX	0.74811	0.39372	0.08971	0.91446	0.66032	0.58418	1.09298	0.38449	1.49022	0.23952
Δ_EREX	0.43923	0.51239	0.48180	0.62269	0.47477	0.70265	0.35825	0.83552	0.99871	0.44500

Note: Indicated probabilities p below the usual significance level of 0.05, which implies a causality between that factor and ΔY.

Source: Own calculations using EViews, based on IMF – International Financial Statistics and Eurostat.

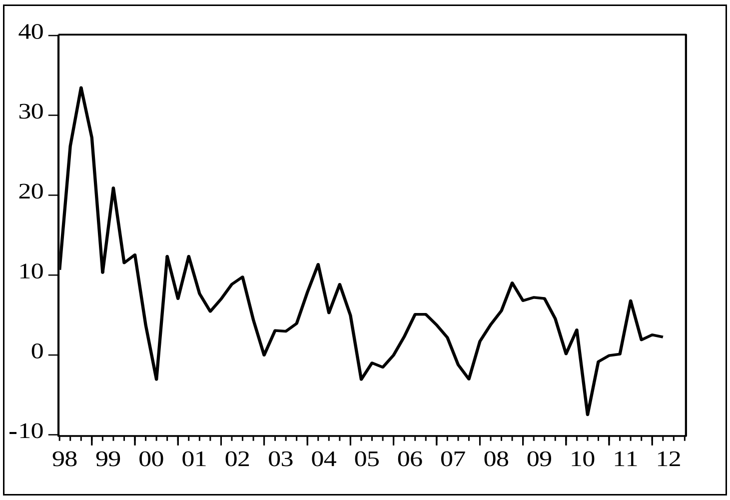
Annex 5

GDP growth rate* (%)

* The GDP series used to compute the growth rate were first seasonally adjusted.

Source: Own calculation based on IMF – International Financial Statistics.

Real three-month interbank interest rate* (%)



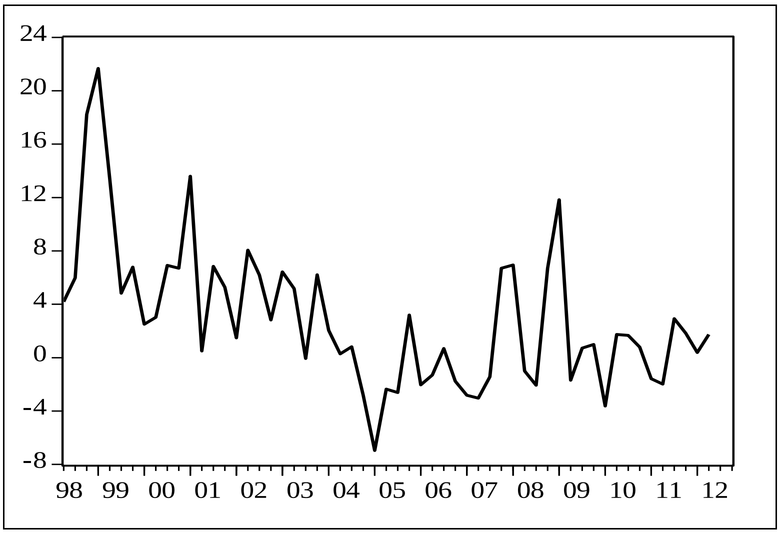
* Seasonally adjusted data.

Source: Own calculations based on Eurostat data.

Real private credit growth rate (%)

Source: Own calculations based on IMF – International Financial Statistics.

Nominal exchange rate growth* (%)



Source: Own calculations based on IMF – International Financial Statistics

* National currency / euro, growth = currency apreciation.

Annex 6

Coefficients of financial variables of MCI, using different orderings for Cholesky decomposition

MCI	Periods considered in IRF	Coefficients of variables, using different orderings		
		(1) *R_IR3*	**(2) *ΔR_PCR***	**(3) *Δ_NEX***
MCI 1	3	-0.142	0.127	0.092
MCI 2	4	-0.089	0.111	0.062
MCI 3	5	-0.146	0.070	0.019
		(2) *R_IR3*	**(3) *ΔR_PCR***	**(1) *Δ_NEX***
MCI 4	3	-0.116	0.086	0.154
MCI 5	4	-0.070	0.082	0.111
MCI 6	5	-0.144	0.071	0.033
		(1) *R_IR3*	**(3) *ΔR_PCR***	**(2) *Δ_NEX***
MCI 7	3	-0.142	0.086	0.130
MCI 8	4	-0.089	0.082	0.097
MCI 9	5	-0.146	0.072	0.007

Source: Own calculations using EViews.

Note: The order within the IRF is in brackets before the variable.

Regression results* Δ_GDP = f (MCI)

MCI	R^2	F	t test**	DW	AIC	No. obs.
MCI 1	0.34	23.54	4.85	1.79	3.37	47
MCI 2	0.35	24.20	7.92	1.85	3.36	47
MCI 3	0.32	21.74	4.66	1.55	3.39	47
MCI 4	0.23	13.85	3.72	1.55	3.52	47
MCI 5	0.37	26.33	5.13	1.81	3.33	47
MCI 6	0.33	21.93	4.68	1.58	3.39	47
MCI 7	0.27	17.01	4.12	1.61	3.47	47
MCI 8	0.29	18.66	4.32	1.71	3.44	47
MCI 9	0.33	21.84	4.67	1.53	3.39	47

* I eliminated two extreme values of Δ_GDP, from equations corresponding to Q1.2001 and Q1.2009.

** t test corresponding to the MCI coefficient.

Source: Own calculations using EViews.