I. Monetary Transmission in Croatia[1]

A. Introduction and Summary of Conclusions

1. **The widespread euroization and the openness of the Croatian economy restrict the scope for autonomous monetary policy.** The high degree of trade and financial integration and euroization underpins the importance of exchange rate stability in the authorities' monetary policy framework. The focus on maintaining a broadly stable kuna-euro exchange rate, combined with a relatively open capital account, limits the scope for autonomous monetary management.

2. **There are good reasons, however, to study the effectiveness of monetary transmission in Croatia in greater depth.** Monetary policy could still play a role provided that the domestic and the international capital markets are not perfectly integrated. Moreover, the exchange rate is not fixed, even though it is closely managed, and the fluctuations in the kuna-euro exchange rate might provide some maneuvering room for monetary policy.[2]

3. **Empirical studies on monetary transmission in Croatia are few and inconclusive.** This largely reflects the short time series with numerous structural breaks. Erjavec and Cota (1999), using multivariate Granger causality tests, found that the interest rate and the nominal exchange rate are econometrically exogenous variables. Billmeier and Bonato (2002) found that the Croatian economy, despite being highly euroized, had a low exchange rate pass-through, which they interpreted as possible evidence that strict exchange rate targeting might not be the best option. Recently, Lang and Krznar (2004), using a structural VAR model, found that monetary policy in Croatia was pro-cyclical—it eased when growth was high and tightened when growth was low—and suggested that there might be a benefit in an active monetary policy for correcting external imbalances. However, they also noted that strong capital inflows might render such policy ineffective and therefore concluded that keeping the existing monetary framework was probably the optimal choice for Croatia.

4. **The evidence analyzed in this chapter supports the view that monetary policy in Croatia is not an effective tool for aggregate demand management.** One of the main conclusions is that financial conditions in the economy are only weakly correlated with the monetary policy stance. Monetary policy can exercise some control over money market interest rates, but its influence on lending rates is uncertain and comes with long lags. The link between these variables was weak even before 2001, under a regime of extensive capital controls, and it has further weakened since then. The ineffectiveness of

[1] Prepared by M. Čihák and T. Konuki.

[2] Actual daily fluctuations were in the range of ±4.5 percent in 1999–2003 and ±7.5 percent in 1996–2003 (but no explicit fluctuation band was in place).

monetary policy is also illustrated by the experience with the credit controls in place during most of 2003.

B. Monetary Policy and Financial Conditions

5. **This section makes a first pass at the issue of monetary transmission in Croatia by constructing and comparing indices of monetary and financial conditions.** A *monetary conditions index* (MCI) is an approximate measure of the degree of restrictiveness of monetary policy. The index is a summary indicator characterizing the monetary tightness in an economy based on several key variables, typically the interest rate and the exchange rate. MCIs became subject of increased interest in 1990s, when a number of researchers and central banks started calculating and publishing them. A *financial conditions index* (FCI) measures the financial conditions actually faced by economic agents. This index expands on the MCI by including indicators of the tightness of financial conditions that economic agents face and are affected—but not necessarily determined—by monetary policy. While MCIs typically use short-term interest rates, FCIs also include long-term rates and even introduce other variables approximating the financial conditions of economic agents.[3] The relationship between the two can provide an indication of the strength of monetary policy transmission.

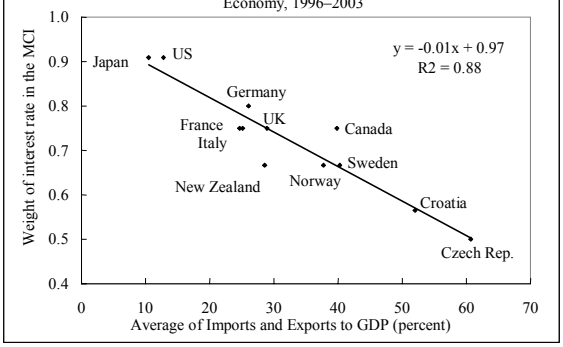
6. **The key parameters of the MCIs (and FCIs) are the relative weights of the exchange rate and the interest rate.** The ratio of the two weights is sometimes referred to as the MCI ratio. For example, the Bank of Canada uses weights of ¾ on the interest rate and ¼ on the exchange rate (an MCI ratio of 3:1), indicating that the effect on demand of a one percentage point interest rate increase can be offset by a three percent depreciation of the exchange rate (Freedman 1996). While exchange rate depreciation typically means a loosening of monetary conditions, it could theoretically lead to a tightening (increase in MCI), depending on the relative sizes of price and income effects. However, the empirical literature reviewed in this paper overwhelmingly finds a positive relationship.[4]

[3] Methods of designing MCIs are discussed, e.g., in Hansson and Lindberg (1994), Freedman (1996), Dennis (1997), Eika et al (1996), and Reserve Bank of New Zealand (1996). Gauthier et al. (2004) survey the literature on FCIs.

[4] In pegged exchange rate regimes that allow for some exchange rate fluctuation, depreciations are likely to lead to monetary tightening indirectly, as they prompt foreign exchange interventions. This indirect effect is captured in the MCI, because the impact of the intervention is likely to be reflected in higher short-term interest rates. However, the direct impact of the exchange rate is likely to be positive and can be substantial in pegged regimes, if economic agents are not well-hedged against exchange rate changes.

7. **The MCI ratio for Croatia can be calibrated by using estimates for other countries and adjusting for the openness of the Croatian economy.** Ideally, the MCI ratio should be based on a macroeconomic model of the Croatian economy. However, this is not feasible, given short time series and numerous structural breaks. Therefore, the method of calibration used here is based on the fact that open economies have a relatively lower weight assigned to the interest rate. To illustrate this point, Figure 1 plots interest rate weights in MCIs reported in the literature for various economies against the degree of openness of these economies.[5] The degree of openness is measured as the average of exports and imports in percent of GDP. For Croatia, this ratio is about 52 percent, the second highest in the sample.[6] The regression estimate presented in Figure 1 implies an interest rate weight of 0.57—an MCI ratio of 1.3:1—for Croatia, meaning that the effect on demand of a 1.3 percentage point of exchange rate appreciation can be offset by a 1 percent decline in interest rates.[7]

Figure 1. Interest Rate Weight in the MCI vs. Openness of the Economy, 1996–2003



8. **Illustrative MCIs and FCIs for Croatia can be calculated using the above MCI ratio.** The MCI, as a measure of the monetary policy stance, incorporates interest rates that are closely influenced by policies. The FCI, as a measure of the overall financial conditions and a broader measure, is based on interest and exchange rates relevant for economic decisions by enterprises and households. As mentioned above, the degree of correlation between the two provides prima facie evidence on the strength of policy transmission.

9. **The calculated MCI is closely correlated with the money market interest rate.** The MCI is defined as a weighted average of a kuna-euro nominal exchange rate index and a money market interest rate index (in both cases 2002 average=100). Both series are

[5] The MCI weights are from IMF (1998) (France, Italy, Germany, Japan, UK, and US); Freedman (1996) (Canada); Eika et al. (1996) (Sweden and Norway); Dennis (1997) (New Zealand); and Čihák and Holub (2000) (Czech Republic). Import and export to GDP ratios are from the World Bank Atlas and relate to 1998 (the data for Croatia are from the CNB and relate to 2003). The regression line and the implied MCI weight for Croatia was calculated by the authors.

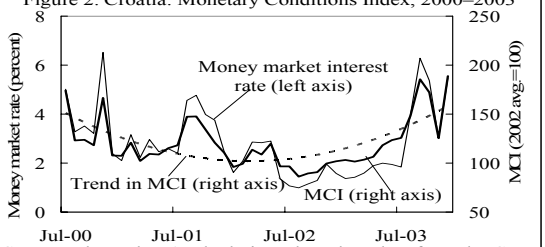
[6] The definition of openness can be adjusted for openness to capital flows, but such adjustments do not change the quantitative result substantially.

[7] The 2002 Article IV staff report (IMF Country Report No. 02/178) showed, for illustration, a monetary condition index based on an assumed MCI ratio of 2:1. Figure 1 suggests that such ratio could have been putting too low a weight on the exchange rate.

adjusted for seasonality. These two indices are then combined into the MCI, using the 1.3:1 ratio derived above. The resulting MCI is strongly correlated with the money market interest rate, reflecting the much lower volatility in the kuna-euro exchange rate. This observation is consistent with Lang and Krznar (2004), who find, using a structural VAR model, that since mid-2000, the monetary policy stance in Croatia is closely related to money market interest rates.

10. **The calculated MCI suggests that monetary policy was loosening during mid-2000 to mid-2002 and tightening since then** (Figure 2). The MCI shows substantial volatility in the last four years (despite the fact that it is based on seasonally adjusted variables). To detect the underlying trend, a Hodrick-Prescott filter was applied to the data.

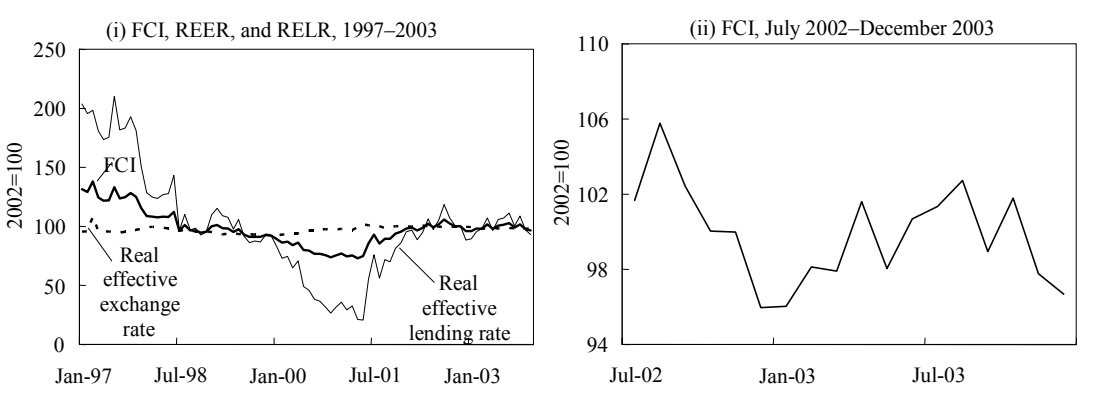
Figure 2. Croatia: Monetary Conditions Index, 2000–2003



Source: The authors' calculations, based on data from the CNB.

11. **The FCI is a weighted average of indices of the real effective exchange rate and the real effective lending rate.** If the FCI is to measure financial conditions faced by economic agents, it needs to be based on the real effective exchange rate (REER) and the real interest rate. This is the prevalent approach in the surveyed literature on FCIs. A similar approach can be applied to Croatia, using the trade-weighted REER (based on consumer price indices) and the real effective lending rate (RELR). The RELR is calculated as a weighted average of the interest rates on domestic and foreign borrowing—the weight being the share of external debt in total private sector debt—adjusted for price developments using the CPI. Both the REER and the RELR are seasonally adjusted using the X-12 method, assuming multiplicative seasonality, and normalized into an index (2002 average=100). These two indices are then combined into the FCI, using the 1.3:1 ratio derived above. Figure 3 shows the REER, RELR, and FCI in 1997–2003.

Figure 3. Croatia: Financial Conditions Index, 1997-2003



Source: The authors' calculations, based on data from the CNB.

12. **According to the calculated FCI there were no major changes in the financial conditions during 2002–03**. Financial conditions were loosening during 1997 to early 2001, followed by a tightening from mid-2001 to mid-2002. Since then, financial conditions have been relatively stable (Figure 3 (i)). A closer look at the mid-2002–2003 period reveals that a mild loosening in the second half of 2002 was followed by a mild tightening during the first half of 2003 and by another loosening at the end of 2003 (Figure 3(ii)).

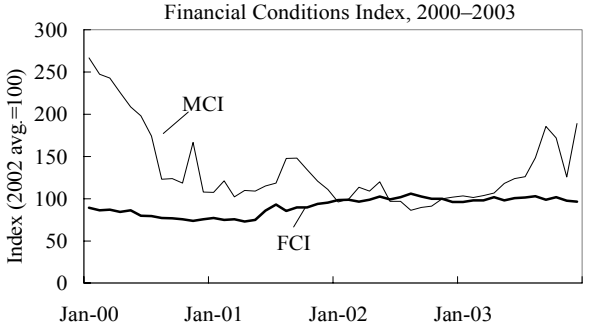
13. **Financial conditions are only weakly correlated with the monetary policy stance.** Figure 4 illustrates that the MCI (and the money market rate) showed a much higher volatility than the FCI. Also, the two series do not seem to be moving together (their correlation is +0.38 for the whole period 1997–2003 but slightly negative for the last three years). This is confirmed by a more detailed analysis, in particular by bivariate Granger causality tests and impulse-response functions based on a VAR model between the MCI and the FCI. Both methods suggest that the impact from the MCI to the FCI is weak in general and insignificant in the period since 2000 (Table 1 and Figure 5).[8]

Table 1. Granger Tests of MCI Versus FCI, 1997–2003
(F-statistics, p-values in parentheses)

	Period	3 lags	6 lags	9 lags
d(MCI) to d(FCI)	1997:1–2003:12	1.785	1.516	2.154
		(0.079)*	(0.187)	(0.040)**
d(MCI) to d(FCI)	2000:1–2003:12	0.198	0.711	0.970
		(0.897)	(0.643)	(0.489)

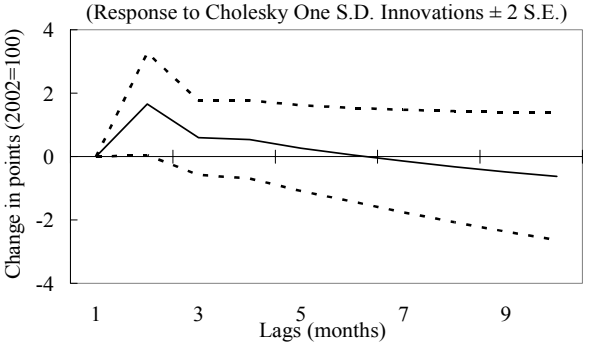
Source: The authors' calculations, based on data from the CNB.
Notes: */** denotes significance at 10/5/1 percent level, respectively. "d" stands for difference.
Granger tests from FCI to MCI were insignificant at the 10 percent level for all the above lags.

Figure 4. Croatia: Monetary Conditions Index versus Financial Conditions Index, 2000–2003



Source: The authors' calculations, based on data from the CNB.

Figure 5. Croatia: Response of FCI to MCI, 2000–2003
(Response to Cholesky One S.D. Innovations ± 2 S.E.)



Source: The authors' calculations, based on data from the CNB.

[8] The same analysis was carried out also with the money market rate instead of the MCI, with similar results.

14. **The calculated MCI and FCI are relatively robust to changes in the weights.** For reasons well-documented in the literature—in particular model dependency, ignored dynamics, parameter inconstancy, and nonexogeneity of regressors—the MCI and the FCI are only rough indicators of the monetary and financial conditions (e.g., Eika et al, 1996). However, the results presented here are not very sensitive to changes in the weights of the interest rate and exchange rate. For example, varying the weight on interest rate from the chosen number of 0.57 to 0.50 or even 0.40 creates indices with pair-wise correlations of about 0.99. Therefore, if the exchange rate has a somewhat higher weight in the transmission mechanism than suggested by the cross-country regression in Figure 1 (e.g., because Croatia is more euroized than the other countries), it would not lead to substantially different conclusions about the developments in the monetary conditions and the policy stance.

C. Interest Rate Channel of Monetary Transmission

15. **This section shifts the focus on the transmission of monetary policy through the interest rate.** The MCI and the FCI developed in the previous section are based on the two traditional channels of monetary policy, the interest rate channel and the exchange rate channel. We have argued that the exchange rate has a potentially larger weight in Croatia than in other countries but its direct impact on monetary conditions is limited. Due to the pegged exchange rate regime, a substantial part of the monetary transmission works through changes in money market rates (which can therefore be used as a proxy variable for the monetary policy stance). This section follows up by examining in more detail the interest rate channel of monetary policy, i.e., the transmission from policy rates to lending rates. The next section will examine other channels of monetary policy, in particular the credit channel.

16. **The CNB has some control over money market rates, since overnight rates tend to respond to changes in bank liquidity.** Money market interest rates are negatively linked to excess liquidity in the system. Econometric estimates based on daily data suggest that excess liquidity in the system is a leading indicator for money market interest rates. Excess liquidity, measured as the daily deviation from a 30-day moving average, shows a weakly negative correlation with the overnight money market rate. Table 2 shows the correlation pattern between excess liquidity and money market rates from January 2001-February 2004.

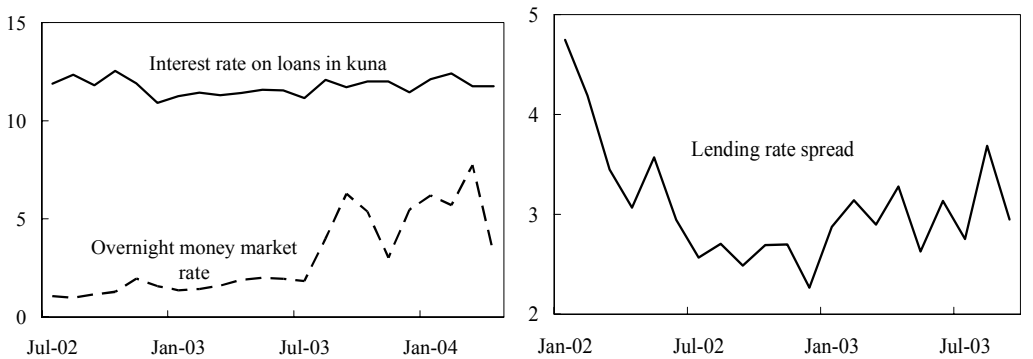
Table 2. Excess Liquidity Versus Money Market Interest Rates, 2001-04
(Correlation coefficient of liquidity and interest rate based on daily data)

	Zagreb Interbank Offer Rate (ZIBOR)					
Excess liquidity defined as	overnight	1W	2W	1M	3M	6M
Daily minus 30-day MA	-0.20	-0.20	-0.18	-0.15	-0.12	-0.23
30-day MA minus 12-month MA	-0.16	-0.20	-0.24	-0.33	-0.35	-0.34

Source: The authors' calculations, based on data from the CNB.
Note: "W" stands for week," M" stands for month, and "MA" stands for moving average. Excess liquidity is defined as departure from a trend of currency in circulation plus government deposits.

17. **However, the transmission from money market rates to bank lending rates is weak.** Although money market interest rates rose during 2003 in response to several hikes in the kuna portion of required reserves (from 25 to 42 percent), the effective lending rate of domestic banks remained largely unaffected and so did the spread between this and foreign interest rates (Figure 6). This can be assessed more formally by using Granger causality tests and an unrestricted VAR model for these variables.

Figure 6. Croatia: Interest Rates and Lending Rate Spreads, 2002–2003
(Percent)



Source: The authors' calculations, based on data from the CNB.

- *Granger tests* indicate only a weak link between lagged money market rates and the effective lending rate (Table 3). There appears to be a link between the two variables in the period 1997–2003. However, this includes a period before the liberalization of capital flows in 2001, when such transmission was more likely. The link disappears if only the period since 2001 is taken into account.

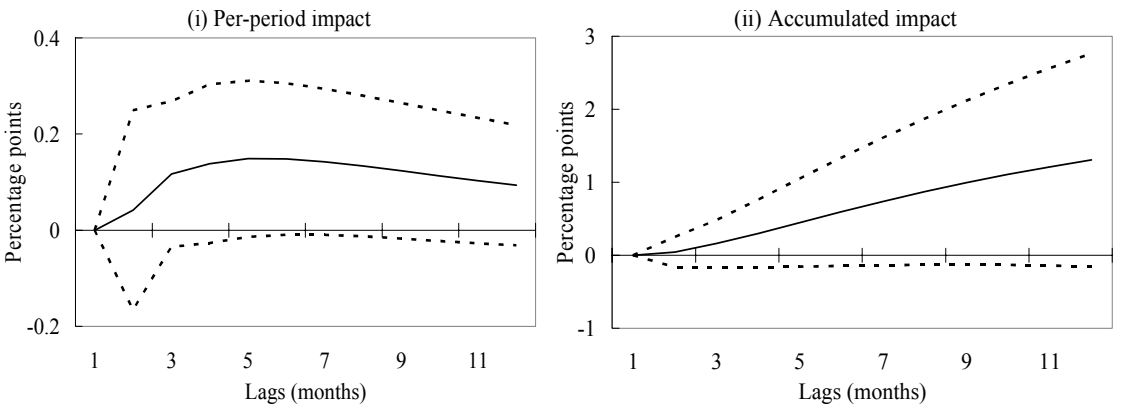
Table 3. Granger Tests of Money Market Rate Versus Domestic Lending Rate, 1997–2003
(F-statistics, p-values in parentheses)

	Period	3 lags	6 lags	9 lags
money market rate to lending rate	1997:1-2003:12	2.411 (0.074)*	1.907 (0.093)*	2.831 (0.008)***
d(money market rate) to d(lending rate)	1997:1-2003:12	1.893 (0.138)	1.632 (0.153)	2.189 (0.037)**
money market rate to lending rate	2001:1-2003:12	0.219 (0.882)	0.847 (0.545)	1.038 (0.440)

Source: The authors' calculations, based on data from the CNB.
Note: */**/*** denotes significance at 10/5/1 percent level, respectively. "d" stands for difference.

- *The VAR model* suggests that changes in policy rates do get transmitted to lending rates but the transmission is very weak. For the Euro Area, Angeloni and Ehrmann (2003) estimate that the maximum impact on lending rates is reached in about 5 months and the maximum impact is about 0.8 of the original shock to money market rates. In comparison, the VAR for Croatia suggests that in 5 months, the impact of money market rates on lending rates is only about 0.15 of the original shock, (Figure 7). Similarly to the Granger tests, if the impulse-response functions are re-estimated for the period since 2001, the response of domestic lending rates is virtually zero.

Figure 7. VAR Models for Money Market Rates and Domestic Lending Rate, 1997–2003
(Response to Cholesky 1 Standard Deviation Innovations ± 2 Standard Errors)



Source: The authors' calculations, based on data from the CNB.
Note: One st. dev. innovation means about 3.7 percentage point increase in money market rates.

18. **These findings are supported also by the analysis of short-term capital flows and interest rate differentials.** The degree of correlation of interest rate differentials and short-term capital flows has been weak and insignificant in 1997–2003 (Table 4).[9] This is consistent with the previous finding that there might have been an interest rate transmission channel in this period. However, as in the case of the previous findings, it should be noted that during a large part of the sample period, short-term flows were restricted. In particular, Chilean-type capital controls had been in effect in 1998 and it was only from mid-2001 that the corporate sector was allowed full access to the foreign exchange markets. As a result, the correlation between the two variables was close to nil before the removal of restrictions in 2001 and about ¼ since then (Table 4). Even though this change is insignificant at the 10 percent level, it suggests that these two series may have become more strongly correlated, and therefore the role of the domestic interest rate

[9] As medium or long-term capital flows are not likely to be interest rate-sensitive, we focused on short-term capital flows.

channel in the transmission mechanism may have weakened further. This finding will need to be verified as more data become available.

Table 4. Croatia: Interest Rate Differentials and Short-Term Capital Flows, 1997–2003

Sample	Correlation coefficient
1997:1–2003:4	0.11
1997:1–2001:2	0.03
2001:3–2003:4	0.24

Source: The authors' calculations, based on data from the CNB.
Note: Interest rate differentials defined as a difference between domestic lending rate and euro-area lending rate.

D. Other Channels and Credit Controls

19. **Monetary transmission may operate through other channels.** The discussion has so far focused on the traditional channels of monetary policy, the interest rate and the exchange rate channel. However, other channels may also play a role in the monetary transmission, in particular: (i) the equity price channel, playing a role through the impact of valuation changes on investment and consumption decisions; (ii) the credit channel, working through a reduction in the supply of bank credit; and (iii) the balance sheet channel, resulting from the fact that the external finance premium facing borrowers depends on the borrowers' financial position (e.g., a monetary restriction leads to a decline in real estate prices, which decreases the effective demand for credit by reducing the value of borrowers' collateral).[10]

20. **The importance of these channels in Croatia is likely to be lower compared to the interest and exchange rate channels.** Given the small size of the equity market in Croatia, the equity price channel is not likely to play an important role in monetary policy transmission. The real estate market plays a more important role, but the real estate prices have so far been driven largely by factors not determined by monetary policy.[11] The credit channel could be substantial, given the dominant role of banks in the financial sector, but it could operate only if banks did not have the capability to react to restrictive monetary policy by finding funding sources abroad. Preliminary bank-by-bank calculations presented by Lang and Krznar (2004) and in Chapter II of this paper suggest that banks—especially foreign-owned banks—have such capability. Therefore, the credit channel does not seem to play a very substantial role in Croatia, even though more research on this issue is warranted.

[10] Mishkin (1996) surveys the literature on monetary policy channels. Bernanke and Gertler (1995) focus on the credit and balance sheet channels.

[11] However, as better data become available, the real estate prices and the related balance sheet effects will become an important area for future research.

21. **The experience with credit controls, imposed by the CNB in 2003, also illustrates the weakness of the credit channel in Croatia.** In January 2003, faced with booming credit and a mounting external imbalance, the CNB introduced credit controls (IMF Country Report No. 03/252). Even though the controls were abolished at the end of 2003, the experience can provide interesting lessons for monetary policy both in Croatia and in other countries. It should be noted that the analysis presented here, while illustrative, cannot fully distinguish the impact of the credit controls from other factors (such as the liquidity rules, which were changed at about the same time). To distinguish that, we would need to use more sophisticated econometric techniques, for which there are not sufficient data.

22. **The credit controls may have contributed to slowing household consumption but did not affect enterprises**. Bank credit decelerated in 2003 (Table 5), possibly affecting spending by households that do not have easy access to foreign borrowing. Enterprises, however, were able to switch their borrowing from domestic to foreign banks (local banks typically directed corporate customers to their parent banks abroad) and use leasing and other forms of financing. As a result, external borrowing in 2003 was about 2.5 times higher than in 2002, and the share of external debt in financing corporate investment rose in 2003. Although the CNB abolished the credit controls at the beginning of 2004, credit growth has not bounced back: seasonally adjusted credit growth for the first five months of 2004, after adjusting for exchange rate movements, indicates an annualized rate of 14½ percent, about the same as in 2003. This indicates that the credit growth deceleration since the spring of 2003 is likely to have been largely demand-driven.

Table 5. Croatia: Credit Growth Before and After the Controls, 2000–03

	2000	2001	2002	2003
Total lending (% change y/y) 1/	5.7	20.8	24.6	20.3
of which (contribution in % points):				
Domestic bank borrowing	5.7	15.9	20.8	10.7
Foreign borrowing (without leasing)	5.6	-3.8	2.3	5.1
Leasing	0.2	2.6	1.9	3.8
Adjustment for write-offs	-5.9	6.1	-0.5	0.6
Corporate sector lending (% change y/y)	3.9	14.0	17.4	16.2
of which (contribution in % points):				
Domestic bank borrowing	1.0	10.7	11.9	2.4
Foreign borrowing (without leasing)	7.3	-5.1	3.2	7.7
Household sector lending (% change y/y)	11.4	41.7	42.1	28.5
of which (contribution in % points):				
Domestic bank borrowing	21.0	31.8	42.5	27.6
Foreign borrowing (without leasing)	0.2	0.1	0.2	0.0
Memorandum items:				
Composition of corporate financing (in %)				
Domestic borrowing (net flow)	2.8	25.8	24.4	4.8
Foreign borrowing (net flow)	20.2	-4.1	12.1	27.1
Other (e.g., reinvested profits)	77.0	78.3	63.5	68.1

Source: Authors' calculations based on data from CNB and the Central Statistics Bureau
1/ Total domestic and external borrowing by the non-government sector in Croatia.

23. **The limits also had a negative impact on the soundness of the financial sector**. Some of domestic banks' best corporate clients were redirected to foreign banks. The limits encouraged a rapid growth of unsupervised and unregulated leasing companies (which were growing rapidly since mid-1990s, but their contribution to overall lending growth increased in 2003). Finally, transparency of monetary and banking statistics deteriorated, as banks engaged—especially in early 2003—in some activities designed mainly to circumvent the limits, such as asset swaps, collateralization, and accelerated write-offs of nonperforming loans. The calculations in Table 5 attempt to approximate the impact of the write-offs on the total credit data.