EVALUATION OF MONETARY POLICY EFFICIENCY IN TRANSITION ECONOMIES: THE CASE OF UKRAINE

by

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Abstract

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The purpose of this thesis is to investigate the main impact of monetary policy on the economy in Ukraine, and to assess efficiency of the current strategy of monetary policy in terms of attaining the specified macroeconomic goals. To provide the analysis of policy efficiency, there were estimated the relationships between key macroeconomic variables representing monetary instruments and policy goals. The research was made in the framework of the vector error correction model. This is a restricted model, formulated on the basis of a reduced-form VAR model. The main findings of the research are the following: effect of monetary policy on the economy is its influence rather on nominal variables and inflation than on real output; a little deviation in money supply can have very distorting effect on the exchange rate, inflation; and output. Possible reasons for policy inefficiency are: the value of the monetary aggregate is mainly determined by other considerations than economic; the monetary authorities have a little control over the monetary aggregates. Thus, the monetary aggregates should not be considered as the optimal monetary instruments and monetary aggregate targeting is not efficient policy strategy.

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GLOSSARY

Monetary Transmission Mechansim (MTM) - the process through which monetary policy decisions are transmitted into changes in real GDP and inflation

Operation Procedure – the setting of the monetary instruments by the Central bank to attain the policy goals.

Chapter 1

INTRODUCTION

The attention paid to monetary policy in both theoretical and empirical studies has increased in the last decade. One reason for this is that the development in the theoretical framework for economic analysis emphasized the role of monetary policy in the economy and made the analysis necessary for policymaking. This gave a rise to vast range of the literature devoting to methodological issues of monetary policy studies. Second, financial markets have been deregulated across the world and thus monetary policy is now more oriented toward market factors than simply regulatory measures. Therefore, conducting monetary policy became a more challenging and interesting job, and the demand for research on the topic of monetary policy has been increasing.

In the face of uncertainty about the true structure of the economy, policymakers may disagree about the macroeconomic effects of monetary policy and thus about the appropriate policy setting. As McCallum (1997) mentioned, the key stumbling block for policy-formation is a limited knowledge of the way the macroeconomy works. So, there are two broad questions to be investigated: how monetary policy influences economic aggregates and how it should be conducted to attain established macroeconomic goals. To answer these questions, we should make assessment of the mechanism, through which monetary policy affects the economy. The empirical evidence on *the monetary transmission mechanism* is examined within wide range of different theoretical frameworks.

Research on methodological issues and theoretical analysis are typically driven by requirements and development of monetary policy in the developed market economies and meet their specifics. Much of the economic research on policy monetary effects during this period has focused on economies with highly developed asset markets, especially markets for debt and foreign exchange.

But monetary analysis is even more important and challenging for transition economies than for developed economies due to certain features they possess : (1) absence of policy conducting experience and lack of knowledge of how the economy works; (2) consequences of unreasonable policy can be very destructive for the economy and difficult to reverse; (3) the investigation of how factors specific to emerging markets and structural distortions interact in determining the effects of monetary policy may give additional useful knowledge about the way an economy works.

Therefore, the main concerns of this paper are twofold. Firstly, to investigate what is the main impact of monetary policy on the economy in Ukraine, and, second, at the basis of these findings, to assess whether the established macroeconomic goals are achieved by the current strategy of monetary policy. The overview of possible approaches to the problem is presented in Chapter 2, as well as arguments for the most relevant methodological approach to adopt for analysis in the case of a transition economy. Chapter 3 briefly describes the theoretical underpinnings necessary for policy evaluation. Chapter 4 proceeds with the preliminary assessment of the efficiency of monetary policy in Ukraine. Finally, the methodology of the research and empirical findings are presented in Chapter 5.

Chapter 2

ANALYSIS OF MONETARY POLICY IN DEVELOPED AND TRANSITION ECONOMIES

Modern Analysis Of Monetary Policy

The role of economic analysis in conducting monetary policy has been increasing recently, so we may conclude that actual policy is determined in part by the results of such analysis. However, deep disagreements still remain on the importance of monetary policy to the economy, as Mishkin (2001) emphasized, in particular regarding the different theoretical frameworks appropriate for evaluating empirical evidence on the effect of monetary policy.

To generalize, during the whole history of development of monetary economics and the practice of monetary policy, there have been two central questions:

1) Does monetary policy affect economic activity? (or What is overall impact of monetary policy on the economy?) and, if so,

2) How to conduct efficient monetary policy? (or What is the optimal monetary policy?)

A positive answer to the first question became possible after a stream of empirical work beginning in the late 1980s, which stressed the role of monetary policy in influencing the short term course of the real economy. Moreover, there

has been considerable improvement in the underlying theoretical framework used for policy analysis.

The new theoretical framework suitable for the evaluation of monetary policy incorporated two basic assumptions that enable policymakers to trace the connection between nominal and real variables and thus to make monetary policy analysis meaningful:

- *rational expectations* – primary theoretical in its nature – which implies that agents know the true structure of the economy and then form their expectations about future course of economic policy accordingly to this knowledge. Thus it is not only current variables that influence the economy but also their expected values also matter.

- *temporary nominal wage and price rigidities* – an assumption based rather on empirical evidence – which generates non-neutral effects of monetary policy in the short run.

These two assumptions ensure that monetary policy can have an effect on the real economy certainly in the short term (see Taylor (1995) for a detailed explanation). On the whole, theory, formal empirical evidence, and the recent experiences of conducting monetary policy all point to the idea that, despite the perceived short-term real influence, viewed from a long-term perspective monetary policy's main effect is upon the growth of the price level.

From this basic conception, as McCallum (2001) summarized, the main macroeconomic duty of a modern central bank was recognized as inflation prevention with a secondary objective of dampening cyclical fluctuations. Thus the optimal conduct of monetary policy became a question for analysis.

However, to solve the problem of optimal policy design, policymakers should know the mechanism through which monetary policy affects the real economy. To evaluate empirical evidence on this is possible in the 'true' macroeconomic model that provide understanding of the timing and the effect of monetary policy – *the monetary transmission mechanism (MTM)* - knowledge about which is crucial for design of monetary policy.

There are two types of empirical evidence in economics: *structural model* evidence examines whether one variable affects another by using data to construct a model that explains the channels through which this variables affects the other; *reduced-form* evidence examines whether one variable has an effect on another by looking at whether movements in one variable are tightly linked to movements in the other.

Recently, the analysis of monetary policy has been increasingly conducted in small structural models, which are wide-economy or general equilibrium models. The models are "economy-wide" or "general equilibrium" because they describe how monetary policy impacts on the whole economy. And they are structural because they are descriptions of how the economy operates using a collection of equations that describe the behavior of economic agents in sectors of the economy.

The models for the analysis are structural in the sense that we can assign economic meaning to the sources of uncertainty in models in terms of such primitives as fundamental shocks, trends or forcing processes, which ultimately drive the endogenous variables. For this type of analysis, researchers use time series modeling techniques, e.g. they estimate statistical VAR and VEC models imposing identifying restrictions with well-defined economic interpretations. A

good example of description of this econometric technique is provided by the paper of Dhar et al (2000).

In the face of uncertainty about the true structure of the economy, policymakers may disagree about the macroeconomic effects of monetary policy and thus about the appropriate policy setting. One approach to resolving this problem is to search for monetary policy rules that work well across a wide range of structural models; that is, rules that are robust to model uncertainty. For about ten years now, the use of monetary policy rules to evaluate and describe central bank policy actions has been growing and spreading rapidly. Much of the economic research on policy rules during this period has focused on economies with highly developed asset markets, especially markets for debt and foreign exchange.

Thus the analysis of monetary policy is made around two central problems:

- How monetary policy affects the economy is supposed to be answered by studies on the monetary transmission mechanism. Clear understanding of the MTM is crucial condition for correct analysis of monetary policy and therefore the correct setting of monetary policy instruments. (Taylor (1995, 1999, 2000), Dhar et al (2000), Mishkin (2000), Bean et al (2002))

- How monetary policy is actually conducted and how to conduct monetary policy[1] is investigated by estimating policy reaction functions (or policy rules) for the central bank. This analysis includes considering the problem of the appropriate choice of goals and targets of monetary policy and monetary

[1] It is necessary to distinguish between normative uses of policy rules – providing a recommendations of a good way to conduct policy, and positive uses of policy rules – providing a description of how the central bank actually set policy (Taylor, 1999).

instruments. (McCallum (1997, 1999), Taylor (1999, 2000), Fair (2001), Rotenberg and Woodford (1998), Levin et al (1998))

In studies on the role of monetary policy, researchers estimate (i) *systematic component* of policy in real economic variability by estimating policy reaction functions within stated structural MTM framework, and (ii) *unsystematic component* of policy by estimating real responses to policy innovation, in other words, effects of policy exogenous shocks defined as stochastic residuals to policy reaction function. (Bernanke et al (2000), Christiano et al (1999)).

Empirical Evidence from Developed Economies

The stable economic relationships, the presence of developed financial markets with a high degree of capital mobility, and accumulated knowledge about the way the macroeconomy works stipulate that the dominant manner in which monetary policy analysis conducted in developed economies becomes dependent for its effectiveness on the normative analysis of alternative *policy rules* for inflation targeting. The theoretical foundations of inflation targeting have been extensively scrutinized in many papers, a review for which is presented by Svensson (1999).

Inflation targeting monetary regimes requires a procedure for achieving the inflation target, and a monetary policy rule is one such procedure. Thus Taylor (1999) formalized the problem of policy design as how monetary instruments should adjust to the current state of the economy to keep the inflation rate close to the target, while taking into account of short run tradeoffs that impinge on output and exchange rate variability.

According to this view, empirical research for developed economies concern mainly with developing models for conditional inflation forecasting, since the

inflation forecast is regarded as the optimal intermediate target for monetary policy. Dhar et al (2000) investigated specifics of the UK transmission mechanism, in particular, the role of money in the transmission mechanism, to reveal the overall effect of monetary policy on the economy. The focus of the research is the interactions between nominal and real variables and their relationships with inflation.

The example of such a research is Jacobson's et al in seminal paper 'Monetary policy analysis and inflation targeting in a small open economy: a VAR approach' (2001). The authors presented research for Sweden economy and concluded that inflation is significantly correlated with output gap and the nominal exchange rate is rather important indicator for stance of monetary policy in a small open economy and can help predict inflation.

This conclusion, about importance of the flexible exchange rate, inflation targeting strategy and monetary policy based on the policy rule, is quite general among wide range of the literature on developed economy and also proposed for transition economy as the optimal monetary policy for a small open economy.

Empirical evidence from transition economies

The main interest of a research for transition economies is empirical investigation of monetary policy impact on a real economy in an environment of changing economic structures and emerging markets. It is important for conducting monetary policy to reveal which transmission channel is more powerful and which monetary instrument is more effective.

Thus the focus in research for transition economies is made on the evaluation of different transmission channels and their relative importance for the economy.

Hurlin and Kierzenkowski (2002) investigated the bank lending channel for Polland, while Kryshko (2001) evaluated the same channel for Ukraine, as the credit channel is considered as the most perspective MTM channel for transition economies. The articles, presented in the special second issue of Baltic Economic Trends (2001), are also devoted to studying MTM channels in Baltic countries. Aron (2001) presented VAR methodological approach to investigating interest rate channel in South Africa.

Skrypnyk and Varvarenko (2000), Shevchul (2001) made research on interactions of dynamics of price level, exchange rate and the money supply in Ukraine.

The general conclusions made on the basis of these researches are the following: there is no convincing evidence on investigated MTM channels or MTM channels are rather weak; interest rate has an inferior impact on the economy, and the more influential monetary instrument is monetary aggregates.

Methodological aspects of monetary policy analysis in transition economies

The models, traditionally used for evaluation monetary policy, are estimated as structural VAR models. Earlier VAR analysis was applied to measure the unsystematic part of monetary policy and its macroeconomic effects. In contrast, now researchers used the VAR approach to study the effects of policy interventions as well as some of the mechanism that policy makers consider when they formulate their systematic reactions, e.g., output gap and equilibrium exchange rate. The aim of such an exercise is to decompose the movements of each of these variables into a small number of independent underlying forcing processes or shocks, with a well-defined economic interpretation.

This structural model approach offers an understanding of how the economy works. If the structure is correct, it predicts the effect of monetary policy more accurately, allows predictions of the effect of monetary policy when institutions change, and provides more confidence in the direction of causation among economic variables. If the structure of the model is not correctly specified because it leaves out important aspects of the transmission mechanism of monetary policy, it could be very misleading.

Thus the application of the structural model approach requires that empirical models to satisfy certain criteria. First, the model should be consistent with a well-justified theoretical model that specifies the relations between variables in the model and predict responses of the model to exogenous shocks. Second, the specified economic relationships are stable and provided by developed financial markets. Third, the theoretical model must consider all important transmission channels that present in the economy.

All such theoretical models were derived for developed economies and account for their specifics, e.g., they describe only interest rate view of transmission mechanism, which is appropriate mainly for developed countries. Many researchers have adopted them for investigating in transition economies, but the question arises whether this is justified.

There are many empirical evidences on that credit MTM channels are more important for transition economies. But, as Taylor (1999) argued, influence of credit aggregates on GDP cannot be structurized. Besides, unstable relationships between economic variables can be hardly specified within some theoretical framework, and there is no persuasive evidence on which particular variables play a role in the MTM.

For all these reasons: reduced-form models tend to give more robust results for transition economies at the level of aggregated macroeoconomic variables. So, we will use the unrestricted VAR methodology for our research.

Chapter 3

THEORETICAL FRAMEWORK FOR ANALYSIS OF MONETARY POLICY

Operation Procedure of the Central Bank

Understanding the conduct of monetary policy is important for policy analysis because it affects the nominal variables in the economy, such as (1) supply of monetary aggregates (M1, M2, M3, deposits, credit), (2) short- and long-term interest rates, (3) the nominal exchange rate, which all in turn have a major influence on the level of economic activity, inflation and hence on the overall economic well-being.

The central bank influences the nominal economic variables by directly controlling the instruments of monetary policy: the monetary base and reserve aggregates, and short-term lending interest rates (e.g., overnight interest rate). This control is performed with the help of such operational tools as reserve requirements, open market operations, and discount policy.

The policy design problem is then to choose the most efficient policy instruments and to characterize how the instruments should adjust to the current state of the economy – to decide on the operational procedure for implementing monetary policy.

Efficiency of monetary policy – how powerful monetary policy is in affecting the economy and achieving its goals is determined by: (i) the ability of monetary

policy to control the nominal variables (by operating the policy instruments) in comparison with other factors in the economy, (ii) how important these nominal variables are for economic activity, and, moreover, (iii) how correctly the operational procedure of implementing monetary policy is enacted.

Tools of the central banks

We mentioned three policy tools that the central bank uses to manipulate the money supply and interest rates: open market operations, which affect the quantity of reserves and the monetary base; changes in the discount rate, which affect interest rates and the monetary base by influencing the quantity of discount loans; and changes in reserve requirements, which affect the money multiplier.

Because the use of these policy tools has such an important effect on interest rates and economic activity, and their use determines monetary policy efficiency, it is important to understand how to wield them in practice and how relatively useful each tool is.

Open-market operations are considered as the most important monetary policy tool because they are the primary determinants of changes in interest rate and the monetary base, the main source of fluctuations in the money supply. For example, open market purchases have positive effect on reserve and the monetary base, thereby raising the money supply and lowering the short-term interest rate.

The second monetary tool is discount policy, which affects the volume of the discount loans and the monetary base. Discount policy plays the very important role, since credit loans are intended to prevent the short-term liquidity problems of the banks that can arise from a temporary deposit outflow. The central bank

can affect the volume of discount loans by affecting the discount rate and the quantity of the loans administratively. A rise in discount loans has a positive effect on reserves and the monetary base and expands the money supply.

Changes in reserve requirements affect the money supply by causing the money multiplier to change. A rise in reserve requirements reduces the amount of deposits that can be supported by a given level of the monetary base and will lead to a contraction of the money supply.

The most effective and preferred tool of monetary policy is open market operations. They are practically under the complete control of the central bank, and they are quite flexible and precise, can be easily reversed and implemented quickly.

Controlling the monetary instruments

The monetary base equals the sum of currency in circulation, C, plus reserves of commercial banks, R. These items are monetary liabilities of the central bank. The monetary base is called high-powered money because an increase in it can lead to a multiple increase in the money supply.

The central bank exercises control over the monetary base via the first two factors: open market operations, selling or purchasing government bonds, and through extension of discount loans to banks.

To see these factors influence the monetary base, we split the monetary base into two components: one that is controlled completely and another that is slightly less controlled. The less controlled component is the amount of the base that is created by discount loans from the central banks. The remainder of the base is non-borrowed monetary base which is under total control, because it results from

the impact of open market operations. Since this part of the monetary base can be controlled directly, it is often chosen as the monetary instrument.

Another liabilities of the central bank by which it can influence the nominal variables is reserves of commercial banks. Total reserves also can be split into two categories: required reserves that the central bank is required to hold, and excess reserves that are any additional reserves the central banks chooses to hold.

To see how the central bank use the reserves as policy instruments consider one more important policy instrument - the interest rate on overnight loans of reserves from one bank to another - we will review the market for reserves where the amount of reserves and the overnight rate are determined.

Excess reserves are insurance against deposit outflows, and the costs of holding these reserves is their opportunity cost, the interest rate that could have been earned on lending these reserves out. This is taken to be equivalent to the overnight interest rate (or the federal reserve rate, as defined in the American literature). Thus, the overnight interest rate is negatively related to demanded reserves.

When discount lending increases, the quantity of reserves supplied to the banking system also increases. When banks borrow from the central bank, they do not need to borrow these funds from the reserve market. Discount loans are a substitute for borrowing funds. Thus the overnight interest rate is positively related to supplied reserves.

So, open market operations influence the quantity of reserves supplied; and when the central bank wants to make the overnight interest rate fall, it purchases the government bonds from the banks. Discount lending also affects the reserves

supplied, and the discount interest rate is positively related to overnight interest rate. On the other hand, reserve requirements affect the reserves demanded and positively influence the overnight interest rate.

One of the policy instruments described above reserves aggregates, the monetary base aggregates or the interest rate, is used by the central bank as the main monetary policy instrument, the primary indicator of the stance of monetary policy and determined by policy tools. Usually it is either the non-borrowed monetary base or overnight interest rate.

The money supply process determination

One of the important issues in conducting monetary policy is how the central bank affects the money supply. The money supply is linked to the monetary base through the following relationship:

$M = m \times MB$

The variable m is the money multiplier, which tells us how much the money supply changes for a given change in the monetary base. Thus the central bank can control the money supply by influencing the monetary base and the multiplier.

The money multiplier reflects the effect on the money supply of other factors than the monetary base. We will not consider derivations of the money multiplier (see Mishkin (2001) for detailed explanations) but only mention the factors which lie behind it.

The multiplier indicates the ability of the banking system to create money by multiplying the components of the monetary base in the process of accepting

deposits and then giving credits to the economy. This ability depends on: (i) changes in the required reserve ratio r_D: the larger this ratio, the less is the ability of the banking system to give additional credits to the economy, and the less the money multiplier; (ii) changes in the currency ratio (C/D): the more depositors convert their checkable deposits into currency, the less again is the ability to give credits and create money; (iii) changes in the excess reserve ratio (ER/D): the more excess reserves the banks decide to keep (due to the rise of the market interest rate – the opportunity cost of holding excess reserves, or due to risk of deposits outflow and decrease in liquidity), the less the money multiplier.

The money supply is determined not only by the money multiplier but also by changes in the components in the monetary base: the money supply increases when the components of the monetary base such as the non-borrowed monetary base and discount loans increase. In turn, discount loans are related positively to the market interest rate and negatively to the discount rate, as was discussed above.

So, we see how the central bank can exercise control over the money supply by controlling the three variables, the required reserve ratio, the non-borrowed monetary base, and the discount rate, also known as the monetary instruments – using them as its tools.

Problems of conducting monetary policy

In conducting monetary policy, the central bank establishes the economic goals and sets out the strategies for attaining them. The goals of monetary policy generally incorporate: (a) high employment; (b) economic growth; (c) price stability; (d) interest-rate stability; (e) stability of financial markets; (f) stability in foreign exchange rate market. Some of these goals may be set as preferable to the

others for some reasons. We return to the question of choosing the goals in the next subsection where we examine how monetary policy affects the economy.

After determining goals, the process of developing a certain strategy includes several stages with problems to be solved at each stage:

(1) choice of the intermediate targets – monetary aggregates (M1, M2, M3) or interest rates (short- and long-term);

(2) choice of operating targets or monetary instruments – reserves aggregates (reserves, non-borrowed reserves, monetary base, non-borrowed base) or interest rates (short-term such as overnight rate);

(3) choice of tools – open market operations, discount policy, reserve requirements;

Choosing the targets

After deciding on the goals and their desirable level, the central bank chooses a set of variables to aim for, called intermediate targets, such as monetary aggregates or interest rates, which have a direct effect on the established goals.

With the interest rate as the targets, the central bank lets the money stock adjust to the money demand shock. Here, there is no impact of money demand shocks on output or inflation because the central bank perfectly accommodates them. With money targeting, the reverse is true: the interest rate and output adjust to clear the money market.

The conclusion from the supply and demand analysis is that interest rate and monetary aggregate are incompatible. The rationale behind a central bank'

strategy of using targets suggests three criteria for choosing an intermediate target:

(1) Measurability – quick and accurate measurement of an intermediate-target variable is necessary because the intermediate target will be useful only if it signals rapidly when policy is off track.

(2) Controllability – a central bank must be able to exercise effective control over a variable if it is to function as a useful target.

(3) Predictability – the most important characteristic a variable must have to be useful as an intermediate target is that it must have a predictable effect on the goal.

Choosing operating targets

An operating target that has a more predictable impact on the most desired intermediate target is preferred. If the desired intermediate target is an interest rate, the preferred operating target will be an interest rate variable like an overnight interest rate because interest rates are closely tied to each other through the term structure relationship states.

However, if the desired intermediate target is a monetary aggregate, a reserve aggregate operating target such as the monetary base will be preferred.

In conclusion, large unobservable shocks to money demand produce a high volatility of interest rates when a monetary aggregate is used as the policy instrument. It is largely for this reason that an interest rate instrument may be preferable.

Transmission Mechanism Channels

Discussing the monetary transmission mechanism, in particular those that are typically assumed to be important for transition economies can be helpful in distinguishing the relative importance of different transmission channels. Even if there is a stable empirical relationship between the policy instrument and the target variables, we should also be concerned with the underlying structure of the economy in general. Since the presence of some financial frictions and imperfect information create an extra degree of uncertainty about the impact of policy instruments on activity and inflation, policy analysis without a theory of the transmission mechanism is obviously incomplete.

We need to distinguish two different approaches to MTM. Those that stress the impact of monetary policy on *financial market prices* – short-term interest rates, bond yields, exchange rate and so on, and those which emphasize *credit quantities* – the money supply, bank credit, the supply of government bonds, foreign denominated assets and so on.

According to the classification of the MTM channels of Mishkin (2000), both the price and credit views indicate that in most channels, monetary policy has its primary impact on real or nominal interest rates and stock prices. While interest rates channels are regarded as classical, stock prices theories have appeared recently and stress the importance of the financial markets and financial instruments for economic activity.

Since the financial markets are underdeveloped in the transition economies, their role for monetary transition is not too significant, so we will concentrate only on the classical interest rate channels and credit channels, bank lending and broad credit channels, in this thesis. The importance of the latter is especially stressed for the transition economies.

Under the classical view of the transmission channel, interest rates influence economic activity by affecting various relative prices in the economy. These are primarily the relative prices of capital and of future consumption in terms of current consumption, and the relative price of domestic goods in terms of foreign goods

Monetary policy strategy

In the context of choosing an intermediate target, the most effective for attaining goals, it would be useful to mention about a central feature of monetary policy strategies in most modern countries - *nominal anchor*. Nominal anchor, a nominal variable that policymakers use to tie down the price level such as the inflation rate, an exchange rate, or the money aggregate, is an intermediate target to achieve an ultimate goal such as price stability, which most countries view as the most important goal for monetary policy.

Mishkin (2000) describes a nominal anchor serves like a behavioral rule: it can help avoid the time-inconsistency problem by providing an expected constraint on discretionary policy.

Exchange rate targeting

Targeting the exchange rate has involved fixing the value of the domestic currency to that of a large, low-inflation country like the United States or Germany. Another alternative is to adopt a crawling target or a peg, in which a currency is allowed to depreciate at a steady rate so that the inflation rate in the pegging country can be higher than that of an anchor country. The nominal anchor of an exchange-rate target directly contributes to keeping inflation under

control by tying the inflation rate for internationally traded goods to that found in the anchor country.

In transition countries, where political and monetary institutions are weak and who therefore have been experiencing continued bounds of hyperinflation, exchange rate targeting may be the only way to arrest inflation and stabilize the economy. But the exchange rate strategy constraints the independence of monetary policy in reacting to domestic shocks and, moreover, may cause speculative attacks and loss of exchange rate signals about stance of monetary policy.

Monetary aggregates targeting

In many countries, exchange-rate targeting is not actually an option because of their large size or because there is no country whose currency can serve as a nominal anchor. These countries choose the other strategies, one of them is monetary targeting, which has been quite successfully exploited for many years.

This strategy involves using monetary aggregates as an intermediate target to achieve such ultimate goal as price stability. A major advantage of monetary targeting over exchange rate targeting is that it enables a central bank to adjust its monetary policy to cope with domestic considerations. It enables the central bank to choose goals for inflation that may differ from those of other countries and allows some response to output fluctuations. But there must be a strong and reliable relationship between the goal variable (inflation or nominal income) and the targeted aggregate. As a result, monetary targeting will not serve as a communications device that increases the transparency of monetary policy.

Inflation targeting

Given the breakdown of the relationship between monetary aggregates and goal variables, many countries that prefer independent monetary policy have recently adopted inflation targeting as the monetary regime. But if the relationship between the monetary aggregate and the goal variable is weak, monetary aggregate targeting will not work.

Inflation targeting involves several elements: (1) public announcement of medium-term numerical targets for inflation; (2) institutional commitment to price stability as the primary, long-run goal of monetary policy and a commitment to achieve the inflation goal (use of a policy rule); (3) an information-inclusive strategy in which many variables and not just monetary aggregates are used in making decisions about monetary policy.

In fact, inflation targeting strategy is considered today as the most preferable monetary strategy for both developed and transition country, which work in trinity with flexible exchange rate and announced policy rule.

Chapter 4

CONDUCT OF MONETARY POLICY IN UKRAINE

Operation procedure of the National Bank

Monetary policy in Ukraine is regarded by the public and the authorities as a key factor of restoring economic growth, since it is responsible for maintaining low inflation environment, which is a prime condition for persistent economic growth, and for stimulating economic activity.

The activity of the National bank of Ukraine is governed by the Constitution of Ukraine and the Law of Ukraine 'On the National Bank of Ukraine'. According to these official documents, the responsibilities of the NBU are determined as conducting monetary and credit policy, governing financial and banking system, exercising capital and foreign exchange control, and so on.

The NBU presents directions and goals of monetary policy in the official document 'The Main Monetary Policy Guidelines'. This document verifies tentative levels of objectives and intermediate target, as well as major instruments that NBU plans to employ in order to achieve the projected levels of targets. It is based on the Constitution of Ukraine, the Law of Ukraine 'On the National Bank of Ukraine', a project of the Law of Ukraine 'On The State Budget of Ukraine', forecasted macroeconomic and fiscal parameters, determined by the state program of economic and social development.

Providing the conduct of monetary and credit policy must be coordinated with demands of to international financial organizations, in particular with IMF, and the economic program of the Cabinet of Ministry of Ukraine. For example, the choice of monetary instruments, as well as their adjusted values, is resolved in such way to provide implementation of economic policy of the Cabinet of Ministry. The main goals of economic policy of the Cabinet of Ministry are overcoming the poverty in the society, stimulating domestic demand, and structural reorganization of the economy.

According to the Constitution, prime goal of monetary policy is to provide the exchange rate stability and related to it price stability. Stability of the exchange rate is very important for overall financial stability in Ukraine, because 60 % of economic growth is contributed by an external sector. As the National bank consider the exchange rate stability as the main factor of depressing inflation and stimulating economic growth, it back up the exchange rate not allowing it to appreciate, by active interventions and currency regulations.

Until 2000, the nominal exchange rate was a clear target of the National bank and directly regulated through a foreign exchange rate corridor. However, this strategy appeared to be not very efficient in providing the exchange rate stability because of insignificant foreign currency inflow to the banking system. The exchange rate was very sensitive for exogenous shocks from the world economy and, therefore, was a very distorting factor for the economy.

In the 2000 year, the flexible exchange rate regime was introduced, which implies that the exchange rate is now determined by demand and supply at the interbank foreign exchange market. Despite this, the nominal exchange rate still remain under control of the National bank and depends mainly on the regulatory measures.

In conducting the main course of monetary policy, the National bank decide on the tentative level of monetary aggregates, monetary base and aggregate m2 and announce them to the public. Orientation on the volume of monetary base and m2 implies the monetary targeting strategy. Thus the main instrument of monetary policy is keeping the monetary aggregates close to their forecasted targets to prevent inflationary expectations. The primary requirement for assessing the perspective level of monetary aggregates is to provide the money supply meets the demand for real money, which is supposed to stimulate real economic growth and remonetization of the economy.

Therefore, the main problem of designing monetary policy is to determine demand for the real money balances and, after this, render the money supply according to projected growth of production, taking into account stability on foreign exchange and credit markets, and preventing inflation. Estimates of the demand for money are based on previous dynamic of key macroeconomic indicators and actual monetary aggregates at the end of period. Besides, the estimates are oriented to forecasted growth of GDP and CPI.

Providing the required level of the money supply is to be realized by the two main directions:

- increasing the nominal monetary base;
- improving the money multiplier.

Increasing the monetary base is executed mainly by intervening on the foreign exchange market and refinancing the banking system.

Improving the money multiplier can be provided in the following way:

- improving the structure of the money by involving the currency circulating beyond the banking system;

- stimulating crediting the real economy by the banking system;

In conducting monetary policy, the National bank employ such tools as: (1) interest rate policy (regulating discount rate and overnight rate to set the true orientation for the credit prices by using deposit certificate and open market operations); (2) reserve requirements; (3) operations on the foreign exchange market; (4) refinancing commercial banks; (5) REPO operations; (6) deposit certificate of the NBU; (7) open market operations.

Summarily: determinants of monetary policy inefficiency

The term 'efficiency of monetary policy' can be defined as the power of monetary policy to attain the established macroeconomic goals through chosen policy strategy that involves certain intermediate targets, instruments and tools. The main macroeconomic goals for monetary policy in Ukraine are stability of the nominal exchange rate and price level, and real economic growth. Monetary aggregate m2 is chosen as intermediate target that is to be achieved with the monetary instrument - the monetary base, which is regulated, in its turn, by reserve requirements, open market operations, interest rate policy, and interventions on the foreign exchange market. Thus, the preferred monetary policy strategy in Ukraine is stated as monetary aggregates targeting.

Exchange rate and price stability have been achieved but not so with market instruments as by introducing restricting regulations on capital flows and operations on the foreign exchange market.

Efficiency of monetary targeting strategy is stipulated by the ability of the monetary authorities to control monetary aggregates and the existence of strong and predictable relationships between monetary aggregates and goals.

First of all, the national bank possess a weak control over money due to the problems of money structure - large fraction of money supply is circulating beyond the banking system and cannot be controlled by the National bank. The reasons for this: (1) distrust to the banking system; (2) underdevelopment of the cashless transfers system; (3) large fraction of the shadow sector in the economy due to imperfections in tax legislation and most of financial transactions are performed beyond the banking system. All these together with tax privilege for particular industries and related to this distorted information about relative efficiency of enterprises lead to unpredictable demand for the money, therefore, to low control for the monetary aggregates and low money multiplier.

Regarding unpredictability of demand for money the central bank cares about transmission mechanism, focusing primarily on development of credit MTM. This is the main goal of the interest rate policy.

Active interest rate policy is aimed to decreasing the discount rate to bring down the commercial credit interest rate. One goal of interest rate policy is to stimulate the process "saving-investment", another – to suppress inflationary pressure. Decreasing the discount interest rate and reserve requirements are supposed to stimulate growth of deposits in the banking system and growth of credits to the real sector of the economy.

But the influence of monetary instruments on the credits is restricted. The barriers to this are (1) bad financial state of potential borrowers; (2) weak

legislation that must defend creditors' rights, (3) weak capitalization of the banking system.

So, the impact of monetary policy on stimulating real activity is obviously restricted. But at the same time, many researches reveal that there is no well-defined relationship 'money – inflation' in the economy of Ukraine. This can be explained by that: (1) CPI structure does not represent the consumption pattern adequately, and (2) because of the large fraction of the shadow economy.

All these reasons question the appropriateness of monetary policy strategy.

Besides, there are some additional important factors beyond the influence of monetary policy:

- Sort-run goals of fiscal policy and unreasonable debt servicing contradict the goals of monetary policy and decreases effectiveness of monetary policy, in particular, if take into account restricted potential of the National bank to sterilize oversupply of money.

- Openness of the economy contributes to difficulties in supporting macroeconomics stability in the current economic environment with only monetary instruments

- Necessity to coordinate the established goals and instruments with requirements of international organizations that often give not adequate estimates of economic conditions in Ukraine.

As these facts impugn the relevance of the current strategy of monetary policy, it is necessary to evaluate the adequacy of the monetary instruments used for the

goals of monetary policy to be achieved, and elaborate recommendations how to improve its efficiency.

Chapter 5

MODEL ESTIMATION AND EMPIRICAL EVIDENCE

Methodology

Investigating policy reactions to, and policy effects on, goals variables, we apply the VAR approach to time series modeling. The VAR approach sidesteps the need for structural modeling since it is a reduced-form representation of a system of endogenous variables treating each of them as a function of the lagged values of all of the endogenous variables in the system.

The vector autoregression (VAR) is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables..

The mathematical representation of a VAR is

$$A(\mathrm{L})x_t = d + e_t \qquad (1)$$

with $A(\mathrm{L}) = A_0 + A_1\mathrm{L} + A_2\mathrm{L}^2\ldots$

where x_t is a vector of endogenous variables, and A is matrix of coefficients to be estimated, and e_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values, and uncorrelated with all of the right-hand side variables.

Since only lagged values of the endogenous variables appear on the right-hand

side of the equations, simultaneity is not an issue and OLS yields consistent estimates. Moreover, even though the innovations may be contemporaneously correlated, OLS is efficient and equivalent to GLS since all equations have identical repressors.

But several problems can arise with the application of VAR modeling to macroeconomic time series, since the variables are often characterized by a high degree of persistence. Frequently, the persistence is well described by a unit-root process, e.g. a random walk. However, often one finds that changes in x_t, denoted by $\Delta x_t = (1\text{-}L)\, x_t$, are stationary ($x_t$ is integrated of order one, I(1) and also that certain linear combination of the variables in x_t are stationary (x_t is cointegrated, CI(1,1)). If so, the VAR model may be rewritten as a vector-error correction (VEC) model:

$$B(L)\Delta x_t = d + \Pi x_{t-1} + e_t \qquad (2)$$

If none of the variables cointegrate, then $\Pi = 0$, and we are left with a standard VAR in the first differences of the variables

$$B(L)\Delta x_t = d + e_t$$

If the variables are cointegrated with r cointegrating vectors or long-run relationships in the data, then rank $(\Pi) = r$ and Π can be written as $\Pi = \alpha\beta$ (check), where β is an n x r matrix of r cointegrating vectors, and α is an n x r matrix of factor loadings.

A vector error correction (VEC) model is a restricted VAR designed for use with nonstationary series that are known to be cointegrated. The VEC has cointegration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their cointegrating

relationships, while allowing for short-run adjustment dynamics. The cointegration term is known as the correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. In other words, the non-stationary or trend components of the variables tend to move together over time in some proportion, and the linear combination of the variables can be thought of as defining a long-run equilibrium relationship. This in turn implies that the non-stationary components of these variables are driven by a 'common' stochastic trends than there are endogenous variables.(cite source)

To test the time series for stationarity and cointegation, the unrestricted VAR system containing the levels of all the variables is estimated, and Johansen's ML procedure for determining the cointegrating rank of the system is applied.

Model Specification and Data Description

The model we employ for policy analysis is represented as VAR (VEC) model. In the model, the vector x_t is given by

$$x_t = [m2_t \quad er_t \quad inf_t \quad y_t]'$$

where $m2_t$ denotes money supply that is interpreted by us as monetary policy instrument. er_t is the nominal exchange rate, inf_t is inflation index, and y_t is a real GDP. Each of the last three variables is interpreted as macroeconomic goals of monetary policy.

The quarterly data set, used for the model estimation, runs from 1996:1 to 2002:1. Due to lags, the effective estimation period begins in 1996:3. All series appear non-stationary and integrated of order one, I(1). The results of the Augmented

Dicker-Fuller test for unit root are presented in Appendix 1.

The model variables, their identifications, and data sources are presented in Table 1.

Table 1. Data description

Variable	Description	Definition	Interpretation in the model	Units	Source
m2	monetary aggregate, M2	money in circulation + deposits in national currency	policy instrument	mln, hrivna	Bulletin of NBU
er	nominal exchange rate	weighted, on the end of period	policy goal	hrivna /USD	Bulletin of NBU
inf	inflation	Δ CPI/CPI(-1)	policy goal	%, quarterly	Derzhkomstat
y	real GDP	GDP/DEF	policy goal	mln, hrivna	Derzhkomstat

Cointegration Analysis

Since the ADF test for stationarity indicates that the time series are non-stationary and integrated of order one, the next step of the estimation procedure is to run Johansen cointegration test to determine the number of cointegrating equations and construct the vector error correction (VEC) model.

The stability of the VAR model may be distorted by the ambiguity in number of

lags included. To avoid misspecification due to lag structure and to prevent loss of degrees of freedom we test for cointegrating relations including from1 to 2 lag sto the model. Table 2 in Appendix presents results of Johansen cointegration test for the different number of lags.

The test verifies the existence of cointegration between the model variables. For lags from 1 to 2, we fail to reject the hypothesis that there is at most one cointegrating equation with probability of 99%. This implies that there can be one common stochastic trend driving the four endogenous variables. We choose the VEC model with 2 lags to be estimated, which provides the highest significance of the long-run cointegration coefficients.

But the estimated cointegrating vector derived from the Johansen procedure is identified in n arbitrary manner and does not in general have straightforward economic interpretation. Dhar et al (2000) propose to test whether the vector can be restricted to conform to meaningful economic relationship.

Economic theory often provides us with priors as to which are the long-run interrelations between time series variables. This can be introduced by imposing certain restrictions on the cointegrating vector β and then tested for their adequacy.

Thus, we formulate the hypothesis, suggested by monetarist economic theory that all nominal variables and inflation move in the same direction in the long run. The hypothesis implies that the common dynamics of nominal economic variables are independent from the dynamics of real economic variables, in the long-run.

According to this, we impose the corresponding restrictions on the cointegrating

vector β and normalize it by m2:

$$\beta = \begin{matrix} m2 \\ [1 \end{matrix} \begin{matrix} er \\ * \end{matrix} \begin{matrix} inf \\ * \end{matrix} \begin{matrix} y \\ 0]' \end{matrix},$$

where * - any value.

The results of the Johansen cointegration test for the restrictions imposed are presented in Table. So, we fail to reject the hypothesis at the marginal value of 5% level of significance.

Thus, we include the restricted cointegrating vector to the VEC model. But the t-statistics for the factor loadings suggests that only the dynamics of the nominal exchange rate and inflation is driven by cointegrating vector. Meanwhile, the behavior of m2 and y are hardly determined by the trend.

Estimation and Tests for Specification

Following the cointegration analysis, the next stage is to estimate the VEC model representation (equation 2 above) with the cointegrating rank 1 and the restrictions imposed on the cointegrating vector. Despite the fact that the hypothesis concerning the identification of the cointegrating vector are at the borderline of acceptability at the 5% level, the estimated VEC model (the estimation output is presented in Appendix 3) has reasonably good properties. Tables 4.1-4.3 in Appendix 4 present some diagnostic tests on the VEC model. However, the normality test identifies some possible problems with the normality of the residuals of the exchange rate.

Overall, the model can be considered as fairly robust, especially as for a model built on data for a transition economy.

The Granger-Causality Test

It would be reasonable to investigate whether in reality, the empirical evidence suggests that the policy instrument m2 adjusts to lagged values of the policy goals variables er, inf, and y, and whether in their turn, er, inf, and y are influenced by lagged values of the variable m2. In order to check this, we implement the Granger-Causality test.

The Granger-Causality test is usually performed by assessing the significance of parameters in the following regression:

$$x_t = a_1 * x_{t-1} + a_2 * x_{t-2} + \ldots + b_1 * y_{t-1} + b_2 * y_{t-1} + \ldots$$

When we test whether a variable *y* causes *x*, we see how much of the current *x* can be explained by past values of *y* and then see whether adding further lagged values of *y* can improve the explanation. *x* is said to be Granger-caused by *y* if *y* helps in the prediction of *x*, or equivalently if the coefficients on the lagged *y*'s are statistically significant.

It is important to note that Granger causality is a purely statistical concept which measures precedence and information content but does not by itself indicate any temporal causality in the nature of cause and effect.

Carrying out pairwise Granger causality tests we test whether an endogenous variables can be treated as exogenous. For each equation in the VAR, the output displays Chi-square (Wald) statistics for the joint significance of each of the other lagged endogenous variables in that equation. The statistic in the last row (All) is the statistic for joint significance of all other lagged endogenous variables in the equation.

Table 2. Pairwise Granger-Causality Test

Sample: 1996:1 2002:1			
Included observations: 22			
Dependent variable: D(M2)			
Exclude	Chi-sq	df	Prob.
D(ER)	1.634960	2	0.4415
D(INF)	1.833544	2	0.3998
D(Y)	5.443512	2	0.0658
All	11.51936	6	0.1736
Dependent variable: D(ER)			
Exclude	Chi-sq	df	Prob.
D(M2)	9.742713	2	0.0077
D(INF)	3.943192	2	0.0392
D(Y)	1.875054	2	0.3916
All	18.01750	6	0.0062
Dependent variable: D(INF)			
Exclude	Chi-sq	df	Prob.
D(M2)	5.595601	2	0.0609
D(ER)	5.756327	2	0.0562
D(Y)	6.363870	2	0.0415
All	19.36260	6	0.0036
Dependent variable: D(Y)			
Exclude	Chi-sq	df	Prob.
D(M2)	8.998900	2	0.0111
D(ER)	7.579828	2	0.0226
D(INF)	9.716640	2	0.0078
All	16.19127	6	0.0128

The test indicates that:

i) None of the variables er, inf, and y do not Granger cause m2;

ii) er is Granger caused by m2 and inf, but not by y;

iii) inf is granger caused by all variables, in particular by m2;

iv) y is Granger caused by all variables;

So, it appears that m2 cannot be explained by past values of the policy goals variables. It may imply either that m2 is hardly adjusted to the previous dynamic of policy goals variables in setting operation procedure or that monetary aggregates can be hardly controlled by the monetary authorities. Meanwhile, all er, inf, and y can be explained by m2 that implies that monetary policy affects policy goals at least with lags. Thus, policy instrument m2 seems to be rather exogenous in the model.

Impulse Response Analysis

Now we proceed with dynamic analysis of the model, and analyze how monetary policy affects the economy over different time horizons. For this purpose, we apply impulse response analysis and variance decomposition analysis.

The impulse response process may be described as the following: a shock to the i-th variable not only directly affects the i-th variable but is also transmitted to all of the other endogenous variables through the dynamic (lag) structure of the model. An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables.

If the innovations are contemporaneously uncorrelated, interpretation of the impulse response is straightforward. The i-th innovation is simply a shock to the i-th endogenous variable. Innovations, however, are usually correlated, and may be viewed as having a common component which cannot be associated with a specific variable. In order to interpret the impulses, it is common to apply a transformation to the innovations so that they become uncorrelated.

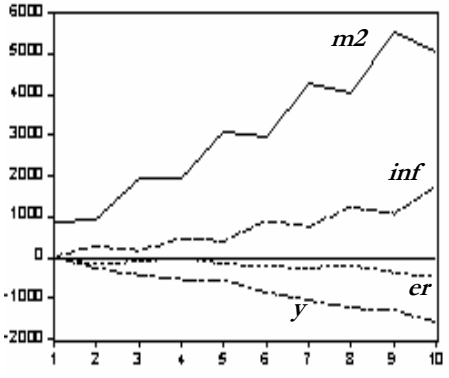
In the analysis, we use Cholesky' transformation of innovations. The procedure transforms the residual covariance matrix to orthogonalize the impulses. This option imposes an ordering of the variables in the VAR and attributes all of the effect of any common component to the variable that comes first in the VAR system.

First, we specify the order of Cholesky shocks:

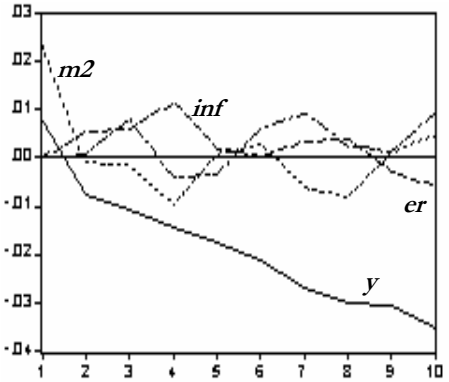
m2 => er => inf => y

This implies that money supply first affects the nominal exchange first, since the exchange rate is almost under direct control of the National Bank and it is considered to be very sensitive to monetary policy. The shock is then transmitted to inflation that usually responds sluggishly to monetary policy, and finally it affects the real output.

Response of ***m2*** to Cholesky one s.d. innovation



Response of ***y*** to Cholesky one s.d. innovation



Response of ***inf*** to Cholesky one s.d. innovation

Response of ***er*** to Cholesky one s.d. innovation

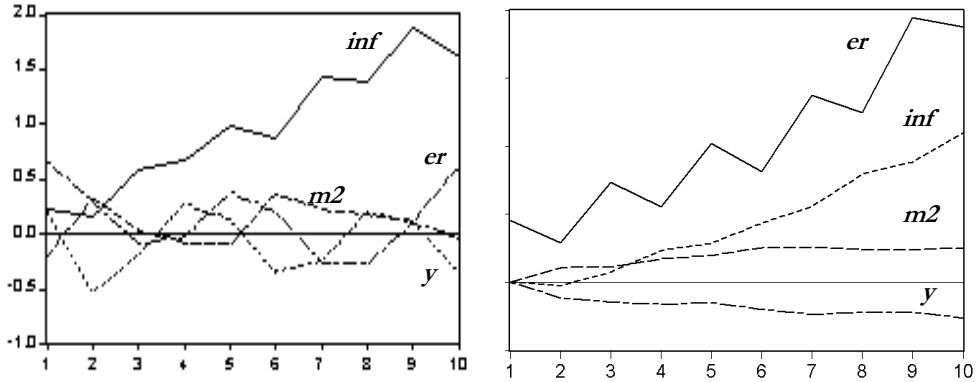


Figure 1. Impulse response functions

These graphs displays the effects:

i) m2 reacts mainly to exogenous policy shocks due to other factors than simply changes in policy goals; the dynamics of goals variables do not actually affect the setting of policy instrument; this confirms the conclusions made on the basis of the Granger-Causality test and may indicate a rather serious source of monetary policy inefficiency: The operating procedure of the National bank is determined mainly by other government structural considerations and international organizations' requirements, which are not always economically reasonable, rather than by targeting the established policy goals;

ii) the nominal exchange rate devalues continuously in response to an increase in the money supply: it is highly reactive to money supply and this effect is magnified by accelerating inflation in the following periods. Thus, an expansionary monetary policy causes a sustained devaluation of the nominal exchange rate;

iii) inflation does not react to monetary policy in the first period as was expected, but then it responds with persistent growth since inflationary expectations were formulated, and then magnified again, by devaluation of the nominal exchange rate;

iv) the real output decreases (with significant volatility) to a devaluation of the exchange rate and increases in inflation. Overall, - by a substantial fall due to the monetary policy shock;

Thus, monetary policy affecting nominal variables transmits generally to inflation rather than to real economic activity and even causes the explosive pattern of the variable dynamics. This is evidence for the weak monetary transmission mechanism. Despite the slight improvement in the MTM recently, this can not influence the results of the analysis.

Variance Decomposition

A variance decomposition analysis derives the contribution of each of the particular variable's shocks to the variance of the forecast error for each variable at different time horizons. While impulse response functions trace the effects of a shock to one endogenous variable on the other variables in the VEC, variance decomposition separates the variation in an endogenous variable into the component shocks to the VEC. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VEC.

The Table 3 displays separate variance decompositions for each endogenous variable. The source of this forecast error is the variation in the current and future values of the innovations to each endogenous variable in the VEC. The

remaining columns give the percentage of the forecast variance due to each innovation, with each row adding up to 100.

Table 3. Variance decomposition

m2

Period	S.E.	m2	er	inf	y
1	881.6030	100.0000	0.000000	0.000000	0.000000
2	1346.996	89.81531	0.155324	6.332666	3.696696
3	2392.562	93.19214	0.064464	2.590907	4.152492
4	3182.666	91.12188	0.788526	2.857741	5.231849
5	4482.501	92.81987	0.498386	2.285086	4.396658
6	5528.013	90.14779	0.780861	3.824903	5.246446
7	7119.960	90.63838	0.598730	3.418725	5.344161
8	8376.069	88.82986	0.935940	4.191072	6.043124
9	10181.53	89.56918	0.769396	3.947780	5.713639
10	11614.93	87.67203	0.968010	5.108134	6.251824

er

Period	S.E.	m2	er	inf	y
1	0.183548	6.513737	93.48626	0.000000	0.000000
2	0.270392	4.846322	62.16458	32.18909	0.800007
3	0.411563	16.28613	36.59358	46.77166	0.348620
4	0.572143	23.51201	22.22982	53.43239	0.825783
5	0.763193	38.46981	14.37703	46.35515	0.798012
6	0.943329	49.31903	10.11233	40.03150	0.537148
7	1.199308	60.28633	6.463193	32.78567	0.464805
8	1.438349	67.49869	4.500790	27.55567	0.444846
9	1.728079	74.90985	3.139719	21.47021	0.480223
10	1.999063	79.81667	2.348745	16.96852	0.866065

inf

Period	S.E.	m2	er	inf	y
1	0.024290	9.648514	55.30480	35.04668	0.000000
2	0.025991	16.52548	49.27770	34.14120	0.055616
3	0.029928	24.74620	37.86069	29.63824	7.754870
4	0.036744	32.04019	25.14581	36.53798	6.276008
5	0.040843	44.10902	20.49852	29.63384	5.758614
6	0.046527	54.96588	16.08523	22.92656	6.022332
7	0.054844	63.09308	11.84878	17.88433	7.173809
8	0.063267	70.02242	9.312173	15.11117	5.554238
9	0.070364	75.53274	7.547824	12.39612	4.523322
10	0.079514	78.51307	5.910686	10.58337	4.992879

y

Period	S.E.	m2	er	inf	y
1	0.752040	9.508652	0.099881	14.31682	76.07465

2	1.033415	7.558057	4.452158	39.82720	48.16259
3	1.206454	28.92049	4.520561	30.61810	35.94085
4	1.407926	43.91282	4.629392	25.00206	26.45572
5	1.773697	59.18875	2.973057	16.54632	21.29187
6	2.050327	62.67090	2.291788	18.22156	16.81575
7	2.535047	72.76953	1.543742	13.65204	12.03469
8	2.909479	77.69602	1.970172	10.36586	9.967951
9	3.472195	84.08664	1.550879	7.288192	7.074285
10	3.889207	83.97503	1.302256	9.071948	5.650765

The variance decomposition shows that the influence of money expansion on all variables is amplified in longer time horizons. Inflation arising from a monetary shock explains a significant part of fluctuations in the real output, especially in the short-run. This signifies a destructive influence of inflationary expectations on output. Inflation and exchange rate influence each other in the medium time horizon, intensifying the effects of monetary shocks. The Monetary policy exogenous shock is the main one, which contributes to the m2 dynamics. So, the influence of the authorities' other considerations as well as exogenous shocks to the economy, contribute more to the targeted value of money supply than the key macroeconomic indicators.

Chapter 6

SUMMARY AND CONCLUSIONS

The purpose of this thesis is to investigate the main impact of monetary policy on the economy in Ukraine, and to assess efficiency of the current strategy of monetary policy in terms of attaining the specified macroeconomic goals. To do this, we have estimated the relationships between key macroeconomic variables representing monetary instruments and policy goals in the framework of the vector error correction model. This is a restricted model, formulated on the basis of a reduced-form VAR model. The estimated VEC model possesses quite a stable structure and satisfactory dynamic features. The specification tests confirm the robustness of the model.

Investigating the relationships, we undertake cointegration analysis of the variables to test them for the presence of stable long-run relations, and implement Granger-Causality test to determine the direction of impact between the variables. Finally, we undertake a dynamic analysis of the estimated model to test the dynamic relationships between the variables under investigation.

In particular, the empirical analysis reveals that:

(1) The main effect of monetary policy on the economy is its influence on nominal variables and inflation rather than on real output. This is quite a predictable result. Moreover, the analysis demonstrates that just a little deviation in the money supply can have very distorting effect on the exchange rate and inflation.

(2) M2 hardly adjusts to the past dynamics of macroeconomic variables and appears to be determined mainly by other considerations than economic ones; the monetary authorities have a little control over the monetary aggregates.

(3) In view of this, and also taking into account the fact that the relationship between the monetary aggregates and inflation are not well-defined, the monetary aggregates should not be considered as the optimal monetary instruments.

(4) Monetary aggregate targeting is not efficient policy strategy in Ukraine.

According to the main findings, we conclude that giving more consideration to both past and forecasted dynamics of macroeconomic variables in setting operation procedure would improve policy efficiency. But, as monetary aggregate targeting was revealed to be difficult to implement, the analysis suggests that inflation targeting would be a more efficient policy strategy (evidence on this – successful application of inflation targeting in developed and transition economies). Besides, the this fact, an actual flexible exchange rate regime would leave more room for monetary policy to operate and to promote further market development of the banking system, since the effective functioning of the banking system is one of the prime conditions for restoring economic growth.

This research cannot be regarded as conclusive, of course. Forthcoming changes in institutional and regulatory arrangements may allow one to employ structural models to investigate monetary policy effects, which is more interesting and fruitful technique. Moreover, employing VAR models is very useful for forecasting inflation when an inflation targeting strategy is chosen for conducting monetary policy.

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APPENDIX 1

Augmented Dicker-Fuller Unit Root Tests

Table 1.

Null Hypothesis: D(M2) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 2 (Automatic based on SIC, MAXLAG=8)				
			t-Statistic	Prob.
Augmented Dickey-Fuller test statistic			-7.383019	0.0006
Test critical values:	1% level		-4.467895	
	5% level		-3.644963	
	10% level		-3.261452	
*MacKinnon (1996) one-sided p-values.				
Null Hypothesis: D(ER) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.145194	0.0099
Test critical values:	1% level		-4.416345	
	5% level		-3.622033	
	10% level		-3.248592	
Null Hypothesis: D(INF) has a unit root Exogenous: Constant, Linear Trend Lag Length: 8 (Automatic based on SIC, MAXLAG=8)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.608233	0.0122
Test critical values:	1% level		-4.728363	
	5% level		-3.759743	
	10% level		-3.324976	
Null Hypothesis: D(Y1) has a unit root Exogenous: Constant, Linear Trend Lag Length: 2 (Automatic based on SIC, MAXLAG=8)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-7.781623	0.0000
Test critical values:	1% level		-4.467895	
	5% level		-3.644963	
	10% level		-3.261452	

APPENDIX 2

Cointegration Tests

Table 2.1

Sample(adjusted): 1996:4 2002:1				
Included observations: 22 after adjusting endpoints				
Trend assumption: Linear deterministic trend				
Series: Y ER INF M2				
Lags interval (in first differences): 1 to 2				
Unrestricted Cointegration Rank Test				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.942995	83.23302	47.21	54.46
At most 1	0.454877	20.21151	29.68	35.65
At most 2	0.262631	6.863145	15.41	20.04
At most 3	0.007268	0.160488	3.76	6.65

APPENDIX 3

Estimation Output of the VEC model

Table 3.1 The VEC model with 2 lags

Vector Error Correction Estimates				
Date: 05/26/03 Time: 09:00				
Sample(adjusted): 1996:4 2002:1				
Included observations: 22 after adjusting endpoints				
Standard errors in ( ) & t-statistics in [ ]				
Cointegration Restrictions:				
B(1,1)=1,B(1,4)=0				
Convergence achieved after 25 iterations.				
Restrictions identify all cointegrating vectors				
LR test for binding restrictions (rank = 1):				
Chi-square(1)	29.82746			
Probability	0.000000			
Cointegrating Eq:	CointEq1			
Y1(-1)	1.000000			
ER(-1)	0.054221			
	(0.13971)			
	[0.38810]			
INF(-1)	35.51792			
	(5.63879)			
	[6.29885]			
M2(-1)	0.000000			
C	-19.02201			
Error Correction:	D(Y1)	D(ER)	D(INF)	D(M2)
CointEq1	-0.305565	-0.261152	-0.028315	494.3284
	(0.29914)	(0.08543)	(0.01131)	(327.496)
	[-1.02148]	[-3.05683]	[-2.50447]	[1.50942]
D(Y1(-1))	-0.425487	0.098198	0.015973	-533.5588
	(0.18109)	(0.05172)	(0.00684)	(198.256)
	[-2.34960]	[1.89872]	[2.33378]	[-2.69127]
D(Y1(-2))	-0.511137	0.124062	0.022381	-364.8367
	(0.14113)	(0.04031)	(0.00533)	(154.509)

	[-3.62174]	[3.07801]	[4.19593]	[-2.36126]
D(ER(-1))	3.059020	0.112222	-0.010438	3207.345
	(1.47404)	(0.42098)	(0.05571)	(1613.78)
	[2.07526]	[0.26657]	[-0.18736]	[1.98748]
D(ER(-2))	-2.266201	0.699595	0.042890	-2167.875
	(1.23060)	(0.35145)	(0.04651)	(1347.26)
	[-1.84154]	[1.99058]	[0.92217]	[-1.60910]
D(INF(-1))	-33.59901	5.174220	0.306947	-36500.72
	(15.5261)	(4.43417)	(0.58680)	(16998.0)
	[-2.16403]	[1.16690]	[0.52308]	[-2.14736]
D(INF(-2))	-1.309780	-2.747468	-0.253049	-828.0644
	(5.78211)	(1.65134)	(0.21853)	(6330.23)
	[-0.22652]	[-1.66378]	[-1.15795]	[-0.13081]
D(M2(-1))	0.000418	8.34E-05	4.95E-06	0.026555
	(0.00018)	(5.2E-05)	(6.8E-06)	(0.19744)
	[2.32045]	[1.61939]	[0.72595]	[0.13450]
D(M2(-2))	0.000479	-2.82E-06	4.20E-06	0.940601
	(0.00025)	(7.0E-05)	(9.3E-06)	(0.26831)
	[1.95562]	[-0.04024]	[0.45391]	[3.50564]
C	-1.326217	-0.162089	-0.030496	284.4612
	(0.56762)	(0.16211)	(0.02145)	(621.424)
	[-2.33647]	[-0.99989]	[-1.42153]	[0.45776]
R-squared	0.887003	0.688812	0.711752	0.804321
Adj. R-squared	0.802255	0.455421	0.495566	0.657562
Sum sq. resids	6.541833	0.533578	0.009345	7840907.
S.E. equation	0.738345	0.210867	0.027905	808.3371
F-statistic	10.46639	2.951325	3.292315	5.480557
Log likelihood	-17.87557	9.694464	54.18743	-171.8387
Akaike AIC	2.534143	0.027776	-4.017039	16.53079
Schwarz SC	3.030071	0.523704	-3.521111	17.02672
Mean dependent	0.131364	0.161439	-0.001727	1781.818
S.D. dependent	1.660377	0.285745	0.039290	1381.344
Determinant Residual Covariance		1.207478		
Log Likelihood		-100.2705		
Log Likelihood (d.f. adjusted)		-126.9405		
Akaike Information Criteria		15.54004		
Schwarz Criteria		17.72213		

Table 3.2 The VEC model with 1 lag

Vector Error Correction Estimates				
Date: 05/26/03 Time: 09:10				
Sample(adjusted): 1996:3 2002:1				
Included observations: 23 after adjusting endpoints				
Standard errors in ( ) & t-statistics in [ ]				
Cointegration Restrictions:				
B(1,1)=1,B(1,4)=0				
Convergence achieved after 39 iterations.				
Restrictions identify all cointegrating vectors				
LR test for binding restrictions (rank = 1):				
Chi-square(1)	15.66467			
Probability	0.000076			
Cointegrating Eq:	CointEq1			
Y1(-1)	1.000000			
ER(-1)	0.463018			
	(0.10283)			
	[4.50284]			
INF(-1)	9.401357			
	(5.04112)			
	[1.86493]			
M2(-1)	0.000000			
C	-19.42157			
Error Correction:	D(Y1)	D(ER)	D(INF)	D(M2)
CointEq1	-0.538701	-0.050473	0.004846	505.8149
	(0.23819)	(0.05393)	(0.00747)	(253.958)
	[-2.26161]	[-0.93597]	[0.64862]	[1.99173]
D(Y1(-1))	0.011267	0.047151	0.008386	-277.4904
	(0.21045)	(0.04765)	(0.00660)	(224.378)
	[0.05354]	[0.98963]	[1.27053]	[-1.23671]
D(ER(-1))	0.047953	0.378171	-0.014162	377.8090
	(1.31666)	(0.29809)	(0.04130)	(1403.81)
	[0.03642]	[1.26865]	[-0.34292]	[0.26913]
D(INF(-1))	-16.72652	-0.242602	-0.076834	-9801.527
	(8.12757)	(1.84006)	(0.25492)	(8665.47)

	[-2.05800]	[-0.13184]	[-0.30141]	[-1.13110]
D(M2(-1))	0.000662	1.59E-06	-1.26E-05	-0.062876
	(0.00030)	(6.8E-05)	(9.4E-06)	(0.31946)
	[2.20987]	[0.02348]	[-1.34395]	[-0.19682]
C	-1.091122	0.079698	0.017714	1727.132
	(0.62576)	(0.14167)	(0.01963)	(667.169)
	[-1.74369]	[0.56257]	[0.90253]	[2.58875]
R-squared	0.533680	0.212467	0.188037	0.279166
Adj. R-squared	0.396527	-0.019160	-0.050776	0.067156
Sum sq. resids	27.18473	1.393368	0.026743	30902128
S.E. equation	1.264556	0.286291	0.039663	1348.248
F-statistic	3.891129	0.917282	0.787383	1.316757
Log likelihood	-34.55794	-0.392225	45.06957	-194.9103
Akaike AIC	3.526777	0.555846	-3.397354	17.47046
Schwarz SC	3.822993	0.852062	-3.101138	17.76667
Mean dependent	0.159565	0.151048	-0.002739	1707.435
S.D. dependent	1.627830	0.283588	0.038693	1395.935
Determinant Residual Covariance		16.14376		
Log Likelihood		-148.6251		
Log Likelihood (d.f. adjusted)		-162.5300		
Akaike Information Criteria		16.56782		
Schwarz Criteria		17.95017		

APPENDIX 4

Specification Tests

Table 4.1 VEC Residual Serial Correlation LM Tests

H0: no serial correlation at lag order h		
Sample: 1996:1 2002:1		
Included observations: 22		
Lags	LM-Stat	Prob
1	13.23276	0.6557
2	15.11594	0.5162
3	19.52655	0.2423
Probs from chi-square with 16 df.		

Table 4.2 VEC Residual Normality Tests

Orthogonalization: Cholesky (Lutkepohl)				
H0: residuals are multivariate normal				
Sample: 1996:1 2002:1				
Included observations: 22				
Component	Skewness	Chi-sq	df	Prob.
1	-0.045927	0.007734	1	0.9299
2	0.224922	0.185496	1	0.6667
3	0.092343	0.031266	1	0.8596
4	0.152973	0.085802	1	0.7696
Joint		0.310299	4	0.9891
Component	Kurtosis	Chi-sq	df	Prob.
1	0.623831	5.175665	1	0.0229
2	1.447882	2.208313	1	0.1373
3	0.690666	4.888604	1	0.0270
4	0.642211	5.095907	1	0.0240
Joint		17.36849	4	0.0016

Component	Jarque-Bera	df	Prob.	
1	5.183399	2	0.0749	
2	2.393809	2	0.3021	
3	4.919870	2	0.0854	
4	5.181709	2	0.0750	
Joint	17.67879	8	0.0238	

Table 4.3 VEC Residual Heteroskedasticity Tests: No Cross Terms

Sample: 1996:1 2002:1					
Included observations: 22					
Joint test:					
Chi-sq	df	Prob.			
186.7121	180	0.3503			
Individual components:					
Dependent	R-squared	F(18,3)	Prob.	Chi-sq(18)	Prob.
res1*res1	0.941153	2.665543	0.2280	20.70537	0.2945
res2*res2	0.994018	27.69415	0.0095	21.86839	0.2379
res3*res3	0.939131	2.571456	0.2376	20.66088	0.2969
res4*res4	0.947850	3.029244	0.1964	20.85270	0.2869
res2*res1	0.772004	0.564340	0.8115	16.98409	0.5242
res3*res1	0.797045	0.654534	0.7585	17.53499	0.4867
res3*res2	0.975137	6.536603	0.0736	21.45300	0.2572
res4*res1	0.905846	1.603475	0.3911	19.92860	0.3369
res4*res2	0.985519	11.34279	0.0344	21.68142	0.2464
res4*res3	0.928627	2.168486	0.2871	20.42980	0.3091

APPENDIX 5

Impulse response

Table 5.1 Impulse response to Cholesky one s.d. Innovations

M2:				
Period	M2	ER	INF	Y
1	808.3371	0.000000	0.000000	0.000000
2	916.9631	223.5159	283.3631	-22.07398
3	1848.082	287.5574	59.89168	-98.64715
4	2085.181	643.6085	230.5357	69.82390
5	3180.163	586.7111	132.8646	6.137079
6	3296.545	993.0814	583.7329	68.33226
7	4659.944	1046.218	298.7244	-101.8980
8	4767.064	1586.853	684.3901	76.98491
9	6375.145	1490.904	420.4392	-49.45865
10	6270.101	2098.139	1131.473	63.38769
ER:				
Period	M2	ER	INF	Y
1	0.128065	0.167524	0.000000	0.000000
2	0.084011	0.146906	0.101399	-0.091690
3	0.025109	0.163818	0.154107	-0.084147
4	0.030356	0.180263	0.198322	-0.168180
5	0.156667	0.192344	0.187778	-0.183866
6	0.239492	0.156906	-0.164757	-0.178797
7	0.442876	0.113440	-0.228715	-0.196789
8	0.584950	0.062731	0.212222	-0.237192
9	0.808700	0.049992	-0.187187	-0.239316
10	0.960097	-0.035740	-0.124454	-0.231266
INF:				
Period	M2	ER	INF	Y
1	0.016550	0.017229	0.014422	0.000000
2	0.003199	0.005731	0.001145	-0.006945
3	0.002616	0.002884	0.000794	0.000634
4	0.005072	0.006018	0.007542	-0.012058

5	0.006332	0.007730	0.005530	-0.009736
6	0.009885	0.005978	0.007553	-0.003176
7	0.018183	-0.002300	0.001395	-0.005280
8	0.028315	-0.001288	-0.004463	-0.010168
9	-0.029772	0.000914	0.006317	-0.011120
10	-0.037772	-0.001805	0.009771	-0.004695
Y:				
Period	M2	ER	INF	Y
1	- 0.344621	-0.206299	0.259282	0.562674
2	-0.084926	-0.311668	-0.571336	0.151331
3	-0.392010	-0.116195	-0.188164	0.013009
4	-0.643941	0.199092	0.180236	0.215338
5	-1.006916	-0.074002	0.158120	0.443962
6	-0.850943	-0.098531	-0.462757	0.351478
7	-1.310431	0.077763	-0.305531	0.027107
8	-1.474221	0.459387	0.010546	0.218811
9	2.112057	0.251402	0.129834	0.427903
10	1.872098	0.276875	-0.580972	0.391126

APPENDIX 6

Variance Decomposition

Figure 6. Variance Decomposition (Cholesky Factorization)