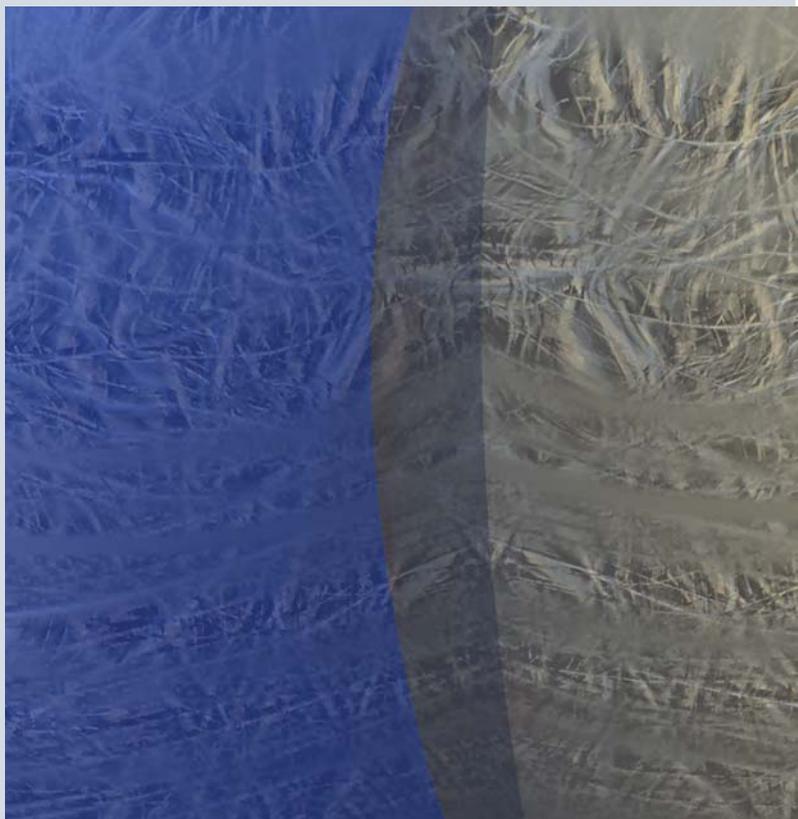


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# TRANSMISSION OF MONETARY SHOCKS IN LATVIA

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1/2003



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RIGA 2003

## **ABSTRACT**

This study deals with short-term reactions of the economy to various monetary shocks. The analysis of the financial system of Latvia supports the view that the wealth channel is currently very weak or even non-existent due to a relatively underdeveloped capital market. The importance of various channels of monetary transmission has been tested empirically by using the structural VAR model and small structural macroeconomic model. The analysis provides evidence that monetary shocks are transmitted to the economy mainly through the exchange rate channel.

**Key words:** monetary policy, monetary transmission mechanism, small structural model, vector autoregression

**JEL classification codes:** C32, C51, E52

The views expressed in this publication are those of the authors, who are employees of the Bank of Latvia Monetary Policy Department. Any errors and omissions are the authors' responsibility.

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## INTRODUCTION

Ten years after the beginning of transition to a market economy, Latvia has achieved one of the highest growth rates in Europe, and after an initial jump in prices, which was caused by market liberalisation, inflation has remained steady and low. Country's successful economic performance is a result of a set of appropriate policy actions, including the prudent monetary policy pursued by the central bank of Latvia.

While it has been acknowledged that the monetary policy pursued by the Bank of Latvia supports Latvia's long-term economic growth, little attempt has been made to ascertain whether the Bank of Latvia is able to affect the short-term fluctuations of economic variables, e.g. interest rates, inflation, output etc. It has been argued that in the light of the existing fixed exchange rate regime in Latvia since 1994, the central bank has been limited in its pursuit of an independent monetary policy. In addition, structural changes in the economy that translate into volatile money demand also tend to constrain active pursuit of monetary policy.

Acknowledging validity of these arguments, a study of possible channels of monetary policy in Latvia may be useful. First, to the extent that domestic and foreign assets in Latvia are not perfect substitutes, the central bank has had some room for maneuvering in setting domestic interest rates. Second, strengthening and improving of the financial system in Latvia may imply that various channels of monetary policy are becoming more powerful, hence rendering monetary policy more effective. Finally, in the light of Latvia's expected accession to the EU and the eventual adoption of the euro, the monetary policy framework in Latvia is bound to undergo significant changes, with interest rates gaining more prominence and the exchange rate losing its role as a monetary policy instrument of choice. Therefore, knowledge of the relative importance of the two instruments in transmission of monetary policy would give a valuable insight into the possible changes in the economy of Latvia after the adoption of the euro.

Chapter I deals with the development of the financial and industrial sectors in Latvia during the last decade and the implications of this development for monetary policy transmission. Chapter II studies the results from the structural VAR model to identify variables that are most important for the monetary policy transmission. In Chapter III the analysis of the VAR model is supplemented with the results obtained from the small structural macroeconomic model. The final section provides a brief summary of the policy implications attributed to its transmission channels.

## I. IMPLICATIONS OF ECONOMIC DEVELOPMENT IN LATVIA FOR DIFFERENT CHANNELS OF MONETARY POLICY

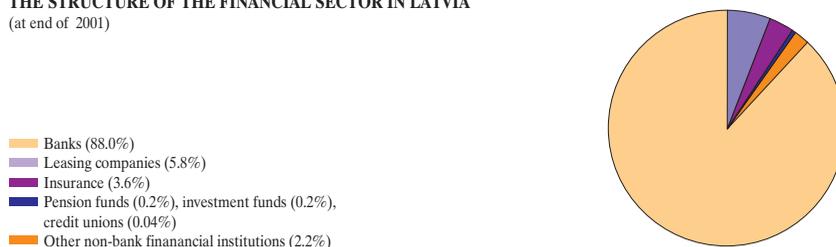
Traditionally, monetary policy is thought to affect the economy, at least in the short term, through four main channels: the user cost of capital (the interest rate channel), bank lending to households and non-financial enterprises (the lending channel), changes in asset prices (the wealth channel), and changes in the exchange rate (the exchange rate channel). Thus, there are different sectors of the economy that are relevant for each of these channels: while the country's banking system is more significant for the lending channel, the importance of the external sector in the economy will determine the significance of the exchange rate channel. The next chapters will provide a brief description of the developments in the economic sectors that may be relevant for each of the transmission channels in Latvia.

### Financial Sector Development and the Lending and Wealth Channels

The Latvian financial sector has undergone remarkable transformation over the last decade, and the country's banking sector has been at the heart of this development. As Chart 1 demonstrates, banks are the single most important player on the domestic financial market. Taking into account the close link between leasing companies and banks (on many occasions, leasing companies have banks as their major shareholders), it seems reasonable to conclude that of all possible channels of monetary policy those involving the banking system are likely to be more important than the ones that assume transmission directly through the capital market. With this in mind, the present analysis does not focus on the possible effects of the wealth channel, for at the current stage of the domestic capital market's development the latter is likely to be either very weak or non-existent. The focus of this paper is on the interest rate, the lending, and the exchange rate channels.

Chart 1

**THE STRUCTURE OF THE FINANCIAL SECTOR IN LATVIA**  
(at end of 2001)

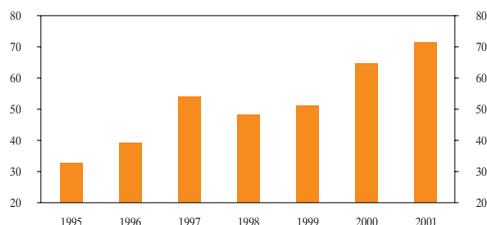


Over the past decade, the Latvian banking sector has been characterised by substantial growth. Total bank assets have increased fivefold since 1995, reaching 6.2 billion euros (73% of GDP) at the end of 2001 (see Chart 2). This continuous strengthening of the financial sector may imply a rising significance of the lending channel. These

remarkable growth rates notwithstanding, the ratio of the bank assets to GDP in Latvia has currently reached a mere one third of the EMU average, so if the lending channel is significant, its role in the Latvian economy as a whole should be less pronounced than in the euro area countries.

Chart 2

**BANK ASSETS**  
(at end of period; % of GDP)



Among other variables significant for the lending channel, three indicators, i.e. bank size, degree of capitalisation and the liquidity of the banks often figure as important prerequisites for an effective transmission of monetary policy through the banking system, though the latest empirical findings suggest that the importance of any of these variables depends heavily on country-specific characteristics.<sup>(3)</sup> Thus, even if the variables change considerably over time, their variances may have only limited relevance for the transmission of the monetary policy through the lending channel.

Along with rising bank assets, the number of banks has decreased drastically (from 61 at the end of 1993 to 23 at the end of 2001). As a result, the average bank size (measured in terms of average assets per bank) over the last eight years has increased more than six times (see Chart 3). In line with the hypothesis that larger banks are more insensitive to the monetary policy impulses, this development may imply weakening of the lending channel. However, in the early stages of the banking system's development, interest rates were arguably not among the variables determining loan supply; hence, any inferences based on observations of changes in the average bank size during this relatively short period must be treated with certain caution.

Chart 3

**AVERAGE BANK SIZE**  
(average assets to GDP; at end of period; %)

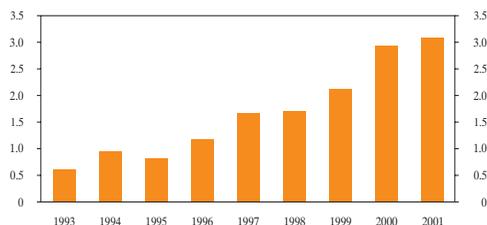
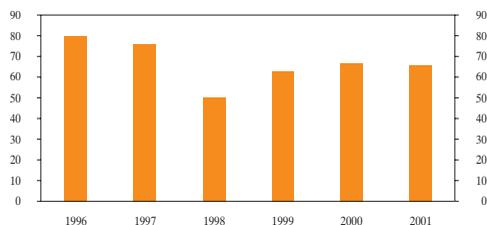


Chart 4 demonstrates that the liquidity ratio (defined as the ratio of current assets to current liabilities) was maintained at a rather high level over the last six years and at the end of 1998 the actual average liquidity ratio exceeded the 30% threshold re-

quired by the Bank of Latvia (see Chart 4). Thus, assuming that lending decisions by less liquid banks are more sensitive to changes in the central bank's interest rates, these relatively favorable liquidity ratios are likely to weaken the potential lending channel of the monetary policy.

Chart 4

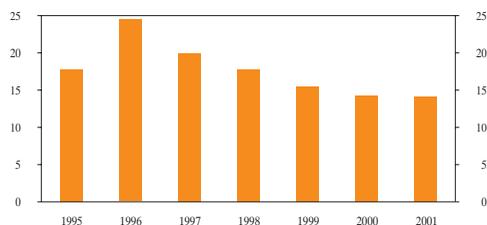
**LIQUIDITY RATIO**  
(%)



Regarding the degree of capitalisation in the banking sector, Chart 5 indicates that the capital adequacy ratio has always exceeded 14% (the law requires a minimum of 10%). Over the last couple of years, however, this ratio gradually diminished as a result of the lending boom. Thus, given the high demand for bank loans and the growing proportion of borrowed funds that the banks use to meet this robust demand, one could reasonably expect that interest rates on the interbank market would gain importance as a variable that determines the volume of loans extended to the non-banking sector.

Chart 5

**CAPITAL ADEQUACY RATIO**  
(%)



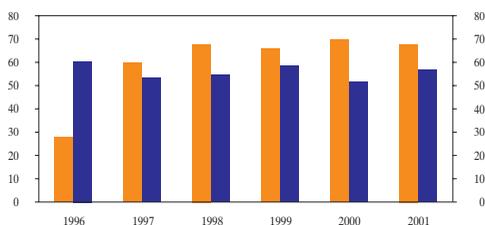
It is worth noting that foreign investors play an important and gradually increasing role in the Latvian banking sector (at the end of 2001, non-residents owned 68% of share capital in Latvian banks; see Chart 6). Foreign investors have provided valuable expertise and enhanced effective functioning of the banking sector. At the same time, the fact that mainly non-residents own the banking sector implies that the response of banks to monetary policy pursued by the Bank of Latvia is likely to weaken and be overshadowed by monetary policy decisions in the host countries of foreign investors. In addition, more than 50% of total loans granted to residents are denominated in foreign currencies. This fact is also likely to minimize sensitivity of the economic activity to changes in domestic interest rates.

Chart 6

**FOREIGN OWNERSHIP OF BANKS' SHARE CAPITAL AND THE SHARE OF FOREIGN CURRENCY LOANS IN TOTAL LOANS TO RESIDENTS**

(at end of period; %)

Foreign ownership  
Foreign currency loans



This leads to an inference that both the relative importance of banks in providing financial resources for the non-banking sector and the ongoing financial strengthening of the Latvian banking system tend to reinforce the transmission of the central bank's monetary policy through the lending channel. However, high liquidity and the rising average bank size may weaken link between the changes in the central bank's interest rates and the lending policy, if these variables are important for the monetary policy transmission. Finally, the growing share of foreign ownership of the Latvian banking sector and the high proportion of loans extended in foreign currencies imply that the domestic lending may be more sensitive to changes in the foreign rather than the domestic interest rates (particularly given the fixed exchange rate and the limited scope for independent interest rate changes in Latvia).

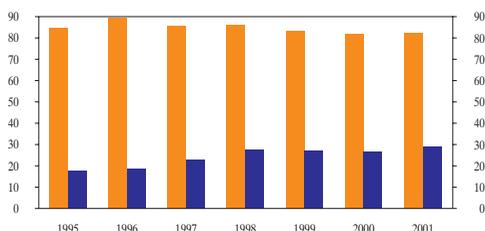
**The Implications of the Real Sector Development for the Interest Rate Channel**

For effective functioning of the interest rate channel of monetary policy, at least one component of total demand should be interest rate sensitive. Theoretically, the most sensitive part of the total demand should be the investment demand, although the consumption demand may also be interest rate sensitive in some cases. Changes in consumption, as shown in Chart 7, indicate that though the consumption ratio to GDP has come down from the peak it reached in the mid-1990s, it still exceeds 80% of GDP. Thus, if the domestic consumption were sensitive to interest rates, monetary policy could potentially have a significant impact on the total demand and the real economy.

Chart 7

**CONSUMPTION AND INVESTMENT RATE**  
(% of GDP)

Consumption  
Investment



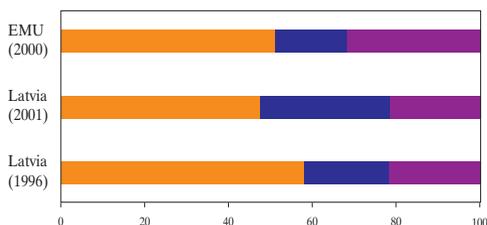
The investment rate has been constantly increasing since the mid-1990s and in 2001 it amounted to almost 30% of GDP. This is a relatively high ratio in comparison with not only other developing countries but also with the EMU average rate. Therefore, the possibility of the interest rate channel having an important role in the monetary policy transmission cannot be ruled out.

Regarding liabilities structure of the corporate sector in Latvia (see Chart 8), it is obvious that the role of the short-term liabilities in the total liability structure is increasing. To the extent that short-term liabilities are presumably more sensitive to interest rate changes than long-term liabilities or equity, this trend may promote the functioning of the interest rate channel in Latvia. However, a large proportion (up to 75%) of these short-term liabilities are made up of debt to creditors and other types of liabilities that are not sensitive to interest rates.

Chart 8

**LIABILITY STRUCTURE OF THE CORPORATE SECTOR (%)**

Equity  
Short-term liabilities  
Long-term liabilities



Therefore, it must be concluded that the liability structure of the corporate sector does not support the assumption that the interest rate channel has become more important over the last decade.

**The Importance of the Exchange Rate Channel**

In small open economies growth is largely based on foreign trade; hence, exchange rate fluctuations may have important implications for a particular country's economy. Accordingly, monetary policy may have a significant real impact on the development of economy, if it can affect the exchange rate.

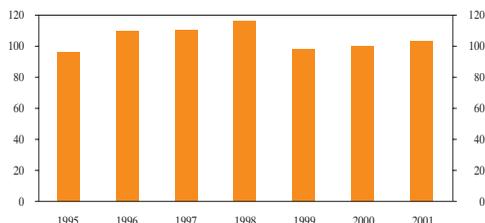
In Latvia, the peg of the lats to the SDR basket of currencies greatly reduces exchange rate volatility but does not eliminate it altogether. First, the exchange rate of the lats is fluctuating against any currency of the SDR basket of currencies in line with their changes against other currencies of the SDR basket of currencies. Second, the lats is floating freely against those currencies that do not enter into the SDR basket of currencies (such as the Russian rouble).

Foreign trade turnover of goods and services is roughly equal to the country's GDP (see Chart 9). Moreover, the importance of foreign trade is enhanced by the fact that the domestic demand in Latvia is very closely related to the performance of the

country's external sector. Thus changes in monetary policy that affect the exchange rate of the lats theoretically are likely to have important consequences for the country's economy.

Chart 9

**EXPORTS AND IMPORTS**  
(% of GDP)



Although it cannot be denied that the exchange rate regime has important implications for the long-term performance of the country's external sector, it is much less clear whether short-term fluctuations of the exchange rate have any significant impact on the real economy. It is well known that currencies of the Central and East European countries are undervalued relative to their long-term equilibrium values that are obtained from the PPP calculations. The latest Eurostat data imply that the lats is currently around 50% below its long-term equilibrium value.(4) Under these circumstances, the relation between short-term fluctuations in the exchange rates and changes in foreign trade turnover may become rather vague.

It must likewise be acknowledged that due to the fixed exchange rate peg all changes in the exchange rate of the lats against the US dollar, the euro, the British pound or the Japanese yen are caused by fluctuations in the global currency markets and are, therefore, independent of the Bank of Latvia's policy. Due to Latvia's small size, the formation of the exchange rate of the lats vis-à-vis the currencies that are not part of the SDR basket of currencies is outside the direct control of the central bank. For that reason, all changes in the exchange rate will be taken as exogenous with respect to the monetary policy of the Bank of Latvia.

**II. VAR MODEL OF MONETARY POLICY TRANSMISSION**

To evaluate different channels of monetary policy transmission, the VAR model widely applied in world's practise is used. VAR models have an advantage not to require introduction of restrictions that do not exist and usually are not supported by empirical data of a country, especially a developing one (e.g. theoretical restrictions imposed by purchasing power or uncovered interest rate parity have not been consistent with the empirical evidence in Latvia so far). A disadvantage of this approach is the need for relatively long time series not yet available for the majority of developing countries. Thus, for instance, to obtain any meaningful impulse reaction function, data of monthly observations shall be used, although for some variables (e.g. GDP) only quar-

terly observations are available. By interpolating the time series that are not available on a monthly basis, a measurement bias is inevitably introduced, so the results obtained have to be considered as approximate estimates only.

To analyse the effects of the Bank of Latvia's monetary policy, the following VAR model covering the period from January 1995 to March 2002 is used:

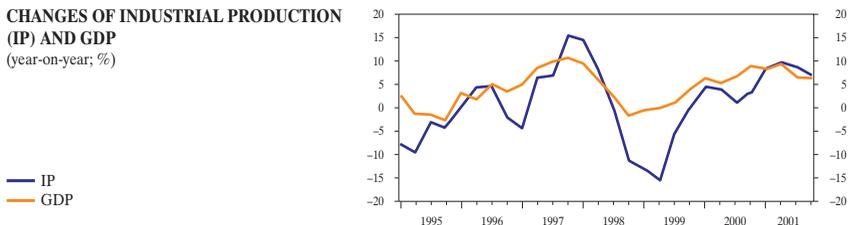
$$Y_t = A_0(L)Y_{t-1} + A_1(L)X_t + u_t, \quad \Omega = E(u_t u_t') \quad [1].$$

The vector of endogenous variables  $Y = (e, i, p, y)$  consists of annual percentage changes in the real effective exchange rate ( $e$ ), nominal interest rate of transactions in lats ( $i$ ), annual producer price changes ( $p$ ), and annual percentage changes of industrial production ( $y$ ). These variables, with the exception of interest rates, are converted into annual percentage changes, as the original series are found to be non-stationary.

The industrial production is used as a proxy for the total GDP dynamics, since the latter is not measured on a monthly basis. Although the industrial production accounts for approximately 25% of GDP, the dynamics of both series are broadly similar (see Chart 10). However, industrial production is more sensitive to external shocks, as evidenced by the response of both the industrial sector and the total GDP to the Russian financial crisis of 1998. Hence, using the industrial production as a proxy for the GDP, the response function would somewhat overestimate the importance of external shocks and, in particular, the exchange rate.

Chart 10

**CHANGES OF INDUSTRIAL PRODUCTION (IP) AND GDP**  
(year-on-year; %)



The use of the PPI also produces higher estimates of elasticity with respect to interest rates and the exchange rate as compared to the CPI, because the latter includes prices on services and administratively regulated prices that are presumably not changing in response to changes in either interest rates or the exchange rate. However, given the close link between the producer and consumer prices, any shock that affects producer prices will eventually have an impact on consumer prices as well. Using producer prices instead of the CPI, it is possible to establish any statistically significant relationship between analysed variables during a much shorter time period, which is a beneficial factor, given the data available from relatively short time series.

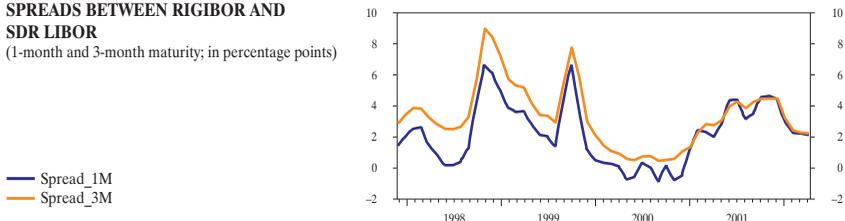
As the inflation of producer and consumer prices differed substantially in the mid-

1990s (mainly due to the importance of administratively regulated prices) and nominal interest rates were adjusted to incorporate consumer price inflation, such interest rates have been adjusted by the Hodrick-Prescott filter to obtain the nominal interest rate data that are more relevant for the industrial sector. Finally, only short-term interest rates are included in this model, even though the economic theory would require the introduction of long-term rates as main determinants of investment demand. However, given the large share of long-term loans with a variable interest rate that is adjusted depending on changes in the short-term interest rates, the hypothesis that the short-term interest rates are used as a variable affecting industrial output can be considered as appropriate.

The vector of exogenous variables  $X = (i^*, y^*)$  consists of nominal interest rate on the SDR currency basket ( $i^*$ ) and changes of the industrial production in the EU countries ( $y^*$ ). These variables are included to separate domestic and external shocks. It is assumed that foreign interest rates and changes in external demand affect domestic interest rates and industrial production, respectively, but changes in the domestic economy have no effect on exogenous variables.

This specification presupposes the existence of a policy reaction function under which the central bank changes interest rates not only in response to foreign interest rate changes but also to shocks that originate in the domestic economy. Under the conventional fixed exchange rate regime this specification would be misleading, as the capital markets would explore arbitrage opportunities to equalise domestic and foreign interest rates adjusted for required risk premium. In this case, however, such specification seems to make sense, as the risk premium for holding assets that are denominated in lats changes over time and, therefore, the domestic and foreign assets are less than perfect substitutes. Chart 11, which shows the spreads between yields on domestic and foreign assets, supports this argument. It can be seen from the Chart that the spreads vary substantially over time and were even negative for short-term maturities for some time during 2000. Hence, this less than perfect asset substitution provides the central bank with at least some degree of independence in terms of monetary policy implementation, albeit the scope for independent monetary policy is still limited by the fact that very wide and persistent interest rate differentials could not be sustained over longer horizons.

*Chart 11*  
**SPREADS BETWEEN RIGIBOR AND SDR LIBOR**  
 (1-month and 3-month maturity; in percentage points)



The VAR model as described above is linked to the following structural model:

$$\Pi Y_t = \Gamma_0(L)Y_{t-1} + \Gamma_1(L)X_t + \varepsilon_t, \quad \Sigma = E(\varepsilon_t \varepsilon_t') \quad [2].$$

If the identities

$$A_0(L) = \Pi^{-1}\Gamma_0(L), \quad A_1(L) = \Pi^{-1}\Gamma_1(L), \quad \Omega = \Pi^{-1}\Sigma\Pi^{-1}'$$

hold, then the VAR model is equivalent to the reduced form structural model:

$$Y_t = \Pi^{-1}\Gamma_0(L)Y_{t-1} + \Pi^{-1}\Gamma_1(L)X_t + \Pi^{-1}\varepsilon_t \quad [3].$$

However, in order to identify structural shocks, some restrictions need to be imposed on the coefficients of the structural matrix. In the light of the fixed exchange rate regime, it is assumed that the changes of the real exchange rate are determined by exogenous factors, and, while the real exchange rate is based on consumer prices but the producer prices have been used, the restriction that  $\pi_{13} = 1$  is not imposed. Since the shocks to inflation and output are unobservable for policymakers *ex ante*, it is assumed that the reaction of interest rates to any of these shocks is not instantaneous. However, the shocks to the real exchange rate that come from changes in the nominal exchange rate can be observed almost instantly as they happen, so the central bank can (at least theoretically) react to these shocks. Moreover, due to some price rigidity, especially given the monthly observations, it can be assumed that there is no contemporaneous effect on prices from shocks originating either from exchange rate volatility or changing demand. Finally, since we are interested in the reaction of production to shocks in both interest rates and the exchange rate, no restrictions on the respective coefficients are posed. Based on the above-mentioned considerations, the following structural matrix has been selected:

$$\Pi = \begin{pmatrix} 1 & 0 & \pi_{13} & 0 \\ \pi_{21} & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ \pi_{41} & \pi_{42} & 0 & 1 \end{pmatrix}$$

The impulse reaction functions and the variance decomposition of this VAR model are given in Appendix 1. The results show that the response of the Latvian economy to various shocks is much quicker than in the advanced economies. While it takes four quarters on the average until the response of GDP reaches its peak after a monetary shock in the EU countries (9), in Latvia any statistically significant impact of the shock on the economy disappears in nearly three quarters. Given the inclusion of the industrial sector as a proxy for GDP, it is not surprising that a price rise tends to lead to rising output (although the effect is not statistically significant), whereas the shocks to output do not have any effect on prices, as the gap between the actual seasonally adjusted output and the potential output is covered by imports. Analysing the respective

impact of the exchange rate and the interest rate on prices and output, it is evident that the single most important variable affecting economy is the exchange rate (see Chart 1.1).

The exchange rate has the largest impact directly on domestic prices. Since the Latvian producers are price-takers in the world markets, a negative shock to the real exchange rate (i.e. appreciation) puts an immediate pressure on the domestic price level. This impact reaches its peak in five months and lasts for approximately eight months.

In contrast, shocks to domestic interest rates do not affect prices directly. This outcome is to be expected, as it is entirely in line with the economic theory and the results from empirical studies on economically advanced countries. These results show that interest rates can affect domestic prices only through changes in total demand and output. However, it usually takes several quarters for this effect to show up.<sup>(10)</sup> In Latvia, the impact of interest rates on output is relatively small and it loses its significance in approximately two months. Consequently, these changes in output that are induced by interest rate changes are too insignificant and short-lived to have any meaningful impact on prices.

Although the exchange rate shocks have about the same impact on output as interest rates in terms of deviation from the baseline scenario (constant endogenous factors), the effect of the exchange rate lasts longer (up to two quarters). Thus, the VAR model supports the assumption that the exchange rate channel is relatively more important for the short-term output and price developments in Latvia than the interest rate channel.

Given the fixed exchange rate regime, the Bank of Latvia cannot control the real exchange rate effectively, as all short-term real exchange rate fluctuations come from changes in the nominal exchange rate (caused either by fluctuations in exchange rates of the SDR currencies or other currencies against the SDR basket of currencies and hence also the lats). Therefore, even though the exchange rate fluctuations are important for the economy, there does not exist an exchange rate channel through which the central bank could deliberately transmit its monetary impulses to fine-tune the economy.

The impulse reaction functions of the VAR model suggest that the industrial production is reacting to interest rate changes, although this channel is relatively weak. Therefore, admitting that the central bank could, in principle, use the interest rate policy to contain excessive output volatility, the attempt to offset exchange rate shocks with active interest rate management may prove inefficient, given the relative importance of the exchange rate and interest rate shocks for the country's economy and the fact that most shocks of the economy are caused by the exchange rate.

In addition, the central bank's power to set interest rates independently is likely to diminish in the coming years, as domestic and foreign assets become closer substi-

tutes. Hence, foreign interest rate changes will gain importance. However, the foreign interest rate incorporated as an exogenous factor in the VAR model and the model specification do not allow for a more detailed analysis of the impact of the foreign interest rate on the domestic economy. Therefore, the next Chapter employs the small structural macroeconomic model to estimate the significance of the foreign interest rates for the Latvian economy and to compare the significance of interest rate changes vis-à-vis the exchange rate changes.

### III. THE SMALL STRUCTURAL MODEL

The small structural macroeconomic model is used for the analysis of monetary policy shocks. The model used in the current analysis consists of four behavioral equations that describe the various components of the total demand and one equation that deals with price developments. In contrast to the VAR model, foreign and domestic interest rate changes are both assumed as exogenous in this model. In addition, due to the fixed exchange rate regime, also the nominal exchange rate changes are fully exogenous and do not react to changes in domestic variables (for a more detailed description of the model see Appendix 2).

Similarly as in the VAR model, only exchange rate fluctuations have a direct impact on domestic prices. Interest rates could therefore only affect the economy through changes in domestic demand. However, since the gap between the real and potential output does not appear to have any statistical relevance to current price dynamics in Latvia (according to equation [5a]), the capacity of the central bank to affect domestic prices through the interest rate channel cannot be explicitly ascertained.

Therefore, the relative importance of the exchange rate and the interest rate channels is tested by studying the impact of each on the total output. In order to analyse the response of the economy to changes in interest rates and the exchange rate, a permanent shock equal to one standard deviation of each respective variable is introduced. In addition to domestic short-term interest rates, foreign short-term interest rates are also considered to account for the fact that, due to a large share of loans in foreign currencies and impressive foreign ownership in the equity of the banking sector, domestic interest rates may not always be relevant for banks. Hence, foreign interest rates may affect the domestic economy to the same extent as the interest rates on transactions in lats.

The structural model is formed assuming the existence of the following transmission channels. Changes in the nominal exchange rate affect the real exchange rate in the first place, as domestic prices do not adjust instantly to the changes in the nominal exchange rate. Changes in the real exchange rate affect only exports, as the import price elasticity is very low. Thus, a negative exchange rate shock leads to a fall in exports. However, as domestic prices start adjusting to changes in the nominal ex-

change rate, the real exchange rate adjustments begin to gradually offset the initial shock. In addition, a lower export demand leads to lower imports as well (because imports are extensively used as an input into the production of exports, and lower exports translate into lower investment demand, which also tends to lower total imports). As a result, the impact of the exchange rate shock gradually declines.

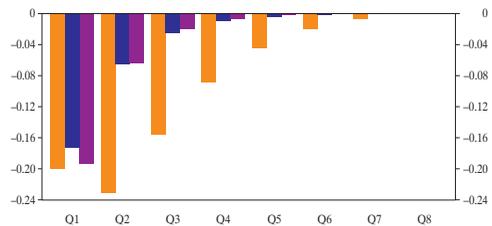
Interest rates affect the economy only through changes in the investment demand, as consumption has been found to be less than flexible with respect to interest rate changes. Hence, a negative interest rate shock initially reduces the investment and also the total demand, but the decline is gradually offset by a lower import demand (for results of these simulations see Chart 12).

Chart 12

**CHANGES IN GDP**

(quarter-on-quarter; relative to baseline, caused by one standard deviation of nominal exchange rate ( $Y_E$ ), domestic interest rate ( $Y_R$ ), and foreign interest rate ( $Y_{R^w}$ ); %)

- $Y_E$
- $Y_R$
- $Y_{R^w}$



The results shown in the Chart seem to indicate that the output is less sensitive to monetary shocks in comparison with the results from the VAR model, as the structural model uses total GDP rather than the industrial output. However, both these models produce similar results in terms of relative importance of interest rates and the exchange rate. A shock to the exchange rate produces a deviation of output from the baseline scenario for about seven quarters, whereas changes in interest rates of similar magnitude are only effective for about four quarters. According to the structural model, the exchange rate channel is nearly three times more important than the interest rate channel: in the first year after a negative exchange rate shock, the output is on the average 0.2% lower than the envisaged baseline, whereas after changes in interest rates, the output is on the average 0.07% below the projected baseline one year after the shock.

Finally, although the domestic and foreign interest rate shocks were studied separately, they produced rather similar results with regard to the domestic economic activity. It is likely to be due to the fact that nearly one half of all loans to the domestic sector are extended in foreign currencies, and, therefore, if the lending channel is an important transmission channel, foreign interest rates should have the same impact on economic activity as the domestic interest rates. In addition, despite the large short-term deviations of the domestic interest rates from the benchmark foreign interest rates (see Chart 11), the domestic interest rates are presumably moving more in line with the uncovered interest rate parity condition when observed on a quarterly basis.

Hence, there should be no fundamental differences between changes in domestic and foreign interest rates.

The fact that it is almost impossible to distinguish between the impact on output from changes in the domestic and foreign interest rates supports the assumption that the Bank of Latvia will not be able to effectively pursue an entirely independent monetary policy over longer time horizons. Hence, the loss of the monetary policy independence after the EU accession and the adoption of the euro in Latvia would not produce a radical regime shift and, therefore, would not hamper the country's economic development.

## CONCLUSIONS AND MONETARY POLICY IMPLICATIONS

This study deals with short-term reactions of the economy to various monetary shocks. The analysis of the financial system of Latvia supports the view that the wealth channel currently is very weak or even non-existent due to a relatively underdeveloped capital market. Strengthening of the banking sector implies that the lending channel is likely to gain importance. However, the large share of loans extended in foreign currencies and the dominating foreign ownership in the equity of the Latvian banking sector tend to diminish the importance of the domestic interest rate channel.

The role of domestic interest rates is further undermined by the country's fixed exchange rate regime that, in theory, is likely to hamper the implementation of independent monetary policy. Nevertheless, since domestic and foreign assets are not perfect substitutes, the central bank does have some limited freedom for independent interest rate policy of its own; hence, a certain impact of the domestic interest rate channel becomes possible.

The importance of the interest rate channel is depressed by the fact that the domestic consumption demand (the largest component of aggregate demand) is not sensitive to interest rate changes, so any changes in domestic demand come as the response of investment to interest rate changes. Moreover, the low share of interest rate-sensitive liabilities in the total liability structure of the corporate sector tends to minimize the significance of the interest rate channel.

The size and the degree of country's openness seem to imply that the economic activity must be very sensitive to exchange rate changes. However, the importance of the exchange rate channel may be diminished by low price elasticity of imports and by the fact that, according to purchasing power parity calculations, in Latvia the exchange rate against the major world currencies is undervalued.

The importance of various channels of monetary transmission has been tested empirically by using the structural VAR model and the small structural macroeconomic model. These two models produced broadly similar results. The exchange rate affects domestic prices directly through changes in import and producer prices. Moreover, both changes in the exchange rate and interest rates have a temporary effect on output. However, the effect of fluctuations in the exchange rate is about three times larger and lasts longer than that of interest rate changes. It is, therefore, concluded that monetary shocks are transmitted to the economy mainly through the exchange rate channel.

However, due to the current fixed exchange rate regime, the Bank of Latvia cannot exert influence upon the economy through the exchange rate channel. Thus, all shocks that are transmitted through the exchange rate channel are exogenous. The central bank may attempt to neutralize negative exchange rate shocks by its interest rate

policy, yet its ability to do so is strictly limited. First, the interest rate channel is relatively weak. Second, the fixed exchange rate regime implies that the central bank has limited room for making independent and sustained interest rate changes.

These conclusions have implications for the future development of Latvia's monetary policy. On the one hand, one could expect an increase in the significance of the exchange rate channel as the lats moves towards the level consistent with the purchasing power parity and as elasticity of import prices increases. This would make the economy of Latvia more vulnerable to external exchange rate shocks. On the other hand, strengthening of the country's financial sector would render the interest rate channel stronger. However, as domestic and foreign assets become closer substitutes, the power of the central bank to set interest rates in line with the country's economic conditions is likely to diminish and the changes in foreign interest rates will become more important for the domestic economy.

Given the diminishing role of domestic interest rates, synchronisation of the business cycles in Latvia with the business cycles abroad is becoming more crucial. As long as the structure of the country's foreign trade remains widely diversified (with roughly one third of exports going to the EMU countries, another third to the EU countries that are currently outside the euro zone, and the remaining one to the rest of the world), the economy of Latvia is likely to remain exposed both to shocks that are related to the EMU and those that come from outside the euro area. Therefore, the interest rates of not only the euro area but also of other main trade partner countries may be substantially relevant for the development of the domestic economy. Hence, the current peg of the national currency to the SDR basket of currencies rather than to one single currency is justified.

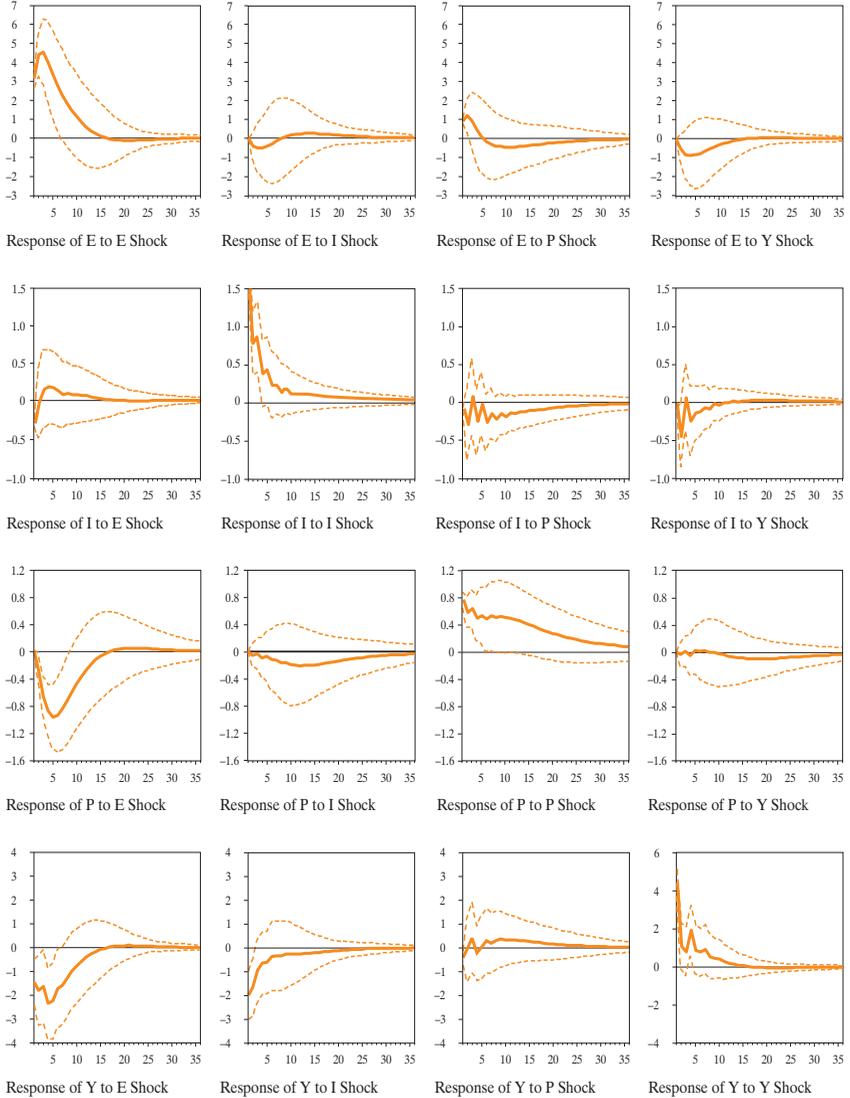
After the EU accession and the adoption of the euro, the exchange rate channel will partly lose its significance, as the current nominal exchange rate volatility with respect to the euro will disappear, whereas the exchange rate fluctuations vis-à-vis currencies other than the euro are likely to become more pronounced. However, to the extent that the adoption of the euro is expected to promote foreign trade between Latvia and other countries in the euro area, the importance of other currencies will gradually decrease. The loss of monetary policy independence after the adoption of the euro is not expected to present a major shock for the domestic economy, as the latter already now responds to the changes in domestic and foreign interest rates (that will replace the domestic interest rates after the adoption of the euro) in a similar way.

# APPENDICES

## Appendix 1

Chart 1.1

### RESPONSE TO STRUCTURAL ONE S.D. INNOVATIONS $\pm 2$ S.E.

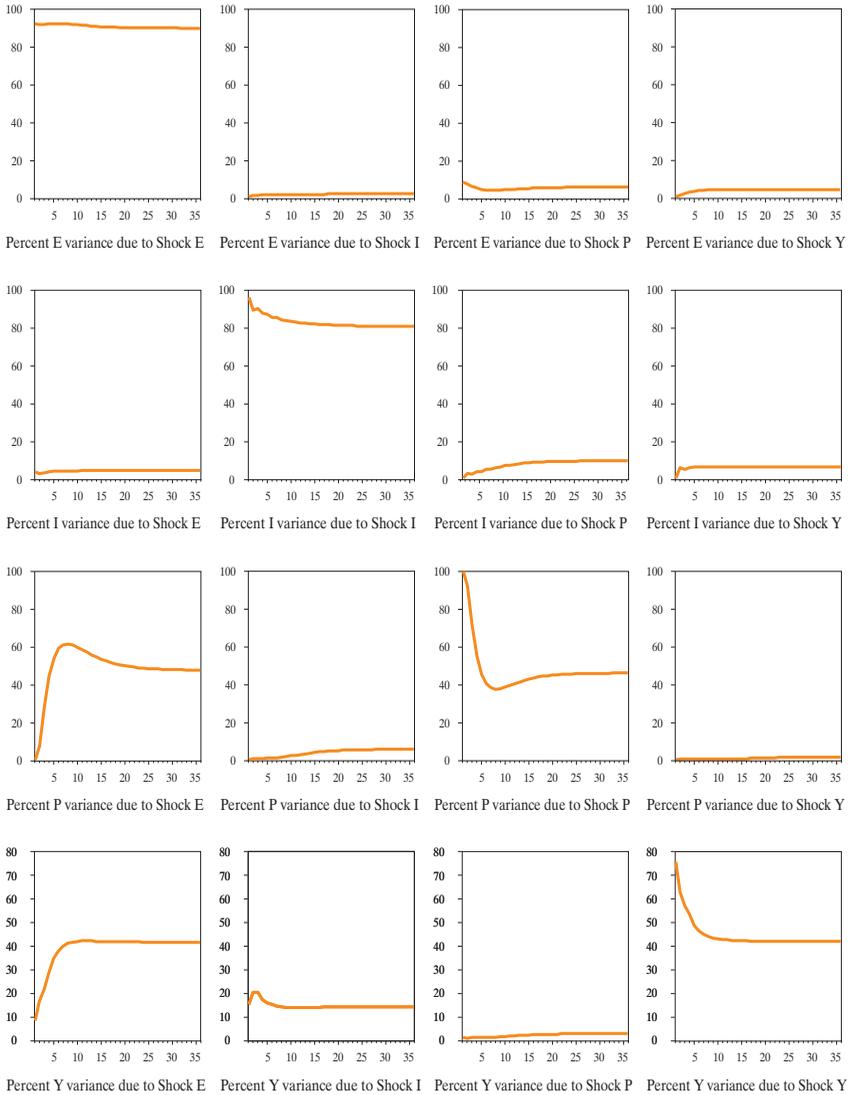


E – year-on-year changes in the real effective exchange rate; %  
 I – nominal interest rate of short-term transactions in lats  
 P – year-on-year changes in producer prices; %  
 Y – year-on-year changes in industrial output; %

Chart 1.2

**VARIANCE DECOMPOSITION**

(%)



E – year-on-year changes in the real effective exchange rate; %  
 I – nominal interest rate of short-term transactions in lats  
 P – year-on-year changes in producer prices; %  
 Y – year-on-year changes in industrial output; %

### The Small Structural Model for the Analysis of Monetary Shocks

The simplified small structural model used for the present study is based on the statistical identity  $Y = C + I + (X - M)$  and consists of four behavioral equations for each of the GDP component, and one equation that describes price formation. The behavioral equations have the following form:

$$\log(C)_t = \alpha_0 + \alpha_1 \log(Y)_t + \text{dummies} + \varepsilon_t \quad [1a]$$

$$d\log(I)_t = \beta_0 \log(I)_{t-1} + \beta_1 \log(X)_{t-1} + \beta_2 d(R)_t + \varphi_t \quad [2a]$$

$$d\log(X)_t = \gamma_0 \log(X)_{t-1} + \gamma_1 \log(Y^w)_{t-1} + \gamma_2 d\log(Y^w)_t + \gamma_3 d(EP^w/P)_t + \text{dummies} + \mu_t \quad [3a]$$

$$d\log(M)_t = \lambda_0 d\log(C)_t + \lambda_1 d\log(I)_t + \lambda_2 d\log(X)_t + \nu_t \quad [4a]$$

$$d\log(P)_t = \phi_0 + \phi_1 d\log(P)_{t-1} + \phi_2 [d\log(P^w)_{t-1} + d\log(E)_{t-1}] + u_t \quad [5a]$$

Endogenous variables: Y – total GDP, C – consumption, I – investment, X – exports of goods and services, M – imports of goods and services (all variables are expressed in real terms and adjusted seasonally), P – consumer price index.

Exogenous variables: R – domestic nominal short-term interest rates,  $R^w$  – average foreign short-term interest rate (proxied by interest rate on SDR basket of currencies),  $Y^w$  – external demand (proxied by the average GDP of Latvia's main trade partners), E – nominal effective exchange rate,  $P^w$  – foreign prices.

Notes:

- (i) to take into account the specific features of the Latvian banking system (i.e. the large share of loans to residents in foreign currencies), two simulations are performed: with domestic and with foreign interest rates entering into the investment equation;
- (ii) interest rates do not affect consumption. Neither short-term nor long-term relationship between any of the interest rates and consumption has been detected during the period analysed here;
- (iii) whereas the real exchange rate has a short-term impact on the volume of exports, there is no relationship between the real exchange rate and imports. The inflexible response of imports to real exchange rate changes can be explained by the country's persisting high investment needs and a low rate of substitution of the domestic and imported goods;
- (iv) price changes are modelled as depending on external price changes caused by changing import prices and the nominal exchange rate plus a constant that reflects changes in administratively regulated prices. The relationship between domestic prices and the economic cycle (a gap between actual and potential output) was statistically insignificant, as the excess demand can more easily be satisfied by imports than through price changes.

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