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Abstract

We examine the recent role of the central bank as crisis-manager in Croatia, as a case study for what may be considered small, open, catching-up, emerging market economies with rigid exchange rate arrangements and a high degree of financial integration. These countries were characterised by abundant capital inflows during the 2000s, especially debt flows, with both positive and negative consequences for their economies. To fight the negative aspects of debt inflows, the central bank in Croatia has persistently pursued counter-cyclical policies since 2003 until the onset of the global crisis of 2008/09. During the crisis period, we find that not only was the central bank crisis management role critical in ensuring the stability of the exchange rate regime and the banking sector, but its actions also contributed to attenuating the cyclical downturn triggered by the global crisis. We use our findings to argue that this would not have been possible had the central bank pursued a more accommodating policy during the period of steady growth prior to the crisis.

JEL:
E44, E58, G01

Keywords:
Croatia, financial crisis, monetary policy, prudential measures

Contents

Introduction [1]

Since the onset of the recent global financial and economic crisis, various proposals for reforming the regulation and oversight of the financial system in order to make it more resilient to crises have been discussed. The debate spans two broad and separate but intertwined areas, the first related to crisis prevention and/or preparedness (popularly termed "macroprudential" policy, see Caprio, 2010) and the second related to crisis management (see Demirgüç-Kunt, 2009). Moreover, it now appears that the conduct of monetary, fiscal, and even industrial policies over the last decade or two has both contributed in sowing the seeds of the current crisis and made some countries less prepared to fend off its negative effects than others. Thus, the ongoing debate also includes potential lessons for the general macroeconomic management from the financial stability viewpoint (see Claessens, 2010).

In an attempt to contribute to the above discussion, we examine the recent role of the central bank as crisis-manager in Croatia, as a case study for what may be termed small, open, catching-up, emerging market economies with rigid exchange rate arrangements and a high degree of financial integration. In the run-up to the crisis, these countries were characterised by rapid growth, especially of the non-tradable sector, fuelled by abundant and inexpensive credit mostly denominated in foreign currency and intermediated primarily by foreign-owned domestically incorporated banks largely financed by their Western European mother-banks. This surge of credit in the 2000s appeared to be a blessing to countries with still low capital stocks and living standards relative to their Western European neighbours.

However, in most of these countries this period was also marked by pronounced asset price inflation in the second half of the decade, and by ballooning trade deficits and stocks of foreign-currency denominated and/or external debt (see for instance Sorsa, 2007). The positives, like higher employment and real wages, proved to have been only short-term gains, as they unwound during the crisis at a much faster pace than that at which they had been built in the run-up to the crisis (see Appendix 1b). Moreover, while containment of the effects of the crisis on the financial sectors has for the most part been impressive, relative to the outcomes of the other financial crises over the past two decades, the repercussions for the real sectors appear much grimmer and much more widespread than in the past, with likely long-term consequences for years ahead (for a recent account, see Backe, 2010).

In Croatia, it has been widely accepted and confirmed by several recent studies (see the next section of the paper) that the countercyclical crisis response of the central bank (Croatian National Bank, CNB) has been instrumental in preserving financial stability, although it alone was not sufficient to prevent a rather deep and long 2008/09 recession. In this paper we build upon those earlier studies and investigate 1) the importance of CNB behaviour in the long tranquil period of growth before the crisis for its ability successfully to perform its role of crisis-manager during the crisis, and 2) the potential short-term side-effects of the CNB measures implemented to fight the crisis. Our aim is to use our results to distil some early lessons for the optimal response of the central bank to a crisis, or more generally to an economic downturn involving pressures on the financial sector, in the group of open, catch-up, emerging market economies with rigid exchange rate arrangements and a high degree of financial integration.

With the above objectives in mind, we attempt to answer four specific questions: 1) should the apparently successful central bank effort to stabilise the financial market during the crisis be attributed to the capital and liquidity buffers built over the pre-crisis period, 2) have the conventional and non-conventional CNB measures [the bank credit growth reserve (CGR), the marginal reserve on banks' net new foreign obligations (MRR), the foreign currency liquidity reserve (FCLR), and prudential measures] been instrumental in building those liquidity and capital buffers, 3) have those CNB measures that have not been instrumental in building liquidity and capital buffers been successful at achieving their stated goals, and 4) what are the potential side-effects of the CNB measures either prior and during the crisis, and could low growth of credit to the private sector in 2009 be attributed to the same CNB actions that stabilised the financial market, or perhaps to the government borrowing crowding out the private sector from the credit market?

Our main findings could be summarised as follows. Regarding the specific instruments used by the CNB in the long period of growth prior to the crisis to stimulate the build-up of banks' liquidity and capital buffers, we find the tightening of prudential measures in conjunction with the marginal reserve requirement on banks' foreign borrowing to have been particularly useful for building capital buffers. For the liquidity buffers, we find that the introduction of the foreign currency liquid reserve requirement was not particularly instrumental in boosting the level of foreign currency liquid reserves, but it shifted composition of these reserves to a more liquid form and at the same time allowed a more autonomous conduct of monetary policy along the path. On the other hand, we find that some instruments were less instrumental in building capital or liquidity buffers, and at the same time not very successful in achieving their stated goals, which calls for a selective and judicious use of them in the future. Overall, we find that to enhance its effectiveness as crisis-manager, the CNB did well by sticking to "leaning against the wind" policies during good times. Moreover, we find that pursuit of these policies prior to the crisis enabled it to fight the pressures on the exchange rate and the financial sector, while at the same time not contributing to the severity of the economic downturn by unduly withdrawing

1 This paper presents a self-contained presentation of a subset of analyses from a more comprehensive unpublished report prepared by the author for the World Bank (see Galac, 2010). The views expressed in the paper are author's own, and do not represent the views of the Croatian National Bank or the World Bank. The author would like to thank Matija Laco and Isfandyar Khan of the World Bank, Nikola Bokan and Ivo Krznar of the CNB, and Goran Vukšić for useful comments on an earlier draft of the full report.

domestic liquidity from the financial system.

The remainder of this paper is organised as follows. A more detailed account of the crisis progression in Croatia can be found in the next section of this paper. Our approach and the data used are described in more detail in the third part of the paper. The results of our analysis of counterfactual scenarios are presented in part four of the paper. Our main findings and conclusions are discussed in the fifth section.

Economy in the crisis

Mihaljek (2009) was among the first to discuss the main shocks emanating from the global financial and economic crisis and impacting the Croatian financial sector and the real economy. He also discusses the central bank responses to those shocks, although his focus is on the fiscal policy response. Mihaljek pinpoints four main international events that sent shockwaves through emerging Europe including Croatia: 1) the failure of two Bear Stearns hedge funds on 17 July 2007, after which sovereign spreads began to rise gradually; 2) the collapse of Lehman Brothers on 15 September 2008 which was followed by an acceleration in the then already year-long trend of declining equity values and rising sovereign bond and CDS spreads, and also triggered a short episode of bank deposit runs that spanned September and October 2008; 3) the default and nationalization of large Icelandic banks on 7-9 October 2008, which reinforced fears about the liquidity and solvency of banking sectors at least in small European nations, thus contributing to savings deposit withdrawals and the related domestic currency depreciation; and 4) the warning by Moody's on 17 February 2009 that it could slash credit ratings of those Western European banks that were heavily exposed to emerging Europe, followed by yet another round of re-pricing of European EME equities, bonds, CDSs and currencies, the most severe to date.

Regarding policy responses in Croatia, Mihaljek argues that the currency depreciation / bank deposit withdrawals shock of late 2008 was effectively dampened by the CNB action of releasing several forms of foreign currency liquidity buffers that had been built over the pre-crisis period, and by conventional foreign currency interventions. This result is confirmed by Galac (2010) using event study methodology to analyze the impact of the CNB actions during the crisis on the level and volatility of the exchange rate and money market interest rate for Croatian Kuna (HRK). He also credits the government's 15 October 2008 decision significantly to increase the deposit insurance coverage from about 15 thousand euros to about 56 thousand euros per depositor per bank with contributing to easing the pressure on banks' balance sheets in late 2008. Mihaljek also recognises that policy responses outside the national realm may have contributed to containment of the crisis, and points to the possible effects of the scheme to secure the rollover of the wholesale funding for the EU banks' subsidiaries in emerging Europe, the so called "Vienna Initiative" announced on 26 March, as being instrumental in calming the fears spurred by the Moody report from a month earlier.

Turning back to the domestic central bank response to the crisis, a more detailed account for Croatia can be found in Bokan et al. (2009) who identified eight actions taken by the central bank between May 2008 and February 2010 specifically designed to boost foreign currency liquidity while at the same time keeping the domestic money tight. With the exception of the May 2008 action, all these actions had the common aim to eliminate the fears that were driving deposit withdrawal and currency depreciation, and were concentrated in October 2008 and February 2009, as may be expected from the previous discussion. The most important ones indicated are 1) abolition of the 55% marginal reserve requirement on foreign borrowing by banks in October 2008, 2) reduction of the general reserve requirement from 17% to 14% in December 2008, and 3) reduction of the foreign currency liquid assets to liabilities ratio from 28.5% to 20% in February 2009.

In Čeh and Krznar (2009), the current crisis is simulated in a small dynamic model of optimal foreign currency reserves with endogenous probability of banking crisis, where reserves are both a self-insurance instrument and a crisis-prevention tool (by the means of boosting confidence and deterring speculation). The model was calibrated on the data from the 1998/99 Croatian banking crisis. Their results suggest that past CNB policies have created a sufficient level of official reserves to prevent the 1998/99 type banking crisis, but only in the case where a cooperative "lender of last resort" role by foreign banks whose subsidiaries operate in Croatia can be assumed (like the one that actually followed the "Vienna Initiative").

In Bokan et al. (2009), macroeconomic developments in Croatia ending with the first quarter of 2009 are analyzed within the proprietary DSGE policy analysis model of the central bank calibrated on the actual data. The central bank actions during the crisis are modelled as changes in the regulatory cost for monetary institutions under central bank supervision, while the crisis impact was modelled through two exogenous shocks: an increase in foreign interest rates and a drop in export demand. As in Čeh and Krznar (2009) and Galac (2010), the simulation in this study suggests that the central bank response could not prevent the impact of the crisis on the real economic activity, but that by increasing the foreign currency liquidity, the central bank contributed to maintaining the stability of the financial sector. In particular, they find that in reality domestic interest rates increased less than suggested by the model, while the growth of foreign borrowing did not slow down as much as suggested by the model. They attribute the former, inter alia, to a reduced wedge between the domestic and foreign interest rates in the form of the regulatory burden, and the latter (on the demand side) to a spike in the credit demand by the government which largely compensated for the lower private sector demand.

The identified spike in government borrowing in the late 2008 is an interesting phenomenon in itself. Jankov (2009) estimates that the net government borrowing from domestic banks between October 2008 and March 2009 absorbed about 50 percent of the reserves released by the central bank and 25 percent of the fall in bank deposits that occurred in October

2008. He also notes that a few of the central bank loosening actions were explicitly conditioned upon granting loans to the government. This indicates an even broader central bank mandate as crisis-manager in Croatia than has been indicated by the previous discussion. As to the causes of increased government borrowing in the domestic market after the escalation of the crisis, Mihaljek (2009) notes that it was an unavoidable reflection of the rapidly deteriorating economic situation in the second half and especially during the last quarter of 2008, in conjunction with a rigid structure of public expenditures supported by highly flexible revenues, and the temporary freeze of the international markets for emerging economies' debt.

Mihaljek then further analyzes the fiscal policy response to the crisis during its peak from October 2008 until the summer of 2009 to conclude that, in contrast to the central bank action, the government response to the crisis was de facto markedly pro-cyclical. Mihaljek implicitly does recognise, however, that the initial government action was rather counter-cyclical in intent: the official government projection of revenues turned from ex-post pessimistic in the long period from 1995 to 2008 to ex-post optimistic for 2009, as the 2009 action was initially presupposed on a real growth of 2 percent, when it was passed on 15 December 2008. Similarly, the first budget revision passed on 3 April 2009 was also pro-cyclical in intent, as the target general government deficit for 2009 was almost doubled from the initially planned 0.9 percent of GDP to 1.6 percent. Moreover, this doubling of the target deficit was accompanied with another optimistic real growth projection of negative 2 percent, at a time when flash estimates were already pointing to a drop in the real activity of around 4 percent for 2009.

Mihaljek notes that reality hit over the summer, and in July the government was finally forced to concede that the lack of fiscal space created by at least eleven consecutive years of general government deficits (no reliable data exist for previous years) left it no option but to switch to a pro-cyclical crisis management mode, in order to preserve fiscal credibility. On 31 July the government announced an increase in the rate of VAT from 22 to 23 percent, and a progressive "crisis" tax of between 2 and 4 percent to be levied on net personal income, effective immediately. Apart from this formal recognition of the lack of fiscal space to support the faltering economy, Mihaljek argues that the increase in bank claims on the central government of a staggering 49 percent in year-on-year terms in the first five months of 2009 not only indicated the dismal revenue outturn, but it also contributed to a serious crowding out of the private sector from the bank loan market. By contrast, Čeh et al. (2010) finds no econometric evidence supporting the crowding out effect in Croatia during the crisis.

Overall, preliminary conclusions reached by other researchers by the time of the writing of this paper suggest that the central bank loosening of its foreign exchange policy has significantly contributed to averting a currency and/or banking crisis in Croatia. Importantly, they attribute this ability of the central bank to stabilise the financial system during the crisis to the policy of "leaning against the wind" in the pre-crisis period from 2003 to early 2008 (for other accounts of this policy see Ljubaj, 2010, and Jankov, 2009), which was characterised by an aggressive build-up of central bank and commercial bank foreign currency liquidity buffers and capital reserves.

Extending the time horizon of Mihaljek and other authors cited above, who end their analysis mostly with the developments in the first half of 2009, we use public sources (see Appendices 3 and 4) to find that after February of 2009, the central bank has not resorted to any significant measures that would reinforce or alter the policy stance. In March, it slightly expanded the eligible collateral for regular weekly REPO auctions, in October it decided to stop remunerating the required reserves denominated in foreign currency, and in November it announced that in 2010 banks would no longer have to subscribe obligatory zero-yield central bank bills if they expanded their credit above a certain limit.

The above mostly exhausts the descriptive analysis of the specific central bank measures taken to contain the financial crisis of 2008-2009. The indication of future central bank policies on the path to recovery is provided by its communication to the public during this period. Most notably, in his "informal" New Year address to the media (see *Jutarnji list*, 17 December 2009), the central bank governor hinted that the central bank would support "pro-active" counter-cyclical government policies if they are designed to support a "different growth model" than that which took place during the credit boom period of 2002-2007. Thus, it became clear that by end-2009 the central bank has taken off its crisis-fighting suit, and has retreated to its old mantra of advocating a better coordination of economic policy makers in setting the course for a more sustainable economic growth.

Data and methodology

We use a comprehensive data set of monthly macroeconomic and financial aggregates, covering the period from January 1997 until February 2010 (since December 2000 for most series). However, to ensure precision, we form the variables representing the aggregate monthly HRK and FX liquidity effects specifically due to the CNB actions by aggregating to the monthly level proprietary daily series of the central bank. As noted in the introduction, we attempt to answer four specific questions: 1) should the apparently successful central bank effort to stabilise the financial market during the crisis be attributed to the capital and liquidity buffers built over the pre-crisis period, 2) have the conventional and non-conventional CNB measures[2] [the bank credit growth reserve (CGR), the marginal reserve on banks' net new foreign obligations (MRR), the foreign currency liquidity reserve (FCLR), and prudential measures] been instrumental in building those liquidity and capital buffers, 3) have those CNB measures that have not been instrumental for building liquidity and capital buffers been successful at achieving their stated goals, and 4) what are the potential side-effects of the CNB measures either prior and during the crisis, and could low growth of credit to the private sector in 2009 be attributed to the same CNB actions that stabilised the financial market, or perhaps to the government borrowing crowding out the private sector from the credit market?

The first question cannot be answered by applying econometric or statistical techniques, so we perform a simple counterfactual analysis. For capital, we model the aggregate capital-to-assets ratio as a linear function of the non-performing to total assets ratio in the period before the former reaches its minimum and then forecast it forward. Then we compare the path of this hypothetical ratio to that of the actual ratio and speculate about possible consequences had the hypothetical scenario materialised instead (i.e. had there been no prudential and/or monetary measures to prompt recapitalization before the crisis). Similarly, for liquidity buffers, we construct the counterfactual end-September 2008 HRK and FX reserves by fixing the actual liquidity reserve ratios used at the end-2002 (before the monetary tightening was officially announced). Then we discuss the implications of these hypothetical levels of liquidity buffers for the options available to the CNB at the time it actually had to use them to stabilise the financial market in the late 2008 and early 2009.

To answer the second question, we assess the success of introducing CGR in slowing overall credit growth on two separate occasions, introducing and subsequently tightening MRR in slowing the growth of banks' gross foreign liabilities prior to the crisis, and MRR changes and tightening prudential measures in inducing a build-up of banks' capital buffers prior to the crisis. We do this by assessing the significance of these instruments for simple forecasts of the variables they were intended to influence. Thus, for each forecast equation, we perform a Wald test for redundancy of the instrument of interest in that equation: CGR ratio in the forecast of growth of the bank and non-bank credit to private sector, and MRR ratio in the forecasts of banks' gross external liabilities and bank capital. We analyze the significance of the three episodes of tightening prudential measures only by visual inspection, due to their qualitative nature and interaction with MRR.

The last question concerns the factors impacting the growth of domestic banks' credit to the private sector in the crisis period. We attempt to build a reasonable reduced-form model for the rate of growth of this credit in the period prior to May 2008, by searching through our data for good monthly proxies of the credit supply and demand factors. For the supply, we seek proxies for economic activity, cost and availability of funding, and profitability of lending to the private sector. For the demand, we look at measures of the cost of credit, and economic activity. We let the variables with "correct signs" in the two equations into the next round, where we combine them into a single equation and then manually remove the variables with inflated variance due to multi-collinearity, while making sure that we retain at least one proxy for each component of the credit demand and supply, where possible.

In the last stage, we construct a standard structural dynamic forecast for the period beginning May 2008 and ending December 2009 based on the selected reduced-form model of credit growth. Then, we compare our forecast with the actual private bank credit growth in the period since May 2008, and draw conclusions about how the differential between the two might have been impacted by the surge of bank lending to government and the CNB's actions that reduced the HRK liquidity in the system. We repeat this procedure for two specifications of the reduced-form forecast equation, as a robustness check on model uncertainty in this exercise.

Results

Our results indicate that the CNB's efforts in 2004-2006 to stimulate recapitalization of commercial banks might have prevented a more pro-cyclical capital-raising episode during 2009, and loss of confidence in the banking sector as a whole. The former implication is suggested by the simulation of the capital-to-assets ratio by extrapolating until the end-2009 its observed co-movement with the non-performing-to-total-assets ratio in the period prior to August 2005, when the capital-to-assets ratio bottomed at the 12.65 mark (see Figure 1 and Table 1 in Appendix 6 for details of this simulation). The simulation shows that in the absence of the CNB measures and the corresponding change of banks' behaviour, banks would have likely finished 2008 with a capital-to-assets ratio of 10.6 and 2009 with a ratio of 13.3 (Table 1). This would have implied

2 The proper reserve requirement (RR), levied on almost all liabilities regardless of their maturity, had a very high rate prior to the crisis – 19% at its peak. A part of the RR is maintained in domestic and another part in foreign currency. Moreover, part is held as a deposit at the CNB and part in the form of liquid assets. There have been many changes in the rate, scope and maintenance procedure in the past, primarily in order to change the monetary policy stance, but also to create and withdraw both kuna and foreign exchange liquidity.
Minimum Required Amount of Foreign Currency Claims (in this paper, FCLR or foreign currency liquidity reserve) requires banks to hold a certain ratio of their foreign currency liabilities in the form of liquid foreign assets. This requirement stems from the fact that Croatian households prefer to keep their savings in foreign currency. Since the central bank is unable to create foreign currency, commercial banks have to keep a large share of their foreign currency liabilities in the form of liquid foreign currency assets, to be used when needed. MRR was initially levied only on short-term foreign exchange liabilities and from 2001 was extended to include all foreign currency liabilities. In 2006 it was extended to include liabilities indexed to foreign currency as commercial banks were encouraging this type of savings due to lower regulatory costs. The rate prior to the crisis was quite high, and most of the time over 30%.
The "marginal reserve requirement" (MRR) was levied on new commercial banks' foreign borrowing from 2005. It was introduced to discourage heavy foreign borrowing by commercial banks to be used to finance domestic credit expansion, which was prevalent in the mid 2000s. The rate was gradually increased from 25% up to 55% of commercial banks' new foreign borrowing. There was also the special reserve requirement, which was similar to the MRR. It was introduced as some banks tried to circumvent the MRR by issuing domestic securities that were supposed to be purchased by foreigners. The MRR was revoked in October 2008 to remove a strong obstacle for capital inflows through the banking sector during the crisis.
The last regulatory requirement is a penalty on fast growing banks in the form of the obligatory CNB bills, (in this paper, credit growth reserve or CGR). Commercial banks whose credit to the private sector grew above a certain limit were required to purchase low yielding obligatory CNB bills in the preannounced proportion to the "prohibited" excess credit growth. This measure was put in place in 2003 with the "subscription rate" of 200%, removed in 2004 and enacted again in 2006, only this time the subscription rate was "only" 50% and 75% since 2008.
In addition to regulatory reserve requirements, the CNB requires commercial banks to meet high capital adequacy requirements, and foreign currency denominated or indexed loans to unhedged borrowers are assigned significantly higher credit risk weights for the purpose of calculating the capital adequacy ratio.

Table 1 Capital-to-assets ratio counterfactual scenario

Date	Bank assets	Bank capital	Capital / assets	CAR	NPLR	Cap/assets forecast	CAR forecast	Capital forecast
12/2007	336,349	53,179	15.8	15.4	4.8	10.6	13.5	35,619
12/2008	361,671	60,317	16.7	14.2	4.8	10.6	13.5	38,446
12/2009	371,386	66,306	17.9	16.4	7.8	13.3	15.1	49,543
2008-2007	25,322	7,138	0.9	–1.1	0.1	0.0	0.0	2,826
2009-2008	9,715	5,989	1.2	2.2	3.0	2.7	1.6	11,097

Note: Minimum capital ratio found for 08/2005 at 12.65

a capital-raising effort of about HRK 11 billion during 2009, compared to the actual capital raised of about HRK 6 billion, the difference amounting to HRK 5 billion, or about 1.4 percent of the actual December 2008 bank assets.

In the absence of the CNB measures and banks' adjustment in 2005-2008, the outcome would have been even more extreme had banks attempted to hoard capital in 2009. In that case, finishing 2009 with the actual capital-to-assets ratio of 17.9 percent (after finishing the previous year at the hypothetical 10.6 mark) would have required a capital raising effort of staggering HRK 28 billion, resulting in the difference between this hypothetical and the actual capital raised of HRK 22 billion, or about 6.1 percent of December 2008 assets. However, this would not have been necessary under the "old" prudential rules since then the capital-to-assets ratio of 10.6 at end-2008 would have corresponded to the supervisory capital adequacy ratio (CAR) of 13.5, which is just slightly lower than the actual CAR at that time of 14.2. Thus, by extrapolating the relationship between the CAR and the capital-to-assets ratio, to raise their hypothetical CAR under old rules to the actual value of 16.4 observed at end-2009, banks would had had to raise their capital-to-assets ratio by (16.4/13.5) x (13.3/10.6) / (15.1/13.5) = 3.3 percentage points to 13.9, implying a capital increase of HRK (13.9/13.3-1) x 49,543 = 2 billion more than the HRK 11 billion from the baseline hypothetical scenario, for the total of HRK 13 billion or HRK 7 billion more than it was actually raised.

The above calculations, although static in nature, stress an important point: had the CNB implemented its prudential tightening during the crisis instead of before (as it had indeed done during the 1998/99 banking crisis, see CNB, 2000) this could have had potentially very serious consequences for the confidence in the banking system. In particular, the simulation above suggests that the aggregate bank CAR at end-2008 under the tightened prudential rules would have been anywhere up to 2.5 percentage points lower than the simulated aggregate capital-to-assets ratio of 10.6. On the one hand, this could have prompted a serious recapitalization drive, possibly to the tune of HRK 28 billion as suggested above (although HRK 11-13 billion is indicated as a more realistic figure), which could have led to a devastating credit crunch. On the other hand, without this recapitalization drive, the aggregate CAR of the banking sector could have fallen to 8.1 percent, possibly triggering central bank action in individual institutions, which has been demonstrated in the past to be a very treacherous path. The recapitalization effort of 2005-2008 thus clearly helped to avoid either of the two extreme outcomes.

Turning to the CNB's liquidity operations during the crisis, we analyze the counterfactual banks' liquidity buffers under the scenario of the unaltered monetary policy between end-2002 and September 2008 (for details see Table 2 and Figure 2 in Appendix 6). Our simulation (Table 2) suggests that at end-September 2008 (the eruption of the Lehman and Iceland episodes), the HRK denominated liquidity buffers would have been about HRK 6.5 billion lower while the FX denominated buffers would have been about HRK 5 billion higher under the simulated scenario than they actually were at that time. This simplified simulation abstracts from all other influences,

Table 2 Counterfactual scenario for banks' required reserves

Date	HRK required reserves	Credit growth reserves	FX required reserves	FX liquidity reserves	Marginal required reserves	HRK required reserves	Credit growth reserves	FX required reserves	FX liquidity reserves	Marginal required reserves
12/2002	11.447	0	14.538	39.066	0	11.447	0	14.538	39.066	0
9/2008	33.308	446	17.929	48.689	3.695	27.208	0	30.057	45.031	0
Total HRK		33.754					27.208			
Total FX					70.313					75.089

including from the potential effect of the overall looser monetary policy and regulation evasion on the real HRK value of the liquidity buffers, and/or their size relative to total banking sector assets and other benchmarks. Thus, the conclusions drawn below should be treated as indicative.

A quick implication of the above simulation is that adequate FX liquidity buffers would have been built before the peak of the financial crisis even under the alternative of unaltered monetary policy instruments. However, the monetary policy stance would have been looser all along the path, with all the implications that this may had had during that period. Regarding the contributions of individual CNB instruments in the build-up of liquidity buffers, it appears that the CGR had had a negligible role in this regard, while the MRR and changes to FCLR contributed by compensating for a slower build-up of ordinary FX required reserves on the actual reserves path. Overall, the effects of introducing and subsequently tightening CGR and MRR on the build-up of liquidity buffers do not appear overly significant. Thus, the CGR and MRR should be assessed in their own right, against their stated objectives, which are not directly related to building banking system liquidity buffers.

The CGR was introduced for a period of one year in 2003 and reintroduced for a longer period and subsequently tightened in 2006 in an attempt to decrease what was judged too high a rate of growth of bank credit primarily to the private sector. The results of a simple econometric exercise (Table 3) aimed at estimating the conditional mean of this growth rate indicate that the introduction of CGR indeed succeeded in meeting its stated objective, on both occasions (see also Figure 3 in Appendix 6). However, it also shows that the effect of CGR on the mean growth of foreign debt of the private sector was exactly the opposite in both periods (see Figure 4 in Appendix 6). This was most likely a sign of the time, rather than due to intrinsically faulty features of the instrument itself, as excess domestic demand had been gladly met by direct credit from abroad in the period of "benign negligence" before the crisis.

To assess the overall impact of CGR on the rate of growth of credit to the private sector, we add up the domestic and foreign components of the private sector debt and repeat the analysis on this aggregate. As suspected, the effect of CGR on the conditional mean rate of credit growth vanishes when the opposite effects on its domestic and foreign components cancel out (rightmost part of Table 3). Thus, it appears that CGR did not affect the rate of growth of the total debt of the private sector.[3] However, many have argued (see IMF, 2008 and references within) that it did adversely affect the composition of credit risk in the banking books of domestic banks, as well as the availability of credit to traditionally credit-constrained categories of bank clients. Together with the apparent inability of the CGR, under the circumstances analyzed here, to significantly affect the total growth of the private sector debt, these considerations call for a very judicious use of this instrument.

Table 3 Growth of credit to the non-government non-financial sector

Jul. 2000 – Jan. 2010	Y = ln(change(MFI_CREDIT))$_t$			Y = ln(change(FOREIGN_DEBT))$_t$			Y = ln(change(TOTAL_DEBT))t		
X	b	se (b)	p-value	b	se (b)	p-value	b	se (b)	p-value
Constant	0.0178	0.0014	0.0000	0.0178	0.0017	0.0000	0.0176	0.0013	0.0000
$CGR_t <> 0$	–0.0067	0.0017	0.0001	0.0164	0.0029	0.0000	–0.0005	0.0016	0.7745
$CGR_t > CGR_{t-1}$	0.0141	0.0047	0.0033	–0.0031	0.0100	0.7580	0.0077	0.0049	0.1238
$EMBISPRCRO_{t-1}$	0.0000	0.0000	0.0109	–0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	ρ	se (ρ)	p–value	ρ	se (ρ)	p–value	ρ	se (ρ)	p–value
AR(1)	–0.4492	0.4519	0.3224	0.6944	0.1820	0.0002	–0.2561	0.3925	0.5154
	θ	se (θ)	p–value	θ	se (θ)	p–value	θ	se (θ)	p–value
MA(1)	0.3329	0.4813	0.4906	–0.8611	0.1334	0.0000	0.0203	0.4070	0.9602
Mean Y			0.0124			0.0144			0.0131
SD(Y)			0.0103			0.0214			0.0107
Adjusted R^2			0.1942			0.1431			0.1348
AIC			–6.4829			–4.9579			–6.3394
BIC			–6.3397			–4.8147			–6.1962
HQC			–6.4248			–4.8998			–6.2813
DW			1.9202			1.9588			1.9861

Note: Monthly data beginning 7/2000 and ending 1/2010 modelled as standard ARMA(1,1) processes, so that Yt=Xtb+ut and ut= r1ut-1+ q1et 1+ et and et~N(0,s2), where X is the matrix of observations on the independent variables, including the constant, and b is the vector of estimated coefficients; MFI_CREDIT refers to credit extended to private domestic sector by domestically incorporated monetary financial institutions; FOREIGN_DEBT refers to the stock of direct borrowings from abroad by the non-financial segment of the domestic private sector; TOTAL_DEBT is the sum of MFI_CREDIT and FOREIGN_DEBT; CGRt <>0 is a dummy variable equal to 1 for months when the credit growth reserve was in effect; CGRt <> CGRt-1 is a dummy variable equal to 1 for the first month upon the introduction or a hike in the credit growth reserve rate; EMBISPRCRO is the spread between the Croatian and the comparable German bond yield; AR(1) is ut-1; MA(1) is et 1.

3 This conclusion would be strengthened even further if one considered domestic borrowing from non-bank financial intermediaries in the period, in addition to borrowing from banks and from abroad. For illustration, according to the internal CNB estimates, the annual growth of the loan and financial lease portfolio of the domestic leasing companies was greater than 100 percent in 2002 and 2003, over 40 percent in the next two years, and over 25 percent in the following two years, thus consistently well above the bank loan growth in the pre-crisis period. Then, in 2007 leasing companies were legally prohibited from extending loans. Thus, as the non-bank financial sector and its supervision and regulation grow in importance, they will have to be explicitly accounted for in studies like this - this point is owed to an anonymous reviewer. However, due to data limitations and its irrelevance for the main conclusions, the non-bank segment of private sector borrowing is not considered in this paper.

Table 4 Growth of bank capital and external liabilities

Dec. 2001 – Feb. 2010	Model 1				Model 2			
	Y = ln(change((GROSS_EXT_LIA))$_t$		Y = ln(change(BANK_CAP))$_t$		Y = ln(change(GROSS_EXT_LIA))$_t$		Y = ln(change((BANK_CAP))$_t$	
X	b	p–value	b	p–value	b	p–value	b	p–value
Constant	0.0360	0.0232	0.0008	0.8420	0.0341	0.0242	0.0005	0.8930
MRR_t	–0.0002	0.6389	0.0003	0.0559			0.0003	0.0001
MRR_t>0	–0.0287	0.1504	–0.0017	0.8313	–0.0364	0.0022		
ln(MFI_CR_NFIt/ MFI_CR_NFIt–1)	1.1788	0.0015			1.1894	0.0013		
$EUR3M_t$– $EUR3M_{t-1}$	–0.0471	0.0578	0.0076	0.4065	–0.0483	0.0489	0.0079	0.3828
$EMBISPRCRO_{t-1}$	–0.0001	0.0476	0.0000	0.2558	–0.0001	0.0517	0.0000	0.2111
	ρ	p–value	ρ	p–value	ρ	p–value	ρ	p–value
AR(1)	0.1215	0.5772	–0.6443	0.0023	0.1293	0.5484	–0.6442	0.0022
AR(12)	0.4403	0.0000	0.1505	0.0535	0.4394	0.0000	0.1499	0.0530
	θ	p–value	θ	p–value	θ	p–value	θ	p–value
MA(1)	–0.1670	0.4881	0.6568	0.0024	–0.1790	0.4524	0.6565	0.0023
Mean Y		0.0131		0.0097		0.0131		0.0097
SD(Y)		0.0439		0.0143		0.0439		0.0143
Adjusted R_2		0.3662		0.2055		0.3152		0.2138
AIC		–3.6949		–5.8133		–3.7128		–5.8330
BIC		–3.4575		–5.6036		–3.5018		–5.6495
HQC		–3.5989		–5.7284		–3.6275		–5.7587
DW		1.9412		1.9692		1.9388		1.9690

Note: Monthly data beginning 12/2001 and ending 2/2010 modelled as standard ARMA(1,1) processes with an addition of the AR(12) term to control for additive seasonality, so that Yt=Xtb+ut and ut= r1ut-1+ r12ut-12+ q1et 1+ et and et~N(0,s2), where X is the matrix of observations on the independent variables, including the constant, and b is the vector of estimated coefficients; GROSS_EXT_LIA refers to external liabilities of monetary financial institutions; BANK_CAP refers to the capital accounts of monetary financial institutions; MRR is the actual rate of the marginal reserve requirement; MRR >0 is a dummy variable equal to 1 for months when the marginal reserve requirement was in effect; MFI_CR_NFI refers to credit extended to non-financial domestic sector by domestically incorporated monetary financial institutions; EUR3M refers to the three-month EURIBOR interest rate; EMBISPRCRO is the spread between the Croatian and the benchmark German bond yield; AR(1) is ut-1; AR(12) is ut-12; MA(1) is et 1.

MRR was introduced in mid-2004 and tightened several times, most notably in 2006, in an effort to reduce the abundant inflow of what was feared to be potentially "hot" capital in the form of wholesale bank funding. In addition, Jankov (2009) claimed that MRR had increased the costs of banks' foreign borrowing to the point where banks found it less expensive to raise additional capital. According to Jankov, the surge in capital-raising was additionally motivated by tightening prudential regulation beyond what was envisaged by Basel II at the time. He supports his argument by actual regulatory cost calculations, and our analysis (Table 4), similar to that performed for CGR, confirms that the rate of bank capital additions is associated with a higher level of the MRR ratio, and not only with the existence of the instrument (see also Figure 5 in Appendix 6). However, statistical evidence is much weaker for the association between the MRR instrument and a lower rate of banks' foreign borrowing, while there is no evidence whatsoever that this rate is associated with the level of the MRR ratio (see also Figure 6 in Appendix 6).

The above relatively weak evidence in favour of MRR should however be interpreted in the context of prudential measures introduced in the period 2004-2007, the first two of which coincided in time with the introduction of MRR and the final hike of the MRR ratio to its maximum value of 55 percent, respectively (Figure 1). The CNB analysis (CNB, 2006) confirms that the latter prudential measure had substantially raised the regulatory capital requirements for almost all banks. Separating these effects is not possible, given our dataset. Thus, it appears that MRR was more instrumental for building banks' capital buffers than in achieving its stated objective of reducing the rate of growth of banks' foreign liabilities.

Figure 1 Marginal reserve requirement and prudential measures

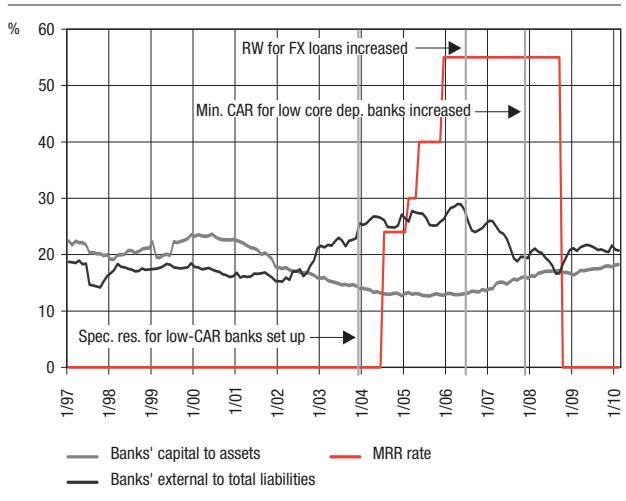


Figure 2 Banks' reserves and claims on the central government

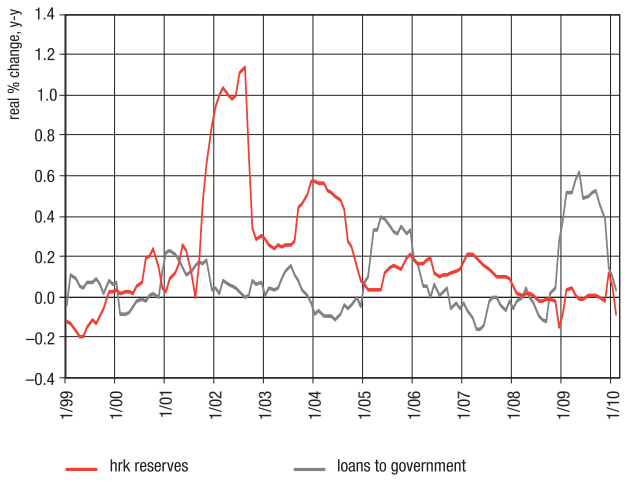
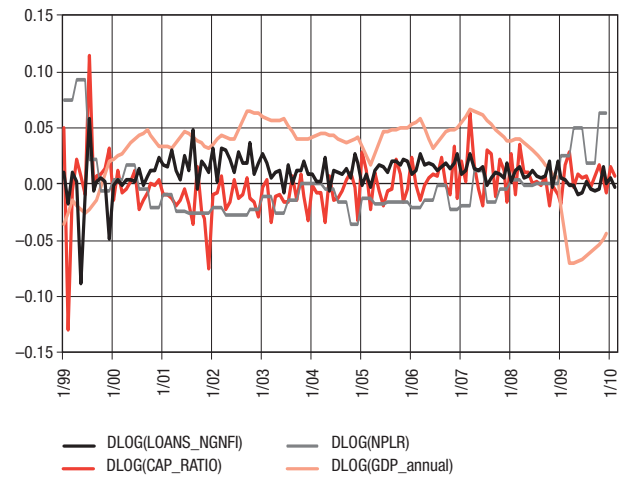


Figure 3 Credit growth vs. capital, non-performing loans, and GDP growth



Given the importance of the CNB behaviour during 2003-2009 for the CNB's subsequent crisis management role during 2008-2009, the discussion so far has been concentrated on the CNB measures taken prior to the outburst of the crisis. Turning to the effects of the measures taken at the peak of the crisis between May 2008 and February 2009, we focus on answering the key question: has the destruction of HRK liquidity by the CNB aimed at preserving the exchange rate stability (or/

Table 5 Credit growth models

NLS estimation of coefficients, HAC standard errors & covariance								
Y = ln(change(MFI_CREDIT))$_t$	Model 1 ("GDP"): 1998M04 2008M04 / N=121				Model 2 ("NPLR"): 1997M06 2008M04 / N=131			
X	b	se(b)	t-value	p-value	b	se(b)	t-value	p-value
C	0.0014	0.0035	0.4094	0.6830	0.0094	0.0019	4.8137	0.0000
ln(change(FX_DEP))$_t$	0.2080	0.0939	2.2156	0.0287	0.2821	0.1073	2.6291	0.0097
ln(change(GROSS_EXT_LIA))$_t$	0.0951	0.0293	3.2468	0.0015	0.0833	0.0429	1.9431	0.0543
ln(change(NPLR_M))$_t$					–0.1377	0.0458	–3.0055	0.0032
ln(change(HRK_REQ_RES)$_{t+1}$	–0.0405	0.0269	–1.5042	0.1353	–0.0482	0.0218	–2.2152	0.0286
ln(GDP_M$_t$/GDP_M$_{t-12}$))	0.2071	0.0657	3.1527	0.0021				
ln(change(CAP_RATIO))$_t$					0.1329	0.0773	1.7178	0.0883
	ρ	se (ρ)	t–value	p–value	ρ	se (ρ)	t–value	p–value
AR(1)	–0.5586	0.2518	–2.2184	0.0285	–0.5481	0.1495	–3.6657	0.0004
	θ	se (θ)	t–value	p–value	θ	se (θ)	t–value	p–value
MA(1)	0.7362	0.2239	3.2884	0.0013	0.7919	0.1289	6.1456	0.0000
Mean Y	0.0116				0.0130			
SD(Y)	0.0153				0.0160			
Adjusted R^2	0.2709				0.3296			
AIC	–5.7854				–5.7788			
BIC	–5.6236				–5.6032			
HQC	–5.7197				–5.7074			
DW	2.1223				1.9305			

Note: Monthly data modelled as standard ARMA(1,1) so that Yt=Xtb+ut and ut= r1ut-1+ q1et 1+ et and et~N(0,s2), where X is the matrix of observations on the independent variables, including the constant C, and b is the vector of estimated coefficients; MFI_CREDIT refers to outstanding debt of the corporate and household sectors owed to domestic monetary institutions; FX_DEP refers to foreign currency denominated deposits at domestic MFIs; GROSS_EXT_LIA refers to the external liabilities of monetary financial institutions; NPLRM refers to intrapolated quarterly data on non-performing-to-total-loans ratio at domestic MFIs; HRK_REQ_RES refers to the stock of all domestic currency denominated required reserves held by domestic MFIs, conventional and non-conventional; GDP_M refers to intrapolated quarterly data on nominal GDP; CAP_RATIO refers to the capital-to-assets ratio of domestic MFIs; AR(1) is ut-1; MA(1) is et 1.

and the surge of borrowing by the central government aimed at preserving the fiscal viability) reduced the supply of credit to the private sector below what would have been observed otherwise (see Figures 4 to 7 in Appendix 5 for the actual data)?

Our analysis suggests that although the surge in government borrowing from domestic banks and the stagnation of banks' HRK reserves in the period from roughly May 2008 until the end of 2009 are unprecedented by historical standards (Figure 2), there is no statistical evidence that these (or any other factors) have directly led to a lower level of credit growth in that period than warranted by other fundamentals. In particular, the retrenchment in bank credit to the private sector during that period is found to be in line with predictions from the model (Model 1 in Table 5) of its growth rate based on the measures of available funding and economic activity (also Figure 7 in Appendix 6).

The actual path of bank credit to the private sector is also within two standard errors of the prediction when an alternative model is used (Model 2 in Table 5) where the credit growth rate is based on the same flow of funds variables as in the first model, but with the economic activity measure replaced by two variables measuring the risk aversion of banks, the capital-to-assets ratio and the non-performing-to-total assets ratio (also Figure 8 in Appendix 6). The interesting feature of this second model is that unlike the first, its central forecast does not feature credit retrenchment during the forecast period. Still, the retrenchment actually observed is mostly within the confidence bounds of this central forecast.

The two credit growth models used in this forecasting exercise are estimated on observations covering the period until April 2008, and beginning with April 1998 and June 1997, respectively. The first model predicts a credit retrenchment sharper than during the previous recession of 1998-99, which appears reasonable, given the indeed steeper real economic contraction this time around, while in the case of Croatia the potential "psychological" effect of the "greatest recession since the Great Depression" could arguably be matched by the effect of the "second Croatian banking crisis" in the estimation period.

The second model does not predict credit contraction or even stagnation in the forecast period, but rather only a mild inflection point on the upward pointing curve of the outstanding private sector debt to commercial banks. This counterintuitive result can be explained by observing that the pace of growth of non-performing loans relative to the drop in economic activity has (so far) been much milder in the current downturn than in 1998-99 (Figure 3). This causes the first model to "punish" the forecast credit growth much more than the second model.

Notably, the actual path of the private sector bank credit in the forecast period lies about half-way between our two central forecasts. Thus, an equally weighted forecast combination – a very useful forecasting procedure (see Diebold, 1996), especially given the model uncertainty raised by the recent crisis – would have predicted a private sector bank credit path very close to that actually observed in Croatia. This further reduces the likelihood that the central bank or government action directly contributed to a greater than warranted private credit retrenchment, a result comparable to that of Čeh et al. (2010).

However, indirect contribution, through the impact of the pro-cyclical fiscal stance in the past on the actual economic activity cannot be excluded by this type of analysis, and thus the above evidence should not be interpreted as fully refuting the crowding-out argument of Mihaljek. In particular, a counter-cyclical government could have used the proceeds from heavy borrowing at the crisis peak for capital rather than for current spending, possibly affecting positively economic activity and negatively non-performing assets, thus increasing our forecast of credit growth. Then, the corresponding forecast combination would be less likely to indicate a lack of the crowding out effect than under the actual pro-cyclical government.

Conclusion

Regarding specific instruments used by the CNB prior to the crisis to stimulate the build-up of banks' liquidity and capital buffers, we find tightening prudential measures in conjunction with the marginal reserve requirement on banks' foreign borrowing to be particularly useful for building capital buffers. We argue that these buffers should be credited both for the absence of individual bank failures and for a rather mild credit contraction in the first year after the peak of the crisis. On the other hand, we find that the marginal reserve requirement was much less successful in achieving its stated goal of reducing the rate of growth of banks' foreign liabilities in the period of abundant international liquidity. Similarly, under those same circumstances, the credit growth reserve was not successful in slowing down the growth of the total private sector debt, although it appears to have slowed down the growth of credit to the private sector extended by domestic banks. Finally, the significant changes of the foreign currency liquidity reserve instrument long before the crisis do not appear to have been important for the overall level of banks' foreign currency liquidity buffers. However, they allowed the build-up of those buffers to be accompanied by a more restrictive monetary policy along the way, and altered their composition from mostly required reserve-dominated to free reserve-dominated liquidity buffers, possibly making them more accessible to banks during the crisis.

The above findings indicate that to enhance its effectiveness as crisis-manager, the central bank in a small, open, financially integrated economy could do well to stick to "leaning against the wind" policies during good times. Our analysis also suggests that these policies not only help build adequate liquidity and capital buffers in the banking sector, but under certain scenarios could perhaps be directly credited for avoidance of serious banking distress or a crisis during the ensuing economic downturn. We find, however, that not all central bank instruments appear to be equally useful, as some of them do not fully achieve their stated goals, while some of them may even have negative side effects. Nevertheless, it is often difficult to disentangle the effects of various instruments

and measures due to their mutually reinforcing features. In any event, the building of an appropriate counter-cyclical policy mix appears to take time and ingenuity, and thus should be explored well before a financial crisis looms on the horizon, and fine-tuned continuously.

We investigate the notion that the central bank actions to support the exchange rate of the domestic currency suddenly falling under pressure by withdrawing domestic currency liquidity in addition to creating foreign currency liquidity may lead to an over-adjustment of domestic credit. We find no statistical evidence of such an over-adjustment in the case of Croatia, although a significant part of the domestic currency liquidity was indeed withdrawn from the banking system during the crisis. On the other hand, until the end of the first quarter of 2010, the actual bank credit to the private sector had adjusted less than during the previous downturn in the 1998/99 period, although the economic downturn was more severe this time around. We attribute this outcome to the consistently counter-cyclical stance adopted by the central bank during the last cyclical upturn, which might have prevented a faster rise of non-performing bank assets and which likely did induce a higher level of bank capital buffers than would have been found otherwise, thus preventing the banking sector-specific factors contributing to the current downturn through tighter credit conditions.

The main implication of our single-country findings is thus similar to the multi-country study of Aisen and Franken (2010) which concludes that countries can be better off developing a macroeconomic and institutional framework enabling them to display a counter-cyclical monetary policy. They analyze "typical" policy responses and their "average outcomes" in a number of emerging market economies, to conclude that countries with (a) high bank credit growth prior to the crisis, (b) suffering stronger demand contraction after the Lehman Brothers shock, (c) with high financial integration with respect to the rest of the world, and (d) with weaker counter-cyclical monetary policy response, presented, on average, lower growth rates of bank credit in the period after the Lehman Brothers collapse. We find that Croatia satisfies their conditions (a)-(c) yet it still has suffered a considerably milder credit contraction after the Lehman debacle than the comparable countries (Appendix 7). We attribute this to Croatia not satisfying condition (d) above, again arguing that the counter-cyclical monetary policy prior to the crisis probably prevented any negative feedback from the financial sector to the real economy, and thus attenuated the severity of the economic downturn.

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Appendix 1a The international crisis timeline

2007	2 April	New Century Financial, largest U.S. subprime lender, files for chapter 11 bankruptcy.
2007	7 June	Bear Stearns & Co informs investors in two of its funds that it is halting redemptions.
2007	10 August	Central banks coordinate efforts to increase liquidity for first time since the aftermath of the September 11, 2001 terrorist attacks.
2007	17 August	The Fed cuts the rate at which it lends to banks by half of a percentage point to 5.75%, warning the credit crunch could be a risk to economic growth.
2007	4 September	The Libor rate rises to its highest level since December 1998, 6.7975%, above the Bank of England's 5.75% base rate.
2007	13 September	The BBC reveals Northern Rock has asked for and been granted emergency financial support from the Bank of England, in the latter's role as lender of last resort.
2007	13 September	Northern Rock depositors withdraw GBP 1 billion in what is the biggest run on a British bank for more than a century.
2007	19 September	After previously refusing to inject any funding into the markets, the Bank of England announces that it will auction GBP 10 billion.
2007	1 October	Swiss bank UBS is the world's first top-flight bank to announce losses – USD 3.4 billion – from sub-prime related investments.
2007	1 October	Citigroup unveils a sub-prime related loss of USD 3.1 billion and over the next day it is forced to write down a further USD 5.9 billion.
2007	30 October	Merrill Lynch's chief resigns after the investment bank unveils a USD 7.9 billion exposure to bad debt.
2007	13 December	The US Federal Reserve co-ordinates an unprecedented action by five leading central banks around the world to offer billions of dollars in loans to banks.
2007	19 December	Standard and Poor's downgrades its investment rating of a number of so-called monoline insurers, which guarantee to repay the loans if the issuer goes bust.
2008	21 January	Global stock markets, including London's FTSE 100 index, suffer their biggest falls since 11 September 2001.
2008	22 January	The US Fed cuts rates by three quarters of a percentage point – its biggest cut in 25 years – to try prevent the economy from slumping into recession.
2008	17 February	After considering a number of private sector rescue proposals, the government announces that struggling Northern Rock is to be nationalised.
2008	16 March	Bear Stearns is acquired for $2 a share by JPMorgan Chase in a fire sale backed by the Federal Reserve, providing up to $30B to cover possible Bear Stearn losses.
2008	14 July	Financial authorities step in to assist America's two largest lenders, Fannie Mae and Freddie Mac.
2008	7 September	Fannie Mae and Freddie Mac are rescued by the US government in one of the largest bailouts in US history.
2008	10 September	Wall Street bank Lehman Brothers posts a loss of USD 3.9 billion for the three months to August.
2008	15 September	Lehman Brothers files for Chapter 11 bankruptcy protection, becoming the first major bank to collapse since the start of the credit crisis.
2008	16 September	Moody's and Standard and Poor's downgrade ratings on AIG's credit on concerns over continuing losses to mortgage-backed securities.
2008	17 September	The US Federal Reserve announces a USD 85 billion rescue package for AIG, the country's biggest insurance company, to save it from bankruptcy.
2008	17 September	Lloyds TSB announces it is to take over Britain's biggest mortgage lender HBOS in a GBP 12 billion deal creating a banking giant.
2008	18 September	Treasury Secretary and Fed Chairman meet with key legislators to propose a USD 700 billion emergency bailout through the purchase of toxic assets.
2008	25 September	In the largest bank failure yet in the United States, Washington Mutual, the giant mortgage lender, is closed down by regulators and sold to JPMorgan Chase.
2008	28 September	The credit crunch hits Europe's banking sector as the European banking and insurance giant Fortis is partly nationalised to ensure its survival.
2008	29 September	The Icelandic government takes control of the country's third-largest bank, Glitnir, after the company faces short-term funding problems.
2008	29 September	The US House of Representatives rejects a USD 700 billion rescue plan for the US financial system – sending shockwaves around the world.
2008	29 September	Wall Street shares plunge, with the Dow Jones index slumping 7% or 770 points, a record one-day point fall.
2008	30 September	Dexia becomes the latest European bank to be bailed out as the deepening credit crisis continues to shake the banking sector.
2008	30 September	After all-night talks, the Belgian, French and Luxembourg governments say they will put in EUR 6.4 billion (USD 9 billion; GBP 5 billion) to keep it afloat.
2008	30 September	The Irish government says it will guarantee all deposits in the country's main banks for two years.
2008	3 October	The US House of Representatives passes a USD 700 billion (GBP 394 billion) government plan to rescue the US financial sector.
2008	7 October	The Icelandic government takes control of Landsbanki, the country's second largest bank, which owns Icesave in the UK.
2008	8 October	The Fed, ECB, BoE and the CBs of Canada, Sweden and Switzerland make emergency interest rate cuts of half a percentage point.
2008	11 October	The G7 nations issue a five-point plan of "decisive action" to unfreeze credit markets, after a meeting in Washington.
2008	15 October	The Dow Jones index falls 733 points or 7.87% – its biggest percentage fall since 26 October 1987.
2008	6 November	The International Monetary Fund (IMF) approves a USD 16.4 billion loan to Ukraine to bolster its economy, shaken by global financial turmoil.
2008	6 November	The Bank of England slashes interest rates from 4.5% to 3% – the lowest level since 1955.
2008	14 November	The eurozone officially slips into recession after EU figures show that the economy shrank by 0.2% in the third quarter.
2008	20 November	The IMF approves a USD 2.1 billion (GBP 1.4 billion) loan for Iceland, the first IMF loan for a Western European nation since 1976.
2008	23 November	The US government announces a USD 20 billion (GBP 13.4 billion) rescue plan for troubled banking giant Citigroup after its shares plunge by more than 60% in a week.
2008	1 December	The US economy is officially declared by the National Bureau of Economic Research to be in recession. The committee concludes that the US economy started to contract in December 2007.
2008	16 December	The US Federal Reserve slashes its key interest rate from 1% to a range of zero to 0.25% – the lowest since records began.
2008	31 December	The FTSE 100 closes down 31.3% since the beginning of 2008 – the biggest annual fall in the 24 years since the index was started.

2009	8 January	The Bank of England cuts interest rates to 1.5%, the lowest level in its 315-year history, as it continues efforts to aid an economic recovery in the UK.
2009	9 January	Official figures show the US jobless rate rose to 7.2% in December, the highest in 16 years.
2009	15 January	The Irish government says it is to nationalise the Anglo Irish Bank after deciding pumping money into the lender was not enough to secure its future.
2009	23 January	The UK has officially entered a recession as fourth quarter GDP falls by 1.5% compared to the previous three months.
2009	2 March	Insurance giant AIG reports the largest quarterly loss in US corporate history of USD 61.7 billion (GBP 43 billion) in the final three months of 2008.
2009	1 May	Chrysler enters bankruptcy protection after pressure from the US government. The majority of its assets are to be sold to Fiat.
2009	1 June	The world's largest carmaker, GM, enters bankruptcy protection after bondholders agree to a deal that means they lose 90% of their money.
2009	10 June	Ten of the largest US banks say they will be able to repay the US Treasury the money they were lent under the TARP bail-out in October.
2009	24 June	The OECD says the world economy is near the bottom of the worst recession in post-war history.
2009	10 July	General Motors says it has emerged from bankruptcy protection after creating a "new GM" made up of the carmaker's best assets.
2009	14 July	US bank Goldman Sachs beats analysts' forecasts with a net profit. Several – but not all – other US banks subsequently announce big profits.
2009	15 July	UK jobless rate increased to 7.6%, the highest in more than 10 years.
2009	16 July	China's economy grew at an annual rate of 7.9% between April and June, up from 6.1% in the first quarter, thanks to the government's big stimulus package.

Appendix 1b The crisis timeline for selected European countries

Small open economies

Iceland:

2008

29 September, a plan was announced for the bank Glitnir to be nationalised by the Icelandic government
4-5 October, British newspapers carried many articles on Glitnir and Iceland's other banks – problems with access to the Icesave internet bank site hinted at a run on savings
6 October, a number of private interbank credit facilities to Icelandic banks were shut down. Trading in shares of six Icelandic financial companies on the OMX NIE was suspended
7 October, the FME placed Landsbanki in receivership after the Guernsey subsidiary of Landsbanki went into voluntary administration with the approval of the Guernsey Financial Services Commission
8 October, the Landsbanki Freezing Order 2008 was passed in the UK, freezing the assets of Landsbanki within the UK
8 October, the Central Bank of Iceland abandoned its attempt to peg the Icelandic króna at 131 krónur to the euro after trying to set this peg on 6 October
9 October, Kaupthing was placed in receivership by the FME, following the resignation of the entire board of directors
9 October, the Icelandic króna was trading at 340 to the euro when trading in the currency collapsed due to the FME's takeover of the last major Icelandic bank
10 October, the central bank introduced restrictions on the purchase of foreign currency within Iceland
14 October, Icelandic negotiators arrived in Moscow on to discuss a possible loan, while the Central Bank of Iceland drew on its swap facilities with the central banks of Denmark and Norway
15 October, the Central Bank set up a temporary system of daily currency auctions – the first auction sold at a rate of 150 krónur to the euro
24 October, the IMF tentatively agreed to loan EUR 1.58 billion. UK and allies begin pressuring the IMF to postpone until depositor dispute is settled
28 October, commercial króna trading outside Iceland restarted at an exchange rate of 240 krónur to the euro, while Icelandic interest rates were raised to 18%
19 November, the IMF-led package was finally agreed on, with the IMF loaning USD 2.1 billion and another USD 8.8 billion coming from Norway, Sweden, Finland, Denmark, and Germany, the Netherlands and the UK.

2009

28 August, Iceland's parliament approved a bill to repay the United Kingdom and the Netherlands more than USD 5 billion lost in Icelandic deposit accounts.

Latvia:

2008

December 2008 – International Monetary Fund (IMF) approves EUR 1.68 billion rescue package to help Latvia ride out severe economic slump.

2009

January 2009 – Hundreds of demonstrators clash with police in Riga as anti-government protests over the collapse of the economy turn violent.
February 2009 – Ruling coalition collapses amid widespread discontent over belt-tightening imposed as price of IMF rescue package.
March 2009 – Valdis Dombrovskis is sworn in at the head of a new six-party coalition government.
June 2009 – The Central Bank spends almost a billion euros in 2009 to support the lat, prevent devaluation and avoid a domino effect elsewhere in Eastern Europe.
August 2009 – Government, trade unions and employers agree deep public spending cuts aimed at saving the country from bankruptcy and getting the IMF to release a further tranche of rescue loans.
October 2009 – Government agrees to slash budget deficit in 2010 in order to meet targets imposed by EU in exchange for EUR 7.5 billion of rescue loans.
November 2009 – Unemployment soars to 22.3%, having almost doubled over the previous 12 months. Latvia now has the highest jobless rate in the EU.

2010

March 2010 – Largest coalition party leaves government following repeated disagreements over austerity measures, depriving PM Valdis Dombrovskis of his majority.

Hungary:

2008

March 2008 – Government defeated in opposition-sponsored referendum, seen as a setback for government plans for economic reforms.
April 2008 – Mr Gyurcsany reshuffles his cabinet after the Alliance of Free Democrats quits the ruling two-party coalition.
October 2008 – Hungary is badly hit by the global financial crisis and the value of the forint plummets.
The International Monetary Fund (IMF), the EU and the World Bank grant the country a rescue package worth USD 25 billion (GBP 15.6 billion).

2009

March 2009 – Hungary and Russia sign deal to build part of the South Stream pipeline across Hungarian territory, a move which will turn the country into a major hub for Russian gas supplies.
Ferenc Gyurcsany announces his intention to resign as prime minister, saying he is quitting to allow a new leader, with broader support, to tackle the country's ailing economy.
April 2009 – Economy Minister Gordon Bajnai takes over as PM; he announces a programme of public spending cuts, tax rises and public wage freezes.
June2009 – Far-right Jobbik party wins three seats in European Parliament elections, gaining almost 15% of Hungarian votes.

2010

April 2010 – Conservative opposition party Fidesz wins landslide victory in parliamentary election, gaining a two-thirds majority. Jobbik enters the Hungarian parliament for first time, winning 47 seats.

Greece:

2009

November 2009 – The new government pledges in its 2010 draft budget on 5 November to save Greece from bankruptcy by cutting the budget deficit of 12.7 percent of GDP.
A final budget draft on 20 November shows Greece aims to cut the deficit to 8.7 percent of GDP in 2010 to show EU partners and markets it is serious about restoring fiscal health.
EU 2010 forecasts on Greece are worse, with the deficit seen at 12.2 percent of GDP and national debt rising to 124.9 percent, the highest ratio in the EU.
8 December – Fitch Ratings, which had cut Greece to A– when the government revealed the higher deficit, cuts Greek debt to BBB+ with a negative outlook.
14 December – Greek Prime Minister George Papandreou outlines policies to cut the budget deficit and try to regain the trust of investors and the EU.
16 December – S&P cuts Greece's rating to BBB+ from A–, saying austerity steps announced by Papandreou are unlikely to produce a sustainable reduction in the public debt burden.
22 December – Moody's cuts Greek debt to A2 from A1, the third agency to downgrade Greece, but still two notches above that of Fitch and S&P.

2010

14 January 2010 – Greece unveils a stability program, saying it will aim to cut its budget gap to 2.8 percent of GDP in 2012. Unions protesting against the austerity plan announce strikes for February.
2 February – Papandreou says the government will extend a public sector wage freeze to those earning below 2,000 euros a month for 2010, excluding seniority pay hikes.
3 February – The EU Commission says it backs Greece's plan to reduce its budget deficit below 3 percent of GDP by 2012 and urges Greece to cut its overall wage bill.
24 February – A one-day general strike against the austerity measures cripples Greece's transport and public services.
25 February – An EU mission to Athens with IMF experts delivers a grim assessment of the nation's economy.
Finance Ministry official says the inspectors anticipate Greece can cut the deficit by about 2 percentage points, short of a 4 percentage point target for 2010.
March 2010 – EU Economic Affairs Commissioner Olli Rehn asks Greece to announce further measures to tackle its budget crisis.
5 March – A new package of public sector pay cuts and tax increases is passed by the government to save an extra EUR 4.8 billion.

11 March – Public and private sector workers strike.
15 March – Eurozone finance ministers agree on a mechanism that will allow them to help Greece financially if needed, but reveal no details.
18 March – Papandreou warns Athens will not be able to make deficit cuts if its borrowing costs remain high and may have to call in the IMF.
19 March – European Commission President Jose Manuel Barroso urges EU member states to agree a standby aid package for Greece.
25 March – ECB President says that the ECB will extend softer rules on collateral, easing the risk of Greek institutions being cut off from funding at the end of this year.
Eurozone leaders agree to create a joint financial safety net, with the IMF, to help Greece, but only if all states agree to the bailout and if it has exhausted its borrowing options.
6 April – A top finance ministry denies that Greece is seeking an amendment to the safety net agreement. Investors batter Greek assets before and after the denial.
11 April – Eurozone finance ministers approve a giant 30-billion-euro (USD 40 billion) emergency aid mechanism for debt-plagued Greece but stress Athens had not requested the plan be activated yet.
13 April – European Central Bank policymakers give the thumbs-up to the euro zone's rescue package as the country passes a key test of its ability to raise fresh funds.
15 April – EU monetary chief Olli Rehn says there is no possibility that Greece will default on its debts and no reason to doubt Germany's commitment to an EU pledge to help.
An International Monetary Fund official says that Greece has expressed interest in a three-year precautionary IMF agreement, which will only be tapped when Greece requests the funding.
Parliament adopts a tax reform bill, backing government moves to tackle tax evasion and shift the fiscal burden to higher-income earners as Athens looks for ways to slash its massive budget deficit.
16 April – European finance ministers, meeting in Madrid, discuss Greece's debt crisis but say Athens is seeking to clarify how an emergency aid mechanism would work, rather than requesting it.

Appendix 2 The crisis timeline for Croatia

2007

15 November – the CROBEX lost 9 percent in one month, the beginning of a one and a half year long descent of 77 percent.

2008

January – Parliament approves Prime Minister Ivo Sanader's new HDZ-led coalition government
10 February – Central bank announces it will not allow HRK/EUR exchange rate to exceed the 7.35 mark
14 August – Statistics Bureau announces the highest annual CPI mark in a decade of 8.4 percent
25 September– Changes to the required reserve maintenance framework implemented to fight inflation, withdrawing about HRK 2.6 billion worth of liquidity from the banking system.
10 October – The 55% marginal required reserve on foreign borrowing by banks abolished, creating EUR 355 million and USD 129 million in FX liquidity.
15 October – Parliament approves a four-fold increase in the deposit insurance limit to HRK 400,000 per depositor per bank (ca. EUR 56 K)
17 October – An intervention fund worth HRK 150 million (ca. EUR 20 million) established to provide liquidity to investment funds.
27 October – Central bank warns it will not tolerate speculation in the FX market and implements an FX intervention.
20 November – Required reserve ratio lowered by three points to 14 percent, freeing about HRK 8.4 billion
26 November – Central bank rejected all bank offers at the regular weekly REPO auction, citing "sufficient HRK liquidity in the system"
November – European Commission says Croatia is likely to end accession talks by 2009 and become a member by 2011, but demands tougher action against corruption and organised crime.
7 December – Slovenia blocks the EU negotiation process over the prolonged border dispute.

2009

2 January– HRK portion of the required reserve on FX deposits raised from 50 to 75 percent, withdrawing about HRK 5.8 billion of liquidity from the banking system.
23 January – Central bank buys about HRK .,43 billion to stabilise the fast sliding HRK/EUR exchange rate.
30 January – Zagreb Economic Institute announced the recession for the first time, forecasting a 1.3 percent contraction of economic activity in 2009.
4 February – FX liquidity ratio for banks lowered from 28.5 to 25 percent, freeing about EUR 840 million of FX liquidity.
20 February – Another decrease in the FX liquidity ratio for banks to 20 percent releases additional EUR 1.25 billion of FX liquidity to banks.
9 March – CROBEX hits the bottom at 1,263 points, a 77 percent drop from its high of October 2007.
10 March – Statistics Bureau announces a 14 percent y-o-y drop in industrial production for January 2009.
17 March – S&P lowers the sovereign rating from BBB+ to BBB
30 March – Parliament amends the 2009 budget, featuring a wage freeze and a hike roll-back for public sector employees
9 April – Croatia officially joins NATO.
14 May – Central bank announces a grimmer GDP forecast, now expecting a 4 percent real contraction in 2009.
20 May– D&B cuts the sovereign credit rating one notch.
28 May – Government issues the first Eurobond in 5 years, collecting EUR 750 million at 6 percent yield and an odd 6 year maturity.
29 June – Statistics bureau announces the first negative quarter of GDP growth since the third quarter of 1999, with a real drop of 6,7 percent, y-o-y.
June – The European Union cancels the next round of EU membership talks with Croatia, citing lack of progress in resolving a long-standing border row with neighbouring Slovenia.
1 July – In a surprise move, PM resigns, and his deputy, Jadranka Kosor, takes over the government.
11 July – A second 2009 budget revision approved by the Parliament, featuring a 10 percent reduction in privileged pensions.
31 July – A 1 pp hike of the VAT tax to 23% and a 0-2-4% progressive "crisis tax" on net wages approved to go into effect immediately, A 6% tax on SMS and MMS mobile services introduced.
11 September – Kosor-Pahor PM deal paves the road for Slovenia's unblocking of Croatia's EU accession negotiations.
25 September – Statistics bureau confirms the severity of the recession, announcing another quarter of negative growth, with GDP falling by 6.3 percent in real terms, y-o-y.
6 October – Central bank buys EUR 154 million from commercial banks.
November – Slovenia lifts its block on Croatia's EU membership talks after the two countries sign a deal allowing international mediators to resolve their border dispute.

2010

January – Ivo Josipović of the opposition Social Democrats wins presidential election.
February – Government announces an EU-compliant 2010 "financial recovery" plan for non-financial enterprises, featuring co-financing of short term and guarantees for long term bank loans.

Appendix 3 Main central bank prudential measures, 2003 – 2010

Announced	Effective	Explanation
24/1/2003	1/4/2003	Maximum allowed f/c exposure of a commercial bank at the end of any working day is capped at 20 percent of its regulatory capital.
15/1/2003	1/1/2004	Banks have to form and maintain additional reserves for general bank risks, and retain any profits if the growth of specific items of their assets and specific items of their off-balance contingent liabilities exceeds 20%. Exceptionally, banks are not required to form reserves for general bank risks if they have the required capital adequacy ratio. A part of this measure replaced a previous monetary measure that obligated banks to subscription of low-yield CNB bills.
12/12/2005	30/6/2006	Capital adequacy risk weights applied to foreign currency or foreign currency-indexed loans to unhedged borrowers in the non-government sector are increased by 25 percentage points. The existing weights for foreign currency or foreign currency-indexed loans to unhedged borrowers (those without adequate foreign currency incomes/revenues) are increased from 50% to 75% and from 100% to 125%. The direct impact of this measure is the decrease of CAR of the banking system by more than 1.5 percentage points, which spurs capital-raising by the banks.
20/6/2006	13/7/2006	The ''20%" threshold for defining "high growth" in terms of additional reserves for general banking risks is replaced by "15%". Accordingly, banks are obliged to form and maintain additional reserves for general bank risks if the growth of specific items of their assets and specific items of their off-balance contingent liabilities exceeds 15%. This measure was abandoned with the new Credit Institutions Act which entered into force on 1 January 2009.
6/12/2007	1/1/2008	Introduction of higher (than 12%) capital requirements on banks whose growth rate of placements exceeds the maximum permissible growth rate of placements (about 12%), proportionate to the share of non-core deposits on the liability side of the balance sheet.
6/12/2007	1/1/2008	Capital adequacy risk weights for unhedged borrowers are increased by a further 25 percentage points. Applied weights are 100% (which replaced 75%) and 150% (which replaced 125%). The direct impact of this measure was the further decrease of CAR of the banking system by more than 1.5 percentage points.
22/3/2010	31/3/2010	Maximum allowed f/c exposure of a commercial bank at the end of any working day is increased to 30 percent of its regulatory capital.

Appendix 4 Main central bank monetary policy measures, 2000 – 2010

ann _date	eff _date	rr _ratio	fxrr _hrk _part	hrkrr _cnb _dep	fxrr _cnb _dep	rr _ir	lombard _ir	on_dep _ir	fclr _ratio	mrr _ratio	cgr _ limit	Note
20/9/2000	8/12/2000	23,5		50	50	4,5	12		53			Unified HRK and FX RR ratio
20/12/2000	8/1/2001	23,5		40	40	4,5	12		53			
7/3/2001	14/3/2001	23,5		40	40	3,7	9,5		53			
16/5/2001	8/6/2001	23,5		40	40	3,7	9,5		53			FX loans added to FX RR base
16/5/2001	9/7/2001	22		40	40	3,5	9,5		53			
5/9/2001	10/9/2010	22	10	40	40	3,5	9,5		53			
5/9/2001	15/9/2001	22	10	40	40	2	10,5		53			
6/9/2001	8/10/2001	22	20	40	40	2	10,5		53			
3/10/2001	8/11/2001	22	20	40	40	2	10,5		53			Hybrids & subordinates added to RR base
7/11/2001	22/11/2001	22	20	40	40	2	10		53			
7/11/2001	10/12/2001	19	25	40	40	2	10		53			
10/4/2002	24/4/2002	19	25	40	40	1,75	9,5		53			
9/10/2002	23/10/2002	19	25	40	40	1,75	9,5		53			Dysfunctional CB base rate reduced to 4,5%
15/1/2003	39/1/2003	19	25	40	40	1,5	9,5		53			
15/1/2003	1/2//2003	19	25	40	40	1,5	9,5		35			l.t. f/c liab. added to the FCLR base
15/1/2003	15/4/2003	19	25	40	40	1,5	9,5		35		16	200% res. cover set on 16ppa+ credit growth
27/8/2003	8/9/2003	19	35	40	40	1,5	9,5		35		16	
3/11/2003	10/11/2003	19	40	40	40	1,5	9,5		35		16	
3/11/2003	13/11/2003	19	40	40	40	1,25	9,5		35		16	
3/11/2003	8/12/2003	19	42	40	40	1,25	9,5		35		16	
17/12/2003	8/1/2004	19	42	40	40	1,25	9,5		35		0	CB bills no longer issued
17/12/2003	9/2/2004	19	42	60	60	1,25	9,5		35			
14/7/2004	9/8/2004	19	42	60	60	1,25	9,5		35	24		MRR on net foreign borrowing set
13/10/2004	8/11/2004	18	42	60	60	1,25	9,5		35	24		
9/2/2005	8/3/2005	18	42	60	60	1,25	9,5		35	30		
10/2/2005	24/2/2005	18	42	60	60	1,25	9,5		32	30		
9/3/2005	1/4/2005	18	42	60	60	1,25	9,5	0,5	32	30		Weekly REPO loan facility created
9/3/2005	8/4/2005	18	42	70	60	1,25	9,5	0,5	32	30		O/N deposit and O/N lombard facilities created
9/3/2005	1/7/2005	18	42	70	60	1,25	9,5	0,5	32	30		Intraday loan facility created
18/5/2005	8/6/2005	18	50	70	60	0,75	9,5	0,5	32	40		
9/11/2005	14/12/2005	18	50	70	60	0,75	7,5	0,5	32	40		Major RR proc. Overhaul
7/12/2005	11/1/2006	17	50	70	60	0,75	7,5	0,5	32	55		OBS items added to MRR base
7/3/2006	21/3/2006	17	50	70	60	0,75	7,5	0,5	32	55		FCL assets incl. FX gov. lending till May
14/6/2006	12/7/2006	17	50	70	60	0,75	7,5	0,5	32	55		Synd. and brokered loans to MRR base
12/9/2006	2/10/2006	17	50	70	60	0,75	7,5	0,5	32	55		F/c-indexed lia. added to FCLR base
21/12/2006	1/1/2007	17	50	70	60	0,75	7,5	0,5	32	55	12	50% cover set on 12ppa+ credit growth
4/7/2007	5/7/2007	17	50	70	60	0,75	7,5	0,5	32	55	12	FCL assets incl. FX gov. lending till October
5/12/2007	1/1/2008	17	50	70	60	0,75	9	0,5	32	55	12	
19/12/2007	31/12/2007	17	50	70	60	0,75	9	0,5	32	55	12	Excess cred. gr. res. cover increased to 75%
3/3/2008	10/3/2008	17	50	70	60	0,75	9	0,5	32	55	12	FCL assets incl. FX gov. lending till May
19/5/2008	26/5/2008	17	50	70	60	0,75	9	0,5	28,5	55	12	
25/9/2008	9/10/2008	17	50	70	60	0,75	9	0,5	28,5	55	12	Vaults excl. from RR maint. instr.
10/10/2008	11/10/2008	17	50	70	60	0,75	9	0,5	28,5	0	12	MRR abolished
12/11/2008	29/11/2008	17	50	70	60	0,75	9	0,5	28,5		12	Em. loan collateral expanded
20/11/2008	10/12/2008	14	50	70	60	0,75	9	0,5	28,5		12	
2/1/2009	14/1/2009	14	75	70	60	0,75	9	0,5	28,5		12	
29/1/2009	6/2/2009	14	75	70	60	0,75	9	0,5	25		12	
18/2/2009	20/2/2009	14	75	70	60	0,75	9	0,5	20		12	
14/10/2009	11/11/2009	14	75	70	60	0,75	9	0,5	20		12	Int. no longer paid for FX RR CB deposit
23/11/2009	8/12/2009	14	75	70	60	0,75	9	0,5	20		0	Credit growth limit abolished
3/2/2010	10/2/2010	13	75	70	60	0,75	9	0,5	20			

* hrk= domestic currency; fx= foreign currency; rr= required reserve; ir= interest rate; on= over-night; cnb_dep= deposited at the CNB

Appendix 5 Economic and financial developments, 1997 – 2010

Figure 1

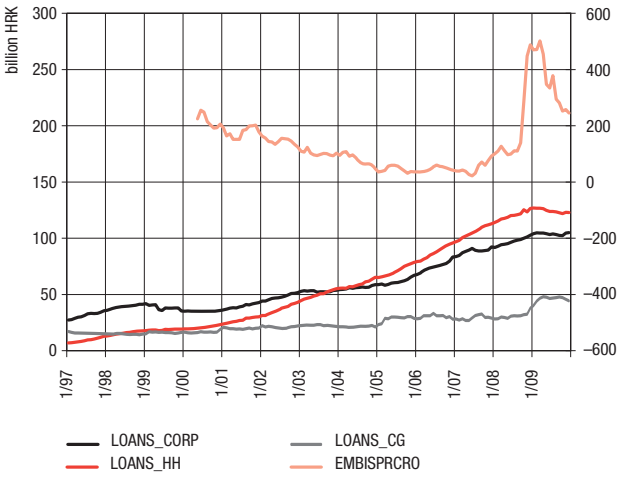


Figure 2

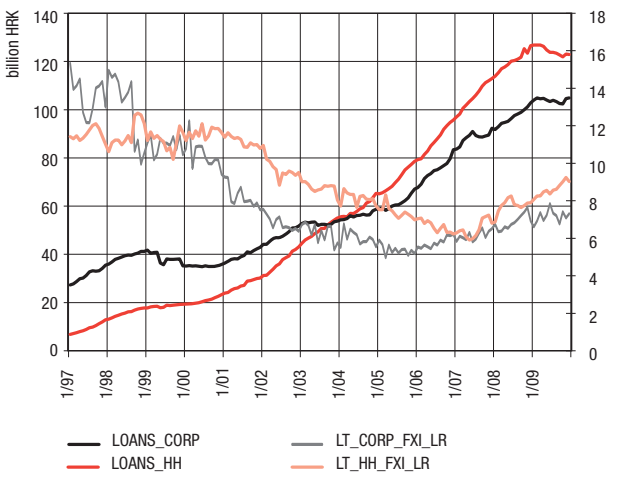
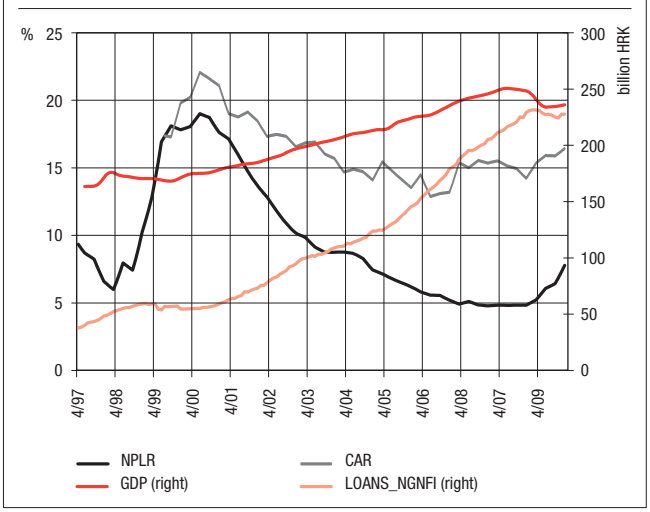


Figure 3



Appendix 6 Counterfactual scenarios for bank credit, capital, and liquidity

Table 1

Date	Bank_ assets	Bank_ cap	Cap_ ratio	CAR	NPLR	Cap_ ratio*	CAR*	Cap*
12/2001	142,606	25,455	17.9	18.5	13.7	18.8	18,3	26,739
12/2002	165,622	26,323	15.9	16.6	10.2	15.5	16,4	25,721
12/2003	195,278	27,390	14.0	15.7	8.8	14.2	15,6	27,808
12/2004	225,546	28,666	12.7	14.1	7.4	13.0	14,9	29,389
12/2005	255,320	32,666	12.8	13.5	6.2	11.9	14,2	30,358
12/2006	299,258	40,805	13.6	13.2	5.2	11.0	13,7	32,829
12/2007	336,349	53,179	15.8	15.4	4.8	10.6	13,5	35,619
9/2008	344,628	59,225	17.2	14.9	4.8	10.6	13,5	36,634
12/2008	361,671	60,317	16.7	14.2	4.8	10.6	13,5	38,446
3/2009	359,864	61,849	17.2	15.4	5.2	11.0	13,7	39,549
6/2009	361,634	62,876	17.4	15.9	6.1	11.8	14,2	42,600
9/2009	366,124	64,474	17.6	15.9	6.4	12.1	14,4	44,264
12/2009	371,386	66,306	17.9	16.4	7.8	13.3	15,1	49,543
2008-2007	25,322	7,138	0.9	–1.1	0.05	0.0	0,0	2,826
2009-2008	9,715	5,989	1.2	2.2	2.95	2.7	1,6	11,097

Note: Minimum capital ratio found for 2005-08 at 12.65
cap_ratio* = 6.19 + 0.92 nplr
car* = 7.22 + 0.59 cap_ratio*

Figure 1

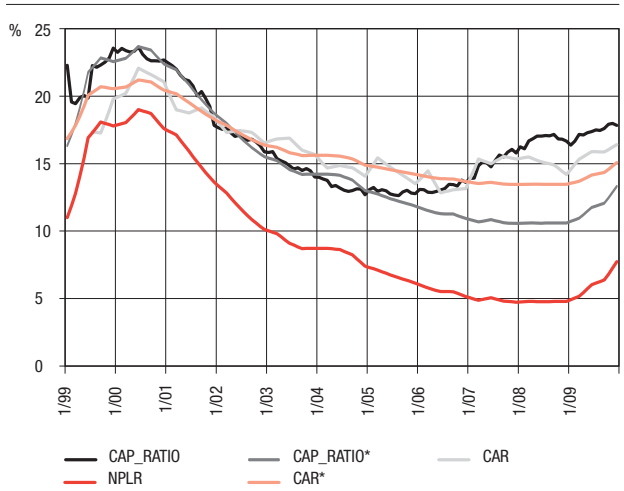


Table 2

Date	Bank_assets	Bank_cap	Cap_ratio	CAR
	Total HRK res	Total FX res	Total HRK res*	Total FX res*
12/2002	11,447	53,604	11,447	42,011
1/2003	11,694	52,979	11,694	42,833
2/2003	12,011	53,162	12,011	43,061
3/2003	12,169	54,310	12,169	43,940
4/2003	12,435	53,255	12,409	43,369
5/2003	12,645	53,476	12,618	43,703
6/2003	13,006	53,734	12,980	44,027
7/2003	13,337	54,236	13,251	44,539
8/2003	13,875	54,804	11,375	47,029
9/2003	15,915	54,444	13,639	46,407
10/2003	16,436	54,393	14,190	46,389
11/2003	17,292	54,586	13,250	48,184
12/2003	18,243	55,387	14,327	49,111
12/2004	20,041	62,480	16,821	55,781
12/2005	24,998	65,466	18,793	66,917
12/2006	28,966	82,071	21,699	74,188
12/2007	35,432	75,301	27,503	72,783
4/2008	33,013	81,665	24,826	79,503
9/2008	33,754	70,313	27,208	75,089
12/2008	30,095	64,253	31,870	74,431
2/2009	35,441	44,166	30,716	76,066
12/2009	33,762	47,525	27,655	82,608
10/2010	33,667	47,297	27,286	82,343
2/2010	32,102	47,121	27,911	83,256

Figure 2

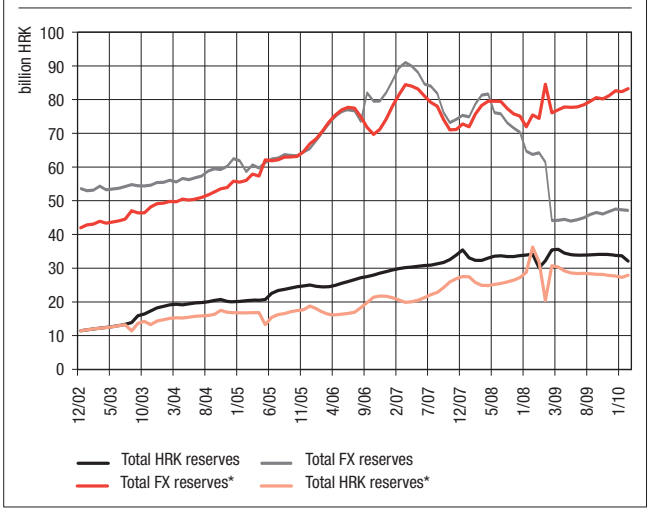


Figure 3

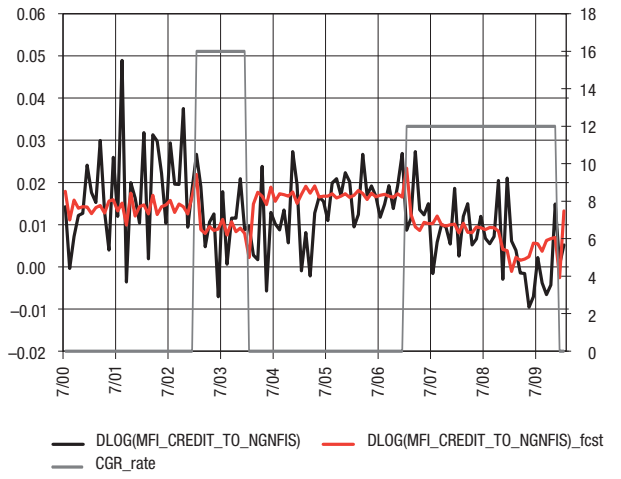
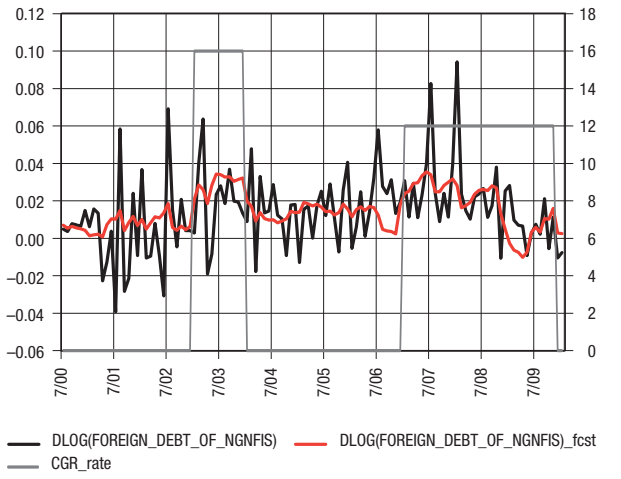


Figure 4



ln(for_dbt_ngnfit/for_dbt_ngnfit-1)= 0.018+0.016 (cgr>0)-0.0031 (cgrt-cgrt-1>0)–0.000075 embi_sprt-1+ARMA(1,1) error
ln(mfi_cred_ngnfit/mfi_cred_ngnfit-1)= 0.018-0.0067 (cgr>0)+0.014(cgrt-cgrt-1>0)–0.000019 embi_sprt-1+ARMA(1,1) error

Figure 5

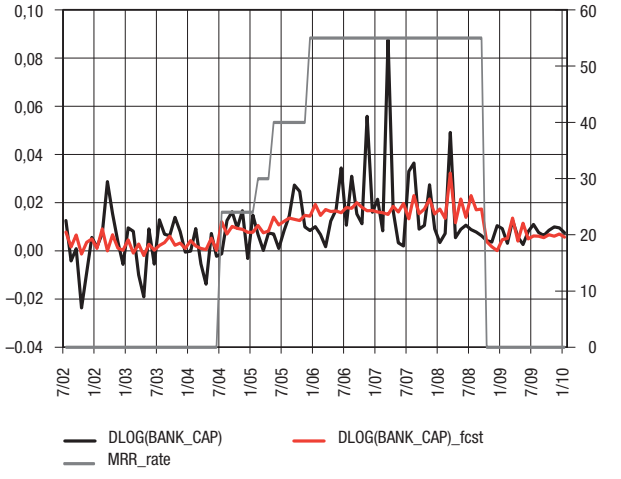
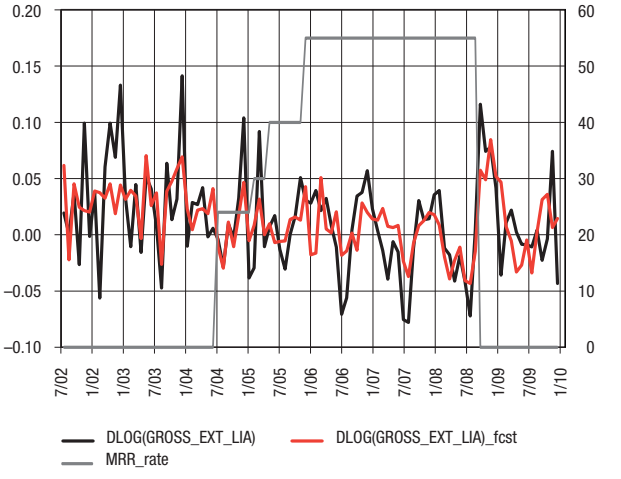


Figure 6



ln(gross_ext_liat/gross_ext_liat-1)= 0.034-0.036 (mrr>0)+1.19 ln(mfi_credit_to_nfist/mfi_credit_to_nfist-1)-0.048 eur3mt/eur3mt-1-0.00011 embi_sprt-1+AR(12) error
ln(bank_capt/bank_capt-1)= 0.00047+0.00027 mrr+0.0079 eur3mt/eur3mt-1+0.000022 embi_sprt-1+ARMA(1,1) error+AR(12) error

Figure 7

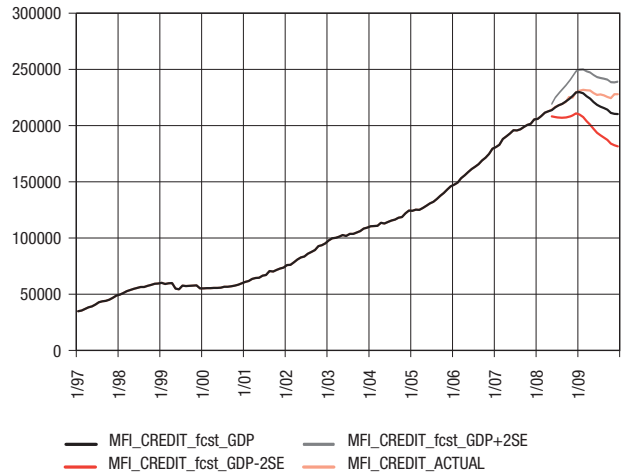
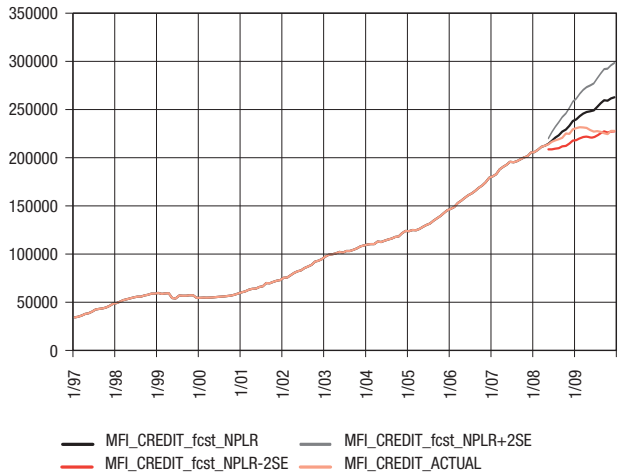


Figure 8



ln(mficredit_gdpt/mficredit_gdpt-1)=a0+a1ln(fx_dept/fxdept-1)+a2ln(gross_ext_liat/gross_ext_liat-1)+a3ln(hrk_rrt+1/hrk_rrt)+a4ln(gdpt/gdpt-12)+ARMA(1,1) error
ln(mficredit_nplrt/mficredit_nplrt-1)=a0+a1ln(fx_dept/fxdept-1)+a2ln(gross_ext_liat/gross_ext_liat-1)+a3ln(nplrt/nplrt-1) +a4ln(hrk_rrt+1/hrk_rrt)+a5ln(cap_ratiot+1/cap_ratiot)+ARMA(1,1) error

Appendix 7 Classification of countries by Aisen and Franken (2010)

Variable (Aisen & Franken, 2010)	Mean	Dev	Min	Max	Croatia		
Real credit growth post LB bankruptcy (October 2008 – May 2009)	–0.39	0.76	–2.88	1.54	0.04	med	above
Real credit growth pre LB bankruptcy (September 06 – August 2008)	0.09	0.32	–0.78	1.26	0.15	med	above
Real GDP growth (Q4:2008 – Q1:2009)	–3.98	4.23	–14.9	1.4	–5.5	med	below
Trading partners' GDP growth (Q4:2008 – Q1:2009)	–2.55	1.06	–6.2	–0.26	–2.3	med	above
Percentage change in terms of trade (Q4,08)	0.98	13.6	–16	72.2			
Percentage change in money market rate (September 2008 – May 2009)	–30	80	–97	497	38	med	above
Credit over GDP – 2007	60	48	2	253	69	med	above
Nominal GDP level – 2007	438	1466	1	14078	59	med	below
GDP per capita – 2007	13,180	18,058	125	103,591	13,205	med	above
Real GDP growth – 2007	5.5	3.33	–6.6	20.3	5.5	med	below
Real GDP growth – deviation from trend – 2007	1.79	2.43	–2.4	16.3			
Financial integration index – 2007	0.72	1.59	–1.81	2.54	1.23	med	above
Trade openness – 2007	104	67	26	433	93	med	below
External debt (percent of GDP, 2007)	43	35	3	221	76.9	med	above
Current account balance (percent of GDP, 2007)	–2.7	10.4	–25.2	25.7	–7.6	med	below
Bank domestic liabilities dollarization – 2004	0.21	0.41	0	3.08	0.74	hi	above
Share of public ownership of the banking system – 2002	0.14	0.18	0	0.86	0.04	med	below
Share of foreign ownership of the banking system – 2002	0.34	0.28	0	0.96	0.90	hi	above
Bank leverage – 2007	12.8	5.22	4.4	30.3	11.5	med	below
Bank return on equity – 2007	19	8.34	4.7	47.7	10.9	med	below
Bank return on assets – 2007	1.73	0.92	0.1	3.9	1.6	med	below
Bank concentration – 2007	0.69	0.2	0.16	1	0.53	med	below
Bank dependence on wholesale funding	0.44	0.13	0.19	0.65	27.3	hi	above
Bank regulatory capital to risk-weighted assets – 2007	14.6	4.08	10	30.1	16.4	med	above
Bank nonperforming loans to total loans – 2007	3.9	4.11	0.2	19.3	4.8	med	above
Bank provisions to nonperforming loans – 2007	97.1	51.35	25.7	214.6	54.4	med	below
Exchange rate regime – 2005	1.9	0.98	1	3	2	med	above

The following Working Papers have been published:

No.	Date	Title	Author(s)
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