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Doctoral thesis:

Inflation Targeting in the Central Eastern European Countries

– A comparison with the Czech Republic

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Statement

I declare that I drew up the doctoral thesis on the topic
"Inflation Targeting in the Central Eastern European Countries -
A comparison with the Czech Republic"
personally.
Used sources and background materials
are quoted in the enclosed list of references.

In Prague, March 21st, 2004

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Preface

This study was developed at a time of dynamic and crucial changes in the monetary policies of transition countries from Central and Eastern Europe. The uniqueness of such shifts raised wide interest among both economic theoreticians and analysts. The topic of the functionality of different monetary policy regimes under conditions of unsettled transition economies encouraged my attention. Thus the decision of some Central Eastern European central banks to adopt the new monetary policy regime -- direct inflation targeting -- provided me with an excellent occasion to deal with the circumstances of the monetary policy shifts and analyze the appropriateness of the direct inflation targeting framework for the less developed economies using the example of three Central Eastern European Countries.

This paper partly takes up on my prior studies dealing with the inflation targeting regime that has already been published and obtained professional recognition.

This study was made much easier by the excellent resources of the library at the Kiel Institute of World Economics. I have greatly benefited from my participation in the ten-month "Advanced Studies Program" at the Kiel Institute of World Economics. Joachim Scheide and Jan Gottschalk at the Kiel Institute of World Economics provided me with many insightful and useful comments that led to significant improvements. A regular association with the Monetary Policy Section at the Czech National Bank as a visiting scholar and later the job position as a macroanalyst at the commercial Bank "Ceska sporitelna, a.s." enriched my knowledge and practical experiences with monetary policy implementation and its market and macroeconomic consequences. The influence of my colleagues at the Faculty of Economics and Public Administration has kept me focused on the issue with relevance to the questions and problems faced in the actual conduct of monetary policy.

I would like to thank Pavel Kysilka for supervising my entire PhD study and Richard Withers for his excellent editorial work. My acknowledgement also belongs to Roman Hajek for his patient production assistance.

I hope readers will find the paper worthwhile.

Prague, March 2004

Introduction

These days monetary policy is primarily focused on price stability. It is not a coincidence but a rational resolve of economists and policy-makers, who have learned from the mistakes of their predecessors and lost confidence that monetary policy can effectively moderate short-term fluctuations in the economy. The majority of economists are confident now that the monetary policy's task is the maintenance of a low and stable inflation to achieve other macroeconomic goals.

A dynamic and volatile price rise is viewed as a negative fact. Besides the inflation distorting the information included in prices, it affects savings, discourages investment, and motivates money transfer into foreign assets, precious metals and less into production sources; it hinders economic growth, hampers economic planning and, in its ultimate form, induces social and political instability.

Since the beginning of the 1980s, the interest in the consequences of high inflation for the economy has gradually increased in many developed countries. The anti-Keynesian critique, embodied by Milton Friedman's monetarism and the school of rational expectations primarily, contributed to the fading reputation of strongly activist policies and induced governments to introduce the conservative fiscal and monetary policies, which would be sustainable in the long run. The negative consequences of activist economic policies and accepting the reality of what monetary policy can do (to affect inflation) and cannot do (to eliminate short-run fluctuations) moved policy-makers to adopt a new concept of monetary policies focusing on price stability. These new policy frameworks utilized "intermediate targets" such as monetary aggregates or exchange rates to meet a final goal. At the same time, central banks' independence from political control and "policy activism" has been gradually increasing. The final goal of monetary policy in most countries became "low inflation" as recommended by many research studies, based on finding a positive influence of low inflation on economic efficiency and growth in the long run.

Hand in hand with the swift progress of financial markets and the rising volume of capital flows among countries the link between the intermediate and final goal of monetary policy had become looser. Moreover, central bankers had to face inflation inertia and their power to effect inflation expectations had been weakening. Behind this remains "the inflation bias", which arises under economic agents' uncertainty concerning the credibility

of the central bank's commitment. If a central bank follows more economic policy goals that could clash with one another, the society lacks any guaranty that the central bank's commitment to stabilize inflation will be not sacrificed for the other goal (e.g. lower unemployment). One of the possible ways to reduce or even eliminate the inflation bias is the credible commitment of a central bank to target inflation exclusively. Besides this, a credible inflation target provides monetary policy with a "nominal anchor" for price development.

In the course of the 1990s, a few small and middle-sized developed economies abandoned the traditional monetary policy relying on an intermediate target and focused on inflation directly. The dynamic development of economic theory and practice played a large role in this process. This new concept of monetary policy was called "inflation targeting". The first country that officially adopted the inflation targeting regime in 1990 was New Zealand. Later it was Canada (1991), the United Kingdom (1992), Israel (1992), Sweden (1993), Finland (1993-1998), Australia (1994), Spain (1994-1998) and Switzerland (2000). We can also find some features o inflation targeting in the monetary policy strategies of the central banks from Japan, the U.S. and the European Monetary Union and others. The successful implementation of inflation targeting in industrial countries attracted the attention of less-developed and developing market economies. The new monetary policy strategy was finally adopted by Chile (1991), Peru (1994), the Czech Republic (1998), Korea (1998), Poland (1998), Brazil (1999), Mexico (1999), Columbia (1999), South Africa (2000), Thailand (2000) and Hungary (2001).

Many articles, studies and books were already written about inflation targeting. Besides the piles of research works produced by inflation targeting central banks, there are few studies that generalize the experiences with the inflation targeting regime in specific countries. One of the most popular publications is the book "Inflation Targeting" written by Bernanke, Laubach, Mishkin and Posen (1999). The authors summarized the practical experiences of the industrial countries that had adopted the inflation targeting regime. Haldane (1995), Leiderman and Svensson (1995) Almeida a Goodhart (1997) a Mishkin a Posen (1997) are the others that have published case studies regarding inflation-targeting implementation. Svensson and his studies (e.g. 1997, 1999 and 2000) have contributed to the improvement and the diffusion of an empirical analysis for the inflation targeting strategy. The first studies dealing with inflation targeting in emerging or less developed countries arose in 1997. Inflation targeting in emerging countries is the subject of Masson and others (1997), Debelle and others (1998), Christoffersen a Wescott (1999), Blejer and

others (2000), Mishkin (2000) and Schaechter and others (2000). These are primarily case studies describing the institutional and operational practicalities of inflation targeting in emerging countries and formulating the prerequisites for adopting an inflation targeting regime by emerging market economies. Unfortunately, these studies did not suggest the means of an appropriate adjustment of particular aspects of the inflation targeting framework to the specific conditions of emerging countries as they draw heavily on the body of knowledge formed by the years of industrial countries' experience with inflation targeting. The present experiences of inflation targeting economies imply that the success of this monetary policy strategy hinges significantly on the details of design and implementation of the inflation targeting regime such as target definition, the methods of communication with the public, the institutional arrangement of connections among central government authorities and so forth.

This paper focuses on unresolved issues of design and implementation of the inflation targeting regime in emerging market economies. Three countries from Central Eastern Europe (the Czech Republic, Poland and Hungary) took the center of attention in this study since they decided to opt for the "experiment" relying on the adoption of inflation targeting as a strategy for real convergence to the Western European countries. The experiences and the practice of the Czech National Bank with the implementation of direct inflation targeting regime as the pilot central bank conducting the new monetary policy regime in the region will serve as the "benchmark" with which the practices of the National Banks of Poland and Hungary will be confronted. A brief analysis of monetary policy history and country-specific arguments for adopting inflation targeting in each of these countries becomes the "foundation stone" for deeper research into all aspects of implementing the inflation targeting regime. This paper is motivated by the ambition to extend the present research outcomes through a country-by-country comparison of statistical and econometric analysis of inflation characteristics and their implications for inflation targeting strategy in the selected countries. The deep investigations into the practice of direct inflation targeting in the region of Central and Eastern Europe will serve, among others, as a rich source of information and suggestions for the other less developed countries that may decide to adopt the direct inflation targeting regime. However, the paper does not attempt to rank CEE inflation targeting countries, since it is almost impossible to abstract from external factors affecting the policy management's success. Rather it concentrates on partial aspects of the inflation targeting regime and their effective consequences.

The paper is divided into four sections. The theoretical background of the direct inflation targeting regime is the content of Section 1 divided into four chapters. The first chapter defines the direct inflation targeting regime and describes in detail particular aspects of inflation targeting theory. Attention is, among other things, paid to the differences between direct inflation targeting and a policy rule or the problem of the "trade-off" between flexibility and discipline. The second chapter develops the mathematical model of the direct inflation targeting regime that testifies the theoretical hypotheses about the benefits of this new monetary policy regime. The third chapter deals with the different motivations for adopting an inflation targeting regime and splits them into two groups: institutional and technical. The fourth chapter defines the prerequisites for adopting inflation targeting that, as stated in the text, have different levels of significance – the basic requirements essential for successfully adopting inflation targeting or the additional prerequisites, not completely necessary for inflation targeting, however, enhancing the probability of successfully implementing inflation targeting. Section 2 opens the pivotal part of the paper; analyzing the inflation targeting in Poland. Section 3 focuses on Hungary, the third country from Central Eastern Europe to announce a direct inflation targeting regime. The structure of both sections is similar. The first chapters briefly describe the history of the monetary policy regimes. The reasons for a shift in monetary policy regime to direct inflation targeting are discussed in the second chapter. The third chapter deals with the prerequisites of adopting inflation targeting and its fulfilment in a country. The fourth chapter analyzes the statistical properties of inflation in comparison with the Czech Republic and the fifth chapter examines the local transmission channels. The sixth chapter goes deeper into the country-specific features of the inflation targeting regime, while the seventh chapter describes the practical aspects of monetary policy procedures. The eighth chapter includes a summary and stresses some local aspects of inflation targeting. Section 4 closes the paper summarizing the key findings and stressing the pivotal aspects of the adoption and implementation of direct inflation targeting that can be full of suggestions for other interested central banks considering a change in monetary policy strategy. At the end the enclosed appendix offers a full-scale survey of the detailed outcomes of the econometric analyses mentioned in this paper.

1 Theory of Inflation Targeting

The theoretical background of the inflation targeting regime relies on the elementary precondition that achieving and preserving price stability is the final goal of monetary policy. This fact emerged from the consensus among economic theorists and practitioners about five main theses. ***The first one presumes the neutrality of money in the mid- and long term horizon*** – in other words rising money supply in the economy immediately causes an identical increase in price level, ceteris paribus and in the long run inflation is the only macroeconomic variable that monetary policy can affect. The second thesis, even moderate rates of ***inflation can be harmful*** to economic efficiency and growth due to it disturbing the optimal allocation of scare sources.[1] Maintaining stable and low or moderate inflation enables other macroeconomic goals to be achieved. Thus, price stability should be accepted as the ultimate goal of monetary policy. Third, ***money is not neutral for short periods*** and thereby affects economic variables such as unemployment and output. Unfortunately, the knowledge of the transmission mechanism that transfers a change in money supply into the real economy and the adjustment's time horizon is generally very restricted. Fourth, ***monetary policy works with "long and variable time lags"*** and the effectiveness of monetary policy depends on the actual macroeconomic conditions. The last thesis refers to the phenomena of ***"inflation bias".*** Discretional policy and the lack of an incentive structure that guarantees the credible commitment of the central authorities to a price stability objective generate inflation bias. Discretion and the policy credibility problem are also known as the "time inconsistency problem". This time inconsistency or the policy credibility problem is linked with the lack of decision in monetary policy or with the asymmetric behaviour of central bankers favouring a restrictive policy against a loosing one ("restrictive bias") and finally with the tendency of central bankers to sacrifice the stated target (e.g. a low inflation rate) for other economic objectives (e.g. output, employment, profits and so forth). The inflation targeting regime helps to reduce the problems arising from discretion by determining the ultimate monetary policy goal and forcing central bankers to look ahead.

[1] Even moderate rates of inflation can distort the tax system and affect incentives for investment and savings. Moreover, when inflation is moderate or high, it tends to be variable and is difficult to predict. Greater inflation variability increases uncertainty, redistributes wealth and makes firms and individuals reluctant to undertake investment projects. Regardless of the inflation level, steady and anticipated inflation may have large costs since inflation induced relative price variability can have complicated effects on market structure, long-term business relationships and efficiency.

1.1 Definition of the Inflation Targeting Regime

Box 1 Definition of Inflation Targeting

"Inflation targeting" is the monetary policy regime that is characterized by five basic features:

I. Public announcement of a formal inflation target. The inflation target has a numerical value and is set for one or more time horizons.

II. Explicit commitment to the ultimate goal of monetary policy – low and stable inflation; the other macroeconomic goals are subordinate to the primary target of price stability.

III. The strategy of monetary policy based on a wide range of economic data.

IV. Instrument independency and responsibility of the central bank for achieving inflation target.

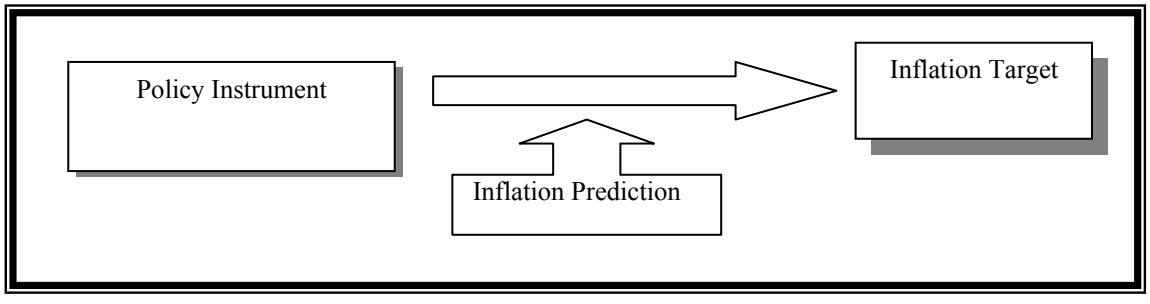
V. Wide communication between policy makers and the public regarding policy plans, goals and decisions in an effort to support the central bank's credibility and accountability.

Adopted from Bernanke and others (1999).

In the following paragraphs the key elements of inflation targeting will be described and analysed step by step.

Inflation targeting works as a process in which the monetary policy instrument is adjusted to keep the forecasted inflation for time "t" at the targeted level. The difference between the inflation forecast and the desired target determines how much the policy instrument has to be adjusted. This makes inflation targeting a forward-looking strategy of monetary policy. The following schema depicts this monetary policy regime.

Figure 1 The Inflation Targeting Regime



It is assumed that the monetary authority has a well-informed view of the transmission mechanism between the instruments of monetary policy and the final goal – inflation. It should know something of the effectiveness of the various instruments of monetary policy and the time lag between the adjustment of monetary instruments and their effect on the inflation rate. The inflation prediction is based on a model or methodology for inflation forecasting that uses a wide range of indicators containing information on future inflation.

The inflation targeting regime can be also expressed more precisely via the equation:

$$i_t = \alpha_0(E[\pi_{t+n}|\Omega_t] - \pi^*_{t+n}) + \alpha_1(E[x_t|\Omega_t] - x^*_t). \quad (1)$$

The variable i_t denotes the instrument of monetary policy (e.g. short-term nominal interest rates). The term "$E[\pi_{t+n}/\Omega_t] - \pi^*_{t+n}$" represents the deviation of the inflation prediction (π_{t+n}) from the target inflation rate (π^*_{t+n}); the prediction is based on a information set (Ω_t), which the central bank has at its disposal at time t. Thus, the central bank's forecast can be characterized as a rational one, incorporating all available information at the time. The parameter "α_0" expresses the sensitivity of the interest rate to the inflation deviation, or it quantifies how much the interest rate should be changed to eliminate one percentage point of inflation gap. The last term in the equation (1) represents the deviation of the other forecasted macroeconomic variables (e.g. output or exchange rate) - the other policy goals - from their equilibrium level (x^*_t). The parameter "α_1" measures the weight placed on deviations of these goals from their equilibrium levels. We refer to "strict inflation targeting" if "α_1" equals 0. The central bank follows the single target – low inflation. We refer to "flexible inflation targeting" if the value of "α_1" ranges between 0 and 1. Here, the central bank targets not only inflation but also the other macroeconomic variables such as output or the exchange rate.

If the central bank tries to smooth the changes in monetary instruments, or to apply a policy of small and gradual changes, the equation (1) takes a new form:

$$i_t = \alpha_0(E[\pi_{t+n}|\Omega_t] - \pi^*_{t+n}) + \alpha_1(E[x_t|\Omega_t] - x^*_t) + \alpha_2 i_{t-n}. \quad (2)$$

The term "i_{t-n}" expresses the connection of the monetary instrument level (interest rate) to its previous high. The weight of this "smoothing variable" quantifies the "α_2" parameter.

The second, alternative, definition of the inflation targeting regime emphasizes the technical features of this policy regime. This definition, however, attempts to interpret equations (1) and (2) as a strict rule, which determines monetary policy steps. In practice, there is a serious distinction between the inflation-targeting framework and the monetary policy rule! The following paragraphs offer a bit of an explanation.

A popular example of such a ***policy rule*** is the gold standard, in which the monetary authority should maintain the price of gold at the official parity. Another example is the constant-money-growth rule associated with Milton Friedman. These and other rules require an automatic adjustment of monetary policy tools to a change in the rules' variables independently of economic or financial conditions. Such a type of monetary policy can be compared to an autopilot that focuses on just a very restricted amount of criteria. Thus, the usefulness of such a rule in the shape of discipline and credibility of monetary policy hinges crucially on the criteria selection. The criteria have to cover all aspects of economic development or otherwise the rules induce high economic costs under unusual and unforeseen circumstances. The advantage of policy rules can be seen in reducing inflation bias and thus average inflation as well, however, at the expense of monetary policy's stabilizing function. If a supply or demand shock hits the economy, the central bank cannot optimally cope with it, since the policy rules eliminate the flexibility of monetary policy.[2]

The exact opposite of a rule-based strategy, is a ***discretionary policy***. In the case of a purely discretionary approach, the central bank makes no public commitments about its objectives or future steps, or it tends to abandon the long-term commitment and takes advantage of the short-term effects of unforeseen inflation. Thus, the economic agents need to consider not only the policy target but also the probability that the target will be sacrificed. Consequently, firms and workers will expect higher inflation, as they can no longer base their expectations on the policy objective. Discretionary policy is inconsistent over time and produces an inflationary bias, which pushes average inflation up above the socially indifferent level. But what motivates the central bank to act in ways that are

[2] Mathematical proof was made by Walsh (2000, p. 363-369), and Obsfeld and Rogoff (1996, p. 641-641).

inconsistent with their proclaimed plans and target? – Generally, it is the problem of monetary policy's time inconsistency. Central banks choose at time "*t*" an optimal policy strategy for time "*t+n*" based on known and foreseen events. The originally planned policy becomes time-inconsistent if new information and conditions at time "*t+i*" require another policy, which would be the optimal response to new conditions. Under such conditions, central banks face the incentive to behave inconsistently. In contrast, a time-consistent policy is one that remains the optimal response to new information once it arrives. Time-inconsistent policy offers more flexibility at the cost of higher inflation.

In fact, monetary policy moves between these two extremes – discretion and fix rule. All monetary policy regimes are, to some extent, discretionary. If central bankers operate within a clearly articulated framework in which the general objectives and tactics are committed to in advance, we speak about ***"constrained discretion"*** [Bernanke et al. (1999)]. Inflation targeting provides such a framework by imposing a conceptual structure and its inherent discipline on the central bank without eliminating all flexibility. The inflation targeting regime combines some of the advantages attributed to strict policy rules (discipline and elimination of inflation bias) with those ascribed to discretion (flexibility).

Nevertheless, we should bear in mind that inflation targeting does not provide simple, automatic operating instructions to the central bank, in contrast to strict policy rules, in the classical sense. Inflation targeting is a strategy based on a wide range of economic variables focusing on a single target - low inflation. The behaviour of inflation-targeting central bankers is constrained by their explicit medium- to long-term inflation target. In the short term, inflation targeting leaves central bankers considerable scope to respond to other economic variables such as employment, exchange rate fluctuations and so forth. The inflation target serves as a nominal anchor that determines the direction of long-term economic development, while it also permits the central bank to respond in the short run to unforeseen events such as a supply shock. Existing experiences of inflation targeting countries show that this monetary policy regime is able to cope with the permanent impact of a temporary supply shock on domestic price level. Inflation-targeting central banks would communicate with the public in an effort to convince them that the effects of a supply shock will be limited to a one-off rise in the price level, rather than creating a permanent acceleration of inflation. For the case of certain events or supply shocks (e.g. changes in the tax system or changes in the prices of food and energy), some central bankers design ***"escape clauses".*** These escape clauses permit the central bank to miss its short-term or medium inflation target in response to unexpected developments.

Strict adherence to the target could imply excessive economic costs in the shape of higher unemployment, an unstable exchange rate or volatile financial markets. Clearly designed escape clauses help to find the appropriate balance between flexibility and credibility.

Besides the above-mentioned ***flexibility*** the inflation-targeting framework also offers higher ***transparency*** of monetary policy. An explicit announcement and commitment of the central bank to a clearly defined inflation target reduces uncertainty about the intentions and goals of central bankers and eases communication between the central authority and the public. Private agents are far more likely to understand what the CPI target means and they can easily confront the final CPI with the announced target. Transparency in monetary policy and improving communication between policymakers and the public reduce uncertainty about the future course of inflation. The proclaimed target directly influences inflation expectations and makes the formation of expectations forward looking. Highly credible inflation-targeting central bank is able to achieve a zero or very small gap between expected inflation and the inflation target. The lower risk of inflation surprise improves planning in the private sector and prolongs the time horizon of investment plans. Under inflation targeting we can expect higher investment activity, longer investment time spans and higher capital yields, more stable financial markets and lower volatility of relative prices.[3]

The last important feature of the inflation-targeting framework is the central bank's ***accountability*** for meeting the target. An explicit announcement of the inflation target means policy-makers undertake meeting their commitments. The central bank takes full responsibility for the implications of its policy steps on long-term inflation development. This fact helps to discipline monetary policy and limits the counterproductive attempts of central bankers or government to apply short-term stimulus. The inflation targeting regime helps the central bank to protect itself from inflationist pressures exerted by the government, since the central bankers may be able to win support from the general public and from the financial community in resisting such policies.

To summarize, the inflation-targeting framework can be described as a monetary policy framework providing the nominal anchor essential for the economy and creates a compromise between the discipline and accountability of rigid rules and the flexibility of the discretionary approach. Unfortunately, not even this regime solves the problem of the "trade-off" between flexibility and discipline. Also under this regime, the central bankers have to

[3] Following D. Romer (1996, p. 364-366, 416), the effects of uncertainty on investment decisions are very complicated and they needn't necessarily be negative.

decide if they prefer more flexibility at the expense of discipline or vice versa and how they adjust each component of the inflation-targeting framework.

1.2 Mathematical background of inflation targeting theory

The above analysis of monetary policy's phenomena is now extended by the mathematical solutions and proofs.

The first step of the analysis is the specification of the central bank's preferences. We assume that the central bank watches inflation and output (or employment) and aims for maximising the objective function. The appropriate objective function, formulated by Barro and Gordon (1983), can take the form

$$U = \lambda(y-y^*) - \tfrac{1}{2}\pi^2,$$

where "y " is output (or employment), "y^*" the potential rate of output and π presents the inflation rate. According to Barro and Gordon, higher output is preferred to less output with constant marginal utility, thus output enters linearly, while inflation is assumed to generate increasing marginal disutility and enters quadratically. The parameter "λ" determines the relative weight placed by the central bank on output expansion relative to inflation stabilization. In this case, we assume that the central bank cares only about the level of output ignoring the variance of output. Under inflation targeting, the inflation term "π" will be replaced by $\frac{1}{2}(\pi-\pi^*)^2$, where "π^*" represents a nonzero inflation target. The objective function of an inflation-targeting central bank takes the form

$$U = \lambda(y-y^*) - \tfrac{1}{2}(\pi-\pi^*)^2. \qquad (3)$$

In the model, output " y" is given by a Lucas-type aggregate supply function[4]:

$$y = y^* + a(\pi-\pi^e) + e,$$

[4] The Lucas supply curve that assumes a positive long-term relation between the departure of output from its potential and the surprise in the price level seems to be a proper form of a supply function with regard to the mid- to long-term character of the inflation targeting regime and the fact that it includes the inflation term $(\pi-\pi^e)$ linking the supply equation to the central bank's objective function.

where parameter "*a*" governs the effect of inflation surprise on output and "*e*" a supply shock.

Since we assume that the central bank acts before observing any inflation disturbance, its objective will be to maximize the expected value of the "*U*" function. Substituting the Lucas-type aggregate supply function into equation (3) yields:

$$U = \lambda[a(\pi-\pi^e) + e] - \tfrac{1}{2}(\pi-\pi^*)^2. \qquad (3')$$

Using a partial derivative of the equation (3'), we get the first-order condition for the optimal value of "π" conditional on "*e* " and taking "π^e" as given:

$$\frac{dU}{d\pi} = \lambda a - (\pi - \pi^*) = 0,$$

$$\pi-\pi^* = \lambda a > 0,$$

$$\pi = \lambda a + \pi^* \qquad (4)$$

Given this assumption, actual inflation will equal "$\lambda a + \pi^*$" or "λa" if the inflation target is zero. Additionally, private agents are rational and they use equation (4) in forming their expectations about inflation. With private agents forming expectations prior to observing any inflation shock, the expected inflation is equal to actual inflation or

$$\pi^e = \pi = \lambda a + \pi^*,$$

Thus, the actual inflation is fully anticipated. Private agents understand the incentives facing the central bank (quantified via "λa") and incorporate it into inflation expectations. As a result, inflation produces no output gain. The size of the ***"inflation bias"*** ("λa") increases in the effect of an inflation surprise on output "*a*" and in the weight the central bank places on its output objective, "λ" . The larger are "*a*" and "λ", the greater is the central bank's incentive to inflate. Thus, private agents anticipate a higher rate of inflation.

To derive the optimal solution under discretion, an alternative specification of the central bank's objective function will be applied. Now, we assume that the central bank

focuses on the loss associated with output and inflation fluctuations around desired levels. Thus, the loss function is quadratic in both output and inflation and can be written as

$$V = \tfrac{1}{2}\lambda\,(y - y^* - k)^2 + \tfrac{1}{2}(\pi-\pi^*)^2. \qquad (5)$$

The central bank desires to stabilize output around "y* + *k*", which exceeds the potential output "y*" by the constant "*k*". The fact that the central bankers care about output fluctuations means that there will be a potential role for a stabilisation policy to reduce output fluctuations caused by a supply shock "*e*". Monetary policy attempting to stabilize output around "y* + *k*" represents a second-best solution; the best would involve eliminating original distortions in the economy e.g. labour-market distortions or the presence of monopolistic competitive sectors which lead the potential output to be inefficiently low. The alternative interpretation is that "*k*" arises from political pressure on the central bank. Since, as we will see, the presence of "*k*" leads to a suboptimal outcome described by inflation bias and lower expected utility.

Substituting the Lucas-type aggregate supply function into equation (5) yields:

$$V = \tfrac{1}{2}\lambda[a(\pi-\pi^e) + e - k]^2 - \tfrac{1}{2}(\pi-\pi^*)^2. \qquad (6)$$

The first-order condition for the optimal value of "π" conditional on "*e*" and taking "π^e" as given in the case of minimising the loss function (6) is:

$$\frac{dV}{d\pi} = \lambda a^2(\pi - \pi^e) + \lambda a(e - k) + (\pi - \pi^*) = 0,$$

$$0 = \lambda a^2\pi - \lambda a^2\pi^e + \lambda a(e - k) + \pi - \pi^*,$$

$$\pi = \frac{\lambda a^2\pi^e + \lambda a(k - e) + \pi^*}{(1 + \lambda a^2)}. \qquad (7)$$

Private agents use the equation (7) in forming their expectations about inflation. However, private agents are atomistic; they do not take into account the effect their choice of expected inflation might have on the central bank's decision. Thus, the public expectations formed prior to observing the aggregate supply shock "*e*" is equal to:

$$\pi^e = \frac{\lambda a^2 \pi^e + \lambda ak + \pi^*}{\left(1 + \lambda a^2\right)}.$$

Solving for "π^e" yields:

$$(1+\lambda a^2)\pi^e = \lambda a^2 \pi^e + \lambda ak + \pi^*,$$

$$\pi^e = \lambda ak + \pi^*.$$

Substituting into (7) gives an expression for the equilibrium rate of inflation under discretion:

$$\pi = \frac{\lambda a^2 \left(\lambda ak + \pi^*\right) + \lambda ak - \lambda ae + \pi^*}{\left(1 + \lambda a^2\right)},$$

$$\pi = \frac{\lambda ak\left(\lambda a^2 + 1\right) - \lambda ae + \pi^*\left(\lambda a^2 + 1\right)}{\left(1 + \lambda a^2\right)},$$

$$\pi^d = \lambda ak - \left(\frac{\lambda a}{1 + \lambda a^2}\right)e + \pi^*, \qquad (8)$$

where the superscript "*d* " stands for discretion. So the fact that the central bank acts with discretion implies in equilibrium a positive actual inflation equal to "$\lambda ak + \pi^*$", or "*λak*" if the inflation target is zero. There is no effect on output, since the private sector completely anticipates this inflation rate ($\pi^e = \lambda ak + \pi^*$). The size of this inflation bias increases by the distortion "*k*", the effect of an inflation surprise "*a*", and the weight the central bank places on its output objective "*λ*", taking "*π**" as given. An increase in "*k*" leads to a higher rate of inflation in equilibrium. An increase in "*a*" raises the output effects of an inflation surprise and increases the marginal benefit to the central bank of more inflation. By increasing the impact of an inflation surprise on output, however, a rise in "*a*" reduces the inflation surprise needed to move output to "y* + *k*". A positive supply shock or negative coefficient on "*e*" leads to lower inflation. If the central bank desires to reduce the impact of the positive supply shock on output, inflation will increase. The larger the weight on the output objective ("*λ*"), the smaller the impact of the supply shock on output and the larger the inflation effect. To summarize, a discretionary policy leads to higher equilibrium inflation compared to targeting rules. Moreover, inflation is more variable under discretion than under commitment to a rule.

The problems that can occur under discretion arise because central banks are responding optimally to the incentives they face, but the incentives are wrong. Once the incentives are correct, complete flexibility in the actual conduct of policy is allowed. An alternative approach acts to reduce the problems arising from discretion by restricting policy flexibility. The gain from reducing flexibility takes the form of a lower average inflation rate. A wide variety of rules designed to restrict the flexibility of the central bank have been proposed and analysed. Inflation targeting is currently the most commonly discussed form of the rule.

Supposing now that the central bank focuses on output and inflation and is, in addition, penalized for deviations of actual inflation from a target level. In other words, the central bank's goal is to minimise:

$$V = \tfrac{1}{2}\lambda\,[E(y_t - y^* - k)|\,\Omega_t)]^2 + \tfrac{1}{2}(1+\alpha)\,[E(\pi_t - \pi^*)|\,\Omega_t]^2. \qquad (9)$$

The term "$E(y_t - y^* - k)/\Omega_t)$ " represents predicted deviations of output from the desired level ("$y^* + k$ "); the prediction is based on the information set (Ω_t), which the central bank has at its disposal at time t. The term "$E(\pi_t - \pi^*)/\Omega_t$" denotes predicted deviations of the inflation prediction (π_t) from the target inflation rate (π^*). The parameter "α" expresses the sensitivity of interest rate to the inflation deviation, or it measures the weight placed on deviations from the target inflation rate. We assume that the central bank sets the target inflation rate exactly at the level of the socially optimal or indifferent inflation rate ("p")[5]. Thus, the expression "$\tfrac{1}{2}\,[E(\pi_t - p)/\Omega_t]^2 + \tfrac{1}{2}\,\alpha\,[E(\pi_t - \pi^*)/\Omega_t]^2$" can be replaced by "$\tfrac{1}{2}\,(1+\alpha)\,[E(\pi_t - \pi^*)/\Omega_t]^2$" .

Firstly, we will refer to targeting rules of the form of ***"flexible inflation targeting"***. This type of targeting rule allows the central bank to trade off achieving its inflation target for fulfilling more desirable values of its other goals.

Substituting the Lucas-type aggregate supply function ($y=y^*+a(\pi-\pi^e)+e$) into equation (9) yields:

[5] The socially optimal or indifferent inflation rate can be associated with a rate of inflation at which costs of inflation roughly match the benefits of inflation. Or, inflation costs (see Footnote 1) should not exceed the rare benefits of inflation consisting of the fact that moderate inflation allows real price adjustment, helps to overcome the limited ability of the monetary authority to stimulate the economy when market interest rates are already near to zero and it is a potential source of government revenues. There is still, however, no consensus about the exact level of an optimal inflation rate. One just assumes that the policy should aim to keep average inflation low to moderate.

$$V = \tfrac{1}{2}\lambda E\,[a(\pi-\pi^e) + e - k]^2 + \tfrac{1}{2}(1+\alpha)E(\pi-\pi^*)^2. \qquad (10)$$

The first-order condition for the optimal value of "π" conditional on "*e*" and taking expectations as given in the case of minimising the loss function (10) is:

$$\frac{dV}{d\pi} = \lambda a^2(\pi - \pi^e) + \lambda a(e-k) + (\pi - \pi^*) + \alpha(\pi - \pi^*) = 0,$$

$$0 = \lambda a^2\pi - \lambda a^2\pi^e + \lambda a(e-k) + \pi - \pi^* + \alpha\pi - \alpha\pi^*,$$

$$\pi = \frac{\lambda a^2\pi^e + \lambda a(k-e) + \pi^* + \alpha\pi^*}{(1+\alpha+\lambda a^2)}. \qquad (11)$$

Assuming rational expectations, the public expectations formed prior to observing the aggregate supply shock "*e*" is equal to:

$$\pi^e = \frac{\lambda a^2\pi^e + \lambda ak + \pi^* + \alpha\pi^*}{(1+\alpha+\lambda a^2)}.$$

Solving for "π^e" yields:

$$(1+\alpha+\lambda a^2)\,\pi^e = \lambda a^2\pi^e + \lambda ak + \pi^* + \alpha\pi^*,$$

$$(1+\alpha)\,\pi^e = \lambda ak + \pi^* + \alpha\pi^*,$$

$$\pi^e = \pi^* + \frac{\lambda ak}{1+\alpha}.$$

Substituting into (11) gives an expression for the time-consistent inflation rate:

$$\pi^T = \frac{\lambda a^2\left(\pi^* + \frac{\lambda ak}{1+\alpha}\right) + \lambda\, a(k-e) + (1+\alpha)\pi^*}{(1+\alpha+\lambda a^2)},$$

$$(1+\alpha+\lambda a^2)\pi^T = \lambda a^2\pi^* + \lambda a^2\frac{\lambda ak}{1+\alpha} + \lambda\, a(k-e) + (1+\alpha)\pi^*,$$

$$\pi^T = \pi^* + \left(\frac{\lambda^2 a^3 k}{(1+\alpha)(1+\alpha+\lambda a^2)}\right) + \left(\frac{\lambda ak(1+\alpha)}{(1+\alpha)(1+\alpha+\lambda a^2)}\right) - \frac{\lambda ae}{(1+\alpha+\lambda a^2)},$$

$$\pi^T = \pi^* + \frac{\lambda ak}{1+\alpha} - \frac{\lambda ae}{1+\alpha+\lambda a^2}. \qquad (12)$$

Or, the inflation target is actually above the rate that is socially preferred, since the central bank desires to stabilize output around "y^*+k", which exceeds the economy's equilibrium output "y^*". Otherwise ("$k=0$"), the inflation goal will equal the socially optimal inflation rate. Setting "α" equal to zero yields a time consistent discretionary solution without an inflation targeting rule:

$$\pi^{NT} = \pi^* + \lambda ak - \frac{\lambda ae}{1+\lambda a^2}, \qquad (13)$$

with "λak" inflation bias. Comparing equations (12) and (13) shows that inflation targeting reduces the inflation bias from "λak" to "$\lambda ak/(1+\alpha)$". The penalty of this reduction in the inflation bias is a very restrained response from the central bank to the supply shock (the coefficient "e" falls from "$\lambda a/(1+\lambda a^2)$" to "$\lambda a/(1+\alpha+\lambda a^2)$"), thereby output (or employment) is more variable than under discretion. Better balance between credibility and flexibility ensures the implementation of clearly defined ***"escape clauses"*** within the inflation targeting regime. If a particular, prior defined event arises, the central bank invokes an escape clause, abandoning the rule and pursuing a discretionary policy, which proves to be ex post optimal, given inflationary expectations. However, inflation will be lower than in the purely discretionary regime because of lower inflation bias.

The preceding analysis considered a flexible targeting rule. However, targeting rules can take the form of ***strict targeting***, when the central bank is required to achieve the target precisely, regardless of the implications for the other objective. The loss function of a strict targeting central bank is given by:

$$V = \tfrac{1}{2}\,[E(\pi_t - \pi^*)|\,\Omega_t]^2. \qquad (14)$$

The first-order condition for the optimal value of "π" taking expectations as given is expressed by the equation:

$$0 = \pi - \pi^*, \text{ or } \pi = \pi^*.$$

Thus, the strict inflation targeting rule ensures that average inflation is equal to "π^*" and public agents set their inflation expectations exactly at the level of the desired rate of

inflation, or $\pi^e = \pi^*$. The inflation bias is removed completely so the gain is larger, the larger is the bias that arises under discretion in the economy. The strict policy rule provides an optimal ***"anchor for inflationary expectations"***. Expectations are exactly where public agents want them to be, namely at the preferred rate of inflation, since we assume that the central bank sets its target exactly at this desired level. The policy rule is thus conditional neither on the observable supply shock ("*e*"), nor on the output target ("*y**"). The central bank's effort to stabilise employment or output only adds costly noise to inflation. The strict inflation targeting restrains the stabilising role for monetary policy. Thus, the credibility-flexibility trade off has disappeared. The cost of doing so will depend on the variance of supply shocks.[6]

To conclude this chapter, we repeat the main conclusions of the previous analysis. First, a simple policy rule is better than discretion if the gain of credibly low inflation is larger than the restriction on stabilization policies. Second, better balance between credibility and flexibility ensures the implementation of clearly defined "escape clauses" within policy rules. And finally, the optimal policy rule provides an anchor for inflationary expectations.

1.3 Motivations for Adopting Inflation Targeting

Inflation-targeting central banks adopted this monetary policy regime for different reasons. Case studies of inflation targeting countries identified several common incentives that motivated central bankers to adopt inflation targeting and that could in future serve as a strong argument for adopting inflation targeting in other countries. In general, it is possible to distinguish between two kinds of motivations: institutional and technical.

The institutional incentives for adopting inflation targeting rested on adjustments in the institutional and legal framework, which frequently invoked deeper changes in monetary policy regimes. Increasing understanding of the potential importance of the central bank credibility and policy transparency led, among other things, to changes in the formal institutional framework in many countries. The central bank law defined the objective of monetary policy as being achieving price stability and provided the central bank with political independence.[7] Price stability became the primary objective of monetary policy and the benchmark of monetary policy success.

[6] Considering the relatively higher vulnerability of emerging markets to supply shocks, strict inflation targeting does not have to be, however, costless.

[7] The next chapter deals with the issue of different kinds of central bank's independence.

The second kinds of incentives are of a ***technical character*** relying on the declining effectiveness of exchange rate- or money-based policy regimes. Profound changes in financial markets and the proceeding liberalisation of capital flows since the 1980s extended the supply of financial instruments. Spreading information technology deepened market integration and made the financial markets more effective. Sophistication of financial instruments increased and to distinguish investment demand from transaction demand became more and more complicated. The emergence of new financial instruments, new types of transaction or new market players made the money demand function very unstable. The central banks responded to this dynamic environment by adjusting the definition of monetary aggregates in an effort to preserve their quality of a monetary indicator. At the same time, the links between the intermediate target (monetary aggregate) and the final target (inflation) became less predictable and reliable. An unstable monetary transmission mechanism complicated the implementation of monetary targeting and communications with the public. The less transparent monetary policy was loosing its credibility and thus its ability to effect inflation expectations.[8] The unstable transmission mechanism and related obstacles to conduct policy motivated inflation targeting in e.g. New Zealand, Canada, Israel, Australia, Poland and Hungary to adapt new monetary policy regime. The other countries such as the United Kingdom, Sweden, Finland, Spain, the Czech Republic, Brazil, Chile and South Africa cite the loss of a nominal anchor – the fixed exchange rate - as the main reason for adopting inflation targeting.

1.4 Prerequisites for Inflation Targeting

Based on practice from inflation targeting countries, several preconditions for successful inflation targeting have been identified in the literature.[9] The generally recognized prerequisites for adopting inflation targeting have, in my view, different levels of significance. ***Basic requirements***, which are essential for successfully adopting inflation targeting, are a sufficiently independent central bank, the absence of fiscal dominance and

[8] Some countries such as Germany, Japan, Switzerland and the US did not experience a significant loss of policy credibility. One explanation can be that these central banks put a priority on targeting inflation over unemployment and the exchange rate.

[9] See, for example, Bernanke et al. (1999), Debelle et al. (1998) and Jonas (2000).

the clearly defined objective of achieving price stability[10] together with the absence of other nominal objectives. ***The additional prerequisites***, which are also considered in the following paragraphs, are well-developed financial and money markets, reasonably low inflation, public support for price stability, and the capacity of the central bank to model and forecast inflation. Though these are not completely necessary for inflation targeting, they markedly increase the probability of successfully implementing inflation targeting.

Sufficiently independent central bank. The precondition primarily relates to the instrumental independence of a central bank, which in reality means the ability of a central bank to conduct monetary policy (to choose the instruments) independently of political pressures. However, several economists (e.g. Olson, Barro and Gordon) believe that broadly defined independence of the central bank from political pressures - political independence - delivers consistently better macroeconomic outcomes (lower average inflation). The legal guarantee of the central bank's political and instrumental independency protects the monetary authority against political pressures aimed at advantagous short-term targets and might subdue the political business cycle. The other economists such as Rogoff or Walsh point to the fact that the central bank tends to place higher weight on an inflation target than the government. Thus, delegating monetary policy to an independent central bank may imply greater "conservativeness" in the sense used in the Rogoff's model of optimal preferences for the central banker[11] or greater independence is negatively correlated with average inflation but should also be associated with higher output variance. According to e.g. Walsh and Fisher, the idea that greater central bank's independence automatically lowers the costs of reducing inflation is wrong since nominal rigidities are the most important determinant of the sacrifice ratio associated with disinflation and disinflation tends to be costly when the effects of surprise inflation on output are large. Recall that the large parameter "*a*" in the basic model presented in chapter 1.2 implies large inflation bias under discretion so the country with a large "*a*" (large sacrifice ratio) should establish an independent central bank to avoid the inflation bias. The disadvantage of such a step might be higher output variability as the model implies. Persson and Tabellini in their book of Political Economics (2000) recall some recent papers [e.g. Cukierman and Lippi (1999)] that have extended the optimality of central bank behaviour to

[10] It is impliedly assumed that the monetary authority can clearly and exactly define an objective of price stability only if it is able to measure inflation with an acceptable, common measurement error. For more details on inflation measurement distortion see e.g. Bryan and Cecchetti (1993) or Wynne and Rodriguez-Palenzuela (2002).

[11] See Walsh (2000), p. 351-355.

the labour market. The conclusion is that the optimal degree of central bank independence and conservativeness depends on the structure of labour markets. Labour markets in which trade unions have more monopoly power may make it best to reduce the central bank's conservativeness. Svensson in his numerous papers represents an alternative interpretation of conservativeness to Rogoff's one. According to Svensson, the independent central bank tends to prefer a lower target for inflation rather than put greater weight on the inflation target. In this case, increased independence will lower average inflation but will not lead to an increase in the variability of output. Walsh together with Waller [Walsh (2000), p. 379] stress additionally the importance of the central bank's institutional structure, the appointment process for central bankers and the length of the term of office, particularly. They are convinced that greater independence – a smaller role of politicians in the appointment process or a longer term of office – can reduce output volatility as well as average inflation. Though more recent empirical works[12] have cast doubt on the role of central bank's independency in determining inflation, in most countries independent central banks became a powerful counterpart to the government in policy making, which could help to reduce the risk of a bad policy decision.

Absence of fiscal dominance. To comply with the first prerequisite, a country cannot moreover exhibit the symptoms of "fiscal dominance", or fiscal policy cannot dictate monetary policy. Freedom from fiscal dominance implies that public finances are stable not only in the short term but also in the long term and that government borrowing from the central bank is low. Furthermore, domestic financial markets are deep enough to absorb placements of public debt. One also assumes that the government has a broad revenue base and doesn't need to rely systematically and significantly on revenues from seigniorage (revenues from having the government's monopoly on issuing domestic money). Central bank legal frameworks in most of the inflation-targeting countries limit or even prohibit financing of government spending from the central bank's funds. This reflects the past experience of high inflation induced by the monetization of fiscal deficits. The lower the level of government debt, the less vulnerable the country is to inflation arising from the monetization of a given level of government spending. If the above criteria are not fulfilled, fiscal dominance exists and a monetary authority exercises limited control over inflation development. Following monetary theory, a contractionary monetary policy measure aimed at lowering inflation pressure of a fiscal origin would initially lower seigniorage revenue and require that the additional debt be issued, which ultimately would lead to higher inflation. Persistently high inflation is likely to spark the

[12] See Posen (1995) or Campillo a Miron (1997).

extension of nominal figure indexation (on the labour market particularly), which reflects price growth, and deepens inflation inertia in the economy. Thus under fiscal dominance, the central bank is forced to accommodate the demands of the government by easing the interest rate to achieve fiscal goals.

Clearly defined objective of achieving price stability and absence of other nominal objectives. The credibility and transparency of inflation targeting depends upon a clearly defined objective of achieving price stability and the absence of other nominal objectives like a pegged exchange rate. Inflation target design follows country-specific factors such as the degree of the central bank's credibility, the country's vulnerability to shocks, data availability and the reliability of price indexes. The choice of an appropriate price index is the trade-off between controllability and credibility. ***A consumer price index (CPI***) seems to be the best and most up-to-data price index available, easily understood by the public, and less susceptible to manipulation by the central bank, as in most of the countries an independent statistical agency compiles it. Unfortunately the CPI often includes components that are beyond the control of the monetary authority such as administered prices, indirect taxes, seasonal price moves and interest charges.[13] The alternative to CPI is a core CPI that includes just the components under monetary policy's control. However, there is no universal technique for constructing core inflation measures and most countries that use it construct and monitor more than one. Consequently, a part of transparency is sacrificed for the advantage of controllability. A further question regarding the inflation target's definition is whether the goal is specified in terms of a point or a band. The public more readily understands a target point, however the risk that the target will be missed is very high***. A target range*** rather than a point provide the central bank with more flexibility to respond to shocks. The width of the range signals in advance how much the central bank will tolerate fluctuation in inflation around the midpoint. The wider the range, the more flexible inflation targeting is but the less clear the focus for inflation expectations and the commitment of the central bank to a clear target is. Moreover, policymakers may be concerned that, in practice, the limits of the range might become the target rather than the midpoint. Generally speaking, the trade-off between a narrow and a wide range depends on the frequency and severity of shocks and the central bank's credibility.

[13] This paper does not explicitly deal with the problem of a limited ability of CPI to trace the true consumer price development as 1) it is very complex challenge – a full-fledged topic for separated paper and 2) it is not regime specific issue that can be in most of cases solved by the policy being aware of inflation measurement shortcomings.

Another issue regarding the target's design is ***the inflation target's time horizon***. The horizon of the inflation target depends, in part, on the inflation rate at the time the policy was adopted. In a transition period or at times of high price level, the central bank tends to choose short target horizons in an effort to accelerate the pace of disinflation. When inflation is already near to the desired long-run objective, the length of the policy horizon reflects more or less policy transmission lags. Long-term horizons have the advantage of giving the central bank more scope to respond to shocks and help guide inflationary expectations. Indeed, short-run target horizons may generate instrument instability, especially if the horizon is short in relation to policy lags. However, the appropriate combination of short- and long-run target horizons can exploit the advantages of both – flexibility and transparency. An annual target or rolling year-on-year inflation rates in addition to their long-term counterparts can make inflation easier to lock into a disinflation path. In the case of faster-than-desired disinflation, short-term targets may be a guarantee that the central bank would not aim for correcting price growth deceleration by increasing inflation, but it takes advantage of such fluctuations.

The requirement for inflation targeting to work is ***a commitment of the central bank not to target other indicators***, such as wages, the level of employment, or the exchange rate. A central bank that adopts inflation targeting and preserves a fixed exchange rate system may induce doubt about the policy objective. The public is not sure whether the central bank prefers an inflation target to an exchange rate objective at all costs or it sacrifices the inflation objective to the advantage of the exchange rate. Conflicts between inflation and the exchange rate target may arise, especially when capital can move freely in and out of the country or proceeding structural adjustment in the economy is likely to be associated with higher exchange rate volatility (see the Balassa-Samuelson theorem[14] describing the effect of higher productivity on inflation and exchange rate's appreciation). Since the public will have no assurance that the monetary authority will give the inflation target precedence over the exchange rate, the policy won't enjoy the credibility needed for success. The commitment of the central bank to an inflation target will not be ex-ante credible, since the risk that the central bank sacrifices the inflation target will not be fully removed. In the case of EU-accession countries, the balance between the inflation target and the goal of a stable exchange rate gains in importance. Excessive volatility on the local foreign exchange market is mostly associated with market expectations that the EU entrance will encourage a large inflow of foreign capital.

[14] For more discussion, see Doyle et al. (2001), who supports that Balassa-Samuelson effects may lie in the range of 1-3% per year.

Moreover, most countries tend to speed up the sell-off of remaining state shares in companies to bolster state revenues and/or to meet the EU requirement on demonopolisation. This tempts the market to speculate on a strong one-off influx of money significantly affecting the market value of the exchange rate. The consequent exchange rate volatility goes beyond the monetary policy's power and none of the monetary policy regimes would be able to effectively cope with it. Under such circumstances, it is necessary to co-ordinate the central bank's and government's policy and to adopt, in advance, effective measures to eliminate such speculations (e.g. opening of a special sterilisation account at the central bank). To summarize, the inflation-targeting central bank should not aim to stabilise the exchange rate, since the credibility of inflation targets could be affected; indeed, the government should seriously consider its role in stabilising the exchange rate.

Well-developed financial markets and a sound banking system. The regime of inflation targeting relies, more than other monetary policy's regimes, upon well-developed financial markets and a sound banking system. To efficiently conduct monetary policy with indirect instruments and short-run interest rates as operating targets under inflation targeting, domestic financial intermediation has to be advanced and the financial sector has to be highly developed. Advanced financial markets have enough deep and many active market players that trade with a wide range of financial instruments. On the other hand, shallow capital markets with a limited number of market players and tradable market instruments are a common indication of fiscal dominance. Sufficient competition in the system of financial intermediation allows the effective mediation of the central bank's impulses towards savers and borrowers. Without the driving force of competition, the monopolist can easily "swallow" the interest rate reduction by the central bank, increasing his interest margins. The effectiveness of interest rate transmission also deteriorates when dynamic banks, intent upon market acquisition, can be found in the banking system with a large weight, as they aim to implement their longer-term strategic objectives instead of maximising their current profits. At a time of economic recession, the soundness and stability of the banking system gains in importance, since in a prolonged period of financial restriction conflicts between the goals of attaining price stability and restoring banking sector profitability can arise. Evidence suggests that, in the early stages of financial liberalisation, policy goals must be clearly ranked and followed in order of priority. Moreover, a different stage of market liberalisation in the financial sector (e.g. liberalised money market and preserved capital control) obstructs the full-development of all financial markets. Thus, the well-balanced process of financial liberalisation is a good way to stimulate the development of the domestic financial sector.

Table 1 Key Financial Ratios for Inflation Targeters

	Time of the adoption of IT	Seignorage to GDP 1980-95	Fiscal Balance to GDP	Quasi-Money to GDP	Private Credit to GDP	Reserve Money to GDP	Stock Market Capitalization to GDP 1997
Industrial Countries							
Australia	April 1993	0.42	-5.6	43.3	69.5	5.3	153.0
Canada	February 1991	0.19	-7.2	35.8	51.6	4.2	88.0
Finland	February 1993	NA	-7.1	32.3	83.6	7.9	59.0
New Zealand	July 1989	0.12	-3.7	32.1**	68.9**	2.3**	99.0
Spain	November 1994	1.61	-6.0	44.4	77.7	N/A	50.0
Sweden	January 1993	0.65	-11.8	49.1	43.7	11.4	115.0
United Kingdom	October 1992	0.20	-6.5	86.4	114.2	3.9	147.0
Average		***0.58***	***-6.9***	***46.2***	***72.7***	***5.8***	***101.6***
Emerging Market Countries							
Brazil	June 1999	5.13	-5.7	24.8	28.4	6.6	29.7
Chile	September 1999	1.66	-1.5	40.5	66.2	37.7	92.3
Czech Republic	December 1997	2.13*	-1.2	45.0	65.7	20.5	28,.6
Hungary	June 2001	1.24*	-3.0	28.2	33.8	10.5	35.8
Israel	June 1997	1.57	-4.3	78.7	73.9	56.7	41.2
Poland	September 1998	1.22*	-0.9	28.5	23.6	8.6	9.8
South Afrika	February 2000	0.68	-1.9	26.6	73.0	4.9	192.2
Average		***1.95***	***-2.6***	***38.9***	***52.1***	***20.8***	***61.4***

Source: Masson and others (1997), p. 26; seignorage calculated by using an monetary concept; IMF International Financial Statistics (different years); ICEG European Center, Hungary; Unless it is directly specified, the data refer to the time of inflation targeting adoption.
* Source: F. Schobert (2001); seignorage calculated by using an oportunity cost concept at the time of IT adopting except for Hungary, for which the data are available up to 2000.
** Data from 1990.

Macroeconomic stability and reasonably low inflation. The requirement of macroeconomic stability, in particular price stability, arises from the recent practice of inflation targeting countries rather than from an economic theory. Most industrial countries adopted inflation targeting at a time when domestic inflation was declining. In contrast, emerging market countries have moved to fully-fledged inflation targeting, when inflation was relatively high and less stable (see Table 2). Notably, however, the inflation-targeting framework has not been used to engineer major disinflation from a starting point of high inflation (let's say above 30% y/y). Thus it is hard to say, whether inflation targeting is an appropriate monetary policy regime for high-inflation-countries or not. Nevertheless, a direct comparison of the inflation levels in transition countries with those prevailing in advanced inflation targeting countries is inappropriate. However, the practice of countries that have struggled against inflation around 20% indicates that the monetary policy itself, lacking the support of other economic policies, is unable ensure a lasting inflation

reduction and subsequent stabilisation.[15] Regardless, the announcement of and commitment to inflation targets in the short- and long-term help to define the desired disinflation path. The inflation targets reduce the uncertainty of economic agents regarding future inflation and eliminate inflation bias. Besides, the credibility of the adopted monetary policy may play a big role in the disinflation process. The adoption of inflation targeting itself may initiate deep structural reforms, e.g. fiscal consolidation. Or the move to inflation targeting may be one of the elements of a broad economic reform. Under such conditions, it is thus likely that the inflation-targeting framework contributes to a reduction in disinflation costs (sacrifice ratio) in the economy.[16] Generally speaking, inflation targeting may help reduce the costs of disinflation in a number of ways, which affect the price- and wage-setting mechanism, or improve the credibility of disinflationary policies. Firstly, a sample of inflation targeters has shown that inflation persistence declined strongly during the 1990s, suggesting that inflation targets strengthened the forward-looking expectations of inflation [see Corbo et al. (2001)]. Corbo also found that with the adoption of inflation targeting, inflation forecast errors, based on country VAR models for emerging market economies, fell consistently to the low levels prevalent in non-inflation targeting industrial countries. Secondly, the framework forces the central bank to concentrate on inflation objective and can improve the central bank's response to inflation shocks. By being particularly visible and easily monitored the targets provide a readily understood and transparent nominal anchor for monetary policy, and help to establish the necessary credibility to make the formation of expectations forward looking. Thirdly, higher accountability of the central bank under inflation targeting helps avoid time-inconsistency problems and bolsters the credibility of inflation targets. Fourthly, with a clearly stated monetary policy objective, the distance between expected inflation and the actual target is closely linked to the credibility of policies [see, for example, Yetman (2001)]. And finally, successfully implementing the inflation-targeting framework strengthens the credibility of the regime, especially when supported by a high level of transparency and adequate fiscal policy.

[15] See research works on the role of fiscal and monetary policy on stabilising moderate or even high inflation: Dornbush and Fisher (1993), Heymann and Leijonhufvud (1995).

[16] Unfortunately, the presumption is not empirically verifiable considering the uniqueness of each economic phenomenon.

Table 2 Inflation During Transition to Fully-Fledged Inflation Targeting

	Time of the adoption of IT	CPI 36 months prior to adoption	CPI 24 months prior to adoption	CPI 12 months prior to adoption	CPI at the time of adoption
Industrial Countries					
Australia	April 1993	8.3	3.4	1.4	1.7
Canada	February 1991	3.9	4.9	4.3	4.4*
Finland	February 1993	7.5	5.0	2.6	2.7
New Zealand	July 1989	8.5	12.8*	5.9	4.9*
Spain	November 1994	5.7	5.1	4.7	4.4
Sweden	January 1993	8.8	10.0	5.2	4.7
United Kingdom	October 1992	7.5	8.9	4.1	1.8
Average		***7.2***	***7.2***	***4.0***	***3.5***
Emerging Market Countries					
Brazil	June 1999	16.3	7.0	3.4	3.3
Chile	September 1999	6.3	6.0	4.8	2.9
Czech Republic	December 1997	9.9	7.9	8.6	10.0
Hungary	June 2001	14.2	9.1	9.1	10.5
Israel	June 1997	12.5	9.7	12.9	8.5
Poland	September 1998	24.2	19.5	13.6	10.6
South Afrika	February 2000	9.7	5.4	6.2	2.4
Average		***13.3***	***9.2***	***8.4***	***6.9***

* CPI excluding the estimated impact of increases in indirect taxes.
Adopted from Schaechter and others (2000).

Public support for price stability. The priority of price and monetary stability has to be observed by policy-makers, the country's main market participants and society as a whole. In some countries inflation targets are announced either by the government or jointly by the government and the central bank. This strategy can strengthen the target's credibility by indirectly committing the government to conduct fiscal policy in a way that supports achievement of the inflation objective. Moreover, one can suppose that the government should assign the monetary policy goal because in a parliamentary democracy the government represents the society's preferences, while the central bank might choose a target that would conflict with the socially optimal level of inflation. On the other hand, governments tend to have short-term priorities and thus favour targets that might be above the socially optimal long-term rate of inflation. The solution is a joint target announcement. The central bank should also play an active role in discussing the consequences of inflation with the government and public. For this purpose, most of the inflation-targeting central banks regularly publish an "inflation report" which sheds light on policy making and its economic consequences. The political economics do not even depreciate an arrangement, in which central banks announce inflation targets without consulting governments, especially when legislation governing central banks provides

them with an explicit mandate for price stability as the primary objective of monetary policy, but does not specify a target. The arguments result indirectly from the model of optimal policy rule in chapter 1.2. Considering the models' outcomes, it seems to be optimal to appoint a central bank that is more conservative on inflation than society itself (to curb the inflation bias) yet not ultraconservative (to preserve some of the benefits of stabilisation). Moreover, the inflation-targeting framework incorporating an "escape clause" should help to prevent the situation when the interests of society and government are overridden by the central bank's decision. In exceptional circumstances and under a pre-specified procedure, an escape clause can even induce a conservative central bank to stabilise extreme supply shocks to the same extent, as the public probably would. L. Svensson (1997a) proposed an alternative interpretation of inflation targets. He assumes that the central bankers have no individual preferences over macroeconomic outcomes; instead society can assign a goal for the central bank. If the inflation target were lower than the central bank would assign, then the lower inflation goal would be associated, according to L. Svenssons' assumptions, with lower inflation but not with higher output volatility. Thus, the disparity between the socially optimal inflation target and the inflation goal assigned by the central bank induces no additional costs in the form of higher output or employment volatility. However, it is not without problems to assume that the public assigns a lower inflation goal than the central bank would. To follow the model of optimal policy rules, the best assignment would be to set the inflation target at a level that coincides with the natural rate of unemployment, thereby completely eliminating the inflation bias (λa or $\lambda ak = 0$).

Capacity of the central bank to model and forecast inflation and appropriate knowledge of the transmission mechanism. Inflation forecasts play a key role in the conduct of policy under inflation targeting. The inflation prediction is viewed as the intermediate target of policy. Less-developed countries rely less on statistical methods than their developed counterparts owing to data shortfalls, ongoing structural changes, and relatively higher vulnerability to shocks. Nevertheless, the above obstacles are not regime specific and would persist under any monetary policy regimes. To overcome this limitation facing the implementation of an inflation targeting strategy, the policy decisions may rely more on a wider range of potential inflationary pressures indicators (such as aggregate demand and supply variables, monetary aggregates, interest rate and exchange rate measures, inflation and further price measures, expectations and financial market indicators) rather than on quantitative models. However, most emerging market inflation

targeting central banks have already devoted extra resources to developing such models for greater future use. Even small-scale models can help central banks think through policy transmission mechanism channels. More important, the models can serve as a framework for policy discussion and can even assist in the presentation of inflation forecasts that are essential to transparency. In practice, inflation forecasts are based on a combination of indicators, quantitative economic models, and quantitative judgements of central bankers. Thus, the temporary shortcomings in the model-background seem to be surmountable and they should not be considered as a serious obstacle to adopting the inflation targeting regime.

Inflation targeting as a forward-looking operating regime requires the central bank to have at least a notion of the time lag between adjusting the monetary instruments and their effect on the inflation rate. The central bankers should also have a well-informed view of the relative effectiveness of the various transmission channels through which the policy instruments affect the final goal - inflation. Through the interest rate channel, an increase in interest rates reduces inflation by affecting aggregate demand and inflation expectations, which in turn influence the wage- and price-setting mechanism. Through the credit channel, two effects are generally distinguished: on credit supply by banks (the lending channel) and on the liquidity of borrowers (the balance sheet channel). The direct exchange rate channel entails a pass-through of currency changes on to tradable goods prices, as well as indirect effects on the prices of domestically produced goods via the prices of imported inputs.[17] In addition, monetary policy may influence inflation indirectly by altering asset value and thereby wealth and aggregate demand. Determining the efficiency of monetary transmission is not an easy task even in developed market economies let alone in transition economies. The impact of changes in monetary policy through the interest rate and credit channels is constrained by the structure of the economy. The direct impact of interest rate adjustment on domestic demand can be expected to be relatively weak in transition countries because of downward price sickness, limited financial deepening, relatively low bank intermediation and the prevailing type of business financing. Also, the highly interest inelastic lending policies of corporate banks, burdened by nonperforming loans and the borrowing practices of unprofitable enterprises or strong capital inflows being a significant source of business finance, stifle the interest rate channel. The balance sheet channel can also be modest in light of the relatively low debt

[17] For a detailed discussion of these channels see e.g. Mishkin (1995) and Svensson (1998).

ratios or serious bank balance sheet problems. On the other hand, a relatively high share of short-term or floating-rate debt is likely to bolster the impact of policy tightening on the balance sheets. There is also a good deal of uncertainty about the size and timing of exchange rate pass-through. Too short a time series prevents econometric estimations of the currency rate transmission mechanism. Moreover, economic relationships are unstable due to transitory changes in developing market economies. Also, there is some evidence in the literature that higher exchange rate volatility leads to a lower pass-through [see Gagnon and Ihring, (2001)] and transitory changes in the exchange rate would be expected to have less of an effect on prices. For example, the development of exchange rate hedging mutes the transmission of exchange rate movement into inflation and simultaneously lengthens the lags between policy instruments and inflation. Ironically, the establishment of the central bank's credibility also appears to be associated with a weaker relationship between the exchange rate and inflation as well as between inflation and the level of economic output. The reason is that domestic prices and inflation expectations are, under high-credible monetary policy, less sensitive to exchange rate movements and the demonstrated ability of the central bank to achieve the target weakens the relationship between inflation and economic growth. Finally, lower inflation has been associated with a lower pass-through because low inflationary development itself may change price-setting behaviour [see Choudhri and Hakura, (2001)].

All the above-mentioned prerequisites for a successful implementation of inflation targeting were defined for the case of full-fledged inflation targeting. The list of prerequisites isn't exactly short; thus I would like to stress the key prerequisites that, in my view, are essential for adopting inflation targeting in a country with an already well established central bank and acceptable measurement bias in the inflation index. These are the instrumental independence of the central bank, the absence of other nominal objectives and sound banking system transferring interest rate changes into the economy. Without these, no central bank should consider adopting inflation targeting. The rest of the prerequisites are also important, nevertheless the inflation targeting regime can perform relatively well even if they are not fulfilled for some transitory period.

In the following section, the reader is acquainted with two comparative case studies and an empirical analysis of Central Eastern European countries that decided to adopt the inflation targeting regime. The first presented country is Poland followed by Hungary.

2 Poland

Poland was the second Central Eastern European (CEE) Country to adopt the inflation targeting regime following the Czech Republic. The National Bank of Poland (NBP) inspired by the Czech example and at the same time motivated by the Maastricht criteria concerning low consumer price inflation to abandon the hybrid monetary policy regime, compounded from money supply targeting and crawling band regime, and adopted the popular inflation targeting regime.

The structure of the subsequent part of the paper keeps the logic of the previous section. Chapter one briefly describes the history of Polish monetary policy. Chapter two refers to the motivations that led to a change in the monetary policy regime. The prerequisites of inflation targeting adoption and their fulfilment in the case of the NBP are closely analyzed in chapter three. The fourth chapter examines the statistical properties of Polish CPI inflation. Aside from this, for comparison purposes, an empirical analysis of inflation in the Czech Republic as the first inflation targeter among CEE countries is also presented. Section five investigates the monetary transmission mechanisms as well as the speed and effectiveness of the pass troughs. Specific features of Polish inflation targeting strategy are described in chapter six, while chapter seven deals with experiences of the NBP with the inflation targeting regime. Chapter eight provides some concluding remarks and a recapitulation of the outcomes.

2.1 The History of Polish Monetary Policy

The new "epoch" of the National Bank of Poland began in 1989 when the two-tier banking system was established. In January 1990, the Polish authorities adopted a fixed exchange rate of the zloty against the US dollar. The growth of the monetary aggregate M2 was defined as the intermediate objective of monetary policy. The initial price liberalisation of 1989 and the abolition of most price controls in January 1990 increased consumer prices by more than 1100 per cent during the first half of 1990. Nevertheless, the initial efforts of price stabilization successfully cut CPI inflation to under 100 per cent by early 1991.

The excessive appreciation of the real exchange rate of the zloty, which deteriorated the external position of the Polish economy, stirred the Polish authorities to

monetary policy adjustments. In May 1991, the zloty was first devaluated by 17 percent against the dollar and then pegged to a basket. Then, in October, the fixed peg was replaced by a crawling peg regime, initially with a 1.8 percent monthly crawl rate. The pre-announced rate of crawl, that was substantially less than the expected change in prices, helped moderate price increases but the disinflation path, in accordance with the Polish authorities' ambition, became more gradual. The general government deficit, which was fluctuating around 3 per cent of GDP, was financed mainly by domestic borrowing. Under these circumstances, the interest rates stayed high, while the pace of disinflation was gradual. High inflation eroding the purchasing power of the Polish currency compelled a currency revaluation that took place in 1995. The "currency reform" helped, via its anti-inflationary effect, to restore the purchasing power of the zloty. During 1993, the annual CPI inflation fell below the 40 per cent rate, and through 1995 fluctuated around 30 per cent (see Figure 2). During this period, pervasive wage-price indexation, domestic producer prices, and the adjustment of officially controlled prices were the main sources of Polish inflation.

Through the 1990s, the rate of crawl was periodically reduced. In 1997, the rate of crawl exceeded the monthly inflation rate, while nominal interest rates were increased sharply. The National Bank of Poland (NBP) gradually enhanced the degree of exchange rate flexibility. In 1995, the zloty was allowed to fluctuate within ±7 per cent of its central parity. In February 1998, the fluctuation band was widened to ±10 per cent and the monthly rate of crawl slowed to 0.8 per cent. In this stage of the NBP's monetary policy, the crawling band regime played an important role in lowering a relatively high inflation rate (round 30 per cent) to a one-digit rate.

The domestic money market rates fell steadily through the years 1991 and 1992 as inflation declined. In 1993, the National Bank of Poland figured that the domestic money market had become advanced enough to use the short-term money market interest rates as an operational target of monetary policy. But in December 1995, the NBP adopted reserve money as its chief operational target and three years later, in February 1998, switched back to targeting short-term interest rates.

During the period of the global financial market gyrations in the first half of 1997, the zloty, managed via a crawling band arrangement with the ±7.0 percent fluctuation band, and with a central rate that depreciated by 1 percent a month throughout 1997, moved on the weak side of parity, while the Czech crown was hit by an exchange rate

crisis. The following description of economic conditions in both countries in the period prior to the financial crisis may shed light on the reasons behind the different behaviour in these financial markets. In comparison with the Czech National Bank, the NBP preferred to maintain the international competitiveness of the Polish economy through real exchange rate stabilization. The CNB proved to be a conservative central bank that emphasized anti-inflation policies. The Czech strategy was accompanied by a real appreciation of the Czech crown (CZK), thereby resulting in some loss in the international competitiveness of the Czech economy. In addition, the more favourable nature of the capital flowing into the Polish economy, considering the high share of non-debt creating inflows, ensured stable financing of the external deficit, while the Czech economy experienced high inflows of short-term capital during the pre-crisis period. Because both countries held high interest rate differentials relative to the main international currencies, one should examine the other explanation of the different types of capital flows.

The Polish authorities decided to postpone the liberalization of the capital account and impose restrictions on non-bank short-term capital flows, while the Czech authorities liberalized capital account transactions in 1995 and never applied capital controls except during a very short time period around the exchange rate crisis. The Czech economy became more open to financial flows, which stimulated, however, further development of the Czech financial markets. The size of the Polish domestic market attracted, in addition, more non-debt creating capital flows exceeding the level of those streaming into the Czech Republic. At the time of the financial crisis in Asia, the Czech Republic, in comparison with Poland, experienced less favourable economic conditions. Increasing imbalances in the economy, like excess domestic demand, external imbalance and a large capital inflow, real appreciation of the Czech crown, and deepening public finance deficit together with the unstable domestic political situation convinced investors that the macroeconomic trends in the Czech Republic were unsustainable. Conversely, the Polish economy preserved investor confidence because economic growth appeared to be strong and the current account deficit of 3.2 percent of GDP was viewed as sustainable.

During the period of targeting the monetary aggregate M2 within the framework of the crawling band system, the NBP missed money supply targets most of the time yet inflation consistently fell. In light of this, in February 1998, the NBP widened the exchange rate band to ±10.0 percent and the rate of crawl was reduced to 0.8 percent per month in aiming to reduce the conflict between two of the intermediate targets of Polish monetary policy. The higher flexibility of the zloty would also help discourage short-term

capital flows and stimulate disinflation. The experiences of the NBP with the crawling band regime of the zloty showed that this exchange rate arrangement kept inflationary expectations at a relatively high level and the rate of crawl could go from imposing a ceiling on inflation to a floor. As in the Czech Republic, the fixed exchange rate arrangement proved to be an ineffective instrument in lowering inflation to one-digit rates. Moreover, the persistence of wage and salary indexation slowed the momentum of disinflation.

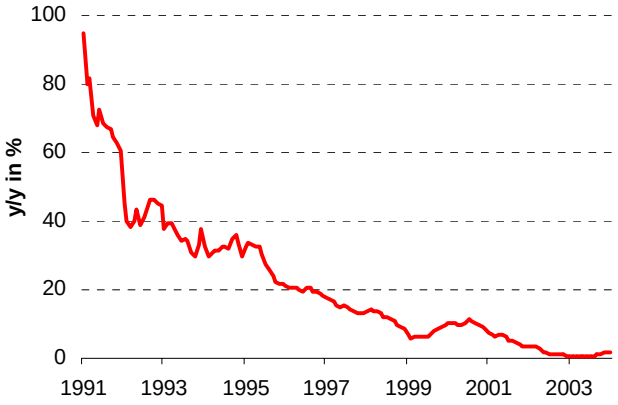
The increasing integration of Polish financial markets with global markets along with dynamic development in Polish financial markets relaxed the link between inflation and two intermediary targets, money supply growth and the exchange rate of the zloty. Moreover, the intermediary targets gradually lost congruity with the underlying conditions of an advanced stage of financial openness of the Polish economy. Under these conditions, monetary policy cannot fully react to internal shocks, because the domestic economy is both hampered by unstable capital inflows and subject to disturbances transmitted from the anchor country. Finally, the problem of considerable excess liquidity in the Polish banking sector distorted the process of transmitting central bank signals to the economy. Under these circumstances, the strategy of inflation targeting offers an attractive alternative to other monetary policy regimes because, among other reasons, it abandons intermediate targets.

Table 3 Adjustment of Monetary Policy Strategies in Poland

	Instruments	***Intermediate Target***	***Final Target***
1990	Direct instruments	M2 growth	Fixed exchange rate
1991			Crawling peg regime with a monthly rate of crawl 1.8% that was gradually reduced.
1993	Reference rate		
1995	Reserve money		Crawling band regime with the fluctuating band ±7.0%
1997			Crawling band regime with a 1.0% monthly rate of crawl and with the fluctuating band ±7.0%
1998	Reference rate		Crawling band regime with a 0.8% monthly rate of crawl reduced to 0.65% in July 1998, and to 0.5% in September 1998, the fluctuating band was widened from ±7.0% to ±10.0% in February 1998, and to ±12.5% in October 1998.
1999	Reference rate	NA	Official CPI & Crawling band regime with a 0.5% monthly rate of crawl reduced to 0.3% in March 1999; the fluctuating band was widened from ±12.5% to ±15.0% in March 1999.

Notes: The "Reference rate" is the rate of interest on short-term open market operations.
Sources: IMF and NBP.

Figure 2 Inflation Path in Poland



Sources: NBP and Bloomberg data (2004).

2.2 Inflation Targeting in Poland

In September 1998, the Monetary Policy Council (MPC) of the NBP announced its decision to change its monetary policy by adopting an inflation targeting regime. As in the Czech Republic, this change in strategy was motivated by the goal of permanent inflation reduction on the way into the European Union and later, with the European Monetary Union (EMU).

The MPC described the major aspect of implementation of the inflation-targeting framework in detail in the "Medium-Term Strategy of Monetary Policy (1999-2003)". This document summarized the main arguments for a change in monetary policy regime, shed light on some operational aspects of a change in monetary policy regime and informed, among others, that the monetary policy instruments used before remained unchanged. The reference rate maintained the key NBP's intervention rate.

Following the above statement of the Council (MPC, 1998), the choice of inflation targeting strategy was supported by relatively strong arguments that stem from the shortcomings of other monetary policy strategies. The most important follow: (1) Under the inflation targeting regime, a monetary policy goal is explicit and comprehensible to economic agents. (2) This system limits the discretionary behaviour of a central bank and allows for public verification of monetary policy directions and effectiveness, thereby enhancing the policy's credibility. (3) Hand in hand with central bank credibility, this strategy allows for minimizing the social costs of a disinflation process. (4) A greater

flexibility in applying monetary policy instruments reduces the shortcomings of a fixed exchange rate and enables the central bank to sensitively react to the specific nature of an inflationary shock.

Since the NBP had been aware of the risks of any type of fixed exchange rate arrangement, it took the decision to adopt a flexible exchange rate. Generally it was believed that this arrangement would help to bring the market rate closer to the equilibrium rate, prior to its renewed fixing within the ERMII. To avoid any shock and give time to economic subjects adapting to new conditions, the NBP chose the gradualist approach consisting of a gradual expansion of the fluctuation band and the gradual reduction of the crawling devaluation.

By then valid Act on the National Bank of Poland of August 29, 1997 that states "the basic objective of NBP activity shall be to maintain price stability, and it shall at the same time act in support of Government economic policies, insofar as this does not constrain pursuit of the basic objective of the NBP" also contributed to the smooth shift to an inflation targeting regime. Moreover, the amendment of the Act from the beginning of 1998 strengthened the independence of the NBP, established a decision-making body "the Monetary Policy Council" and prohibited direct financing to the government by the central bank. Or the legislature had opened enough room for adopting a straightforward monetary policy regime.

While choosing the inflation targeting strategy, the MPC was aware of its limitations under Polish conditions including limited accessibility to the information required for the assessment of inflationary reactions to monetary policy instruments, the absence of co-ordination of fiscal and monetary policies, and the problem of delayed reactions. Notwithstanding these limitations, compared with alternative strategies, the MPC judged the inflation targeting regime to be the best policy approach for the time leading to Poland’s expected accession to the EU and the EMU, respectively. The following chapter describes the possible limitations of inflation targeting in more detail.

2.3 Prerequisites for Inflation Targeting

The following paragraphs examine the main elements of the inflation targeting regime in Poland referring to the basic and additional prerequisites specified in the theoretical part of this paper. The first group of basic requirements includes a sufficiently

independent central bank, the absence of fiscal dominance and a clearly defined objective of achieving price stability and the absence of other nominal objectives. The second group of additional prerequisites is composed by well-developed financial markets and a sound banking system, macroeconomic stability and reasonably low inflation, public support for price stability and finally a capacity of the central bank to model and forecast inflation and appropriate knowledge of the transmission mechanism.

A sufficiently independent central bank. This prerequisite primarily relates to the instrumental independence of a central bank, which in reality means the ability of a central bank to conduct monetary policy independently from other political pressures. In the case of Poland, the Constitution and the National Bank of Poland Act safeguard the political independence of the NBP through e.g. prohibiting Council members to hold any political or public post and the longer term of Council members' office exceeding the four-year parliamentary cycle. Also a representative of the Council of Ministers may only participate in meetings of the Council without voting rights.

Additionally, any "support" of Government economic policies is subordinated in law to the basic objective of the NBP activity -- to maintain price stability. Moreover, in accordance with the European convention, direct financing to the government by the central bank is prohibited. The financing of NBP activity is under the authority of the NBP Management Board that (1) adopts the NBP plan of activity and budget, (2) specifies the principles applicable in NBP funds management and (3) draws up the balance sheet and profit and loss account of the NBP. However, the Council of the Ministers, at the request of the Minister of Finance, shall appoint a commission charged with auditing and assessing the annual accounts of the NBP. As the facts showed, the potential source of tensions between the central bank and government seeking additional budget revenues represents the provision regarding to the obligation to remit a portion of the annual net profit of the NBP to central government. The NBP Law also enacts the informative obligation of the President of the NBP. For example, the President shall submit to the Sejm and Council of Ministers quarterly reports on the balance of payments, forward to the Council of Ministers and Minister of Finance draft monetary policy guidelines and opinions on the draft Budget, draw up periodic reports on transfers of (payments from) profit etc.

According to the amendment of the NBP Act (valid since 1998), the decision-making power, in the field of monetary policy, lies in the hands of the Monetary Policy Council (MPC). The Council consists of the President of the NBP and nine other members appointed in equal numbers by the President of the Republic of Poland, the Sejm (lower

chamber) and the Senate (upper chamber) of the Parliament. Unfortunately, the mandates of MPC members do not overlap. This fact casts doubt on the politically "balanced" structure of the MPC when the terms of all current members (except Chairmen) will expire. The appointment process in 2004, however, confirmed the justice of such fears. The tensions among the prior MPC members and the political representatives regarding monetary policy stance were mirrored in the profile of and candidates of the Sejm and Senate. According to the general market view, the new MPC is more dovish than the outgoing prudent committee and a more pro-growth oriented monetary policy is expected. To prevent such a discrete change in the MPC profile, an amendment of the NBP law enacting overlapping mandates of the MPC members will be needed unconditionally.

Absence of fiscal dominance. The recent development of fiscal discipline in Poland cannot be considered as favourable. While the general government deficit declined over the nineties from 7% of GDP to 3% of GDP according to IMF statistics, the new century brought about a marked worsening of the public finance stance. Pervasive indexation of public expenditures (particularly social transfers) and lower tax revenues, because of economic slowdown, deepened the public finance imbalance back toward 7% of GDP. At the same time, public debt being reduced to around 40% of GDP by the end of the nineties reversed to above 50% limits. Though domestic financial markets are deep enough to absorb placements of public debt, the dynamics and level of public finance deficit is likely to keep a lid on credit supply of the commercial banks that instead of funding more risky investment projects finance public debt investing into government bonds. Under such conditions, it is likely that the credit policy of the commercial bank becomes less sensitive to interest rate environment and the effectiveness of the interest rate policy channel may be hurt.

The other aspects of the fiscal stance of Poland seem to be more favourable. For example, the seigniorage revenues (revenues from having the government's monopoly on issuing domestic money) went down at roughly 2% of GDP, below the average level among inflation targeting emerging markets [see Jonas (2000) or Schobert (2001)]. The Polish government has a broad revenue base and doesn't need to rely systematically and significantly on revenues from seigniorage, though in context with the restoration of public budget health an elimination of many rebates and exemptions are, besides deep expenditure reforms, highly recommended. The direct financing of government spending from the central bank's funds is also prohibited, as the European rules require. Similarly to

Hungary, the NBP shall be entitled to issue and sell securities as well as buy and sell Treasury securities under open market operations.

Restriction of the fiscal dominance in Poland would require a rapid change in current mid- and long-term unsustainable fiscal policy development. The economic revival itself will not solve the deep problems established in the budget, mainly on its expenditures side.

Clearly defined objective of achieving price stability and the absence of other nominal objectives. The credibility and transparency of inflation targeting depends upon the clearly defined objective of achieving price stability and the absence of other nominal objectives like a pegged exchange rate. In the first stage of adopting inflation targeting by the NBP in Poland, the crawling band of the zloty was not abolished but the tolerance band was widened from ±12.5% to ±15.0% on March 24, 1999. The Polish authorities suggested that the band was wide enough to minimize possible conflicts with the inflation target. Following the recommendations of the theory of inflation targeting and the gradually accepted opinion that the role of the band in capping appreciation pressures was probably small, the NBP joined the "pure" inflation targeting regime with a floating exchange rate regime in April 2000. The central bank believes that a floating exchange rate regime is the most appropriate regime for Poland on its path to the EMU and it expects that this exchange rate arrangement will help bring the market rate of the zloty to the equilibrium rate. Notwithstanding this, the NBP has maintained the right to intervene in foreign exchange markets when it recognizes a need to do so for monetary policy reasons. Contrary to the NBH, the risk of possible conflict between inflation and foreign exchange target was removed. Or, the priority of the inflation target is unambiguously set and the public need not cast doubt on the primacy of the inflation target. Unfortunately, the NBP broke the "good rules" inflation targeting regime by revising inflation targets.

The NBP defined the inflation target as a December annual Consumer Price Index. The selection of inflation indicators was, from a specific point of view, simple. The other inflation indicators such as common used core inflation index had had a short history and, moreover, their explanatory power had been curbed by the structure of the consumer basket in which food and non-alcoholic beverages shared 28%. On the other hand, the headline inflation index remained notably affected by officially controlled prices, holding a 27% share in the basket, it is also subject to significant seasonal variations or temporary supply/demand shocks. Beyond the lack of core inflation time series, the NBP pointed at the rooted indexation in the economy referring to headline inflation and its generally broad

recognition as a measure of price changes. Any alternative inflation measures based on specific statistical formulas were considered to be too complex for the public. While the decision to define an inflation target in a transparent and familiar consumer price index seems to be proper, the failure to adopt so-called escape clauses from inflation targeting in the case of certain events or shocks might turn out to be a handicap, particularly in the process of tax harmonization, administrative price deregulation e.g.. Under the above circumstances, the NBP decided to rely on an active communication strategy that would explain any possible apparent inconsistencies to the public.

The NBP much like the Czech Republic defined the target not as a point but as a range. The ±1pb bandwidth was a compromise between a narrow one that would require too frequent adjustments of monetary policy tools and a wider one that would provide greater flexibility of monetary policy and comprehend the weight range of historical inflation volatility. The main criterion of the bandwidth choice became its credibility.

The NBP set the inflation targets for two time horizons: short-term and mid-term. The 1999 target was designed in the range 8% to 8.5%. The narrow band was aimed to demonstrate the strength of the central bank's commitment to reduce inflation. Besides the MPC decided that the short-term inflation target would be announced in September with a one-year span. The medium target was set more generally promising inflation below 4% by 2003-end. Unfortunately, the ensuing economic development showed how strong these commitments for the MPC were or weren't.

Despite its initial good intention to demonstrate strong commitment to the first inflation target, the NBP ran away with marked inflation slowdown and government's promise to tight fiscal policy and amended the short-term inflation target at 6.6% - 7.8% in its March's Monetary Policy Meeting, though it was clear that the year-end target already laid beyond the monetary policy scope considering a time lag in the interest rate transmission channel. At the same time, the central bank abandoned the narrow tolerance range and referring to uncertainty surrounding inflation outlook adopted a broader bandwidth. The post-adjustment of the inflation target to actual inflation development did not contradict the actual path of inflation expectations but neither did it prevent later revival inflation expectations. The initial short-term inflation target did not have time to gain enough credibility and the new one lost it as soon as the CPI started to climb. For the second time, the NBP undertook a risk to the credibility of its inflation targeting regime in 2002, when it reviewed its 2002's inflation target from 5% ±1pb to 3% ±1pb in June 2002 in view of strong disinflation being beyond control. The MPC explained the change as

solidifying market expectations of disinflation. Thought it is clear the central bank tried to take advantage of extraordinary disinflation and settled the inflation on a downward path, the ex-post adjustment of the inflation target to actual development does not notably alter inflation expectations and less so inflation-indexed nominal variables such as wages. Moreover, the monetary policy lacks instruments that can affect price development in a horizon of six months or the inflation trend till the year-end was beyond monetary policy influence much like in 1999's case. The only aim of the central bank to indicate to the public that it is not going to reverse the current disinflation trend might justify such a non-standard step. Nevertheless, the role of the key indicator of the central bank's disinflation aim is played by the mid- and long-term inflation target, thus any ex-post adjustment of the short-term goal might contribute very little to the credibility of a disinflation strategy and either negative consequences may be recorded.

Well-developed financial markets and a sound banking system. The Polish financial markets are the most liquid CEE market and also have the largest capitalization. The last obstacle to the dynamic evolution of financial markets -- restriction on short-term capital flows -- was removed in September 2002. These capital controls, which forced non-residents to seek central bank permission to buy zloty debt instruments shorter than three months, should be abandoned in January 2000 as was agreed with the OECD. Until September 2002 the country forced many short-term investors/speculators to buy and roll zloty swaps to take advantage of high Polish yields. Moreover following IMF criticism, the sizeable offshore spot and forward markets for the zloty along with unfettered access for residents to foreign currency deposits and credits from domestic banks meant that the remaining exchange controls did not constitute much of an impediment to speculative pressures on the zloty or to the accumulation of foreign debt (IMF, 2000). Hopes laid on full capital liberalization had more or less materialized. The financial market (especially the derivate market) got a new stimulus to advance. What is more the money market in Poland had been developing such that the NBP could shorten the maturity of its deposit rate from 28-days to 14-days, the common maturity in the CEE countries.

While the financial markets are relatively well-developed, the Polish banking sector is apparently less developed taking into account the share of bank assets in the GDP that amounts to about 130 percent of GDP in the CR vs. slightly more than 60 percent of GDP in Poland. Moreover in the course of economic slowdown in Poland, the former health of the Polish banking sector compared to e.g. the Czech system markedly worsened. The share of non-performing loans increased from 17% of total loans in 2000 to 25% in Poland,

while in the Czech Republic the development was exactly the opposite (19.3% in 2000 vs. 9.4% in 2002 according to EBRD statistics). The initially low share of non-performing loans in Poland reflected, among others, the Polish strategy of relying on relatively high inflation, which contributed to a devaluation of the real value of bad loans. It should also be noted that the privatisation of the Polish bank sector is not yet finished. Also completion of bank privatisation increasing competition and a further drop in market yields will surely increase the effectiveness of the banking sector as well as the transmission of official interest rate changes to banking interest rates. The relatively low effectiveness of the local banking sector is mirrored in the persistence of excessive spreads between lending and deposit rates. However, in contrast to the Czech Republic, Polish enterprises are less dependent on bank loans. The adjustment of the interest rates influences their financial situation and investment intentions by a relatively small amount. On the other hand, the indirect effect of interest rate changes on inflation through the movements of a nominal exchange rate seems to have a stronger impact on firms' behaviour.[18]

Macroeconomic stability and reasonably low inflation. The Polish economy was the most dynamic economy among the CEE-3 countries (Czech Republic, Hungary and Poland) in the second half of the nineties. The high pace of growth was, however, accompanied by relatively high price growth and external imbalance. Even the dynamic economic growth did not prevent public finance to fall into deficits. Above-average social expenditures, inflation-indexation of some public expenditures and expenditure overrun outside the central state budget kept the public finance in the red. Thus, the macroeconomic environment was not overly favourable for adopting inflation targeting.

The level of inflation in transition countries such as Poland and the Czech Republic should be judged by the process of price adjustment. Therefore, a direct comparison of the inflation levels in transition countries with those prevailing in advanced inflation targeting countries is inappropriate. Moreover, the adoption of inflation targeting in transition economies is associated primarily with a policy goal to disinflate instead of stabilizing low inflation. Following this argument, the level of inflation in Poland should be compared with that in other advanced transition economies that also adopted inflation targeting like the Czech Republic, Chile and Israel. Unfortunately, the Polish inflation rate, in

[18] This assumption is coherent with the results of the bivariate Granger causality test. The interest rates are not Granger-causal to industry production at the 5 per cent probability as opposed to the nominal exchange rate of the zloty, which proves to be Granger-causal to industry production.

confrontation with other emerging inflation targeting countries, proved to be the highest one, particularly before inflation targeting adoption. In the past less conservative, more pro-growth oriented monetary policy laid behind this fact. Nevertheless, at the time of adopting inflation targeting the inflation markedly slowed down near to the average emerging market inflation.

The capacity of the central bank to model and forecast inflation and appropriate knowledge of the transmission mechanism. The NBP like other central banks in transition countries has to face the difficulties of unsettled economic relations and the patterns of the main economic agents. An insufficient level of macroeconomic stability and permanent changes to market institutions complicate any effort to investigate economic features based on statistical (econometric) techniques and available macroeconomic time series. It must be noted that all these shortcomings are not regime specific and would persist under different monetary policy regimes.

To overcome this limitation facing the implementation of the inflation targeting strategy in Poland, the NBP much like the NBH or the CNB had adopted a pluralistic approach to the forecasting process. The forecast system consists of autoregressive and expert forecasts as well as a structural model. While autoregressive modelling focuses on examining the current state of the links between monetary policy instruments and the main economic variables, the structural models of inflation attempt to describe a stylised version of the economy rather than the current state of the economic environment. The NBP, according to the CNB's standard, publish a point estimate and range in its Inflation Report. The MPC, however, does not publish a quantified inflation forecast, but rather the MPC's view on the inflation prospects in Poland once every quarter. The relatively high weight assigned to subjective expert judgments in the forecasting process of the NBP poses the risk of subjective mistakes and inconstancies. From this reason, the NBP staff develops and tests more regular macroeconomic models such as a quarterly structural model of inflation. As long as the robustness of these models is not verified, the NBP should avoid inadequately relying on the unsettled forecasting models and incorporate into its decision-making process a wide range of potential inflationary pressures indicators. The rash decisions (such as revising the short term inflation targets) just harm the credibility of the regime.

Public support for price stability. The priority of price and monetary stability has to be observed by policy-makers, the country's main market participants, and society as a whole. Unfortunately, the confidence of Polish governments in the positive consequences

of monetary stabilization appears to be the weakest among the CEE countries. The lukewarm stance towards the announced inflation target or plan states that Ministry of Finance predictions are or are not in line with the NBP inflation prediction and do not support the credibility of the inflation targets. Under such circumstances to discuss the benefits of joint target announcement is unavailing.

Notwithstanding, the NBP decided to actively communicate to the public in an effort to explain the background of monetary policy decisions, inform on expected economic trends and last, but not least, influence inflation expectations. The main way how to communicate with the public chosen by the Council was the so-called "Inflation Report" in line with the common standard in inflation targeting countries. This quarterly bulletin explains recent policy decisions and their impacts on target fulfilment. In aiming to strengthen monetary policy transparency, the Inflation Report includes the information about voting by each Council member, helping market participants with orientation in the policy stance of the MPC's members.

Though the information value of the NBP materials has been improving, there are still particular areas in which an improvement would be welcomed. The introduction of the regular publication of a quantified inflation forecast is one example. On the contrary, the transparency of the NBP regarding the votes of each MPC's member is highly valued and should find a similar response in the two other CEE inflation-targeting countries.

The economic environment in which the decision to adopt inflation targeting was taken, was not overly favourable. The symptoms of fiscal dominance, un-coordinated fiscal policy and an underdeveloped forecasting model pose the main obstacles to effective inflation targeting proceeding in Poland. Also the revisions of short-term inflation targets do not help establish the credibility of the regime. Notwithstanding, the inflation targeting regime proved to be more transparent than the other policy regimes and can help in settling down Polish inflation.

2.4 Technical Issue of Inflation Targeting in Poland

The following chapter initiates the empirical analysis of the Polish inflation development and the basic relations among the main macroeconomic variables in the Polish economy. The paragraphs below examine the statistical and econometric attributes of Polish inflation, whereas it is supposed that even the basic statistical methods might

shed light on the relevant characteristics and consequences of inflation development. Such information is key for all central banks, particularly for those that decided to directly target inflation. The analysis of Polish inflation is simultaneously accompanied by a similar Czech inflation analysis with the aim of highlighting the country-specific features of the inflation environment in these countries.

The unit root test and the standard descriptive statistics open the examination of Polish and Czech inflation. Then variation analysis follows extended by the recursive residuals test. The second part of the inflation analysis examines the autoregressive process (AR) of inflation. The next chapter of the empirical part of this paper tries to identify the basic economic linkages between inflation indicators and various macroeconomic figures applying the basic bivariate Granger causality test, impulse response functions of inflation, and the vector autoregression process (VAR) test.

Considering the short-term history of inflation targeting and still unsettled economic relationships being weighted on more frequent revisions of economic variables, the following results should be considered as preliminary.

The process of economic transition that was launched in 1989 markedly affected Polish inflation development. Poland passed through a period of the highest inflation among the key CEE countries in 1989-1991. Thus, in an effort to avoid a distortion of the analysis outcomes, the period of hyperinflation was separated or even excluded from the analysis below. A further shortcoming of the inflation path was pointed out by the augmented Dickey-Fuller Unit Root test. As Table 4 shows, the Polish headline inflation did not prove to be stationary even at the 10% significance level. The core inflation that is followed just as a one of the inflation indicators seems to have some favourable statistical characteristics, at least according to the Augmented-Dickey-Fuller test. Seemingly favourable results brought about the unit root test for the Czech headline inflation– the stationary was not excluded for three to eleven lagged difference terms at the 5% or even the 1% probability level. On the other hand, net inflation, being chosen at the initial stage of Czech inflation targeting as the key inflation indicator, proved to be non-stationary.

Table 4 Unit Root Test of Polish and Czech Inflation Indicators

Number of adding lagged difference terms	Polish CPI Inflation	Polish Core Inflation	Czech CPI Inflation	Czech NI Inflation
Available sample period	*1992:01 2003:12*	*1998:01 2003:12*	*1993:01 2003:12*	*1995:01 2003:12*
Adjusted sample period	*1992:05 2003:12*	*1998:03 2003:12*	*1993:03 2003:12*	*1995:03 2003:12*
1	-2.1617	-2.6068	-2.7244	-2.5761
2	-1.7044	-2.3300	-3.3024	-3.0362
3	-2.0671	-2.5578	***-3.5010***	-2.7376
4	-2.5271	-2.6343	***-3.7025***	-2.9890
5	-2.4870	-2.8818	***-3.7676***	-2.7272
6	-2.4121	-2.9165	***-4.2406****	-2.9261
7	-1.8038	***-3.1916****	***-4.6524****	***-3.1730****
8	-1.9238	***-3.2425****	***-4.7161****	-2.9916
9	-1.9696	***-3.3699****	***-4.7682****	-2.9621
10	-2.2756	***-3.5552****	***-4.3430****	-2.4145
11	-1.5161	-2.9497	***-4.8154****	-2.4181
12	-1.0682	-2.3056	-2.5013	-1.7078

Notes: Based on monthly data on annual consumer price index with a base of 100 (for more details about the definition of net inflation (NI) see, for example, CNB (2000) or Horska (2001a)). The Augmented Dickey-Fuller Unit Root test (ADF) includes the time trend and the constant term. The actual τ-values in the ADF are marked by "***"or "**" or "*", if they exceed the McKinnon critical values at 1, 5, or 10 per cent probability level, respectively.
Source: Author's calculations based on NBP, CNB and Bloomberg data.

The non-normal distribution of Polish inflation verified by a Jarque-Bera test represents another possible obstacle facing effective monetary policy management and the investigation of the key transmission mechanism in the economy (see Table 5). The distribution of the inflation time series in both countries is asymmetric: in the case of the Polish CPI and the Czech net inflation the series displays a long right tail while the case of Czech headline inflation displayed a long left tail. Moreover, the distribution of the Polish inflation time series proved to be strongly peaked relative to the normal distribution. On the other hand, the Czech net inflation time series was characterized by a flat distribution relative to the normal.

The analysis of inflation variability indicates that the adoption of inflation targeting in Poland was accompanied by a reduction in the inflation level and, most importantly, in the fluctuation of the CPI. According to the theory of inflation targeting[19], a direct inflation targeting regime should in fact contribute to a more stable inflation trend. As Table 5 shows, the standard deviation, a measure of the variable's volatility, of the inflation series during the pre-inflation targeting period in Poland was almost threefold compared to the

[19] On the other hand, the fiscal theory of price level assumes that the central bank can determine the average rate of inflation. The variance of inflation cannot be perfectly controlled because the central bank is not able to eliminate the impact of shocks on the price level caused by fiscal policy [Christiano, 2000].

inflation-targeting period. At the same time, the inflation level dropped to one-quarter of the prior levels. Contrary to the development in Poland, the variability of Czech headline and net inflation after the adoption of inflation targeting did not change much. However, the Czech economy passed through a longer period of disinflation and the local monetary policy was always more conservative than in its neighbours. Thus, the inflation stabilization (in the sense of lower volatility) proceeded already ahead of inflation targeting adoption. Both countries were similarly successful in lowering the inflation level -- Poland from 23.8% y/y to 5.1% y/y and the Czech Republic from 11.1% y/y to 3.9% y/y. Notwithstanding, inflation in Poland has remained above the Czech one which might reflect a higher inflation bias in Poland or the lower elasticity of Polish inflation to external price factors. Though the outcome corresponds to the theoretical assumptions, it should be added that it is almost impossible to abstract the effect stemming from a regime switch from the external disinflation factors. Or, the inflation targeting in Poland coincided with inflation stabilization and reduction, but it does not automatically mean that the regime change was the reason lying behind that.

The variability test allows us to test the other theoretical hypothesis being advocated by Lars E.O. Svensson, the famous protagonist of the inflation targeting regime. According to Svensson [Svensson, 2000], strict inflation targeting, adopted among others in Poland and the Czech Republic, aims at stabilizing inflation around the inflation target and in doing that, it might hamper the stabilization of other macroeconomic variables such as the exchange rate, for example. While a separate analysis of the Czech crown's volatility proved to be consistent with the above assumption, the development of the Polish zloty went in the opposite direction – the inflation targeting coincides with exchange rate stabilization although at weaker levels (see Table 5).

Finally, the variability test pointed at the generally high degree of inflation variability during the previous years in Poland posing a risk that Poland's inflation tolerance bands prove to be inadequately narrow, if the macroeconomic environment turns to be less favourable.

Table 5 Descriptive Statistics of Polish Inflation Indicators and Exchange Rate of the Zloty

	CPI (y-o-y changes)				**Exchange Rate** (unit of the PLN)		
Sample period	***90:01 93:12***	***90:01 92:12***	***93:01 98:12***	***99:01 03:12***	***93:01 98:12***	***93:01 98:12***	***99:01 03:12***
Mean	**78.19**	308.86	23.75	5.12	**3.32**	2.68	4.08
Median	**18.15**	65.05	21.30	5.40	**3.51**	2.53	4.06
Maximum	**1183.10**	1183.10	39.70	11.60	**4.65**	3.80	4.65
Minimum	**0.30**	38.10	8.60	0.30	**1.59**	1.59	3.67
Std. Dev.	**224.48**	412.63	9.20	3.58	**0.84**	0.60	0.20
Skewness	**3.98**	1.22	0.08	0.14	**-0.43**	0.11	0.53
Kurtosis	**17.64**	2.73	1.59	1.63	**1.81**	1.93	3.28
Jarque-Bera	**1943.52**	9.09	6.06	4.88	**11.77**	3.57	3.03
Probability	**0.00**	0.01	0.05	0.09	**0.00**	0.17	0.22

Note: The core inflation data are available from January 1998 and the exchange rate PLN/USD from January 1993 (the FX rate data prior to the 1995 currency reform are re-counted in accordance with the official convertible ratio of 1:10000.)
Source: Author's calculations based on NBP and Bloomberg data.

Table 6 Descriptive Statistics of Czech Inflation Indicators and Exchange Rate of the CZK

	CPI (y-o-y changes)			**Net Inflation** (y-o-y changes)			**Exchange Rate** (unit of the CZK)			
Sample period	***93:01 03:12***	*93:01 97:12*	*98:01 03:12*	***95:01 03:12***	*95:01 97:12*	*98:01 03:12*	***93:01 03:12***	*93:01 97:04*	*97:06 97:12*	*98:01 03:12*
Mean	**7.32**	11.08	3.90	**3.91**	7.59	2.07	**31.59**	27.93	33.55	34.02
Median	**7.35**	9.60	3.70	**3.20**	7.30	2.00	**30.18**	27.83	33.45	34.47
Maximum	**21.9**	21.90	13.40	**11.30**	11.30	7.9	**41.06**	30.97	34.55	41.06
Minimum	**-0,4**	6.30	-0.40	**-0.60**	4.60	-0.60	**25.61**	25.61	32.52	25.71
Std. Dev.	**5.66**	4.58	3.64	**3.40**	1.81	2.35	**4.28**	1.38	0.78	4.03
Skewness	**-0.09**	1.60	1.25	**0.33**	0.70	0.87	**0.49**	0.16	-0.01	-0.20
Kurtosis	**3.67**	4.01	4.01	**2.02**	2.71	3.13	**2.02**	2.03	1.51	1.97
Jarque-Bera	**22.53**	27.21	21.85	**6.60**	3.08	9.13	**10.62**	2.26	0.65	3.62
Probability	**0.00**	0.00	0.00	**0.04**	0.21	0.01	**0.01**	0.32	0.72	0.16

Note: The net inflation data are available from January 1995. In the sub-period analysis of the exchange rate I omitted May 1997 due to the very high volatility of the CZK in the course of the exchange rate crisis.
Source: Author's calculations based on CNB and Bloomberg data.

The recursive residuals test for Polish and Czech headline inflation offers a more sophisticated investigation into inflation variations. The modification of the Dickey-Fuller procedure and the application of the t-test on the specification of the lag length give us the following equation:

$$\Delta\pi_t = a + b\pi_{t-1} + c\,\pi_{t-2} + \omega_t, \qquad (15)$$

where π is the inflation indicator at time t, t-1 and t-2, and ω the error term.

The recursive residuals of the OLS estimation, in general, suggest instability in the estimated parameters as indicated in the distribution of structural shocks when the residuals exceed the standard error band. The outcomes from the recursive residual test for Polish and Czech CPI inflation are shown in Figure 3 and 4. While the Polish inflation was stabilized in the course of the second half of the nineties and the Asian financial crisis in 1997 did not change this fact, Czech inflation proved to be more volatile and vulnerable to external shocks. At the time of the Asian financial crisis, Czech inflation underwent structural shocks because of upward pressures on inflation expectations caused by the exchange rate crisis of the CZK in May 1997. The subsequent macroeconomic policies supported faster disinflation in the Czech economy relative to that in Poland. The infraction of the band in 1998 in the Czech Republic suggests that the Czech direct inflation targeting regime gained more credibility relative to the Poland case, when this break did not appear at the time of adopting the inflation targeting regime. In general, Figure 3 and 4 suggest that the implementation of inflation targeting was accompanied in both cases by a decreased volatility of recursive residuals leading to the possibility of a higher predictability of inflation.

Figure 3 Recursive Residuals of Poland's CPI

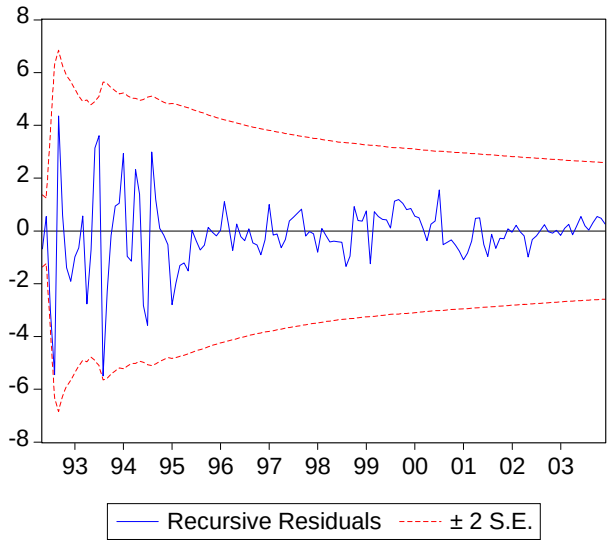
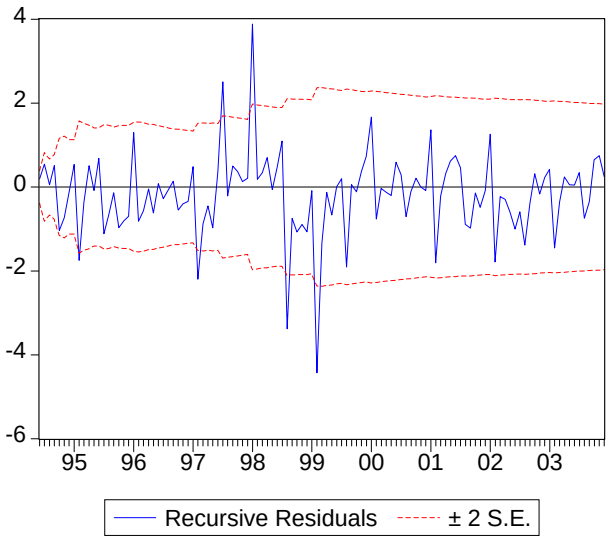


Figure 4 Recursive Residuals of the Czech CPI



Notes: Monthly data on year-on-year CPIs.
Source: Author's calculations based on CNB, NBH and Bloomberg data.

The investigation of the inflation series carries on with the verification of the significance of a time series trend, and an autoregressive (AR) process described in the following equation:

$$\Delta\pi_t = a + b\,t + c\,AR(p) + d\,MA(q) + \mu_t, \qquad (16)$$

where $\Delta\pi_t$ is the first difference of inflation indicator at time t, t is the time trend, $AR(p)$ the autoregressive component of order p, $MA(q)$ the moving average component of order q and μ_t the error term.

As Table 7 shows, Polish CPI inflation is characterized by a statistically significant negative time trend that suggests that the Polish economy has been successfully set on a disinflation path and that the inflation reduction is still a significant determinant of price development in Poland. Contrary to Poland, Czech inflation appeared to be already stabilized at a low level since constant or time trend proved to be insignificant. Otherwise, the statistical significance of the autoregressive trends indicates some persistence of inflation in both countries. In Poland, the inflation autoregressive process seems to be deeper rooted than in the Czech Republic likely because of prevailing persistent inflation indexation maintaining inflation inertia.

Table 7 Estimation of AR Process of Inflation Paths

First differences of			*ARMA process*				R^2
Polish CPI Inflation (1993:02 2000:03)	***Constant Term*** ***-0.512*** *(-2.477)*	Time Trend *0.003* *(1.329)*	AR (1) 0.152 (1.923)	***AR (2)*** -0.297 (-3.609)	***AR (4)*** 0.191 (2.387)	***AR (12)*** -0.221 (-3.393)	**26%**
Czech CPI (1994:08 2003:12)			AR (6) 0.102 (1.074)	***MA (6)*** 0.350 (2.773)	***MA (12)*** 0.267 (2.802)		**23%**

Notes: The annual CPI inflation in Poland and that in the CR are observed as monthly data. Due to the nonstationarity of Polish inflation or just limited stationarity of Czech inflation time series only for some lagged difference terms (see Table 4) the estimation is run in the first differences of inflation indicators.

The estimation of the ARMA process of Czech inflation does not prove the statistical significance of the constant and the time trend; instead, their inclusion worsens the statistical property of the model. Contrarily, in the Polish case, the constant appeared to be statistically significant and the time trend, although insignificant, improved the model's properties. Although some AR terms in Czech and Polish CPI proved to be statistically insignificant for the considered time period, they enhanced the statistical quality of the model.

The residual tests reject at the 1%, 5% and less significance levels the serial correlation. But the autoregressive conditional heteroskedasticity (ARCH) in the case of Polish model and the hypothesis of the normality of residuals is not confirmed in both cases (see Appendix).

The t-statistics are in parentheses. The statistical significant values are presented in bold italics.

Sources: Author's calculations based on CNB, NBP and Bloomberg data.

Applying the estimations of the ARMA process of inflation, the inflation path's structural consistency can be examined. The Chow's Breakpoint and Chow's Forecast Test are designed to verify whether a significant structural change in a (inflation) time series occurs at some particular time point (e.g. at the time of adopting inflation targeting). Consistent with the outcomes of the Recursive Residuals Test, both stability tests (see Table 8) as well as the Unit Root Tests, run separately for the period of inflation-targeting, did not confirm a structural break in Polish inflation development at the time of the inflation targeting regime nor at the beginning of the next year. On the contrary, the structural change was confirmed in the case of Czech inflation. It can mean that Czech inflation targeting immediately gained some degree of credibility (perhaps thanks to a persistently conservative monetary policy), while the Polish strategy was not so successful and the NBP had to build up the credibility for its newly adopted policy regime.

Table 8 Estimation of ARMA Process of Inflation Paths – stability test

First differences of	*Breakpoints*	*Test*	*Log likelihood ratio*
Polish CPI Inflation (1993:01 2000:03)	***1998:09***	Chow Breakpoint Chow Forecast	10.998 (0.088) 26.715 (0.999)
Czech CPI (1995:01 2003:12)	***1998:01***	Chow Forecast Chow Breakpoint	***194.607*** (0.000) ***71.669*** (0.000)

Note: The probability of the F-statistic or the log likelihood ratio statistic is in brackets. The statistically significant values at the 5% significance level are presented in bold italics.
Source: Author's calculations based on IMF, Bloomberg, NBP and CNB data.

Further investigation into the change in inflation development's patterns is based on the tests of the autocorrelation process. These tests were run separately for the pre-inflation-targeting period and for the period of inflation targeting.

Table 9 shows that the autocorrelation in Polish inflation remained untouched by the change in the monetary policy regime and remained, unfortunately, relatively strong compared to Czech inflation. Still higher values of the autocorrelation coefficients for Polish inflation suggest the persistence and backward-looking character of inflation expectations.

Table 9 Inflation Autocorrelation

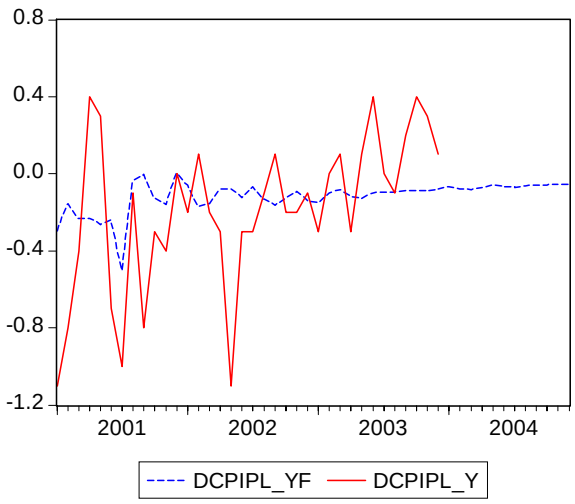
Inflation	*Period*	*Inflation Autocorrelations by periods lagged*					
		1	*2*	*3*	*4*	*5*	*6*
Polish CPI Inflation	***1992:02 1998:12***	0.137 (0.204)	***-0.292*** (0.011)	***-0.082*** (0.022)	***0.165*** (0.017)	***-0.018*** (0.033)	***-0.135*** (0.032)
	1999:01 2000:04	***0.283*** (0.025)	***0.270*** (0.008)	***0.114*** (0.014)	***0.159*** (0.016)	***0.196*** (0.011)	***0.070*** (0.019)
Czech CPI	***1994:02 1997:12***	-0.025 (0.859)	-0.047 (0.930)	0.023 (0.982)	-0.006 (0.996)	-0.006 (0.999)	0.014 (1.000)
	1998:01 2003:12	-0.029 (0.802)	0.002 (0.969)	0.107 (0.813)	-0.066 (0.863)	-0.028 (0.929)	***0.535*** (0.000)

Note: The probability of the Q-statistic is in brackets. The statistically significant values (at least at a 5% significance level) are presented in bold italics.
Source: Author's calculations based on CNB, NBP and Bloomberg data.

The "pseudo-inflation model" based on the estimation of equation 16 can serve as a useful comparison of the modelled inflation path with actual inflation development and finally with the inflation target as well. The forecast below is the conditional one, assuming

unchanged economic conditions including monetary policy instruments. Thus, a comparison of the modelled inflation path and inflation target outlines whether the central bank, keeping its policy instrument untouched, meets or misses the target. The above pseudo-inflation model implies undershooting of 2004's short-term inflation target set at 2.5% ± 1pb. However, it should be added that this model just prolonged the past development coincident with strong disinflation and thus it is not able to indicate any possible trend reversal.

Figure 5 Inflation Forecast from Polish CPI Model



Notes: The graph plots the first differences of Polish CPI data.
Source: Author's calculations based on Bloomberg and NBP data.

2.5 Policy Instruments and their Effects on Inflation

The knowledge or at least awareness of the monetary policy transmission channel is one of the important prerequisites for effective inflation targeting management. Unfortunately, the investigation of the links between monetary policy instruments and price development is complicated by a number of country- or region-specific factors. The unsettled economic environment, evolving market institutions and changes in the behavioural patterns of economic agents raise the question of the reliability of economic figures, enforce their frequent revisions and cause methodology breaks in the time series of an economic variable. In Poland, the investigation of the monetary policy transmission channel is, moreover, hampered by major revisions in the monetary policy regime and operating procedures, which materialized more frequently than in other advanced transition

countries. A further obstacle is the steady motion of inflation and interest rates in the course of transition, hampering any statistical and econometric research into macroeconomic relationships in the economy.

The Polish central bank facing the problem of the absence of robust country-specific macroeconomic models and shallow knowledge of the monetary policy transmission mechanism has been forced to rely upon various forecasting methods. Besides expert judgments and autoregressive models, the NBP works with so-called inflation indicators and tries to find a way of involving them into a more general, large structural economic model similar to that being developed by the CNB.

With the aim of unveiling the basic linkages between inflation and monetary instruments, the links between leading indicators, inflation and interest rate will be examined. Real economic activity variables (industrial sales and retail sales), money market variables (3-month Treasury bill rate and broad money), inflation indicators (CPI, PPI, share price index, oil and motor fuel price index, commodity index GJX, German's CPI, PPI, food and wholesale prices), labour market variables (unemployment rate and nominal wages), internal balance (12-month central state budget balance) and external balance indicators (12-month trade balance, nominal and real effective exchange rate, zloty exchange rate) were classified as the potential leading indicators.[20] The bivariate Granger causality test opens the investigation of the links among the above macroeconomic variables.[21]

The Granger causality test proved the statistical importance[22] of two main monetary transmission mechanisms: (1) exchange rate pass-through and (2) the interest rate channel, while the asset price channel failed to classify.[23] The exchange rate channel proved to more obvious and widespread. The external value of the zloty seems to affect domestic price development in a few ways. The first one is the direct exchange rate channel that seems to

[20] All variables are observed as monthly data. The data sources include IMF, Bloomberg and NBP statistics. Excluding the 3-month Treasury bill rate, all variables are transformed by taking logarithms.

Monthly figures were chosen to get over the problem of short and unsettled quarterly data time series. The particular indicators are intended to serve as proxy variables of the respective quarterly macro figures.

[21] In accordance with the results of the unit root test, all variables are applied in first differences. More detailed results of the Granger causality test are available in Appendix 5.

[22] …at least at the 10% significance level;

[23] The expectation channel was not tested because of a lack of inflation expectation time series.

operate under a 6 to 9 month lag. The others are indirect channels influencing inflation levels, for example through import prices, production cost and industrial sales. This outcome is consistent with the NBP's own estimations[24] indicating the strong dominance of the exchange rate change over the interest rate. Contrary to Hungary, the "dirty" inflation targeter, the NBP proved to pursue strict inflation targeting, adjusting the key monetary policy instrument - interest rate- strictly to inflation development and not to e.g. exchange rate as the NBH does.

The interest rate policy channels proved to be statistically significant only with a long time lag of 12 months. Moreover, the interest rate changes do not, for the meantime, spread over the economy to such an extent as the exchange rate does. The Granger causality test indicated a statistically significant impact of short-term interest rates on retail sales and gross wages. Or the interest rate changes seem to be transferred into domestic price development via consumer demand, while investment activity and production demand seems to less sensitive to "the price of money". While bank claims on households and the share of consumer credits in private consumption expanded over the last couple of years, the credit expansion at private corporations was a rank lower. Beyond the fact that almost one-third of the loans are denominated in foreign currencies and thus are independent on the domestic interest rate policy, the private sector is used to financing the majority of their investment outlays from their own financial sources. Thus the credit channel interferes with a relatively low business credit penetration or limited financial intermediation and very low leverage of the households and corporate sector in Poland. The impact of interest rate adjustment on firms' and households' balance sheet positions is therefore modest. The other hamper for the effective operation of a credit channel is represented by excessive spreads between lending and deposit rates that imply enough room to enhance the effectiveness of banking intermediation. However, a boom in household indebtedness (particularly in the mortgages segment) and improving the effectiveness of the Polish banking sector are likely to gradually rise the role of the interest rate and credit channels on the Polish transmission mechanism.

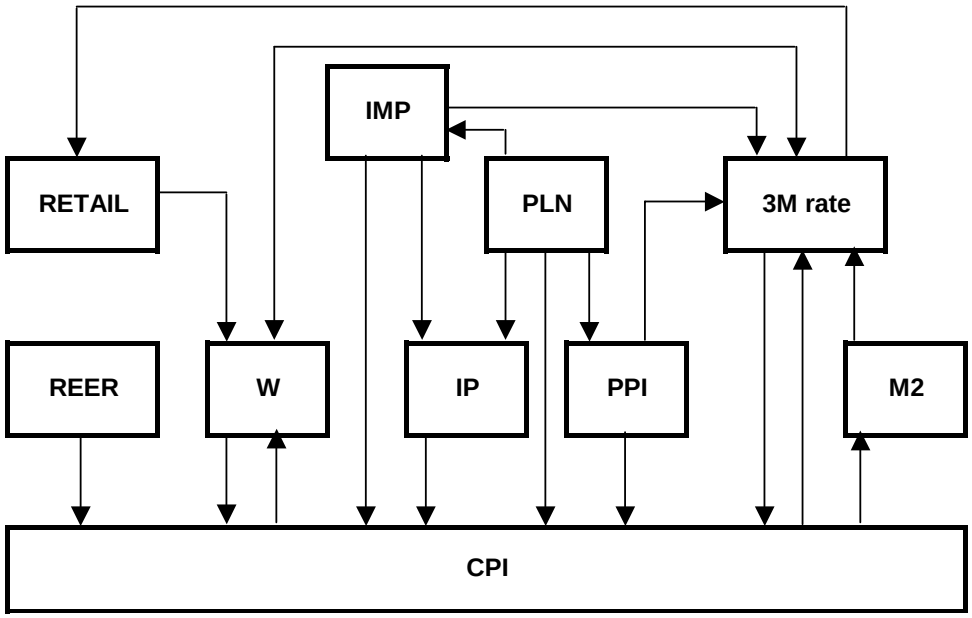
The Granger causality test failed to confirm the statistical robustness of the asset price channel. While the causality relations between manufacturing performance, the zloty's exchange rate and nominal wages on the one hand and the Warsaw equity index WIG on the other hand were confirmed, interest rate adjustment proved to be statistically insignificant for equity market performance as well as for production performance. It seems that the NBP lacks

[24] See, for example, Lyziak, 2002.

an effective tool to manage the supply side of the economy, whereas the demand side is, at least, under the partial control of monetary policy.

The outcomes of the causality test pointed out other macroeconomic consequences of inflation development than just interest rate transmission channels. For example, the supply side inflationary pressures proved to in a numerical majority as import and producer price development or production activity tamper with consumer prices. Moreover, the external price development of raw materials or consumer goods determines the price trend in Poland via import and production prices, exactly in conformity with the presumptions for a small-open economy. The test also indicated the causality link between price development and changes in short-term interest rates. Or, inflation plays the dominant role in determining interest rate adjustment in the NBP's reaction function, as it should be in the regime of strict inflation targeting. A less favourable finding is the robust link between inflation and wages confirming the persistence of wage indexation in Poland's economy. Indexation of other economic variables such as social benefits also explains why inflation development proved to have a statistically robust impact on the state budget balance.

Figure 6 Simplified scheme of the transmission mechanism in Poland



Note: The scheme is compiled from the Granger causality test results. "CPI" denotes the consumer price index, "IMP" the import price index, "IP" industrial sales, "M2" broad money, "3M rate" the 3-month Treasury bill rate, "PLN" the zloty exchange rate, "PPI" the producer price index, "REER" the real effective exchange rate, "retail" retail sales and "w" nominal gross wages.
Source: Author's calculations based on IMF, Bloomberg and NBP data.

Further investigation into the monetary policy transmission channel impinged on an important shortcoming of bivariate Granger causality testing – the inability to provide information about the sign of the bivariate relationship. For this reason the VAR test and the estimation of impulse response functions was run in an attempt to assess the short-run as well as the long-run dynamic relationship between inflation and economic indicators and to investigate the cumulative effects of variables' changes and the magnitude and duration of impulse responses. The policy variables, such as the zloty's exchange rate and the interest rate, were ordered just behind variables related to economic activity and consumption in the VAR.[25] The estimation was run in log terms (except the short-term interest rate), since the relation between economic variables are assumed to be non-linear. According to the Akaike Information criterion and advisability of the model, three time lags appeared to be appropriate.[26] The sample period was limited to the available time series, or from January 1996 to December 2003.

Figure 7 shows the impulse responses of local economic variables to monetary policy and exchange rate shock together with the respective 90 percent confidence intervals. The effects given by the impulse response functions are measured as changes in the log of all variables except for the interest rate, where these effects are given in percentage points. The VAR model and impulse response analysis confirmed the outcomes of the Granger causality test that pointed to the dominance of the inflation consequences of exchange rate over the interest rate development in the short term. While the exchange rate shock on inflation seems to culminate in tree months at roughly 0.2-0.3% pass-through to the consumer price level, the impact of interest rate adjustment proved to be weak in the short-run but gradually strengthened in the course of months at almost a 0.5% pass-through. Thus, the interest rate changes spread into inflation with a long time lag and may be overshadowed by other contradictory economic factors. Or, the NBP has in its hand a tool to guide consumer price development, however, it works with a relatively long time delay.

[25] Placing the policy variables in the final position in the VAR does not change the basic shape of estimations. The test is based on monthly data because of short time series of quarterly macroeconomic figures that are from time to time subject to revision.

[26] The VAR model presented in the form of impulse response charts satisfied the stability condition (no inverse roots lies outside the unit circle). The LM test up to 12 lags indicated no serial correlation in residuals at the 5% significance level.

Detailed results of the VAR test and impulse response analysis are available in Appendix 6.

Therefore, the NBP has to anticipate inflation development many quarters ahead and adjust the monetary policy instrument in advance.

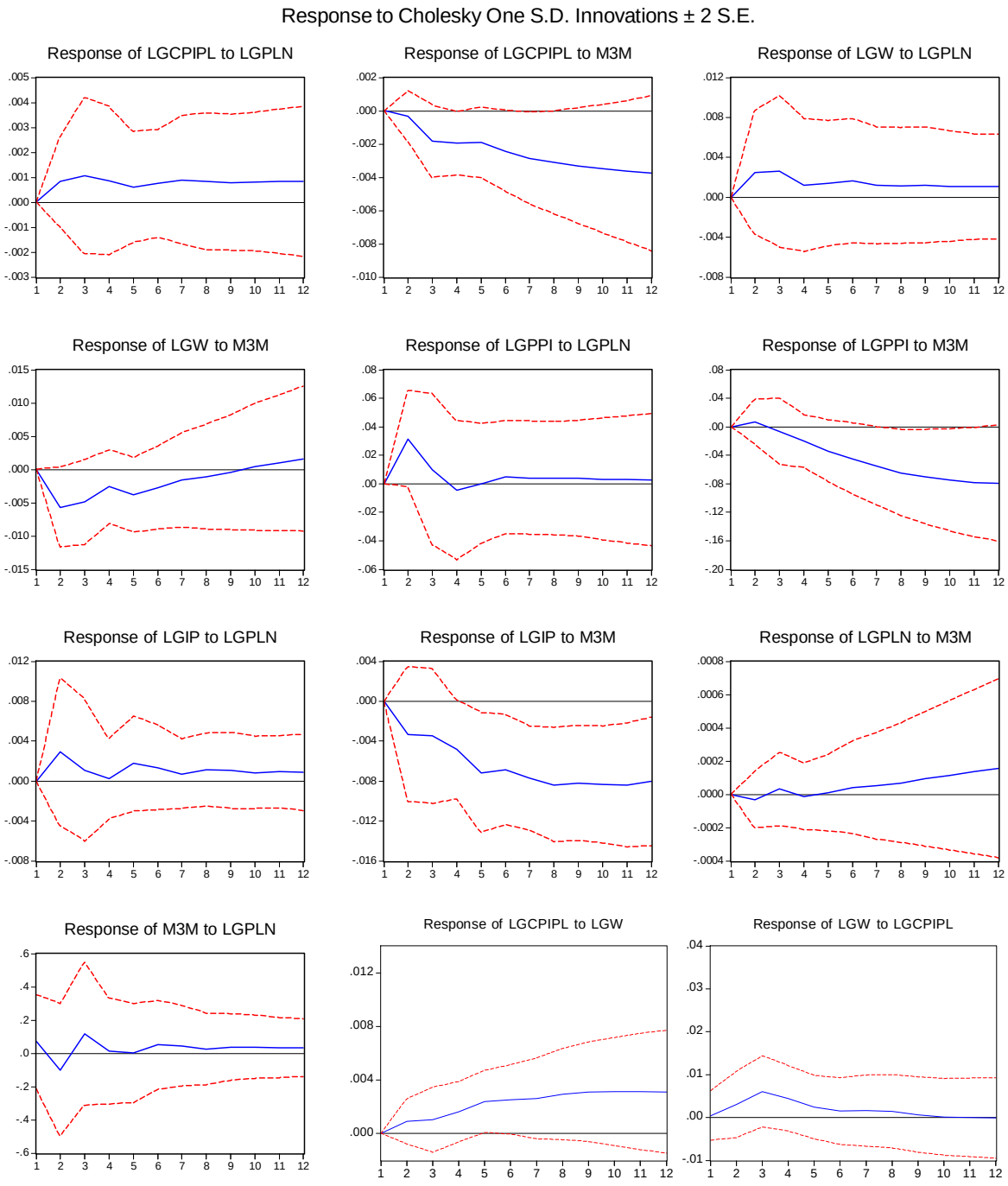
The contractionary monetary policy shock manifested its power to affect the production activity of Polish manufacturers, local producer prices as well as nominal wages as far as the mid- and long term. While a strong and quick response from industrial output to exchange rate shock is not excluded, the interest rate effect seems, in the course of the time, to override the exchange rate effect and cause a significant reduction in production activity. The finding of the long-term negative interest rate shock on activity of Polish industry is consistent with the outcomes of other studies such as Klos (2001). In the model, the contractionary interest rate shock also causes a temporary nominal wage drop that, however, felt to be statistically robust and later is offset by a statistically significant rise. The widespread indexation mechanism in Poland hampers wage flexibility and makes the wage setting mechanism rigid. The response of nominal wages on inflation development proved to be more robust and stronger than on interest rates or exchange rate. The response of Polish producer prices (representing supply inflationary factors) on the exchange rate development dominated correctly to the interest rate impact. Nevertheless, in the long run the power of interest rate shocks increases and overshadows the exchange rate effect. The reaction of exchange rate itself on interest rate shock is initially conventional (a strengthening) but it soon reveres into a longer-lasting weakening. The temporary character of the modelled shocks, being expected by the majority of economic agents to reverse in the time to come, offers an explanation for this finding. Or, the temporary interest rate hike seems not to be accompanied by a longer lasting appreciation of the zloty that would support the contractionary affect of interest rate on inflation. In this case, the interest rate transmission channel relies largely on the sensitivity of real economic variables on interest rate changes. Finally, the VAR model indicated that the response of short term money markets on the zloty's development is not statistically significant and stable over time, confirming the "strictness" of the inflation targeting regime in Poland.[27]

The short-term character of the presented VAR model and the lack of reliable long-time series of various macroeconomic variables impede an investigation in the consequences of a persistent interest rate and exchange rate shock. Nevertheless, the investigation into the short-term dynamics of inflation and inflation indicators stressed the

[27] The other economic variables (such as unemployment rate or money supply) proved to be statistically insignificant and their involvement into the model even worsened the model's properties.

robustness of exchange rate transmission channels in the short-run and at the same time indicates the rising significance of interest rate channel with extending time lags.

Figure 7 Impulse Response Functions



Notes: The upward movement of the PLN signifies a depreciation.
Source: Author's calculations based on NBP, IMF and Bloomberg data.

2.6 Specific Features of Inflation Targeting in Poland

The country-specific features of the inflation targeting strategy in Poland result from the specific economic conditions that stem from the pertinent transformation process and the gradual process of economic integration with the European Union countries.

The decision of the NBP to change the monetary policy regime into direct inflation targeting was, contrary to other developed countries that also adopted the inflation targeting regime, motivated by disinflation rather than inflation stabilization. In view of the aim to join the EU, the Polish inflation-targeting framework should help to design the optimal trajectory of disinflation by choosing a longer-term inflation goal that should anchor the inflation expectations of the Polish economic agents. It required the unambiguous declaration of a disinflation path and explicit quantitative targets for disinflation.

While many advanced inflation targeting countries set the inflation target in the shape of the so-called "core inflation" index, the MPC of the NBP chose to target the Consumer Price Index with the belief that it is a more accurate measure of structural changes in the economy's price level. This decision referred to the presumed widespread public recognition of the CPI and, from a pragmatic point of view, the MPC's choice was, moreover, restricted by the lack of a "core inflation" time series for the domestic economy.

The inflation target was linked to one specific time point (December) and not to the specific time period. As well as the Czech Republic, Poland chose three levels to the inflation target: (1) short term, (2) mid-term and (3) long-term. According to the MPC decision, the short-term inflation target was announced regularly in September with a one-year span. The medium target was set more generally promising inflation below 4% by 2003-end. The mid-term target, defined as a 3%± 1pb for 2003-end, was formulated to help settle inflation into the desired disinflation path and to anchor inflation expectations. The short-run target, with a time span of one year and regularly redefined in September, should support the medium-term target in anchoring inflation expectations (for more details on the inflation target see Table 10). The following disinflation allowed the MPC to adopt the second "phase" of the inflation targeting regime – the monetary stabilization phase. In 2003, the downward inflation targets were replaced by the so-called continuous target of 2.5% ± 1pb adopted beyond 2003.

The tolerance band was intentionally defined narrowly in order to be regarded as credible, although the NBP expressed its intention to gradually widen the target interval in the future. In contradiction to the principles of credibility, the NBP reviewed its first inflation target for 1999-end and at the same time defined a wider tolerance band at ±0.6 percentage points. The band was finally widened at ±1 percentage point in an attempt to better reflect the volatility in inflation and the virtual absence of satisfactorily reliable models of inflation in Poland. Unfortunately, the analysis of historical inflation volatility and the limited ability of the NBP to model inflation even one year ahead cast doubt on the adequacy of the defined bandwidth particularly in the absence of the so-called caveats or escape clauses. The exclude clauses exactly specify the events (mostly unexpected supply shocks) at which monetary policy authority is entitled not to react with a policy tool adjustment. The NBP chose another strategy – to communicate and provide detailed explanations when the monetary policy reactions apparently conflict with the direction of the discrepancy between the inflation target and the observed level of inflation.

In addition to the CPI inflation target, the NBP initially maintained the crawling band regime of the zloty. This so-called flexible inflation targeting regime was abandoned on April 12, 2000 reflecting an effort to strengthen the effectiveness of the monetary policy framework focused solely on an inflation target. The Polish currency had been moved to free floating, while the Polish monetary policy strategy shifted to a strict inflation targeting regime. The revocation of the crawling band regime proceeded very smoothly with only a relatively brief period of higher exchange rate volatility and thanks to the resolute stance of the MPC against currency interventions except emergency situations and the establishment of a special account for privatisation proceeds contributed to relative currency stabilization.

The specific shortcoming of the inflation targeting regime in Poland is the less-developed forecasting process. Though the NBP adopted a pluralistic approach to the forecasting process, the forecasting by the NBP still assigns a relatively high weight to expert judgments which poses the risk of subjective mistakes and inconsistencies. Moreover, the NBP regularly publishes a point estimate and range in its Inflation Report, however, it does not disclose quantified inflation forecasts, but just the MPC's view on the inflation prospects in Poland once in a quarter.

Another but not local disadvantage of inflation targeting is the absence of an effective tool coordinating macroeconomic policies. The NBP announced the inflation targets independently without an explicit obligation for the monetary authority counterpart – the national government – to facilitate the target's fulfilment. The Polish practice with inflation targeting under the conditions of a loose fiscal policy stance demonstrates the consequences of uncoordinated policy management.

2.7 Practical Experiences with Inflation Targeting in Poland

The modern history of monetary policy in Poland began in September 1998 when the MPC adopted a "Medium-Term Strategy of Monetary Policy (1999 - 2003)". The period of inflation targeting in Poland was much like in other CEE countries accompanied by successful disinflation except for the short term period of inflation revival in Poland in the second half of 1999 and the first half of 2001. However, external favourable conditions played a significant role in the recorded disinflation process. The Polish inflation decelerated from 10.4% y/y in September 1998 to 1.7% in December 2003. Though the general goal of the MPC to set Polish inflation on a downward path has been achieved, Figure 8 demonstrates that the MPC has never managed to meet the announced inflation target. There can be plenty of reasons. Firstly, Polish inflation proved to be highly vulnerable to external price shocks as well as to the proceeding deregulation in administered price and tax harmonization with EU standards. Secondly, the unsettled macroeconomic and institutional environment complicates any investigation into the main macroeconomic links and pass-troughs. Though these problems are not country specific, the Polish central bank lags behind other inflation targeting CEE countries in building-up a general macroeconomic model. Thus the inflation predictions, the key element of the direct inflation targeting, remain covered by a relatively high level of uncertainty. Unfortunately, the need for reliable long-term inflation predictions comes hand in hand with the length of time lags in the monetary policy transmission channels. Or, the MPC aims to target one of the most volatile targets in the region. Third, unforeseeable fiscal policy development and the lack of mid-term reliable fiscal strategy including the program of administered prices deregulation or tax harmonization represent other sources of uncertainty.

Despite all the above-mentioned setbacks in effective inflation targeting, the MPC decided to review its short-term inflation target twice, firstly in 1999 and secondly in 2002. In both cases the post-adjustment of inflation targets did not prevent the target-miss. The only results were an erosion of the inflation target's credibility. While it managed to lower the inflation expectations at the beginning of the inflation targeting, the expectations remained strongly backward looking and after the NBP failed to meet even the reviewed short-term target in 1999, the confidence in the official targets fell and the backward looking character of inflation expectations built up.

As Figure 8 shows, the interest rate policy of the MPC was characterized by large changes that, however, tended to come with a significant time lag. The notable monetary easing in 1998 and

at the beginning of 1999 lowered the key intervention rate in all by 11 percentage points to 13%. The rapid disinflation, related among other thinks to the external shock of the Russian financial crisis, was quickly replaced by an inflation revival caused by higher food and oil prices and the weaker PLN against the dollar. The entry into an upward trend was unexpectedly fast and the monetary policy facing long time lags in monetary transmission channels could only watch inflation accelerating. All the worse is the fact that the MPC reviewed the short-term target down. The following period of interest rate tightening returned the key intervention rate at 19% in four steps during one year. From the current point view, the monetary restriction seems to come too late and to be relatively exaggerated. The break in inflation development that occurred in mid-2000 was not repeatedly caught by monetary policy and real interest rates remained high. The rate cuts launched by the end of 1Q2001 came late and markedly lagged behind the inflation slowdown. Additionally, high interest rates invoked a PLN strengthening that deepened the restriction of monetary conditions in Poland (see Figure 11).

The interest rate reduction that finally totalled 13.75 percentage points and spread over three years lowered the real interest rates and contributed to the easing of the appreciation pressures on the zloty. Though the reference rate steadily dropped, the MPC monitored the fiscal development (especially the outcomes side) with fear for the whole period of monetary easing. Also the argument of a possible drop in household savings and too rapid growth of cash in the circulation were used in defending the "hawkish" stance of the original MPC. The personal reconstruction of the MPC scheduled for the beginning of 2004 was expected to shift the policy stance to a less "hawkish" stance.

The new MPC will need to consider carefully how best to establish its credibility from the outset. Under conditions of recovery, uncertainty surrounding the effective impact of planned fiscal austerity measures and the steep yield curve, the NBP will need to gear interest rate decisions to the objective of meeting the recently set linear inflation target of 2.5% ± 1 percentage point. The narrow differential between the midpoint of the Polish inflation target and the upper bound of the ECB’s inflation target poses the risk of overshooting the target under less favourable inflation conditions especially when non-fully effective price competitiveness, strongly backward-looking expectations and sustained inflation indexation are considered.

Table 10 Inflation Targets in Poland

Official CPI (December of previous year = 100)	*Target range*	*Exchange Rate Regime*	*Actual inflation*
1999	8.0 – 8.5% reviewed to 6.6 – 7.8%	Official CPI & Crawling peg regime with a 0.5% monthly rate of crawl reduced to 0.3% in March 1999; the fluctuating band was widened from ±12.5% to ±15.0% in March 1999.	9.8%
2000	5.4 – 6.8%	Managed floating regime since April 12, 2000	8.6%
2001	6.0-8.0%		3.7%
2002	4% - 6% reviewed to 2% - 4%		0.7%
2003	2% - 4%		1.7%
2004-	1.5% - 3.5%		

Source: The Monetary Policy Council, 2001 and Monetary Policy Guidelines, 2001-2004.

Figure 8 Inflation vs. Targets

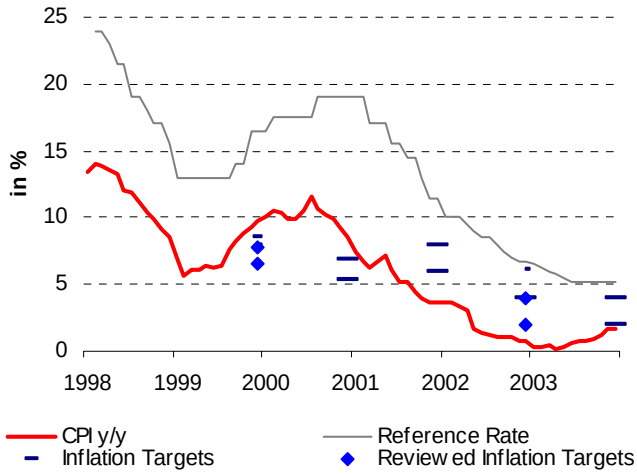


Figure 9 Fiscal Deficits and Wages

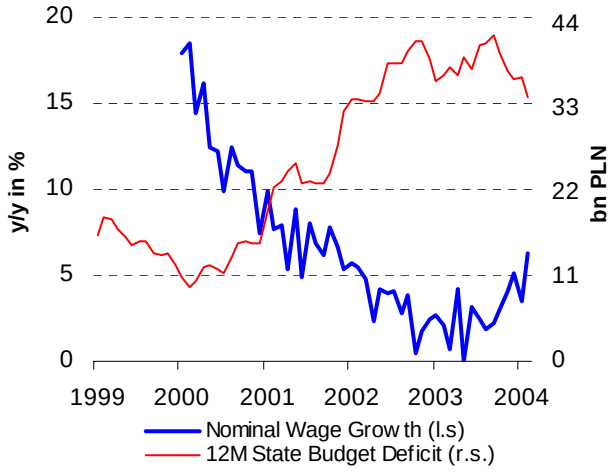


Figure 10 PLN and Real Interest Rates

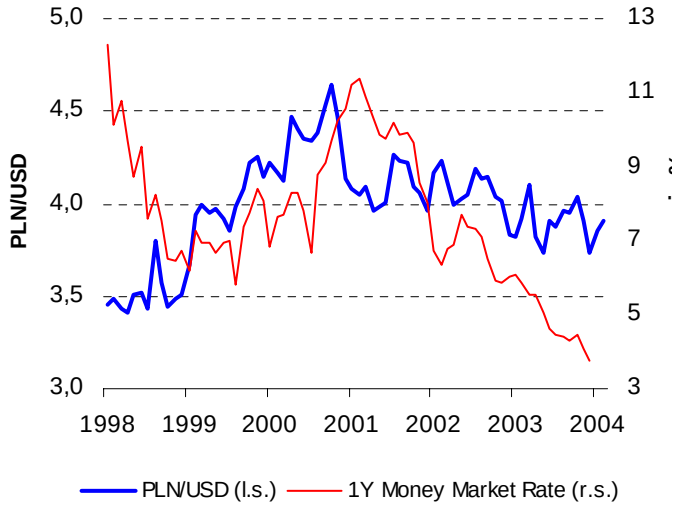
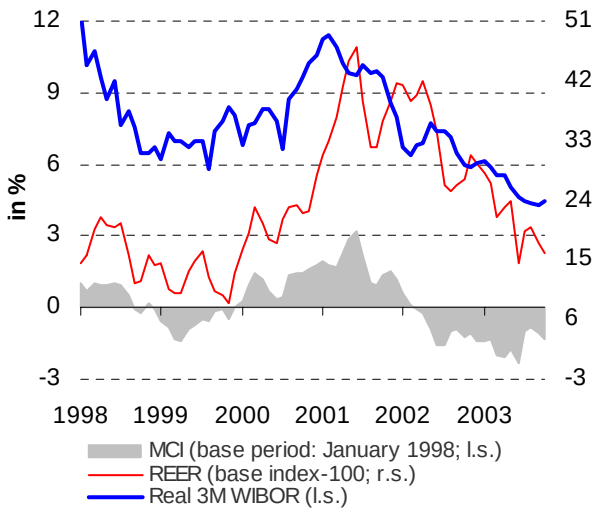


Figure 11 Monetary Conditions Index



Note: The Monetary Conditions Index (MCI) under zero indicates a tightening of the monetary conditions. The MCI is designed as an average of annual change of the NBP's reference rate deflated by annual CPI and of an annual change in the real effective exchange rate.
Source: Author's calculation based on IMF, OECD and NBP data, 2004.

2.8 Conclusion

The adoption of inflation targeting in Poland coincided with the disinflation process. Consumer price growth slowed down from 10.6% y/y in September 1998 to 1.7% y/y in December 2003. Although it is almost imposable to distinguish between the impact of the change in monetary policy regime and the contribution of the external favourable factors, the new policy regime enhanced the transparency of the monetary policy, improved communication strategy with the public and improved the monetary policy framework. The volatility of inflation and real economic variables such as exchange rate shrank as well as the inflation expectations.

The adoption and implementation of the inflation targeting regime in Poland faces, however, a number of problems and restrictions. The absence of monetary and fiscal policy coordination and elements of fiscal dominance being visible in the Polish economy belong to the most evident shortcomings. The unfavourable mix of a restrictive monetary policy on the one hand and an expansionary fiscal policy on the other hand brought "fruits" in the form of higher real interest rates, rapid appreciation of the zloty, rising unemployment and deeper fiscal deficits. Assuming that a personal reshuffling in the MPC helped to resolve the problem of an inappropriate policy mix should be considered as very naive. It "just" caused a discrete change in the MPC profile affecting the market view on the probable future scenarios of interest rate development. An amendment of the NBP law enacting overlapping mandates of the MPC members and the establishment of an effective tool coordinating macroeconomic policies would be the proper response to the above shortcomings in the Polish inflation targeting framework.

The investigation into the properties of inflation development and the monetary policy transmission mechanism unveiled other difficulties in conducting an inflation targeting regime. The significant disinflation and the change in the monetary policy strategy did not manage to break the inflation persistence. The deep-rooted inflation indexation and still non-fully effective price competitiveness on the Polish market preserved some degree of inflation inertia. Moreover, no statistically significant structural break in the inflation time series occurred at the time of the adoption and subsequent implementation of an inflation targeting regime in Poland, implying that the new monetary policy regime did not immediately gain credibility. Unfortunately, the subsequent incorrect decision to review the short-term inflation target jolted the credibility of the inflation

targets and the new policy strategy did not manage to break the backward-looking character of inflation expectations.

The practice experience with inflation targeting in Poland detected a bottleneck in the local monetary policy regime – a less-developed and less-established forecasting and modelling framework. Prevailing uncertainty regarding the speed and effectiveness of monetary policy channels hampers the ability of the NBP to predict the future path of inflation and consequently set the interest rate at the appropriate levels. As the causality and vector autoregression test indicated, the interest rate pass-through proved to be weak and outweighed by the exchange rate pass-through in the short-run. Nevertheless, the effects of interest rate changes gradually strengthen over time and spread into inflation figures with a long time lag. The MPC seems to have in its hand a tool to guide consumer price development, however, it works with a relatively long time delay. Therefore, the MPC has to anticipate inflation development a couple of quarters ahead and adjust the monetary policy instrument in advance.

Beyond a few wrongdoings, the Polish monetary authority conducted the monetary policy in harmony with the best guides for direct inflation targeting and strengthening the forecasting and modelling background of the monetary strategy can markedly improve the monetary policy's proceeding …

3 Hungary

Hungary was the third Central Eastern European Country to adopt an inflation targeting regime. This enabled the National Bank of Hungary (NBH) to exploit Czech and Polish experiences with the inflation targeting regime. The following chapters will analyze how the NBH grasped its opportunity and took advantage of facilities providing by the new monetary policy regime.

The organization of the following part of the paper matches the logic of the previous parts. The first chapter briefly describes the history of the monetary policy regimes in Hungary. The motives of the NBH for a shift in monetary policy regime to flexible inflation targeting are described in the second chapter. The third one deals with the prerequisites of adopting inflation targeting and its fulfilment in the case of Hungary. The fourth chapter analyses the statistical properties of inflation in Hungary in comparison with the Czech Republic and the fifth chapter examines the Hungarian transmission channels. The sixth chapter goes deeper into the specific features of the Hungarian inflation targeting regime, while the seventh chapter describes the practical aspects of monetary policy proceeding in Hungary. The last chapter includes a summary and stresses some aspects of inflation targeting in Hungary.

3.1 The history of Hungarian Monetary Policy

The new era of monetary policy in Hungary was launched by the new Act on the Central Bank accepted in 1986, which declared the independence of the policy authority and set out the task of the NBH -- the protection of internal and external purchasing power of the national currency (the forint). This act has been amended more or less every year in an effort to follow or even spur the development of the financial system. Later, based on European provisions, the financing of the budget through the central bank was explicitly prohibited and the goal of "the protection of the national currency’s purchasing power" was replaced by the wording "the priority of price stability".

Until the early 1990s, the central bank was strongly restricted in developing its monetary policy instruments, partly because of the absence of a money market and partly because of the limited nature of competition among the banks. The central bank was forced to regulate the market liquidity by direct instruments: adjustment in the normative short-

term refinancing credit lines of commercial banks and the reserve requirement. Besides these, it used the instrument of an interest rate ceiling on household deposits, lending rates, and certificates of deposits. In 1993 the NBH introduced quotations for the repurchase agreements and reverse repurchase agreement with respect to government papers. This indirect policy instrument was aligned to the process of financial liberalization and deregulation of the financial market. Nevertheless, the medium term refinancing (mainly foreign exchange credits) continued to represent a substantial share in the NBH's assets. A well developed interbank foreign exchange market enabled the central bank to subdue the refinancing channel and finally to close it in 1995. The instrument of the reserve requirement continued to be used for adjustments in banking sector liquidity owing to the relative underdeveloped money market.

The years 1994 and 1995 were hit by a deepening general economic imbalance. Unmistakably critical development of macroeconomic figures during the spring of 1995 forced the Hungarian government to implement an austerity package. Stabilization of economic development and the admission of Hungary into the OECD in 1996 led international investors to regain confidence and the subsequent capital inflow into the country took on magnitudes never experienced before. The neutralization of the surplus of liquidity by sterilized intervention soon compelled the central bank to use deposit-like means instead of credit in monetary policy. The NBH was thereby forced to transform its monetary policy instruments. Along with development of the money market the central bank gradually abandoned "long-term maturities". It initially used a six month, later twelve month, deposit rate as a means of sterilization and it finally reduced it to two weeks. In the effort to enhance the international competitiveness of the Hungarian banking system, the central bank gradually reduced the compulsory reserve ratio from 17% in 1995 to 5% on August 2002. Gradual lifting capital restrictions in conjunction with the country's international commitments contributed, in a significant manner, to a relatively fast capital markets' evaluation. The more advanced the financial market, the stronger the speculative capital flows into the country. Thus the NBH's interest rate policy had to consider more and more the speculative foreign exchange deals. In early 1997, a significant part of the state forint debt towards the NBH was swapped into foreign exchange rate debt. At the same time, the fundamental step towards a clear and transparent separation of monetary and fiscal policies was made.

According to the NBH, the instability of the money demand function in the period of transformation ruled out monetary targeting as an option for the central bank. Therefore, the central bank decided to use the exchange rate as its intermediate target for a range of reasons. Exchange rate directly influences the price of tradable goods. The credible exchange rate target may efficiently shape inflationary expectations and thus the price of non-tradables as well. The exchange rate target is considered to be transparent, easily monitored by the public. Transparency itself enhances the central bank's accountability, which in turn boosts the central bank's credibility and the public's confidence in economic policy. Unfortunately, regular devaluation of the forint resulted in disruptive speculation that perpetuated higher inflation. The central bank authorities looked for an exchange rate regime, which would be more predictable, helped disinflation, but also allowed the economy to run a higher rate of inflation than in the developed countries.

In March 1995, the NBH introduced, in co-operation with the government, a narrow-band, crawling peg exchange rate scheme. The depreciation rate was announced in advance (one month) and the exchange rate band was defined in the range of ±2.25%. Together with the government, the NBH adjusted the announced monthly rate of devaluation to changes in expected inflation. The crawling peg exchange rate system was intended to break the adverse trend in inflation expectations and establish the credibility of monetary policy. Announcing the rate of devaluation in advance assisted in making expectations forward looking. The restrictive fiscal and income policies guaranteed that the surge in inflation induced by cost-side pressures created by the radical stabilization measures remained temporary.

This regime significantly contributed to enhancing the credibility of economic policy. Under the pre-1995 exchange rate regime, forint yields contained a substantial premium for the risk of an unexpected exchange rate adjustment. It was also successful in bringing down the rate of inflation from over 30% to 10% and in enhancing economic competitiveness. On the other hand, it limited the freedom in the movement of the operating target -- interest rates. The NBH uses a two-week (previously one-month) deposit facility in an effort to affect market yields, which determine both domestic savings and the volume of interest sensitive capital flows. Besides, foreign capital movement reciprocally influenced the exchange rate. Due to this fact, domestic interest rates adjusted for the stated devaluation rate contained a sufficiently high premium over foreign interest rates to keep the exchange rate of the forint within the band. With financial market liberalization the relationship between domestic and foreign interest rates became tighter

through unhedged interest rate parity, reducing the NBH's room to manoeuvre in setting interest rates. The room was determined by the exchange rate and the country risk that investors perceived and the width of the exchange rate's fluctuation band. In the case of an interest rate adjustment, the NBH had to take into account how the exchange rate varied within the band, further the timing and the extent of an adjustment of the depreciation rate.

Under the narrow exchange rate band regime, in which the central rate was adjusted according to a pre-stated rate of crawl, the NBH had "its hands tied" to tighten monetary policy, encouraging strong capital inflows that kept the forint at the strong edge of the band (except the period of during the Russian rate crisis in 1998 and the Brazil crisis in 1999). Therefore, the NBH had to, at times, conduct sterilized intervention through its deposit facilities, bonds and reverse repo operations. The risk of fueling additional inflows prevented the active use of interest rate hikes to curb inflation. Since early 1996, the central bank declared neither the period for the announced extent of the rate of devaluation, nor the date of the next modification in aiming to increase the exchange rate risk. The higher risk should curb the short-term speculative capital inflow and increase the elbowroom of the NBH's interest rate policy.

As a result of structural liquidity surplus, the central bank’s deposits have been determined to be the NBH's policy instrument. The limited government paper stock, used as collateral in NBH’s repo operations, made the administration of the reverse repo transaction more difficult. As the role of the reverse repo could be fully substituted with deposit facilities, the NBH decided to adopt the deposit rate first for terms of six months, then for twelve months as the operative target. By the end of 1997 the NBH shortened the period of the deposit rate to 28 days. At that time, the policy instrument’s role was to influence interest rates and to reinforce sterilization. With the introduction of NBH bonds in June 1997, which completely took over this role, the relatively longer-term deposit arrangement was terminated. In March 1999 the central bank shortened once again the period of its policy instruments from one-month to two weeks in an effort to effectively influence the short end of the yield curve and ease liquidity management by the banks. The interest rate on the central bank over-night deposit facilities serves as the floor of the interest rate corridor in the case of excess liquidity. The over-night repo rate represents the ceiling of the interest rate corridor and is employed in the event of liquidity shortage. Unfortunately, the need of sterilization kept the O/N active repo rate at an artificially high level. Owing to this high level, it did not practically play the role of an interest rate ceiling. This was the general obstacle to any kind of credible fixed exchange rate regime, where the

central bank had to sterilize capital inflows. The central bank dampened the pace of interest rate reducing to maintain attractive yields on the so-called sterilization instruments.

By 2000, it was evident disinflation had stalled. The NBH met the same problem as the CNB; monetary policy strategies based on an intermediate target were not efficient to reduce inflation from a moderate, 10% level to a lower one. To provide greater independence for monetary policy in pursuing a relatively faster and more effective anti-inflationary policy, the central bank restructured the exchange rate regime and eliminated some existing restrictions on capital flows.

On May 4th 2001, the authorities widened the exchange rate band from ± 2.5% to ± 15.0% around a central parity defined against the euro, while retaining the 0.2% monthly rate of the forint's central parity devaluation. The new band resembles ERM2, the transition regime toward adopting the euro. This step closed the transition period of the monetary policy and opened the room for adopting a modern monetary policy regime.

Table 11 NBH's Monetary Policy Strategies– pre-inflation targeting period

<table>
<tr><th></th><th>Instruments</th><th>Intermediate Target</th><th>Final Target</th></tr>
<tr><td>1993</td><td>Reserve requirement & 7- day repo rate</td><td>Fixed exchange rate with unexpected devaluations at variable rates (band width ±0.5%)</td><td rowspan="6">Protection of the internal and external purchasing power of the national currency</td></tr>
<tr><td>1994</td><td>7-day or 28-day repo rate</td><td>Fixed exchange rate (band width ±0.5%, later ±1.25%)</td></tr>
<tr><td>1995-6</td><td>28-day reverse repo rate (since mid-1995)</td><td rowspan="3">Crawling peg exchange rate scheme with the band of ±2.25% (since March 1995)</td></tr>
<tr><td>1997-98</td><td>28-day deposit rate (since October 1997)</td></tr>
<tr><td>1999-2000</td><td rowspan="2">14-day deposit rate (since March 1999)</td></tr>
<tr><td>2001</td><td>Crawling band widened from ± 2.5% to ± 15.0 % in May 2001</td></tr>
</table>

Sources: NBH (2000), "Monetary Policy in Hungary". Budapest, May 2000.

3.2 Inflation Targeting in Hungary

On June 12th, 2001, following the widening of the exchange rate band, the NBH adopted inflation targeting as the new monetary policy framework. Hungary thus became the third CEE country, following the Czech Republic and Poland, to adopt a progressive monetary policy regime. Such a policy step was consistent with the new Act on the National Bank of Hungary approved by Parliament on June 19th, 2001 (and effective as of 13 July 2001), which emphasized price stability as the central bank's primary objective and established the Monetary Policy Council (MPC), a monetary policy decision making

organ. These all marked a significant change in Hungary's monetary and exchange rate regime; an inflation target replaced the exchange rate as a new anchor for monetary policy, at least formally. At the same time the few remaining restrictions on capital movements were lifted on June 15th, 2001, making the forint fully convertible. The crawling peg foreign exchange rate regime was abandoned in October 2001.

The operation and implementation of the inflation targeting framework was described in detail in the NBH's Quarterly Inflation Report, the central bank's principal monetary policy publication. The monetary policy instruments used before remained unchanged. The two-week deposit rate maintains the key NBH's intervention rate.

As in the Czech Republic and Poland, the change in strategy was motivated by the goal of entry into the European Monetary Union. Nevertheless, the NBH indicated a very ambiguous aim of bringing inflation down to EMU-compatible levels by 2004/2005 to qualify for early adoption of the euro.[28] From the long-term perspective, the central bank "seeks to achieve a gradual but firm reduction in inflation to around 2%" (NBH, 2001a).

The MPC believed that the new monetary policy regime enhances the transparency of monetary policy decisions and that it has a beneficial impact on market expectations. Central bankers concluded that the previous monetary policy framework was inefficient to cut inflation below the 10% mark. Thus, the new regime was adopted to help avoid the risk that inflation would settle at 10% or more, building high inflation expectation into the economy. This would have raised the costs of achieving lower inflation and complicated the approach to EU membership and the later adoption of the euro.

From the start, the NBH stressed that for the purpose of reducing the cost of disinflation, it had adopted a gradual but ambitious program of disinflation of several year's duration. Once again the Hungarian central bank demonstrated the pro-growing stance ("dovish stance") that the central bank is ready to defend at all costs, even at the cost of loosing credibility and violating the principles of the inflation targeting regime as the development in 2003 showed (for more details see chapter 3.7). Such facts raised the question why the Hungarian central bankers were "fanatical about growth". One explanation could be the political past of the central bankers as members of various Hungarian governments and another being a theoretical one referring to research works focusing on a sacrificed ratio for the Hungarian economy. Estimations of the costs of disinflation are generally very sensitive to the structural features of the economy,

[28] See NBH, Statement on The New System of Monetary Policy (2001).

especially the share of tradables and inflation persistence. The NBH's estimations[29] indicate relatively high sacrifice ratios in the range of 0.8-1.8. Nevertheless as the theory states, the inflation targeting framework helps to reduce the disinflation costs through changes in the price- and wage-setting mechanism, or by improving the credibility of disinflationary policies, and the experiences of inflation targeters during 1990 confirmed it with, as they saw, a marked fall of the inflation persistence and a shift toward more forward-looking expectations of economic agents who started to take the inflation targets of the central banks more seriously.

Now an analysis of the inflation-targeting framework adopted by NBH follows in more detail.

3.3 Prerequisites for Inflation Targeting in Hungary

The following paragraphs examine the arrangement and the procedures of the inflation targeting regime in Hungary taking into account the theoretical information about the basic and additional prerequisites mentioned in the theoretical part of this paper. These are a sufficiently independent central bank, the absence of fiscal dominance, a clearly defined objective of achieving price stability and the absence of other nominal objectives, well-developed financial markets and a sound banking system, macroeconomic stability and reasonably low inflation, public support for price stability and finally a capacity of the central bank to model and forecast inflation and appropriate knowledge of the transmission mechanism.

A sufficiently independent central bank. The Act on the Central Bank guarantees as instrumental the political independence of the NBH. The government, according to the Act, may not instruct the central bank in its activities and the central bank conducts the policy independently, without depending on the government's approval. In addition the new Act on the National Bank of Hungary, approved in 2001, specified price stability as the primary objective of the NBH. Support for the economic policy of government was subordinated to the task of achieving and maintaining price stability. The government has an opportunity, however, to expound and represent its opinion vis-à-vis the central bank through its participation in the central bank council in an advisory capacity. The NBH also

[29] See, for example, Benezur et al (2002), Jakab and Kovács (2002).

enjoy financial independence when it obtains the funding required for the performance of monetary policy tasks. In an effort to meet the requirement of controllability, the central bank obligatorily provides information to the Hungarian Parliament in the form of an Annual Report, which is discussed by the representatives during the plenary session. The heads of the central bank regularly present reports to the relevant Parliamentary committees. The political independency of the members of the NBH's governing bodies is ensured by two rules. First, the mandates of the President and Vice-president of the NBH exceed the four-year parliamentary cycle by two years. Additionally, the members of the governing bodies of the NBH may not hold any office in any political party and may not undertake a public role in the interest of any parliamentary party but this rule does not relate to a government post in the past. The President and the Vice Presidents may be recalled only in well-defined cases.

Though the NBH independence is legally guaranteed, in practice the Hungarian central bank seems to conduct a less conservative policy than its CEE counterparts. While the other central banks from CEE put apparently higher weight on low inflation over higher output, the Hungarian counterpart tends to prefer higher output as the governments generally do. The reason behind the pro-growth preferences of the NBH can be e.g. the former orientation of monetary policy or less conservative Board members, which in many cases, had hold a key post in the governments, and the relatively high sacrifice ratio associated with disinflation. According to the model, Hungary can serve as an example of a country that should establish a truly independent central bank to avoid inflation bias. Unfortunately the disadvantage of such a step is likely to be higher output volatility as the high sacrifice ratio suggests. This seems to be, however, unacceptable for the former and the current Hungarian authorities.

Absence of fiscal dominance. The NBH seems to fulfil the formal features of the absence of fiscal dominance. (1) The Act on the Central Bank prohibits lending by the NBH to the central budget not only by direct lending but also through purchasing government debt papers directly from the state. However, purchases of government debt papers in the secondary market in the form of open-market operations are not prohibited while pursuing its monetary policy objectives.[30] (2) Liberalization of capital inflow and dynamic development of financial markets in Hungary enhanced the capacity of the

[30] See the direct intervention on the fixed income market against a huge sell-off on the Hungarian bond market at the beginning of November 2003.

domestic market to absorb placements of public debt. Or the financial markets seem to be deep enough to offer enough funds to finance public debt at reasonable yield costs. (3) The seigniorage revenues from having the government's monopoly on issuing domestic money decreased from above 2% of GDP to less than 1.5% in the course of the second half of nineties of the 20th century[31]. In spite of it, the level remained more than twofold compared to the industrial countries. Besides relatively high seigniorage revenues, the Hungarian economy experienced the period of highly expansionary fiscal policy contributing to macroeconomic imbalances and a considerable burden on monetary policy. The election year 2002 brought extremely rapid wage growth about and a twofold increase in general government budget deficit from 4.5% of GDP in 20021 at 9.3% in 2002 instead of target of 5.5%. The public debt went up from 52.4% of GDP at 56.8% according to IMF statistics. Fiscal laxity lasting in 2003 put the monetary policy in a difficult bind. Deepening public finance and external imbalance threatened the NBH's inflation target and evoked the speculation on interest rate hikes. Thereafter speculative attack against the strong edge of the exchange rate band followed in January 2003. Decision of the monetary policy makers to subordinate (and later even to abandon) the inflation target for 2003 to exchange rate hurt the credibility of Hungary's inflation targeting framework. All of the above indicates that Hungarian monetary policy has to face some degree of fiscal dominance that, in my view, partly arises from an absence of credible long-term fiscal strategy and the less conservative nature of central bankers. Unfortunately Hungary, contrary to the Czech Republic and later also Poland, adopted the "flexible" inflation targeting regime in the context of a wide foreign exchange rate band. Such a policy framework highlights the important role of fiscal policy… Only decisive fiscal action helped underpin disinflation and contributed to avoiding conflicts between the inflation and exchange rate targets.

Clearly defined objective of achieving price stability and absence of other nominal objectives. The NBH formulated the final target of the monetary policy as a 12-month rise in the CPI at end-December. The decision to use headline inflation instead of core inflation was motivated by the aim of keeping the framework transparent and simple. Though the targeting of headline inflation seems to be more transparent than for example core inflation or another price index derived from the CPI (e.g. net inflation), the perspective of tax adjustments according to the EU rules or an unexpected one-off price shock increase the risk that the central bank misses the inflation target. With the aim of

[31] see Jonáš (2000) or Schobert (2001).

reducing the costs of missing the inflation target and simplifying communication with the public, some of the inflation targeting central banks (e.g. Czech National Bank) adopted so-called escape clauses from inflation targeting. These defined certain events or permanent supply shocks (e.g. changes in the tax system or changes in the prices of food and energy) when the central bank is allowed to miss its short-term or medium inflation target in response to them. The absence of clearly defined escape clauses in Hungary complicates the communication of the central bank with the public as the Hungarian experience in 2003 unveiled. The experiences of other CEE inflation targets showed that a simply defined inflation target and unambiguously defined exception to the inflation target might significantly enhance the transparency of an inflation targeting regime in less "settled" economies.

In compliance with the practice of other inflation targets from CEE, the NBH adopted an inflation band not a target point. The tolerance band of one percentage point around central parity was designed to allow for unexpected shocks to inflation. Unfortunately as the analysis of historical inflation volatility and the experience of the NBH with the impacts of uncoordinated fiscal policy showed, the tolerance band of ±1 percentage point proved to be insufficiently wide. In general, the 1 percentage point seems to be a good compromise between flexibility and strength of the central bank's commitment, particularly when the regime might invoke the escape clauses. The decision on the time horizon of the inflation target was, much as it was in the Czech Republic and Poland, effected by the objective of satisfying the Maastricht criteria on inflation. To set the disinflation path towards the desired levels, the NBH defined short-term, mid-term and long-term inflation targets (3.5-5.5% for end-2002, 2.5-4.5% for end-2003 and 2004). From the long-term perspective, the central bank "seeks to achieve a gradual but firm reduction in inflation to around 2%"[32]. Though the NBH had clearly defined the inflation targets and explicitly committed itself to them, it did not abandon the exchange rate target and decided to adopt "flexible" inflation targeting operating in conjunction with a wide exchange rate band, ±15.0% around a central parity against the euro. In the early stage of inflation targeting, the NBH signalled that it would resort to intervention only in emergency situations. Out of the extreme conditions, the NBH considered the width of the exchange rate band to be sufficient to mitigate the risk that the inflation target had to be sacrificed to the advantage of the exchange rate counterpart. However economic theory

[32] NBH (2003), Quarterly Report on Inflation, p.7.

warns that though a central bank pledges to prioritise the inflation target when it adopts inflation targeting, the market should, particularly under unfavourable economic development, incorporate a probability as to which one of the targets could be sacrificed for another. Unfortunately the practice of the Hungarian monetary policy confirmed such suspicions. Under pressures stemming from loosing fiscal policy, the NBH in an agreement with the government announced the devaluation of central parity from 276.1 to 282.36 HUF/EUR, by 2.26% in June 10, 2003 leaving the width of the exchange rate band unchanged. The official explanation of such an unexpected and unsystematic measure was not to "jeopardize Hungarian exporters' competitiveness"[33]. Such unexpected, competitive devaluation that is, moreover, forbidden under ERM II shook the market and put the credibility and transparency of monetary policy at risk. The rest of the credibility vanished after the NBH twice increased, in the course of June, the key policy rate by 300bp; referring to a weak exchange rate that, as was stated, endangered the inflation target for 2004. In contradiction to the rules of the strict inflation targeting, the central bank announced its preferred exchange rate band between 250-260 HUF/EUR and tried to stabilize the exchange rate at these levels. Verbal intervention even interest rate hikes missed, however, the aim. Finally, the NBH decided to make the next unsystematic step, to abandon its 2004's inflation target formally due to the inflation impact of tax hikes in early 2004. From the Hungarian experience at least one important conclusion can be made: adopt an inflation targeting regime if, and only if, you are fully convinced of the benefits that the regime brings along.

Well-developed financial markets and a sound banking system. Hungary has one of the most advanced and sound financial systems among the CEE countries. Since the beginning of the transition in Eastern Europe, the country has always been at the forefront of financial sector reform. Modernization progressed through three rounds of government-led bank restructuring (the last one covered the 1993-1996 period), based on a strategy of selling state-owned banks to strong strategic foreign investors. The financial system now contains a broad set of institutions, markets, and financial instruments. The dominance of foreign ownership and of large financial groups on the Hungarian financial markets intensified competition between financial institutions though the degree of concentration has been high. Domestic financial intermediation remains low (see the lower share of private sector claims in GDP compared to the other emerging countries), but is growing.

[33] NBH (2003), Quarterly Report on Inflation, p.61.

The change of monetary policy framework to inflation targeting boosted financial market development. Foreign exchange liberalization enhanced the activity on the local financial market. The main growth took place in the swap markets. On the other hand, the options and forward markets have not shown major signs of growth. The forint interbank market has been deepening, albeit at a slow pace. Investment by non-residents in government securities markets remains a driving force of the Hungarian bond market. Despite the widening of the exchange rate band the short-term capital inflows after transitory outflows came back to the local market, making it highly sensitive to changes in foreign investors' moods. Additionally, the risk of volatility spillovers from the Polish foreign exchange market to the Hungarian foreign exchange market through common investors remains significant.

Macroeconomic stability and reasonably low inflation. In the second half of the 90s, the Hungarian economy enjoyed a period of careful macroeconomic management. However, with the elections in 2002, fiscal policy became one of the tools of the political fight and turned very expansionary. The deepening twin macroeconomic imbalance inhibited the effective control of monetary and inflationary development. The Hungarian experience with fiscal policy instability highlights the importance of policy coordination and policy makers' prudence.

The appropriateness of the inflation level in Hungary as well as in further transition countries such as Poland and the Czech Republic should be judged in the context of price adjustment. Therefore, a direct comparison of inflation levels in transition countries with those prevailing in advanced inflation targeting countries is inappropriate. Moreover, the adoption of inflation targeting in transition economies is associated primarily with a disinflationary policy goal instead of stabilizing low inflation. Nevertheless, the comparison of consumer price indexes before and at the time of inflation targeting adoption (see Table 2) showed that Hungary had one of the highest inflation levels in the advanced transition economies. The inflation rigidity, stemming at least partially from less conservative, more pro-growth oriented monetary policy was, however, one of the arguments for adopting inflation targeting. As subsequent developments showed, the inflation bias had a solid foundation deep-rooted in the economic system.

The capacity of the central bank to model and forecast inflation and appropriate knowledge of the transmission mechanism. The NBH like other central banks in transition countries has had to face the difficulties of estimating the monetary policy transmission

mechanism, specifically the interest rate and credit channels. It has to be highlighted that the problem is not regime specific and would persist under different monetary policy regimes. One of the most marked obstacles of monetary policy modelling is an overall lack of long-term time series that embarrasses reliable econometric estimations of the pass-through. To overcome the problem, the CEE central banks targeting inflation adopted a pluralistic approach that is based on expert judgments, simulation models, partial equations or even macroeconomic models (see Czech Republic and Poland). The NBH bases its central inflation forecast on both partial and aggregate econometric equations and expert judgment (non-model approach). The NBH possesses only one empirical general-equilibrium model, which is mostly used for special issues and policy simulations. Moreover, only a conditional forecast (presuming unaltered monetary conditions) is published. Similarly to Czech practice, Hungarian policy makers are iterative involved in the forecasting process. As such, policy-makers can generally propose modifications of assumptions on the exogenous variables before the forecast is made. While Czech Board members enter the forecasting processes in a discrete way, the Hungarian policy-makers are repeatedly involved in the process via several rounds of discussion. Though there is a slight difference between these two approaches, the Hungarian one seems to be more affected by the subjective feeling of the policy-makers contrary to the Czech-forecasting procedure that seems to put higher weight on the expert judgments.

All CEE countries made big progress in analyzing the economic relations and rules of the economic system during the last couple of years. Nevertheless, the aim to converge toward a fully-developed forecasting system requires all inflation targeting central banks from CEE, and especially from the Hungarian one, a further effort in improving the current system.

Public support for price stability. The adoption of inflation targets in all three CEE countries gained (sooner or later) official support from the respective governments but no government committed to the announced inflation targets. The advantages of a joint inflation strategy would be particularly apparent in the case of Hungary. Joint target announcement would strengthen the target's credibility by indirectly committing the government to conduct fiscal policy in a way that would support achievement of the inflation objective. Unstable fiscal policy hinders not only the effective management of monetary policy but also hurts the credibility of inflation targets as witnessed in Hungary in 2003.

Much like the other inflation targeting central banks, the NBH tries to play an active role in discussing the consequences of inflation with the government and public. For this purpose, the NBH publishes the Annual Report following the annual general meeting held in spring. This report is sent to the Parliament and discussed by the representatives during a plenary session. The Bank releases the monetary policy guidelines every year in late autumn. These discuss the anticipated key events and trends regarding to macroeconomic development in the coming year. Next, there is the Quarterly Report on Inflation, considered to be the leading monetary policy publication. Generally speaking, it analyses the correlation between macroeconomic and monetary processes and presents the central bank's projections and underlying considerations. The study entitled the Report on Financial Stability evaluates the possible risks of financial instability in Hungary. For the academic public the central banks' analytic team releases the results of their own research in the NBH Working Papers and in Occasional Papers as well. For the purpose of disseminating information the central bank takes advantage of its own internet home pages. In an attempt to gain transparency of monetary policy, decisions by the MPC are publicly announced and explained. The central bank publishes the projections and considerations underlying the decision of the MPC. Inflation projections cover the upcoming six quarters, which is consistent with the period of the most effective transmission. Fan-charts are used to present the public with the variety of risks that underlie the projections. The quarterly inflation report should help communicate to the public the forward-looking nature of monetary policy, and thus affect the inflation expectations of economic agents.

Though the formal conditions for effective communication are fulfilled, the critique of monetary policy and communication strategy of the NBH coming from financial market participants, international institutions and public media indicates that the Hungarian central bank has to work on it.

Testing the appropriateness of inflation targeting for Hungary drew a mixed picture. While the central bank is legally independent and inflation targets clearly defined, the subordination of the inflation target to the exchange rate one and fiscal dominance presents the main obstacles of effective inflation targeting management in Hungary. If the NBH attempts to minimize the disinflation costs, it should work on the restoration of its currently low credibility, stick to its official priorities (inflation target) and demand a prudent fiscal policy from the government as a counterpart.

3.4 Technical Issue of Inflation Targeting in Hungary

This chapter opens the empirical part of the analysis dealing with inflation targeting in Hungary. Having at its centre the key role of inflation in the inflation targeting regime, this chapter will focus on the statistical attributes of Hungarian inflation. Even the basic statistical methods might point out the relevant characteristics and consequences of inflation development. To highlight the country-specific features of inflation, the analysis will also be run using Czech data.

The statistical analysis is initiated by the unit root test complemented by the standard descriptive statistics. Then variation analysis follows extended by the recursive residuals test. In the second step, the autoregressive process (AR) of inflation is estimated. The next chapter of the empirical part of the paper tries to identify the basic linkages between inflation and various so-called leading indicators of inflation applying the basic bivariate Granger causality test, impulse response functions of inflation, and the vector autoregression process (VAR).

Considering the short time period in which inflation targeting was implemented, the following results should be perceived as preliminary.

The process of economic transition in Hungary has seriously affected the development of domestic inflation. As Table 12 shows, Hungarian inflation does not prove stationary at the 5% probability level even in the case of a more stable inflation indicator -- core inflation. In the case of the Czech inflation indicators, these results are more favourable (perhaps thanks to a successful and credible disinflation policy). The Czech CPI inflation seems to be stationary for six to eleven lagged difference terms at the 1% probability level, while the base index of net inflation is also non-stationary.

Table 12 Unit Root Test of Hungarian and Czech Inflation Indicators

Number of adding lagged difference terms	**Hungarian CPI Inflation**	**Hungarian Core Inflation**	**Czech CPI Inflation**	**Czech NI Inflation**
Available sample period Adjusted sample period	*1992:01 2003:12* *1992:03 2003:12*	*1996:01 2003:12* *1996:03 2003:12*	*1993:01 2003:12* *1994:03 2003:12*	*1995:01 2003:12* *1995:03 2003:12*
1	-1.4811	-2.7743	-2.7244	-2.5761
2	-2.0919	-2.6296	-3.3024	-3.0362
3	-2.1947	-2.7812	***-3.5010*****	-2.7376
4	-2.4877	-2. 4119	***-3.7025*****	-2.9890
5	-2.6890	-2.2729	***-3.7676*****	-2.7272
6	-2.4111	-2.5951	***-4.2406******	-2.9261
7	-1.9675	-2.5680	***-4.6524******	***-3.1730****
8	-2.3212	-2.4106	***-4.7161******	-2.9916
9	-2.9743	-1.9786	***-4.7682******	-2.9621
10	-2.9050	-1.6536	***-4.3430******	-2.4145
11	**-3.4174***	-2.2716	***-4.8154******	-2.4181
12	-3.1351	-1.5458	-2.5013	-1.7078

Notes: Based on monthly data on annual consumer price index with a base of 100 (for more details about the definition of net inflation (NI) see, for example, CNB (2000) or Horska (2000)). The Augmented Dickey-Fuller Unit Root test (ADF) includes the time trend and the constant term. The actual τ-values in the ADF are marked by "***"or "**" or "*", if they exceed the McKinnon critical values at 1, 5, or 10 per cent probability level, respectively.
Source: Author's calculations based on NBH and CNB data.

A further obstacle facing inflation forecasting and the statistical estimation of a monetary policy transmission mechanism is the non-normality of price development in Hungary. Applying a Jarque-Bera test, one has to reject the null hypothesis of normality for the whole sample period. In spite of this, the normality of CPI inflation cannot be rejected for the period of a fixed exchange rate for the forint when regular devaluations of the currency supported, however, inflation inertia and consequently hindered faster disinflation.

The analysis of inflation variability indicates that in the period of inflation targeting in Hungary the inflation level and, most importantly, the fluctuation of the CPI (measured through the standard deviation) went down. These outcomes just correspond to the presumptions of inflation targeting theory[34] assuming that a direct inflation targeting regime should in fact contribute to a more stable inflation trend. As Table 13 shows, the standard deviation of the inflation series during the pre-inflation targeting period in Hungary (from March 1995 to May 2001) was almost six times higher than in the period following this monetary policy regime. Contrary to the case of Hungary, the variability of Czech inflation figures (headline and "net" inflation) after the adoption of inflation targeting did not change much. Based on the above criteria, the Hungarian inflation targeting regime can be considered as having been successful in reducing the volatility of inflation while both central banks managed to markedly lower overall inflation (from 11.1% y/y at 3.9% vs. 16.7% y/y and 5.7% y/y in Hungary). However, it is tricky to abstract from the exceptional coincidence of strong external disinflation factors on the one hand and on the other hand the strong pro-inflationary fiscal policy. The coincidence of these contradictory factors might result in the rare stabilization of headline inflation. Only further development shows whether the inflation stabilization was permanent. If the inflation variability remains near to the current levels, the Hungarian inflation tolerance bands (±1 percentage point) may prove to be adequately wide.

[34] On the other hand, the fiscal theory of price level assumes that the central bank can determine the average rate of inflation. The variance of inflation cannot be perfectly controlled because the central bank is not able to eliminate the impact of shocks on the price level caused by fiscal policy [Christiano, 2000].

The thesis of one of the famous protagonist of inflation targeting, Lars E.O. Svensson [Svensson, 2000] that strict inflation targeting, where stabilizing inflation around the inflation target is the only objective for monetary policy, may require frequent adjustments of the monetary policy instrument leading to considerable variability in other macroeconomic variables (e.g. in the exchange rate) was tested here on the exchange rates. This hypothesis seems to be confirmed by an analysis of the variability of the CZK after the adoption of inflation targeting (see Table 6, last column), when the standard deviation of CZK/USD almost tripled under the inflation targeting regime compared to the period of the fixed exchange rate regime. Inflation targeting in Hungary coincides with the flexible inflation targeting regime, when the crawling band of the forint existed as an additional objective for monetary policy. The variability in both inflation and the exchange rate proved to be lower, however, under extraordinary circumstances (strong external disinflation compensating for the inflationary impact of loose fiscal policy and the priority of exchange rate stabilization over the fulfilment of 2003's inflation target).

Table 13 Descriptive Statistics of Hungarian Inflation Indicators and Exchange Rate of the Forint

	CPI (y-o-y changes)				**Exchange Rate** (unit of the forint)			
Sample	***92:01 03:12***	*92:01 95:02*	*95:03 01:05*	*01:06 03:12*	***92:01 03:12***	*92:01 95:02*	*95:03 01:05*	*01:06 03:12*
Mean	**15.63**	21.48	16.76	5.73	**187.47**	93.30	209.62	249.29
Median	**16.90**	21.30	16.00	4.90	**205.25**	94.90	212.98	246.72
Maximum	**31.00**	28.20	31.00	10.50	**310.27**	111.74	310.27	287.58
Minimum	**3.60**	16.60	8.90	3.60	**76.65**	76.65	119.72	208.70
Std. Dev.	**7.72**	2.59	7.12	1.66	**72.23**	12.15	55.50	26.13
Skewness	**0.13**	0.18	0.61	1.29	**-0.09**	0.01	0.11	0.1356
Kurtosis	**1.84**	3.11	2.04	3.98	**1.65**	1.52	1.90	1.52
Jarque-	**8.43**	0.22	7.49	9.78	**11.17**	3.49	3.93	2.91
Probabilit	**0.01**	0.90	0.02	0.01	**0.00**	0.17	0.14	0.23

Source: Author's calculations based on IMF and OECD data.

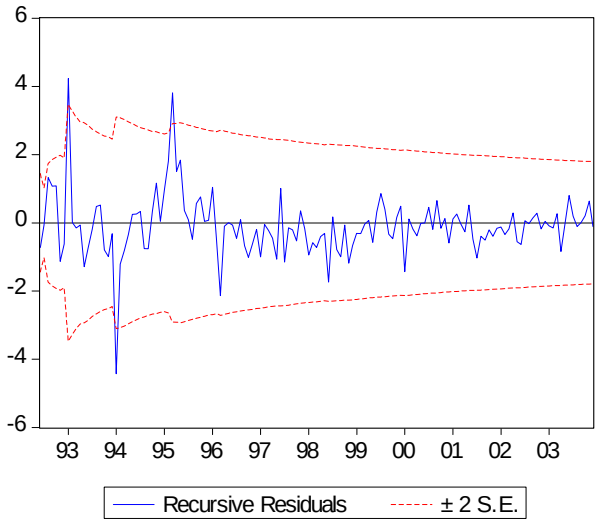
A more sophisticated investigation into inflation variations is provided by the recursive residuals test for Hungarian CPI and the Czech CPI. The modification of the Dickey-Fuller procedure and the application of the t-test on the specification of the lag length give us the following equation:

$$\Delta\pi_t = a + b\pi_{t-1} + c\,\pi_{t-2} + \omega_t, \qquad (17)$$

where π_t is the inflation indicator at time t, t-1 and t-2, and ω_t the error term.

The recursive residuals of the OLS estimation, in general, suggest instability in the estimated parameters as indicated in the distribution of structural shocks when the residuals exceed the standard error band. The outcomes from the recursive residual test for Hungarian and Czech CPI are shown in Figure 12 and Figure 4. While the recursive residuals of Hungarian inflation were stabilized during the second half of the 1990s, Czech inflation noticed structural changes due to upward pressures on inflation expectations caused by the exchange rate crisis of the CZK in May 1997. The infraction of the band in 1998 in the Czech Republic can suggest that the Czech direct inflation targeting regime gained more credibility relative to the Hungarian case considering the fact that this break did not appear at the time of adopting the inflation targeting regime.

Figure 12 Recursive Residuals of Hungarian CPI



Notes: Monthly data on year-on-year CPIs.
Source: Author's calculations based on CNB, NBH and Bloomberg data.

A further investigation of the inflation series verifies the significance of a time series trend, and autoregressive, moving average (ARMA) process described in the following equation:

$$\Delta\pi_t = a + b\,t + c\,AR(p) + d\,MA(q) + \mu_t, \qquad (18)$$

where $\Delta\pi_t$ is the first difference of inflation indicator at time t, t is the time trend, $AR(p)$ the autoregressive component of order p, $MA(q)$ the moving average component of order q and μ_t the error term.

The inflation stabilization in Hungary and the Czech Republic contributed to the change in statistical features of local CPIs. While the prior estimations working with shorter inflation time series (up to end-2002)[35] implied a statistically significant negative constant term, the last estimation of the ARMA process in Hungarian and Czech inflation does not confirm it (see Table 14). Nevertheless, the statistical significance of the autoregressive, moving average process still indicates some persistence of inflation in both countries.[36] However, the ARMA process in Czech inflation has a significantly lower contribution to inflation development than in the Hungarian case. In Hungary, some degree of inflation inertia is due to the persistent nominal wage indexation while in the Czech Republic, weakening but still existent inertia is likely to relate to a gradual lowering of inflation expectations. From the ARMA process point of view, Czech inflation seems to be, to a larger extent, determined by economic fundaments as import prices, exchange rate etc..

Table 14 Estimation of ARMA Process of Inflation Paths

First differences of	***ARMA process***				***R^2***
Hungarian CPI (1993:02 2003:12)	***AR (2)*** 0.199 (2.895)	***AR (12)*** -0.355 (-5.473)	***MA (1)*** 0.514 (6.343)	***MA (8)*** 0.280 (3.829)	**36%**
Czech CPI (1994:08 2003:12)	AR (6) 0.102 (1.074)	***MA (6)*** 0.350 (2.773)	***MA (12)*** 0.267 (2.802)		**23%**

Notes: The CPI inflation in Hungary and that in the CR are observed as monthly data. Due to the nonstationarity of Hungarian inflation or just limited stationarity of Czech inflation time series for only some lagged difference terms

[35] See Horska, 2002.

[36] While the autoregressive process of the first Czech inflation differences proved to be statistical insignificant for the whole time period, the moving average process still plays a statistically significant role in determining Czech inflation development.

(see Table 12), the estimation is run in the first differences of inflation indicators.
The estimation of the ARMA process of the Czech and Hungarian CPI does not prove the statistical significance of the time trend; instead, its inclusion worsens the statistical property of the model. Therefore, the time trend is not included in the model. Though the AR terms in Czech inflation proved to be statistically insignificant for the considered time period, the AR(6) term enhanced the statistical quality of the model.
The residual tests reject at the 1%, 5% and less significance levels the serial correlation, autoregressive conditional heteroskedasticity (ARCH) but the hypothesis of the normality of residuals is not confirmed in both cases.
The t-statistics are in parentheses. The statistical significant values are presented in bold italics.

Sources: Author's calculations based on CNB, NBH and Bloomberg data.

The estimation of the ARMA process of inflation allows the inflation path's structural consistency to be investigated. Using the Chow Forecast and Breakpoint Test, it is possible to examine whether the adoption of inflation targeting has contributed to a significant structural change. Likewise in the case of the Recursive Residuals Test, both Chow Tests did not confirm a structural change in Hungarian inflation at the time of the inflation targeting regime's adoption. On the contrary, the structural change was unambiguously confirmed in the Czech inflation time series, as being new the policy regime had immediately gained some degree of credibility.

Table 15 Estimation of ARMA Process of Inflation Paths – stability test

First differences of	*Breakpoints*	*Test*	*Log likelihood ratio*
Hungarian CPI (1995:01 2003:12)	***2001:06***	Chow Forecast Chow Breakpoint	9.499 (0.999) 2.952 (0.566)
Czech CPI (1995:01 2003:12)	***1998:01***	Chow Forecast Chow Breakpoint	***194.607*** (0.000) ***71.669*** (0.000)

Note: The probability of the log likelihood ratio statistic is in brackets. The statistically significant values (at least at a 5% significance level) are presented in bold italics.
Source: Author's calculations based on CNB, NBH and Bloomberg data.

Another insight into the change in inflation time series' characteristics is provided by the autocorrelation and the unit root tests. These tests[37], run separately for the pre-inflation targeting period and for the period of inflation targeting in Hungary, indicate just a marginal change in the statistical features of Hungarian inflation as most of the above tests did. The inflation autocorrelation did not markedly alter at the time of the inflation targeting regime's implementation (see Table 16), which suggests that inflation inertia has not seen a tangible lowering and rigid inflation expectations have not been subdued. Contrariwise, the AR process in Czech inflation did not change much.

[37] Detailed results of unit root tests are available from author.

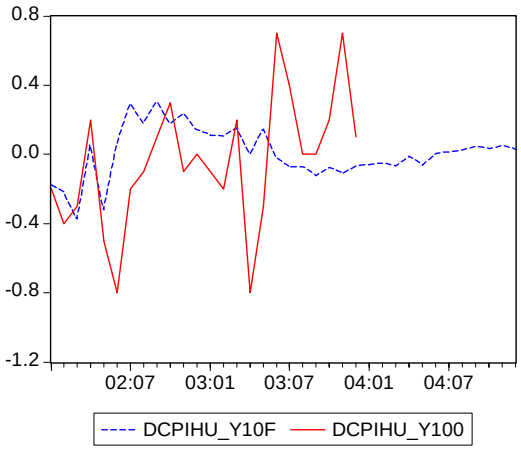
Table 16 Inflation Autocorrelation

Inflation	*Period*	*Inflation Autocorrelations by periods lagged*					
		1	*2*	*3*	*4*	*5*	*6*
Hungarian CPI	***1992:01 2001:05***	***0.289*** (0.002)	***0.148*** (0.002)	***0.178*** (0.001)	***0.002*** (0.003)	***-0.050*** (0.006)	***-0.046*** (0.012)
	2001:06 2003:12	***0.450*** (0.009)	***0.127*** (0.024)	***0.216*** (0.027)	***0.208*** (0.029)	***0.212*** (0.028)	***0.048*** (0.049)
Czech CPI	***1994:02 1997:12***	-0.025 (0.859)	-0.047 (0.930)	0.023 (0.982)	-0.006 (0.996)	-0.006 (0.999)	0.014 (1.000)
	1998:01 2003:12	-0.029 (0.802)	0.002 (0.969)	0.107 (0.813)	-0.066 (0.863)	-0.028 (0.929)	***0.535*** (0.000)

Note: The probability of the Q-statistic is in brackets. The statistically significant values (at least at a 5% significance level) are presented in bold italics.
Source: Author's calculations based on CNB, NBH and Bloomberg data.

The "pseudo-inflation model" based on the estimation of equation 18 also allows for the comparison of the modelled inflation path with actual inflation development, and an inflation target. The forecast that relies on the ARMA equation should be viewed as a "conditional" one presuming that the monetary policy stance of the NBH remained unchanged during this year. As such, the comparison of the modelled inflation path and inflation target implies whether the central bank, keeping monetary policy conditions unchanged, meet or miss the target. Unfortunately, the NBH seems to risk, under unchanged conditions, overshooting the 2004 inflation target (2.5-4.5% y/y), since the December-2004 inflation is predicted at 5.7% y/y.

Figure 13 Inflation Forecast from Hungarian CPI Model



Notes: The graph plots the first differences of Hungarian CPI data.
Source: Author's calculations based on Bloomberg and NBH data.

3.5 Policy Instruments and their Effects on Inflation

Investigation of the monetary policy channels is, much as it is in other CEE countries, complicated by at least four facts. Firstly, the reliable macroeconomic time series are relatively short and data are, from time to time, subject to revision. Secondly, the mentioned economies went through deep structural changes, especially in the early 1990s. Thirdly, the monetary policy regime changes and revisions were more frequent than is obvious in advanced countries. And finally, the statistically unfavorable behavior of inflation and interest rates in the course of the transition process, when both variables have been falling nearly monotonically, hampers any statistical test to identify the basic macroeconomic relationships in the economy.

The central bank using inflation targeting relies upon various econometric models of inflation, though there is no formal requirement for this. Perhaps all inflation targeting central banks depend, to a lesser or greater extent, on leading inflation indicators. This fact raised the natural demand to investigate and identify the basic linkages between inflation and various so-called leading indicators of inflation. Real economic activity variables (industry production and retail sales), money market variables (3-month Treasury bill rate and broad money), inflation indicators (CPI, PPI, share price index, oil and motor fuel price index, commodity index GJX, German's CPI, PPI, food and wholesale prices), labor market variables (unemployment rate and wages), internal balance (consolidated state budget balance) and external balance indicators (nominal and real effective exchange rate)[38] were classified as the potential leading indicators[39] .The bivariate Granger causality test served as the first step on the way to shed more light on the statistical relationships between inflation and leading indicators of inflation.[40]

The causality test pointed out the statistical significance of three monetary policy channels: exchange rate pass-through, interest rate and credit channel. The asset price channel proved to be non-complex since the interest rate seems to lack a robust link with

[38] All variables are observed as monthly data. The data sources include IMF and Bloomberg statistics. Excluding the 3-month Treasury bill rate, all variables are transformed by taking logarithms.

[39] Monthly figures were chosen to get over the problem of short and unsettled quarterly data time series. The particular indicators are intended to serve as proxy variables of the respective quarterly macro figures.

[40] More detailed results of the Granger causality test see Appendix 9. The test is based on monthly data because of short and unsettled quarterly data time series. In accordance with the results of the unit root test, all variables are applied in first differences.

asset prices.[41] The exchange rate channel appeared to be important and wide, covering production activity (in our "model" industrial output) as well as money and financial variables such as money supply and interest rates. This outcome corresponds to the Hungarian monetary policy authority's presumption, which considers the exchange rate channel as dominant, but at once it adds that its ability to influence the exchange rate is rather limited. However, the causality test indicated that the short-term interest rate (proxy for intervention rate of the NBH) is belatedly adjusted to exchange rate development. In other words, the Hungarian authority rarely tends to adjust interest rate instruments to inflation development but mainly to the exchange rate. This appears to be the biggest error of the NBH strategy.

The Granger causality test hinted at the robustness of the interest rate and credit channel. Nevertheless, the effects of interest rate adjustments are likely to be, for the meantime, moderate for four main reasons. First, the direct impact of interest rate adjustments on domestic demand can be expected to be relatively weak because of limited financial deepening (e.g. the ratio of broad money to GDP is low at about 50% of GDP). Second, bank intermediation is relatively low in Hungary. The ratio of bank loans to GDP reaching less than 40% compared with an EU average higher than 100% reflects a fairly low leverage of the household and corporate sector. Third, taking into account the balance sheet channel, the impact of rising interest rates on firms' and households' balance sheet positions should be modest, in light of the relatively low debt ratios in Hungary. Fourth, the volatility of the lending risk premium relative to the government bond yield has fluctuated substantially over the past few years. Thus, the lending rates were just partially affected by the NBH's interest rate policy. On the other side, the duration of the banks' assets and liabilities is short, which naturally reduces the lag in the transmission mechanism.

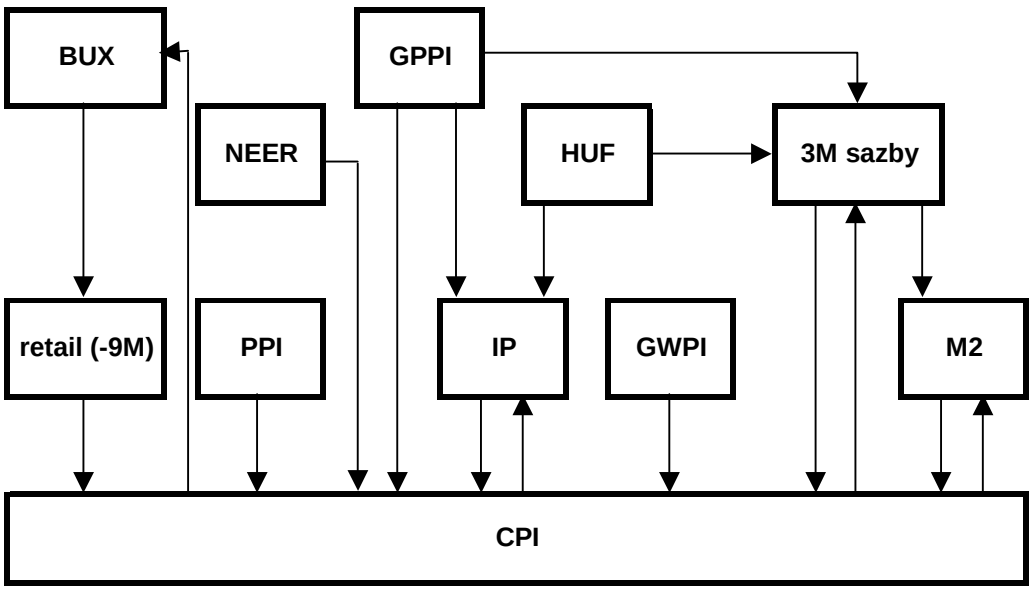
The asset price channel broke down due to a statistically insignificant relation between interest rate and asset prices according to the Granger causality test. The above-mentioned weakness of the balance sheet effect explains, for this once, the lack of a straightforward and forcible impact of interest rate changes on equities and prices of other financial assets. However, the causality test indicated the existence of a link between equity market performance, retail sales and CPI that finally affects short-term interest rates.

[41] The expectation channel was not tested because of a lack of inflation expectation time series.

This relation is unfortunately non-reversible, or discontinued between interest rates and asset prices.

Beside transmission policy channels, the Granger causality test stressed other macroeconomic consequences of inflation development. For example, the relevance of foreign (in our case German) inflation indicators such as food, wholesale and producer prices, and world commodity prices reflects the openness of the Hungarian economy and its sensitiveness to external, imported inflation. Also domestic supply and monetary inflation factors (represented by PPI and M2) proved to be relevant for domestic consumer price development. On the other hand, the Granger causality test for the entire period examined did not find any robust relation between Hungarian CPI and wages. Nevertheless, the link between CPI and wages made a gain in its significance in the last couple of years coinciding with the inflation-targeting period. This is a very unpleasant outcome that points to the probable existence of an unfavourable structural break point holding up inflation indexation.

Figure 14 Simplified scheme of the transmission mechanism in Hungary



Note: The scheme is compiled from the Granger causality test results. "BUX" denotes the Budapest Stock Exchange Index, "CPI" the consumer price index, "GPPI" the German producer price index, "GWPI" the German wholesale price index, "HUF" the forint exchange rate, "IP" industrial output, "M2" broad money, "3M rate" the 3M Treasury bill rate, "NEER" Nominal Effective Exchange Rate, "PPI" the producer price index, and "retail" retail sales.
Source: Author's calculations based on IMF, Bloomberg and NBH data.

A further step in analyzing the monetary policy instrument pass-through is the VAR test and the estimation of impulse response functions. The aim is to assess the short-run as well as the long-run dynamic relationship between inflation and economic indicators as well as an investigation of the cumulative effects of variable changes and the magnitude and duration of impulse responses. The constant and policy variables, such as the interest rate and nominal effective exchange rate, were placed ahead of the wholesale price index.[42] The estimation was run in log levels (except short-term interest rate), since the relation between economic variables are assumed to be non-linear. According to the Akaike Information criterion and advisability of the model, a lag order of one and two appeared to be appropriate. The sample period covers nine years, from March 1994 to July 2003.

Figure 15 depicts the impulse response functions together with the respective 90 percent confidence intervals. The effects given by the impulse response functions are measured as changes in the log of all variables except for the interest rate, where these effects are given in percentage points. The impulse response analysis approved the statistical significance of exchange rate pass-through. The magnitude of the exchange rate shock (derived from past development) is markedly affected (1) by choosing a model-propitious nominal effective exchange rate (NEER) that is significantly more stable than a single exchange rate e.g. to the euro or the US dollar and (2) by a long time period of fixed exchange rate regime. The VAR model, based on monthly data, suggested a longer-lasting impact of an exchange rate shock on inflation indicating that the HUF movements were mostly considered to be permanent and not transitory. According to the presented VAR model, the trade weighted exchange rate pass-through culminates at almost 15 % in the two-year horizon. This finding is consistent with the NBH's "working assumption" posits that the permanent change in the forint's exchange rate leads to a 15% pass-through to the price level over the course of two years. As the followed lines confirmed, the exchange rate pass-through proved to be faster and stronger than the interest rate counterpart.

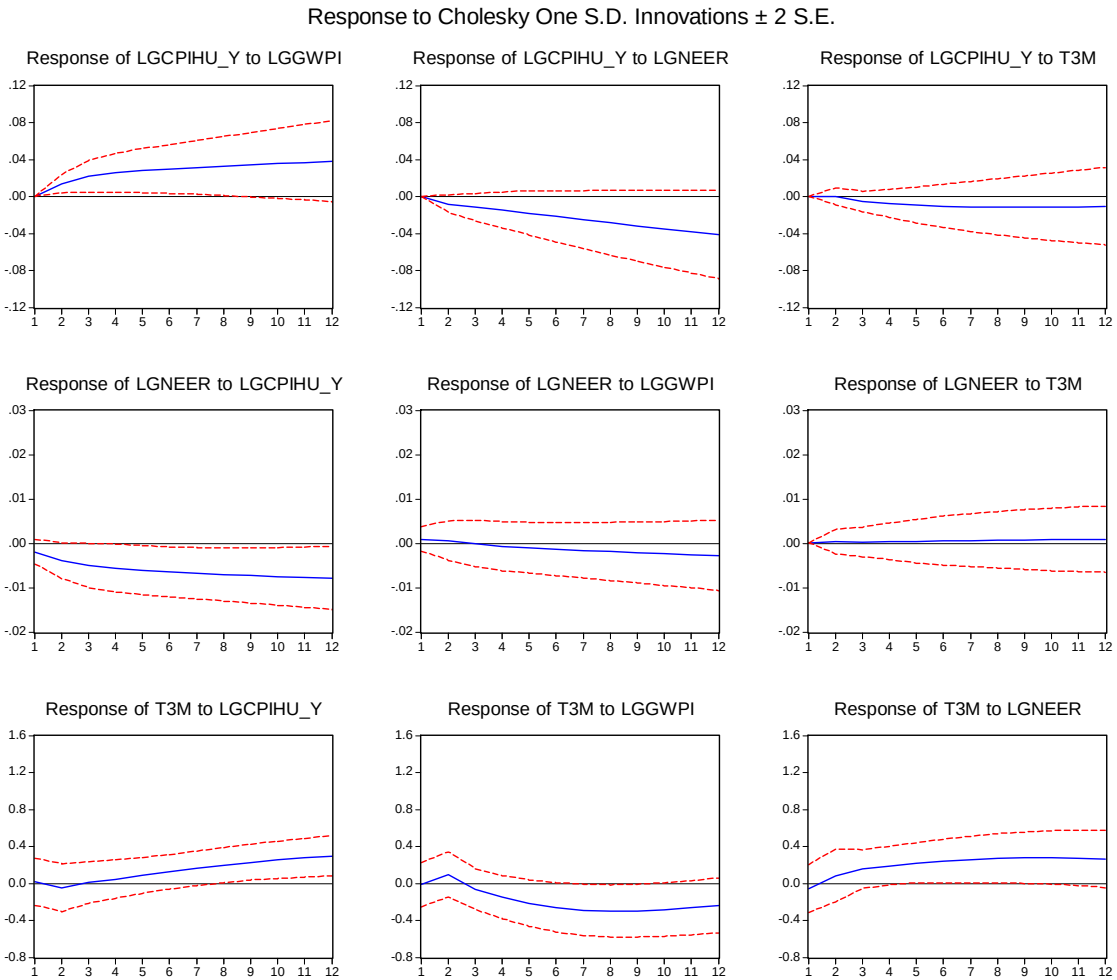
The VAR model confirmed the robustness of the interest rate channel. A rate hike of a 1/4-percentage point should effectively reduce inflation within tree quarters by less than 1 basis point. The response of NEER to a rate hike is marginal, thus the HUF's subsequent mild strengthening does not notably support the concractionary impact of an interest rate hike. As Figure 15 shows, along with inflation, which initiates interest rate tightening, there are also external inflation factors – supply shocks, represented in the VAR model by German wholesale prices index, that cause a

[42] The other variables do not appear statistically significant and their inclusion into the model did not improve the results.

permanent interest rate adjustment. A drop in the short-term interest rate on NEER's strengthening proved to be temporary and at the same time vulnerably exposed to a reversal. The impulse response function pointed to an unconventional shape of the NBH's reaction function, since the inceptive reaction on inflation expansion proved to be irresolute, later replaced by unambiguous tightening, and the initial aim to counteract the currency's strengthening by monetary easing is replaced by antagonistic interest rate growth. This finding supports the assumption that the NBH's disinflation strategy relies almost fully on the currency channel.

The Granger causality test and VAR model confirmed the pronounced hypotheses on the effectiveness and promptness of the exchange rate monetary policy channel and pointed to the country-specific properties of the inflation targeting regime consisting of a strong dominance of the exchange rate pass-through in the Hungarian anti-inflation strategy.

Figure 15 Impulse Response Functions



Notes: The upward movements of the NEER signify the appreciation of the HUF.
Source: Author's calculations based on Bloomberg and NBH data.

3.6 Specific Features of Inflation Targeting in Hungary

The country-specific features of the inflation targeting strategy in Hungary, as well as in the Czech Republic or Poland, result from the specific economic conditions that come from the incomplete transformation process.

Despite the fact that many inflation targeting countries apply the so-called "core inflation" index, the NBH has chosen to target the Consumer Price Index with the belief that it is the most appropriate inflation indicator because it is considered to be a transparent indicator and fairly simple to understand. From a pragmatic point of view, the NBH's choice was restricted by the lack of a "core inflation" long time series for the domestic economy and the structure of the Hungarian consumer basket that is comprised of volatile food prices from more than one fourth compared, for instance, with less than one fifth in Germany.

The second regionally specific feature of Hungarian and CEE countries' inflation targeting regime is the designed trajectory of disinflation by choosing three levels of inflation target: (1) short-term, (2) mid-term and (3) long-term. The long run policy inflation target objective was set to be 2% y/y in line with the European Central Bank's (ECB) target. To settle inflation onto the desired disinflation path, the short- and mid-term inflation targets were formulated. In the transition stage from an old to a new monetary policy regime the 7% in annual headline inflation was set to be achieved. Strictly speaking, it was more a projection than a target. The further immediate targets (4.5% for 2002-end, 3.5% by 2003-end and later 3.5% by 2004-end; see Table 17) were determined to design a trajectory of disinflation, being consistent with the Maastricht criterion on inflation to adopt the euro by 2006-2007 and thus fulfil the ambitious Hungarian plan to enter the EMU as soon as possible. The inflation target was not set as a concrete point but as a system formed by a central parity and a tolerance band. The tolerance band was defined as the extent of ±1 percentage point along the announced disinflation path to lessen the need for too active monetary policy in the case of unexpected shocks to inflation. The central bank stressed that its goal is to meet the inflation target at a minimum cost in terms of output volatility, by confining policy responses solely to divergence over a longer horizon of 1 to 1.5 year. Therefore, a temporary deviation of actual inflation from the targeted path due to unforeseen events over a short time period cannot be ruled out. However, the practice showed the communication strategy of the central bank stressing the central parity

of the target does not prevent the public from focusing on the edges of the inflation tolerance band.

Similarly to the other CEE central banks targeting inflation, the NBH announces the inflation target without it being obligatory for the monetary authority counterpart – the national government. Though the NBH had agreed with the government on inflation targets, the fiscal policy stance was, for most of the time, developed inconsistently with the desired inflation targets. To conduct suitable economic policies, Hungary and other CEE countries lack an effective tool coordinating macroeconomic policies. One of the feasible tools is simply a common obligation of the central bank and the government to an inflation target accompanied by regular mutual consultation of proposed policy steps. The political and operational independence of the central bank would remain untouched and the government has to submit a mid- or long-term macroeconomic strategy.

The most specific and at once the most apparent shortcoming of the Hungarian inflation targeting regime is the coexistence of an inflation target and an exchange rate target band. Though officially the NBH announced the priority of inflation targets over the exchange rate, the policy makers have not been ready to abandon currency tuning. The NBH in its macroeconomic forecasting model and than in its regular publications refers to a "desired exchange rate path" which is strongly inconsistent even with a flexible inflation targeting regime. In other words, the Hungarian central bank says to the financial markets and ordinary public that besides the inflation target there is something – the exchange rate – that the central bank follows and sets for it a desired level. So the question arises as to whether a possible conflict between inflation and the currency target persuade the central bank to abandon the first or second mentioned target. As 2003 demonstrated, the winner of the conflict was, unfortunately, the currency target. The credibility of inflation targeting "was hit below the belt".

3.7 Practical Experiences with Inflation Targeting in Hungary

The history of the Hungarian inflation targeting regime began in July 2001 as has already been stated many times. The introduction of inflation targeting followed a period during which disinflation stalled. Year-on-year headline inflation fell from its peak of 10.8% in May 2001 to 5.9% in March 2002 (see Figure 16), owing in part to the appreciation of the forint in the wake of widening the exchange rate band but mainly to

favourable exogenous factors (drop in oil and food prices). At the same time, inflation expectations had been gradually lowering, however, they remained close to the upper edge of the inflation target. It is not clear whether the drop in inflation expectations bore on the credibility of the inflation targeting regime or favourable external factors. Recalling the outcomes of econometric analysis, the second mentioned reason seems to be more plausible. The favourable development of inflation and inflation expectations was, in the course of 2002, disrupted by fiscal policy taking a strongly expansionary stance and thus the market felt, in fiscal loss and extensive wage growth, an eminent menace to the 2003 inflation target. So the burden of lowering inflation moved to the monetary policy authority. Deepening twin deficit and rising intensity of demand inflationary pressures forced the NBH to tighten monetary conditions. Nevertheless, its interest rate decisions primarily reflected currency movement and not inflation development. Thus, the base rate moved up and down between 8.5% and 9.5% in the course of the year and closed up at 8.5%. In other words, the NBH relied on the disinflation pressure of a firming HUF and on the import of low inflation from abroad.

More and more evidence of conflict between expansive fiscal policy and deepening external imbalance and the NBH's statement that it was ready to raise interest rates, if it saw the potential conflict between the current exchange rate band and meeting its inflation targets give rise to expectations of unavoidable rate hikes. Anticipation of rising interest rates stirred up speculation on a massive HUF appreciation that would finally force the NBH to adjust the central parity of the forint's fluctuation band. The speculative attack at the strong edge of the HUF on January 15, 2003 was aimed to test the readiness of the central bank to defend the exchange rate band. The NBH was forced to actively intervene two days on the market and in an effort to lower the cost of interventions cut drastically in two steps the base rate by 200 basis points to 6.5% within two days. Also quantity limits on two-week deposits were introduced and the overnight rate corridor widened. The HUF stabilized relatively fast then, around 245 to the euro. The quantity limits were removed by February-end. High uncertainty surrounding further development of the exchange rate and interest rates swayed the market. Growing scepticism on the attainability of the 2003 inflation target, insufficient measures on fiscal policy side and persistent problems with a twin-deficit invoked currency weakening towards 250 to the euro. Though at that time the actual inflation prediction of the NBH had relied on 243.63 to the euro (see Quarterly Reports on Inflation) and 80% of rapid real exchange rate appreciation has come from rising wages, the central bank, in an agreement with the Government, devalued the central

parity of the forint by 2.26%. The strong edge of the band was shifted from 234.7 to 240 against the euro. According to the Government, it should help to avoid any potential overshoot of the exchange rate that could jeopardize Hungarian competitiveness. The approval for the competitive devaluation (by the way impermissible under ERM II) was given by exchange with the government commitment to implement the radical fiscal adjustment. Instead of this the central bank itself had to later indirectly admit (see e.g. Inflation Reports from August 2003 and February 2004) that the fiscal tightening was less intensive than it had initially predicted. Further development on the foreign exchange market that enforced drastic rate hikes (by 300 basis point in the course of June) and also, later, the direct intervention on the forint and local bond market merely reflected the broad confusion over the NBH's strategy. Nobody was surprised when the NBH abandoned the 2003 inflation target and acknowledged overshooting 2004's one.

The aim to fine-tune the exchange rate proved to be a way into darkness. Though the interest rate channel might not be efficient enough and sufficiently fast, it is a transparent and correct way how to direct inflation development. The strategy of running interest rates up and down in an effort to bring the currency to the "desired levels" and through the exchange rate pass-through to influence inflation poses a high risk of financial instability, apart from the fact that such a monetary strategy loses credibility and confuses the market. Whether the inflation-targeting framework should be effective and useful, the strategy must rely upon conventional operation tools and channels.

Table 17 Inflation Targets in Hungary

Official CPI (December of previous year = 100)	***Target range***	***Exchange Rate Regime***	***Final inflation***
2001	6-8%	Exchange rate band widened from ± 2.5% to ± 15.0 % in May 2001	6.8%
2002	3.5% - 5.5%		4.8%
2003	2.5% - 4.5%	Central parity was devaluated from 276.1 to the euro to 282.36	5.7%
2004	2.5% - 4.5%		
2005	3% - 5%		

Source: NBH, 2004.

Figure 16 Inflation vs. Targets

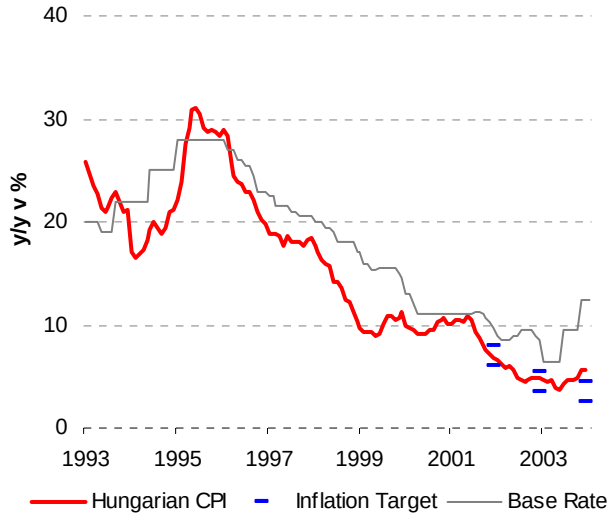


Figure 17 Food Price Indexes

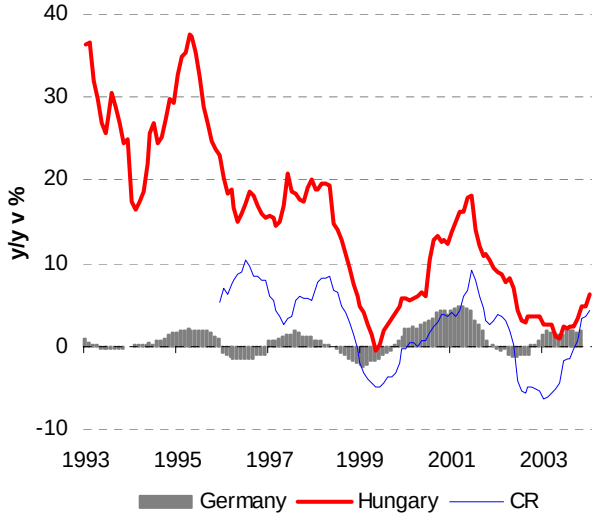


Figure 18 Fiscal Deficits and Wages

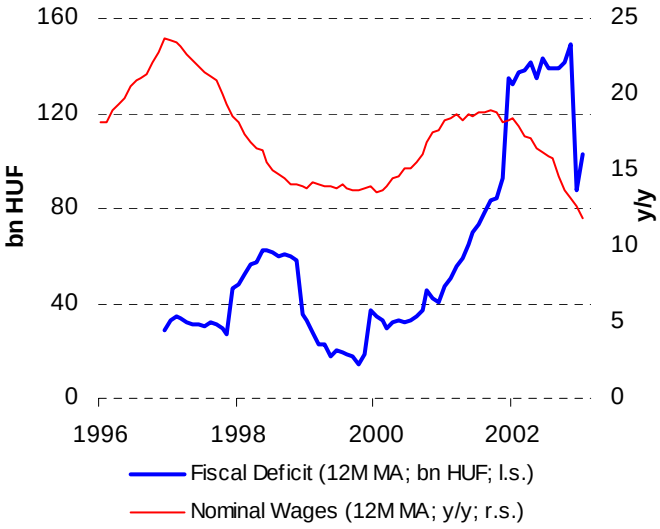
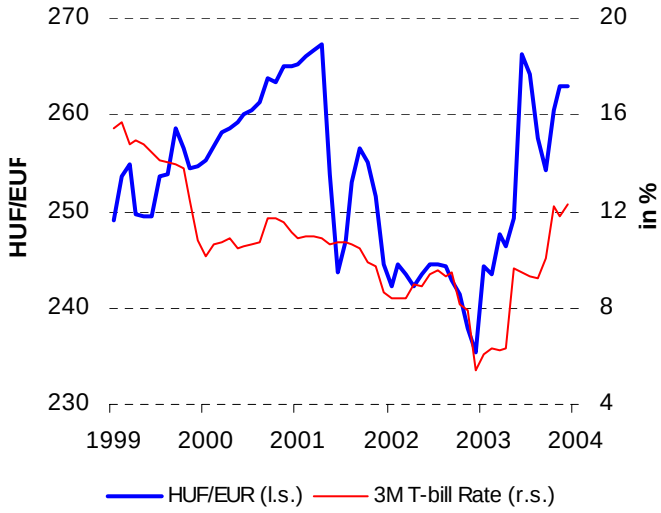


Figure 19 HUF a 3M T-bill Rate



Source: IMF, Bloomberg and central banks' data.

3.8 Conclusion

The above analysis of Hungarian inflation targeting did not deliver a positive result. Though the NBH has a legal obligation to care about the price stability, it is famed for its "dovish", more or less pro-growing oriented policy stance.

The most specific and at the same time the most apparent shortcoming of the Hungarian inflation targeting regime is the coexistence of both an inflation target and an exchange rate target band. Though officially the NBH announced the priority of inflation targets over the exchange rate, the policy makers not have been ready to abandon currency tuning. The evidence is apparent: (1)

macroeconomic forecasts set on "desired exchange rate path" or (2) the conviction of the NBH that it is able to target inflation through exchange rate tuning. Though even our econometric analysis of the monetary policy transmission mechanisms pointed out the dominance of exchange rate pass through, it does not mean that the central bank should concentrate on it and blindly belief that it reaches inflation targets by the help of currency fine-turning.

The inflation targeting in Hungary did not manage to gain credibility as the analysis of recursive residuals, ARMA process and structural breaks confirmed. Though the inflation and exchange rate development stabilized (at least in terms of statistical measures), it does not need to bear upon inflation targeting adoption but rather a favourable coincidence of factors. Moreover, at the time when the economy needed an anchor in the form of a credible monetary policy, the NBH made big mistakes and disobeyed the principles of inflation targeting. The early confidence in the inflation target was soon undermined by an inconsistent fiscal policy and later ruined by unsystematic monetary policy decisions. Inflation expectations were not anchored and wage barging remains off the control. The fruits that the inflation targeting regime should bring, in the shape of lower inflation inertia and inflation bias, were thrown out of the window.

Nevertheless, the problem is not just from the central bank side. Similarly to the other CEE central banks targeting inflation, the NBH announces the inflation target without it being obligatory for its monetary authority counterpart – the national government. Though the central bank had agreed with the government on the inflation targets, the fiscal policy stance developed inconsistently with the desired inflation targets and the problem of fiscal dominance came to light. To conduct suitable economic policies, Hungary and other CEE countries lack an effective tool coordinating macroeconomic policies. One of the feasible tools is simply a common obligation of the central bank and the government to an inflation target accompanied by regular mutual consultation of proposed policy steps. The political and operational independence of the central bank would remain untouched and the government has to submit a mid- or long-term macroeconomic strategy. Unfortunately, the NBH chose its own way in how to deal with fiscal exuberance.

The experiences of the NBH showed that the official revision of a monetary policy regime does not automatically ensure success. Until policy makers are disciplined and loyal to the principles of the particular regime, monetary policy will never be transparent, systematic and will not bring the expected fruits e.g. in the form of minimal inflation bias and macroeconomic stabilization.

While flexible inflation targeting calls for economic policy discipline and coordinated fiscal and monetary policies, Hungary ignored it and paid for it with currency and interest rate instability. The near future shows how costly discrediting the inflation-targeting framework can be…

4 Summary

The Czech Republic created the space for the expansion of the popular inflation targeting regime into Central Eastern European Countries. The more or less positive experiences with implementing of inflation targeting provoked interest among the other CEE countries that in all aimed to break down inflation persistence and lower inflation.

The Czech Republic, Poland and Hungary are the only fully fledged direct inflation targeters among the new-comers to the European Union that have fulfilled all five key features of the inflation targeting regime. While the Czech and Polish monetary policy strategy can be ranked as a strict inflation targeting regime, the Hungarian approach belongs to the flexible, or even hybrid inflation targeting, combining the explicit inflation target with a wide exchange rate band, ±15.0% around a central parity against the euro, and disobeying the rule of the inflation target being dominant. The cross-country comparison did not fully confirm the theoretical presumption that strict inflation targeting attempting to stabilize inflation around the inflation target hampers the stabilization of other macroeconomic variables such as exchange rate, for example. While the implementation of strict inflation targeting in the Czech Republic was accompanied by an increase in exchange rate volatility, the zloty's volatility went down in Poland. The variation coefficients for all three CPI indexes and exchange rates seem to be indifferent to the sort of inflation targeting regime. Country-specific and external factors most likely played the dominant role in determining the variability or stability of the macroeconomic indicators. To get a less ambiguous answer other research has to be done.

Based on practice from inflation targeting countries, several preconditions for successful inflation targeting could be identified. The experiences of implementing inflation targeting in CEE countries emphasized three of the identified prerequisites: (1) instrumental independence of the central bank, (2) the absence of other nominal objectives and (3) a sound banking system transferring interest rate changes into the economy. Without satisfying these, no central bank, however well established and able to measure inflation with an acceptable measure of deviation, should consider adopting inflation targeting. The rest of the prerequisites are also important, nevertheless the inflation targeting regime can perform relatively well even if they are not fulfilled for some transitory period. An example of this is the sophisticated forecasting models that unambiguously facilitate the implementation of the inflation targeting but it is not absolutely necessary. Of course, for the central bank it is nice and helpful to have a sophisticated modelling framework since it maps out feasible inflation

development scenarios and simplifies communication at least with the financial markets, however the central bank that, for the time being, just has partial models at its disposal and only has juts a general knowledge about the effectiveness and readiness of the main monetary policy transmission channels can still successfully target inflation, of course with higher degree of uncertainty, and take advantage of at least some of the benefits that inflation targeting brings. The central bank has to be aware of the shortcomings of the "primitive" forecasting background and avoid premature interest rate adjustments or even target reviews. The NBP can serve as an example of overestimating its ability to precisely forecast the future inflation path.

The relevance of fiscal dominance and the troublesome co-ordination of policies is proportional to the extent that fiscal development affects local price stability. Considering the relatively high share of social benefits on the total public finance outlays in the considered countries, the presence of fiscal dominance and the evident lack of any mechanism that will ensure the coordination of the economic policies within the country proved to be, from time to time, a source of inflation shock (see the wage acceleration in Hungary) or ineffectiveness in monetary policy (see the relatively high real interest rates in Poland). It would be surely worthwhile to establish an effective tool coordinating macroeconomic policies and safeguarding the appropriateness of the policy mix in our CEE countries. One of the feasible tools is simply a common obligation of the central bank and the government to an inflation target accompanied by regular mutual consultation of proposed policy steps.

The Hungarian experience of conducting the hybrid inflation targeting warns against the effort to target other economic variables such as the exchange rate besides inflation. The "blind" conviction of the NBH that it is able to target inflation through exchange rate tuning strayed onto the wrong path. Though even our econometric analysis of the monetary policy transmission mechanisms pointed out the dominance of exchange rate pass through in the short- and mid-term, it does not mean that the central bank should concentrate on it and blindly belief that it reaches inflation targets through the aid of currency fine-turning. On the other hand, the strict Polish strategy of only emergency interventions on the foreign exchange markets and the timed adoption of measures against currency overshooting, because of the transaction related to privatization proceeds, can serve as an exemplary case.

For both CEE countries, the dominance of the exchange rate transmission channel is typical, at least in the short run, while the second important interest rate channel proved to be initially weak though it appeared to gradually gain strength over time. The interest rate and credit pass-through seems to, meanwhile, interfere with a number of obstacles, for example

in the shape of low interest rate sensitivity of credit demand, an ineffective banking system with a high lending margin or low credit penetration of households and companies. Despite this, the investigation into the basic links between macroeconomic variables pointed out that the CEE central banks have at their disposal a tool to guide consumer price development, however, it works with a relatively long time delay. Therefore, the central banks have to anticipate the inflation development a couple of quarters ahead and adjust the monetary policy instrument in advance.

The CEE inflation-targeting countries are still in the process of building-up sophisticated, fully fledged inflation targeting. While the Czech National Bank managed to gain some degree of credibility from the beginning of inflation targeting itself, the National Bank of Poland and Hungary failed to do so as stability tests indicated. Nevertheless, the investigation into the statistical properties of inflation time series suggested that some degree of inflation persistence, or inertia remained in all three countries despite the policy regime change. The limited trustworthiness of the regional inflation targets hinders the full exploitation of all benefits that the inflation targeting regime offers, for example in the shape of lower inflation inertia/bias and a minimized sacrifice ratio. Moreover, the theoretical verifications that the conflict between credibility and flexibility of inflation targets can be smoothed by the implementation of clearly defined "escape clauses" within policy rules. This recommendation was only answered by the Czech National Bank, which had adopted them. The other central banks strongly believe in their ability to communicate and explain to the public the reasons behind missing a target. The slight and hard won credibility of inflation targets lost the power to break down inflation inertia and the backward-looking character of inflation expectations are deeply rooted in Poland and Hungary.

As one can see from the above text, the experiences of the three inflation-targeting countries offer practical lessons for the other less developed countries with an already well established central bank that aim to break down inflation inertia and stabilise price development and may decide to adopt an inflation targeting regime. However, further investigation into the mid- and long-term economic consequences of strict or flexible inflation targeting regime need to be done. Moreover, it should be stressed at the end that the official revision of a monetary policy regime does not automatically ensure success. Until policy makers are disciplined and loyal to the principles of the particular regime, monetary policy will never be transparent, systematic and will not bring the expected fruits e.g. in the form of minimal inflation bias and macroeconomic stabilization…

Abstract

This paper focuses on unresolved issues of design and implementation of the inflation targeting regime in emerging market economies. The experiences and the practice of the Czech National Bank (CNB) will serve as the "benchmark", as the CNB was the first central bank in Central Europe to adopt the new monetary policy regime, followed by the National Bank of Poland and National Bank of Hungary.

This study intends to extend the present research results through a cross-country comparison of statistical and econometric analysis of inflation characteristics and their implications for inflation targeting strategy in the selected countries. We examine the importance of three key pre-requisites for successful adoption of inflation targeting: the instrumental independence of the central bank, the absence of other nominal objectives and a sound banking system which transfers interest rate changes to the economy. Although the above pre-conditions are fulfilled by the CEE inflation targeting countries (with the exception of the National Bank of Hungary), inflation targeting in these countries faces other obstacles. The most evident of these are the absence of coordination of macroeconomic policies and signs of fiscal dominance.

Other obstacles – albeit of lesser importance – include the under-developed forecasting framework of the central banks and the less effective interest rate pass-through. On the other side, our tests confirmed the dominance of the exchange rate pass-through in Poland and Hungary, at least in the short run. The comprehensive investigation into the practice of direct inflation targeting in Central and Eastern Europe also serves as a rich source of information and suggestions for other less developed countries that are deciding whether to adopt the direct inflation targeting regime.

Keywords: direct inflation targeting – policy rule – inflation inertia – monetary policy – monetary policy transmission channels – exchange rate pass-through – interest rate pass-through.

JEL Classification: C22, E 44, E47, E52, E59, E60.

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Appendix

The following appendix includes the detailed outcomes of the econometric analysis mentioned in this paper. All estimations were run in EViews software.

Appendix 1 Recursive Residuals of Poland's CPI

Dependent Variable: DCPIPL_Y
Method: Least Squares
Included observations: 143 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.088655	0.177928	-0.498263	0.6191
CPIPL_Y(-1)	-0.175640	0.058841	-2.985012	0.0033
CPIPL_Y(-2)	0.162140	0.057191	2.835053	0.0053
R-squared	0.064953	Mean dependent var		-0.260839
Adjusted R-squared	0.051596	S.D. dependent var		1.329303
S.E. of regression	1.294556	Akaike info criterion		3.374969
Sum squared resid	234.6226	Schwarz criterion		3.437126
Log likelihood	-238.3103	F-statistic		4.862578
Durbin-Watson stat	1.720388	Prob(F-statistic)		0.009085

Note: CPIPL_Y denotes the year-on-year Consumer Price Index and DCPIPL_Y the first difference of the year-on-year Consumer Price Index.

Appendix 2 Recursive Residuals of the Czech CPI

Dependent Variable: DCPICR_Y100
Method: Least Squares
Sample(adjusted): 1994:03 2003:12
Included observations: 118 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.471357	2.376733	1.039813	0.3006
CPICR(-1)	-0.028792	0.068816	-0.418397	0.6764
CPICR(-2)	0.004902	0.068629	0.071420	0.9432
R-squared	0.010375	Mean dependent var		-0.073876
Adjusted R-squared	-0.006835	S.D. dependent var		0.985072
S.E. of regression	0.988433	Akaike info criterion		2.839703
Sum squared resid	112.3549	Schwarz criterion		2.910144
Log likelihood	-164.5425	F-statistic		0.602839
Durbin-Watson stat	2.053563	Prob(F-statistic)		0.548976

Note: CPICR_Y100 means the year-on-year Consumer Price Index and DCPICR_Y100 the first difference of the year-on-year Consumer Price Index.

Appendix 3 Estimation of AR Process of Polish Inflation Paths and diagnostic tests

Dependent Variable: DCPIPL_Y
Method: Least Squares
Included observations: 131 after adjusting endpoints
Convergence achieved after 3 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.512403	0.206897	-2.476611	0.0146
TIME	0.002569	0.001933	1.328658	0.1864
AR(1)	0.152322	0.079213	1.922949	0.0568
AR(2)	-0.297478	0.082416	-3.609454	0.0004
AR(4)	0.191316	0.080164	2.386547	0.0185
AR(12)	-0.220628	0.065019	-3.393268	0.0009

R-squared	0.293029	Mean dependent var	-0.248855
Adjusted R-squared	0.264750	S.D. dependent var	1.143568
S.E. of regression	0.980572	Akaike info criterion	2.843358
Sum squared resid	120.1902	Schwarz criterion	2.975047
Log likelihood	-180.2400	F-statistic	10.36214
Durbin-Watson stat	1.986026	Prob(F-statistic)	0.000000

Inverted AR Roots	.85 -.22i	.85+.22i	.60 -.62i	.60+.62i
	.21 -.90i	.21+.90i	-.18+.89i	-.18 -.89i
	-.58 -.62i	-.58+.62i	-.83+.22i	-.83 -.22i

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.043908	Probability	0.987713
Obs*R-squared	0.141287	Probability	0.986459

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006633	0.212036	0.031280	0.9751
TIME	-5.40E-05	0.001977	-0.027317	0.9783
AR(1)	0.026220	0.181792	0.144233	0.8856
AR(2)	0.032005	0.210039	0.152374	0.8791
AR(4)	0.014243	0.108060	0.131803	0.8954
AR(12)	0.001446	0.065942	0.021929	0.9825
RESID(-1)	-0.023928	0.200820	-0.119153	0.9054
RESID(-2)	-0.050207	0.228135	-0.220075	0.8262
RESID(-3)	0.023219	0.118236	0.196381	0.8446

R-squared	0.001079	Mean dependent var	-1.66E-13
Adjusted R-squared	-0.064425	S.D. dependent var	0.961530
S.E. of regression	0.992020	Akaike info criterion	2.888081
Sum squared resid	120.0606	Schwarz criterion	3.085613
Log likelihood	-180.1693	F-statistic	0.016465
Durbin-Watson stat	1.990499	Prob(F-statistic)	0.999999

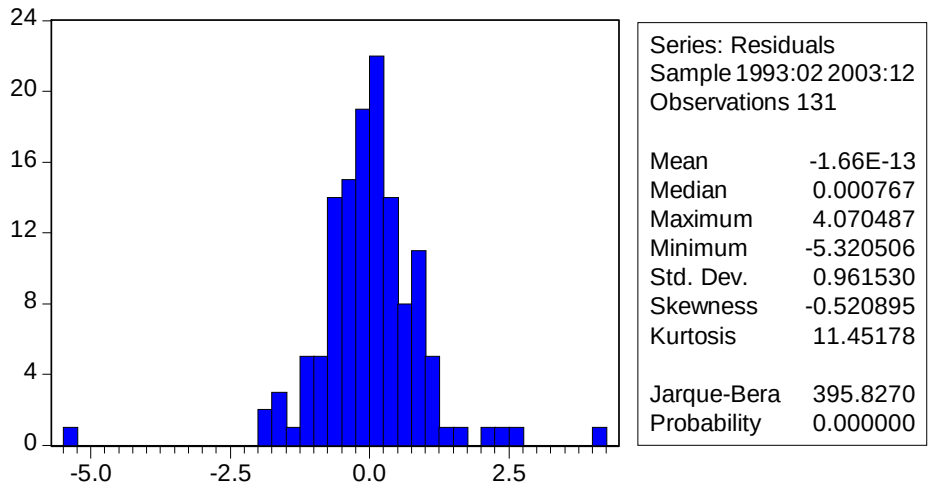
ARCH Test:

F-statistic	12.46080	Probability	0.000000
Obs*R-squared	29.64974	Probability	0.000002

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample(adjusted): 1993:05 2003:12
Included observations: 128 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.500409	0.255094	1.961662	0.0520
RESID^2(-1)	0.514797	0.089477	5.753409	0.0000
RESID^2(-2)	-0.087271	0.100233	-0.870688	0.3856
RESID^2(-3)	0.007131	0.089485	0.079692	0.9366

R-squared	0.231639	Mean dependent var	0.903531
Adjusted R-squared	0.213049	S.D. dependent var	3.005386
S.E. of regression	2.666086	Akaike info criterion	4.829851
Sum squared resid	881.3936	Schwarz criterion	4.918977
Log likelihood	-305.1105	F-statistic	12.46080
Durbin-Watson stat	1.983397	Prob (F-statistic)	0.000000



Appendix 4 Estimation of AR Process of Czech Inflation Paths and diagnostic tests

Dependent Variable: DCPICR_Y100
Method: Least Squares
Sample(adjusted): 1994:08 2003:12
Included observations: 113 after adjusting endpoints
Convergence achieved after 9 iterations
Backcast: 1993:08 1994:07

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(6)	0.101886	0.094840	1.074298	0.2850
MA(6)	0.349840	0.126161	2.772956	0.0065
MA(12)	0.267234	0.095356	2.802484	0.0060

R-squared	0.242504	Mean dependent var	-0.082970
Adjusted R-squared	0.228731	S.D. dependent var	1.004354
S.E. of regression	0.882043	Akaike info criterion	2.613037
Sum squared resid	85.57993	Schwarz criterion	2.685446
Log likelihood	-144.6366	Durbin-Watson stat	1.795280

Inverted AR Roots	.68	.34+.59i	.34 -.59i	-.34+.59i
	-.34 -.59i	-.68		
Inverted MA Roots	.85+.28i	.85 -.28i	.67+.60i	.67 -.60i
	.18 -.88i	.18+.88i	-.18+.88i	-.18 -.88i
	-.67+.60i	-.67 -.60i	-.85+.28i	-.85 -.28i

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.953876	Probability	0.417421
Obs*R-squared	2.637273	Probability	0.450993

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(6)	0.002585	0.095011	0.027211	0.9783
MA(6)	-0.017314	0.126776	-0.136569	0.8916
MA(12)	0.029555	0.099207	0.297912	0.7663
RESID(-1)	0.097628	0.100267	0.973678	0.3324
RESID(-2)	0.067034	0.097146	0.690033	0.4917
RESID(-3)	0.098411	0.097173	1.012744	0.3135

R-squared	0.023339	Mean dependent var	-0.045832
Adjusted R-squared	-0.022300	S.D. dependent var	0.872919
S.E. of regression	0.882598	Akaike info criterion	2.639742
Sum squared resid	83.35078	Schwarz criterion	2.784559
Log likelihood	-143.1454	Durbin-Watson stat	1.960850

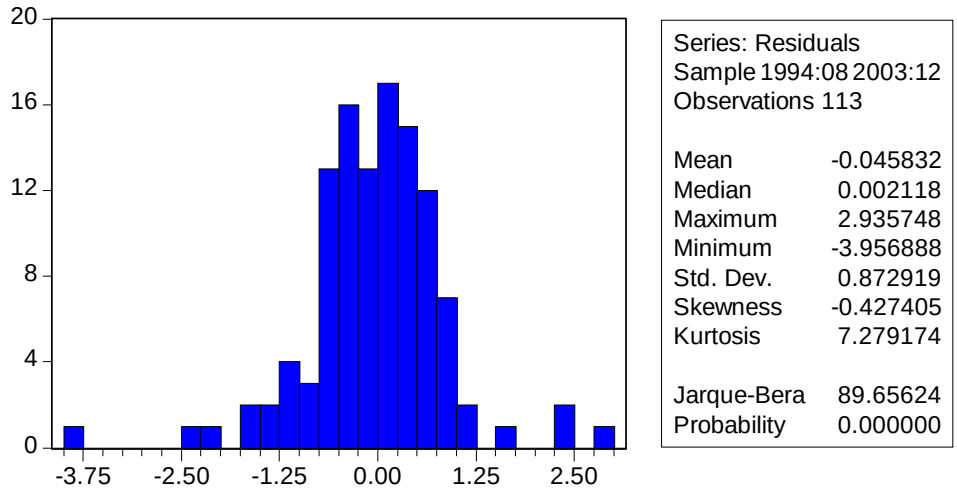
ARCH Test:

F-statistic	0.376341	Probability	0.770241
Obs*R-squared	1.159281	Probability	0.762786

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample(adjusted): 1994:11 2003:12
Included observations: 110 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.888645	0.228976	3.880946	0.0002
RESID^2(-1)	-0.017151	0.096814	-0.177156	0.8597
RESID^2(-2)	-0.061729	0.096639	-0.638764	0.5244
RESID^2(-3)	-0.082287	0.096812	-0.849965	0.3973

R-squared	0.010539	Mean dependent var	0.764398
Adjusted R-squared	-0.017465	S.D. dependent var	1.940321
S.E. of regression	1.957191	Akaike info criterion	4.216584
Sum squared resid	406.0434	Schwarz criterion	4.314783
Log likelihood	-227.9121	F-statistic	0.376341
Durbin-Watson stat	2.011802	Prob(F-statistic)	0.770241



Appendix 5 Pairwise Granger Causality Tests – selection of statistically significant relations

Sample: 1990:01 2004:12

Null Hypothesis:	3M Probability	6M Probability	9M Probability	12M Probability
DLGBUDGET does not Granger Cause DLGCPIPL	0.25186	0.30013	0.22811	0.65281
DLGCPIPL does not Granger Cause DLGBUDGET	0.13677	0.13535	0.01082	0.09917
DLGIMP does not Granger Cause DLGCPIPL	0.01599	0.02249	0.00866	0.12060
DLGCPIPL does not Granger Cause DLGIMP	0.02219	0.00844	0.01188	0.09559
DLGIP does not Granger Cause DLGCPIPL	0.12746	0.31168	0.06521	0.16110
DLGCPIPL does not Granger Cause DLGIP	0.22577	0.63260	0.82788	0.31866
DLGM2 does not Granger Cause DLGCPIPL	0.46242	0.55844	0.11629	0.30562
DLGCPIPL does not Granger Cause DLGM2	0.41395	0.07298	0.04510	0.31649
DLGOIL does not Granger Cause DLGCPIPL	0.20772	0.33808	0.13815	0.39700
DLGCPIPL does not Granger Cause DLGOIL	0.42125	0.80980	0.03512	0.07096
DLGPPI does not Granger Cause DLGCPIPL	0.09446	0.00092	0.00175	0.12113
DLGCPIPL does not Granger Cause DLGPPI	0.82891	5.6E-07	1.5E-08	3.2E-05
DLGREER does not Granger Cause DLGCPIPL	0.17102	0.00695	0.10015	0.24330
DLGCPIPL does not Granger Cause DLGREER	0.06306	0.13607	0.23852	0.21728
DLGW does not Granger Cause DLGCPIPL	0.90001	0.88495	0.03510	0.05290
DLGCPIPL does not Granger Cause DLGW	0.45271	0.05396	0.03158	0.36868
DM3M does not Granger Cause DLGCPIPL	0.30434	0.21631	0.12115	0.01724
DLGCPIPL does not Granger Cause DM3M	0.68212	0.08663	0.03481	0.09759
DLGRETAIL does not Granger Cause DLGBUDGET	0.05428	0.03295	0.00462	0.06235
DLGBUDGET does not Granger Cause DLGRETAIL	0.56316	0.35994	0.23039	0.43020
DLGW does not Granger Cause DLGBUDGET	0.31329	0.20572	0.20266	0.64245
DLGBUDGET does not Granger Cause DLGW	0.15264	0.21175	0.02885	0.13517
DLGIMP does not Granger Cause DLGGFOOD	0.10524	0.18120	0.29080	0.61626
DLGGFOOD does not Granger Cause DLGIMP	0.02163	0.03116	0.02460	0.05545
DLGIP does not Granger Cause DLGGFOOD	0.06167	0.05637	0.13703	0.25083
DLGGFOOD does not Granger Cause DLGIP	0.06410	0.35022	0.36554	0.08211
DLGM2 does not Granger Cause DLGGFOOD	0.41690	0.63319	0.11686	0.10479
DLGGFOOD does not Granger Cause DLGM2	0.00029	0.00422	0.00842	0.08463
DLGIMP does not Granger Cause DLGGJX	0.52737	0.21638	0.02628	0.24849
DLGGJX does not Granger Cause DLGIMP	0.89077	0.08028	0.07261	0.43191
DLGIP does not Granger Cause DLGGJX	0.13222	0.38231	0.19828	0.23882
DLGGJX does not Granger Cause DLGIP	0.45872	0.05408	0.09665	0.14487

Appendix 5 cont.

	3M	6M	9M	12M
Null Hypothesis:	Probability	Probability	Probability	Probability
DLGIMP does not Granger Cause DLGGPPI	0.02382	0.05724	0.20434	0.07686
DLGGPPI does not Granger Cause DLGIMP	0.05248	0.14148	0.00979	0.08431
DLGW does not Granger Cause DLGGPPI	0.01410	0.03238	0.16782	0.20053
DLGGPPI does not Granger Cause DLGW	0.09830	0.11418	0.05126	0.43364
DLGIMP does not Granger Cause DLGGWPI	0.22041	0.01932	0.00817	0.46157
DLGGWPI does not Granger Cause DLGIMP	0.04147	0.06507	0.00151	0.00956
DLGIP does not Granger Cause DLGGWPI	0.09955	0.05722	0.17794	0.67698
DLGGWPI does not Granger Cause DLGIP	0.05774	0.03889	0.03454	0.01152
DLGOIL does not Granger Cause DLGGWPI	0.01114	0.09709	0.03761	0.01475
DLGGWPI does not Granger Cause DLGOIL	0.11948	0.00038	0.00097	0.00411
DLGPPI does not Granger Cause DLGGWPI	0.94765	0.58313	0.21795	0.24092
DLGGWPI does not Granger Cause DLGPPI	0.05839	0.15634	0.51064	0.84618
DM3M does not Granger Cause DLGGWPI	0.14234	0.17964	0.09185	0.64429
DLGGWPI does not Granger Cause DM3M	0.10077	0.00348	0.01561	0.02614
DLGIP does not Granger Cause DLGIMP	0.95695	0.91639	0.96275	0.82118
DLGIMP does not Granger Cause DLGIP	0.08659	0.01430	0.03581	0.11323
DLGNEER does not Granger Cause DLGIMP	0.04090	0.31348	0.13299	0.21390
DLGIMP does not Granger Cause DLGNEER	0.47972	0.77211	0.22651	0.51240
DLGPPI does not Granger Cause DLGIMP	0.60658	0.11973	0.04199	0.04456
DLGIMP does not Granger Cause DLGPPI	0.28889	0.52862	0.10027	0.24726
DLGREER does not Granger Cause DLGIMP	0.04632	0.23193	0.04106	0.09989
DLGIMP does not Granger Cause DLGREER	0.42342	0.67992	0.21303	0.37790
DLGW does not Granger Cause DLGIMP	0.00248	0.00717	0.01417	0.01084
DLGIMP does not Granger Cause DLGW	0.23331	0.59357	0.82726	0.62150
DM3M does not Granger Cause DLGIMP	0.41503	0.14134	0.23991	0.51976
DLGIMP does not Granger Cause DM3M	0.13049	0.20303	0.07873	0.15168
DLGM2 does not Granger Cause DLGIP	0.35024	0.06301	0.05538	0.01131
DLGIP does not Granger Cause DLGM2	0.42329	0.60033	0.02050	0.04099
DLGPPI does not Granger Cause DLGIP	0.74576	0.71866	0.74932	0.81418
DLGIP does not Granger Cause DLGPPI	0.22099	0.05845	0.18122	0.22368
DLGREER does not Granger Cause DLGIP	0.38195	0.56906	0.37493	0.06379
DLGIP does not Granger Cause DLGREER	0.47679	0.68050	0.62720	0.45322
DLGTB does not Granger Cause DLGIP	0.00743	0.01597	0.03853	0.06531
DLGIP does not Granger Cause DLGTB	0.14491	0.10501	0.04363	0.21375

Appendix 5 cont.

Null Hypothesis:	3M Probability	6M Probability	9M Probability	12M Probability
DLGU does not Granger Cause DLGIP	0.55576	0.39602	0.39092	0.48266
DLGIP does not Granger Cause DLGU	0.45813	0.54964	0.66743	0.00300
DLGW does not Granger Cause DLGIP	5.6E-05	0.00025	0.00014	0.00060
DLGIP does not Granger Cause DLGW	0.08497	0.06857	0.04204	0.29417
DLGWIG does not Granger Cause DLGIP	0.96259	0.18166	0.43407	0.57618
DLGIP does not Granger Cause DLGWIG	0.11702	0.01296	0.00357	0.05827
DM3M does not Granger Cause DLGIP	0.65929	0.51062	0.68601	0.55015
DLGIP does not Granger Cause DM3M	0.44941	0.15979	0.01279	0.00533
DLGW does not Granger Cause DLGM2	0.44238	0.17341	0.15265	0.06289
DLGM2 does not Granger Cause DLGW	0.03044	0.03740	0.29837	0.91901
DM3M does not Granger Cause DLGM2	0.32470	0.08396	0.20093	0.49528
DLGM2 does not Granger Cause DM3M	0.00078	0.20130	0.82885	0.66555
DLGTB does not Granger Cause DLGNEER	0.01735	0.07173	0.04293	0.03440
DLGNEER does not Granger Cause DLGTB	0.36503	0.22892	0.36862	0.38817
DLGU does not Granger Cause DLGNEER	0.69650	0.07199	0.02396	0.10524
DLGNEER does not Granger Cause DLGU	0.32570	0.36391	0.72849	0.34042
DLGWIG does not Granger Cause DLGNEER	0.14027	0.16060	0.20211	0.10420
DLGNEER does not Granger Cause DLGWIG	0.12456	0.21235	0.25110	0.03273
DM3M does not Granger Cause DLGPPI	0.40292	0.58842	0.19017	0.00048
DLGPPI does not Granger Cause DM3M	0.30172	0.00026	0.00013	2.4E-05
DLGW does not Granger Cause DLGRETAIL	0.03099	0.07929	0.17731	0.45083
DLGRETAIL does not Granger Cause DLGW	0.16843	0.21599	0.07665	0.39361
DM3M does not Granger Cause DLGRETAIL	0.06748	0.32834	0.45489	0.25092
DLGRETAIL does not Granger Cause DM3M	0.71276	0.05354	0.13556	0.12953
DM3M does not Granger Cause DLGW	0.15565	0.05225	0.01034	0.09842
DLGW does not Granger Cause DM3M	0.77157	0.00338	0.56218	0.01150
DLGIMP does not Granger Cause DLGPLN	0.69847	0.82363	0.95801	0.96510
DLGPLN does not Granger Cause DLGIMP	6.1E-06	8.4E-05	0.00060	0.00741
DLGIP does not Granger Cause DLGPLN	0.76219	0.76746	0.91241	0.91994
DLGPLN does not Granger Cause DLGIP	0.13803	0.19414	0.01754	0.12054
DLGPPI does not Granger Cause DLGPLN	0.42785	0.76817	0.66039	0.62088
DLGPLN does not Granger Cause DLGPPI	0.16922	0.01944	0.03344	0.20426
DLGRETAIL does not Granger Cause DLGPLN	0.06413	0.01741	0.03022	0.20248
DLGPLN does not Granger Cause DLGRETAIL	0.01844	0.06109	0.02807	0.03089

Appendix 5 cont.

Null Hypothesis:	3M Probability	6M Probability	9M Probability	12M Probability
DLGTB does not Granger Cause DLGPLN	0.13119	0.36417	0.09573	0.07209
DLGPLN does not Granger Cause DLGTB	0.84066	0.22768	0.11052	0.21049
DLGU does not Granger Cause DLGPLN	0.05265	0.21112	0.32400	0.61635
DLGPLN does not Granger Cause DLGU	0.85058	0.98051	0.61675	0.05069
DLGW does not Granger Cause DLGPLN	0.02283	0.01844	0.01161	0.12072
DLGPLN does not Granger Cause DLGW	0.50114	0.32654	0.38983	0.44453
DLGWIG does not Granger Cause DLGPLN	0.06857	0.02979	0.09241	0.14657
DLGPLN does not Granger Cause DLGWIG	0.32789	0.06497	0.06269	0.06916
DM3M does not Granger Cause DLGPLN	0.49273	0.12663	0.18336	0.10526
DLGPLN does not Granger Cause DM3M	0.09278	0.12133	0.10991	0.07242

Note: Detailed results of the Granger causality test are available from author. The DLG denotes the first difference of the variable's logarithms.

List of variables:

BUDGET	12-M Central Govt. Balance (in mn PLN; IMF Statistics)
CPIPL	Consumer Price Index (y/y; Bloomberg and IMF Statistics)
GFOOD	German Food Price Index (y/y; Bloomberg)
GJX	Commodity Index (y/y; Bloomberg)
GPPI	German Producer Price Index (y/y; Bloomberg)
GWPI	German Wholesale Price Index (y/y; Bloomberg)
IMP	Import Price Index (y/y; Bloomberg)
IP	Industrial Sales Index (y/y at constant prices; Bloomberg)
M2	Money Supply Index (y/y; IMF Statistics)
M3M	3M Money Market Rate (p.a. in %; IMF Statistics)
NEER	Nominal Effective Exchange Rate (1995=100; IMF Statistics)
OIL	European Brent Spot Price Index (y/y; Bloomberg)
PLN	Annual performance of PLN/USD (y/y; Bloomberg)
PPI	Producer Price Index (y/y; Bloomberg)
REER	Real Effective Exchange Rate (1995=100; IMF Statistics)
RETAIL	Retail Sales Index (y/y at current prices; Bloomberg)
TB	12-M Trade Balance (in mn USD; Bloomberg)
U	Jobless Rate (in %; Bloomberg)
W	Average Gross Wage Index (y/y at current prices; Bloomberg)
WIG	Warsaw Stock Exchange Top 20 Index (y/y; Bloomberg).

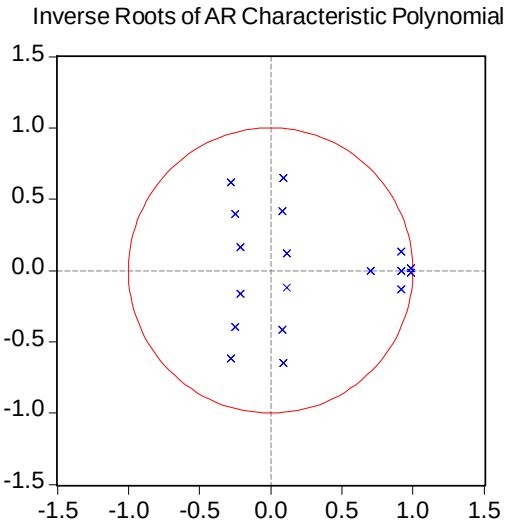
Appendix 6 Vector Autoregression Estimates and diagnostic tests

Sample (adjusted): 1993:04 2003:12
Included observations: 122
Excluded observations: 7 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

	LGCPIPL	LGW	LGPPI	LGIP	LGPLN	M3M
LGCPIPL(-1)	1.195205	0.320133	-1.002237	-0.504295	0.008582	15.13905
	(0.08961)	(0.31041)	(1.82273)	(0.38786)	(0.01058)	(18.7946)
	[13.3384]	[1.03131]	[-0.54986]	[-1.30020]	[0.81089]	[0.80550]
LGCPIPL(-2)	-0.615141	0.065486	-0.453414	0.511571	-0.008820	-37.50320
	(0.13430)	(0.46523)	(2.73182)	(0.58130)	(0.01586)	(28.1683)
	[-4.58043]	[0.14076]	[-0.16598]	[0.88004]	[-0.55606]	[-1.33140]
LGCPIPL(-3)	0.385412	-0.386426	1.770223	0.057518	-0.004371	30.64503
	(0.09172)	(0.31773)	(1.86569)	(0.39700)	(0.01083)	(19.2376)
	[4.20211]	[-1.21620]	[0.94883]	[0.14488]	[-0.40348]	[1.59298]
LGW(-1)	0.017509	0.585413	0.339931	-0.251751	0.005292	-0.990411
	(0.02817)	(0.09758)	(0.57301)	(0.12193)	(0.00333)	(5.90839)
	[0.62156]	[5.99907]	[0.59324]	[-2.06471]	[1.59052]	[-0.16763]
LGW(-2)	-0.012670	0.131164	0.652034	0.413125	-0.001073	-4.806315
	(0.03383)	(0.11719)	(0.68810)	(0.14642)	(0.00400)	(7.09517)
	[-0.37456]	[1.11929]	[0.94758]	[2.82148]	[-0.26869]	[-0.67741]
LGW(-3)	0.022578	0.170403	-0.132772	-0.080505	-0.001544	9.308979
	(0.02769)	(0.09594)	(0.56335)	(0.11988)	(0.00327)	(5.80882)
	[0.81525]	[1.77615]	[-0.23568]	[-0.67157]	[-0.47214]	[1.60256]
LGPPI(-1)	-0.002956	0.023166	1.135469	0.013730	-0.000402	0.192268
	(0.00504)	(0.01747)	(0.10259)	(0.02183)	(0.00060)	(1.05780)
	[-0.58611]	[1.32596]	[11.0683]	[0.62897]	[-0.67480]	[0.18176]
LGPPI(-2)	0.005442	-0.016453	-0.378290	-0.006360	-0.000239	-0.385413
	(0.00743)	(0.02575)	(0.15118)	(0.03217)	(0.00088)	(1.55887)
	[0.73220]	[-0.63905]	[-2.50222]	[-0.19770]	[-0.27284]	[-0.24724]
LGPPI(-3)	-0.001352	0.008262	0.080832	0.002144	0.000337	0.555080
	(0.00465)	(0.01610)	(0.09456)	(0.02012)	(0.00055)	(0.97499)
	[-0.29089]	[0.51304]	[0.85486]	[0.10654]	[0.61335]	[0.56932]
LGIP(-1)	0.034166	-0.223136	0.552072	0.313749	-0.001633	9.400965
	(0.02236)	(0.07747)	(0.45491)	(0.09680)	(0.00264)	(4.69069)
	[1.52772]	[-2.88020]	[1.21358]	[3.24118]	[-0.61835]	[2.00417]
LGIP(-2)	-0.006560	-0.057472	-0.392288	0.068596	0.002910	3.029422
	(0.02422)	(0.08392)	(0.49277)	(0.10486)	(0.00286)	(5.08105)
	[-0.27078]	[-0.68484]	[-0.79609]	[0.65419]	[1.01714]	[0.59622]
LGIP(-3)	-0.009732	-0.029637	1.143550	0.375747	-0.000175	-6.465076
	(0.02351)	(0.08144)	(0.47818)	(0.10175)	(0.00278)	(4.93067)
	[-0.41397]	[-0.36393]	[2.39144]	[3.69273]	[-0.06295]	[-1.31120]
LGPLN(-1)	0.858765	1.869248	31.03264	3.022088	0.902692	-69.90895
	(0.83386)	(2.88867)	(16.9620)	(3.60936)	(0.09848)	(174.899)
	[1.02986]	[0.64710]	[1.82954]	[0.83729]	[9.16597]	[-0.39971]
LGPLN(-2)	-0.736875	-2.056830	-56.17454	-2.177195	-0.091044	221.5064
	(1.12237)	(3.88810)	(22.8307)	(4.85815)	(0.13256)	(235.412)
	[-0.65654]	[-0.52901]	[-2.46049]	[-0.44815]	[-0.68683]	[0.94093]

Appendix 6 cont.

	LGCPIPL	LGW	LGPPI	LGIP	LGPLN	M3M
LGPLN(-3)	-0.106802	-0.891556	21.77500	-0.839978	0.137404	-58.71184
	(0.83890)	(2.90613)	(17.0645)	(3.63117)	(0.09908)	(175.956)
	[-0.12731]	[-0.30679]	[1.27604]	[-0.23132]	[1.38682]	[-0.33367]
M3M(-1)	-0.000190	-0.002851	0.003902	-0.001861	-5.17E-06	0.402001
	(0.00044)	(0.00153)	(0.00900)	(0.00192)	(5.2E-05)	(0.09285)
	[-0.42890]	[-1.85947]	[0.43336]	[-0.97123]	[-0.09886]	[4.32968]
M3M(-2)	-0.000598	0.000162	-0.006903	-0.001478	6.16E-05	0.281033
	(0.00046)	(0.00160)	(0.00940)	(0.00200)	(5.5E-05)	(0.09688)
	[-1.29571]	[0.10108]	[-0.73468]	[-0.73935]	[1.13010]	[2.90078]
M3M(-3)	0.000368	0.001828	-0.003797	-0.000324	-2.42E-05	0.172669
	(0.00042)	(0.00145)	(0.00854)	(0.00182)	(5.0E-05)	(0.08801)
	[0.87812]	[1.25774]	[-0.44478]	[-0.17832]	[-0.48796]	[1.96184]
C	-0.119311	6.984341	4.344936	0.459386	0.240393	-513.1013
	(1.17020)	(4.05379)	(23.8035)	(5.06517)	(0.13821)	(245.443)
	[-0.10196]	[1.72292]	[0.18253]	[0.09070]	[1.73939]	[-2.09051]
R-squared	0.992778	0.948135	0.976295	0.607787	0.986448	0.937390
Adj. R-squared	0.991515	0.939072	0.972153	0.539245	0.984080	0.926448
Sum sq. resids	0.007263	0.087165	3.005414	0.136085	0.000101	319.5392
S.E. equation	0.008398	0.029091	0.170818	0.036348	0.000992	1.761341
F-statistic	786.5609	104.6075	235.6751	8.867358	416.5320	85.67249
Log likelihood	420.3543	268.7717	52.80945	241.5980	680.9690	-231.8449
Akaike AIC	-6.579579	-4.094618	-0.554253	-3.649147	-10.85195	4.112211
Schwarz SC	-6.142887	-3.657926	-0.117561	-3.212456	-10.41526	4.548903
Mean dependent	4.733636	4.805256	2.099291	4.679122	4.637728	18.48811
S.D. dependent	0.091166	0.117854	1.023631	0.053549	0.007860	6.494528
Determinant Residual Covariance		6.21E-18				
Log Likelihood (d.f. adjusted)		1378.207				
Akaike Information Criteria		-20.72470				
Schwarz Criteria		-18.10455				



VAR Residual Serial Correlation LM Tests
H0: no serial correlation at lag order h
Sample: 1990:01 2004:12
Included observations: 122

Lags	LM-Stat	Prob
1	38.78412	0.3452
2	39.30497	0.3241
3	35.91378	0.4727
4	35.84019	0.4761
5	50.91490	0.0508
6	48.30873	0.0825
7	39.02343	0.3354
8	16.75790	0.9974
9	36.80569	0.4314
10	27.78828	0.8347
11	20.77298	0.9801
12	76.70716	0.0001

Probs from chi-square with 36 df.

Johansen Cointegration Test Summary
Sample: 1990:01 2004:12
Included observations: 120
Series: LGCPIPL LGW LGPPI LGIP LGPLN M3M
Lags interval: 2 to 3

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	2	1	1	1	2
Max-Eig	2	2	1	2	2

Appendix 7 Recursive Residuals of Hungarian's CPI

Dependent Variable: DCPIHU_Y
Sample (adjusted): 1992:03 2003:12
Included observations: 142 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.051031	0.172161	0.296415	0.7674
CPIHU_Y(-1)	0.288503	0.079353	3.635676	0.0004
CPIHU_Y(-2)	-0.297801	0.079093	-3.765207	0.0002

R-squared	0.096410	Mean dependent var	-0.141549
Adjusted R-squared	0.083409	S.D. dependent var	0.935603
S.E. of regression	0.895735	Akaike info criterion	2.638556
Sum squared resid	111.5255	Schwarz criterion	2.701003
Log likelihood	-184.3375	F-statistic	7.415424
Durbin-Watson stat	2.048957	Prob(F-statistic)	0.000871

Note: CPIHU_Y denotes the year-on-year Consumer Price Index and DCPIHU_Y the first difference of the year-on-year Consumer Price Index.

Appendix 8 Estimation of AR Process of Hungarian Inflation Paths and diagnostic tests

Dependent Variable: DCPIHU_Y100
Method: Least Squares
Sample (adjusted): 1993:02 2003:12
Included observations: 131 after adjusting endpoints
Convergence achieved after 9 iterations
Backcast: 1992:06 1993:01

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(2)	0.199096	0.068757	2.895633	0.0045
AR(12)	-0.355019	0.064872	-5.472625	0.0000
MA(1)	0.514212	0.081065	6.343163	0.0000
MA(8)	0.279898	0.073092	3.829383	0.0002

R-squared	0.376393	Mean dependent var	-0.154198
Adjusted R-squared	0.361662	S.D. dependent var	0.835764
S.E. of regression	0.667743	Akaike info criterion	2.060231
Sum squared resid	56.62679	Schwarz criterion	2.148023
Log likelihood	-130.9451	Durbin-Watson stat	1.890611

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.710220	Probability	0.547668
Obs*R-squared	0.000000	Probability	1.000000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(2)	-0.084474	0.101940	-0.828670	0.4089
AR(12)	-0.012972	0.066832	-0.194100	0.8464
MA(1)	-0.048971	0.157514	-0.310900	0.7564
MA(8)	0.018360	0.078720	0.233229	0.8160
RESID(-1)	0.075998	0.169191	0.449184	0.6541
RESID(-2)	0.133150	0.161338	0.825287	0.4108
RESID(-3)	0.067924	0.104587	0.649449	0.5172

R-squared	-0.007525	Mean dependent var	-0.102353
Adjusted R-squared	-0.056276	S.D. dependent var	0.651946
S.E. of regression	0.670040	Akaike info criterion	2.088995
Sum squared resid	55.67023	Schwarz criterion	2.242632
Log likelihood	-129.8292	Durbin-Watson stat	1.967352

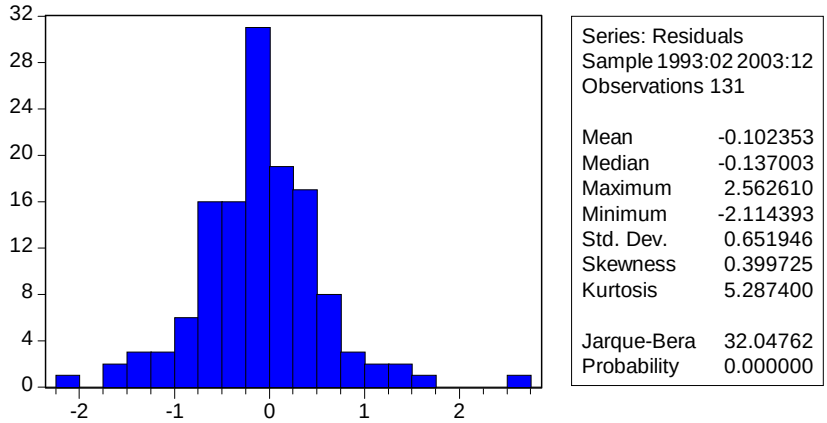
ARCH Test:

F-statistic	0.923043	Probability	0.431856
Obs*R-squared	2.796017	Probability	0.424156

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample (adjusted): 1993:05 2003:12
Included observations: 128 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.327574	0.092994	3.522545	0.0006
RESID^2(-1)	0.131978	0.089569	1.473474	0.1432
RESID^2(-2)	0.049926	0.088182	0.566166	0.5723
RESID^2(-3)	0.003065	0.085972	0.035654	0.9716

R-squared	0.021844	Mean dependent var	0.403207
Adjusted R-squared	-0.001821	S.D. dependent var	0.829650
S.E. of regression	0.830405	Akaike info criterion	2.496945
Sum squared resid	85.50702	Schwarz criterion	2.586071
Log likelihood	-155.8045	F-statistic	0.923043
Durbin-Watson stat	1.941538	Prob(F-statistic)	0.431856



Appendix 9 Pairwise Granger Causality Tests – selection of statistically significant relations

Sample: 1992:01 2003:12

Null Hypothesis:	3M Probability	6M Probability	9M Probability	12M Probability
DLGGJX does not Granger Cause DLGCPIHU_Y100	0.00328	0.01943	0.01157	0.01157
DLGCPIHU_Y100 does not Granger Cause DLGGJX	0.34581	0.17476	0.25116	0.25116
DLGGPPI does not Granger Cause DLGCPIHU_Y100	0.03298	0.02815	0.24870	0.24870
DLGCPIHU_Y100 does not Granger Cause DLGGPPI	0.87989	0.96659	0.15093	0.15093
DLGGWPI does not Granger Cause DLGCPIHU_Y100	0.09253	0.29246	0.32636	0.32636
DLGCPIHU_Y100 does not Granger Cause DLGGWPI	0.09426	0.04202	0.85856	0.85856
DLGIP does not Granger Cause DLGCPIHU_Y100	0.00627	0.02063	0.36034	0.36034
DLGCPIHU_Y100 does not Granger Cause DLGIP	0.08601	0.00205	0.04398	0.04398
DLGM2 does not Granger Cause DLGCPIHU_Y100	0.00627	0.02063	0.36034	0.36034
DLGCPIHU_Y100 does not Granger Cause DLGM2	0.08601	0.00205	0.04398	0.04398
DLGNEER does not Granger Cause DLGCPIHU_Y100	0.36927	0.56475	0.08876	0.08876
DLGCPIHU_Y100 does not Granger Cause DLGNEER	0.53579	0.44738	0.54757	0.54757
DLGRETAIL does not Granger Cause DLGCPIHU_Y100	0.30393	0.19503	0.00517	0.00517
DLGCPIHU_Y100 does not Granger Cause DLGRETAIL	0.55489	0.87935	0.49347	0.49347
DT3M does not Granger Cause DLGCPIHU_Y100	0.00594	0.01926	0.34644	0.34644
DLGCPIHU_Y100 does not Granger Cause DT3M	0.08362	0.00192	0.03995	0.03995
DLGBUX does not Granger Cause DLGCPIHU_Y100	0.20602	0.41117	0.81331	0.81331
DLGCPIHU_Y100 does not Granger Cause DLGBUX	0.47265	0.84504	0.00174	0.00174
DLGPPI does not Granger Cause DLGCPIHU_Y100	0.01090	0.00976	0.00863	0.00863
DLGCPIHU_Y100 does not Granger Cause DLGPPI	0.87583	0.60532	0.73064	0.73064
DLGIP does not Granger Cause DLGGJX	0.81842	0.98577	0.94749	0.94749
DLGGJX does not Granger Cause DLGIP	0.02866	0.00072	0.06087	0.06087
DLGPPI does not Granger Cause DLGGJX	0.47270	0.59478	0.55353	0.55353
DLGGJX does not Granger Cause DLGPPI	0.10093	0.07346	0.03096	0.03096
DLGGWPI does not Granger Cause DLGGPPI	0.15229	0.00692	0.00099	0.00099
DLGGPPI does not Granger Cause DLGGWPI	0.03358	0.01047	0.19229	0.19229
DLGIP does not Granger Cause DLGGPPI	0.06019	0.02245	0.54710	0.54710
DLGGPPI does not Granger Cause DLGIP	0.01750	0.07091	0.10541	0.10541
DLGW does not Granger Cause DLGIP	0.15925	0.29295	0.20562	0.20562
DLGIP does not Granger Cause DLGW	0.15214	0.46701	0.07465	0.07465
DLGHUFY does not Granger Cause DLGIP	0.00029	0.00102	0.04436	0.04436
DLGIP does not Granger Cause DLGHUFY	0.14053	0.28588	0.21540	0.21540
DLGPPI does not Granger Cause DLGIP	0.18888	0.14583	0.01083	0.01083
DLGIP does not Granger Cause DLGPPI	0.12884	0.41791	0.90673	0.90673

Appendix 9 cont.

Null Hypothesis:	3M Probability	6M Probability	9M Probability	12M Probability
DT3M does not Granger Cause DLGM2	0.08145	0.25216	0.83918	0.83918
DLGM2 does not Granger Cause DT3M	0.07472	0.24394	0.82205	0.82205
DLGHUFY does not Granger Cause DLGM2	0.00029	0.00102	0.04436	0.04436
DLGM2 does not Granger Cause DLGHUFY	0.14053	0.28588	0.21540	0.21540
DLGPPI does not Granger Cause DLGM2	0.18888	0.14583	0.01083	0.01083
DLGM2 does not Granger Cause DLGPPI	0.12884	0.41791	0.90673	0.90673
DLGU does not Granger Cause DLGNEER	0.72826	0.24922	0.48066	0.48066
DLGNEER does not Granger Cause DLGU	0.07225	0.37462	0.26813	0.26813
DLGHUFY does not Granger Cause DLGOIL	0.18691	0.11257	0.38852	0.38852
DLGOIL does not Granger Cause DLGHUFY	0.04737	0.09605	0.15287	0.15287
DLGBUX does not Granger Cause DLGRETAIL	0.01177	0.02751	0.34022	0.34022
DLGRETAIL does not Granger Cause DLGBUX	0.77013	0.39735	0.98971	0.98971
DLGW does not Granger Cause DLGU	0.04967	0.05585	0.08680	0.08680
DLGU does not Granger Cause DLGW	0.72810	0.98730	0.52510	0.52510
DT3M does not Granger Cause DLGW	0.14987	0.46818	0.08171	0.08171
DLGW does not Granger Cause DT3M	0.15645	0.28123	0.19921	0.19921
DLGPPI does not Granger Cause DLGW	0.96343	0.79927	0.97980	0.97980
DLGW does not Granger Cause DLGPPI	0.39063	0.12335	0.09845	0.09845
DLGGFOOD does not Granger Cause DT3M	0.07380	0.20405	0.03845	0.03845
DT3M does not Granger Cause DLGGFOOD	0.47268	0.64950	0.56230	0.56230
DLGHUFY does not Granger Cause DT3M	0.00031	0.00115	0.04493	0.04493
DT3M does not Granger Cause DLGHUFY	0.14480	0.29392	0.21848	0.21848
DLGPPI does not Granger Cause DT3M	0.19080	0.14456	0.01087	0.01087
DT3M does not Granger Cause DLGPPI	0.12745	0.41664	0.90332	0.90332
DLGPPI does not Granger Cause DLGHUFY	0.27513	0.03018	0.23667	0.23667
DLGHUFY does not Granger Cause DLGPPI	0.85066	0.62217	0.73744	0.73744

Note: Detailed results of the Granger causality test are available from author. The DLG denotes the first difference of the variable's logarithms.

List of variables:

BUX	Budapest Stock Exchange Index (Bloomberg)
CPIHU_Y100	Consumer Price Index (y/y; Bloomberg and IMF Statistics)
GFOOD	German Food Price Index (y/y; Bloomberg)
GJX	Commodity Index (y/y; Bloomberg)
GPPI	German Producer Price Index (y/y; Bloomberg)
GWPI	German Wholesale Price Index (y/y; Bloomberg)
HUFY	Annual performance of PLN/USD (y/y; Bloomberg)
IP	Industrial Production Index (y/y at current prices; Bloomberg)
M2	Money Supply Index (y/y; IMF Statistics)
NEER	Nominal Effective Exchange Rate (1995=100; IMF Statistics)
OIL	European Brent Spot Price Index (y/y; Bloomberg)

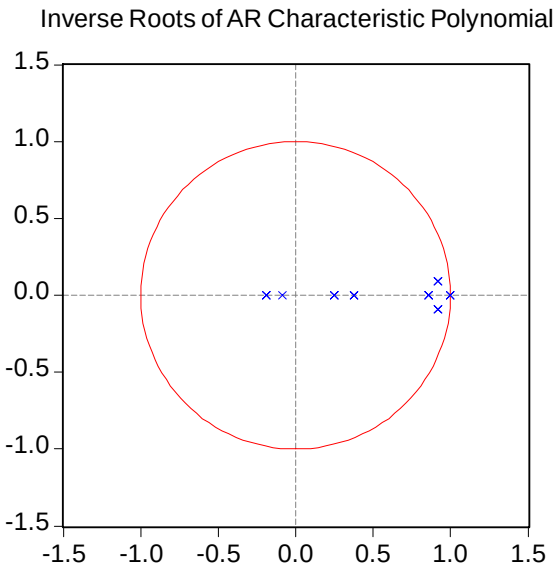
PPI	Producer Price Index (y/y; Bloomberg)
REER	Real Effective Exchange Rate (1995=100; IMF Statistics)
RETAIL	Retail Sales Index (y/y at constant prices; Bloomberg)
T3M	3M Treasury Bill Yield (p.a. in %; IMF Statistics)
U	Jobless Rate (in %; Bloomberg)
W	Average Gross Wage Index (y/y at current prices; Bloomberg).

Appendix 10 Vector Autoregression Estimates and diagnostic tests

Sample(adjusted): 1994:03 2003:07
Included observations: 113 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

	LGCPIHU_Y	LGGWPI	LGNEER	T3M
LGCPIHU_Y(-1)	1.183433	-0.004948	-0.036138	-1.439652
	(0.09912)	(0.01224)	(0.02922)	(2.46008)
	[11.9391]	[-0.40424]	[-1.23661]	[-0.58521]
LGCPIHU_Y(-2)	-0.181248	-0.001267	0.025765	3.671979
	(0.10241)	(0.01265)	(0.03019)	(2.54161)
	[-1.76986]	[-0.10015]	[0.85337]	[1.44474]
LGGWPI(-1)	2.408404	1.317756	-0.068369	16.57244
	(0.78094)	(0.09644)	(0.23023)	(19.3817)
	[3.08399]	[13.6643]	[-0.29695]	[0.85506]
LGGWPI(-2)	-2.222795	-0.346275	0.071271	-37.74262
	(0.80954)	(0.09997)	(0.23867)	(20.0916)
	[-2.74574]	[-3.46376]	[0.29862]	[-1.87852]
LGNEER(-1)	-0.565637	-0.011841	1.071060	7.587248
	(0.33185)	(0.04098)	(0.09784)	(8.23604)
	[-1.70449]	[-0.28895]	[10.9476]	[0.92122]
LGNEER(-2)	0.488296	-0.020713	-0.137146	0.231672
	(0.33935)	(0.04191)	(0.10005)	(8.42227)
	[1.43890]	[-0.49426]	[-1.37081]	[0.02751]
T3M(-1)	-0.000114	-0.000249	0.000293	0.470435
	(0.00372)	(0.00046)	(0.00110)	(0.09230)
	[-0.03072]	[-0.54231]	[0.26721]	[5.09703]
T3M(-2)	-0.003546	0.000513	-0.000276	0.227698
	(0.00350)	(0.00043)	(0.00103)	(0.08693)
	[-1.01231]	[1.18556]	[-0.26684]	[2.61923]
C	-0.445257	0.296222	0.325054	60.22635
	(1.23886)	(0.15299)	(0.36524)	(30.7465)
	[-0.35941]	[1.93626]	[0.88999]	[1.95880]
R-squared	0.993199	0.946989	0.977101	0.841350
Adj. R-squared	0.992676	0.942911	0.975340	0.829146
Sum sq. resids	0.253514	0.003866	0.022035	156.1541
S.E. equation	0.049372	0.006097	0.014556	1.225350
F-statistic	1898.403	232.2302	554.7200	68.94120
Log likelihood	184.2943	420.6442	322.3125	-178.6153
Akaike AIC	-3.102554	-7.285739	-5.545354	3.320625
Schwarz SC	-2.885328	-7.068513	-5.328128	3.537850
Mean dependent	2.527227	4.615743	4.709516	16.68381
S.D. dependent	0.576895	0.025518	0.092692	2.964471

Determinant Residual Covariance	2.62E-11
Log Likelihood (d.f. adjusted)	735.3687
Akaike Information Criteria	-12.37821
Schwarz Criteria	-11.50930



VAR Residual Serial Correlation LM Tests
H0: no serial correlation at lag order h
Sample: 1992:01 2003:12
Included observations: 113

Lags	LM-Stat	Prob
1	13.27020	0.6529
2	27.76677	0.0337
3	13.58234	0.6298
4	33.17487	0.0070
5	22.00041	0.1432
6	10.13712	0.8594
7	23.57594	0.0992
8	19.17407	0.2597
9	13.32164	0.6491
10	13.54778	0.6324
11	19.87204	0.2260
12	76.49010	0.0000

Probs from chi-square with 16 df.

Johansen Cointegration Test Summary
Sample: 1992:01 2003:12
Included observations: 112
Series: LGCPIHU_Y LGGWPI LGNEER T3M
Lags interval: 1 to 2

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	1	1	1	1	2
Max-Eig	1	1	1	1	1

Abstract

In questo paper si esamina il problema non ancora completamente risolto di come elaborare ed implementare il modello di politica economic detto di *inflation targeting* nei paesi ad economia emergente. L'esperienza e il modello messo in atto dall Banca Nazionale Ceca (CNB) vengono presi da "*benchmark*" siccome la CNB fu la prima banca centrale dell'Europa Centrale ad adottare questo nuovo regime di politica economica.

Attraverso l'analisi statistica ed econometrica questo studio vuole essere un'approfondimento ed un ampliamento dell'attuale letteratura attraverso un confronto *cross-country* delle caratteristiche dell'inflazione e le conseguenti implicazioni per l'*inflation targeting* dei tre paesi presi in esame. Dopo una approfondita introduzione a questa tematica si esamina l'importanza di tre prerequisiti per l'attuazione con successo dell'*inflation targeting*: l'indipendenza della banca centrale nel predisporre gli strumenti di politica economica, l'assenza di altri obbiettivi nominali di politica economica ed un solido sistema bancario capace di trasmettere i movimenti nei tassi d'interesse all'economia reale. Benche' soddisfino i sopradetti prerequisiti (con l'eccezzione della Banca Nazionale d'Ungheria) i paesi dell'Europa Centrale che hanno adottato l'*inflation targeting* incontrano altri ostacoli nella attuazione di questo regime. I piu' evidenti di questi sono l'assenza di coordinazione nelle politiche macroeconomiche e segnali di dominanza fiscale.

Altri ostacoli – ma di minore importanza – si sono evidenziati essere modelli previsionali non ben sviluppati e una trasmissione poco effettiva dei tassi di interesse. Al contrario i nostri test hanno messo in luce la predominanza della trasmissione del tasso di cambio, almeno per quanta riguarda il breve periodo. Questa approfondita analisi sull'applicazione dell'*inflation targeting* puo' servire anche da fonte di informazione ed confronto per altri paesi in via di sviluppo che volessero decidere di adottare questo regime di politica economica

Einleitung

Der Schwerpunkt dieser Arbeit liegt in den noch ungelösten Fragen der Strukturierung und der Umsetzung einer Inflationsziel-Politik in aufstrebenden Volkswirtschaften. Als "Meßlatte" werden dabei die Erfahrungen und Vorgangsweisen der tschechischen Nationalbank (CNB) verwendet, da die CNB als die erste Notenbank in Zentraleuropa diese neue Ausrichtung der Geldpolitik anwendete. Später folgten die Notenbanken von Polen und Ungarn.

Ziel dieser Studie ist, bereits bestehende Forschungsergebnisse zu erweitern, indem statistische und ökonometrische Analysen der Inflationscharakteristika sowie deren Auswirkungen auf die jeweilige Strategie zur Umsetzung des Inflationsziel-Politik in ausgewählten Ländern verglichen werden. Wir untersuchen die Bedeutung von drei wichtigen Vorraussetzungen für die erfolgreiche Einführung einer Inflationsziel-Politik: die instrumentale Unabhängigkeit der Notenbank, die Abwesenheit anderer Ziele sowie ein gesunder Bankensektor, der Zinsänderungen weitergibt. Diese erwähnten Voraussetzungen werden von den zentral- und osteuropäischen Ländern, die eine Inflationsziel-Politik anwenden, zwar erfüllt (mit Ausnahme der ungarischen Notenbank), die Umsetzung dieser Politik ist aber mit anderen Problemen konfrontiert. Die offensichtlichsten sind das Fehlen einer koordinierten Wirtschaftspolitik und Anzeichen für eine Dominanz der Fiskalpolitik.

Andere Hindernisse, wenn auch von geringerer Bedeutung, umfassen die unterentwickelte Struktur der Notenbanken für die Erstellung von Prognosen sowie den wenig effektiven Zins-Transmissionskanal. Gleichzeitig haben unsere Tests die Dominanz der Transmission über den Wechselkurs, zumindest für den kurzen Zeitraum, im Polen und Ungarn bestätigt. Diese umfassende Untersuchung soll auch als Quelle von Informationen und Vorschlägen für jene Länder dienen, die vor der Entscheidung über die Implementierung einer Inflationsziel-Politik stehen.