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Estimation of weights for the monetary conditions index in Albania

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Discussion:
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Editorial

On 19-21 November 2009, the Bank of Greece co-organised with the Bank of Albania the 3rd Annual South Eastern European Economic Research Workshop held at its premises in Athens. The 1st and 2nd workshops were organised by the Bank of Albania and took place in Tirana in 2007 and 2008, respectively. The main objectives of these workshops are to further economic research in South Eastern Europe (SEE) and extend knowledge of the country-specific features of the economies in the region. Moreover, the workshops enhance regional cooperation through the sharing of scientific knowledge and the provision of opportunities for cooperative research.

The 2009 workshop placed a special emphasis on three important topics for central banking in transition and small open SEE economies: financial and economic stability; banking and finance; internal and external vulnerabilities. Researchers from central banks participated, presenting and discussing their work.

The 4th Annual SEE Economic Research Workshop was organised by the Bank of Albania and took place on 18-19 November 2010 in Tirana. An emphasis was placed upon the lessons drawn from the global crisis and its effects on the SEE macroeconomic and financial sectors; adjustment of internal and external imbalances; and the new anchors for economic policy.

The papers presented, with their discussions, at the 2009 SEE Workshop are being made available to a wider audience through the Special Conference Paper Series of the Bank of Greece.

Here we present the paper by Oriela Kodra (Bank of Albania) with its discussion by Michael Loufir (National Bank of Greece).

February, 2011

Altin Tanku (Bank of Albania)
Sophia Lazaretou (Bank of Greece)
(on behalf of the organisers)

ESTIMATION OF WEIGHTS FOR THE MONETARY CONDITIONS INDEX IN ALBANIA

Oriela Kodra
Bank of Albania

ABSTRACT

The Monetary Conditions Index is used as an indicator of the orientation of monetary policy. Monetary conditions represent the combined effect of the interest rates and the exchange rate on the economy. This study aims at assessing the relative weights of the real interest rates and the real exchange rate in the case of Albania. The methodology is based on OLS estimation and considers quarterly data for the period 1998Q1–2008Q4. The new ratio derived from these weights is equal to 3.8, which implies that the effect of an appreciation of the real exchange rate by 3.8 percentage points may be neutralized by one percentage point increase in the real interest rate.

Keywords: monetary conditions index, exchange rates, interest rates, least squares.

JEL Classifications: C22, E52, E59.

Acknowledgments: Special thanks are due to the participants of the 3rd SEE Economic Research Workshop, Athens, 19-21 November 2009, and especially to my discussant Michael Loufir who put time and effort to read and discuss the paper.

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1. Introduction

The Monetary Conditions Index (MCI) was first introduced by the central bank of Canada (see Freedman 1995). Thereafter, many banks and international institutes used this index as a mechanism to interpret the orientation of monetary policy and the effect it has on the economy. The MCI is calculated as the linear combination of the variables which represent the main channels of the transmission of monetary policy in an open economy, namely the real interest rate and the real effective exchange rate where the coefficients represent their relative effects on aggregate demand. This index has as an object is to give information about monetary conditions. Explicitly, it considers both changes in interest and exchange rates, expressed in real terms. It is a weighted average of these two indicators and can be used to determine whether monetary conditions in any economy have been "loosened" or "tightened". It summarizes in a single number the pressure that monetary policy is exercising at any point in time on the economy and, therefore, on inflation.

Through the interest rate and the exchange rate, monetary policy can affect both economic activity and inflation. Loose monetary conditions are expected to support economic growth, while growth is not supported in neutral monetary conditions. It should be noted that the components of the monetary conditions index do not necessarily affect the economy in the same direction. For example, the exchange rate can be estimated as "loosened" and the interest rate as "tightened", and *vice versa*. To determining monetary conditions, the interest rate plays a crucial role, while the exchange rate responds to the interest rate: lower interest rates in a given period tend to bring in low returns on local currency and hence weaker exchange rates, and *vice versa*. Monetary policy affects inflation mainly through two channels, *via* the interest rate and the exchange rate. An increase in either variable causes a slowdown in growth and a decline in inflationary pressures. In a similar way, a decrease in the interest rate or the exchange rate stimulates the economy and can lead to higher inflationary pressures. Hence, the aim of the construction of the MCI is to consider both channels.

The MCI, at time *t*, is determined as the weighted sum of changes in the interest rate (*i*) and the exchange rate (*e*) from their levels in a base year (*t=0*), and can be written as:

$$MCI = \theta_i (i - i_b) + \theta_e (e - e_b) \quad (1)$$

where, θ_i and θ_e ar, the weights of the interest rate and the exchange rate, respectively.

According to Tase (2006), in the case of Albania, the Monetary Conditions Index (MCI) is the weighted average of changes in the base interest rate (REPO) and the nominal effective exchange rate of LEK (NEER) relative to a base period. The ratio of this index was estimated at 1.82:1, meaning that the effect of a depreciation of the exchange rate of 1.82 percentage points can be offset by one percentage point increase in the interest rate. The base period of the estimated of MCI was September 2000.

The estimate of the ratio of the Monetary Conditions Index in the case of Albania was made through calibration based on IMF (2004). Such an approach is rather indirect and not quite precise. Hence, following the need for a new method and given greater data availability, in this paper we try to calculate the average weights of the interest rate and the exchange rate. This methodology is based on the OLS estimation and considers quarterly data for the period 1998Q1–2008Q4. The new ratio derived is *3.8*, implying that the appreciation of the real exchange rate (REER) by 3.8 percentage points can be neutralized by one percentage point increase in the interest rate.

The rest of the paper is organized as follows. Section 2 analyses the data set used taking into account the stationary properties of the time series. Section 3 presents the method applied for the construction of the MCI for Albania. Section 4 concludes.

2. Analysing the data

We first start analysing the stationary properties of the data set used. Then, the short-run dynamics of aggregate demand are estimated by least squares. Finally, the weights obtained by this equation are used in constructing the MCI for Albania. The

analysis is performed using quarterly data covering the period from 1998Q1 to 2008Q4. Some of the variables are in logs.

The data considered are the following:

- REER; the effective exchange rate of the LEK based on foreign and domestic CPI (Consumer Price Index)
- TB_3; the three-month treasury bill rate
- TB_6; the six-month treasury bill rate
- TB_12; the twelve-month treasury bill rate;
- INF; the inflation rate
- GDP;
- GAP; the output gap measured as the percentage deviation of the real GDP from its potential value.

Initially, unit root tests are conducted for each of these variables. These tests show that for inflation, the null hypothesis can be rejected at the 5 per cent level but it cannot be rejected for the Treasury bill rates and the effective exchange rate. In contrast, the unit root hypothesis is rejected at the 5 per cent level taking the first difference of the Treasury bill rates and the effective exchange rate. Hence, we conclude that the variables are integrated of order one. On the basis of the unit root tests, the coefficients of the Treasury bill rates and the exchange rate are thus estimated by least squares. In the regression equation the output gap is considered the dependent variable. The coefficients derived from this estimation are presented in Tables 1-3 in the appendix at the end of the paper. In all cases that we examine, the adjusted R-squared takes a high value that is equal to 0.830, 0.853 and 0.853. This result implies that a high percentage of the variation in the dependent variable may be explained by the explanatory variables considered. The high level of the *F-statistic* also confirms the importance of the model. The *DW-statistic* values are within the range 2 with a variation of +/- 0.2. Therefore, we can conclude that the model is statistically significant.

Using the estimated coefficients we derive three different ratios for the Monetary Conditions Index, for the three-, six- and twelve-month Treasury bill rates, equal to -2.163, -4.967 and -4.277, respectively. Thereafter, we compute the simple mathematical average of these three ratios to obtain -3.8. Finally, we get the new ratio of the Monetary Conditions Index multiplying this value by -1, since a numerical increase in the REER indicates a depreciation of the LEK. Therefore, the ratio of this index derived by the new methodology is equal to *3.8*.

3. The monetary conditions index for Albania

For the construction of the Monetary Conditions Index (MCI) for Albania, monthly data are used for the period from January 1996 to September 2009. The base period of the estimation of the MCI is January 1996. The real Monetary Conditions Index is defined as:

$$\mathbf{MCI = (Real\_TB - Real\_TB_{(base)})*3.8 + (\log(REER) - \log(REER)_{(base)}) + 100} \quad (2)$$

where:

- Real_TB is the real Treasury bill rate
- $Real\_TB_{(base)}$ is the real Treasury bill rate at the base year
- REER is the Real Effective Exchange Rate
- $(REER)_{(base)}$ is the Real Effective Exchange Rate at base year
- 3.8 represents the value obtained from the ratio between the coefficients of the real Treasury bill rates and the coefficients of the real effective exchange rate.

An increase in the MCI indicates a tightening of the monetary conditions. By contrast, a decrease indicates an easing of the monetary conditions relative to the base year. In the case of Albania, the MCI ratio is equal to 3.8, implying that the effect of a depreciation of the exchange rate by 3.8 percentage points is offset by one percentage point increase in the interest rate. Figures 1-2 in the appendix indicate the evolution over time of the MCI over the period from January 2006 to September 2009 and its comparison with the real effective exchange rate and the real Treasury bill rate. During 2007 and till the third quarter of 2008 monetary activity had shown significant tightening

in contrast to the average term prevailed over the last 15 years. This development was largely affected due to the corresponding exchange rate strengthens, which can be described as a less favourable economic condition. Fluctuations in interest rates have not been an explanatory factor of monetary conditions. The beginning of the financial crisis is reflected in the tightening of monetary conditions. Real currency depreciation increases the volume of exports; it makes domestic goods more competitive abroad, stimulates an offsetting expansion in demand, and dampens the contraction in domestic economic activity. However, monetary conditions remain tight due to exchange rate appreciation and higher rates on Treasury bills.

We also construct another index, namely the Financial Conditions Index (FCI) based on the real lending rate and the real effective exchange rate. This index can be considered a measure of the domestic financial conditions and represents an attempt to capture the effect of the other channels of transmission of monetary policy. In fact, it includes the lending rate to analyse the effect of monetary policy implemented on the financial activity.

The real Financial Conditions Index in the case of Albania is defined as:

$$\mathbf{FCI = (Real\_LR - Real\_LR_{(base)})*3.8 + (log(REER) - log(REER)_{(base)}) + 100} \qquad (3)$$

where, Real_LR is the real lending rate and $Real\_TB_{(base)}$ is the real lending rate at the base year. It uses the same weights as the MCI. Figures 3-4 in the appendix plot the time trend of the FCI during the period from January 2006 to September 2009 and its comparison with the real effective exchange rate and the real lending rate. In contrast to the average value prevailed over the last 15 years, financial activity has shown tightening during 2007 and well till the third quarter of 2008. The wake of the financial crisis is accompanied by tightening financial conditions again, in conjuncture of the impact of the exchange rate volatility on international trade. After mid-2009, financial conditions have loosened due to the falling lending rate.

4. Conclusions

The Monetary Conditions Index (MCI) represents an operational tool in the conduct of monetary policy. This index evaluates the impact of monetary policy implemented by central banks on the evolution of the economic cycle. The MCI represents the combined effect of the interest rate and the exchange rate on the economy. This index is a weighted average of these two indicators. We also construct the Financial Conditions Index (FCI), which represents an attempt to capture the effect of monetary policy on financial activity. The real Treasury bill rate and the real effective exchange rate are used for constructing the MCI while the real lending rate is used for constructing the FCI.

Further, we estimate the ratio of the weights in the MCI proposing a new methodology based on least squares. The estimated value of the MCI ratio is found to be 3.868:1, which implies that the effect of a depreciation of the exchange rate by 3.8 percentage points is offset by one percentage point increase in the interest rate. The FCI uses the same weights as the MCI. Both indices give us additional information concerning monetary and financial conditions. In contrast to the average value of the indices prevailed over the last 15 years, monetary and financial activity in Albania, during 2007 and until the third quarter of 2008, has shown significant tightening. This development is chiefly attributed to the strengthening of the exchange rate. Fluctuations in the interest rates do not seem to be an important explanatory factor of the changes in monetary conditions. The beginning of the financial crisis is reflected into the tightening of monetary and financial conditions; monetary conditions in Albania remain tight due to an exchange rate appreciation and an increase in the Treasury bill rate. Nonetheless, after mid-2009, financial conditions have loosened due to falling lending rates.

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Appendix – Figures

Figure 1. MCI in comparison with REER and Real Interest Rates

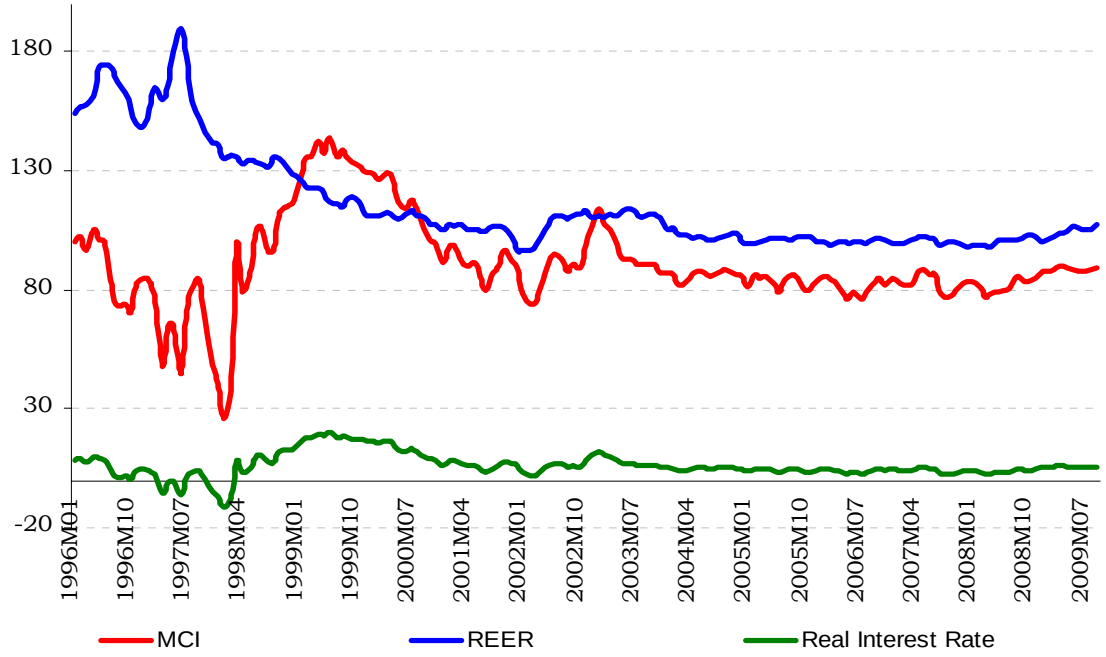


Figure 2. Monetary Conditions Index for the period 1996M01 - 2009M09

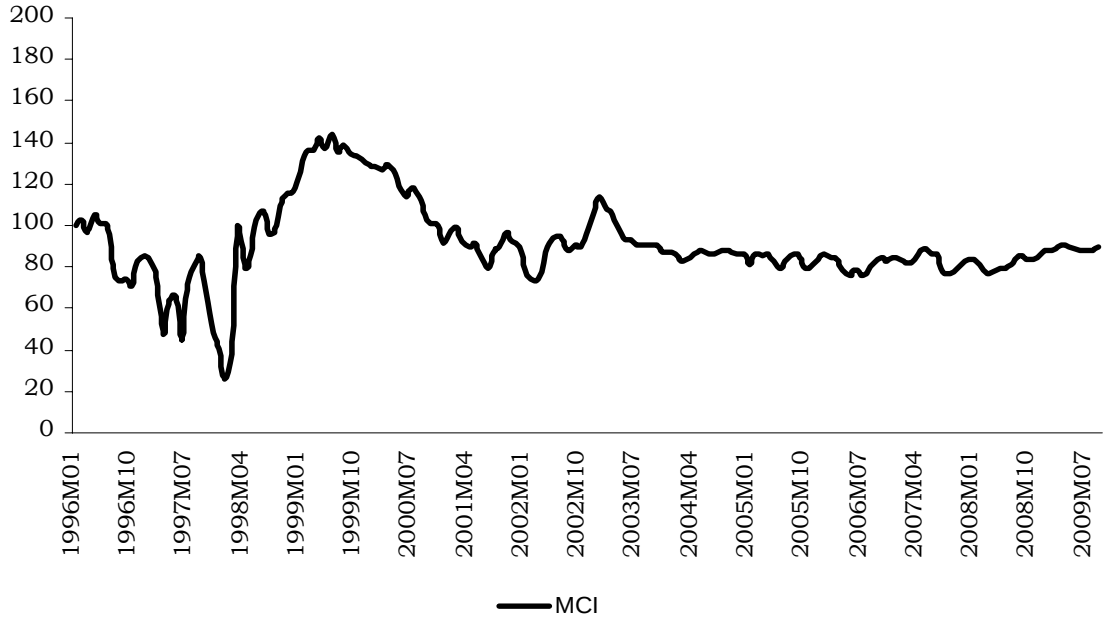


Figure 3. FCI in comparison with REER and Real Lending Rates

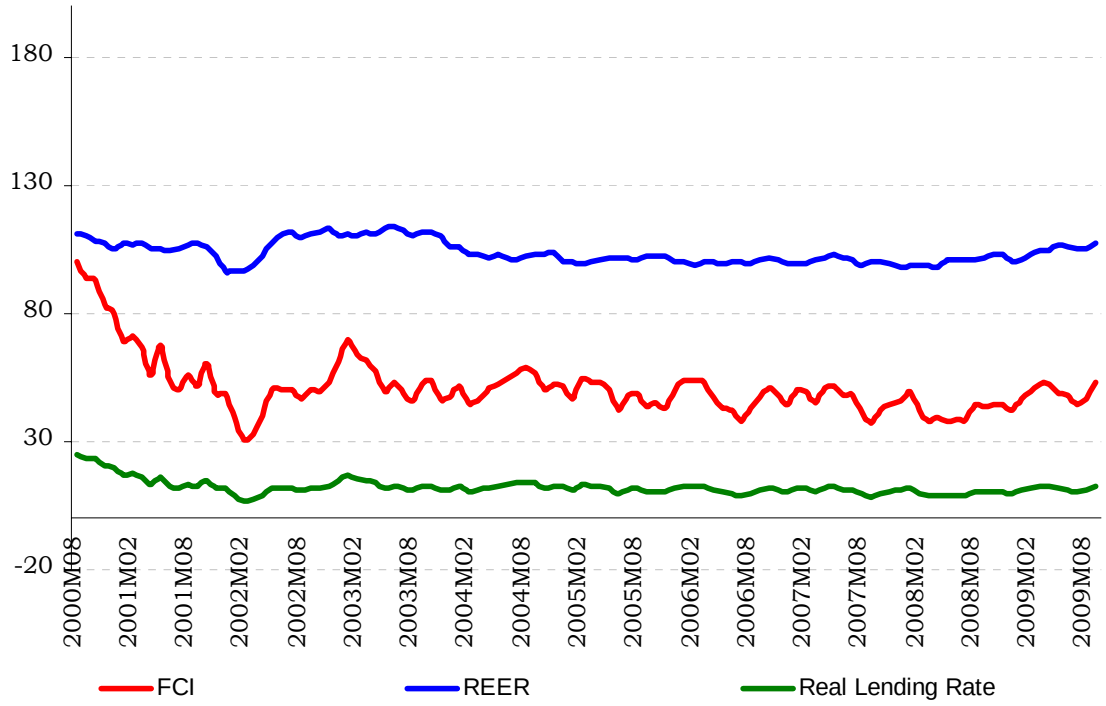
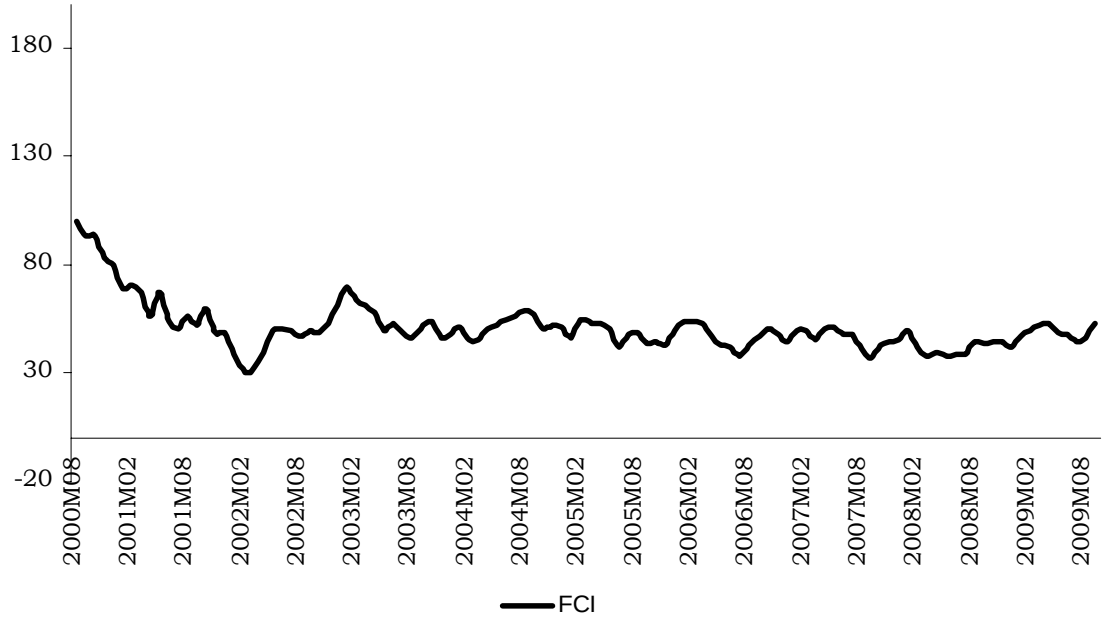


Figure 4. Financial Conditions Index for the period 2000M08 – 2009M09



Appendix – Tables

Table 1. OLS estimation based on the three-month Treasury bill rate

Dependent Variable: GAP				
Method: Least Squares				
Date: 07/19/10 Time: 13:24				
Sample: 1998Q1 2008Q4				
Included observations: 44				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(REER(-1))	0.169160	0.089161	1.897247	0.0654
D(BONO_3(-3))	-0.365834	0.178913	-2.044760	0.0479
D(INF(-5))	-0.306712	0.098075	-3.127334	0.0034
GAP(-1)	0.431393	0.107043	4.030080	0.0003
GAP(-4)	0.242004	0.095481	2.534581	0.0155
C	0.118298	0.312628	0.378400	0.7072
R-squared	0.830149	Mean dependent var		-0.620206
Adjusted R-squared	0.807800	S.D. dependent var		4.241113
S.E. of regression	1.859330	Akaike info criterion		4.204433
Sum squared resid	131.3701	Schwarz criterion		4.447732
Log likelihood	-86.49753	F-statistic		37.14506
Durbin-Watson stat	2.085663	Prob(F-statistic)		0.000000

Table 2. OLS estimation based on the six- month Treasury bill rate

Dependent Variable: GAP				
Method: Least Squares				
Date: 07/19/10 Time: 13:25				
Sample: 1998Q1 2008Q4				
Included observations: 44				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(REER(-1))	0.142869	0.081866	1.745158	0.0890
D(BONO_6(-3))	-0.709624	0.217751	-3.258882	0.0024
D(INF(-5))	-0.313903	0.090224	-3.479170	0.0013
GAP(-1)	0.352671	0.104923	3.361232	0.0018
GAP(-4)	0.324855	0.094929	3.422080	0.0015
C	-0.014647	0.295709	-0.049531	0.9608
R-squared	0.852644	Mean dependent var		-0.620206
Adjusted R-squared	0.833255	S.D. dependent var		4.241113
S.E. of regression	1.731834	Akaike info criterion		4.062363
Sum squared resid	113.9715	Schwarz criterion		4.305661
Log likelihood	-83.37198	F-statistic		43.97575
Durbin-Watson stat	2.020142	Prob(F-statistic)		0.000000

Table 3. OLS estimation based on the twelve- month Treasury bill rate

Dependent Variable: GAP				
Method: Least Squares				
Date: 07/19/10 Time: 13:27				
Sample: 1998Q1 2008Q4				
Included observations: 44				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(REER(-1))	0.163905	0.079557	2.060221	0.0463
D(BONO_12(-3))	-0.701024	0.214230	-3.272287	0.0023
D(INF(-5))	-0.322242	0.089914	-3.583895	0.0009
GAP(-1)	0.354044	0.104591	3.385021	0.0017
GAP(-4)	0.316702	0.093331	3.393307	0.0016
C	-0.005670	0.294503	-0.019251	0.9847
R-squared	0.852909	Mean dependent var		-0.620206
Adjusted R-squared	0.833555	S.D. dependent var		4.241113
S.E. of regression	1.730277	Akaike info criterion		4.060564
Sum squared resid	113.7666	Schwarz criterion		4.303862
Log likelihood	-83.33240	F-statistic		44.06862
Durbin-Watson stat	1.991964	Prob(F-statistic)		0.000000

Discussion

Michael Loufir[1]
National Bank of Greece

Kodra's paper is the second attempt by the Bank of Albania to estimate the best weights for the monetary conditions index (MCI), which could be used as i) a monetary policy rule, ii) an operational target for monetary policy and/or iii) an indicator measuring how "tight" or "loose" monetary conditions are.

My comments will follow five standard steps of the econometric modelling process, namely: i) model specification; ii) data collection and processing; iii) model estimation; iv)model validation; and v) model use. For each step, I will present the weaknesses and eventually suggest how they could be addressed. At the end, I will present the National Bank of Greece's MCI for Albania, based on an alternative methodology.

i) Model specification: A single equation model is derived from the "IS curve" and an econometric approach is used to estimate the "best" MCI ratio. The explained variable of the "IS curve" is the output gap and the explanatory variables are the output gap of the previous period, the first difference of the nominal TB rate, the first difference of the inflation rate, and the first difference of the real effective exchange rate. Note that the policy rate (1-week repo rate) would have been the best choice in view of this study (rather than the TB rate).

This specification obviously tries to overcome the problems that could arise from the properties of the "IS curve" model (i.e. non stationarity); but it is not homogeneous. We suggest here an Error Correction Model, which not only combines the short-term dynamics with the long-term equilibrium of the explained variable, but also rules out problems of heterogeneity and undesirable properties of the variables.

ii) Data collection and processing: the cointegration of the variables of the selected specification is not tested.

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iii) Model estimation: The OLS method is used to estimate the coefficients of the "IS curve". Here, both the estimates of the coefficients and the standard statistical tests would be inappropriate. Hence, the errors of the estimation should not satisfy the standard properties.

iv) Model validation: The standard battery of tests is omitted:

a) tests of autocorrelation, heteroskedasticity, and normality of the residuals are omitted, which make the estimates of the coefficients and the testing of their statistical significance irrelevant.
b) a test of stability of the coefficients is needed, as well;
c) a test of confidence should also be conducted for the MCI ratio.

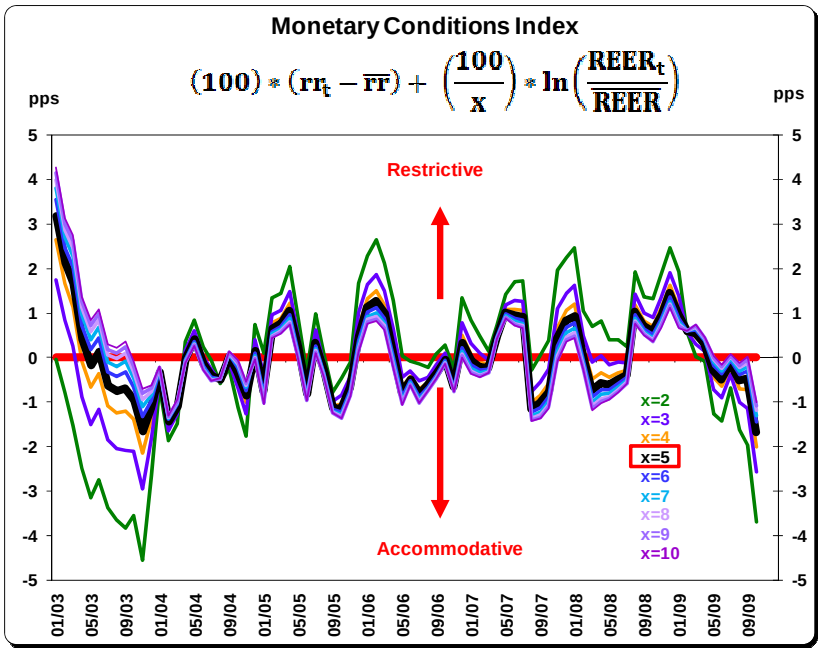
Furthermore, the *DW-statistic* used by the author, in the context of the statistical validation, is not appropriate, as the lagged dependent variable is an explanatory variable. In this case, the *H-statistic* is adequate.

v) Model use: The "new" MCI neither traces closely the pace of the monetary policy stance over the period under review nor shows the unprecedented loosening initiated by the Bank of Albania in early-January 2009 (see Figure 1).

All said, there is a dire need to review the first 4 steps of the econometric modelling process to get an operational tool.

An alternative to the previous 2-step methodology, which is adequate in the case of lack of large samples and/or very volatile time series, consists in calibrating directly the coefficients of the MCI equation, according to the degree of openness of the country under review. This methodology is adopted by the National Bank of Greece to determine the "best" MCI ratio for Albania (see Figure 1). In contrast to those of the empirical literature, the NBG's specification calculates the changes of the real interest rate (policy rate) and the real effective exchange rate from their long-term averages rather than from their level in an arbitrary base point of time.

Figure 1


Monetary Conditions Index
$(100) * (rr_t - \overline{rr}) + \left(\frac{100}{x}\right) * \ln\left(\frac{REER_t}{\overline{REER}}\right)$
pps
pps
Restrictive
Accommodative
x=2
x=3
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x=5
x=6
x=7
x=8
x=9
x=10
5
4
3
2
1
0
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3. Kota, Vasilika "The Persistence of Inflation in Albania", including discussion by Sophia Lazaretou, February 2011.
4. Kodra, Oriela "Estimation of Weights for the Monetary Conditions Index in Albania", including discussion by Michael Loufir, February 2011.
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