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Transmission Mechanism of Monetary Policy in Croatia

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CROATIAN NATIONAL BANK

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1. Introduction

In the last decade Croatia had one of the lowest inflation rates among the transition countries. The key to low inflation rests on nominal exchange rate anchor to euro. The exchange rate, however, is not fixed, but is managed by the Croatian National Bank (CNB). Rather than adopting a general rule, and putting monetary policy on auto-pilot, the CNB has been very active, by relying on a large number of different monetary policy instruments influencing both money supply, required reserve, as well as other direct instruments of monetary policy.

The variety of the applied monetary instruments makes it hard to describe the stance of monetary policy, and further explore the transmission mechanism of monetary policy. The CNB did not lead interest rate based monetary policy, and using policy or market interest rates as indicators of monetary policy is unreliable since they suffer from structural breaks due to problems in the banking sector. Monetary aggregates also include various structural breaks, originating from changes in money demand (remonetisation in the mid 1990's and in 2002 during the euro changeover), while frequent changes in required reserves introduce additional level shifts in the base money series, which must be "removed" if base money is to be used.

Another possible approach would be to use the "narrative approach" popularised by Romer and Romer (1989) and expanded by Boschen and Mills (1991). However, the CNB Council's Press Releases do not contain elements that describe the monetary policy stance, and such indicator would need to be constructed based on intended changes in different monetary policy instruments or CNB's balance sheet items. Similarly, the relative weights for construction of the Monetary Conditions Index (MCI) are hard to determine since there is no reliable macro-model of Croatian economy that could be used for their construction, and there is no significant correlation between interest rates and prices. In addition, in a low inflation environment (achieved through nominal exchange rate targeting), the CNB reacts to non-price developments, notably the sustainability of current account deficit.

To overcome these difficulties, this paper applies a structural VAR model which combines different monetary policy instruments to construct an indicator of monetary policy stance in Croatia. It uses the approach introduced by Bernanke and Mihov (1995, 1998) of isolating monetary policy shocks from overall monetary policy that otherwise reacts to real sector developments. This method is applied by Cuche (2000) to analyse monetary policy in a small open economy framework. The basic idea is to estimate a general VAR that includes both non-policy and policy variables to eliminate elements of monetary policy reaction functions on policy variables, and then combine different policy instruments using a structural model of monetary policy.

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This paper is the first to construct such an indicator of monetary policy for Croatia. The estimated indicator provides a reasonably good explanation of monetary policy developments that broadly corresponds with anecdotal evidence about monetary policy. It is highly correlated with money market interest rates during the last few years. The indicator implies that monetary policy in Croatia is pro-cyclical, probably because of the exchange rate targeting regime. Furthermore, impulse response functions show that monetary tightening (as measured by the indicator) causes a decline in real activity and improvement in the current account deficit. Contrary to expectations, tightening leads to increases in the price level, probably also the result of exchange rate targeting - monetary policy tightens during exchange rate depreciation, which causes increase in prices.

The second part of the paper explores the transmission mechanism of monetary policy in Croatia. This is an area that is largely unknown and has not been analysed empirically. A notable exception is the pass-through from exchange rate to prices, which is considered to be the most important channel of monetary policy. It was analysed by Billmeier and Bonato (2002), and Gattin-Turkalj and Pufnik (2002). They found imperfect and weak pass-through, which points to the possibility of leading a more active monetary policy. However, during the analysed period the exchange rate has been very stable, which makes it difficult for pass-through to take full effect.

The underdeveloped financial markets in Croatia, eurized economy and "direct" monetary policy operations indicate that monetary policy transmission is primarily carried through the exchange rate mechanism (exchange rate channel) and a change in the credit activity (credit channel). Specifically, this paper explores the bank lending channel, which, in a bank-centric financial system, should be the most important channel of monetary policy. The analysis of the bank lending channel has two implications for economic policy. First, the (non-) existence of the bank lending channel would confirm the differences (or similarities) in the functioning of monetary policy in Croatia and the EMU (e.g. Favero, Giavazzi and Flabbi, 1999; Brissimis, Kamberoglou and Simigiannis, 2001; Hernando and Mertinez-Pages, 2001), where analyses show ambiguous results concerning the existence of the bank lending channel. This fact may be an indicator of the European Central Bank's influence on credit supply in Croatia once Croatia becomes a member of the EMU (because the factors through which monetary policy influences credit supply depend on the characteristic of the local financial system). Second, the non-existence of the bank lending channel may warn the monetary authorities against an active role in a situation of the "impossible trinity" (with a modification of the quasi currency board), which assumes passive behaviour of the monetary authorities and putting emphasis on active fiscal policy.

The paper is organised as follows. The second chapter describes the details of monetary policy regime in Croatia, with a detailed look at the monetary policy instruments employed by the central bank. The third chapter constructs an alternative indicator of monetary policy stance using a VAR approach and uses this indicator to produce impulse responses of monetary policy on some of the main macroeconomic aggregates. The fourth chapter explores the bank lending channel of monetary policy by analysing a panel of commercial banks. The final chapter concludes.

2. Monetary policy in Croatia

2.1. The Monetary policy framework

During the last decade, the average yearly inflation in Croatia amounted to 3.9% and core inflation to 3,0%, which was one of the lowest among transition countries. The key to low inflation was nominal exchange rate anchor to euro[2]. The exchange rate anchor was set as one of the main elements of the Stabilisation Programme in 1993. This fixed the prices of tradeables, and immediately ended depreciation (and inflation) expectations.

The reason why the exchange rate stability was pursued even after successful disinflation is a large and prevailing euroization (in all three functions of money) that persists even after a decade of price stability. Domestic currency has assumed the function of the medium of exchange (transactions are mostly conducted in domestic currency). However, domestic currency is only partially used as the unit of measure since many prices are still indexed to foreign currency.[3] Above all, domestic currency is still not used as a store of wealth, and 80% of all savings and time deposits are kept in foreign currency. Thus, in addition to being the nominal anchor for prices and price expectations, the exchange rate stability is also very important for the stability of the financial sector faced with foreign currency liabilities. Commercial banks try to avoid the exchange rate risk by granting domestic loans indexed to foreign currency. Borrowers, however, do not have instruments to insure themselves from the exchange rate risk, so banks are still faced with increased credit risk due to the inherent currency mismatch between lenders and borrowers.

The exchange rate, however, is not fixed. Croatia adopted a managed float regime, that at the same time managed to provide the central bank with necessary credibility,[4] and put some flexibility in the exchange rate that discouraged speculative capital inflows (Vujčić, 2003). This flexibility also ameliorates strong seasonal exchange rate effects on the real economy, due to strong foreign currency inflows during summer tourist season, and allows for some degree of freedom in the conduct of monetary policy.

2.2. A brief overview of the use of monetary policy instruments in Croatia

Before describing individual monetary policy instruments, it is informative to give a brief chronological overview of monetary policy. The attached table showing the main economic indicators and graphs showing developments in economic instruments are given in Appendices 1-3.

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[2] Before the introduction of euro in 1999 the nominal anchor was set to DM. Therefore in this paper exchange rate is constructed as HRK/DEM rate multiplied by the DEM/EUR conversion factor (1,95538) prior to 1999 and HRK/EUR rate afterwards

[3] Price indexation is most common for big-ticket items as prices of real estate and (used) cars. In addition, many catalogues (price-lists) are still printed in euros, and domestic currency value is recalculated by current daily exchange rate.

[4] The value of international reserves of the CNB has during the entire time exceeded the money supply, thus monetary regime resembled currency board. Therefore, this type of monetary regime is referred to as a "quasi currency board" (Vujčić) or "floating with a large lifejacket" (Calvo and Mishkin).

Early 1990's

State formation in the early 1990's was accompanied with the war of independence and heavy economic cost, that included a sharp drop in the output (real output decreased by 36% from 1990 to 1993) and high inflation that reached 35% per month in October 1993. Croatian National Bank became the central bank of Croatia, and Croatian currency was introduced. The CNB abolished direct credits inherited from Yugoslavia, and liberalised interest rates. International reserves were growing rapidly since low economic activity and considerable trade restrictions limited imports.

Post-Stabilisation period (1994-1998)

Current monetary framework of nominal exchange rate targeting was established as a fundamental part of the Stabilisation Programme in the fall of 1993 (fiscal consolidation prior to the launch of the Stabilisation Programme). Nominal exchange rate ceiling was initially set to 4,444 HRK/DEM, but the exchange rate soon appreciated to 3,7 HRK/DEM (and later to 3,5 HRK/DEM) due to increased confidence in domestic currency and large capital inflows that followed. Capital inflows during that period were primarily in the form of the repatriation of domestic savings previously held abroad or outside the banking sector (foreign currency cash) to domestic banking sector after the end of war, successful stabilisation and increasing confidence in the banking sector after its rehabilitation. Very attractive deposit rates, due to bank competition for deposits (financial liberalisation and low requirements resulted in a large number of new banks), also contributed to the repatriation of savings. Monetary policy accommodated capital inflows by purchases of foreign currency in order to prevent appreciation. The created liquidity was sterilised primarily through reserve requirement - by increases in the rate of required reserve, which was then levied only on short-term kuna liabilities. Although the CNB relied primarily on direct instruments for sterilisation of created liquidity, during that period the CNB also started issuing voluntary CNB bills in kuna for managing liquidity. High interest rates offered on voluntary bills were not enough to attract their purchases, so additional obligatory CNB bills in kuna were also issued in order to sterilise the excess liquidity. Although the CNB was oriented primarily to the sterilisation of the excess liquidity, it succeeded to lower (money market) interest rates by reducing interest rates on its bills.

Banking crisis (1998-1999)

The problem of liberalised bank entry and a fast growth of a group of small and medium sized banks surfaced in June 1998 and a total of 14 banks bankrupted, while two were rehabilitated, from 1998 to 2000 (Jankov 2000). The banking crisis was accompanied by recession and resulted in "strong" depreciation pressures in the second half of 1998 and first half of 1999. The CNB intervened heavily to smoothen this depreciation and the exchange rate settled around a new equilibrium of 7,5 HRK/EUR (down from 7,0 before the banking crisis). Inflation did not react to this depreciation, which supports the findings of a weak pass-through[5].

[5] Billmeier and Bonato (2002), and Gattin-Turkalj and Pufnik (2002).

In order to create liquidity drained through sales of foreign currency, the CBN increased credits to commercial banks (both lombard and other credits that serve the lender-of-last-resort function). The CNB continued to issue CNB bills, together with repo operations for managing short-term liquidity. In order to prevent the drainage of foreign reserves, the base for required reserves expanded and included foreign currency liabilities, with required reserves on foreign currency liabilities paid in foreign currency. The CNB bills in foreign currency that could be used for maintaining the required reserve in foreign currency but also as a collateral for drawing CNB's credits (lombard loan) were also introduced. It is important to emphasise that the money market interest rate did not react very much to the banking crisis because of an agreement between unaffected banks for a fixed overnight interest rate ceiling of 10% that lasted until early 2000.

Expansion and euro changeover (2000-2002)

At the beginning of 2000 the Government paid its arrears which were the main cause of then prevalent illiquidity in the economy that clogged the economy and prohibited normal economic development. It jumpstarted the economic growth that has since been fuelled by increases in aggregate demand driven by strong credit growth and big public investments. At the beginning of 2000 the CNB started reducing the required reserve rate. Initially it led to monetary easing, but this led to increase in the excess liquidity increased, so the CNB broadened the base for required reserve. Freed reserves, fuelled by an increase in the purchases of foreign currency by the CNB, led to an increase in excess reserves that were, during that period, sterilised primarily by CNB bills in kuna. In June 2001 the Law on Foreign Exchange was liberalised and enterprises were allowed to purchase and hold foreign currency without restrictions. This, in addition to the response of commercial banks, led to a currency attack in August 2001. The CNB reacted heavily by strong sales of foreign currency, but also by additional sterilisation through further changes in reserve requirement. Since September 2001 a part of reserve requirement levied on liabilities in foreign currency has to be paid in kuna. A special problem for the CNB during this currency attack was that commercial banks were taking lombard loans in kuna in order to purchase foreign currency, which additionally fuelled depreciation pressures.

The attack was not successful. In the following months the exchange rate appreciated due to strong inflows of foreign currency notes (primarily DEM) held by the public due to the introduction of euro notes at the beginning of 2002. For public, depositing in-currency cash, widely held in Croatia, was the cheapest way of converting it into euro notes. Around 3,3 billion euros of in-currency notes were deposited to the banking system, of which 60% remained in banks (Kraft and Šošić, 2003). When banks realised that those deposits would remain, they increased domestic lending to other sectors. The lending boom continued even after the funds based on those deposits were used for lending, and banks started to borrow heavily from abroad to finance a further lending boom. The result of such activity was domestic credit growth of 30% in 2002 with widening current account deficit from 3,7 in 2001 to 8,5% in 2002.

Monetary tightening in 2003

As the result of these developments, the CNB decided to tighten its monetary policy in 2003. Increasing the interest rate was not a viable option since, due to excess liquidity, the CNB relied on passive operations (CNB bills) to mop up excess liquidity (and set domestic interest rate). In addition, the increase in interest rates could also attract additional capital inflows. Instead the CNB relied on different measures. On the one hand, it was announced that commercial banks, which increase their domestic placements more than 16% in 2003, would be penalised with the obligatory purchase of low-yielding CNB bills (in effect, required reserve). In addition the former ratio between claims and obligations in foreign currency was extended and tightened. The idea was to discourage domestic credit growth financed by foreign borrowing.

After CNB bills in kuna reached record levels in March 2003, the CNB decided to discourage their further sales by offering bellow market interest rates. This resulted in a huge increase in excess liquidity, which was mopped up by further increase in kuna part of required reserves levied on foreign liabilities.

In 2004 the penalties for fast growing banks were revoked. Further changes in reserve requirement immobilised a larger part of required reserves. Regular weekly auctions of CNB bills in kuna with the duration of 35 days were terminated and left to the discretion of the CNB, while CNB bills in foreign currency were completely abolished.

2.3. Monetary policy instruments

The use of monetary policy instruments is determined by the exchange rate targeting framework of monetary policy in Croatia. It is important to emphasise that there is no specified path or band for the exchange rate (Lang and Šošić, 2003). Instead the CNB primarily reacts to sudden changes in the exchange rate[6]. This behaviour resulted in a stable exchange rate in the last 10 years[7].

The exchange rate management is conducted mainly through foreign exchange interventions, which are the main instrument of monetary policy. Individual interventions are often unsterilised, which means that they change the stance of monetary policy (overall, however, they are offset by sterilisation). Most interventions (in number and size) were purchases of foreign currency in order to prevent appreciation resulting from large capital inflows.[8] Heavy purchases of foreign currency by the CNB in order to prevent exchange rate appreciation during the last decade caused a large increase in domestic liquidity (liquidity surplus), which has a major effect on the overall conduct and effectiveness of monetary policy in Croatia.

In order to offset monetary effect of interventions, the CNB has been very active in managing domestic liquidity. Due to predominate purchases of the foreign exchange,

[6] The reaction function of the CNB is shown in Appendix 4.

[7] During that period the exchange rate fluctuated in a band of 15% (the maximum was 5,5% above the average of daily exchange rate and minimum 8,8% below in period 1996-2003).

[8] Capital inflows originated from repatriation of domestic savings (remonetisation), privatisation of state enterprises, external borrowing (government, banks and other sectors), and other foreign investments.

the main challenge was to sterilise created liquidity. Although high liquidity might not, in the short term, have negative effect on real economy (particularly prices), there is a danger that it could trigger domestic credit growth and influence prices in the medium and long term.[9] Liquidity surplus also decreases the effectiveness of monetary policy since it makes it hard and expensive to use interest rate based monetary instruments. Instead of setting a short term interest rate through active money creation (repo), the CNB can only set a short term interest rate on its liability side by selling its deposits (short term bills). In addition to being both less effective and more expensive, such a behaviour can be counterproductive since it might encourage additional speculative capital inflows and further appreciation pressures (Vujčić, 2003).

During the last decade the CBN used a variety of instruments for managing domestic liquidity. The main money sterilisation instrument is the reserve requirement. There has been a number of changes in both the rate and the base (scope) of reserve requirement. The complexity of the current calculation of the reserve requirement is an informative indicator of the changes that took place in the development of this instrument.[10] Although the CNB is determined to gradually decrease the reserve requirement (the rate is currently 19%) in order to make domestic banks more competitive to foreign banks after the EU accession, it has often relied on this instrument for monetary tightening.

The CNB was also managing domestic liquidity with market-based instruments, short-term CNB bills in kuna. They became the most important sterilisation instrument in the period 2000-2003. Due to strong purchases of foreign currency during the euro changeover and corresponding sterilisation, the amount of the outstanding CNB bills in kuna reached 1/4 of M0 in early 2003, and the CNB decided to replace them with the increase in required reserve in kuna in the second half of 2003.

After some money creation primarily through the CNB's loans to commercial banks during the banking crisis in 1998 and 1999, liquidity improved and there has been little further need for additional money creation. The CNB stopped using repos and

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[9] Actually, the increase in credits and domestic consumption during the last years did not have an immediate impact on the prices (thus no relation between interest rates and prices). The reason was that a large proportion of domestic consumption is of the foreign origin (imports). Thus, increase in aggregate demand in short term leads to increase in imports, i.e. current account deficit, which threatens the long run external sustainability.

[10] Currently there is the reserve requirement in both domestic and foreign currency. The reserve base is divided by the currency of commercial banks' liabilities. Deposits and credits received in domestic currency make the domestic currency reserve base, while deposits and credits received in foreign currency make the foreign currency reserve base. The required reserve rate is the same for both required reserve in domestic and foreign currency and currently amounts to 19%. The required reserve levied on domestic currency base is deposited in domestic currency. The required reserve on the foreign currency reserve base is divided in two parts – one part has to be deposited in domestic currency (42%) and the rest is deposited in foreign currency (58%). The formula is:

RRk = 19% * RBk + 42% * 19% * RBfc

RRfc = (1-42%) * 19% + RBfc

Where RR stands for required reser

ve and RB for reserve base. Subscript *k* denotes kuna (domestic currency) and *fc* (foreign currency). Current required reserve rate is 19% and the kuna part of the required reserve levied on the foreign currency liabilities is 42%.

currency swaps in 2000's, while banks significantly reduced the use of CNB credits (now only standing facilities (lombard) are used).

In addition to the monetary instruments directed to managing domestic liquidity, the CNB also used other measures. Due to systemic currency mismatch, the CNB requires banks to hold foreign exchange liquidity above the reserve requirement. This measure is called the minimal foreign exchange liquidity and is defined as a required ratio of liquid short-term assets in foreign currency to the total liabilities in foreign currency. The current rate of the minimal foreign exchange liquidity requirement is 35%.[11] In 2003 a direct credit control measure was temporarily applied after domestic credits grew 30% in 2002. This measure penalised commercial banks that achieved the credit growth above 16% in 2003, by requiring them to purchase low yielding CNB bills (in effect an additional reserve requirement).

2.4. Excess reserves - an intermediate indicator of monetary policy in Croatia

The variety of different monetary instruments the CNB used during the last ten years requires their simultaneous assessment in the analysis of monetary policy. Since most measures were directed to the domestic liquidity management (base money), they can be combined. As shown bellow, these measures have influenced both money supply and money demand, which caused shocks in the base money. In order to use the base money as a policy variable, it needs to be adjusted for the changes in reserve requirement, which were very common during the last decade. Otherwise the growth of the base money that results from the increase in required reserve could be interpreted as monetary easing, while the opposite is true.

It is important to emphasise that the CNB did not lead interest rates based monetary policy. Its open market instruments (CNB bills) were sold on Dutch-style auctions where banks offered both quantity and price (interest rate). The CNB was deciding what to accept primarily based on quantities, although the price (interest rate) was also considered. The interest rates on CNB bills in kuna became an unreliable indicator of monetary policy in 2003 since their price was lower than money market interest rate in order to reduce amount outstanding. The series ceased to exist after September 2003[12].

The lack of policy interest rate series could be circumvented by another interest rate series that reflects monetary policy stance, i.e. money market interest rate. However, this series also reflects the changing structure (and problems) of Croatian banking sector. Rehabilitation of four large banks brought a sharp drop in the series in mid-1996. The banking crisis in 1998, when a group of small and medium banks were liquidated, prompted the unaffected banks (and central banks) to make provisions to fix the overnight money market interest rate, so it remained flat at level of 10% for almost two years. This lasted until early 2000 after which the interest rate declined

[11] There have also been changes in the rate and base for the application of this measure taking place in the beginning of 2003. The existing instrument of required ratio of short term assets in foreign currency to short term liabilities was changed so that the base was extended from short term liabilities in foreign currency was extended to include all liabilities in foreign currency, while the rate was lowered from 53% to 35%.

[12] Since September 2003, the CNBbills in kuna were sold on two (irregular) auctions in April 2004.

significantly as the result of improvement in banks' efficiency after privatisation and entry of foreign banks, as well as more expansive monetary policy. Graph 1 shows a downward trend in money market interest rate from 1995 to 2002 which does not truly reflect monetary easing. This series, however, is better in explaining monetary policy after mid-2000.

Instead, the CNB has often relied on excess reserves as an intermediate indicator of monetary policy. It includes most of monetary instruments used by the CNB, with the exception of the minimal foreign liquidity requirement and credit ceilings in 2003. The connection of excess liquidity and other monetary policy instruments is explained in the following model. The model is built on the concept of demand (Rd) and supply (Rs) of commercial banks' reserves at the CNB:

(1) $Rd = RR(rr,RB) + ER$

(2) $\Delta Rd = \Delta RR + \Delta ER = rr^* \Delta RB + RB^* \Delta rr + \Delta ER$

The demand for reserves (Rd) is equal to required reserves (RR) and excess reserves (ER). In a developed financial system, such as in the Eurozone, with well-functioning marginal facilities, the preferred excess reserves are zero. However, if there is a shallow and inefficient money market and standing facilities are non-existent or expensive, commercial banks may prefer to hold positive excess reserves ($ERp>0$). The (preferred) excess reserve can be modelled as a function of the cost of the use of credit facility (difference between interest rate on credit facility and money market interest rate). Thus, the excess reserves are closely linked to the (money market) interest rate, which is reflected in a negative correlation between these two series (-0,36).[13]

Monetary policy can influence the demand for reserves through the change in the rate of required reserves and the change in the scope of the reserve base (application of the reserve requirement). During the last decade a number of changes in both rate and scope of required reserves have been implemented in Croatia.

The supply of the reserves (Rs) is the difference between the base money (M0) and autonomous factors (Af - cash in circulation and government deposits):

(3) $Rs = M0 - Af$

(4) $\Delta Rs = -\Delta Af + \Delta NFAcb + \Delta NDAcb$
$= -\Delta Af + INTb + INTg + \Delta CR + \Delta OMO$

The change in the supply of the reserves is the sum of the (negative) change in autonomous factors, the change in the foreign assets of the central bank and the change in the net domestic assets of the central banks. The change in the net foreign assets (NFA) is equal to the amount of foreign exchange interventions (both transactions with commercial banks INTb and government INTg). The change in net domestic assets (NDA) is the sum of the change of CNB's credits to commercial banks (credit facility) and open market operations. OMO includes both rarely used

[13] Even if the central bank targets the excess reserves rather than interest rate, change of the excess reserves influences the money market interest rate: $i_{mm} = i_{cf} - ER^{-1}(ER)$, where i_{mm} is money market interest rate, i_{cf} is credit facility and ER^{-1} is an inverse of excess reserves function $ER = ER(i_{cf} - i_{mm})$. Increase in excess reserves, other things held constant, decreases the money market interest rate.

money creating open market operations (repo), and widely used money destructing monetary operations (CNBbills in kuna), which enter with a negative sign.

Combining the demand (1) and supply (3) of the reserves, the excess reserves are equal to the difference between base money, required reserves and autonomous factors:

(5) $Rs = Rd$
(6) $ER = M0 – RR – Af$

The change in excess reserves are therefore influenced both by changes in the supply and demand of the reserves, both of which the CNB is influencing with its monetary policy instruments:

(7) $\Delta ER = - \Delta Af + \Delta NFAcb + \Delta NDAcb - \Delta RR$
(8) $\Delta ER = - \Delta Af + INTb + INTg + \Delta CR + \Delta OMO - rr^* \Delta RB - RB^* \Delta rr$

Excess reserves are a function of interventions, open market operations, reserve requirement and autonomous factors (signs of coefficient are given in parentheses):

(9) $ER = f$ (INT (+), OMO (+), CR (+), RR (-), Af(-))

The purchase of foreign currency results in the increase of excess reserves, i.e. monetary easing. Money creation through open market operations (or the decrease of outstanding CNB bills) and the CNB's credits also leads to monetary easing, and an increase of the required reserves leads to monetary tightening.

This definition of excess reserves is consistent with reserve targeting, but is adapted to include monetary instruments influencing both money supply and money demand. Indeed, it is an interesting measure since it combines the intention of the policymaker in the sense that its increase corresponds with monetary easing and its decrease with monetary tightening.

3. Constructing the indicator of monetary policy stance for Croatia

The aim of this chapter is to construct the indicator of monetary policy stance in Croatia. Although the previous chapter argues that excess reserves is a possible candidate for the measure of monetary policy, it has serious shortcomings; the optimal excess liquidity is zero (or small) and oscillations of liquidity only reflect the fact that the CNB does not fully sterilise the effects of foreign exchange interventions. Thus, even a short glance at the graph of excess liquidity shows that it does not represent a good measure of monetary policy stance. Similarly, money market interest rate has been a meaningful measure only from 2000, after the problems in Croatian banking sector have been solved.

Therefore, in order to analyse monetary policy in Croatia, it is important to construct an alternative indicator of monetary policy stance, which should combine different instruments of monetary policy. A popular candidate for a small open economy is the Monetary Conditions Index (MCI), weighted average of deviations in exchange rate and interest rate, popularised by the Bank of Canada. However, it is hard to determine the weights in case of Croatia (weights are based on relative influence of interest rate and exchange rate on real economy and prices), since there is no macromodel of Croatian economy that could be used to construct the weights. Similarly, available analyses show a weak pass-through of exchange rate on prices, but no significant correlation between interest rates and prices. The inability to find those relations probably results from short data series that include many structural breaks. Furthermore, in the low inflation environment (achieved through nominal exchange rate targeting), the CNB reacts to non-price developments, notably the sustainability of current account deficit. Therefore, the MCI[14] that describes monetary tightening as an increase in the interest rate and/or exchange rate appreciation might not be an optimal indicator for exchange rate targeting monetary framework.[15]

Another possible approach would be to use the "narrative approach" popularised by Romer and Romer (1989). They read the minutes of the Federal Open Market Committee to determine the starting dates of monetary policy tightening. Boschen and Mills (1991) adopted the same approach and constructed a continuous narrative-based measure of monetary policy stance in the US. However, the CNB Council's press releases do not contain elements that describe the monetary policy stance. Instead, it would be possible to account for changes in different monetary policy instruments or CNB's balance sheet items and construct an instrument based on them. However, it is hard to differentiate between substitutability between different instruments, and to exclude elements of policy reaction function. On the other hand, the measure of excess reserves combines different instruments in a meaningful way.

Instead, the indicator of monetary policy stance in Croatia is constructed by using a structural VAR model which combines different monetary policy instruments. This approach introduced by Bernanke and Mihov (1995,1998), has become a standard approach of isolating monetary policy shocks from the overall monetary policy that otherwise reacts to real sector developments. A similar approach was applied by

[14] There are many other shortcomings of the MCI as described by Eike, Ericsson and Nymoen (2001). It is susceptible to Lucas critique since it assumes a constant economic structure, so it is dangerous to use it as the intermediate monetary policy target.
[15] Calibration can be used to determine the weights of the MCI indicator for Croatia.

Clarida and Gertler (1997) in their analysis of Bundesbank's monetary policy. Cuche (2000) applied these two papers to a small open economy in his analysis of monetary policy in Switzerland.

The basic idea is, by estimating a general VAR that includes both non-policy and policy variables, to eliminate elements of monetary policy reaction functions on policy variables. More specifically, the residuals from such VAR are cleaned from dynamics that originates from the central bank reaction function and represent true monetary policy innovations. However, these residuals contain interdependence between different monetary policy instruments, which needs to be solved by a structural model of monetary policy in order to extract true monetary policy stance i.e. unanticipated monetary policy.

In addition to constructing an alternative indicator of monetary policy, Bernanke and Mihov also test different hypotheses of monetary policy framework in the USA (federal funds rate targeting, non-borrowed reserves targeting, borrowed reserves targeting), that were used in other papers as a measure of monetary policy. Similarly, Cuche tests whether the Swiss National Bank is targeting bank reserves, interest rate or exchange rate. This paper conducts only a part of their exercise - it constructs the indicator of monetary policy stance assuming that the CNB targets nominal exchange rate - while testing monetary policy regime is left for extensions of the paper.

There are good reasons why the hypothesis about monetary framework in Croatia has not been tested. The main problem is a short data series that contains 7 years of data[16]. Including more than two policy variables, which is necessary for testing the monetary policy framework, dramatically decreases the number of degrees of freedom. Thus, rather than building the monetary policy model around supply and demand for bank reserves as in Bernanke and Mihov, and Cuche (in order to isolate supply shocks, that reflect true monetary policy, from demand shocks that do not), they are combined into a single measure of excess liquidity. This is in line with the CNB's policy, which influenced both demand and supply of reserves, as described in the previous chapter.[17] Thus, the main monetary policy variables are the nominal exchange rate and the excess liquidity. In the calculation of the indicator, we check for some stylised facts about the monetary transmission mechanism in Croatia by reporting the results of the VAR, as well as estimate the relationship between the calculated indicator and real sector variables.[18]

Following Bernanke and Mihov, the first step is to estimate the following VAR:

$$(10) \qquad Y_t = \sum_{i=0}^{k} B_i Y_{t-i} + \sum_{i=0}^{k} C_i P_{t-i} + A^y v_t^y$$

$$P_t = \sum_{i=0}^{k} D_i Y_{t-i} + \sum_{i=0}^{k} G_i P_{t-i} + A^p v_t^p$$

[16] More extensive discussion of the data problems is given later.
[17] However, it might be possible to exclude the impacts of the autonomous factors from the inovations in monetary policy.
[18] We hope that this indicator will be used in further research of the transmission mechanism – notably the credit channel of the monetary policy.

Y_t is a vector of macroeconomic (non-policy) variables and P_t is a vector of policy variables. This can be rewritten as ordinary VAR, introducing restriction that monetary policy does not immediately influence non-policy variables ($C_0 = 0$).

$$(11) \qquad Y_t = \sum_{i=0}^{k} B_i Y_{t-i} + \sum_{i=1}^{k} C_i P_{t-i} + A^y v_t^y$$

$$P_t = \sum_{i=0}^{k} D_i Y_{t-i} + \sum_{i=0}^{k} G_i P_{t-i} + A^p v_t^p$$

Non-policy and policy variables are orthogonal by construction, i.e.

$$(12) \qquad A = \begin{bmatrix} A^Y & 0 \\ 0 & A^P \end{bmatrix}$$

As noted by Cuche, Bernanke-Mihov and Clarida-Gertler approaches differ in the treatment of the VAR residuals. Clarida and Gertler use the first step residuals and build restrictions on them. Bernanke and Mihov first construct the second set of residuals in the policy block that is orthogonal to the VAR residuals in monetary policy block by (13). However, as reported by Cuche, the non-orthogonalised and orthogonalised are very similar.

$$(13) \qquad u_t^p = (I - G_0)^{-1} A^p v_t^p$$

In order to retrieve true monetary policy shocks v^s, it is necessary to model the relationship between different monetary instruments. Bernanke and Mihov do this by modelling the market for bank reserves by distinguishing between borrowed and non-borrowed reserves. Cuche applies their analysis for small open economy models demand and supply for reserves, as well as exchange rate.

$$(14) \qquad u_s^{mon} = u_d^{mon}$$

$$(15) \qquad u_s^{mon} = \lambda v^d + \phi v^x + v^s$$

$$(16) \qquad u_d^{mon} = \rho u^i + v^d$$

$$(17) \qquad u^x = \delta u^i + v^x$$

Money supply (15) is a function of demand shock and exchange rate shock, as well as true money supply shock (true monetary policy shock). Money demand (16) is a function of interest rates, i.e. the opportunity cost of holding money, and demand shock. Exchange rate (17) is also a function of interest rate (interest rate parity) and exchange rate shock.

This system can be solved by the GMM estimator. There are 6 variables and 7 unknowns, so one additional restriction is needed. By setting different restrictions and over-identifying the system in order to model different monetary policy frameworks, it is possible to test which restriction (policy framework) is best explained in data.[19]

[19] For example, exchange rate targeting restrictions are that $\lambda=1$ and $\phi = \rho/\delta$ (two restrictions means that the model is overidentified and can be tested). Those restrictions mean that the central bank

Due to short data series and relatively stable (or too unstable) monetary policy instruments, a simpler model was used for Croatia, consisting of only two different monetary instruments: exchange rate and excess liquidity. This means that supply and demand shocks are combined, which is in line with the conduct of monetary policy in Croatia:

(18) $u^x = v^x$

(19) $u^l = \phi u^x + v^s$

Exchange rate u^x is a function of the exchange rate shock (18). Monetary policy variable u^l (excess liquidity or money interest rate) is a function of shock in exchange rate v^x (monetary policy reacts to changes in exchange rate, i.e. exchange rate targeting) and unanticipated shock in monetary policy v^s (19). This system of equations can be solved by using the GMM method. It is just-identified; there are three known variables: variances and covariance of u^x and u^l; and three unknown variables: variances of v^x and v^s (their covariance by construction equals zero) and reaction parameter ϕ.

The true monetary policy shock v^s is constructed from equation (19). Finally, the indicator of (unanticipated) monetary policy stance is constructed by summing up previous unanticipated monetary policy shocks v^s:[20]

(20) $$MP_t = \sum_{i=0}^{t} v_{t-i}^s$$

3.1. Data description

Data problems are the biggest obstacle for econometric research in Croatia. As in other transition countries, most of the series are very short and contain many structural breaks which makes it hard to apply advanced statistical techniques (see Erjavec, 2004). Thus, a lot of the existing research of monetary policy relies on narrative analysis facilitated by basic techniques better suited for analysing Croatian data.

The length of the estimated VAR in this paper is determined by the quarterly GDP series (y), which is available from 1997. In order to have enough degrees of freedom, quarterly GDP data is interpolated to monthly frequency using industrial production series (Bernanke, Gertler and Watson, 1998). This approach differs from earlier monetary VARs estimated for Croatia (Erjavec-Cota (1999, 2003), Cziraky and Gillman, (xxxx) where real activity is estimated with longer available industrial production series. However, in addition to industrial production, the dynamics of GDP also includes, for monetary policy very important, tourism (and retail) sector, which generates a large seasonal inflow of foreign currency and influences exchange rate that triggers monetary policy reaction. It might be possible to extend the GDP series backward with some composite series (plus interpolation of yearly data), but it would

accommodates money demand shocks and partially offsets exchange rate shocks. It results that $v^s = \rho/\delta\, u^x$.

[20] MP at the end of the period by construction equals 0 (sum of residuals equals yero)

introduce additional noise in the model. It is also important to emphasise the existence of large shocks in the first half of the 1990's. Those were the war for independence with main military activities taking place in 1991-1992, but with the last military operation in summer of 1995; and Stabilisation Programme in late 1993 that ended hyperinflation. It is worth to note that there was a recession in 1998-99. The GDP series is integrated of order 1.

Core inflation (p) is used as the price variable in order to control for an increase of administered prices that had major effect on the overall price dynamics in the low inflation environment. Consumer prices are available from 2000 and GDP deflator is not very reliable due to problems in its construction. As pointed out earlier, the rate of inflation was very low during the entire period under investigation, with some inflation occurring in 2000. The price series is integrated of order 1.

The third non-policy variable is the external imbalance, described by the current account (ca). Although it is largely included in the real GDP series (trade in goods and services, but not other items), it is highly relevant for monetary policy in Croatia, and it is prudent to include it as a separate series. Current account is constructed as a ratio of (seasonally adjusted) current account balance and nominal GDP, and is interpolated to monthly frequency by the series of net payments abroad, which is used for the construction of the balance of payments statistics. The current account series is stationary and well-behaved.

The exchange rate variable (e) is the average monthly nominal exchange rate HRK/EUR (before 1999 HRK/DEM adjusted for DEM/EUR conversion factor). This variable does not pass unit root test for stationary due to level shift in 1998 during the banking crisis. In order to control for this shift, the exchange rate series was modified by adjusting the mean of the series before September 1998 for the mean of the series afterwards.[21] Such adjusted exchange rate series is well-behaved and stationary. (Note that increase in exchange rate describe depreciation).

In line with the discussion in the first section of the paper, the excess liquidity/ reserves (l) is used for modelling monetary policy of the CNB. It is expressed as the ratio of excess reserves to required reserves (monthly averages). The variable is well-behaved and stationary.

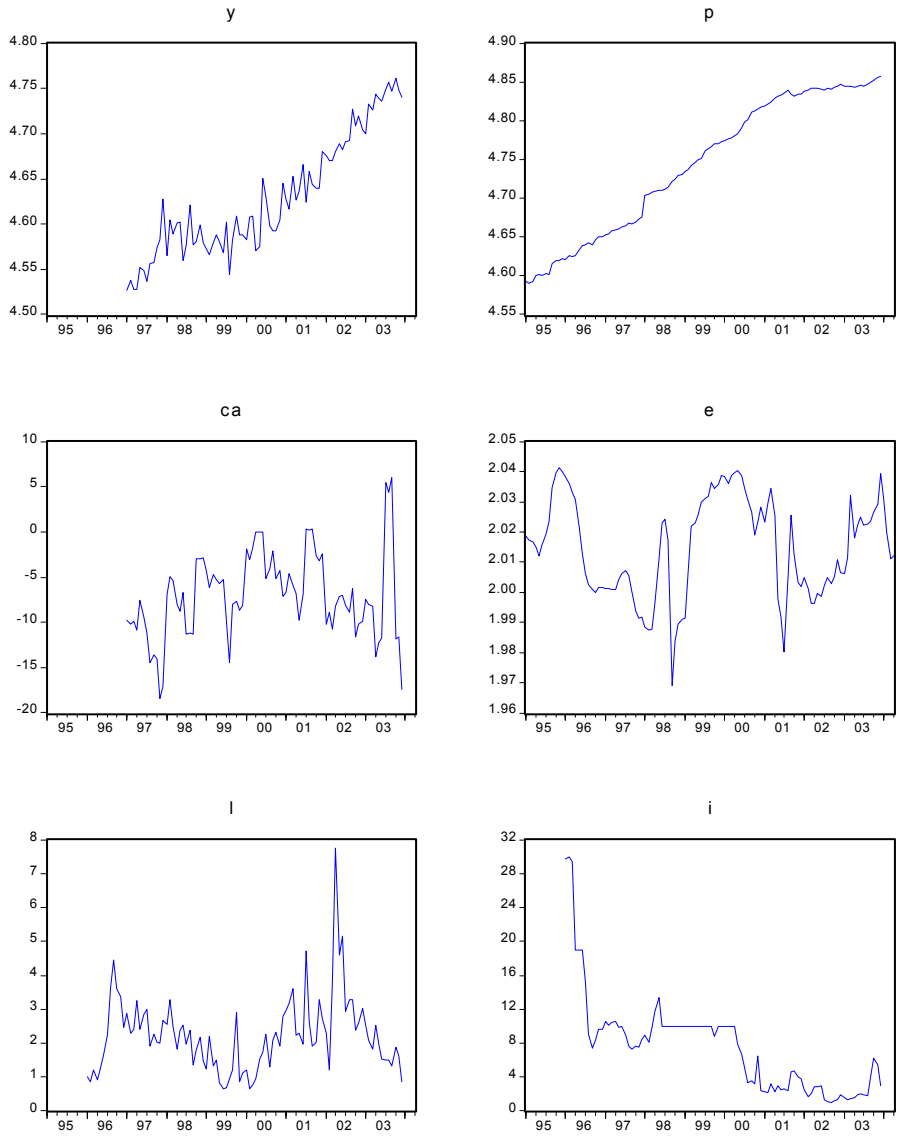
In order to check for the robustness of the results, money market interest rate (i) is also used as an alternative monetary policy variable. It shows strong downward trend that is due to gradual rehabilitation of the banking sector. However, it is not readjusted (for trend component) .

All variables are seasonally adjusted (including the exchange rate[22]). GDP, prices, and the exchange rate are in logs, while the ratio of the current account, excess liquidity and money market interest rates are in percentage points. In order to have stationary

[21] Chow test for structural break applied on simple AR model of exchange rate isolates September 1998 as the most likely candidate for the structural break in the series.
[22] There is a seasonality in nominal exchange rate dynamics due to strong tourism (inflows of foreign currency) and shallow and underdeveloped financial sector that is not exploiting the arbitrage possibilities

series, the first differences of real activity and prices are used[23]. Unit root tests are given in the appendix.

Graph 1: Data description



3.2. Estimation

As described above, the first step was to estimate a VAR in form (11). Non-policy variables are changes in real GDP (Δy), changes in prices (Δp), and the ratio of current account to GDP (ca). Policy variables are exchange rate (e) and excess liquidity (l). Two lags are chosen in order to get more dynamics, although Schwarz information criterion points to only one lag. The estimated VAR is:

[23] Using log levels of GDP and prices, like Bernanke and Mihov, gives similar results which are reported in the appendix.

(21)
$$\Delta y_t = a_1 + \sum_{i=1}^{2} b_{1i}\Delta y_{t-i} + \sum_{i=1}^{2} c_{1i}\Delta p_{t-i} + \sum_{i=1}^{2} d_{1i} ca_{t-i} + \sum_{i=1}^{2} g_{1i} e_{t-i} + \sum_{i=1}^{2} h_{1i} l_{t-i} + r_{1t}$$

$$\Delta p_t = a_2 + \sum_{i=1}^{2} b_{2i}\Delta y_{t-i} + \sum_{i=1}^{2} c_{2i}\Delta p_{t-i} + \sum_{i=1}^{2} d_{2i} ca_{t-i} + \sum_{i=1}^{2} g_{2i} e_{t-i} + \sum_{i=1}^{2} h_{2i} l_{t-i} + r_{2t}$$

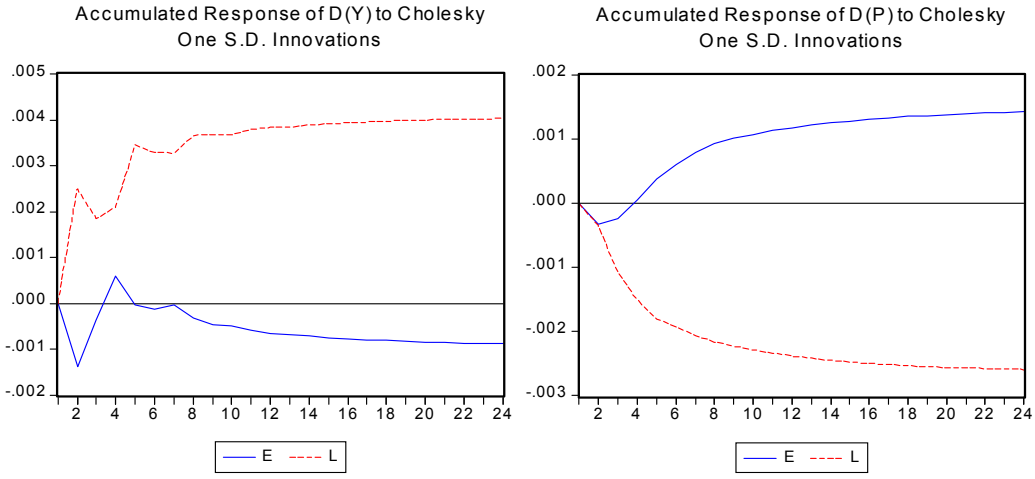
$$ca_t = a_3 + \sum_{i=1}^{2} b_{3i}\Delta y_{t-i} + \sum_{i=1}^{2} c_{3i}\Delta p_{t-i} + \sum_{i=1}^{2} d_{3i} ca_{t-i} + \sum_{i=1}^{2} g_{3i} e_{t-i} + \sum_{i=1}^{2} h_{3i} l_{t-i} + r_{3t}$$

$$e_t = a_4 + \sum_{i=1}^{2} b_{4i}\Delta y_{t-i} + \sum_{i=1}^{2} c_{4i}\Delta p_{t-i} + \sum_{i=1}^{2} d_{4i} ca_{t-i} + \sum_{i=1}^{2} g_{4i} e_{t-i} + \sum_{i=1}^{2} h_{4i} l_{t-i} + r_{4t}$$

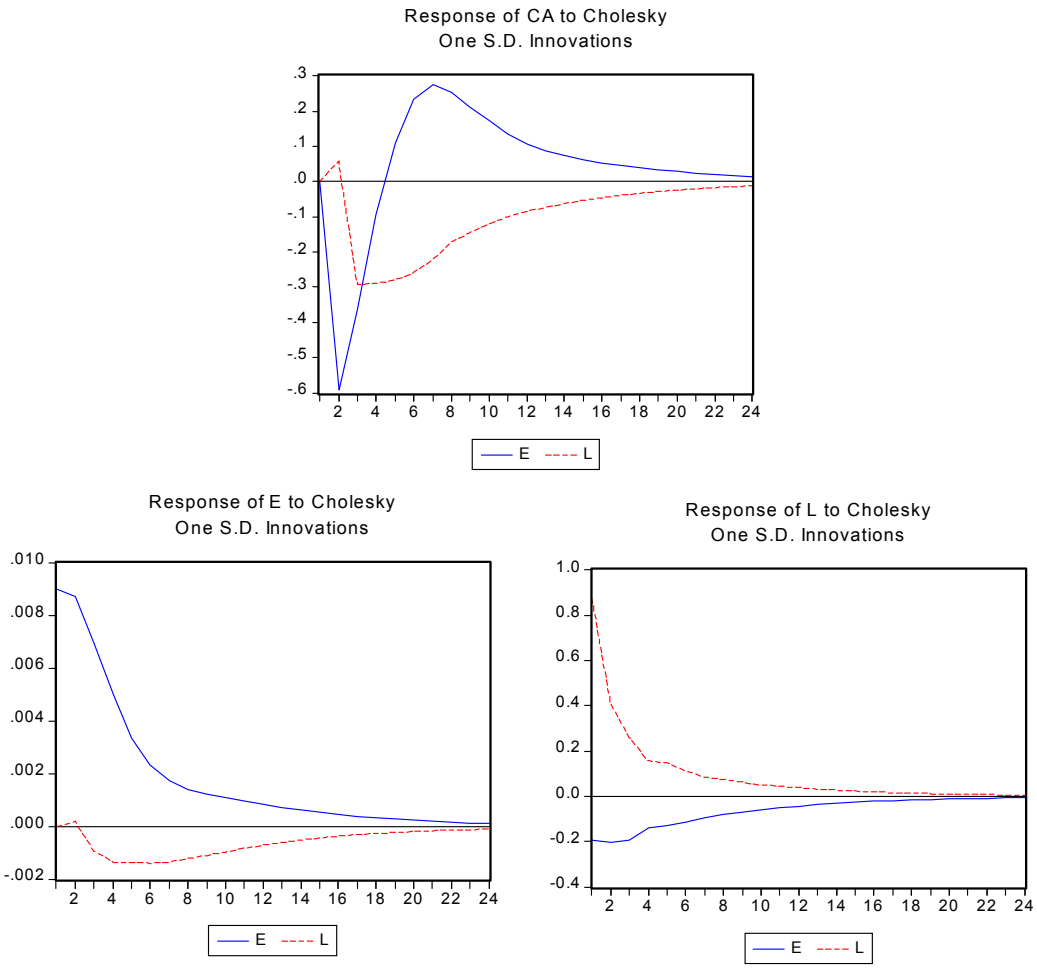
$$l_t = a_5 + \sum_{i=1}^{2} b_{5i}\Delta y_{t-i} + \sum_{i=1}^{2} c_{5i}\Delta p_{t-i} + \sum_{i=1}^{2} d_{5i} ca_{t-i} + \sum_{i=1}^{2} g_{5i} e_{t-i} + \sum_{i=1}^{2} h_{5i} l_{t-i} + r_{5t}$$

Although the purpose of this VAR is to retrieve the residuals free of monetary policy reaction, it is interesting to observe some of the results, i.e. impulse response functions. Impulse responses in the changes of GDP and prices are shown below (due to first difference of GDP and prices, effects of shocks are accumulated for those variables).[24]

Graph 2: Var 1 impulse responses of shock in monetary policy



[24] Results from similar VAR run in levels (approach used by Bernanke and Mihov) are shown in the appendix and are similar to those from first differences.



The results suggest that monetary policy variables have no significant impact on real activity. Excluding large confidence bands, results however show that the increase in liquidity positively influences GDP, which is comparable with the usual result that a decrease in interest rates stimulates growth. Depreciation, on the other hand, negatively influences GDP, which can probably be explained by a decrease in disposable income (increased kuna value of loan repayment because of currency clause in loan contracts) and a weak response of exports to the exchange rate.

The reaction of prices to depreciation, although not significant, points to the existence of pass-through. Croatian data also show a familiar "price puzzle" i.e. depreciation first causes a decline in prices, to be followed with an increase in prices.

Very interesting is the response of the current account to the exchange rate shock and liquidity shock. The graph shows that the positive effect of the exchange rate depreciation on the current account takes 4-5 months, and is preceded by a negative effect. These numbers, however, are not significant. An increase in liquidity, on the other hand, has a negative effect on the current account i.e. increases the deficit, which is probably caused by the credit channel and an increase in imports.

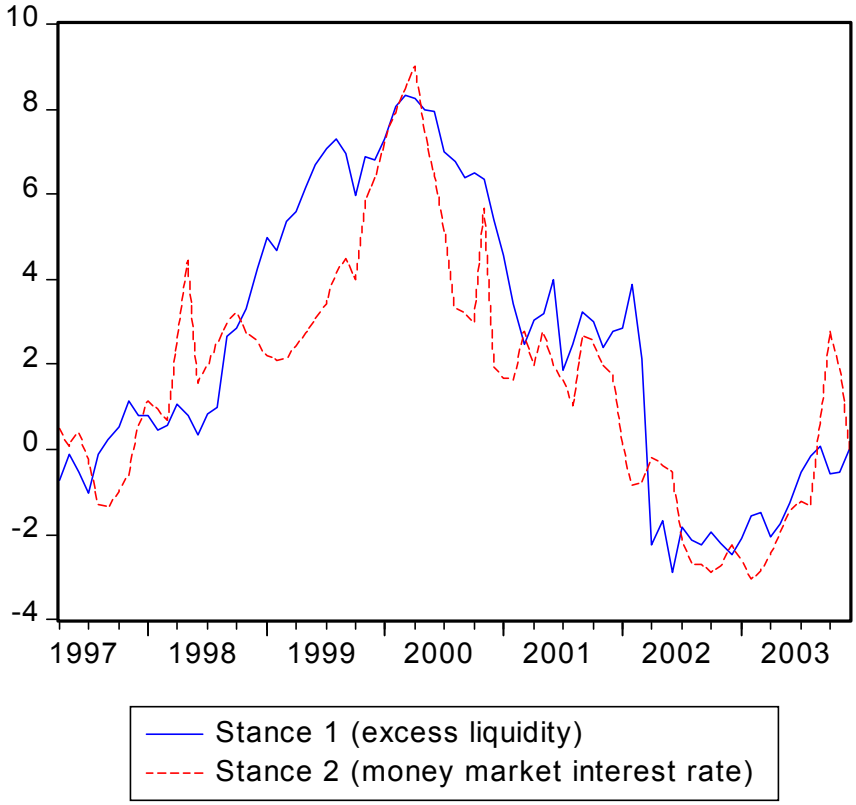
The exchange rate does not react much to the liquidity shocks, probably because of policy response. Liquidity, on the other, hand, decreases after depreciation, which is the result of reaction function of the CNB - unsterilised foreign exchange intervention

reaction to exchange rate change. These results are in line with the exchange rate targeting and support the chosen structure of the model (18) - (19).

Step2: Calculating the indicator of monetary policy

Finally, monetary policy indicator is calculated by summing up all (autonomous) shocks of monetary policy v^s. The indicator of monetary policy stance is shown in graph x (an increase in the indicator describes the tightening of monetary policy). Two measures are constructed in order to check for robustness: one using excess liquidity (Stance 1) and another using money market interest rate (Stance 2). These two indicators are very similar (correlation coefficient -0,86).

Graph 3: Indicator of monetary policy stance in Croatia (increase in the indicator represents monetary tightening)

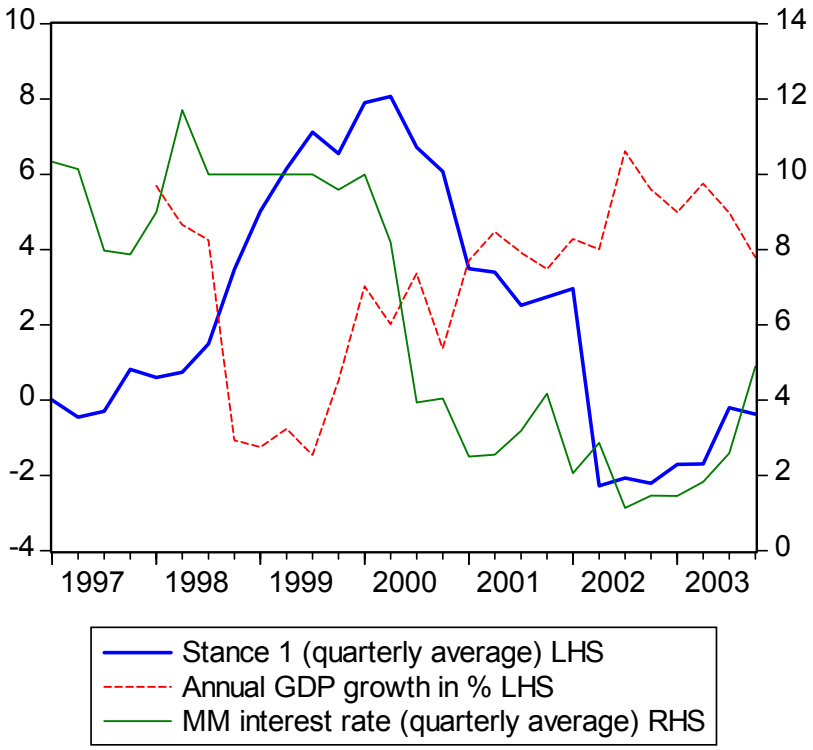


Constructed indicators of monetary policy stance show that monetary tightening started after the banking crisis in mid-1998 and reached its maximum in early 2000. It was followed by a sharp monetary easing that lasted until (end) 2002. Very interesting is that the indicator shows tightening from the beginning of 2003. This is in line with the CNB management's announcements at that time. It is worth mentioning that administrative measures to control credit growth applied in 2003 were not included in the construction of this indicator.

Such dynamics of monetary policy stance supports the hypothesis that monetary policy in Croatia is pro-cyclical; it tightens during recession and eases during expansion. Such pro-cyclical monetary policy is the general characteristic of the

exchange rate targeting monetary regimes. The correlation coefficient of the GDP growth and the indicator of monetary policy is -0,72. This indicator is also highly correlated with money market interest rates, especially since the beginning of 2000 with correlation coefficient 0,70, which suggests that money market interest rates well resemble monetary policy during the last few years.

Graph 4: Correlation between indicator of monetary policy stance, real activity and money market interest rate



Finally, it is possible to observe impulse response functions of the indicator of monetary policy to real sector variables. Monetary policy tightening has a temporary negative effect on aggregate growth, which would support the idea that monetary policy might be used for counter-cyclical adjustment.

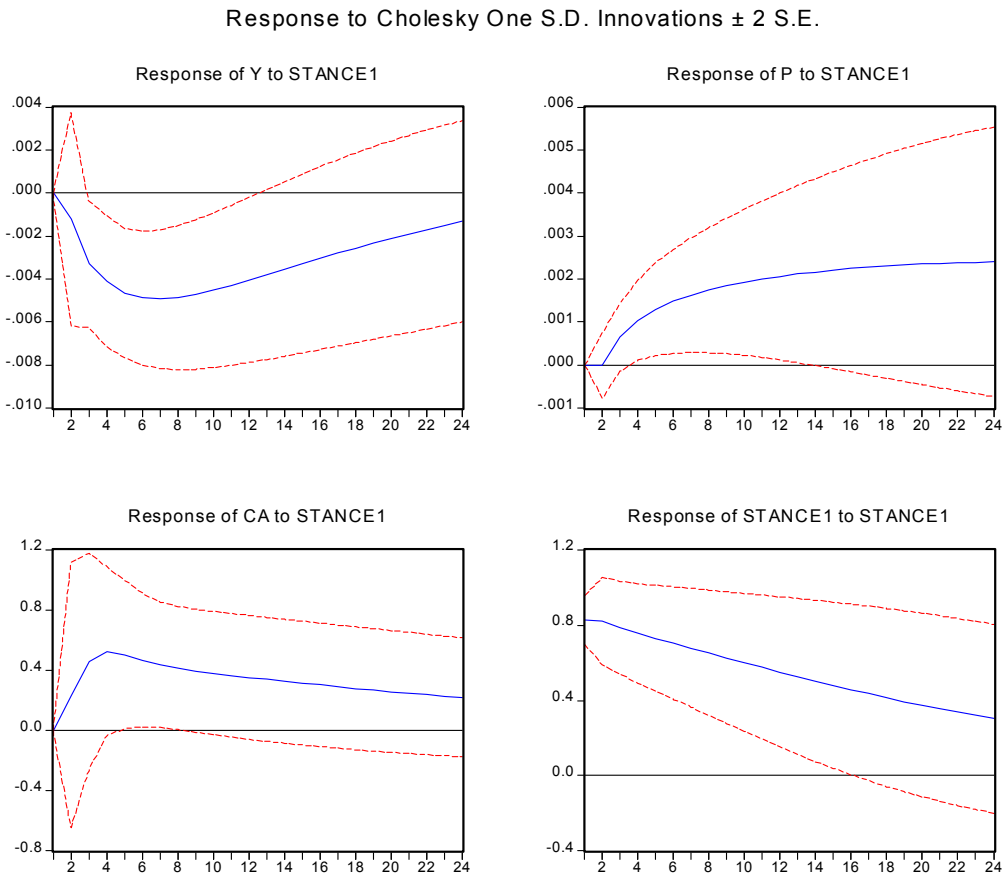
Monetary policy tightening, however, seems to have a permanent positive effect on prices. This counterintuitive result is the direct outcome of exchange rate targeting. In order to prevent appreciation pressures, the CNB intervenes by purchasing foreign currency, creating liquidity in this process i.e. by monetary easing. Similarly, during depreciation pressures the CNB sells foreign currency and decreases the banks' liquidity, i.e. monetary tightening. Thus the exchange rate movement is negatively correlated with excess liquidity and monetary policy stance[25], so the correlation between monetary tightening and an increase in prices is also positive.

[25] For such treatment of the exchange rate, this indicator of monetary policy is very different from the MCI, which does not exhibits major changes in monetary policy during the same period (appendix?).

Monetary policy tightening improves the current account, which corresponds to the result reported by Stučka (2003) that exchange rate depreciation increases net exports. However, it is not clear whether the improvement in CAD is the result of an increase in exports, due to exchange rate depreciation (not likely), or a decrease in imports, due both to the credit channel and exchange rate appreciation (more likely).

Finally, reported results suggest that in the existing monetary framework, the central bank's attempts to decrease external imbalance will, in addition to a decrease in the GDP (growth), incur an additional cost of price increase.

Graph 5: Impulse responses of shock of indicator of monetary policy stance



4. Bank Lending Channel in Croatia

The financial market development and the choice of exchange rate regime primarily determine the monetary policy transmission, i.e. create various channels through which monetary policy affects the economic activity. In a bank-centric financial system where enterprises have no alternative sources of finance, bank lending plays the key role in the monetary policy transmission mechanism. In a non-fixed exchange rate regime monetary policy has an autonomous role and can affect economic variables. Therefore, a bank-centric system and an autonomous monetary policy create a situation where changes in monetary policy indirectly affect the business operations of enterprises, i.e. economic activity by changing credit supply. This argument is contrary to the traditional approach to the transmission monetary policy mechanism based on the interest rate channel, where a change in monetary policy affects the economy exclusively through the change in credit demand.

The underdeveloped financial markets in Croatia, eurized economy and "direct" monetary policy operations indicate that in this country monetary policy transmission can primarily be implemented through the exchange rate mechanism (exchange rate channel) and a change in the credit activity (credit channel). On the basis of an empirical analysis this part of paper tries to improve the understanding of the role of banks in the monetary policy transmission mechanism in Croatia. More specifically, this part of the paper tries to prove the existence of the bank lending channel in Croatia, as one of the possible CNB's monetary policy mechanisms.

The analysis of the bank lending channel has two consequences for the economic policy. First, the (non-)existence of the bank lending channel would confirm the differences (or similarities) in the monetary policy functioning between Croatia and the EMU (see e.g. Favero, Giavazzi and Flabbi, 1999; Brissimis, Kamberoglou and Simigiannis, 2001; Hernando and Mertinez-Pages, 2001), where the analyses show ambiguous results concerning the existence of the bank lending channel. This fact may be an indicator of the European Central Bank's influence on credit supply in Croatia once Croatia becomes member of the European Monetary Union (because the factors through which monetary policy influences credit supply depend on the characteristic of the local financial system). Second, the non-existence of the bank lending channel may advise the monetary authorities against an active role in a situation of the "impossible trinity" (with a modification of the quasi currency board), which assumes a passive behaviour of the monetary authorities and putting emphasis on active fiscal policy.

The basic concept of the bank lending channel includes heterogeneous effects of the monetary policy changes on the credit policy of banks, which depend on the level of information asymmetries approximated by different characteristics of banks. Moreover, a bank lending channel implies a bank-centric financial system, i.e. the enterprises' dependence on the bank credit supply (or inconsistency with the Modigliani-Miller proposition on the part of enterprises), a direct influence of the monetary policy on credit supply (or inconsistency with the Modigliani-Miller proposition on the part of banks, where deposit and non-deposit sources of funds on the liabilities side do not provide perfect substitutes), and, of course, a positive correlation between bank lending and economic activity.

The theoretical structure of the bank-lending channel is very simple: if we assume that monetary policy directly influences banks (primarily the liabilities side of a bank's balance sheet), monetary contraction will reduce the funds for bank lending. As a result, some banks will not be able to offset their reduced deposits (e.g. by issuing bonds or foreign borrowing) due to the information asymmetry problem. In literature, the proxy variable for information asymmetry is the bank size and capitalisation variable (bank credit rating), because theoretical and empirical analyses of market imperfections show that small and poorly capitalised banks are unable to offset their reduced deposits by non-deposit sources of funds (due to asymmetric information between small banks and owners of non-deposit sources of funds) in a restrictive monetary policy environment. Therefore, their credit supply is more susceptible to changes in monetary policy than the credit supply of well-capitalised large banks, which will more easily offset their reduced deposits by non-deposit funds (without changing their credit supply). Under such circumstances, the credit supply of poorly capitalised small banks will decrease thus forcing private entities to reduce their planned investment and production (provided that there is an at least partial non-existence of alternative sources of finance or at least partial inconsistency with the Modigliani-Miller proposition on the part of enterprises). Apart from credit policy adjustment on the liabilities side (by substituting deposit sources of funds by non-deposit ones), bank credit supply can also be adjusted on the assets side, where this is not conditioned by the liabilities side adjustment. Thus, liquid banks can reduce their liquid assets (cash and securities) in order to offset the reduced credit supply due to a restrictive monetary policy.

The relationship between credit and production must be examined with great caution, since there may be a two-way causality between these two variables, depending on whether we are dealing with reduced credit supply (where reduced credit supply results in reduced production) or reduced credit demand (a decline in consumption and investment results in reduced credit demand) due to a restrictive monetary policy (Kashyap, Stein and Wilcox, 1993). Due to the problem of distinguishing between a change in credit supply and in credit demand as the result of monetary policy changes, it is impossible to make an empirical analysis at the aggregate or macro level (Kashyap and Stein, 1997). Moreover, the explanation of the bank lending channel at the aggregate level conceals potential distributional consequences of monetary contraction for credit supply of banks with different characteristics. Numerous empirical studies have demonstrated that, in the situation of changes in the monetary policy, banks adjust their credit policies in different ways, depending on their characteristics (size, capitalisation and liquidity). Therefore, empirical studies are based on panel data for individual banks related to a particular period of time. The identification of a change in credit supply is aimed at distinguishing between banks according to the characteristics related to their lending power, which are independent of credit demand shocks.

By taking into account credit supply adjustments on both assets and liabilities sides as the result of a restrictive monetary policy, some empirical studies of the bank lending channel (e.g. Kashyap and Stein, 1995; Kashyap and Stein, 1997; and Kishan and Opiela, 2000) confirm theoretical explanations than the strongest influence of monetary policy on economic activity is through the credit policies (reduced credit supply) of small, illiquid or poorly capitalised banks. Therefore, the hypothesis that

the bank-lending channel exists is tested by analysing various responses (in terms of credit supply) of banks with different characteristics to monetary policy changes.

The assets size variable (total assets) and capitalisation variable (capital-to-total assets ratio) have been taken as approximations of the adjustment variable on the liabilities side of the balance sheet or the possibility of offsetting the reduced deposits (in the Croatian case) by foreign deposits or loans, as the result of restrictive monetary policy. It is assumed that larger well-capitalised banks (banks with a credit rating) have better opportunities to borrow and collect deposits on foreign markets, because the negative consequences of imperfect information are less serious than in the case of smaller, poorly capitalised banks.

Bank liquidity is measured by the ability of a bank to adjust its credit policy on the liabilities side of its balance sheet in reaction to a monetary policy change. It is assumed that, irrespective of the liabilities adjustments, banks with higher liquidity are able to offset more quickly and easily their reduced credit supply resulting from a restrictive monetary policy by selling their liquid assets.

Apart from the above mentioned standard characteristics of banks, this part of paper also introduces a factor which probably has significant consequences for credit policy adjustment in reaction to changes in the monetary policy, i.e. the binary ownership variable. This is caused by the fact that foreign banks in Croatia belong to larger foreign banking groups, so their credit policy in Croatia is not completely autonomous. On the one hand, such situation could affect the stability of the credit supply, irrespective of the change in monetary policy (restriction), as the parent bank abroad provides financial support to its daughter bank in Croatia. On the other hand, the parent bank may have a procyclic effect on the change in the domestic market by reducing its financial support to the daughter bank and allocating the funds to more profitable regions, irrespective of the change in monetary policy (expansion).

One of the key prerequisites for the existence of the bank-lending channel is a reduced credit supply as the consequence of restrictive monetary policy. If credit demand factors are under control, changes in credit supply can be exclusively attributed to credit supply factors. Moreover, if banks with the above mentioned different characteristics react differently (in terms of changes in the credit supply), it can be concluded that the bank lending channel can account for a part of the monetary policy transmission mechanism in Croatia.

The role of banks in the transmission mechanism and the importance of banks' heterogeneous characteristics in the adjustment of credit supply to monetary policy changes (primarily its restriction) in the period from June 1999 to December 2003, can be analysed empirically from banks' panel data by estimating the following model (following Kashyap and Stein, 1995):

$$(22) \quad \Delta K_{i,t} = \alpha_j \Delta K_{i,t-1} + \sum_{j=1}^{3} \beta_j \Delta r_{t-j} + \sum_{j=1}^{3} \chi_j \Delta r_{t-j} Z_{i,t-1} + \delta Z_{i,t-1} + \sum_{j=1}^{3} \varphi_j \Delta GDP_{t-j} + \phi_i + \varepsilon_{i,t}$$

where $K_{i,t}$ presents a credit value (in the log transformation) in time t; GDP_{t-j} is economic activity (in the log transformation), which controls shocks on the credit demand side in the estimation; r_{t-j} is a monetary policy indicator; $Z_{i,t-1}$ is a vector of a

specific bank characteristic (size, liquidity, capitalisation and ownership); $\Delta r_{t-j}Z_{i,t-1}$ is the interaction between monetary policy and banks' characteristics, Φ_i stands for individual bank effects; $\varepsilon_{i,t}$ is the error term; $i=1,....,N$ stands for a bank, while $t=1,....T$ is the time index from 1999:6 to 2003:12. The dynamics structure is established by introducing one lag, j, for the endogenous variable and three lags for the macroeconomic variables (GDP and the monetary policy indicator). The independent variable showing banks' characteristics, $Z_{i,t-1}$, is included in the model with one lag to account for possible endogeneity.

The above model specification (22) is a reduced form model of a bank that is compatible with the existence of the bank lending channel and in which different banks' characteristics are the key factors in the change of credit supply. The coefficients of the estimated model which are in the focus of the bank lending channel in Croatia are $\Sigma\beta_j$ and $\Sigma\chi_j$, assumably identical for all banks. As monetary contraction presumably leads to a credit decline, $\Sigma\beta_j$ should be negative. Furthermore, the assumption is that large, liquid, well-capitalised foreign owned banks will make easier and quicker adjustments in their credit policies, both on the liability side (by attracting foreign deposits or by borrowing abroad) and the asset side (by selling liquid assets), following a monetary contraction. This means that a restrictive monetary policy will make only a minor or negligible impact on the credit supply of banks with these characteristics. On the other hand, it is expected that small, poorly liquid and poorly capitalised banks in domestic ownership will be most affected by a restrictive monetary policy. Banks with such characteristics will take longer to make credit supply adjustments on both assets and liabilities sides in times of a monetary contraction, or fail to do that, and will therefore be forced to decrease their credit supply. The sign of $\Sigma\chi_j$ ($\frac{\partial \Delta K_{i,t}}{\partial \Delta r_{t-j} \partial Z_{t-1}}$) should therefore be positive. In other words, the situation when the coefficient $\Sigma\beta_j$ is statistically significant and negative, and the coefficient $\Sigma\chi_j$ statistically positive and has a positive sign represents the existence of the bank lending channel in Croatia.

This paper uses two different indicators of monetary policy: the money market interest rate and indicator of monetary policy calculated in the previous chapter (used is the indicator based on money market interest rates - Stance 2 in Graph 3). Money market interest rate closely resembles the calculated indicator of monetary policy stance from mid-2000. Thus, the money market interest rate reflects the true stance of monetary policy for the most part of the time series under consideration. Figure 1 shows the time series of the two indicators together with credit growth.

4.1 Data and the Model Estimation Method

Commercial bank's balance sheet data are used for the equation estimation (22). Due to the unavailability of data prior to 1999, namely a change of the methodology of specific time series in 1999, and the 1998 banking crisis, the sample covers monthly data in the period from June 1999 to December 2003. The sample includes 46 banks (descriptive statistics of Croatian banking system can be seen in Table 1 - in Appendix) whose share in the total banking system assets in the observed period ranged from 98% (in June 1999) to 100% (in December 2003). The sample excludes banks undergoing bankruptcy proceedings in the period from June 1999 to December

2003. Bank data have been adjusted in case of five bank mergers, i.e. it has been assumed that the merged banks existed as such from the beginning of the observed period. Concerning the ownership structure (a domestic owner versus a foreign owner), the assumption is that a change in the ownership structure occurs when a foreign owner acquires 50% or more of the total bank capital or a greenfield investment takes place. The controlling GDP variable has been interpolated from the quarterly to the monthly level by the cubic spline method.

The equation method (22) is estimated by SUR weighted least squares which is appropriate when residuals are both cross section heteroscedastic and contemporaneously correlated. As stated previously, the consequences of different bank characteristics are analysed by variables related to a specific bank size, its liquidity, capitalisation and ownership structure. Bank liquidity is defined as the share of liquid assets (cash, debt and equity securities) over the total bank assets. The bank size is measured by the total value of its assets, whereas the capital to asset value ratio is an indicator of the bank's capitalisation. The ownership structure variable equals one in the month of the year when a foreign bank completed the privatisation procedure or made a greenfield investment, as well as in all the following months of the observed period, and otherwise equals zero.

In order to interpret the variables' effects on credit supply in the interaction with the influence of the money market interest rate as a monetary indicator, and to exclude the trend form a specific variable, different bank characteristics have been normalised. Bank size is therefore defined as a monthly deviation of a specific variable value from the average size variable value (to eliminate the trend). Liquidity and capitalisation (variables without trends) have been normalised in relation to the total sample average.

4.1. Findings

Table 3 (in Appendix) shows the findings associated with the estimated model. Effects of a specific variable are presented as the sum of coefficients' values with lags introduced for specific variables. This shows each variable's direct influence on credit growth. The table displays two estimated models. The credit growth model was estimated using two different monetary policy indicators (money market interest rate and Stance 2 indicator). The each column in the table shows the estimated model that includes all bank characteristics and provides a basis for the interpretation of empirical facts on the bank lending channel in Croatia.

As shown in the table, monetary policy's direct influence results in an expected (negative) and statistically significant sign in relation to bank credit growth in both estimated models. The precondition for the existence of the bank lending channel (monetary policy's direct influence on banks' credit policies) is therefore met. However, the estimation of the two models has not shown strong evidence of the bank lending channel in Croatia. The results of estimation of the model that uses money market interest rate as a monetary policy indicator show little evidence that there are heterogeneous reactions of banks to monetary policy changes (in terms of their credit policies) in accordance with the bank lending channel - coefficients related to size, liquidity and capitalisation interacting with a change in monetary policy have a

negative sign. Thus, according to these findings, large, well liquid and well-capitalised banks react more strongly, by modifying their credit activities, to monetary policy changes. The results of estimation of the second model that uses the indicator of monetary policy stance (based on interest rates) show similar results. However, liquidity has now expected (positive) sign indicating that more liquid banks can better shield their loan portfolio from monetary policy changes. The ownership structure in both estimated models is positive, showing that the impact of a monetary policy change on a bank's credit policy depends on whether the bank is in foreign or domestic ownership, as proposed by the bank lending channel theory. In other words, these findings suggest that foreign owned banks react differently (in terms of their credit activities) to monetary policy changes than domestic owned banks. The positive coefficient related to the binary ownership variable suggests that the ownership structure of foreign owned banks is not autonomous. In particular, in times of restrictive monetary policy, foreign owned banks decrease their credit supply to a lesser degree than domestic owned banks, being able to borrow abroad with their parent banks. Economic activity has a positive and statistically significant influence on credit policy in both models, indicating that credit demand is one of the essential factors of banks' credit policies.

Despite the fact that these findings provide little evidence of the bank lending channel in Croatia, future analyses of the credit channel in Croatia should focus on a wider research area. Research into the bank lending channel on the enterprises' side would provide an additional and more complete insight into information imperfections encountered by small and medium sized enterprises.

5. Conclusion

Understanding of possible benefits but grave dangers of exchange rate instability, influenced the choice of monetary policy in Croatia during the last decade. As described in this paper, the CNB adopted the exchange rate targeting regime, in which it reacted to changes in the exchange rate, but not to its level. Faced with large capital inflows, the CNB was mainly purchasing foreign currency, while it used a variety of monetary policy instruments to sterilize created liquidity. It also applied direct instruments for the additional impact of its policies.

The indicator of monetary policy stance constructed in this paper shows that the monetary policy in Croatia was procyclical - it eased during expansions and tightened during recessions. This is an inherent characteristics of the exchange rate targeting in any small open economy; the monetary policy reacts and tightens during depreciation pressures which usually build during recession. Thus, the exchange rate depreciation is positively correlated with monetary tightening. The indicator shows that the monetary policy reacts to current account deficit. Tightening in the indicator leads to improvement in current account, suggesting that the monetary policy can be used for dealing with external imbalances, but with a cost on both real economy (decrease in GDP) and inflation (due to depreciation). However, monetary easing, that can be achieved by reducing the reserve requirement and increasing liquidity (lowering of money market interest rates), could lead to depreciation due to capital outflow or portfolio shift from domestic currency to foreign currency (Vujčić 2003). If this was happening during recession, such depreciation could be devastating for the financial stability, so monetary policy cannot be used counter-cyclical adjustment.

This paper also found the evidence of bank lending channel of monetary policy, operating through the ownership structure. Although banks' credit activity reacts to monetary policy i.e. interest rates, the results show that foreign owned banks, having easy access to foreign financing, respond less to monetary tightening than domestic banks. Since 90% of Croatian banking system is owned by foreigners, monetary policy has less influence now than before.

Therefore, the obtained results, with reservations due to short and unstable data series, suggest that there is some benefit in leading an active monetary policy in Croatia for correcting external imbalances. However, strong capital inflows are expected to continue with further integration with the EU, and will bring further appreciation pressures. In such circumstances the CNB policy might be unable to deal with external imbalances (unless it implements some drastic direct monetary policy measure) since increasing interest rates could encourage additional capital inflows.

Even if possible to implement, exchange rate depreciation would still not be a viable alternative for the highly euroised Croatian economy. Although successful in correcting external imbalances, it could create problems that outweigh possible benefits. Thus, an intermediate solution of keeping the existing monetary framework is probably the optimal choice for Croatia during the run-up to the EMU. It allows for some flexibility in the exchange rate, but low enough not to endanger the financial stability. The existing maneuverability of for active monetary policy relying on excess reserves targeting (and/or interest rates) as well as other "creative" monetary policy measures, could also somewhat help in dealing with external imbalances.

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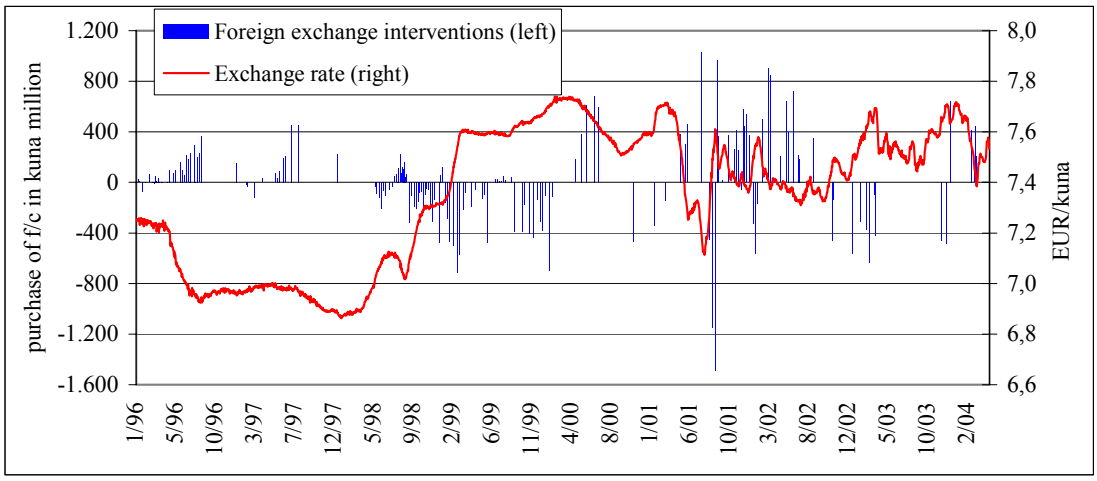
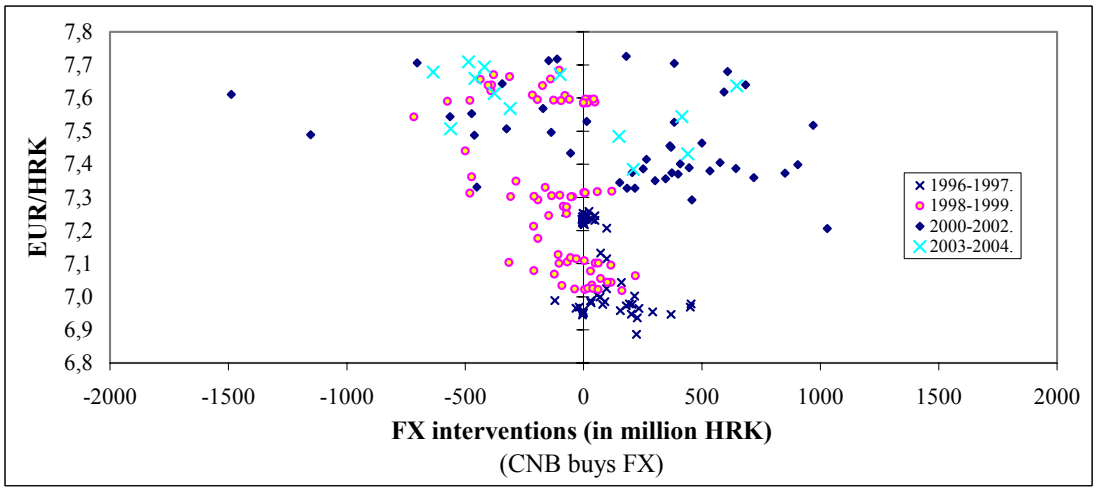
Appendix 1: Main Economic Indicators

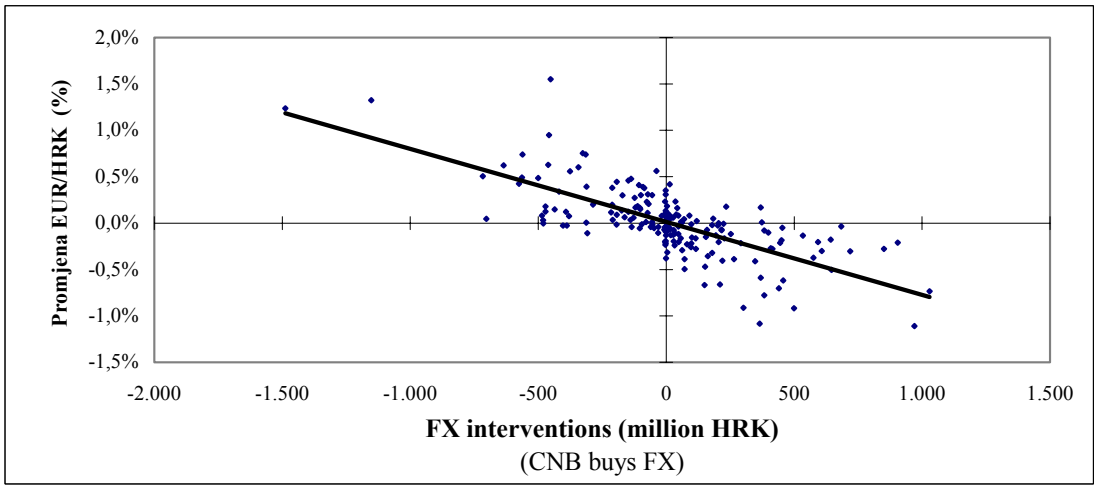
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Area (square km)	56,538	56,538	56,538	56,538	56,538	56,538	56,538	56,538	56,538
GDP[a] (million USD, current prices)	18,811	19,872	20,109	21,628	19,906	18,427	19,863	22,436	28,335
GDP – year-on-year rate of change[a] (in %, constant prices)	6.8	5.9	6.8	2.5	–0.9	2.9	4.4	5.2	4.3
GDP per capita[a,b] (in USD)	4,029	4,422	4,398	4,805	4,371	4,206	4,477	5,050	6,377
Average year-on-year inflation rate[b]	2.0	3.5	3.6	5.7	4.2	6.2	4.9	1.7	1.8
Population (million)	4.7	4.5	4.6	4.5	4.6	4.4	4.4	4.4	4.4
Exports of goods and services (as % of GDP)	37.1	40.1	39.9	39.5	40.8	47.0	48.5	47.1	52.6
Imports of goods and services (as % of GDP)	48.7	49.7	56.6	48.7	49.2	52.1	54.4	58.2	60.7
Current account balance (as % of GDP)	–7.5	–4.8	–12.5	–6.7	–7.0	–2.5	–3.7	–8.5	–7.2
Outstanding external debt (million USD, end of year)	3,809	5,308	7,452	9,683	9,878	11,055	11,317	15,421*	23,570*
Outstanding external debt (as % of GDP)	20.2	26.7	37.1	44.8	50.1	60.0	57.0	68.7*	83.2*
Outstanding external debt (as % of exports of goods and services)	54.6	66.6	92.9	113.3	122.9	127.6	117.5	145.9*	158.1*
External debt service[c] (as % of exports of goods and services)	10.1	9.0	9.9	12.5	20.8	23.3	24.4	26.0	17.6
Gross international reserves (million USD, end of year)	1,895	2,314	2,539	2,816	3,025	3,525	4,704	5,886	8,191
Gross international reserves (in terms of months of imports of goods and services, end of year)	2.5	2.8	2.7	3.2	3.7	4.4	5.2	5.4*	5.7
Exchange rate on 31 December (HRK : 1 USD)	5.3161	5.5396	6.3031	6.2475	7.6477	8.1553	8.3560	7.1457	6.1185
Average exchange rate (HRK : 1 USD)	5.2300	5.4338	6.1571	6.3623	7.1124	8.2768	8.3391	7.8637	6.7014

Appendix 2:

FOREIGN EXCHANGE INTERVENTIONS







Source: Lang and Šošić (2003).

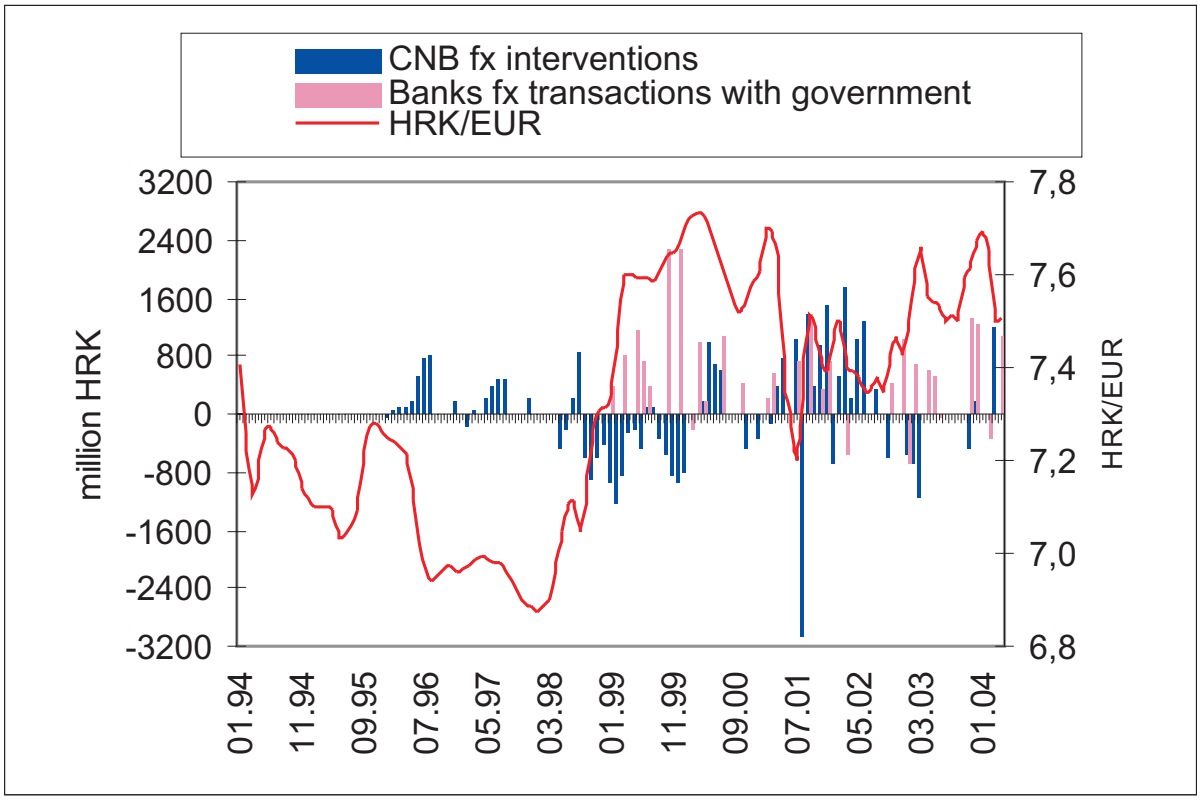
Appendix III.

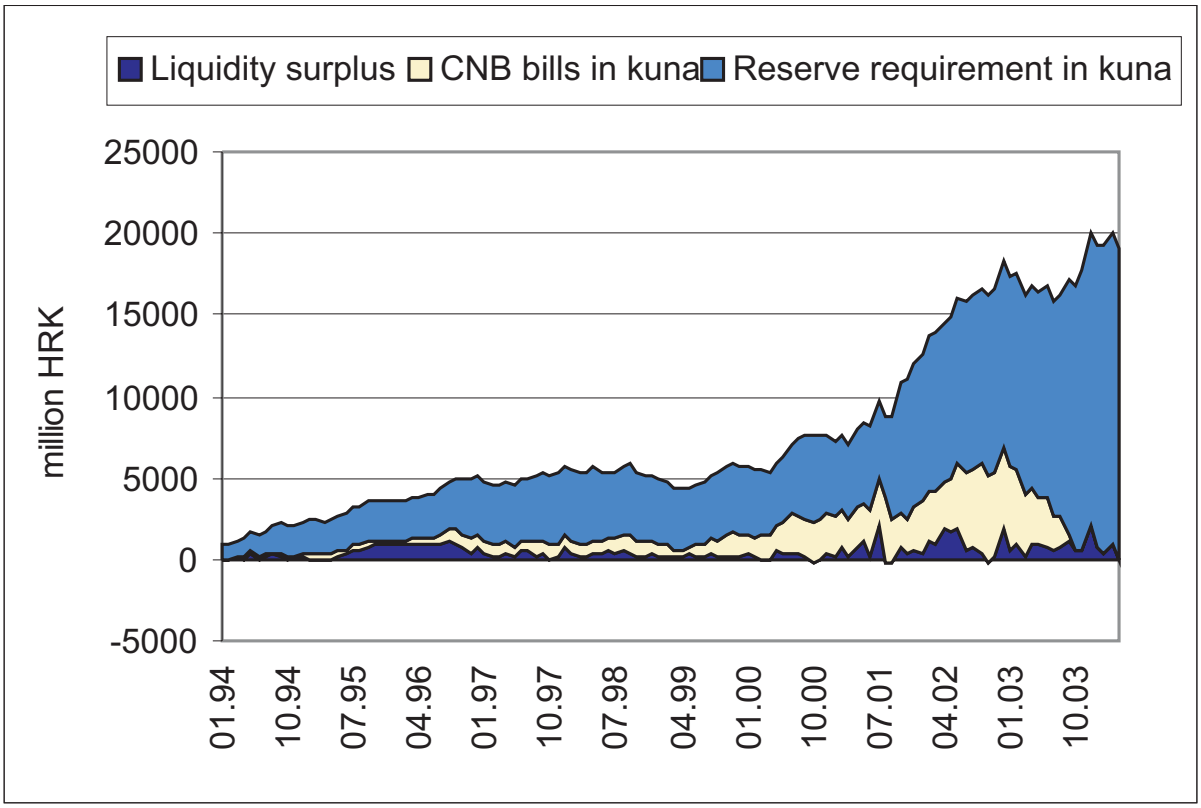
MONETARY INSTRUMENTS DEVELOPMENT 1992-2004

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Special credit collateralised with savings and current accounts	■	■											
Credits for money exchanging		■											
Reescont credit - general and special quotas	■	■	■										
Reescont credit - for financing special banking credits	■	■	■										
Collaterised credits for daily liquidity requirement (based on short-term bills)	■	■	■										
Inicial credit			■										
Banks minimal liquidity	■	■	■	■									
Restrictions on the growth of credits				■									
CNB bills on obligatory basis in kuna				■	■							■	
Special credit for payment of f/c savings				■	■								
Daily credit for the			■	■	■	■							
Daily credit for current liquidity problems						■	■						
Reserve requirement in kuna	■	■	■	■	■	■	■	■	■				
Reserve requirement in foreign currency							■	■	■				
Bank pre-rehabilitation credit							■	■	■				
Short term credit to the government	■	■	■	■	■	■	■	■	■	■			
Interventional credit			■	■	■	■	■	■	■	■			
Deposit in kuna on the basis of foreign fin. credits, deposits in foreign currency and guarantees							■	■	■	■			
CNB bills in kuna on a voluntary basis	■	■	■	■	■	■	■	■	■	■	■	■	■
CNB discount rate	■	■	■	■	■	■	■	■	■	■	■	■	■
Interventions in foreign currency		■	■	■	■	■	■	■	■	■	■	■	■
Lombard credit			■	■	■	■	■	■	■	■	■	■	■
Repo auctions on the basis of CNB bills			■	■	■	■	■	■	■	■	■	■	■
CNB bills in foreign currency							■	■	■	■	■	■	■
Short term liquidity credit								■	■	■	■	■	■
Unified required reserve on kuna and f/c liabilities									■	■	■	■	■
Ratio between f/c claims and f/c obligations				■	■	■	■	■	■	■	■	■	
Minimum required aount of foreign exchange claims												■	■

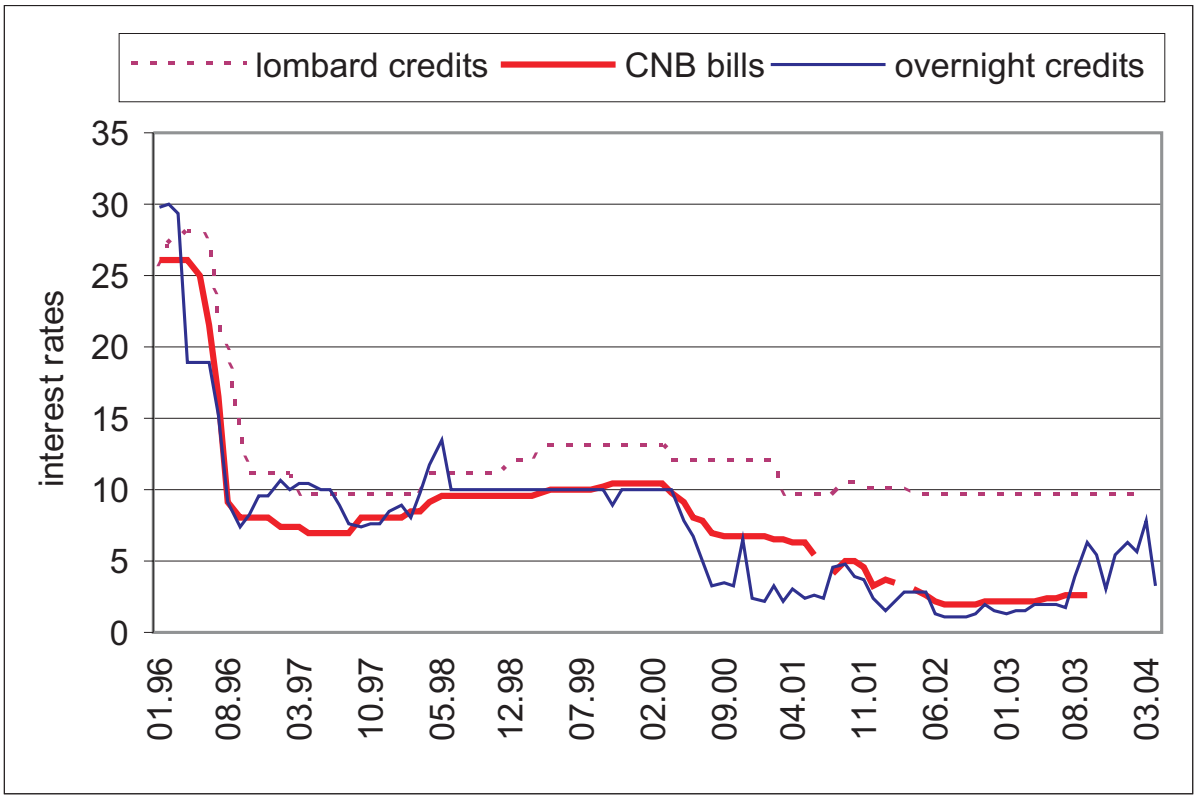
Appendix 4:

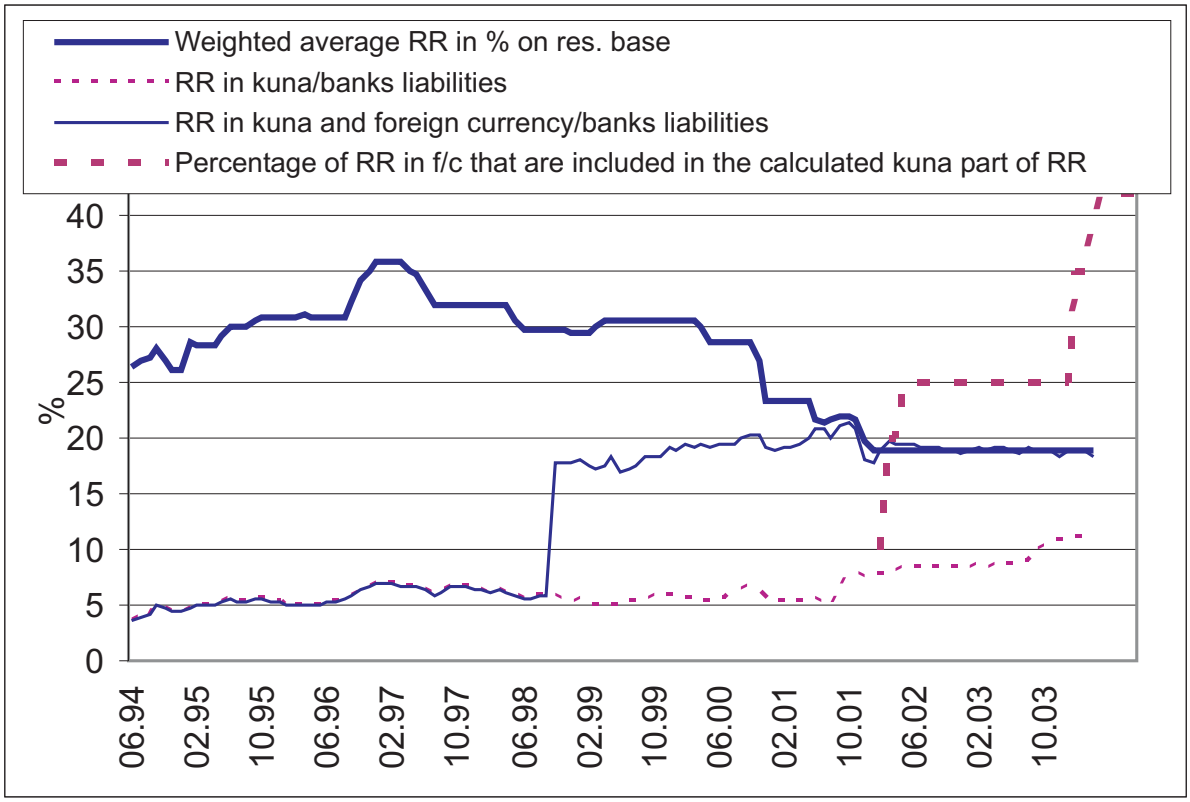
The use of monetary policy instruments





Appendix 4


lombard credits
CNB bills
overnight credits
interest rates
35
30
25
20
15
10
5
0
01.96
08.96
03.97
10.97
05.98
12.98
07.99
02.00
09.00
04.01
11.01
06.02
01.03
08.03
03.04


Weighted average RR in % on res. base
RR in kuna/banks liabilities
RR in kuna and foreign currency/banks liabilities
Percentage of RR in f/c that are included in the calculated kuna part of RR
%
40
35
30
25
20
15
10
5
0
06.94
02.95
10.95
06.96
02.97
10.97
06.98
02.99
10.99
06.00
02.01
10.01
06.02
02.03
10.03

Appendix 5.

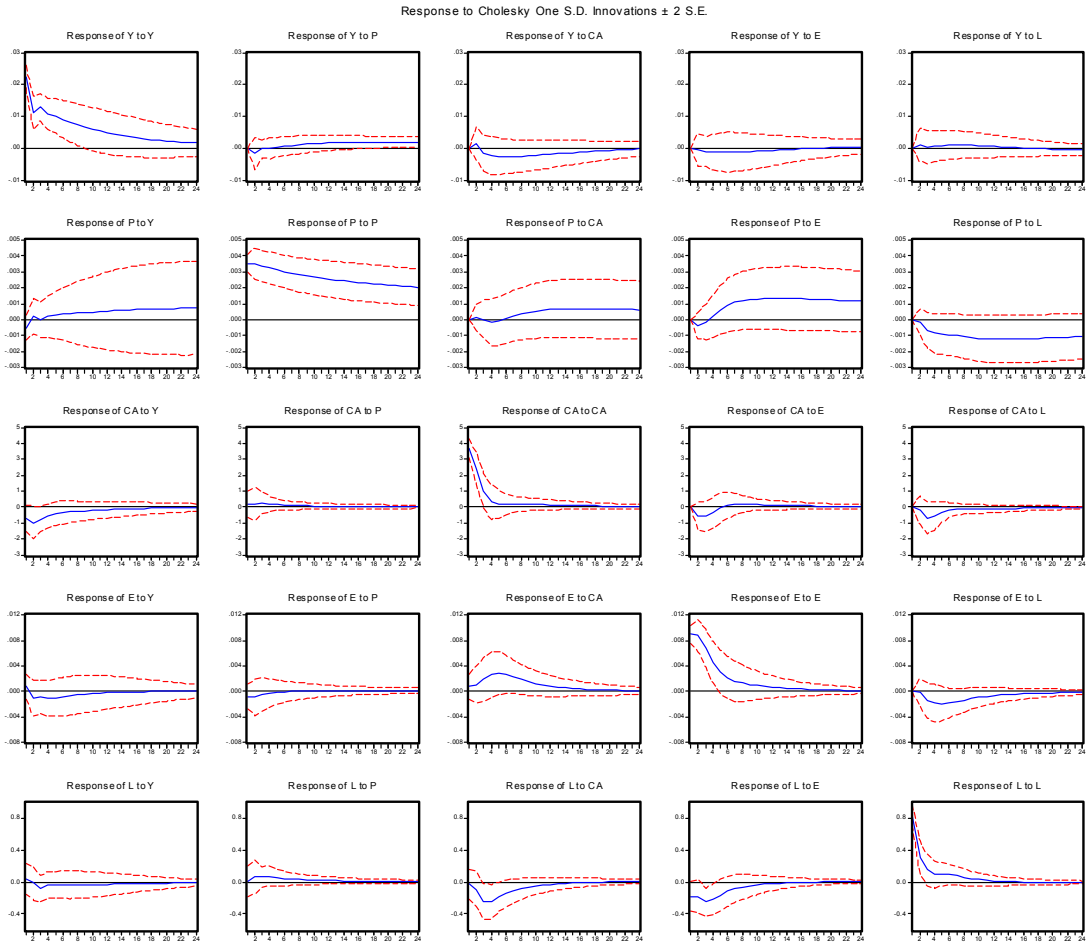
Unit root tests

	ADF value Constant included	ADF value Constant and trend included	KPPS value H0 stationary arround a level	KPPS value H0 trend stationary
y	-0,4113	-6,9579	1,0707	0,2607
dy	-9,3961 **	-9,6974 **	0,2546 **	0,0773 **
p	-1,9946	-0,2464	1,1050	0,2737
dp	-8,2478 **	-8,5701 **	0,4429 *	0,1013 **
ca	-5,6985 **	-5,8528 **	0,3050 **	0,1881 *
e	-2,3567 **	-2,5156 **	0,2403 **	0,1543 *
l	-4,8360 **	-4,8629 **	0,1963 **	0,1371 *
i	-1,4994	-3,7675 *	0,9375	0,1322 *

Note: **, and * indicate no unit root at 1% and 5% significance.

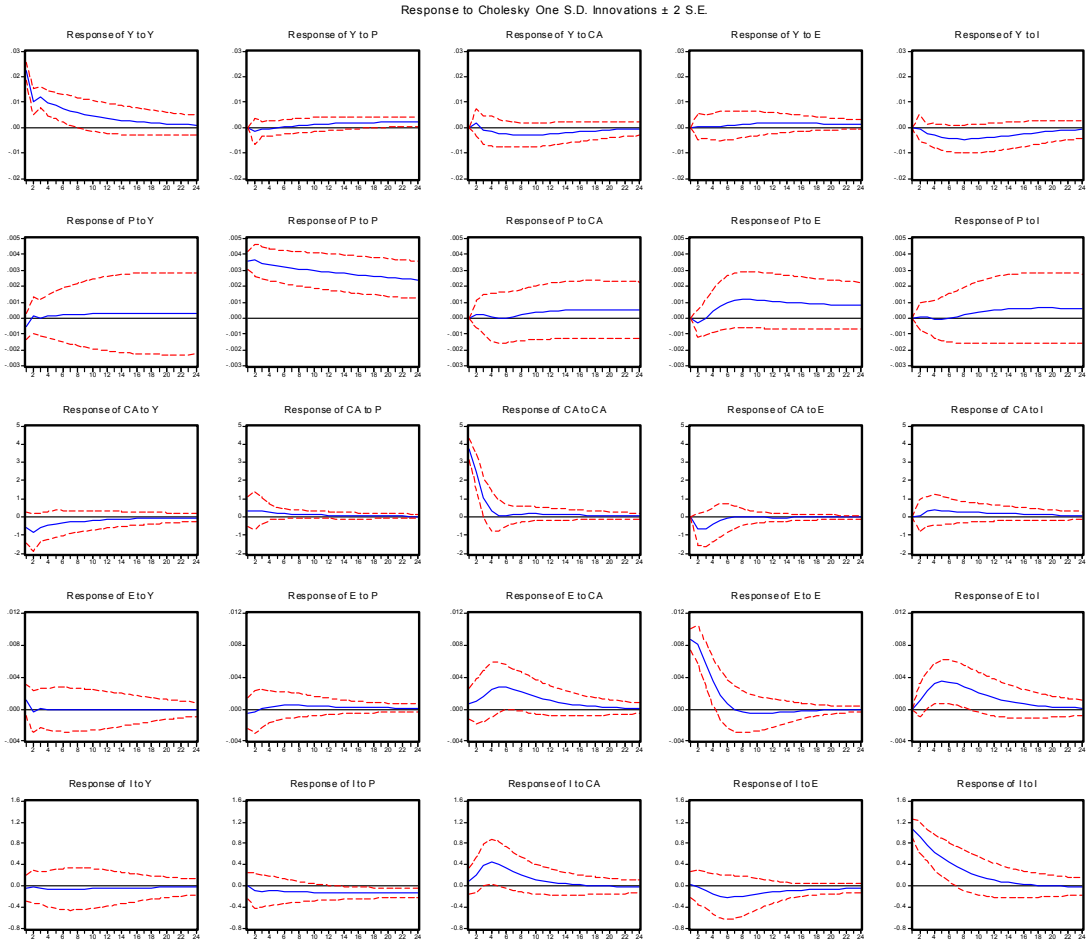
y - real GDP
dy - change in real GDP
p - core prices (inflation)
dp - core inflation
ca - current account / GDP
e - modified nominal exchange rate
l - liquidity (excess reserves/required reserves)
i - money market interest rate

Appendix 6: Impulse responses for VAR estimated in levels (y, p ,ca, y, l)



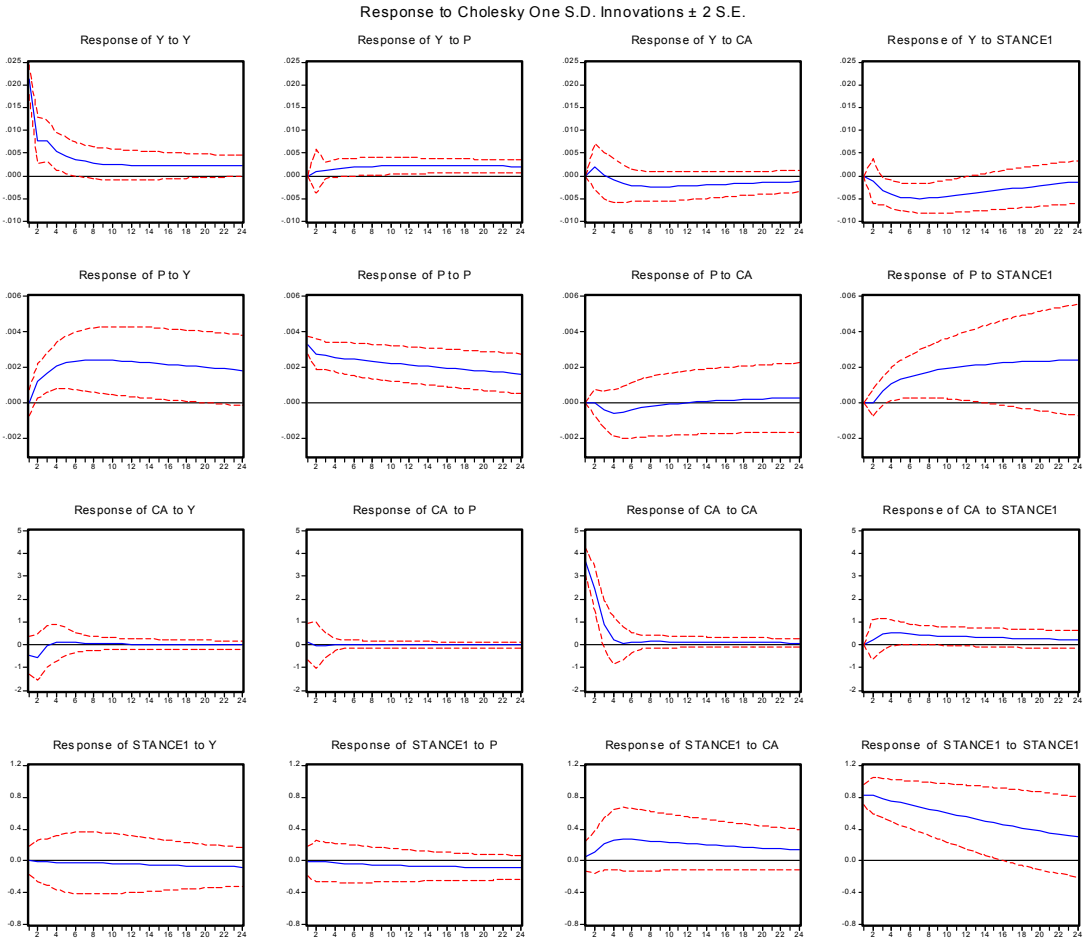
Appendix 7

Impulse responses for VAR estimated in levels (y, p ,ca, y, i)

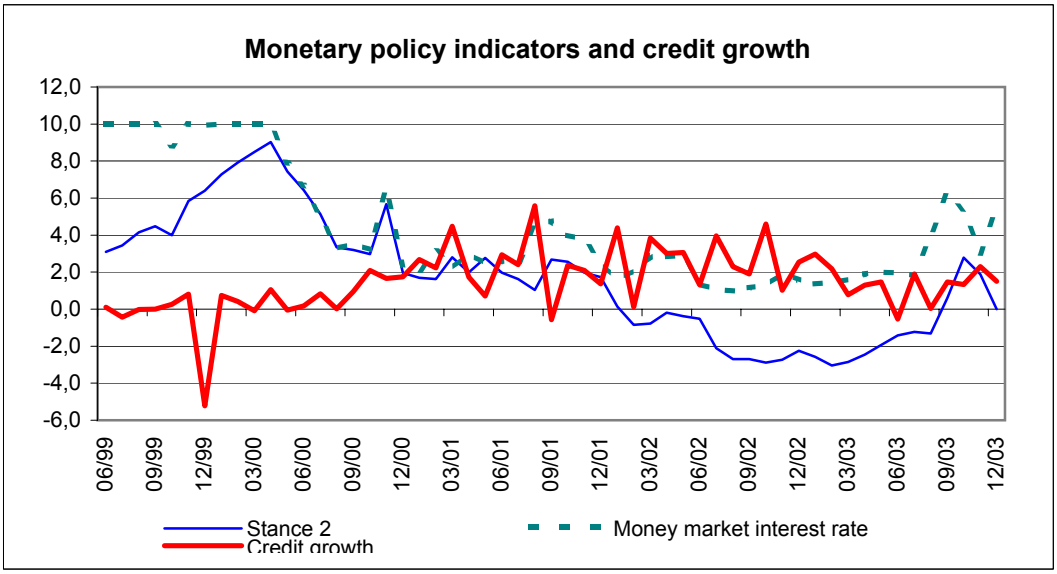


Appendix 8

Impulse responses of the indicator of monetary policy stance on y, p and ca



Appendix 9:



Correlation	Stance 2	Money market interest rate	Credit growth
Stance 2	1,00	0,82	-0,45
Money market interest rate	0,50	1,00	-0,56
Credit growth	-0,45	-0,56	1,00

TABLE 1 DESCRIPTIVE INDICATORS OF CROATIAN BANKING SYSTEM FOR THE YEARS 1999-200

	1999	2000	2001	2002	2003
Structure of banking system					
Number of banks	53	43	43	46	43
Number of banks with majority private sector ownership	10	3	3	2	2
Number of foreign-owned banks	13	20	24	23	20
Share of banking assets in total assets of the financial sector	89,9	89,4	89,8	88,7	88,5
Share of assets of foreign-owned banks in total assets of banking system	39,9	84,1	89,3	90,2	90,8
Share of assets of public-owned banks in total assets of banking system	45,6	5,7	5,0	4,0	3,5
Share of assets domestic-owned banks in total assets of banking system	14,5	10,2	5,6	5,8	5,7
Herfidahl indicator (all banks)					
for loans	1157,2	1201,5	1067,8	1118,2	1254,0
for assets	1189,9	1368,4	1315,5	1237,4	1268,2
for deposits	1312,7	1552,1	1450,5	1329,6	1302,8
Concentration index (5 largest banks)					
for assets	62,1	66,3	66,5	64,6	70,7
for deposits	64,7	69,8	69,0	66,3	69,3
Financial depth indicators (% of GDP)					
Bank loans	38,0	38,8	44,0	54,3	59,0
Bank assets	65,9	72,1	86,1	92,3	101,1
Bank deposits	35,5	43,2	58,7	59,2	61,0
Banking sector stability indicators					
ROA (%)	0,7	1,4	0,9	1,6	1,6
ROE (%)	4,8	10,7	6,6	13,7	16,3
Capital adequacy (%)	20,6	21,3	18,5	17,2	16,0
Leverage (equity/assets)	15,2	11,9	10,4	9,4	9,4
Bad placements and off-balance sheet items to total placements and off-balance sheet items (%)	10,3	9,5	7,3	5,9	5,2
Banking sector balance sheet items					
Assets (in % of total assets)					
Reserves	9,6	9,6	10,5	12,3	13,7
Foreign assets	13,3	17,9	23,0	15,7	18,1
Loans	57,6	53,8	51,1	58,8	58,3
Securities	19,4	18,0	14,8	12,5	9,3
Other	0,0	0,7	0,5	0,7	0,6
Liabilities (in % of total liabilities)					
Deposits	64,2	70,3	76,8	71,2	66,8
Foreign liabilities	22,0	19,0	17,3	23,5	28,3
Other	13,8	10,7	6,0	5,4	4,9

TABLE 2 SUMMARY STATISTICS (1999:6-2003:12)

		NUMBER OF BANKS	SIZE				LIQUIDITY				CAPITALIZATION				OWNERSHIP	
			average	st. deviation	min [1]	max [1]	average	st. deviation	min [1]	max [1]	average	st. deviation	min [1]	max [1]	number of foreign b.	number of domestic b.
TOTAL SAMPLE		46	4.368	9.373	52	49.215	0,12	0,08	0,00	0,38	0,19	0,17	0,05	1,00	23	23
SIZE	LARGE	14	13.939	14.088	3.307	49.215	0,15	0,09	0,04	0,28	0,09	0,03	0,05	0,15	13	1
	SMALL	32	709	634	52	2.678	0,12	0,08	0,00	0,38	0,22	0,18	0,06	1,00	11	21
LIQUIDITY	HIGH	15	8.513	14.894	52	49.215	0,18	0,10	0,08	0,38	0,19	0,24	0,06	1,00	13	2
	LOW	31	2.481	4.297	55	18.606	0,10	0,06	0,01	0,28	0,18	0,12	0,05	0,52	10	21
CAPITALIZATION	HIGH	14	279	232	52	790	0,10	0,10	0,00	0,38	0,36	0,21	0,20	1,00	4	10
	LOW	32	6.272	10.890	301	49.215	0,14	0,08	0,04	0,29	0,11	0,04	0,05	0,20	19	13
OWNERSHIP	FOREIGN	23	8.094	12.411	52	49.215	0,14	0,09	0,00	0,38	0,17	0,21	0,05	1,00	23	0
	DOMESTIC	23	802	1.103	55	5.428	0,11	0,07	0,01	0,28	0,20	0,11	0,06	0,52	0	23

[1] end of 2003

Notes:
The size indicator is given by total assets (millions of kunas)
The liquidity indicator is defined as sum of cash and securities over total assets
The capital indicator is represented by the ratio of capital to total assets
A bank with "high" characteristics has the average ratio (value) above the 70th percentile of the distribution
A bank with "low" characteristics has the average ratio (value) below the 70th percentile of the distribution

Correlation	SIZE	LIQUIDITY	CAPITALIZATION	OWNERSHIP
SIZE	1,00	0,22	-0,29	0,24
LIQUIDITY	0,22	1,00	-0,09	0,26
CAPITALIZATION	-0,29	-0,09	1,00	-0,10
OWNERSHIP	0,24	0,26	-0,10	1,00

TABLE 3 ESTIMATED MODEL OF CREDIT GROWTH
Dependent variable: first difference of credit growth
Estimation method: SUR least square method

	MONETARY POLICY INDICATOR			
	STANCE 2[1)]		MONEY MARKET INTEREST RATE	
VARIABLE, coefficient	coefficient	probability	coefficient	probability
ΔK_{t-1}, α	**0,0202**	**0,0000**	**0,0299**	**0,0000**
$\sum \Delta r_{t-j}$ ($\Delta r_{t-1}+\Delta r_{t-2}+\Delta r_{t-3}$), β	**-0,0015**	**0,0000**	**-0,0010**	**0,0000**
Δr_{t-1}	-0,0004	0,0000	-0,0009	0,0000
Δr_{t-2}	-0,0012	0,0000	-0,0003	0,0000
Δr_{t-3}	0,0001	0,0466	0,0001	0,0924
Z_{t-1}, δ				
size	**0,0120**	**0,0000**	**0,0105**	**0,0000**
capitalization	**0,0000**	**0,8929**	**0,0010**	**0,0054**
liquidity	**-0,0134**	**0,0000**	**-0,0181**	**0,0000**
ownership	**0,0091**	**0,0000**	**0,0095**	**0,0000**
$\sum Z_{t-1}\Delta r_{t-j}$ ($Z_{t-1}\Delta r_{t-1}+Z_{t-1}\Delta r_{t-2}+Z_{t-1}\Delta r_{t-3}$), χ				
size	**-0,0019**	**0,0000**	**-0,0035**	**0,0000**
$Z_{t-1}\Delta r_{t-1}$	-0,0005	0,0000	0,0001	0,0000
$Z_{t-1}\Delta r_{t-2}$	-0,0017	0,0000	-0,0011	0,0000
$Z_{t-1}\Delta r_{t-3}$	0,0003	0,0000	-0,0025	0,0000
capitalization	**-0,0056**	**0,0000**	**-0,0181**	**0,0000**
$Z_{t-1}\Delta r_{t-1}$	-0,0010	0,0000	0,0144	0,0000
$Z_{t-1}\Delta r_{t-2}$	-0,0146	0,0000	-0,0125	0,0000
$Z_{t-1}\Delta r_{t-3}$	0,0100	0,0000	-0,0200	0,0000
liquidity	**0,0075**	**0,0000**	**-0,0071**	**0,0000**
$Z_{t-1}\Delta r_{t-1}$	-0,0193	0,0000	-0,0088	0,0000
$Z_{t-1}\Delta r_{t-2}$	0,0075	0,0000	-0,0057	0,0000
$Z_{t-1}\Delta r_{t-3}$	0,0193	0,0000	0,0074	0,0000
ownership	**0,0008**	**0,0000**	**0,0014**	**0,0000**
$Z_{t-1}\Delta r_{t-1}$	0,0030	0,0000	0,0028	0,0000
$Z_{t-1}\Delta r_{t-2}$	-0,0007	0,0000	0,0005	0,0000
$Z_{t-1}\Delta r_{t-3}$	-0,0015	0,0000	-0,0020	0,0000
$\sum \Delta BDP_{t-j}$ ($\Delta BDP_{t-1}+\Delta BDP_{t-2}+\Delta BDP_{t-3}$), φ	**0,0693**	**0,0000**	**0,0575**	**0,0000**
ΔBDP_{t-1}	-0,0091	0,4741	-0,0942	0,0000
ΔBDP_{t-2}	-0,2025	0,0000	-0,0164	0,4972
ΔBDP_{t-3}	0,2810	0,0000	0,1681	0,0000
Time period	1999:6-2003:12		1999:6-2003:12	
Panel data	2340		2340	
Adjusted R^2	0,52		0,62	
Probability (F-statistics)	0,00		0,00	

[1)] Stance 2 is monetary policy indicator based on money market interest rate