Measuring credibility of monetary policy of the eurozone candidates: an application of a regime-switching autoregressive model

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Abstract

The paper studies the monetary policy credibility, transparency and structural reforms in the eurozone candidate countries. Credibility of monetary institutions is of particular relevance for the participation in a monetary union. High credibility lowers risk premium and attracts more foreign capital by delivering stable financial market expectations. The paper analyses the need of rules and flexiblity for monetary policy institutions before joining a monetary union. A trade-off appears when there is high uncertainty, structural differences and fixed criteria. We address the following two questions: i) which institutional mechanisms establish credible commitments and how they influence on the policy formation process; ii) what determines central bank's preferences and incentives. The paper highlights the importance of credibility in designing monetary policy for emerging economies. The final aim is to contribute to the debate on the optimal monetary institutional arrangements for the new EU member countries on the run up to EMU. We use Markov regime switching VAR model to estimate empirically the credibility of the non eurozone member central banks in comparison to the eurozone.

1 Introduction

Credibility of monetary policy rules has been studied extensively in the last decides. The research was encouraged by the monetary integration of the European Union. In addition, the benefits and the risks of alternative institutional arrangements for credible monetary policy were reassessed in view of several financial crises in the emerging markets.[1] New analytical instruments have been applied to improve institutional development and to help in understanding how institutional structure affects policy outcomes.[2]

Despite the abundance of theoretical models, only few studies have explored empirically the determination of output and inflation policy of countries on the run up to the monetary union. [3] None of these studies have attempted to explain the trade-off between inflation variability and output gap variability in Eastern Europe in comparison to the core EMU countries. The goal of this paper is to provide a formal and empirical link between the institutional arrangements (rules or monetary policy mechanisms) and the credibility of the central banks in the period prior to the monetary union. To test empirically credibility, we employ a Markov switching VAR model. Using monthly time series data from 1994 to 2004 we analyze the probability of changes in credibility as a function of inflation, output gap and the interest rate differential. In particular, the paper analyzes regime switching and hence differences in approaches between the central banks concerning the trade-off between stabilization of output variability or/and inflation variability. If preferences and approaches differ, a stronger pressure on ECB could be expected in the future once acceding countries join EMU.

In the real world, policy instruments are chosen sequentially, whereby the time-path of the monetary policy is determined on the basis of different political and economic incentives and preferences. Different members within

[1]The term "institutions" here is understood as formal and informal monetary policy mechanisms, rules or legal contracts with certain properties which central banks follow in order to ensure price stability and sustainable output growth

[2]Traditional analysis in macroeconomics studies how private agents respond to the choice of different policy rules and policy instruments. The new approach treats policy as endogenous, by specifying which are the policy-maker‘s objectives and constraints by borrowing methods from the game theory. The incentives of the policy maker affect economic policy choice and help in considering which policies are credible and politically feasible (for details see Persson-Tabellini, 1994)

[3]A notable exceptions are Mouratidis (2003) and Arestis and Mouratidis (2004) who evaluate the preferences of EMU central banks and the euro area as a whole, based on a state dependant Taylor types rules.

the union, as well as the new entrants may have different preferences about the conduct of the monetary policy. Asymmetries in the preferences reflect specific economic situation in different countries and might be due to higher inflation, unemployment or asymmetric shocks (*Kenen and Meade, 2003*). Once transition economies join the monetary union, the symmetric shocks will be dealt using union-wide monetary policy. The last might be inefficient to respond to idiosyncratic shocks or even to the aggregate shocks because of their relatively different impact. In addition, the ongoing structural reforms also require using the monetary policy as a stabilization tool. The more the economy embarks structural reforms, the more it is resilient to asymmetric shocks.

The paper studies different stages of credibility which monetary institutions pass through time, as the policy is perceived to be credible in some periods and not in others. We analyze the appropriate institutional arrangements which commit central banks to welfare increasing behavior. A set of credible arrangements are shown to reduce the costs related to future collective decisions in a monetary union. By emphasizing the role of the central banks and the role of the economic structure , the paper provides policy recommendations on the design of the monetary institutions in transition countries.

The paper is organized as follows: In section 2 we discuss the relevant literature on the monetary policy credibility. Section 3 empirically analyzes credibility of monetary policy using Markov regime switching VAR model. Section 4 outlines the key results of the model with respect to the preferences and the optimal institutional choice. Section 5 concludes.

2 Existing theoretical literature

2.1 Models of credibility [4]

The economic literature so far has not agreed upon a single definition of credibility. *Drazen and Masson (1993)* define it as the expectation that the announced policy (both desired and within policymakers ability) will be carried out in the future[5]. *Faust and Svensson* (2001) measure credibility

[4]Credibility problem has been profoundly studied in the monetary theory literature. Nevertheless, its basic arguments are crucial for the institutional arrangements and the current study cannot move on without mentioning them.

[5]The authors distinguish between the toughness of a poicy and the credibility of a policy maker. They assume that the policy maker type changes through time due to

as "the negative if the absolute value of the deviation of the inflation expectations from zero". In the present context, credibility is defined as the capacity of the policymakers to announce a policy which is trusted by the private agents, who base their current behavior on rational expectations.[6] Credibility problem arises from the sequential nature of the policy making - as the policy maker has incentives to deviate from the announced policy rule. The reason is that monetary arrangements cannot be made binding and the optimal conditions can change depending on the state of the world[7]. During the post war period, monetary authorities in many countries searched for an optimal balance between inflation and unemployment. Some succeeded in achieving lower inflation, but very often at the expense of higher short term unemployment. Economic literature explains these costs to the lack of credibility. In addition, monetary authorities gradually had chosen to use in a discretionary manner the interest rate as a policy instrument, instead of pre committing to certain monetary targets. This made the link between the monetary growth and the inflation unpredictable and resulted in higher inflation rates (for details see *Goodhart ,1993*). The idea to separate legal institutions and create autonomous central bank which main objective is to achieve price stability has been seen theoretically as a solution to the credibility problem. The procedure is to assign to the central bank certain loss function for minimization designed to bring the equilibrium under discretion closer to the optimal equilibrium under commitment[8].

The importance of credibility was first put forward by *Kydland and Prescott (1977)* in a seminal political economy model[9]. Their key result is that monetary policy should be based on rules rather than discretion, because discretion may result in the so called "inflation bias" (when the unconditional mean of inflation exceeds the target inflation).

Barro and Gordon (1983) extended the framework to a non-Markov trigger strategy equilibria to explain the stagflation experienced by many

"external circumstances". Though policies may make devaluation more likely if there is persistent effect on output and employment. Blinder (1999) defines credibility as "deeds are expected to match the words".

[6]This study measures credibility as the negative of the absolute value of the deviation of the inflation expectations from zero, see Cuckierman and Meltzer (1986) who call it "average credibility of announcements"

[7]Policy rules can always be abandoned or suspended and the central banker fired.

[8]The folk theorem states that there is a multiple equilibria in a repeated game with perfect information. Different institutional arrangements contribute to choosing unique equilibrium which improves upon the discretionary solution.

[9]Nobel prize laureats for 2004

countries in 1970s. They modelled the optimal central banking which involves a trade-off between credibility and flexibility and introduced the dynamic-inconsistency problem as an explanation of the positive inflation rates. Barro-Gordon model emphasizes the need of credible commitment which will minimize the incentive for surprise inflation. *Rogoff* extended model analyzes the preferences of the central banker, which may differ from those of the government. The objective function has quadratic form with linear constraints:

$$L_t = \frac{1}{2}\left[(1+\varepsilon)(\pi_t - \pi^*)^2 + \chi(y_t - y^*)^2\right]$$

and the optimal preferences for inflation are given by

$$\pi = \pi^* + \frac{\chi}{1+\varepsilon} y^* - \frac{\chi}{1+\varepsilon+\chi}\mu_t$$

where $0 < \varepsilon < \infty$. A larger weight (relative to society´s loss function) is assigned to inflation, because it is always optimal for the society to appoint a conservative central banker. Rogoff' s equilibrium is to appoint a central banker, who has stronger low inflation preferences. Later *Walsh (1995)* challenged this result by modelling a simple optimal contract between the central bank (as an agent) and the government (as a principle) where the difference is that the agent delegates power to a central banker with the same preferences. The last is being punished if the inflation exceeds the target (or awarded in the opposite case). He changed the central banker´s loss function to:

$$V = \frac{1}{2}\left[(1+\varepsilon)(\pi_t - \pi^*)^2 + \chi(y_t - y^*)^2\right] + \chi y^* \pi_t$$

where $c - \chi y^* \pi_t$ is a transfer which eliminates the inflationary bias and also enters central banker´s utility function. The optimal policy rule is given by

$$\pi_t = \pi^* - \frac{\chi}{1+\chi}\mu_t$$

The model achieves first best solution: optimal output stabilization and no inflation bias.

Svensson (1997) proposed another optimal solution by assigning an explicit inflation target to the central banker $\pi^b = \pi^* - \chi y^*$, which offsets the inflationary bias. The central bank loss function is given by

$$L_t = \frac{1}{2}\left[(\pi_t - \pi^b)^2 + \chi(y_t - y^*)^2\right]$$

He argues that it is possible to eliminate the inflation bias, without loosing flexibility and stabilization. His proposal for first-best institutional arrangement is a central bank with both an inflation target and output target equal to the potential output rate, rather than exceeding the potential output.

A final argument in the discussion is that establishing a targeting rule by higher inflation country can be viewed as an attempt to import credibility. In the view of this, pegging to euro is used to transfer credibility from union to non-union countries. Target zone exchange rate systems or currency pegs can be seen as enforcing credibility on behalf of the union central bank. The quadratic specification of the loss function implies that an equal weight is placed on the positive and negative deviations of inflation and output from the target. However, in contrast to the clear analytical tractability of such model, this may not be the case in practice. Specification like this is questionable implying that the central bank will be willing to accept any increase in output variance for a marginal decrease in inflation. There are losses of different order between positive and negative deviations of the state variable. As a consequence policy makers respond more aggressively to either inflation or output deviations [10]. A new strand of the literature (*Nobay and Peel*, *1998* and *Ruge-Murcia*, *2001*) studies central bank asymmetric preferences by Linex loss function in a Bayesian context. A deflationary bias emerges due to a stronger response to negative output (or positive inflation) deviations from the target. This suggests non-quadratic form of the loss function with the quadratic form as a special case:

$$L = \frac{e^{a(\pi-\pi^*)} - a\,(\pi - \pi^*) - 1}{a^2} + \phi\frac{e^{b(y-y^*)} - b(y - y^*) - 1}{b^2}$$

They deliver the non-conventional results that committed policy maker is not unambiguously preferred to his discretionary counterpart.

The behavior of the central bank raises the issue of the public's uncertainty in relation to the "'type" of central bank (see, *Backus and Driffill*

[10] Kahneman and Tversky (1979) argue that people tend to place more weight on future losses than on prospective gains in the decision process under uncertainty.

1985; *Ball*,1995).The 'type' is related to the preferences between inflation and output or to the ability to commit to rules. The central bank (government) has low reputation and her "self-perceived" type is not believed by the public In the finite horizon it always inflate with some probability, nevertheless sequential equilibrium might exist in the period before the last.

2.2 Main institutional features of the credibility argument

Credibility of future central bank policies requires combination of several institutional features closely related to its independence and accountability – operational targets, appointment procedures, duration of governors mandate, incentive schemes of the executives, structural reorganizations of supervisory systems, etc. The main goal is to establish a central bank which is both credible, yields low inflation and maintains enough flexibility to respond to shocks. That means it will be able to pursue socially optimal monetary policy. The academic debate so far could not reach uniform conclusion about an optimal institutional mechanism to enhance credibility. The three main monetary policy arrangements are related to the delegation to a conservative central banker with less weight on the output target. This incorporates a reputation cost as in the basic repeated game version of the Barro-Gordon model. The second option is to arrange an institutional reforms in the form of explicit contracts between the central bank and the government. One possibility is the government to appoint an independent central banker who weights heavily inflation stabilization[11]. Another possibility is to appoint a central banker with a contract including compensation-penalty scheme, which rises the marginal costs of inflation. The third option is to establish targeting rules on the macroeconomic variables, which limit central banker's desire to inflate. Her credibility is judged by the ability to meet the target. Rules defined over some intermediate targets such as the exchange rates seem to be enforced in practice more strictly than rules for other intermediate targets[12].

[11] Using the standard terminology the central banker are stylised being " hawk" or " dove" type (Siebert and Mihov, 2004), " wet" or " dry" type (see among others Backus and Driffill, (1985), Muscatelli (1998)) or "strong" and "weak", Ball (1995) , etc. The classification is done on the basis of inflation and output (unemployment).

[12] A problem that follows from the folk theorem is that there is no unique equilibrium between commitment and discretion. Credible monetary rules can, however, help to find an optimal solution. Thus, reputation is essential, given that there is incomplete information and the central bank's preferences are not directly observable.

Cukierman (1999) argues that preferences of the central bank are state dependant. If the economy is in expansion phase, the central bank will react more to an inflation than in recession The minimization of the loss function leads to two state Taylor rule.

$$L(\pi, y) = \left\{ \begin{array}{c} \alpha(\pi - \pi^*) + (1-\alpha)(y - y^*), s_t \text{ is in expansion} \\ \beta(\pi - \pi^*) + (1-\beta)(y - y^*), s_t \text{ is in recession} \end{array} \right\}$$

where $\alpha > \beta$ and $(1-\alpha) < (1-\beta)$, and s_t is the state variable.

A general conclusion is that by reducing principle's interference, central banks become more independent, private sector better estimates the preferences and hence the policy is more credible. The most of the work so far has been concentrated on the link between the central bank independence and the inflation rates in different countries. In general there is negative correlation between central bank independence and the average inflation rates. Significant research has been focused on developing escape clause models (among others *Flood and Isard 1989, Obstfeld, 1991*). *Lohmann (1992)* showed that certain institutional settings can derive strong welfare increasing effects. She proposed monetary policy in normal times, to be run by a conservative central banker. In case of large shocks, the central bank might be dominated by the government if the former does not stabilize inflation and output. This possibility enters into the society´s loss function as a strictly positive and finite cost:

$$L_t = \frac{1}{2}\left[(\pi_t - \pi^b)^2 + \chi(y_t - y^*)^2\right] + \delta c$$

with δ being a binary variable taking values 1or 0. *McCallum (1995)* however, doubts that punishing the central bank and closely monitoring it by the government solves the dynamic inconsistency problem. Rather, it reallocates the problem from the central bank to the government. From institutional point of view Lohmann's model is interesting because requires unlimited credibility granted by the private agents to the government and not to the institutions set by the government[13]. Also the inflation targeting can be type a type of an optimal contract. Another problem, related to the monetary policy rules is that they cannot take into account the unexpected

[13]Such solution might lead to multiple equilibrium and thus be destabilizing (see Obstfeld, 1991)

shocks which are one of the main reasons for inflation[14]. Committing central bankers to low inflation targets (and thus removing the inflation bias) reduces their ability to respond to stochastic shocks. Hence, there is a trade off between the short term credibility benefits, based on adherence to rules and limited discretion and the long term costs which may arise if rules are not optimal anymore and discretion is required. This trade off is related to uncertainty and has an impact on which instruments and how actively they are being used. *Goodhart (1993)* points another key aspect of the principle-agent relations:

" . . . the Governments have never been willing to delegate to their Central Banks [. . .] the right to take the strategic decisions on the exchange rate regime [...] Central banks have one major instrument, their ability to vary interest rates. As a generality this cannot be used to hit two objectives simultaneously, e.g. an external objective for the exchange rate and an external objective for price stability, except by a fluke. "

It is well accepted that financial markets have multiple equilibrium and economy passes through different levels of credibility (or devaluation expectation) (see also *Jeane and Masson, 2000*). Devaluation expectations shifts are exogenously driven by uncertainty (i.e. sunspots) and play an important role in generating cyclical fluctuations. That means with time monetary rules can become sub-optimal because incentives change and the fixed policy rules cannot update through learning and past experience. Hence, there is clear inconsistency between on one hand optimizing monetary policy through learning, which requires flexibility and on the other hand gaining credibility through commitment by fixed rules.

Persson and Tableini (1993) discussed a specific problem related to the "second best institutional design", namely a central bank governed by legislative rules or by targets set up by the government. They propose two types of institutions that may help to resolve the incentives problem a) legislative approach - to create by law very independent central bank, (an example is the Deutschebundesbank) and b) targeting approach - imposes explicit inflation targeting. They conclude that building credible monetary policy institutions is a slow process, because credibility and reputation require clear objectives and long term commitment. Such commitment requires sufficient reputation as part of the institutional structure of the central bank.

[14]Nevertheless the second string of the modern exchange rate theory views the discretionary monetary policy and exchange rate as source of instability and doubts its effectiveness to deal with regional shocks (see Schelkle, 2001 for an excellent review)

3 Econometric methodology

This section employs heteroskedastic bivariate Markov switching VAR (MSMH (2)-VAR(3))[15] model to test credibility of monetary policy of central banks in eight Central and Eastern European countries (Czech Republic, Hungary, Poland, Lithuania, Slovenia, Slovakia, Croatia, Romania) for the period 1994 - 2004. The paper follows the methodology and it is consistent with the work by *Dahlquist and Gray* (2000) and *Mouratidis* (2003). These studies investigate the probability to switch across two regimes low and high credibility during the EMS period as a function of certain macroeconomic variables - interest rate differentials, exchange rate in a band, output gap variability and inflation variability. Based on their methodology, we evaluate the preferences of the central banks in the euro area candidate countries over the conduct of monetary policy. Chosen monetary policy concerns stabilization of the output-gap variability or of the inflation variability in the period before joining a monetary union. The results derived in the paper allow to compare the preferences of the EMS central banks on the basis of the results, reported by Mouratidis (2003). Strong asymmetry will imply that transition countries have not been integrated economically. If this is so, the preferences of the median voter may not be captured by the ECB regarding the formulation of the monetary policy. This will imply pressure for different voting schemes once these countries become fully fledged members of the euro area.

Macroeconomic time series often undergo significant changes due to financial crisis or government switches which is the case in transition countries. Markov switching VAR models, developed by *Hamilton* (1989) are appropriate instrument to assess the transition probabilities of the information variables. [16] The model is useful for its flexibility, as well as in describing variables that follow different time series process over different subsamples. The change in the regime itself can be regarded as a random variable (see *Hamilton*, 2003). MS-VAR allows to test whether macroeconomic variables affect the transition between different levels of credibility over different time series sub-samples. Their path depends on unobserved stochastic state variables, thereby enabling the unobserved component to follow a Markov

[15]The first biltivariate MS-VAR model was analysed by Phillips (1991). Filardo and Gordon (1994) have extended it to three variate case using leading indicators to predict the turning points.

[16]Detailed studies on MS-VAR include also Krolzig (1997), and Clements and Krolzig (2002,2003) .

chain[17]. Another advantage is that specification comovments between macro aggregates can be better estimated by using MS-VAR. *Jeane and Masson* (2000) argue that in sunspot equilibrium the economy passes through different states of devaluation expectations, each having own threshold where the currency crisis could be foreseen. Transition across the devaluation expectations is governed by an unobserved state variable s_t which follows first order Markov process. The general specification takes form:

$$\begin{aligned} \Delta y_t - \mu(s_t) &= A_1(\Delta y_{t-1} - \mu(s_{t-1}) + A_2(\Delta y_{t-2} - \mu(s_{t-2}).... \\ &\quad + Ap(\Delta y_{t-p} - \mu(s_{t-p}) + \sum u(s_t) \end{aligned}$$

where $y_t = (y_{1t,...}y_{nt})$ is an n dimensional time series vector, μ is the regime dependant vector of intercepts[18], $A_{1...p}$ are matrices with autoregressive parameters, s is the state variable which controls the switching between different states and u is the white noise process with $NID\ (0, \Sigma(s_t))$. The conditional mean $\mu(s_t)$ switches between the two states

$$\mu(s_t) = \left\{ \begin{array}{l} \mu_1 > 0 \text{ if } \ s_t = 1 \text{ (high credibility(low volatility) state)} \\ \mu_2 < 0 \text{ if } s_t = 2 \text{ (low credibility(high volatility) state)} \end{array} \right\}$$

Thus, we take into consideration that the impact of the output gap and the inflation on the monetary policy preferences is regime dependant.

The transition probability p_{ij} that the current regime s_t depends only on the regime one period ago and event i will be followed by event j is given by

$$P\left\{s_t = j / s_{t-1} = i, s_{t-2} = k, ...\right\} = P\left\{s_t = j / s_{t-1} = i\right\} = p_{ij}$$

[17] An example of a Markov chain is a process given by $P\left\{s_t = j / s_{t-1} = i, s_{t-2} = k...\right\} = P\left\{s_t = j / s_{t-1} = i\right\} = p_{ij}$

where the probability P a random variable s to be equal to some particular value j depends on the most recent past value s_{t-1}

[18] The dynamic responce of the regime shift in the intercept term is equivalent to a shock in the white noice process u_t.

or in a transition matrix form

$$P = \begin{bmatrix} p_{11} & p_{21} & .. & p_{N1} \\ p_{12} & p_{22} & .. & p_{N2} \\ ... & .. & ... & ... \\ p_{1N} & ... & ... & p_{NN} \end{bmatrix}$$

$$\text{with } \sum_{j=1}^{N} p_{ij} = 1, \text{where } i = 1, 2..N \text{ and } 0 \leq p_{ij} \leq 1$$

The process of regime generating is assumed to be a two state hidden Markov chain where p_{12} is the probability to switch from high credibility state to low credibility state and p_{21} is the probability to switch to high credibility state. If the macroeconomic variables are subject to shifts in the regime, the mean and other variables will vary with the state s_t. Maximum likelihood estimation of the model is based on the Expectation Maximization (EM) algorithm proposed by Hamilton (1989), which first estimates smoothed probabilities of the unobserved state and then conditional regime probabilities are replaced with the smoothed probabilities. This technique (referred to as expectation and maximization step) produces by iteration new joint distribution that increases the probability of the observed data.

3.1 Data

The study uses the International Financial Statistics (IFS) database. The three aggregated series are industrial production (IP), taken from line 66, consumer prices index (CPI), line 64 and money market rates (IR), line 66b for the eight Eastern European countries (Croatia, Czech Republic, Hungary, Lithuania, Poland, Romania, Slovakia and Slovenia[19]) and Germany. The data consists of monthly observations and covers the period from 1994:1 to 2004:6 .

[Table 1 is about here]

IP, CPI, IR are seasonally adjusted by additive moving average method. The annualized inflation and the output-gap are measured using the twelve order difference (IP-IP_{12})/IP_{12} and (CPI-CPI_{12})/CPI_{12}. These measures are used mainly because Central banks concentrate on the annual inflation rate. The output gap series have been measured assuming a random walk plus

[19] Croatia and Romania are candidate EU countries.

drift process. In order to achieve stationary we take the natural logarithm of the time series.We also experimented with a model with one lag, but we found that the value of the likelihood function increases when three lags are used. Therefor the preferred bivariate model is with three lags and two regimes. Moreover, the non-linear specification of the bivariate VAR yields to higher maximum likelihood function for each sample country than the linear VAR does.It measures the goodness of fit for the maximum likelihood estimator, which represents the value of the model's parameters most likely to have been observed. The normal LR test does not apply here, because of the existence of nuisance parameters. The LR test statistics is compared to $\chi^2(r+n)$ where the degrees of freedom r and n are the nuisance perimeters. In all sample countries, the LR test statistic exceeds the critical value, thus the null hypothesis of linearity has been rejected at high significance level. As a result, the non-linear regime switching specification is more appropriate compare to the conventional linear approach.

4 Empirical results

In this section the results of the Markov switching model specification MSM (2)-BVAR(3) are presented. We test the question what is the probability to switch between regimes as a function of some macroeconomic variables. We study the variability of the interest rate differentials between each country and Germany as a benchmark case[20]. The size of the differentials reflects the risk premium for the domestic central bank to deviate from the target interest rate. It also reveals central banks's preferences concerning growth and inflation stabilization. Asymmetries in the preferences are due to different weights on the inflation and output gap in the national welfare function, as well as to structural differences and country specific shocks. By assumption, analyzed countries follow two different regimes of credibility during the estimated period - high credibility regime and low credibility regime, where high credibility regime is characterized by expansion. The probability of regime-switching is a function of inflation and output gap. Also the operability of transition between regimes and inflation variability/output-gap variability depends on the current regime. In the estimation we use the variables in the transition probability, first to test whether they are significant, and second to investigate the preferences of the central bank regarding the stabilization

[20] According to Drazen and Masson (1995) interest rate differentials provide good proxy for the expected devaluation and for the lack of credibility of fixed parities.

of the output-gap variability or the inflation variability.

High credibility regime. In case of significant inflation variability[21], interest rate differentials will be high and monetary authorities will react to stabilize inflation. If output gap variability is stronger than monetary authorities will stabilize output. The credibility depends not only on the significance of these variables in the transition probabilities,but also on their signs. If both variabilities are significant with the same sign, in order to derive conclusion regarding the centrals banks preferences, we compare the size of the coefficients. When the interest rate differential is in the high credible regime, then an increase of inflation variability, reduces the credibility of monetary authorities and therefore increases the probability to switch to a low credible regime. A negative coefficient implies that with high variability of inflation, the transition probability decreases.[22]

Low credibility regime. Low credibility regime is associated with recession due to high inflation expectations. The variability is high and the central bank has incentives to deviate from the common monetary policy. Output gap can be expected to be significantly influencing interest rate differentials. In this case, high inflation variability, reduces the probability to switch to high credibility regime. If output is significant, monetary authorities put more emphasis on output stabilization and alternatively if inflation is significant. If both are significant, central bank preferences depend on the relative size of the coefficients.

[Table 2 is about here]

Table 2 presents equations estimated with respect to the output gap and the interest rate differential. The reported transition matrices and the regime duration make it clear that the credibility regimes in transition countries are characterized by different degree of persistence. A general observation is that high credibility state lasted much longer for almost all transition countries, concerning the output gap. This indicates that the central European countries have put more emphasis on the objective of stable output from its trend than inflation from its target. A notable exception are Romania and Croatia, where the low credibility state lasted longer during the

[21] Small output variability in the high credibility regime might be due to the absence of shocks.In expansion, inflation expectations are low (as well as incentives to inflate), which results in higher economic growth.

[22] Clarida at al (1999) explains such state as due to high credibility the central bank is able to convince the agents that in case of supply shock inflation will not increase. This reduces inflation expectations, thus lowering the probability to switch between regimes .

period 1994-2004. For Romania and Croatia the output gap variability is significant in all states. The results show that the probability to stay in the high credibility state was the highest for Slovenia. Romania has the lowest probability to switch from high credibility state to high credibility state and the highest probability to stay in the low credibility state. Romania had high probability to switch from high to low credibility state. The low transition probability of Croatia suggests that there were no significant changes of the regime. Moreover, there are differences between countries that are already EU members and the candidate countries - Romania and Croatia in the last months before and after EU accession.

Table 3. presents equations estimated with respect to the inflation and the interest rate differential. In Hungary the output gap is significant, but not the inflation in the high credibility state.

[Table 3 is about here]

This is probably due to the high inflation experienced by Hungary during the researched period and the speculative pressure on the Hungarian forex market which decreased the transparency and accountability. Poland and Hungary have the highest probability to stay in the low credibility state. In the case of Romania, inflation has significant effect on the interest rate differentials while output gap was not significant.

An important characteristic for the bivariate specification is that it captures stronger relative to the univariate specification the temporal persistency for the low credibility state. Transition probabilities point out an expected duration of 15.12 months for high credibility state and 2.97 months for the low credibility state in Germany. The results show that Germany enjoyed high credibility during the researched period. At such circumstances, the central bank can stabilize inflation without increasing output variability. Expected durations for Romania are 1.39 months for the high credibility state and 10.16 months for the low credibility state. Figure 1 gives graphical representation of the smoothed and filtered probabilities of the high and low credibility regimes for industrial production (IP) and interest rate differential (IR) in the different countries.

[Figure 1 is about here]

Hungary, Czech Republic and Poland display highly persistent upswings in the high credibility state concerning output-gap stabilization. Romania

displays persistent downswings in the low credibility regime. Figure 2 shows the fit for the MSMH(2)-VAR(3) model with filtered and smoothed probabilities of the high credibility regime (regime 1) and the low credibility regime (regime 2) for inflation (CPI) and interest rate differential (IR) in various countries.

[Figure 2 is about here]

The results show that smoothed probabilities determine longer recessionary periods for Poland, Slovakia and Hungary. It can be seen that most of the transition countries did not aim stabilizing inflation during the researched period. A conclusion could be made that the monetary policy in transition countries was more directed to correct deviations of the output from its trend than inflation from its target. This is not in line with the objective of price stability induced by ECB. Credibility of ECB is such that it has anchored inflation expectations in the euro area. Our findings differ from the results for eight EMS countries, reported by Mouratidis (2003). His findings suggest that monetary authorities in all eurozone countries put more weight on the deviation of inflation from its target than on the output gap.

In general the results show that monetary policy followed by the central and eastern European countries was not consistent with the objective of price stability introduced by the ECB. The paper provides evidence for an existence of differences in stabilization of the output and inflation variability between euro area and transition countries. Monetary authorities put more weight on the output gap stabilization than on the deviation of inflation from the target. These are due to either different preferences concerning the monetary policy, to different economic structure or different degree of credibility. Therefor it is arguable to what extent transition countries will be able to follow the ECB objective of price stability. The need of further structural reforms in the new EU members can put strong pressure on the ECB, once they join the monetary union, thereby undermining its credibility. The results show, however, that there is convergence in the monetary policy objectives with ECB during the last years when the EU accession was envisaged. At that time EU countries were constrained by the Maastricht conditions and were preparing to enter in EU. Therefore they were forced to behave more like the core EMU countries. This supports the argument that incentives matter for transition countries. Results help in understanding the determinants of the centrals´s banks policy during transition.

5 Conclusion

This paper examines the stabilization policy of the central banks in eight Central and Eastern European transition countries. We have investigated credibility based on the trade-off between inflation variability and output gap variability. The study employs Markov switching VAR model. Based on time series data we analyze the probability of changes in credibility through time as a function of inflation and the output gap. We find that the CEE countries have attached higher weight on stabilizing output variability during the ten years of transition. This findings differ from findings for the eurozone countries concerning the same period. The result underline the structural differences and asymmetries between the new EU members and the euro area. Nevertheless, we also find a convergence in the stabilization preferences during the last years before EU accession. This implies that gaining credibility - apart from importing it - is a gradual process.

6 References:

Arestis, P and K. Mouratidis (2004)"Is there a tradeoff between inflation variability and output gap variability in the EMU countries", Scotish Journal of political economy, Vol.51, No.5

Backus D. and J. Driffil (1985)"Rational expectations and a policy of credibility following a change in regime", Review of economic studies, Vol. 52, No2, pp. 211-221

Ball L. (1995) "Time-consistent policy and persistent changes in inflation", Journal of monetary economics, 36, pp. 329-350

Barro, R and D. Gordon. (1983), "Rules, discretion and reputation in a model of monetary policy". JME,, Vol.12, No.1, pp. 101-121

Blinder, A. (1999) "Central bank credibility: why do we care? how do we build it?", NBER WP No 7161

Clarida, R., Gali, J. and M. Gertler (2002), "A simple framework for international monetary policy analysis", Journal of monetary economics 49,pp. 879-904

Clements M and H.M Krolzig (2003)"Business cycles asymmetries:characterization and testing based on MS-VAR models", Journal of business and economic statistics, 21, 196-211

Cukierman, A. (1992), "Central Bank Strategy, Credibility, and Independence: Theory and Evidence". Cambridge, MA & London: MIT Press. -

Cukierman, A. and Meltzer (1986),

Dahlquist M. and S. Gray (2000) "Regime-switching and interest rates in the Europeanmonetary system", Journal of International Economics 50, 399-419

Drazen, A. and P.Masson (1993) "Credibility of policies versus credibility of policymakers", NBER Working paper 4448

Faust J. and L.O. Svensson "Transperancy and credibility: monetary policy with unobservable goals", JER, vol. 42/2

Flood R. and P. Isard, (1989) "Simple rules, discretion and monetary policy",NBER WP 2934

Giavazzi, G., and Pagano, M. (1988), 'The Advantage of Tying One's Hands: EMS Discipline and Central Bank Credibility', European Economic Review, vol.32, 1055-1082

Goodhart, Ch. Central bank independence (1993), Special paper No.57 Financial Markets Group, LSE

Hamilton J. D (1989) "A new approach to the economic analysis of the non stationary time series and the business cycle",Econometrica, 57, pp.m 357-84

Jeane, O and P. Masson (2000) "Currency crises and Markov-switching regimes",Journal of international economics, Vol. 50, pp. 327-350

Kahneman, D. and A. Tversky (1979) "Prospect theory: an analysis of decision under risk", Econometrica, 47: 263 - 291"

Kenen, Peter and Ellen Meade (2003) EU Accession and the Euro: Close Together or Far Apart?, International Economic Policy Briefs 03-9, Institute for International Economics.

Krolzig,H.M(1998)"Econometric modelling of Markov-switching vector autoregressions using MSVAR for Ox", Department of economics, University of Oxford

Kydland F. and E. Prescott (1977)"Rules rather than discretion: the incosnsistency of optimal plans", Journal of political economy, vol. 85, no.3

Lohmann, Suzanne (1992) " Optimal Commitment in Monetary Policy: Credibility versus Flexibility," American Economic Review 82, 273-286

Mihov I. and A. Siebert (2004) "Credibility and Flexibility with Independent Monetary Policy Committees", forthcoming

Mandilaras A. and G. Bird (2003)"A Markov Switching Model of Volatility Transmission in the EMS"

Mouratidis K. (2003) "Asymmetries and credibility in monetary policy of euro area", European commission working papers and studies

McCallum, Bennett (1995), " Two Fallacies Concerning Central Bank Independence," American Economic Review, Papers and Proceedings 85: 207-11

Nobay Robert A, and D. Peel (1998)"Optimal monetary policy in a model of asymmetric central bank preferences", LSE, FMG discussion paper 306

Obstfeld, M. (1991), " Destabilizing effects of exchange rate escape clause"

Obstfeld, M. (1995), "Models of currency crises with self-fulfilling features", NBER WP5285

Ozkan, G, Sibert, A and Alan Sutherland (1998) "Monetary union, entry conditions and economic reform"

Persson T. and G. Tabellini (1994) "Designing institutions for monetary stability", in "Monetary and fiscal policy Vol.1: Credibility", Persson and Tabellini, Editors

Ruge-Murcia F. (2002) "Inflation targeting under asymmetric preferences",IMF working paper 01/161

Sarantis N. and S. Piard "Credibility, Macroeconomic fundamentals, and Markov regime switches in the European monetary system"

Svensson L.O (1994) "An interpretation of recent research on exchange rate target zones", Cambridge University Press in "Capital mobility: the impact on consumption, investment and growth",by Leiderman L and A. Razin, Eds.

Svensson L.O (1997) "Optimal inflation contracts, "conservative" central banks and linear inflation contracts", AER 87 (1), Mar. 1997

Walsh, C. E. (1995) "Optimal contracts for central bankers", American economic review, 85 (1), pp. 150-167