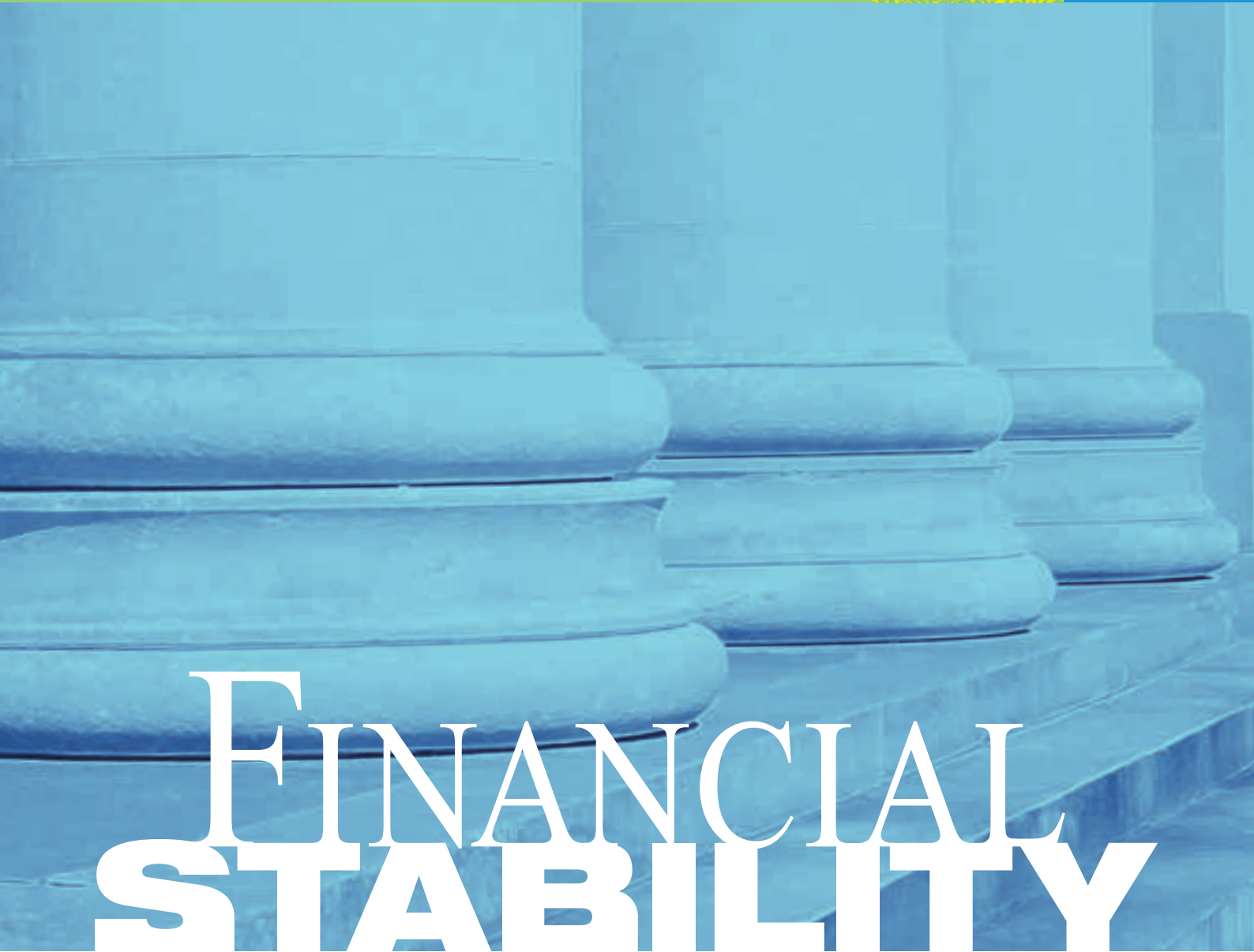


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# FINANCIAL STABILITY



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# Financial Stability

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## Contents

Introductory remarks	5
Overall assessment of the main risks and challenges to financial stability policy	7
Macroeconomic environment	9
Box 1 Redesigning the systemic risk map	17
Government sector	19
Household sector	23
Box 2 Interest rate risk in the Republic of Croatia	28
Real estate	32
Box 3 Preliminary research of residential real estate market liquidity as a determinant of price dynamics	34
Non-financial corporate sector	37
Box 4 Forecasting the probability of default of non-financial corporations by means of sectoral micro models with macroeconomic variables	42
Banking sector	45
Stress testing of credit institutions	53



# Introductory remarks

Finance plays a key role in the allocation of resources, i.e. the process of transforming savings into investments, and therefore into economic growth and an increase in the overall level of social welfare. At the same time, because financial stability is based on the confidence of financial market participants, it largely depends in turn on their perceptions and behaviour, which are subject to cyclical swings. As financial crises create considerable economic and social costs, the maintenance of financial stability has the character of a public good and is thus an important economic policy objective.

Financial stability is characterised by the smooth functioning of all financial system segments (institutions, markets, and infrastructure) in the resource allocation process, in risk assessment and management, payments execution, as well as in the resilience of the system to sudden shocks. This is why the Act on the Croatian National Bank, in addition to the main objective of the central bank – maintenance of price stability and monetary and foreign exchange stability – also lists among the principal central bank tasks the regulation and supervision of banks with a view to maintaining the stability of the banking system, which dominates the financial system, as well as ensuring the stable functioning of the payment system. Monetary and financial stability are closely related, for monetary stability, which the CNB attains by the operational implementation of monetary policy, performing the role of the bank of all banks and ensuring the smooth functioning of the payment system, lowers risks to financial stability. At the same time, financial stability contributes to the maintenance of monetary and macroeconomic stability by facilitating efficient monetary policy implementation.

The CNB shares the responsibility for overall financial system stability with the Ministry of Finance and the Croatian Financial

Services Supervisory Agency (HANFA), which are responsible for the regulation and supervision of non-banking financial institutions. Furthermore, owing to the high degree to which the banking system is internationalised, as reflected in the foreign ownership of the largest banks, the CNB also cooperates with the home regulatory authorities and central banks of parent financial institutions.

The publication *Financial Stability* analyses the main risks to banking system stability stemming from the macroeconomic environment of credit institutions and the situation in the main borrowing sectors, as well as credit institutions' ability to absorb potential losses should these risks materialise. Also discussed are CNB measures to preserve financial system stability. The analysis focuses on the banking sector, due to its predominant role in financing the economy.

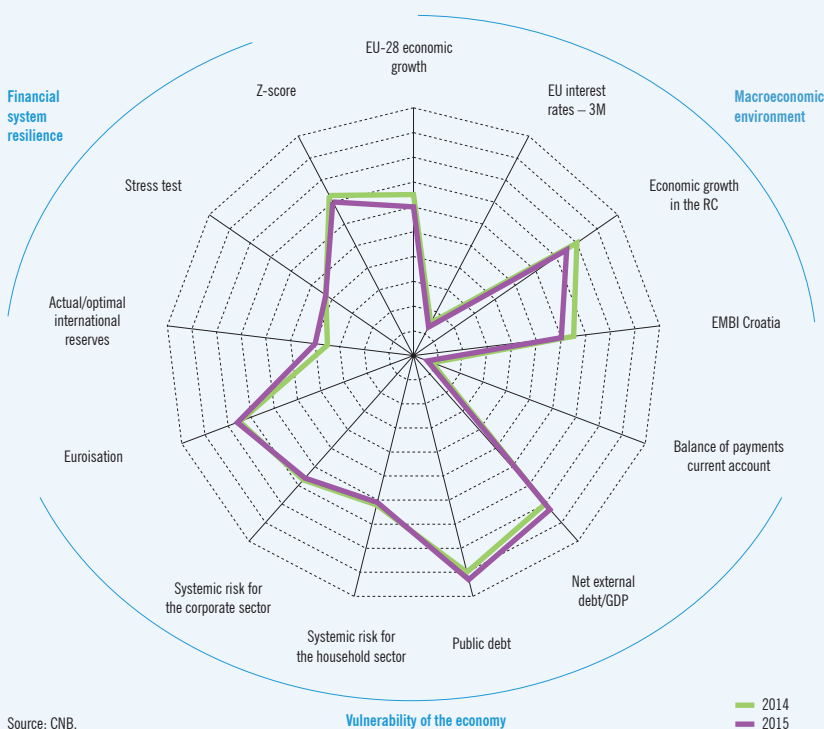
The purpose of this publication is systematically to inform financial market participants, other institutions and the general public about the vulnerabilities and risks threatening financial system stability in order to facilitate their identification and understanding as well as to prompt all participants to undertake activities providing appropriate protection from the consequences should these risks actually occur. It also aims at enhancing the transparency of CNB actions to address the main vulnerabilities and risks and strengthen the financial system's resilience to potential shocks that could have significant negative impacts on the economy. This publication should encourage and facilitate a broader professional discussion on financial stability issues. All this together should help maintain confidence in the financial system and thus its stability.





# Overall assessment of the main risks and challenges to financial stability policy

Figure 1 Financial stability map



Source: CNB.

Although the risks related to international financial market developments are still relatively low, the increased volatility and uncertainty surrounding the outcome of Greece's negotiations with the EU are potential threats to Croatia's financial stability as they could adversely affect domestic sectors' foreign borrowing costs. The expected modest recovery of the domestic economy and small reduction in the risk of the private sector are insufficient to halt the growth of domestic vulnerabilities, driven primarily by a surge in public debt. A model estimate shows that international reserves fluctuate around an optimal level while stress testing confirms that the financial system is resilient to highly unlikely but plausible stress scenarios.

Figure 1 summarises the main indicators of financial stability in Croatia. The financial stability map shows changes in the key indicators of the possibility of occurrence of risks related to the domestic and international macroeconomic environment and the vulnerability of the domestic economy, as well as changes in the indicators of financial system resilience that can eliminate or reduce costs should such risks materialise. The map shows the most recent developments or forecasts of selected indica-

tors and their values in the reference period, i.e. the previous year. An increased distance from the centre of the map for each variable indicates a rise in the risk or vulnerability of the system, that is, of a decrease in its resilience and, accordingly, a greater threat to stability. Any increase in the area of the map, then, indicates that the risks for the system's financial stability are increasing, while a diminution of the area suggests they are decreasing.

The risks to financial stability coming from the external environment have remained unchanged from those presented in the last issue of Financial Stability, while the risks stemming from the domestic economy have increased. The risks of the private sector have been diminishing, while the risks related to the public sector have continued to grow, due primarily to the accumulation of public debt, that is, to relatively high budget deficits.

Continued gradual economic recovery in Croatia's main trading partners has led to a decline in the risks to the country's financial stability. The uncertainties surrounding the resolution of the Greek crisis have so far had no significant influence on the risk premiums of other European countries. However, a rise in risk aversion could generate pressures on the financing costs for Member States with vulnerable public finances and weakened growth outlooks. In addition, a considerable volatility of the main European benchmark issue – the ten-year German government bond – and a sharp increase in its yield, which widened by about 0.8 percentage points since the beginning of June, have had an indirect impact on the financing costs of other euro-denominated issues. Increased financial market volatility has resulted, among other things, from similar investor strategies and a drop in market liquidity, irrespective of the continued expansive monetary policy of the ECB.

For the countries like Croatia, a surge in the risk premium and the price of the benchmark German bond could significantly increase the costs of international market financing. This would produce a strongly negative effect on the financing costs of the government and domestic sectors and indirectly influence the expected growth rates. The effect of such a scenario on the stability of the banking sector and other sectors of the domestic economy has been quantified in the stress testing (see the chapter Stress testing of credit institutions).

A slight increase in the expected growth rates of the domestic economy has reduced the risks to financial stability. However, due to the stated risks, economic policy makers should make use of the low interest rate period and continue with the implementation of reforms to improve the business environment and boost potential GDP growth rates. Higher growth rates will also reduce the risks related to public finances and strengthen the resilience of the domestic economy in the event of a marked increase in the cost of foreign borrowing. In the meantime, the continued high levels of budget deficit and public debt growth, coupled with the expected low economic growth rates, increase the risks to financial stability, due to both risk accumulation and a possible strong impact of an increase in the financing cost on the sustainability of public debt. However, it should be emphasised that the European Commission assessed that the fiscal adjustment measures implemented, although not resulting in a turnaround of the unfavourable fiscal trends, were nevertheless in line with the requirements of the excessive deficit procedure. However, the excessive deficit procedure does reduce risks of

a deficit increase and aids in formulating a sustainable medium-term fiscal policy.

Although market participants expect benchmark interest rates to hold at relatively low levels, their potential growth poses a risk to all domestic sectors. This issue of Financial Stability therefore analyses the impact of a sharp increase in interest rates on the household sector, which is exposed to the risk of interest rate movements primarily due to variable interest rates on loans. In addition, there is a discussion of potential ways to reduce this risk in the relatively complex situation arising from the introduction of an otherwise good practice of linking the interest rate to a benchmark index (see Box 2 Interest rate risk in the Republic of Croatia).

Notwithstanding the potential vulnerabilities in the scenario of future interest rate growth, the risks to the household sector are currently decreasing, primarily due to a general decline in interest rates and a slow growth of disposable income, spurred mainly by a change in tax regulations. On the other hand, the appreciation of the Swiss franc exchange rate has not made a significant impact on the system's financial stability, which might however be threatened by some proposals made in public for the resolution of the issue for certain debtors, mainly because of the potential negative effects of such proposals on the level of international reserves of the Republic of Croatia (see the text on the CNB website *Some facts about loans in Swiss francs and some options for government intervention*).

The risk of the non-financial corporate sector has dropped slightly, mainly because of a recovery in this sector's profitability and decrease in interest rates, occurring under the circumstances of improved business expectations and a gradual recovery of activity. The profitability of the non-financial corporate sector has increased, driven by income growth stemming from a considerable increase in foreign sales. In addition, a drop in expenses has led to an increase in this sector's margin.

The banking sector has continued to deleverage abroad on the back of comfortable liquidity and a relatively weak, although slightly recovered, demand for loans. As described in the previous issue of Financial Stability, an increase in the risk for this sector is related to an increasingly higher exposure to the government sector, the debt of which has continued to surge, and a declining exposure to the private sector that alone is capable of guaranteeing a stable source of income in the long term. At the same time, a halt in the growth of non-performing placements of the corporate sector has led to a decline in the pressures on bank profitability coming from this source.

Finally, the results of integrated solvency and liquidity tests suggest that the domestic financial system is capable of withstanding highly unlikely but plausible shocks that might jeopardise the operation of credit institutions.

# Macroeconomic environment

Due to favourable conditions in international financial markets, the risks to Croatia's financial stability associated with high external debt refinancing requirements are decreasing. However, the slow pace of economic recovery expected for 2015 is insufficient to significantly improve macroeconomic and financial indicators and poses, together with the fast growth and high level of public debt as well as a great sensitivity of domestic debtors to exchange rate and interest rate changes, the main risk to financial stability in the forthcoming period.

Macroeconomic and financial conditions in the environment were in the first half of 2015 marked by continued economic recovery and stability in international financial markets stemming from a high global liquidity and low risk premiums. In most EU countries positive trends continued from the end of the previous year and might continue towards the end of 2015, driven by growth in exports, caused by the weakening of the effective exchange rate of the euro, and by an increase in household disposable income and consumption resulting from a price decrease in energy products. These developments were fostered by ECB's measures to bring inflation to about 2% in the medium term (Table 1). However, growth rates in EU countries remained uneven. Central and East European countries had the fastest pace of growth, Croatia being an exception (Table 1).

The ECB successfully launched its quantitative easing programme aimed at strengthening aggregate demand and boosting inflation expectations by stepping up bank lending activity, as well as at reducing market financing costs for both public and private sectors, which, at the same time, creates room for an inadequate formation of the price of risk. ECB interest rates

Table 1 Economic growth, exports and industrial production in selected developed and emerging market countries

	Annual GDP growth rate			Quarterly GDP growth rate, $\Delta Q_t/Q_{t-1}$		Annual rate of change in exports		Annual rate of change in industrial production (seasonally adjusted)	
	2013	2014	2015 <sup>a</sup>	Q4/2014	Q1/2015	Q4/2014	Q1/2015	Q4/2014	Q1/2015
USA	2.2	2.4	1.1	0.5	-0.2	0.6	-4.7	4.6	3.5
EU	0	1.3	1.8	0.4	0.4	3.7	2.9	0.8	1.4
Germany	0.1	1.6	1.9	0.7	0.3	4.7	4.8	0.8	0.5
Italy	-1.7	-0.4	0.6	0.0	0.3	3.9	2.6	-1.0	-0.5
Slovenia	-1	2.6	2.3	0.3	0.8	9.6	5.0	2.2	4.6
Slovak R.	1.4	2.4	3.0	n.a.	n.a.	-2.6	1.2	3.2	4.2
Czech R.	-0.7	2.0	2.5	0.4	3.1	4.9	7.2	4.4	4.4
Poland	1.7	3.4	3.3	0.8	1.0	4.2	9.4	2.7	4.9
Hungary	1.5	3.6	2.8	0.8	0.8	6.4	7.7	4.2	7.8
Estonia	1.6	2.1	1.9	1.0	-0.3	3.1	-0.4	5.5	2.4
Latvia	4.2	2.4	2.3	0.5	0.3	3.7	0.7	-1.0	1.9
Lithuania	3.3	2.9	2.8	0.7	-0.6	1.1	-4.4	3.1	3.8
Bulgaria	1.1	1.7	1.0	0.4	0.9	2.2	n.a.	0.6	2.1
Romania	3.4	2.8	2.8	1.0	1.6	3.4	5.9	3.5	3.2
Croatia <sup>b</sup>	-0.9	-0.4	0.5	-0.1	0.0	6.1	6.1	3.6	0.1

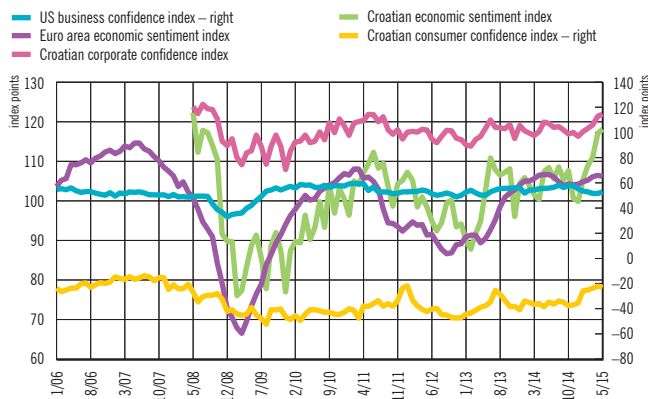
<sup>a</sup> Estimate. <sup>b</sup> The seasonal adjustment methodology of Croatia's GDP has been presented in the manuscript titled Description of the X-12 seasonal adjustment methodology that is available at request.  
Sources: Eurostat, CBS, Bloomberg, OECD and CNB (for Croatia).

are at very low levels – the repo rate remained at 0.05% and the deposit facility interest rate is negative at -0.20% (Figure 3). In addition to the existing covered bond and asset-backed securities purchase programmes, an expanded asset purchase programme was launched in March, involving monthly purchases of government bonds of euro area countries and bonds of European institutions and countries in the secondary market

in a cumulative amount of EUR 60bn. The programme will be carried out until September 2016, that is, until the annual inflation target for the euro area of just under 2% is attained.

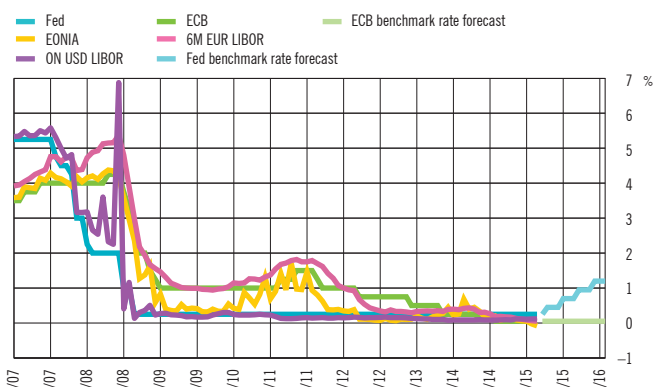
The initial assessments of ECB measures suggest an improvement in overall financing conditions. The improvement is reflected in a decrease in government bond yields, some of which

Figure 2 Economic sentiment and business confidence indices



Sources: Bloomberg and CNB.

Figure 3 Key interest rates of the main central banks and leading market interest rates



Sources: Fed, ECB and Bloomberg.

Table 2 Fiscal balance and current account balance in selected developed and emerging market countries

	Fiscal balance, as % of GDP			Current account balance, as % of GDP		
	2013	2014	2015 <sup>a</sup>	2013	2014	2015 <sup>a</sup>
USA	-5.6	-4.9	-4.2	-2.5	-2.6	-2.2
EU	-3.2	-2.9	-2.5	1.5	1.6	1.9
Germany	0.1	0.7	0.6	6.9	7.6	7.9
Italy	-2.9	-3.0	-2.6	0.9	2.0	2.2
Portugal	-4.8	-4.5	-3.1	0.9	0.5	1.2
Ireland	-5.8	-4.1	-2.8	4.4	6.2	5.7
Greece	-12.3	-3.5	-2.1	-2.3	-2.2	-1.6
Spain	-6.8	-5.8	-4.5	1.5	0.6	1.2
Slovenia	-14.9	-4.9	-2.9	4.8	5.3	5.4
Slovak R.	-2.6	-2.9	-2.7	0.8	1.9	1.8
Czech R.	-1.2	-2.0	-2.0	-2.2	-0.9	0.4
Poland	-4.0	-3.2	-2.8	-1.3	-1.4	-1.8
Hungary	-2.5	-2.6	-2.5	4.2	4.4	5.5
Estonia	-0.2	0.6	-0.2	-0.4	0.1	-0.3
Latvia	-0.7	-1.4	-1.4	-2.0	-2.9	-2.3
Lithuania	-3.1	-2.6	-0.7	1.5	0.6	-0.2
Bulgaria	-0.9	-2.8	-2.9	1.6	0.9	1.3
Romania	-2.2	-1.5	-1.6	-1.2	-0.5	-0.8
Croatia	-5.2	-5.7	-5.3	0.8	0.7	1.1

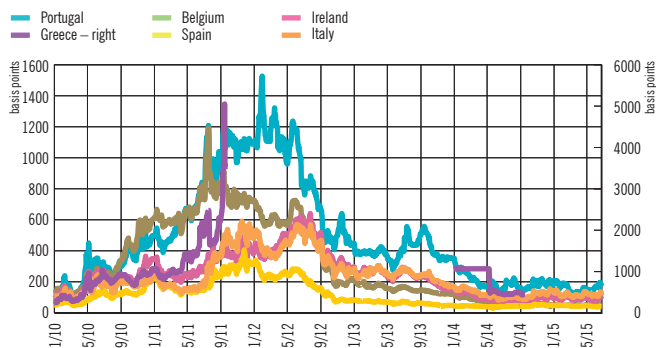
<sup>a</sup> Estimate.

Sources: European Commission, *European Economic Forecast*, spring 2015 and CNB (for Croatia).

entered negative territory, in a decline in the costs of corporate borrowing in the financial market and in reduced market fragmentation in terms of significantly lower differences in financing conditions across euro area countries (Figures 4, 5 and 6). Nevertheless, high risk propensity in financial markets is not accompanied by propensity to take risks in the real economy, with the result that investment levels have remained low. In addition, the high indebtedness and relatively low economic growth rates coupled by deflation pressures have continued to foster private sector deleveraging in some countries.

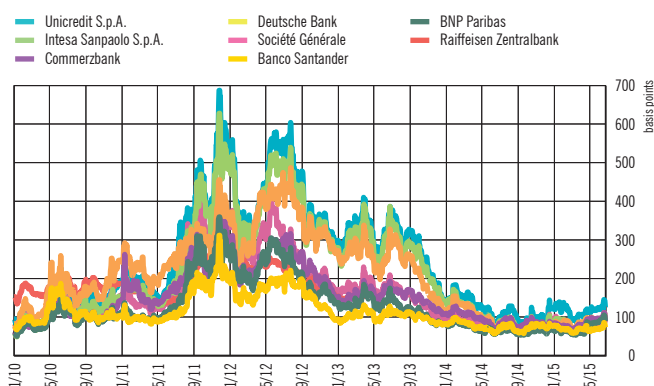
ECB readiness to respond to increased yield volatility has further strengthened the expectations of low yields in the forthcoming period. Temporary turbulences in the bond market in April and May, accompanied by a slight increase in bond yields stemming from a change in the fundamentals caused by a stronger than expected recovery in the euro area, by reduced fears of deflation and the stabilisation of oil prices, were lowered by the ECB's announcement that it would conduct larger bond purchases than initially planned in order to avoid a drop in market liquidity during the summer months.

Figure 4 CDS<sup>a</sup> spreads for 5-year bonds of selected euro area countries



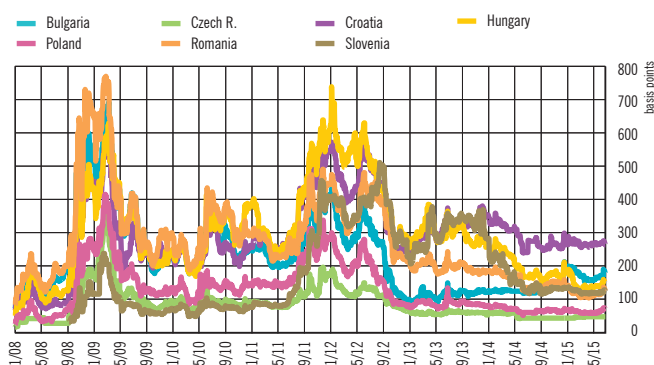
<sup>a</sup> Credit default swaps (CDS) spread is an annual premium that a CDS buyer pays for protection against credit risk associated with an issuer of an instrument. Source: Bloomberg.

Figure 5 CDS spreads for 5-year bonds of selected banks



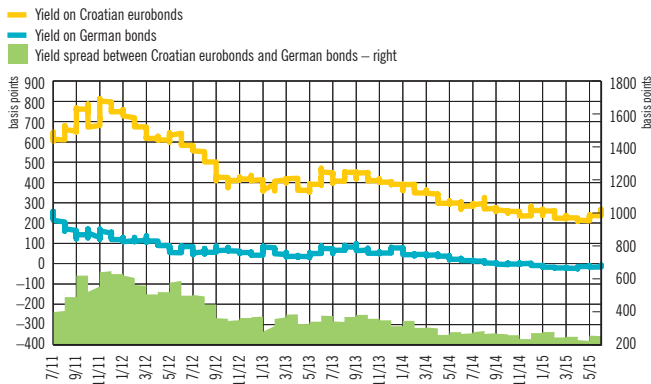
Source: Bloomberg.

Figure 6 CDS spreads for 5-year bonds of selected emerging market countries



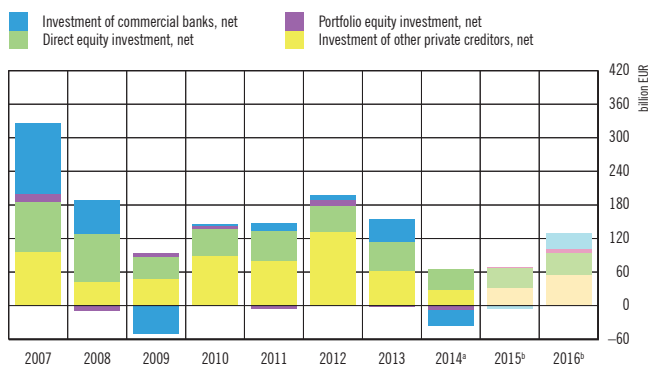
Source: Bloomberg.

Figure 7 Yields on Croatian and benchmark German bonds maturing in 2018 and their spread



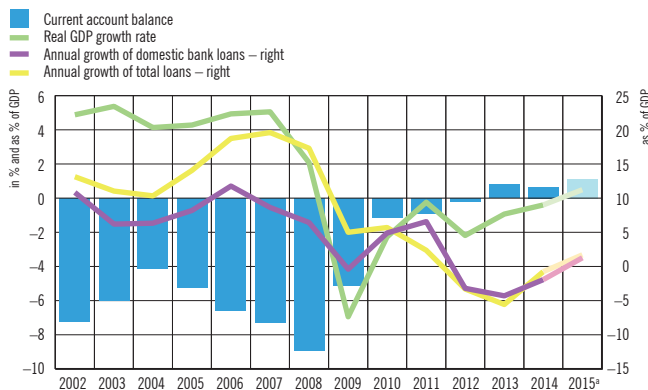
Source: Bloomberg.

Figure 8 Capital inflows to European emerging market countries



Source: International Institute of Finance, *Capital Flows to Emerging Market Economies*, January 2015.

Figure 9 Foreign capital inflows and GDP growth in Croatia



Sources: CBS and CNB.

Table 3 Public and external debt in selected European emerging market countries as % of GDP

	Public debt			External debt		
	2013	2014	2015 <sup>a</sup>	2012	2013	2014
Italy	127.9	132.1	133.1	121.9	119.0	125.2
Portugal	128.0	130.2	124.4	232.3	228.0	234.7
Ireland	123.3	109.7	107.1	1004.9	938.1	927.3
Greece	174.9	177.1	180.2	226.6	229.1	236.3
Spain	92.1	97.7	100.4	168.2	155.0	159.9
Slovenia	70.4	80.9	81.5	147.1	111.5	123.9
Slovak R.	54.6	53.6	53.4	57.5	81.3	88.5
Czech R.	45.7	42.6	41.5	50.9	63.5	66.4
Poland	55.7	50.1	50.9	72.8	70.1	70.1
Hungary	77.3	76.9	75.0	159.3	146.3	144.8
Estonia	10.1	10.6	10.3	95.6	93.7	97.1
Latvia	38.2	40.0	37.3	135.9	131.4	138.5
Lithuania	39.0	40.9	41.7	75.8	69.9	69.8
Bulgaria	18.3	27.6	29.8	96.2	91.8	96.3
Romania	37.9	39.8	40.1	76.7	68.1	62.8
Croatia	76.0	85.1	88.2	103.0	105.4	108.4

<sup>a</sup> Estimate. Sources: European Commission, *European Economic Forecast*, spring 2015, World Bank, *Quarterly External Debt Statistics* and CNB (for Croatia).

The expectations of the divergence between the monetary policies of the ECB and the Fed in 2015 should not markedly influence capital flows to emerging markets. Despite the expectations that the Fed would start tightening its monetary policy as early as the first half of the year, due to mixed signals about the US economic recovery, the benchmark interest rate has remained unchanged, ranging between 0% and 0.25%, and it is expected to increase by the end of the year (Figure 3). The Fed's clear communication strategy regarding its future moves should contribute to the avoidance of excessive volatility in financial markets. Accordingly, expectations are that global financial market conditions will remain propitious towards the end of 2015 and that capital inflows to European emerging markets will increase relative to the previous year (Figure 8). The beginning of the Fed's monetary tightening cycle could make a stronger impact on non-European emerging markets.

Very benign financial market conditions also increase the probability of excessive risk-taking by market participants. This is evident in the growth of prices of certain types of financial assets, especially of developed countries' bonds and in equity markets, accompanied by a decline in risk premiums, whose links with the fundamentals weaken in such conditions. In addition, relaxed financial market conditions alleviate the pressure to implement required fiscal and structural reforms.

Despite the strong capitalisation of the banking sector confirmed by the ECB's asset quality review, the risks of bank operations have remained elevated; the recent economic recovery is still not strong enough to reverse negative trends in the profitability of banks in some countries burdened with rising non-performing placements. Such developments, combined with increasingly tight regulations, provide an additional impetus to the development of shadow banking and increase the risks associated with this type of operation, still relatively under-regulated. Strong efforts are therefore being made in the EU to strengthen the regulatory framework for this market segment.

Political risks are constant threat to stable financial market conditions. This primarily concerns uncertainty surrounding the outcome of Greece's negotiations with the EU, the Russian-Ukrainian crisis and geopolitical tensions in the Middle East.

All these risks considerably increase the probability of a surge in general risk aversion. The scenario of a tightening of financing conditions would be especially detrimental for countries with high financing needs and macroeconomic vulnerabilities.

The continuation of favourable conditions in international financial markets reduces the risks to Croatia's financial stability. However, the modest recovery of the domestic economy, which is expected to grow by 0.5% in real terms in 2015, is insufficient to improve debt indicators (Table 1, Figures 9 and 10). The main risks to financial stability therefore stem from the slow pace of economic recovery, growth in public debt and the significant vulnerabilities of all domestic sectors to changes in borrowing conditions and exchange rate changes caused by a high level of euroisation of liabilities.

External debt could reach 110% of GDP at the end of 2015. However, as this is primarily due to developments in the exchange rate of the US dollar versus the euro and to CNB repo operations, the debt will not effectively change significantly. In addition, external vulnerability indicators have somewhat improved due to needs for the refinancing of debt maturing in 2015 that are slightly lower than in 2014 and to the expected current account surplus. The risk of external debt refinancing is also offset by its structure as the bulk of the liabilities can be attributed to parent banks of domestic banks and affiliated enterprises (Figure 13). Furthermore, a model estimate of the optimal international reserve level suggests that the current reserve level is sufficient to cushion any potential shock and preserve the stability of the exchange rate of the kuna, which is a key precondition for the maintenance of overall financial system stability (Figures 18 and 22).

In contrast, the decision of the Swiss central bank to abandon the Swiss franc's peg against the euro was followed by an increase in uncertainty over trends in the kuna to euro exchange rate, which will depend on international economic, financial and geopolitical developments in the forthcoming period (Figure 22). Although a part of the domestic non-financial sector is

Figure 10 GDP growth pattern (contribution to growth)

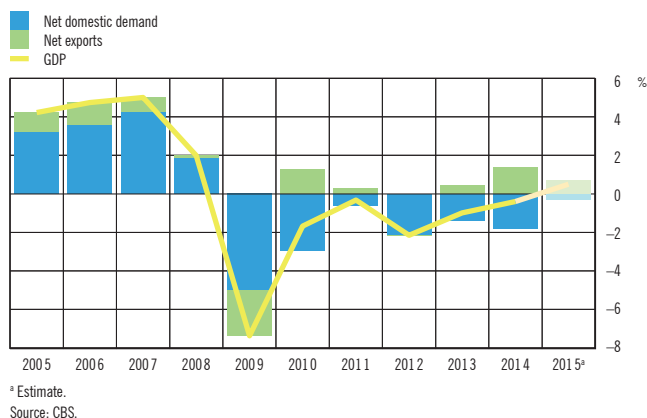


Figure 11 Savings and investment – total and by sector



Figure 12 External debt by domestic institutional sector

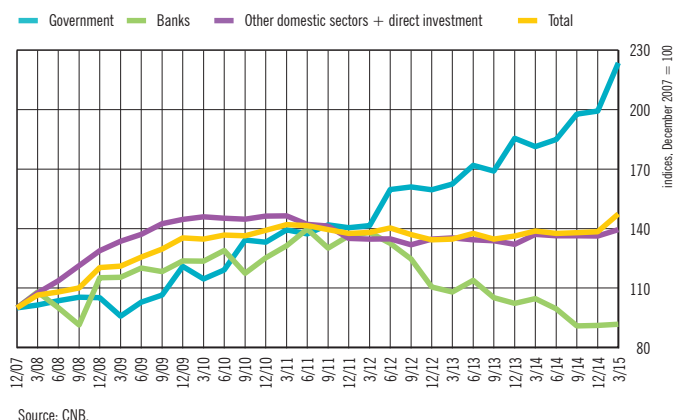
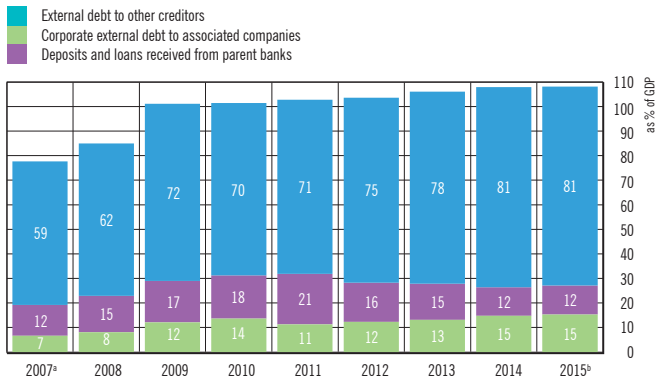
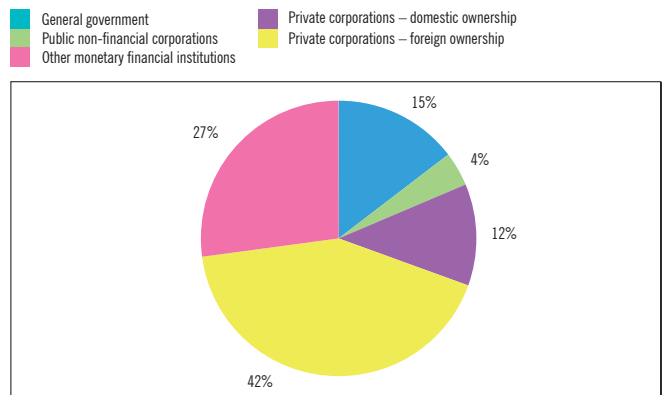


Figure 13 Total external debt by creditor



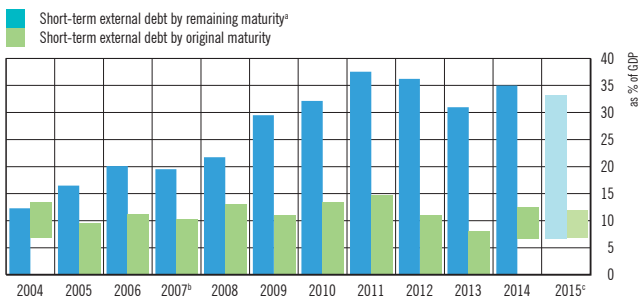
<sup>a</sup> Since end-2007, external debt has been calculated according to the new methodology. <sup>b</sup> Forecast. Source: CNB.

Figure 16 Projection of external debt principal payments in 2015 by sectors



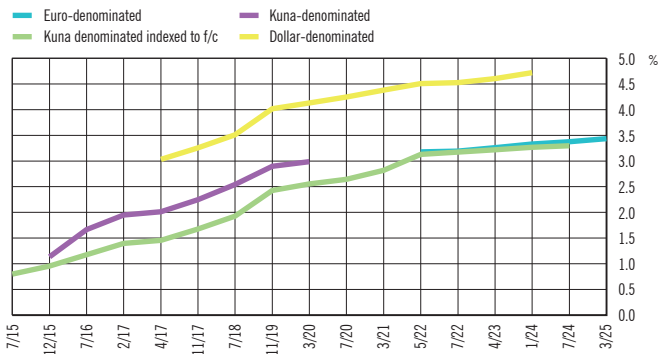
Source: CNB.

Figure 14 Short-term external debt



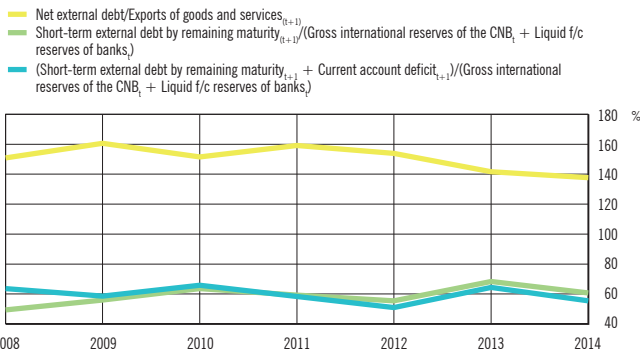
<sup>a</sup> Short-term external debt by remaining maturity is the amount of debt maturing in the reference year, representing the sum of the balance of short-term debt at the end of the previous year and long-term debt maturing in the reference year. <sup>b</sup> Since end-2007, external debt has been calculated according to the new methodology. <sup>c</sup> Forecast. Note: From 2008 on, short-term debt by remaining maturity includes round-tripping transactions which represent an accounting item that has a neutral effect. Source: CNB.

Figure 17 Yield curves of Croatian bonds issued on the domestic and foreign markets by currency



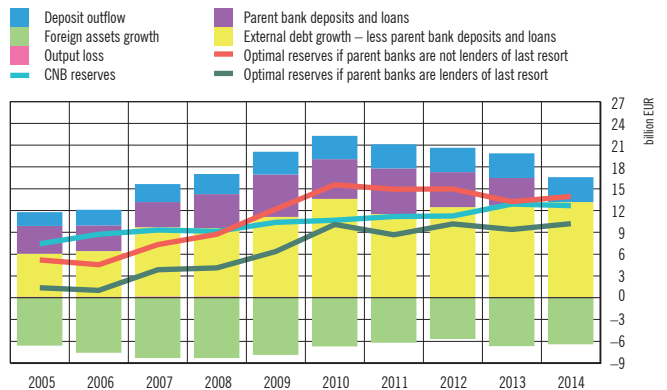
Note: Yield curves are the result of the interpolation of the data on bond yields by the currency of the issue. Source: Bloomberg.

Figure 15 Selected indicators of external vulnerability



Note: Net external debt is calculated as a difference between gross external debt and gross international reserves and bank foreign assets. Source: CNB.

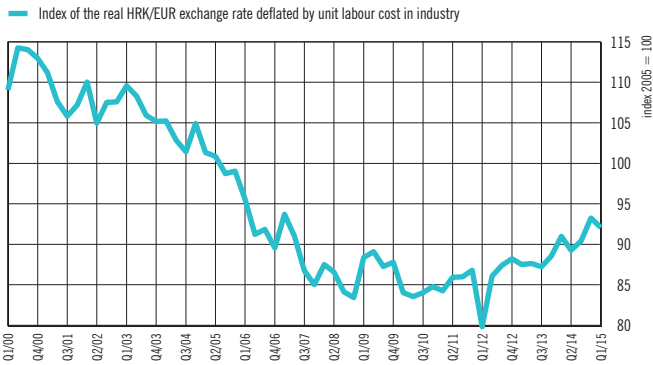
Figure 18 Optimal international reserves – contribution of individual components



Source: CNB.

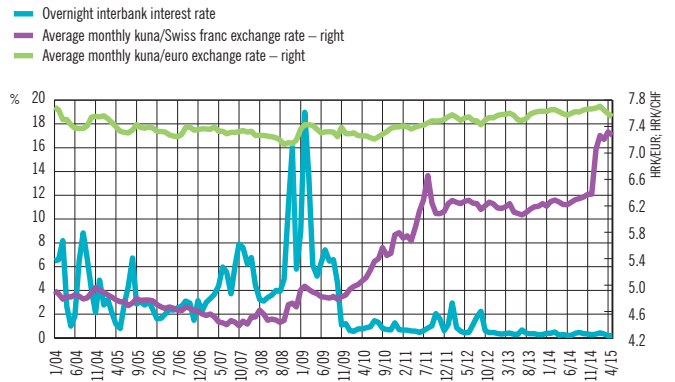


Figure 19 Real kuna/euro exchange rate



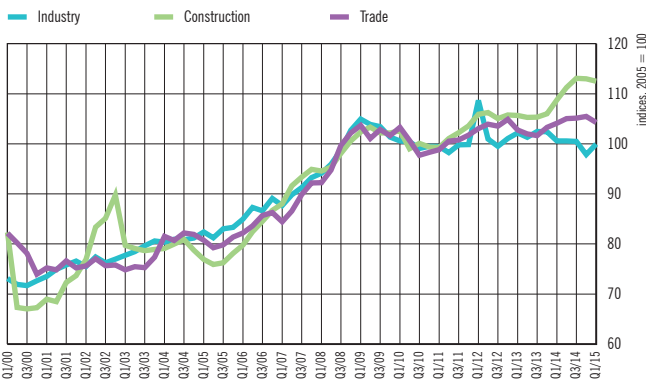
Note: A fall in the index indicates a real appreciation of the kuna against the euro.  
Sources: CBS, CNB and CNB calculations.

Figure 22 Kuna/euro and kuna/Swiss franc exchange rates and overnight interest rates



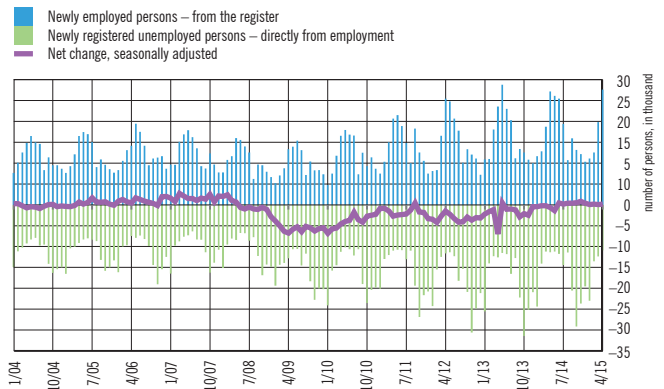
Source: CNR.

Figure 20 Unit labour cost



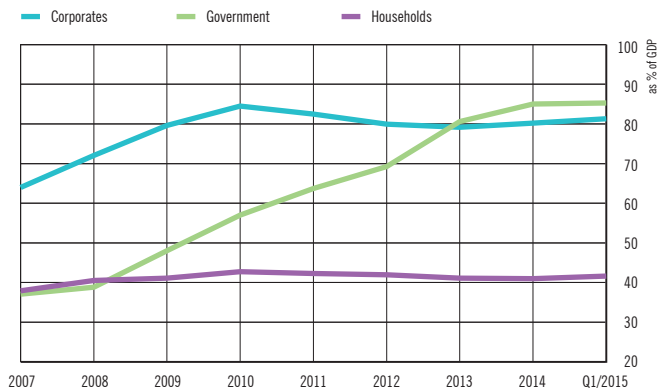
Sources: CBS and CNB calculations.

Figure 23 Changes in employment registered with the Croatian Employment Service (CES)



Sources: CES and CNB calculations.

Figure 21 Total debt by sector



Source: CNB – financial accounts.

exposed to the risk of a sudden appreciation in the Swiss franc exchange rate, as are banks, whose indirect exposure is related to a potential increase in non-performing placements indexed to this currency, at this moment this risk is not a threat to the stability of the financial system as a whole.

In addition to economic stagnation and a lack of strong fiscal consolidation, the main risk to the domestic economy stems from the high growth rates and high level of public debt, which is expected to reach 88% of GDP in 2015 (Tables 2 and 3). The resulting low credit rating and the high level of risk premium for Croatia, which significantly exceeds those for peer Central and Eastern European countries, have led to an increase in the borrowing costs of both the public and the private sectors (Figures 6, 7 and 17). Should financial market instability increase due to the occurrence of any of the mentioned potential shocks, this would weigh on the sustainability of public debt, while the private sector would face the tightening of financing conditions

and debt repayment difficulties, with the result that risks to the banking system stability would increase.

The banking system is stable and highly capitalised, with non-performing placements adequately provisioned for, so that the risks to its stability have remained relatively low. Nevertheless, a slow economic recovery and unfavourable labour market developments have continued negatively to affect bank placement quality, which is why the share of non-performing loans in total loans is expected to remain high in 2015. Lending activity is weak, despite the CNB's policy of supporting high liquidity in the domestic banking system, with negative labour market trends continuing to drive household sector deleveraging and weakened corporate balance sheets destimulating both credit supply and credit demand. Under such conditions, the government is relatively the most attractive debtor (Figures 9 and 23).

The export sector is expected to remain the main generator of economic activity in 2015. Notwithstanding the positive effects

of tax changes on disposable income, with the final outcome depending on a potential increase in surtaxes and communal charges by local government units, consumption has continued to be negatively affected by stagnant employment, deleveraging and a relatively high household debt burden, whereas investment has remained low. The pick up in exports is therefore expected to make the largest positive contribution to economic activity in the context of the required fiscal consolidation (Figure 10). However, this contribution will remain limited by the low competitiveness and unfavourable structure.

Due to these reasons, economic activity and, consequently, the main risks to financial stability, will in the forthcoming period depend on the recovery in EU countries, and especially in Croatia's main trading partners, external shocks that could influence financing conditions and domestic structural reforms that could improve the attractiveness of investing in export-oriented sectors and ensure the sustainability of public debt.

## Box 1 Redesigning the systemic risk map

In order to improve the systemic risk analysis and facilitate communication with the public, both of which are required for the formulation and efficient implementation of macroprudential policy, techniques for the visual presentation of key information on potential disturbances threatening financial stability should be developed.

In line with the IMF approach<sup>1</sup>, the CNB has so far used the so-called *financial stability map*, which has shown changes in specific indicators, but has not enabled an assessment of overall systemic risks or their gradation. The European Systemic Risk Board is currently developing an alternative approach, used mainly for the early warning of disturbances in the banking sector<sup>2</sup>, under which numerous indicators are standardised, put on a comparable scale and synthesised in some form. These are known as the *risk maps*, which are, depending on the limits of the thresholds used for the identification of the degree of the problem, most often shown as more or less complex “traffic lights”.

This box describes a modification of this approach on the macro-level based on a simplified standardisation of indicators and the relation between structural vulnerabilities and short-term developments in the financial and non-financial sectors on the one hand and sectoral distribution of risk on the other. The link between structural vulnerabilities and short-term developments is treated as a specific dimension of risk evolution. These elements form a basis for the quantification of a synthetic assessment of the degree of systemic risks.

The main advantage of such an approach compared with existing risk maps is that it provides for a concurrent examination of the relation between systemic risks, subsidiary objectives and macroprudential policy instruments as well as their direct correlation. This enables a consistent display of vulnerabilities and developments that might pose a risk to financial stability, facilitates the identification of the sources of disturbances and the understanding of the factors potentially spreading the shocks and allows for the correlation of the observed vulnerabilities and risks with the reaction functions of the implemented policies to create a uniform interpretation matrix. Accordingly, the risk map has three dimensions (Figure 1).

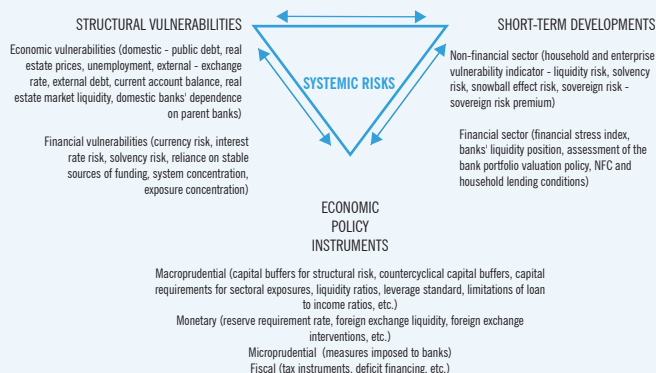
The first dimension includes an *assessment of structural economic and financial vulnerabilities* and points to systemic risks stemming from the structural features of the economy, that is, the financial system, which can exacerbate or alleviate the consequences of systemic shocks.

The second dimension is related to *short-term developments in the financial and non-financial sectors*, which are potential triggers for the materialisation of systemic risks, reflecting potentially dangerous regular oscillations or irregular, exogenous shocks that are usually difficult to envisage.

1 See, for example: IMF (2015): *Global Financial Stability Report*, World Economic and Financial Surveys, Washington D.C. (<http://www.imf.org/External/Pubs/FT/GFSR/2015/01/index.htm>).

2 See Box 3: Improvement of the early warning system for signalling banks in difficulties, *Financial Stability*, No. 10 (2013); EBA (2014): *Risk Dashboard Q4/2014*, European Banking Authority, Oversight – Risk Analysis Unit London, United Kingdom (<http://www.eba.europa.eu/risk-analysis-and-data/risk-dashboard>).

Figure 1 Three-dimensional examination of systemic risks



Source: CNB.

The third dimension consists of *the measures and instruments of economic policy*. Their structure is determined by the degree of development and interaction of individual instruments, macroprudential, monetary, microprudential and fiscal instruments in particular. Through various mechanisms, these instruments in return influence<sup>3</sup> systemic risks, structural vulnerabilities and the system's resilience. The changes occurring within this dimension are defined by the activation of measures during the phases of the accumulation and the materialisation of systemic risks. In addition to enabling an analysis of the interaction of goals and instruments, this dimension is also a supplementary tool for a clearer differentiation of the indicators from the first two dimensions and their classification.

### Operationalisation of the system

The described structure of the systemic risk map includes the basic factors of their evolution: accumulation, materialisation and propagation<sup>4</sup>. However, the operationalisation of the system is seriously limited by the fact that the indicators reflecting financial stability, that is, trends

Table 1 Risk assessment based on individual indicators

Level	Indicator	
	Direction	Overall risk assessment
1	1	3
1	0	2
0	1	1
0	0	0

Source: CNB.

3 This enables the possibility to evaluate the efficiency and consistency of policies, that is, to determine whether a degree of risk (“a reading on the thermometer”) is accompanied by adequate instruments in terms of their number, intensity and method of use (“temperature reduction measures”). In line with expectations, the largest number of measures in this system is currently concentrated in the area of currency risk.

4 Blancher, N., S. Mitra, H. Morsy, A. Otani, T. Severo, and S. Valderram (2013): *Systemic Risk Monitoring (-SysMo-) Toolkit – A User Guide*, IMF Working Paper, WP/13/68.

in structural vulnerabilities, systemic risks and resilience of the system are numerous and often difficult to compare. Furthermore, even when analysed individually, they fail to provide absolutely reliable or complete information on the risk of a specific segment of the system or to separate the risk from its potential impact on the system, which depends on the degrees of its vulnerability and resilience.

Therefore, the indicators need to be transformed (standardised) to make them mutually comparable. For this purpose, a simple key was used with two basic pieces of information within each indicator:

- a) the level – a comparison with a critical value, a threshold established according to a model calibration, regulatory standard or historical distribution enables an assessment of whether the level is excessive (1) or not (0);
- b) the direction – shows whether the degree of vulnerability or risk increased (1) or did not increase (0) in the observed period.

Drawing on information of a binary nature, a transformed indicator attains the value 0 or 1 and the summary assessment is graded from 0 to 3 (Table 1).

The quantification of the assessments in specific groups of indicators (*i*) showing structural vulnerabilities in the system ( $O_1$ ) or reflecting short-term developments ( $O_2$ ) was made in the following way:

$$O_1 = \sum_{i=1}^n O_{1i} / (3n); O_2 = \sum_{i=1}^n O_{2i} / (3n)$$

As these assessments are calculated for the financial and non-financial sectors, one should bear in mind that there are multidimensional and complex links between the sectors and types of risks. As this is subject to ongoing research, their formal model is impossible to present within such a matrix so that the sector's sensitivity is for this purpose observed in a simplified manner:

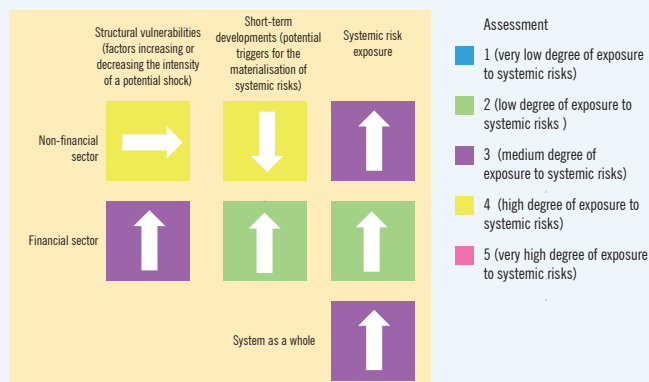
$$OS_{nef} = [(O_{2nef} \cdot O_{1nef} + O_{1nef}) / 2] + [(O_{2nef} \cdot O_{1fin} + O_{1fin}) / 2] \cdot 0.5$$

(the application in the non-financial sector is analogous to the application in the financial sector).

The equation shown contains the interaction between short-term developments and structural vulnerabilities (e.g. the impact of an exchange rate shock is quantified taking into account the degree of currency mismatch), but it does not allow structural risks to be neglected at any time due to potentially subdued short-term developments.

By averaging the grades for the non-financial and financial sectors, an assessment of the exposure to systemic risks at a given moment that

Figure 2 Exposure of the domestic economy to systemic risks



Note: The direction of the arrow shows the change in relation to the assessment of the exposure to systems risks in the previous period.  
Source: CNB.

can be graphically represented is achieved. The colours indicate the assessment of the degree of exposure to systemic risks, while the arrows show the direction of the changes in these exposures in comparison with the previous period (Figure 2).

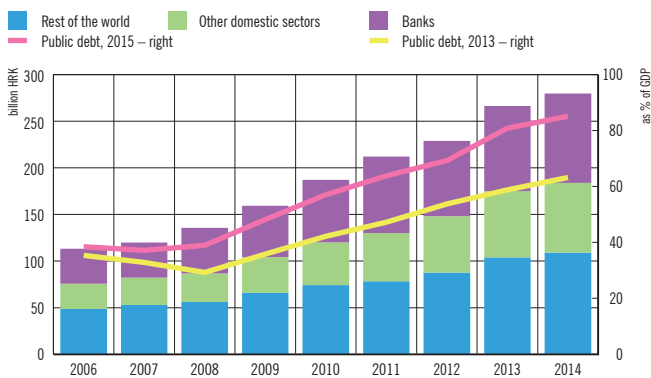
The risk map points to a medium degree of exposure of the domestic economy to systemic risks and its slight increase relative to the previous assessment. This is primarily due to the accumulation of risks in the non-financial sector caused by an increase in domestic vulnerabilities, primarily induced by the strong growth and high level of public debt. In parallel, external vulnerabilities, although stabilised to some extent, have remained elevated, largely due to the high share of external debt in GDP. Structural vulnerabilities in the financial sector are lower and are for the most part related to the high degrees of euroisation and risk concentration.

The cyclical indicators reflecting the vulnerability of the non-financial corporate sector, households and the government have stabilised, although they remain at increased levels, whereas the conditions in financial markets are currently relatively mild and stable, slightly deteriorating from the previous assessment.

The established framework for perceiving and understanding systemic risks is useful for an analysis of the need for the activation of macroprudential and other policies, assessment of their coordination and efficiency and communication with the public. The model will be continually improved pursuant to progress in the research on systemic risks and the development and calibration of macroprudential instruments that enable a more precise measurement of the degree and evolution of systemic risks in the model.

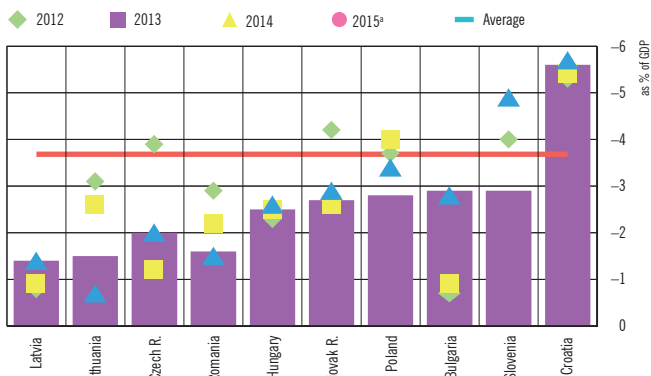
# Government sector

Figure 24 General government debt



Sources: EC, MoF and CNB (projections).

Figure 25 General government deficit

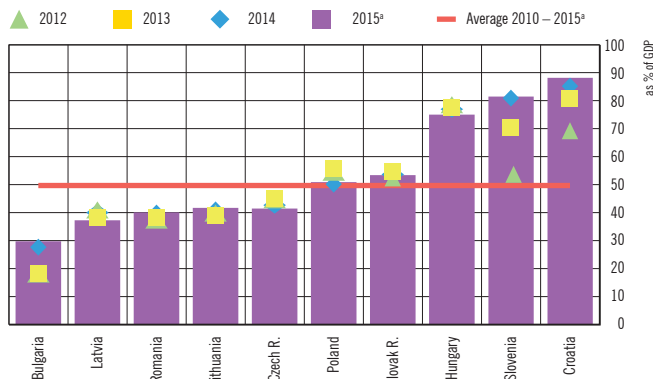


\* EC projections.  
Source: EC.

The public debt to GDP ratio is expected to reach 88% by the end of 2015, partly as a result of a change in the statistical coverage and partly of the growing general government deficit and lack of capital inflows to the budget. The need for financing, which has remained substantial for the second consecutive year, amounts to about 20% of GDP. Croatia has the highest fiscal imbalances in the peer group of countries. In view of the current conditions, Croatia will for some time remain subject to the excessive deficit procedure because of the slow pace of the deficit reduction. The implementation of structural fiscal adjustment measures has enabled Croatia to avoid sanctions for not meeting the deficit reduction target.

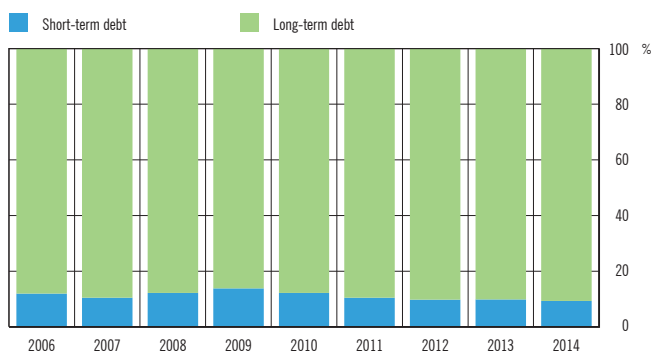
Croatia's public debt level ranks first on the comparable scale of public debt, considerably exceeding the average debt levels of peer countries. Public debt increased significantly to over 85% of GDP in late 2014 due to the application of the European sector classification of the Croatian economy, in which government clearly has too big a share. Immediately before accession to the EU (in the first half of 2013) the share of public debt in GDP was approximately 22% lower than in the first half of 2015 (Figure 24). The change in the sectoral coverage resulted from the application of a new statistical methodology, which classifies into the government sector a number of institutions that were classified elsewhere two years ago, including the CM, CBRD, CR Infrastructure and CRT. The high public debt level relative to peer economies has coincided with the lack of economic growth and reflects the government's limited ability to

Figure 26 Public debt



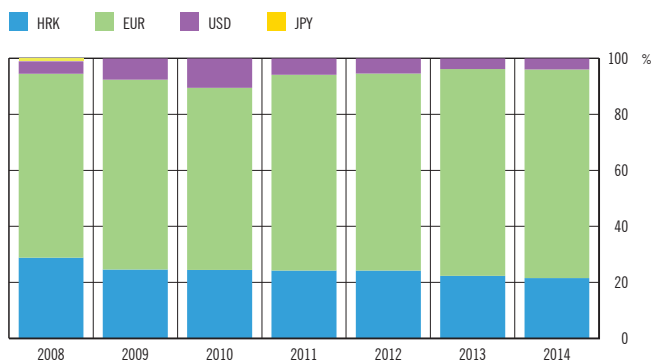
\* EC projections.  
Source: EC.

Figure 27 Maturity breakdown of public debt



Source: CNB.

Figure 28 Currency breakdown of public debt



Source: CNB.

Table 4 Thresholds of the fiscal sustainability risk indicator in 2015<sup>a</sup>

Indicator	Direction to be safe	Threshold	Observation for Croatia	Change
$r - g^b$ (2015)	<	1.1%	4.3%	↓
General government public debt (as % of GDP) (2014)	<	42.8%	85.1%	↑
Cyclically adjusted primary balance (as % of potential GDP) (2014)	>	-0.5%	-0.6%	↓
Gross financing needs (as % of GDP) (2015)	<	20.6%	19.4%	↓
Share of short-term debt as a ratio of total debt (2014)	<	44.0%	9.3%	↑
Debt denominated in foreign currencies (2014)	<	40.3%	78.5%	↓
Weighted average maturity of public debt (years) (2014)	>	2.3	4.8	↓
Short-term external public debt (as % of international reserves) (2015)	<	61.8%	11.1%	↑

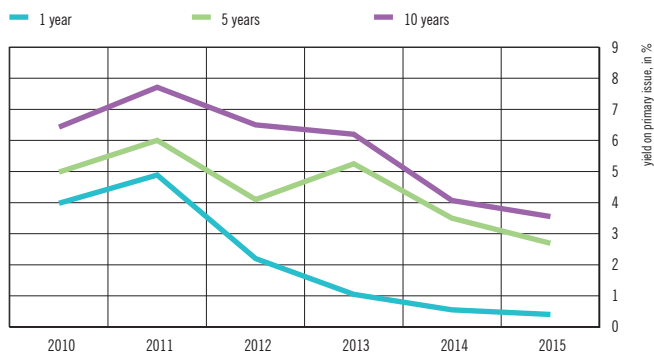
<sup>a</sup> Baldacci, E., I. Petrova, N. Belhocine, G. Dobrescu, and S. Mazraani: *Assessing Fiscal Stress*, IMF Working Paper, WP/11/100.

<sup>b</sup> Imputed interest rate on general government debt, deflated by the GDP deflator (5-year average), minus real GDP growth rate (5-year average).  
Sources: IMF WP/11/100 and CNB.

solve the issue of the gap between fiscal revenues and expenditures. The general government deficit level, ranging between 5% and 6% of GDP, displays downward rigidity, which is not the case in any of the peer countries (Figure 25). This generates an increase in debt repayment costs and interest amount paid from the budget. In 2015, Croatia ranked first among peer economies (Figure 35) as regards the share of general government interest expenses in GDP. Croatia is also the only country in this peer group with an increase in the share of interest expenses, resulting from a growth in nominal expenditures and the stagnation of nominal GDP. Due to the growing debt, interest expenses rose by over 100% between the pre-recession year 2007 and 2014. Such a situation limits policy makers' efforts to stimulate economic growth or respond to potential external shocks.

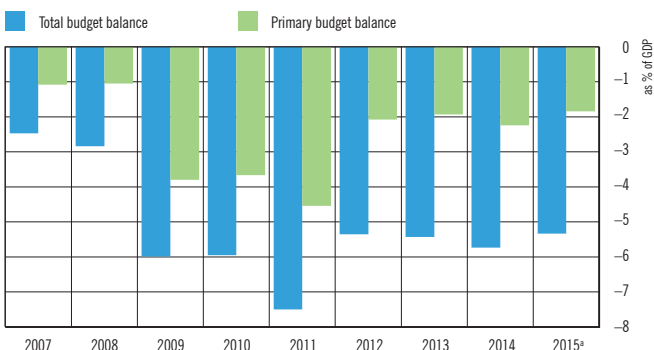
The public debt structure has the same advantages and weaknesses. The maturity structure of public debt is unquestionably a considerable advantage under the conditions of its fast growth. Short-term debt accounts for less than 10% of the total, while the safe level is below 44%. The most significant weakness of public debt is its currency structure, given that 78.5% of public debt is denominated in foreign currency, the safe area being below 40.3% (Table 4). The sustainability of public debt depends to a large degree on the exchange rate risk as the share of foreign currencies (mainly the euro and US dollar) in public debt is 78.5%. However, one should bear in mind that a large portion of the euro-denominated debt is financed through domestic financial institutions due to the high level of

Figure 29 Yield on primary issue of euro and euro-indexed securities



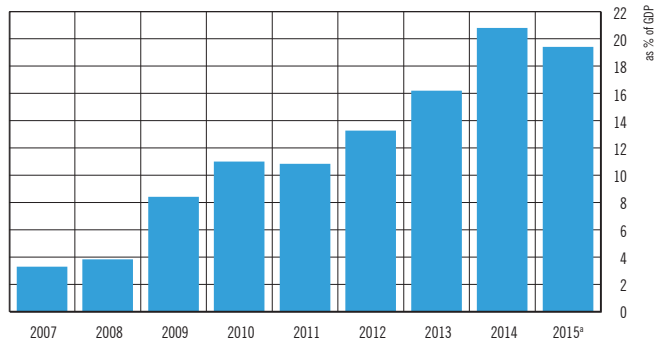
Source: Bloomberg.

Figure 30 General government deficit



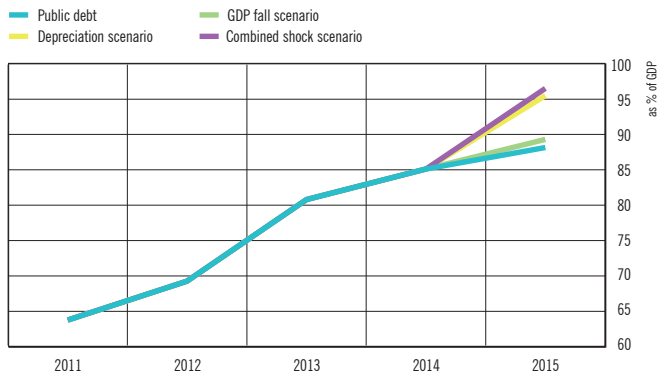
\* EC projections.  
Source: CNB.

Figure 31 Financing needs



\* EC projections  
Note: Amounts are stated including T-bills.  
Source: CNB.

Figure 32 Projection of public debt under various scenarios



Sources: EC and CNB.

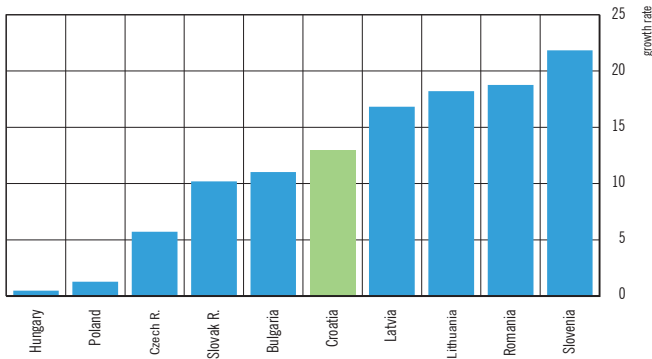
euroisation in Croatia. A factor that alleviates the exchange rate risk in public debt is the long-term exchange rate stability maintained by the central bank.

Favourable borrowing conditions in international financial markets enable the government to borrow at interest rates that are very low, but still higher than those of peer countries. The interest rate on the last international ten-year bond issue went down to 3%, while, for example, in Slovakia the interest rate on a twelve-year bond issue comes to only 0.46%. This is a consequence of the non-investment grade credit rating and a high CDS spread (June 2015) of 267 basis points, compared with 48 basis points CDS spread for Slovakia. Additional concern is raised by the fact that the implicit interest rate net of GDP growth rate has remained at a high 4.4% (Table 4). Consequently, a “snowball effect” is created, which means that the public debt level automatically changes due to the difference between the interest rate and the economic growth rate so that a high initial level of public debt and a large difference between the interest rate and the economic growth rate create a stronger “snowball effect”. Borrowing at relatively “low” interest rates with a considerably lower economic growth will therefore produce new additional “snowball effects”, even in a situation of a potential primary general government surplus.

The need for financing the budget deficit and maturing public debt is very high. The needs for financing amount to 19.5% of GDP in 2015, the benchmark ceiling being 20.6% of GDP. This is the second consecutive year that the need to finance the budget deficit and public debt is at such a high level. The amount allocated to public debt refinancing includes short-term treasury bills (about 7.3% of GDP). High borrowing requirements are not a problem under conditions of strong international and domestic liquidity, but the high public debt level calls for extreme caution on the part of economic policy makers.

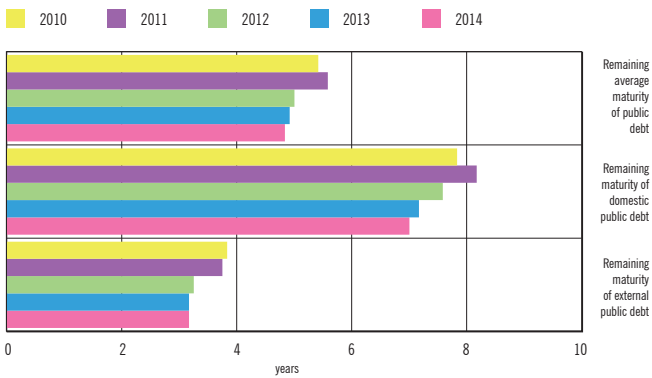
The remaining maturity of public debt has been slowly decreasing. The remaining public debt maturity in 2014 was 4.83 years, which is a decrease from the previous years (Figure 34),

Figure 33 Public debt growth rate (2009 – 2015)



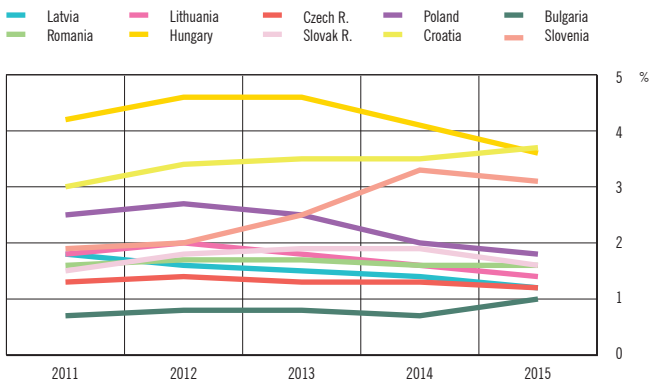
Sources: EC and CNB.

Figure 34 Average remaining maturity of general government debt



Source: CNB.

Figure 35 General government interest expenses



Source: EC.

but it still considerably exceeds the benchmark level of 2.3 years (Table 4).

Croatia has been under the excessive deficit procedure since January 2014, which creates an institutional framework for fiscal consolidation in the short-term period. Due to long-standing fiscal imbalances, Croatia entered the mentioned procedure, which requires that the general government deficit be reduced to below 3% of GDP by 2016. The European Commission recommended Croatia to reduce the deficit by structural measures amounting annually to 2.3%, 1% and 1% of GDP in the 2014 to 2016 period. However, notwithstanding the implemented measures, the general government deficit has increased to 5.7% of GDP on account of the weaker than expected economic growth and the assumption of the debt of government enterprises. As with public debt, the general government deficit was also affected by the change in statistical methodology and the new sectorisation. It needs emphasising that while the inclusion of the CBRD in the budget has reduced the general government deficit, it has also significantly boosted public debt.

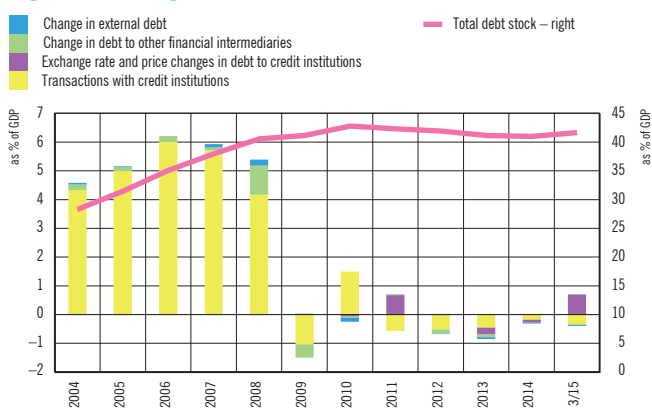
Fiscal developments in 2014 suggest that Croatia will need more than three years to exit the excessive deficit procedure. The listed factors, including the low economic growth rate, the assumption of activated guarantees and the introduction of new statistical rules, are excluded from the assessment of fiscal effort, so that no sanctions will be imposed on Croatia for failing to meet the fiscal target related to the reduction of the general government deficit. The European Commission has assessed that, notwithstanding poor macroeconomic results, the Government did implement structural measures for the Commission's recommendations to be accepted.

Sensitivity analysis shows that a combined stress scenario involving a sharp decrease in GDP and the depreciation of the kuna could boost public debt to 96.5% of GDP. In a stress scenario involving a 0.5% decrease in GDP, public debt would rise to 89.3% of GDP relative to the baseline scenario. In the event of a one-time depreciation of 10%, public debt would increase to 95.5% of GDP instead of to 88.2% as foreseen in the baseline scenario. Under a combined stress scenario involving a drop of 0.5% in GDP and a one-time depreciation of the kuna of 10%, public debt would increase to 96.5% of GDP.



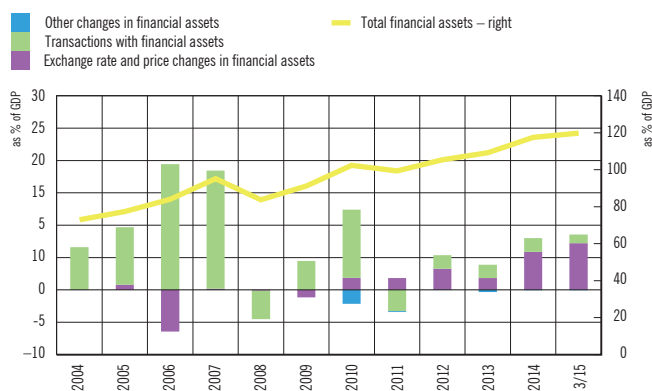
# Household sector<sup>1</sup>

Figure 36 Change in and stock of household debt



Source: HANFA and CNB.

Figure 37 Change in and stock of household financial assets



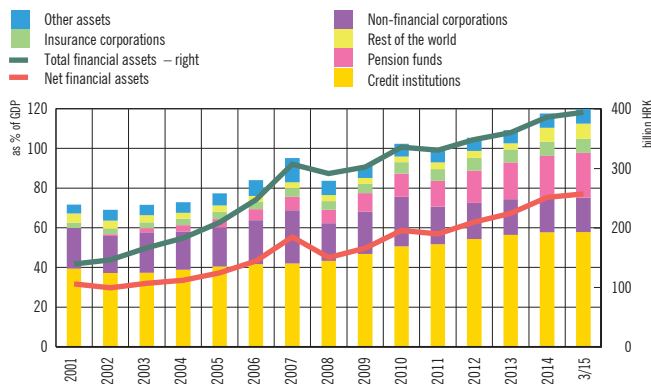
Sources: HANFA and CNB.

The sharp appreciation of the Swiss franc increased the household sector debt in the first quarter of 2015. However, the fixing of the CHF/HRK exchange rate at the level it had stood prior to the impact neutralised the short-term effects on the debt repayment burden of some households, transferring the entire burden to the banking sector. Although this event had no significant impact on systemic risk, the approaches to its resolution may have, which is why caution is needed. The expected further stagnation of employment and the continuously high exposure to exchange rate and interest rate risks remain a threat, which may, in the event of a more severe shock, make debt repayment difficult for some households. Still, the projected cessation of negative trends in the economy and the labour market may slow down the further deterioration of quality of household placements.

The household sector debt mostly stagnated in late 2014 and early 2015 (Figure 36). The weakening of the kuna against the Swiss franc led to a mild nominal growth in household debt, causing total year-on-year household debt to increase slightly (by 0.7%) by the end of the first quarter of 2015. However,

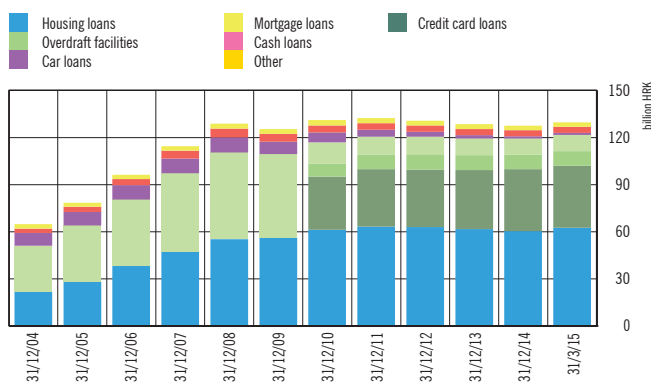
<sup>1</sup> The data published in this issue have been harmonised with the official financial accounts statistics. As all series have been revised backwards, the data may differ from those published in previous issues.

Figure 38 Household financial assets



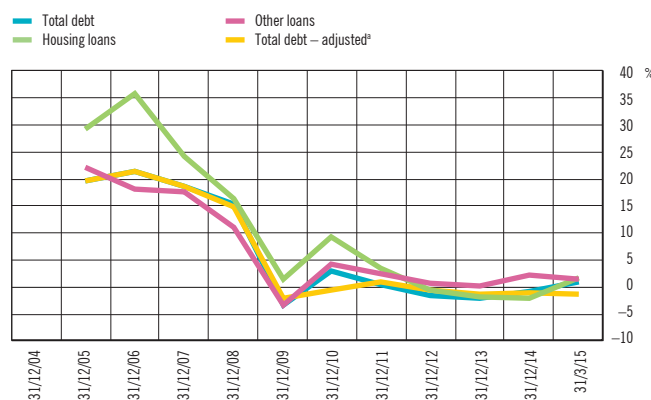
Source: HANFA and CNB.

Figure 39 Household loans by purpose



Note: Cash loans and overdraft facilities have been excluded from the category other household loans since the end 2010 due to the fact that they have become new categories.  
Source: CNB.

Figure 40 Annual rate of change in debt and loans



\* Denotes total debt growth rate adjusted by exchange rate and price changes.  
Source: CNB.

household debt adjusted by exchange rate and price changes continued to drop, shrinking by 1.4% on a yearly basis by the end of the first quarter (Figure 40). The deleveraging process therefore continued effectively in the household sector. As credit institutions participate in total household sector debt with a share of slightly below 95%, the bulk of debt changes in the observed period, as expected, involved transactions (−0.3% of GDP) and exchange rate, price and other changes in debt (0.7% of GDP) to credit institutions, while the exposure of households to other financial intermediaries remained virtually unchanged.

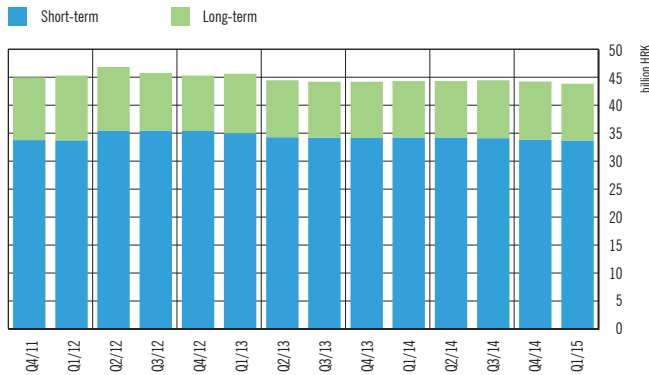
By the end of March 2015, financial assets of households grew further (Figure 38), up by 7.7% on an annual basis. Household assets in pension funds<sup>2</sup>, which have been growing constantly since 2004, increased as usual, reaching around 23% of GDP by the end of March. Assets held by households with credit institutions continued to dominate the structure (standing at slightly above 57% of GDP at end-March). However, the greatest contribution to the change primarily came from the revaluation on a price basis deriving from an acquisition made by a domestic corporation abroad, rather than by the effective growth in assets (Figure 37). The aforementioned increase in financial assets consequently affected net financial assets, which increased by around 4% in the observed half of the year, despite being partly slowed down by the nominal increase of debt in the same period.

The rise in nominal and real net wages (of 2.2% from September 2014) and eased credit standards of banks (Figure 43) at the end of 2014 and the beginning of 2015 failed to provide a strong enough incentive to increase demand for new household loans, as the risk of unemployment, although somewhat lower, remained at a relatively high level (Figure 44) in the same period. According to the seasonally adjusted data, total newly-granted loans decreased by 0.9% from September 2014 at the end of the first quarter of 2015 as a result of a drop both in short-term and long-term newly-granted loans (Figure 41). On the other hand, even though total new long-term loans declined, the observed half of the year witnessed an increase in new housing loans (Figure 42), partly as a consequence of the considerable easing of credit standards in that loan category at the end of 2014 (Figure 43).

Furthermore, the specific regulatory circumstances to which certain households have recently been exposed, notably those relating to the legalisation of illegally built residential facilities and the grants for the energy renovation of residential property, also stimulated the demand for housing loans. However, these circumstances did not suffice to compensate for the weak demand for flats, as evident from the high illiquidity on the real estate market (see Box 3 Preliminary research of residential real estate market liquidity as a determinant of price dynamics).

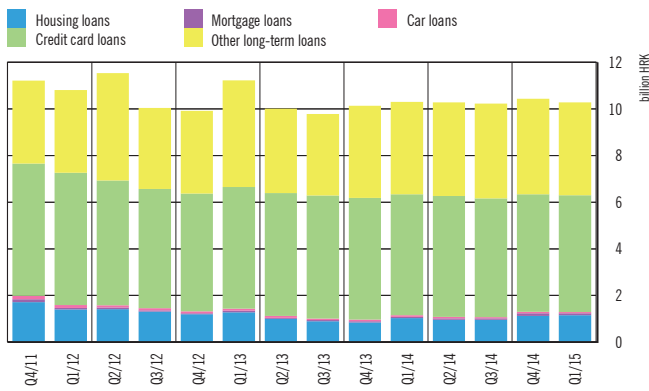
<sup>2</sup> This involves pension contributions, i.e. allocated funds held by autonomous and non-autonomous pension funds established by employers and/or employees or groups of self-employed persons to provide income to the employed and self-employed following retirement.

Figure 41 Maturity breakdown of newly-granted household loans, adjusted by seasonal fluctuations



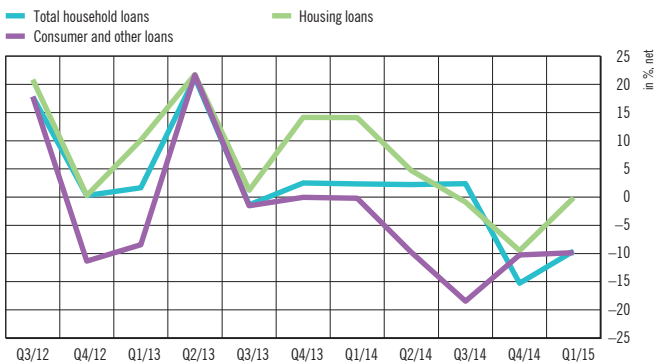
Source: CNB.

Figure 42 Newly-granted long-term household loans by purpose, adjusted by seasonal fluctuations



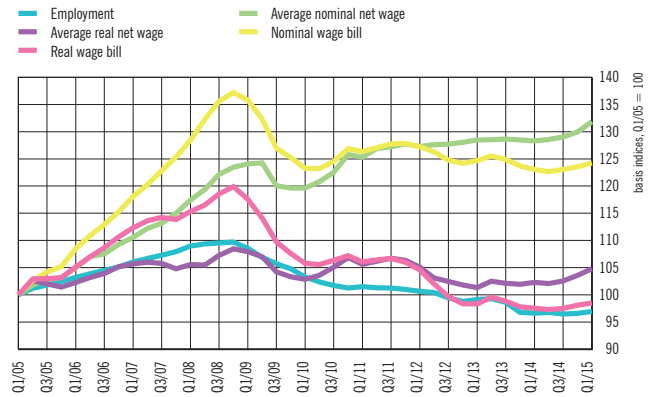
Source: CNB.

Figure 43 Change in household lending criteria in the last three months



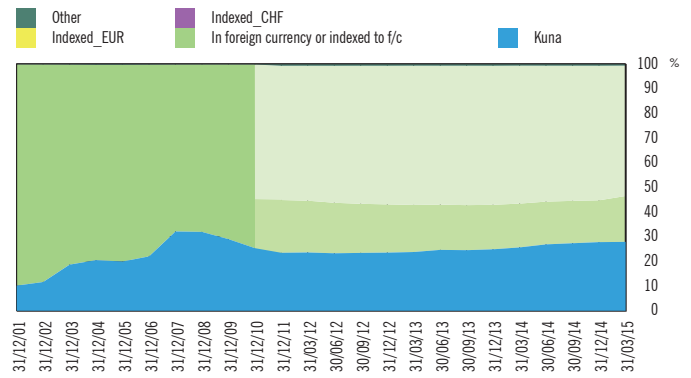
Note: Positive and negative values denote the tightening and easing of credit standards, respectively.  
Source: CNB.

Figure 44 Employment and wages (seasonally adjusted)



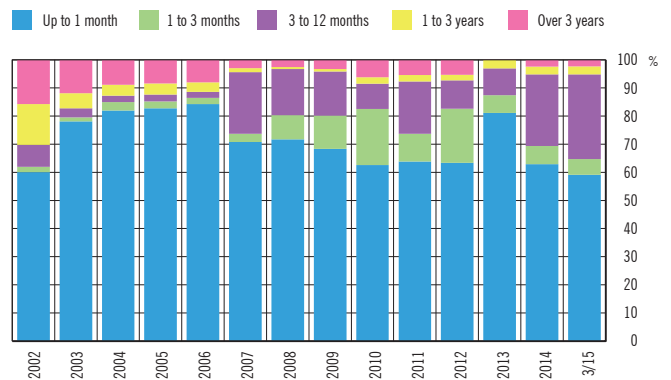
Source: CBS and CPII.

Figure 45 Currency breakdown of household loans



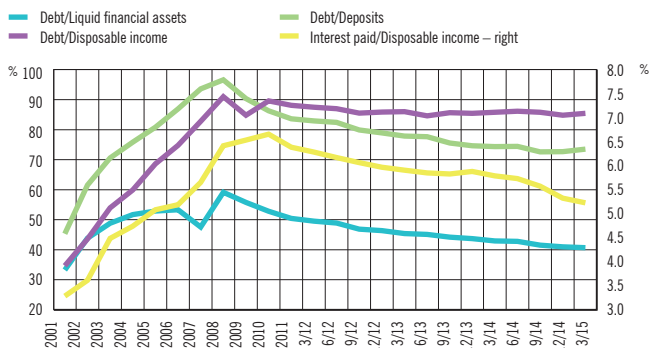
Note: Since the end of 2010, the category Denominated in or indexed to foreign currency has been divided into two subcategories: loans indexed to the euro and loans indexed to the Swiss franc.  
Source: CNB.

Figure 46 Household loans by interest rate variability



Source: CNB.

Figure 47 Household debt and debt burden



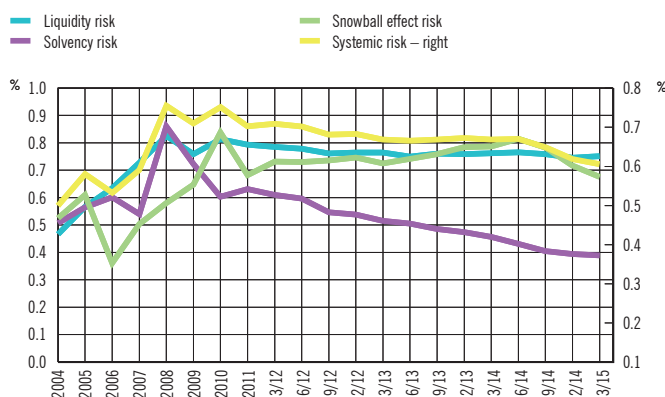
Source: HANFA and CNB.

The total balance of housing loans at the end of 2014 and the beginning of 2015 thus effectively decreased (sliding by 0.5% from September 2014<sup>3</sup> at end-March). In addition to the slight increase in credit card loans, the period under review also saw an effective rise in the balance of cash loans<sup>4</sup> (Figure 39), whose share in the total structure of household loans has been constantly increasing since the end of 2010 (at end-March 2015 it stood slightly above 50%). The growth is a result of the continued easing of banks' credit standards for consumer and other loans since the second half of 2013 (Figure 43) and the changed preferences of consumers.

The structure of loans granted to households according to currency and interest rate variability remained mostly the same, with persisting risks of exchange rate and interest rate change (Figures 45 and 46). At the end of January 2015, currency risk was at the centre of attention due to the abandoning of the Swiss franc-euro cap by the Swiss National Bank. The potential effects of such a decision by the Swiss National Bank on the household sector were neutralised by the amendments to the Consumer Credit Act, whereby the Swiss franc exchange rate was fixed at HRK 6.39 for a period of one year, the entire burden thus being transferred to the banking sector. Nevertheless, the exposure of households to currency risk remains high despite its gradual decline, as more than 72% of loans were indexed to a foreign currency at the end of March 2015. Since the share of loans with interest rates variable within a period of one year is still exceptionally high (hovering around 95%), some households may experience difficulties in the regular settlement of their credit obligations due to the possibility of a sudden in-

<sup>3</sup> Housing loans grew (by 3.6%) in nominal terms in the first quarter of 2015 driven by the strong depreciation of the kuna against the Swiss franc, considering that at the end of 2014, around one third of housing loans were indexed to that currency.

<sup>4</sup> The annual rate of change of household cash loans, which include collateralised and non-collateralised general-purpose cash loans, stood at 4.1% at the end of March, or 4.3% if exchange rate changes are excluded.

Figure 48 Indicators of vulnerability in the household sector<sup>a</sup>

<sup>a</sup>Household sector vulnerability is measured by the household systemic risk, i.e. by the average of liquidity risk (LR), solvency risk (SR) and "snowball effect" risk (SNR) which are defined as follows:

$$LR_t = 0.5 \cdot \frac{\text{Debt}_t}{\text{Disposable income}_t} + 0.5 \cdot \frac{\text{Interest payments}_t}{\text{Disposable income}_t}$$

$$SR_t = \frac{\text{Debt}_t}{\text{Net financial assets}_t}$$

$$SNR_t = \frac{\text{Interest payments}_t}{\text{Debt}_t + \text{Debt}_{t-1} + \text{Debt}_{t-2} + \text{Debt}_{t-3}} \cdot \left( \frac{\text{Interest payments}_t}{\text{Disposable income}_t} - 1 \right)$$

Sources: HANFA and CNB.

crease in interest rates and the consequent rise in annuities (see Box 2 Interest rate risk in the Republic of Croatia).

The increase of nominal debt in the first quarter of 2015 caused the majority of indicators of household debt to deteriorate slightly (Figure 47). As a result, the ratio of debt to deposits and disposable income grew slightly in spite of an increase in the aforementioned financial categories<sup>5</sup>. At the same time, the indicator of the debt servicing burden improved owing to a decrease in interest payments (in the last quarter of 2014, payments were reduced by 3.7%, and by the end of March 2015, they shrank by an additional 1%).

Against the backdrop of declining interest payments and a slight increase in disposable income, the snowball effect risk, measured by the difference between the implicit interest rate on debt (defined as the share of interest paid in average debt) and the annual rate of change in disposable income, has begun to decline for the first time since the onset of the crisis, during which the snowball effect risk and solvency exhibited divergent trends, leading to a positive contribution to the total systemic vulnerability of households (Figure 48). At the same time, the liquidity risk, measured by the ratio of average debt and interest paid to disposable income, and the solvency risk, in which debt is expressed as a part of net financial assets, underwent no significant change from the third quarter of 2014.

<sup>5</sup> Estimated disposable income of households does not include some forms of income generated in the official economy (e.g. royalties, temporary service contracts and income from capital) or income from the unofficial (or grey) economy.

The expected gradual recovery of the Croatian economy in the rest of 2015 is not likely to have a significant short-term effect on the labour market. Therefore, the aforementioned vulnerabilities will probably keep personal consumption at a low level, limit the demand for new loans and hamper the regular loan repayments of certain households. On the other hand, the aforementioned legalisation procedures and the current possibilities of improving the energy efficiency of existing residential facilities are likely to stimulate the demand of some households

for housing loans in the upcoming period. The growth in kuna loans noticeable in the previous four years may continue, considering the changed preferences of households in the previous years and the increased caution following the recent depreciation of the kuna against the Swiss franc. However, bearing in mind the general economic environment, the tendency of household deleveraging is expected to continue in the forthcoming period.

## Box 2 Interest rate risk in the Republic of Croatia

The regulation of loan interest rate variability began with the Consumer Credit Act adopted in 2009, while the amendments to the Act adopted in 2013 (Article 11 Information concerning the interest rate) additionally increased the transparency of the determination of interest rates, which have, since then, consisted of a reference rate and a fixed part. However, as the Act was adopted during the period of low reference rates, interest rates on household loans mostly consist of a fixed part. Consequently, any increase in current reference interest rates from their exceptionally low levels or a deterioration of the risk perception for Croatia could lead to a sharp increase in lending interest rates and a materialisation of interest rate risk for clients. In addition, the increase of the loan servicing burden gives rise in turn to the materialisation of credit risk for banks. To illustrate, a rise of two percentage points in interest rates on loans would trigger an increase of 0.3 percentage points in the share of non-performing loans in housing loans and 3.2 percentage points in consumer loans.<sup>1</sup>

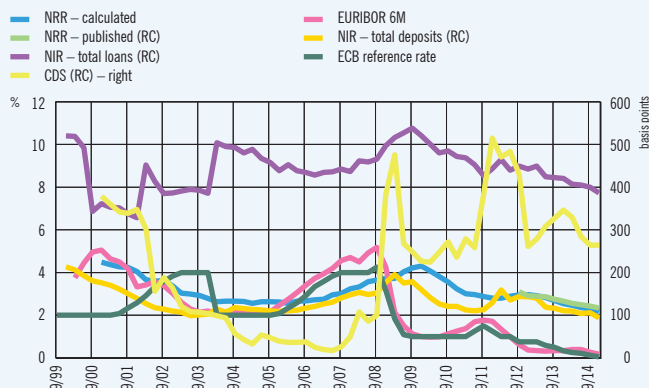
Given the currently low interest rates, which are not expected to grow substantially in the short-term period, and the relatively favourable price of instruments for hedging against interest rate risk, current circumstances are favourable for taking measures to hedge against interest rate risk. All reference interest rates set by the Consumer Credit Act as the basis for the calculation of variable interest rates (primarily the national reference rate and EURIBOR) have potential advantages and disadvantages both for the debtors and for the banks. Although the simplest way to reduce interest rate risk for clients is to use loans with a fixed interest rate, such loans are usually initially more expensive and do not offer the positive effects of a possible decrease in the interest rate.

### Interest rates on the international market and in Croatia

Since the onset of the global financial crisis, reference interest rates of central banks and market interest rates have stood at their lowest levels to date. However, even though current market expectations do not suggest that the following one-year period is likely to witness their significant rise, future levels will depend on the trends in economic and monetary indicators, i.e. on the level of interest rates of central banks, which may lead to changes in reference and market interest rates in the long term. Over a longer period of time, reference interest rates of central banks exhibit significant oscillations, and as the trends in market interest rates are usually influenced by them, interest rates in Croatia are likely to oscillate as well (Figure 1).

Until the escalation of the financial crisis in late 2008, lending interest rates in Croatia had displayed a downward trend, reflecting a relatively low risk premium, but also a relatively large share of housing loans (which have a lower interest rate) in newly-granted loans. Following the outbreak of the financial crisis, interest rates jumped, primarily as a result of an increase in the risk premium, which, in addition to exceptionally low reference rates, became the main determinant of interest rates in Croatia after 2009. An analysis of the average cost of second-

Figure 1 Trends in selected rates



Sources: Bloomberg and CNB.

ary sources of banks, later included in the regulatory framework as the “national reference rate” (NRR), shows that the trends in banks’ lending interest rates primarily follow the developments in deposit interest rate expenses (Figure 1).

In the period until 2013, banks in Croatia applied administered interest rates, meaning that banks were allowed to change interest rates on existing loans depending on internal procedures. When the Consumer Credit Act was adopted in 2013, administered interest rates were replaced by variable interest rates, which the banks had to link to one of the following interest rates: the NRR, EURIBOR, deposit rate or yield on MoF T-bills. On the other hand, the share of loans with a fixed interest rate, which do not expose clients to interest rate risk, was negligible until 2013, when it began to increase gradually. The change is attributable to an increase in the preference for such loans brought about by the materialisation of interest rate risk during the crisis. After 2014, the proportion of such loans increased due to the fixing of the interest rate on loans indexed to the Swiss franc at 3.23% (Figure 2).

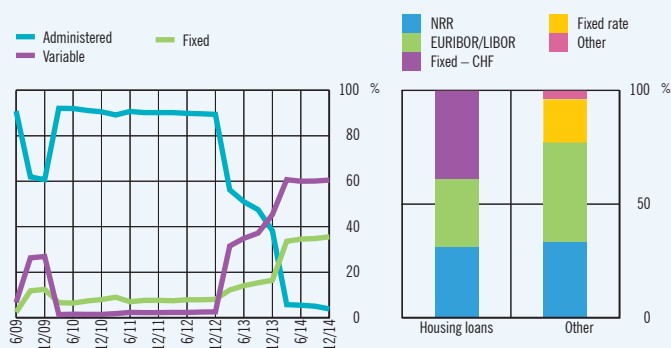
### Comparison of NRR and EURIBOR as reference rates

Using the methodology for the calculation of the NRR<sup>2</sup>, it is also possible to simulate its future developments in the event of nominal deposit interest rate growth and compare it with a simulated increase of the EURIBOR. Such an approximation demonstrates that the NRR as a reference rate reacts to EURIBOR changes with a certain lag for several reasons. First, the NRR is calculated on the basis of previous data (e.g. its level in the May-August period is calculated according to the data from the first quarter). Furthermore, it is calculated on the basis of banks’ funding costs which, in turn, depend on the average balance of liabilities and their average price. On the other hand, the EURIBOR would reflect an overall increase in interest rates within a much shorter period of time. Although the Consumer Credit Act does not expressly stipulate the term within which banks have to adjust their interest rates to a EURIBOR increase, banks usually adjust their lending interest rates to reference rates within a period of six months. Consequently, due to a

<sup>1</sup> The estimate is based on satellite models for household credit risk.

<sup>2</sup> The methodology of NRR calculation is available at: [http://www.hub.hr/sites/default/files/2015\\_metodologija\\_nrs.pdf](http://www.hub.hr/sites/default/files/2015_metodologija_nrs.pdf) (in Croatian)

Figure 2 Structure of household loans according to interest rate variability (left) and reference rates at end-February 2015 (right)



Sources: CNB and bank websites.

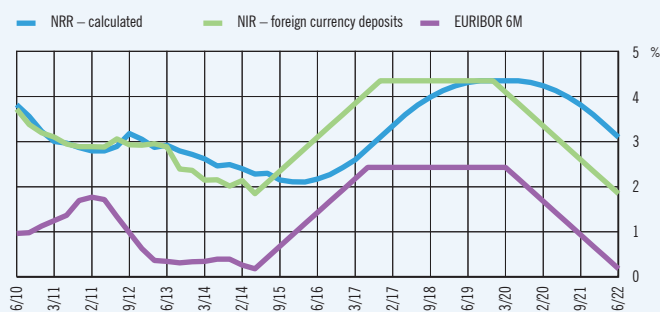
slower spillover of nominal deposit interest rates on the NRR relative to EURIBOR, lending interest rates on loans with the NRR as the reference rate would increase at a slower pace. In this way, in the event of an interest rate increase, households' loan servicing burden would spill over to loans linked to the NRR more slowly (with a lag of several quarters on average) than to those linked to the EURIBOR (Figure 3).

Slow reaction in the context of interest rate increase, irrespective of the reference rate, may also result from the rules on the maximum allowed level of interest rates in line with the Consumer Credit Act. As the Act defines the maximum nominal interest rates on household loans as a function of the average weighted rate on loans of all banks, it is evident that the distribution of interest rates among banks may affect their ability to raise the interest rate.<sup>3</sup> In this way, banks with higher average interest rates have less room to raise lending rates, which may cause a temporary substantial decline in their interest margins. However, if interest rates rise, the averages defining maximum interest rates will also grow gradually, making the distribution effect only temporary. Therefore, in the event of significant interest rate growth, the restrictions would not affect all clients equally; the manner of adjustment would rather depend on the client's position in the distribution of interest rate level, making the interest rate increase at a slightly slower pace for clients of banks that are closer to the legally allowed interest rate maximum.

Regardless of the advantages of the NRR, such as its seemingly greater stability and predictability, there are circumstances in which its application could cause difficulties in terms of interest rate risk. Its stabilisation role primarily derives from the fact that newly-received bank deposits account for a relatively small share in the banks' total liabilities, which is why nominal interest rates increase with a time lag. However, a substantial deposit rate increase may result in an early withdrawal of existing deposits with a view to achieving a higher interest rate. In this case, the spillover of nominal deposit rates to a higher NRR, and, subsequently, to interest rates on loans linked to the NRR, will be much faster.

3 For instance, the interest rate must not exceed the average interest rate by one third for housing loans, or by one half in the case of consumer loans.

Figure 3 Trends in reference interest rates according to the trends in the overall level of deposit rates



Note: The imagined interest rate growth of 0.25 percentage points has a quarterly duration of 8 quarters from the beginning of 2015, followed by a stagnation in interest rates of one year, and finally, a fall of 0.25 percentage points. Source: CNB.

Finally, it is necessary to mention another difference between the NRR and EURIBOR reference interest rates considering the specific circumstances of the adoption of new regulations which stipulate the distinction between the fixed and the variable part of the interest rate. At the beginning of 2015, average euro housing loans linked to the NRR had a variable part of around 2.2 percentage points and a fixed part of around 3.5 percentage points. On the other hand, the variable and the fixed

Table 1 Advantages and disadvantages of the NRR and EURIBOR from the perspective of clients and banks

CLIENTS' POSITION	
NRR	EURIBOR
<b>ADVANTAGES</b>	
Increases more slowly in case of overall deposit rate increase	Decreases faster in case of overall deposit rate decrease
Increase in lending rates followed by an increase in deposit rates	Unaffected by the risk premium for Croatia
<b>DISADVANTAGES</b>	
Decreases more slowly in the case of an overall deposit rate decrease	Increases faster in the case of an overall deposit rate increase
	Locks the currently high risk premium
<b>BANKS' POSITION</b>	
<b>ADVANTAGES</b>	
Decreases more slowly in the case of an interest rate decrease	Increases faster in the case of an interest rate increase
Reflects the banks' funding costs	Offers hedging options
Implicitly reflects the country's risk premium	
<b>DISADVANTAGES</b>	
Increases more slowly in the case of an interest rate increase	Decreases faster in the case of an interest rate decrease
Cannot easily be fixed	Does not reflect the cost of total bank liabilities
Aggregate indicators used in its calculation may not be favourable for some banks	

Source: CNB.

interest rate part of euro housing loans linked to the EURIBOR hovered around 0.2 percentage points and 5.5 percentage points respectively. Therefore, euro housing loans linked to the EURIBOR have an interest rate almost entirely made of the fixed part. Banks may influence the fixed part through their internal procedures, but are not required to do so under the Act. In that way, should the risk premium for Croatia fall, the NRR would gradually decrease as a result of lower borrowing costs of banks. However, as the EURIBOR would remain the same, the banks could, but would not have to, lower the borrowing costs for their clients by reducing their margins. Since the Consumer Credit Act prohibits the increase of margins once they have been lowered, banks would hesitate to lower them even in favourable market conditions.

#### Exposure of banks and clients to interest rate risk in Croatia

Even though regulatory changes increased the transparency of interest rate structure from the clients' perspective, interest rates are still influenced by the banks' decisions, particularly in the case of loans linked to the EURIBOR, where the interest rate consists almost entirely of a fixed part, influenced solely by the bank. In the case of loans linked to the NRR, interest rate structure is less administered, as the fixed and the variable part of the interest rate are more evenly distributed. Therefore, from the clients' point of view, the most significant measure to reduce interest rate risk was imposed by the amendments to the Consumer Credit Act in 2014, when the interest rate on loans indexed to the Swiss franc was fixed at 3.23%. The aim behind the measure was to mitigate clients' positions following the materialisation of currency risk.

From the banks' point of view, interest rate risk is manifested both directly and indirectly, i.e. through potential losses the banks may suffer due to interest rate risk in their balance sheets, or through the credit risk they are exposed to on account of their clients' interest rate risk. The Decision on the management of interest rate risk stipulates that banks have to regularly assess the direct interest rate risk in the non-trading book based on the assumed increase in interest rates of 2 percentage points for all maturities. At the end of 2014, the loss which the banks would suffer in the event of such a shock stood around 3.5% of total own funds (Figure 4). However, the actual interest rate risk faced by the banks is in fact larger because the aforementioned method of interest rate risk calculation assumes that all concluded agreements will remain unchanged, i.e. it is assumed that, in case of a sharp growth in interest rates, all concluded deposit agreements will continue to be fulfilled under the previously arranged lower interest rates, whereas a substantial amount of deposits would be withdrawn and then again placed as fixed-term in order to achieve a higher interest rate. It is important to note that, besides the interest rate risk in the non-trading book, a part of the interest rate risk and the hedge against interest rate risk from the non-trading book are also contained in the trading book covered by capital requirements, rendering the full quantification of interest rate risk impossible for the time being due to that effect as well. The mentioned part of interest rate risk is governed by the CRD IV package and is subject to SREP.

All of the above indicates that the interest rate risk in the system is currently impossible to measure precisely, but the actual effect of a shock caused by a parallel increase in the overall level of interest rates of 2 percentage points would currently most probably exceed the 3% of own funds shown in Figure 4. In addition, interest rate shock may actually

materialise through the increased steepening of the yield curve, which would aggravate the shock for banks in terms of the existing maturities of assets and liabilities. Finally, due to the provisions of the Consumer Credit Act regarding the distribution of lending interest rates on loans, banks would not be able to compensate for the increase in interest rate expenses within such a short period of time.

#### Possible solutions to the issue of interest rate risk in Croatia

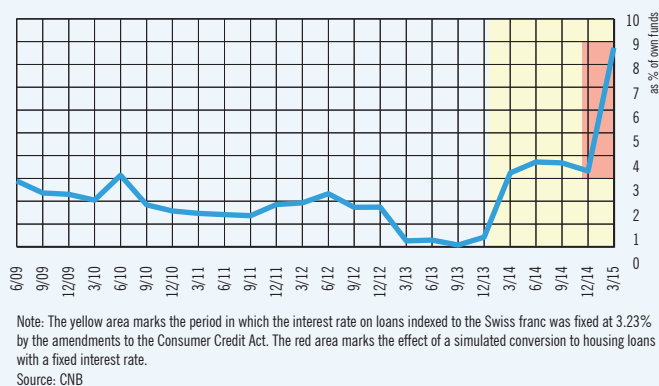
The first step in solving the issue of client interest rate risk management in Croatia should involve defining the loans where intervention would be reasonable. Considering the fact that household consumer loans are usually associated with smaller amounts, shorter maturities and fixed interest rates, emphasis should be placed on housing loans, the monthly repayments of which impose a much greater burden on households (Table 2).<sup>4</sup>

Table 2 Loans according to level of exposure to interest rate risk

Measure	Share in bank assets (%)	Average remaining maturity (years)	Significant exposure to interest rate risk	
			NRR	EURIBOR
Housing loans	8.0	10.3	Yes	Yes
Consumer loans	8.5	3.8	No	No

Source: CNB.

Figure 4 Interest rate risk in the non-trading book



In order to simulate the effects of a possible solution for client credit risk, euro housing loans with a remaining maturity of over a year were taken into consideration, as the annuities for housing loans with a short remaining maturity mostly consist of the principal.<sup>5</sup> In that way, out of a total of HRK 31.6bn of housing loans to loans indexed to the euro, it

<sup>4</sup> EU-u member states predominantly apply variable interest rates, the structure of which greatly depends on the form of government regulation, while direct government intervention, whereby the level of interest rate at which loans are granted is imposed on the banks, is uncommon in the EU.



Table 3 Measures which banks may take to reduce clients' exposure to interest rate risk in Croatia

Measure	Description of measure	Advantage/disadvantage
1. Interest rate fixing	a) Clients pay the full price of hedging against interest rate risk b) Banks and clients share the expenses	The cost of fixing may be fully or partially transferred to clients. The clients are granted a fixed interest rate instead of a variable one in exchange for an increase of interest rate. Fixing may be performed by converting loans to loans with a fixed interest rate or by using interest rate swaps. Clients risk a less favourable position in the event of an interest rate decrease.
2. Proposal of an instrument of hedging against interest rate risk for clients by introducing floors and caps	Clients are provided with a standing option of hedging against interest rate risk through interest rate swaps or defined interest rate floors and caps.	Possible lower price than in the case of interest rate fixing. In exchange for a lower price, clients assume a part of the risk, but also enjoy the benefits in the event of an interest rate decrease. Clients may choose if and when they want to hedge against risk, and the measure helps maintain a certain level of flexibility.
3. Introduction of flexibility in margin management	Banks are allowed to raise and lower margins, but only to the initial margin.	Such a regulatory change would not materially reduce interest rate risk exposure, but it would reduce interest rate variability. Banks may lower the margin and mitigate the clients' position without fear of experiencing losses in the future/The position of clients in some banks may depend on the current "possibilities", i.e. the cost competitiveness of the bank.

Source: CNB.

would be reasonable to take measures with a view to reducing exposure to interest rate risk for around HRK 25.0bn worth of loans. The options for solving the issue of interest rate risk in Croatia are presented in Table 3.

Since the reduction of the interest rate risk of clients leads to an increase in the interest rate risk for banks, banks might react to such an increase either by hedging against the risk on the international market or by retaining it in the non-trading book. The current exposure of banks to interest rate risk in the non-trading book stands around 3% of own funds, but it would grow to around 8% if banks assumed the interest rate risk should the aforementioned HRK 25.0bn worth of euro housing loans be converted to loans with a fixed interest rate (Figure 4), thus causing a major increase in capital requirements. Alternatively, banks could hedge, at a certain cost, by purchasing instruments for hedging against interest rate risk on the financial markets. In that case, the cost

of hedging against interest rate risk would be assumed by clients or jointly by banks and their clients through an annex to the agreement in which interest rates would be fixed.<sup>6</sup> The final resolution of this issue may also require cooperation between the banks themselves due to the fact that larger, foreign-owned banks tend to conclude agreements abroad more easily in order to hedge against market risks.

### Conclusion

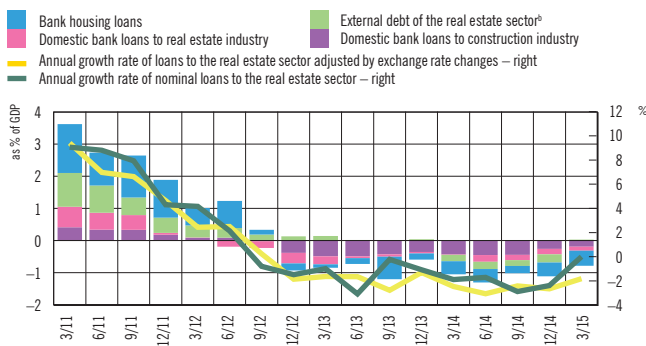
As explained earlier, the currently low interest rates and the formal abolition of administered interest rates failed to result in a significant reduction of interest rate risk in Croatia. Regardless of the measures that might be taken to reduce interest rate risk in Croatia, it is necessary to continue to increase the awareness of the risk and to improve the reporting system and interest rate risk monitoring.

5 In the case of a EUR 100,000 housing loan with a maturity of 20 years, only around HRK 2,000 worth of interest is paid in the last year of repayment.

6 The exposure to interest rate risk in the non-trading book of certain banks is initially already close to 20%. However, as the banks in question do not grant housing loans, conversion would not affect their exposure to interest rate risk.

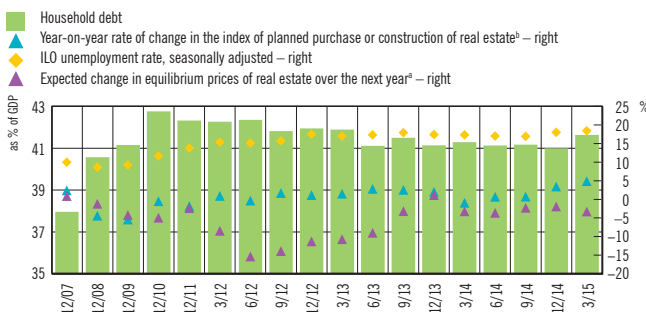
# Real estate<sup>6</sup>

Figure 49 Annual change<sup>a</sup> of the real estate sector debt



<sup>a</sup> Changes in debt adjusted by exchange rate changes.  
<sup>b</sup> External debt includes the debt of real estate and construction industries.  
 Source: CNB calculations.

Figure 50 Household debt, unemployment rate, consumer optimism and real estate market expectations



<sup>a</sup> Refers to the expected annual change in the same period of the next year (+ 12 months) and is estimated based on the equilibrium price model, taking into account CNB projections for the main determinants of demand for residential real estate.  
<sup>b</sup> Index of planning the purchase or construction of real estate was calculated based on consumers' answers to the question on plans regarding the purchase or construction of real estate in the next 12 months from the CNB's consumer confidence survey.  
 Sources: CNB.

The real estate market is still primarily characterised by lower liquidity than in the pre-crisis period, persistent despite considerable price adjustments undertaken in the previous years. The total debt associated with the real estate market continued to decrease effectively at the end of 2014 and the beginning of 2015. Although available data suggest that the financial availability of residential property increased, no sharp changes in demand for real estate and real estate prices are likely in the short term.

In late 2014 and early 2015, the real estate market continued to reflect unfavourable economic developments, failing to show significant signs of recovery. Therefore, the demand for loans remained weak in that sector, and the deleveraging continued. By the end of March 2015, the effective debt (excluding the impact of exchange rate decrease) decreased still further, sliding by 1.8% on a yearly basis, even though its nominal amount held steady (Figure 49). The greatest contribution to the sector's continued deleveraging came from the drop in housing loans adjusted for the exchange rate effect (0.5% of GDP). At the same time, construction and real estate companies recorded a decline in financial liabilities to domestic banks (by an average of 0.3% of GDP and 0.2% of GDP respectively), while their foreign liabilities also decreased slightly (by 0.2% of GDP on average).

Against the background of high unemployment (Figure 50) and high exposure to exchange rate and interest rate change risks,

<sup>6</sup> In this chapter developments in the real estate market are analysed and operations of non-financial corporations in the construction and real estate activities are monitored.

average households were reluctant to assume additional risks by purchasing new housing units. The demand of households thus remained relatively subdued in the observed period, as in the preceding years. Consequently, the period of low liquidity in the real estate market, which began in 2009, continued (see Box 3 Preliminary research into residential real estate market liquidity as a determinant of price dynamics). Until the end of March 2015, prices of housing units in Croatia mainly continued to stagnate on an annual basis. However, prices were lower (by 4%) than in the third quarter of 2014 as a result of a decline in real estate prices on the Adriatic coast (down by 14% from September 2014<sup>7</sup>), while the inland part of Croatia witnessed a slight rise (of 1.4%) in the same period.

As in the previous half-year period, real estate prices on the Adriatic coast proved to be considerably more unstable than those in the inland part of Croatia. This is partly attributable to the greater heterogeneity of housing units, the smaller number of transactions, and the consequent low liquidity of the real estate market in the previous years, which is difficult to adequately include in a hedonic regression<sup>8</sup> (Figure 51).

Indicators of financial availability of residential property are still relatively favourable (Figure 53). Although average housing loan repayments grew faster than the disposable income of households in early 2015, causing their ratio to deteriorate slightly, this indicator of availability nevertheless remained close to the lowest levels recorded to date. However, it is important to note that such aggregate indicators do not take into account the specific features of various households.

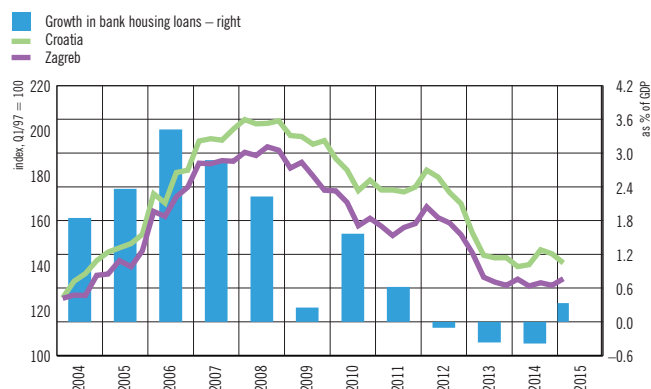
Therefore, as in the previous years, the real estate market remains characterised by low liquidity. The trend is unlikely to reverse considering the still relatively high interest rates on housing loans (Figure 52) in line with the country's risk premium, the possible tightening of the banks' credit standards<sup>9</sup> and the increase of the overall price level. Permanent stabilisation and increased real estate market activity are not achievable without a significant rise in demand, which is currently discouraged by macroeconomic uncertainties. In such circumstances, the financial availability and residential property prices are not likely to see significant changes.

7 The decline in real estate prices on the Adriatic coast is also evident from the market indices of real estate asking prices (Real estate asking price index, *Centar Nekretnina*); however, the price decrease is significantly smaller (5% from September 2014).

8 Details on the calculation of HREPI are available in Kunovac, D. et al.: *Use of the Hedonic Method to Calculate an Index of Real Estate Prices in Croatia*.

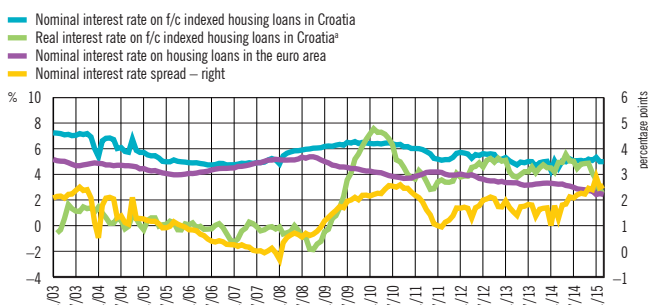
9 The data refer to the question on the change in the credit standards in the following three months included in the Bank Lending Survey which has been conducted by the CNB since October 2012.

Figure 51 Housing loans and HREPI<sup>a</sup> on a quarterly basis



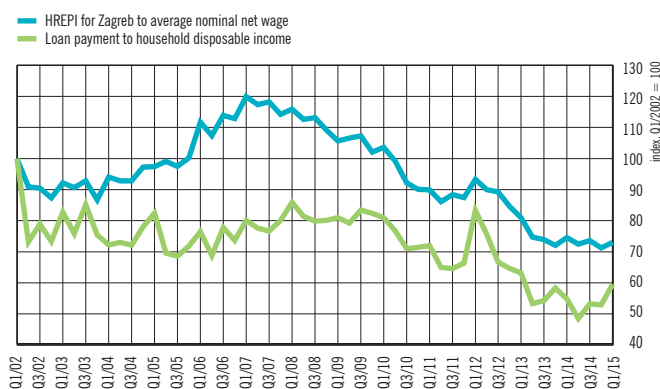
<sup>a</sup> The hedonic real estate price index takes into account qualitative characteristics of the real estate. Source: CNB calculations.

Figure 52 Comparison of interest rates on newly-granted housing loans in Croatia and the euro area



<sup>a</sup> The real interest rate on f/c indexed housing loans was deflated by the change in the average nominal net wage, excluding the effect of the crisis tax, and it is presented as the moving average of three successive time periods. Note: Since December 2011, interest rates have been calculated according to the new methodology (for more details on the new interest rate statistics, see *CNB Bulletin*, No. 204, June 2014). Sources: ECB and CNB.

Figure 53 Financial availability of residential property



Sources: CBS and CNB calculations.

## Box 3 Preliminary research of residential real estate market liquidity as a determinant of price dynamics

The lack of information on residential real estate market liquidity makes it difficult to obtain a fuller picture of the developments in this market capable of contributing to a more reliable interpretation of risks associated with the purchase and sale of residential property and the issues related to the quality of real estate used as collateral. Such information would also help in the calibration of macroprudential instruments, primarily in setting the level of the structural systemic risk buffer<sup>1</sup>, which, among other things, determines the aforementioned risks from the aspect of potential systemic limitations conditioned by specific long-term market features, such as its level of liquidity. In addition, the monitoring of real estate market liquidity or illiquidity opens up new possibilities for the modelling of the expected dynamics of housing unit prices, thus helping in the assessment of the likelihood of disturbances caused by the misallocation of resources, which may, for example, result in price bubble risk in segmented markets.

### Construction of indicators and necessary bias corrections

Real estate market liquidity may be defined as a trading process which takes place rapidly and without disturbance, as reflected in the average amount of time necessary for realisation or change of conditions which accompany market clearing. The process inherently contains specific structural dimensions such as size, in terms of the number of participants and market development, supply heterogeneity, etc. A relatively reliable calculation of (il)liquidity is difficult to achieve based on the partial information from the Croatian market, such as the original data on the year of property construction and the number of purchases made. The indicator therefore also contains other features of the real estate market in order to eliminate potential bias issues.

In order to quantify the time necessary to sell a residential property, the average time on the market (TOM), i.e. the liquidity index, is defined as follows:

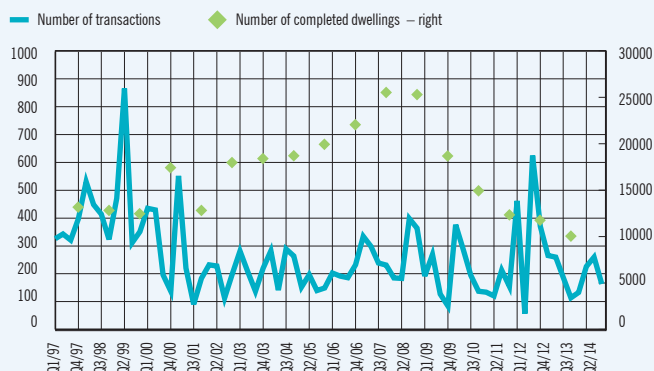
$$TOM = \left[ \frac{1}{N} \sum_{i=1}^N (Y_s - Y_c) \right] \cdot \left( T \frac{Z_t}{\sum_{t=1}^T Z_t} \right); (Y_s - Y_c) < 5$$

where  $N$  is the number of transactions,  $Y_s$  is the year of property sale,  $Y_c$  is the year of property construction,  $Z_t$  is the total volume index of construction works for buildings, and  $T$  is time.

The first indicator member is based on the average difference between the year of sale and the year of construction ( $Y_s - Y_c$ ) for all properties sold in a particular year (provided that relevant data are available).

The second indicator member adjusts the number of sold dwellings for the inflow of new housing units to the market using the total volume index of construction works  $Z_t$ . This is done because the number of newly constructed dwellings is much higher in times of real estate market upturn than in "difficult" times (Figure 1), which results in an uneven

Figure 1 Number of realised purchases and number of completed dwellings



Sources: Burza nekretnina, CNB and CBS.

inflow of newly built dwellings in different periods, creating a potential bias issue, since the TOM could be significantly shorter or longer without adequately reflecting market developments.

At the same time, older housing units sold on the secondary market could also disrupt the consistency of the TOM, which is why older dwellings<sup>2</sup> were excluded from the calculation, i.e. the following condition was set:  $(Y_s - Y_c) < 5$ .

In addition, the TOM was calculated at a yearly frequency in the first step in order to avoid irregularities with regard to the small and uneven number of transactions in different quarters (Figure 1), which would make the constructed index unnecessarily volatile and potentially difficult to use<sup>3</sup>.

### Liquidity features on the real estate market

A favourable macroeconomic environment associated with low inflation, interest rate decrease and relatively favourable labour market conditions stimulated the rapid credit and economic growth which characterised the Croatian economy from 2002 to mid-2008. Such circumstances influenced the real estate market as well, encouraging its robust growth in the period. However, destabilising factors in international financial markets and the spillover of the effects of the global financial crisis onto the Croatian economy sharply reversed upward trends and increased the uncertainty in the labour market, thus changing the real estate market which had up to that point been active. The changes in question were most likely not only regular short-term market oscillations, but also changes in structural characteristics, i.e. substantial changes of

2 As the database used unfortunately does not include a time series long enough to identify new housing units, the difference between the year of sale and the year of construction was limited to no more than 5 years. The threshold value of 5 years was set arbitrarily. Sensitivity was tested with regard to values ranging from 5 to 15 years, and unofficial information obtained from real estate agents was used in the selection of an optimum threshold value.

3 Following the construction on a yearly basis, the TOM was re-mapped to a quarterly frequency using simple interpolation.

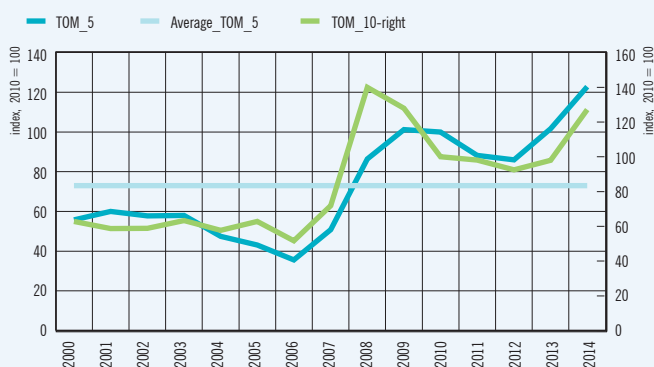
1 See the Decision on the application of the structural systemic risk buffer (OG 31/2014), in effect since 19 May 2014.

significant market features and operating conditions. Such an interpretation partly derives from the fact that the exposure to recessionary conditions affected the potential shift in the entire distribution of the disposable income of households, which, in turn, influenced the demand for real estate.

The constructed liquidity indicator noticeably differentiates two real estate market regimes described above: the period of relatively high liquidity prior to 2008 linked with the expansionary phase and the period of marked illiquidity of the market during the recession following 2008. At the same time, periods of liquidity or illiquidity do not depend on the choice of threshold value, which excludes old housing units (Figure 2).

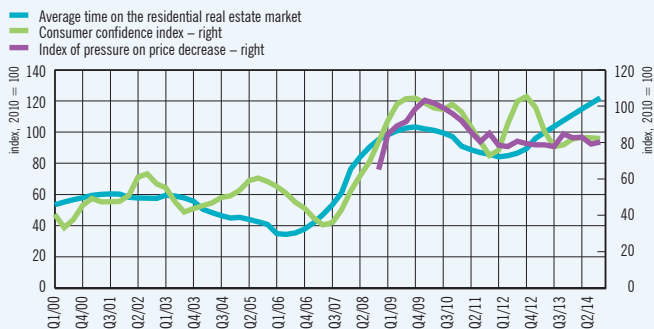
It is interesting to note that the quantification of the two liquidity regimes on the Croatian residential real estate market based on the TOM calculated from quantitative sources of data (databases of Burza nekretnosti)

Figure 2 Average time on the residential real estate market



Source: CNB.

Figure 3 Comparison of the constructed index with survey data on market liquidity



Note: The original consumer confidence index was seasonally adjusted and transformed so that the increase of the index indicates confidence decline. Index of pressure on price decrease is based on the business optimism survey. Both indices were transformed to make 2010 their reference period (2010 = 100). Sources: CNB and Ipsos Puls.

nina – Croatian association of real estate agencies and the Croatian Bureau of Statistics) corresponds to the information obtained from survey data on the factors on the demand side (consumer confidence index) and the supply side (index of pressure to decrease the price of construction works), which point to similar conclusions, confirming indicator credibility (Figure 3).

Specifically, the inverse value of the consumer confidence index, which reflects the reluctance of households to expose themselves to a long-term and relatively large burden of debt due to housing loans<sup>4</sup> in a period of relatively high liquidity on the real estate market is at a significantly lower level (consumer confidence is higher) than during periods of extreme illiquidity, characterised by a lack of confidence and the hesitance of consumers to assume additional risks arising from the purchase of a new housing unit. On the other hand, the reluctance to increase the price of construction works (measured by the index of pressure to decrease the price<sup>5</sup>), implying a smaller probability of the increase of prices of real estate as a final product, is as expected higher in the period of low liquidity on the real estate market.

#### Modelling of real estate price dynamics in relation to market liquidity

Empirical research usually links real estate market liquidity to real estate prices, whereby two different approaches are applied: the simultaneous approach<sup>6</sup> (which implies parallel changes of prices and liquidity indicators triggered by short-term market fluctuations) and the individual approach, as market structural changes will primarily impact a change of the liquidity or illiquidity regime, and subsequently the real estate prices themselves, via the liquidity indicator. Although the simultaneous assessment of real estate prices and market liquidity is justified within an individual liquidity or illiquidity regime, it is not possible adequately to measure the shift from one regime to the other using that approach. In order to model real estate prices in this box, TOM was used as an independent variable in the regression, in the form of information on the current market regime. At the same time, the indicator enables an alternative to approaches to modelling which frequently involve a considerable number of variables to describe the same market developments<sup>7</sup>.

The direction of the impacts of all the variables used on the dynamics in residential real estate prices in the assessed model<sup>8</sup> is in line with expectations and has statistical significance. The autoregressive com-

4 The survey structure of the consumer confidence index includes a direct question on the expected investment in real estate.

5 Index of pressure to decrease the price is defined as the difference between the share of construction companies expecting a decrease and those expecting an increase of the price of their works relative to the share of construction companies which do not expect to alter their prices (in the following three months).

6 Clayton, J., G. MacKinnon, and L. Peng: *Time Variation of Liquidity in the Private Real Estate Market: Causes and Consequences*.

7 See for example Olszewski et al.: *On the dynamics of the primary housing market and the forecasting of house prices* and Nobilli, A., and F. Zollino: *A structural model for the housing and credit markets in Italy*.

8 In addition to the aforementioned model, additional models were tested which included interest rates, credit activity, consumer confidence index, etc., but all provided less satisfactory results.

Table 1 Results of the assessed model

Independent variable	Coefficient
Hedonic real estate price index (-1)	0.519***
Misery index (-1)	-0.806***
TOM_dummy	-7.318***
C	21.206***
R2	0.686
SE	5.057

Note: The sign \*\*\* marks variables significant at a level of 1%.  
Source: CNB.

ponent thus as expected has a positive impact on real estate prices, while the misery index, obtained as the sum of inflation rate and unemployment rate, has the opposite, negative impact, since its growth implies a decline in the purchasing power, which subsequently leads to

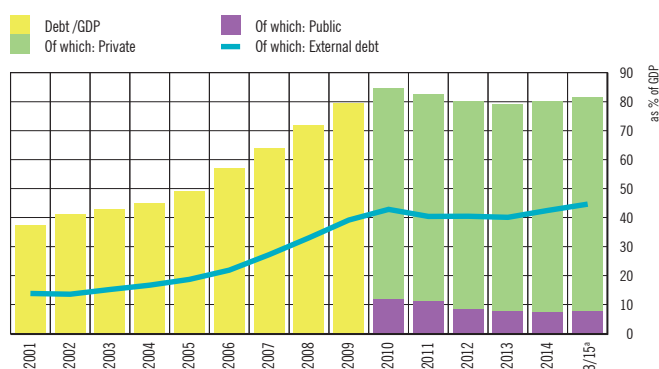
subdued demand and the consequent drop in real estate prices. At the same time, the impact of the TOM is expectedly negative, considering that the period of extreme market illiquidity, characterised by subdued demand, exerts downward pressure on prices (Table 1). The described model provides relatively satisfactory results and points to a possible further decrease in real estate prices in 2015 (of 2.7% on average, on a yearly basis).

As model errors are partly a result of the questionable quality of the hedonic price index itself, assessing future trends in real estate market prices is a delicate task. It is therefore reasonable to rely on other information as well, which provides a more comprehensive overview of market conditions (e.g. the equilibrating real estate price level<sup>9</sup>). In view of the above, research into alternative liquidity measures would certainly contribute to a better understanding of the correlation between real estate prices and market activity.

<sup>9</sup> See *Financial Stability*, No 12 (<http://www.hnb.hr/publikac/financijska%20stabilnost/h-fs-12-2014.pdf>).

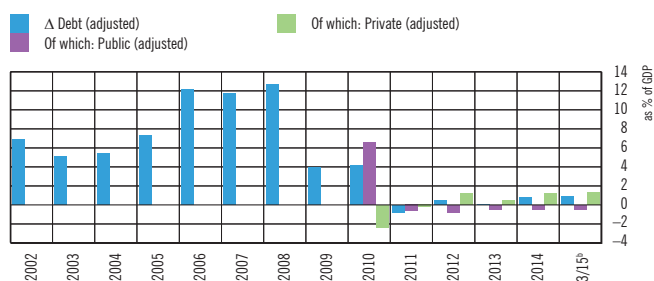
# Non-financial corporate sector

Figure 54 Indebtedness of the non-financial corporate sector



\* Assessment of the indebtedness is based on monetary statistics and external debt statistics. Sources: HANFA and CNB.

Figure 55 Change in and stock of non-financial corporate debt<sup>a</sup>



<sup>a</sup> Based on the audited data from the consolidated balance sheet of the financial accounts of the non-financial corporations sector and adjusted to the changes in the sector classification according to the ESA 2010 standard.

<sup>b</sup> Assessment of the indebtedness is based on monetary statistics and external debt statistics.

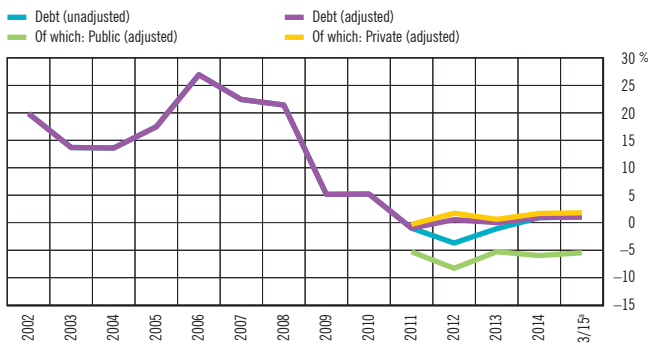
Note: Changes in non-financial institutions' debt exclude effects of the sale of a portion of claims of a major bank to a company in the direct ownership of the parent bank in December 2012 and 2013, the assumption of a portion of shipyard debt by the government in June 2012 and the conversion of debt into equity.

Sources: HANFA and CNB.

The total debt of the non-financial corporate sector increased slightly in 2014 and early 2015 due to the rise in the debt of private and public enterprises. Increasingly vigorous external borrowing of enterprises in that period ran parallel to their deleveraging in relation to domestic banks. However, the pace of deleveraging was generally somewhat slower. Although vulnerability indicators of the non-financial corporate sector still indicate a high level of risk, the overall risk in the sector decreased thanks to improved financial business performance in 2014.

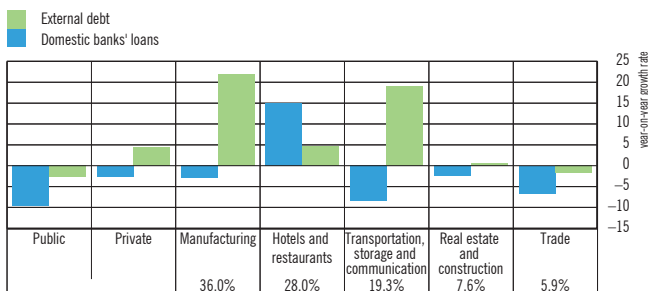
The total debt of non-financial corporations edged up from March 2014 to March 2015, to 81.3% of GDP, primarily due to the rise in the total debt of private non-financial corporations. Total debt of the non-financial corporate sector grew by 1.0 percentage point in that period. The bulk of the increase related to the growth in total corporate debt of 1.1% on an annual basis. The debt increase in effective terms (excluding the impact of exchange rate changes) was somewhat higher, 1.2%. The debt build-up was also due to the parallel decrease in GDP (an effect of 0.1 percentage point). Within such overall developments, differences were observed between changes in the debt of private and public enterprises. Borrowing of the private sector picked up steam in 2014 and the first quarter of 2015, while the deleveraging process of public enterprises stabilised on an annual basis. The debt-to-nominal GDP ratio of private enterprises stood at 73.5% at the end of March 2015 (growing by 1.3 percentage points from March 2014), while this ratio was 7.8% for public enterprises (down by 0.5 percentage points on an annual basis). Such developments were largely the result of the decrease in the total debt of public enterprises and a parallel

Figure 56 Annual growth rate of non-financial corporate debt



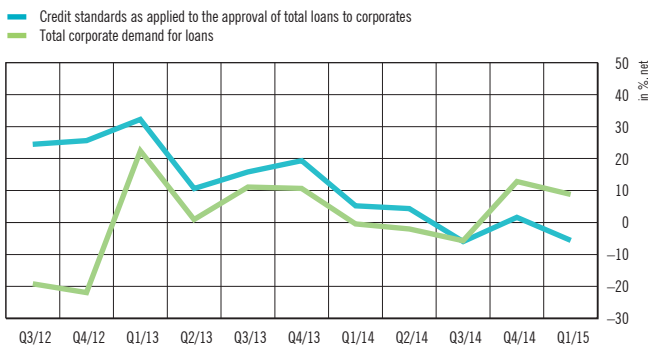
\* Assessment of the indebtedness is based on monetary statistics and external debt statistics.  
 Note: Annual growth rates of non-financial institutions' debt exclude effects of the sale of a portion of claims of a major bank to a company in the direct ownership of the parent bank in December 2012 and 2013, the assumption of a portion of shipyard debt by the government in June 2012 and the conversion of debt into equity.  
 Sources: HANFA and CNB.

Figure 57 Year-on-year growth rates of domestic banks' external debt and loans by activity in the period from 31 March 2014 to 31 March 2015



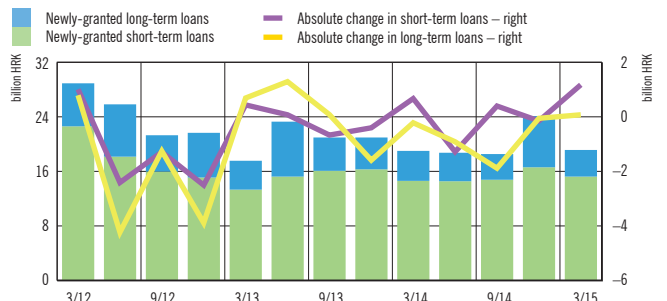
Note: The structure of the change in debt by activity is shown only for the sector of private non-financial corporations, with the percentages on the x axis showing the share of export revenues in total revenues of the respective activity in 2013. Growth rates are not adjusted by the change in the external debt to capital ratio.  
 Sources: CNB (loans and external debt by activity) and FINA (export and total revenues).

Figure 58 Change in credit standards and demand for loans to corporates



Note: Positive values show the increase in demand, i.e. the tightening of credit standards, whereas negative values show the decrease in demand, i.e. the easing of standards.  
 Source: CNB.

Figure 59 Newly-granted bank loans and absolute change in the stock of gross loans



Note: Due to a change in the methodology of monitoring of stock and maturity of loans which are the consequence of change in the classification of sectors, the data from 31 December 2011 onwards are revised in line with the new methodology. The decrease in the stock of loans in December 2012 and 2013 is the result of the sale of a portion of claims of a major bank to a company in the direct ownership of the parent bank, with the decrease in June 2012 being the result of the assumption of a portion of shipyard debt by the government.  
 Source: CNB.

increase in the total debt of private enterprises (annual growth rates of -5.5% and 1.8% respectively), Figures 54, 55 and 56.

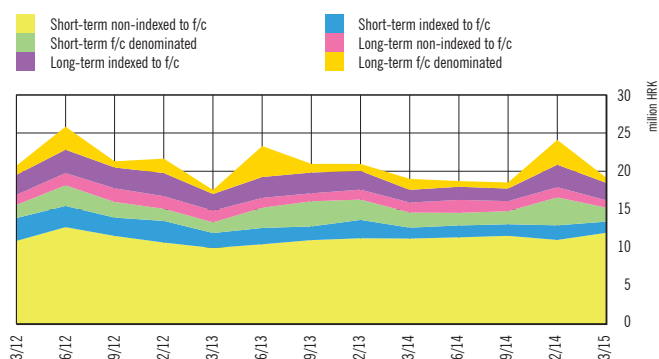
Public enterprises mostly reduced their debt to domestic banks, while their external debt was decreased slightly less. Private non-financial corporations borrowed abroad and reduced their debt to domestic banks, with the exception of enterprises in the hotels and restaurants activity, which also borrowed from domestic banks, and enterprises dealing in trade, which reduced both their debt to domestic banks and external debt. The upsurge in external debt of the manufacturing sector was due to new foreign borrowing from parent companies in the pharmaceutical industry and dressing of leather, while the debt growth in the transportation, storage and communications activity was the consequence of new borrowing by airports and seaports and mobile operators (Figure 57).

The results of the bank lending survey in the last quarter of 2014 and the first quarter of 2015 point to improved conditions for corporate loans and a recovery in demand for loans, mostly in the segment of small and medium enterprises and short-term loans. Favourable changes in lending standards, observed in three consecutive quarters, were for the first time recorded in all groups of corporate loans in the first quarter of 2015. Together with the comfortable bank liquidity situation, this relaxation of lending standards was driven by an improvement in the general economic outlook. In addition to better supply characteristics of corporate loans, the major factors behind larger demand for loans were the need to finance investment in inventories and working capital, and debt restructuring, while the opposite effect was produced by reduced activities related to fixed capital formation, internal financing and mergers, acquisitions and corporate restructuring (Figure 58).

The stock of non-financial corporate debt to domestic banks grew from the end of 2014 to the beginning of 2015, but its growth rates remained relatively low. Notwithstanding a noticeable increase in newly-granted loans in the last quarter of 2014, the absolute stock of loans decreased slightly (regardless

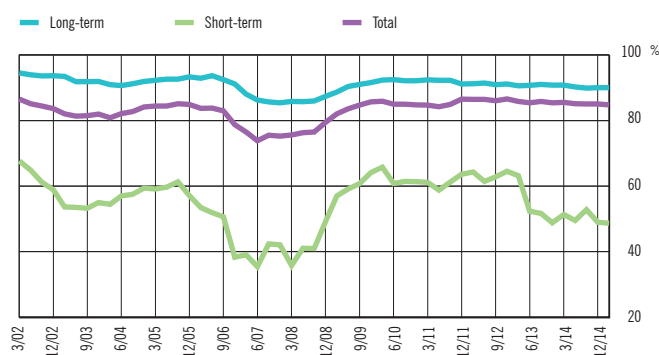


Figure 60 Breakdown of newly-granted loans to non-financial corporations by maturity and currency



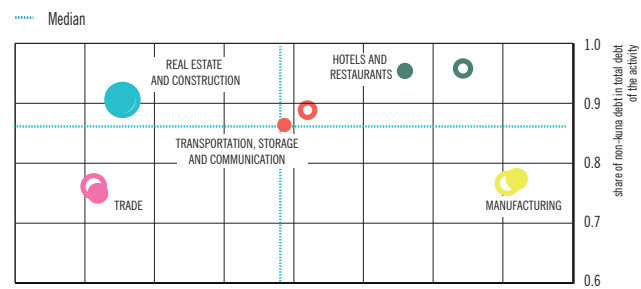
Source: CNB.

Figure 61 Share of corporate non-kuna debt<sup>a</sup> in total loans



<sup>a</sup> It is assumed that total external debt is denominated in foreign currencies. Debt indexed to foreign currencies (a foreign currency clause) is also included.  
Source: CNB.

Figure 62 Currency exposure in March 2015



share of export revenues in total revenues generated by individual activities  
Note: A full circle denotes the debt dynamics in the last two quarters observed. An empty circle denotes the same change in the debt balance in the previous period. The size of the circle denotes the significance of a particular activity's share in total external debt of non-financial corporations. Activities accounting for a relatively minor share in total debt are not presented.  
Sources: FINA and CNB.

of maturity) from September to December 2014. Such developments were largely driven by the stronger need to refinance corporate debt (as evident from the results of the bank landing survey) and the parallel slow deleveraging of enterprises in relation to domestic banks. By contrast, early 2015 saw simultaneous growth in the absolute stock of both short-term and long-term debt, with a more dynamic increase being recorded in short-term kuna financing. In such conditions, excluding developments in newly-granted corporate loans in late 2014, loan breakdown by maturity and currency remained unchanged (Figures 59 and 60).

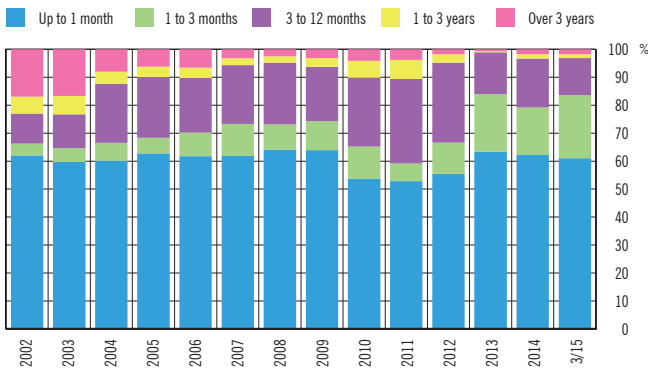
Notwithstanding slightly changed exposure to currency risk across activities, the overall exposure of the non-financial corporate sector to currency risk remained stable at a high level. The usually high foreign currency revenues of tourism firms were slightly lower, which, coupled with the stagnant currency risk exposure, slightly elevated the currency risk of that sector. As enterprises dealing in trade, construction and manufacturing also recorded stagnant currency exposure, currency risk of these activities remained unchanged as their foreign currency revenues held steady from the previous period. The currency risk of firms dealing in transportation, storage and communications also stayed the same as they adjusted their foreign currency financing to changes in export sale revenues (Figure 62). The described changes in the last two quarters only slightly affected the currency structure of total loans granted to non-financial corporations (Figure 61).

Corporate interest rate risk edged up from the end of 2014 to the beginning of 2015. In particular, the structure of loans by interest rate variability shows an increase in the share of loans with a variable interest rate in the period from 1 to 3 months, which offset the decrease in the share of loans whose interest rates can change in the period from 3 to 12 months (Figure 63). The total share of loans with an interest rate variable within 12 months still remained at a high 97%, posing a potential risk in the event of an increase in interest rates on corporate loans.

The several-year downward trend in interest rates of domestic banks continued in late 2014 and early 2015. Such movements were largely due to the still exceptionally favourable access to domestic and foreign financing sources. In the last two quarters, prices of short-term corporate financing in Croatia dropped more than prices of long-term financing.

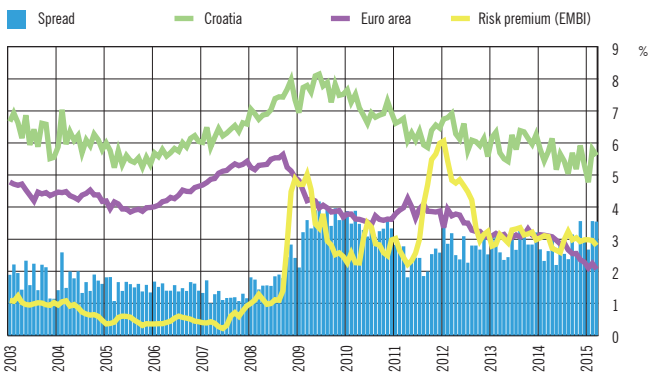
Thus interest rates on loans with shorter maturities fell to slightly below interest rates on long-term loans. The smaller decrease in long-term interest rates was probably due to the several-year slump in demand for investment financing and the stagnation of yields to maturity on long-term Croatian government bonds at high levels. Parallel with such movements in interest rates in Croatia, their somewhat more dynamic decline has also been recorded in the euro area since the beginning of 2014. However, in contrast with Croatia, such trends were particularly evident in long-term corporate financing. In such conditions, the spread between interest rates on corporate loans in Croatia and

Figure 63 Breakdown of bank loans to non-financial corporations by interest rate variability



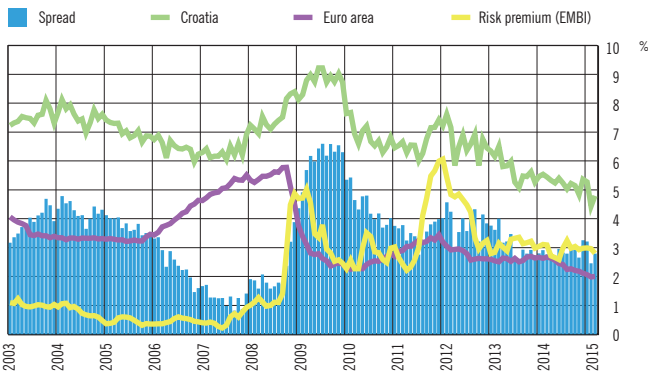
Source: CNB.

Figure 64 Interest rates on long-term loans to non-financial corporations in Croatia and the euro area



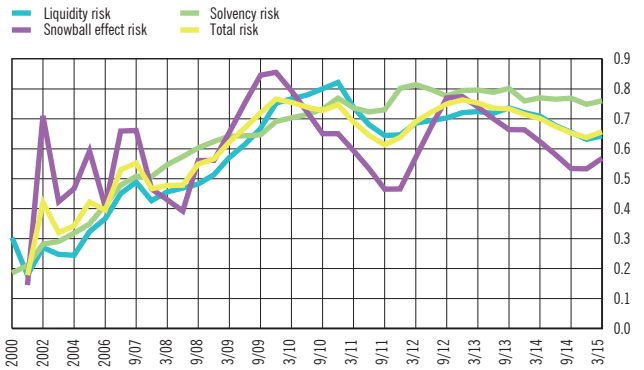
Sources: ECB, Bloomberg and CNB.

Figure 65 Interest rates on short-term loans to non-financial corporations in Croatia and the euro area



Sources: ECB, Bloomberg and CNB.

Figure 66 Indicators of vulnerability in the corporate sector



Note: The vulnerability in the corporate sector was estimated by three indicators. The liquidity risk indicator was calculated as the ratio of the total debt amount and interest payments of the sector to gross operating profit, i.e. EBITDA:

$$LR_t = 0.5 \cdot \frac{Debt_t}{EBITDA_t} + 0.5 \cdot \frac{Interest\ payments_t}{EBITDA_t}$$

The solvency indicator was calculated as the debt-to-equity ratio:

$$SR_t = \frac{Debt_t}{Equity_t}$$

The snowball effect risk was calculated as the ratio of interest payments to the average debt adjusted by the growth in gross operating profit, i.e. EBITDA:

$$SNR_t = \frac{Interest\ payments_t}{\frac{Debt_t + Debt_{t-1} + Debt_{t-2} + Debt_{t-3}}{4}} - \left( \frac{EBITDA_t}{EBITDA_{t-4}} - 1 \right)$$

These indicators were normalised to the value range 0 – 1 and the total risk was calculated as the average of the three mentioned normalised indicators:

$$TR_t = \frac{LR'_t + SR'_t + SNR'_t}{3}$$

The methodology is slightly changed compared to the previous issue due to the implementation of the EBITDA (instead of the gross operating surplus) of corporations interpolated to the quarterly dynamics in line with the developments in the quarterly nominal GDP.

Sources: FINA and CNB.

the euro area widened slightly, reflecting the still relatively high country risk premium (Figures 64 and 65).

Favourable corporate financial performance in 2014 led to a reduction in vulnerability indicators of the sector. According to the summary of business performance results of Croatian entrepreneurs for 2014, which were published by FINA, the net income of 104,470 entrepreneurs that are corporate income tax payers (excluding banks, insurance corporations and other financial institutions, and including enterprises in the government sector, tradesmen and natural persons subject to corporate income tax) stood at HRK 9.8bn. Corporate financial performance improved strongly from 2013 to 2014. In that period, the number of employed persons grew by 1.8%, total income increased by 3.3%, total expenditure went up 2.3%, while profit earned in the current period leaped by 17.4% and loss in the current period was cut by 2%. The surplus in foreign trade in goods and services was a result of a 9.5% increase in exports and a 4.6% decrease in imports. The overall effect on the consolidated financial performance was an increase in net income of 139.5%. All this had a favourable effect on the indicators of return, with the

return on equity (ROE) growing from 2.2% to 3.7%, while the EBITDA margin went up from 9.2% to 9.8%.

The described trends led to a fall in the vulnerability indicators of the non-financial corporate sector (Figure 66), in particular

the indicators of liquidity risk and snowball effect risk, which contributed to the overall decrease in the vulnerability of the non-financial corporate sector. Solvency risk held steady in late 2014 and early 2015.

## Box 4 Forecasting the probability of default of non-financial corporations by means of sectoral micro models with macroeconomic variables

The years-long economic crisis has put greater emphasis on a more precise identification and measurement of all risks arising from the operations and functioning of the financial system. Under the new legal provisions, both the regulator and the banks are obliged to carry out regular stress tests of the system in order to set additional capital, liquidity and other requirements. Credit risk is the main risk to which the banking sector is exposed.

Predictive models that include both macroeconomic and microeconomic features are particularly suitable for testing and simulating the potential impact of economic developments and stresses on the probability of default of individual corporations, which enables the generation of specific stress tests and adverse scenarios for each corporation, group of connected legal persons, a particular segment, activity or an individual bank's credit portfolio. The described model will be used in the Croatian National Bank to assess the riskiness of the non-financial corporate sector portfolio of individual banks and, indirectly, the riskiness of banks, and to test stress sensitivity of banks and the financial system as a whole.

Regression models for forecasting riskiness of individual corporate entities (corporations) are currently the most frequently used tool to assess the risk profile of the financial system and credit risk exposure of an individual bank, a part of its portfolio or a particular placement. The micro models used in the Croatian National Bank are based on financial indicators of individual corporations according to their financial statements: the balance sheet and the income statement at time  $T_0$ . Such a micro model estimates the probability of default on financial obligations on the part of the observed corporation in the time horizon of one year ( $T_{+1}$ ). The main problem of relying solely on the existing micro model for assessing the risk of an individual client or bank arises from two

assumptions used in the development of the model: the model is calibrated to assess the probability of default on financial obligations based on the balance of client's non-performing loans and it does not include the possible influences of macroeconomic developments (variables) on the probability of new defaults on financial obligations.

The main motive for the development of a new model is to improve the predictive power of the model that takes account of the specifics of an individual corporate segment in terms of size, ownership type and business purpose. The goal is to estimate better the probability of new defaults (PD) on a micro level based on the most recent available financial statements and the estimated impact of observed and forecasted macroeconomic variables. Preliminary research into differences in the risk profile and stress sensitivity of individual segments shows that the model performance may be improved by taking into account the specific business conditions of corporate segments. This text describes the main steps in developing this group of models, the problems encountered and the methods of dealing with them, as well as the results obtained and their assessment.

### Client segmentation

The basic segmentation of non-financial corporations was done according to their size in terms of the number of employees, total assets and operating income, in line with the criteria set out in the Accounting Act and in line with the criteria used in the FINA base of financial statements: small, medium and large enterprises. Also tested was the risk profile of a micro-segment according to various criteria of extraction from small enterprises, but no significant differences in risk were observed in relation to the segment of small enterprises. As the segment of medium enterprises does not differ considerably from that of small enterprises in terms of risk, these two segments were added to the segment of small and medium enterprises, SMEs. Regardless of the size, two additional segments were extracted according to the criterion of ownership (state owned enterprises, SOEs) and the criterion of the form of financing, purpose—project financing or special purpose vehicle (SPV). This mostly

Table 1 Model results by segments

Segment of micro, small and medium enterprises		Segment of project finance enterprises		Segment of public and large enterprises	
Indicator for 2005	0.8255	Indicator for 2005	0.6696	Indicator for 2005	0.6766
Crisis indicator	0.1041			Indicator for the segment of public enterprises	-0.5422
Net working capital/Total assets	-0.0481	Net working capital/Total assets	-0.0582	Capital and reserves/Total assets	-0.0894
Total income/Total assets	-0.0449	Total income/Total assets	-0.0574	Operating income/Operating expenses	-0.5313
Total liabilities/Retained earnings – depreciation	0.0004	Depreciation/Long-term assets	0.0660	Depreciation/Long-term assets	-0.7371
EBITDA/Debt to FI	-0.0022	EBITDA/Debt to FI	-0.0022	EBITDA/Debt to FI	-0.0215
Growth rate of EUR/HRK exchange rate (-1)	0.0309	Growth rate of HREPI	-0.0293	Growth rate of EUR/HRK exchange rate	0.1431
Change in LTIR (-1)	0.2286	IBIR	0.1231	Change in LTIR	0.2433
Inflation (-1)	0.1069				
Real GDP growth rate (-1)	-0.0344	Real GDP growth rate (-1)	-0.0603	Real GDP growth rate (-1)	-0.0465
Constant	-2.2073	Constant	-2.2330	Constant	-0.8012

Note: All variables in the estimated model are significant at the level of 1%.  
Source: CNB calculations.

refers to parts of the SME segment that are extracted as separate segments because of their specific business and balance sheets. As original data on SPVs are not available, a model for SPV recognition was applied according to known SPVs, which is based on financial indicators. The model was developed by means of logistic regression on a sample of the construction sector, with a dependent variable being the binary sign for a project finance enterprise.

### Macroeconomic variables and financial indicators

To accurately assess the probability of default, a development sample was created with a condition that an enterprise was timely in meeting all its liabilities in the period preceding the default. “Bad” clients from the period covered in the financial statement are not included in the development sample.

A dummy was introduced for 2005 to eliminate the one-off effect of introducing an additional classification group for non-performing loans (A90).

### Model development and results

Arbitrariness in selecting statistically significant variables was eliminated by the application of the Bayesian Model Averaging (BMA<sup>1</sup>) analysis, which indirectly, based on the BIC<sup>2</sup> criterion, selects from the group of variables those that have the best predictive power in estimating the probability of default (Table 1).

The variables and models with the best predictive power are different for each of the given segments, while dummies for the groups of activities within individual segments were not statistically significant predictors of default. The signs of the coefficients in all models are expected and show certain regularities that are common to all non-financial corporations, as well as some specifics of individual segments of the corporate sector. It should be noted above all that favourable macro-economic developments (measured in terms of economic growth) have a direct impact on reducing the probability of default by strengthening the income-generating capacities of enterprises. By contrast, a potential deterioration in financing conditions, such as exchange rate depreciation or an increase in financing costs (interest rates), associated with pressures on liquidity and working capital at a corporate level, creates preconditions for default.

Price categories – inflation and real estate prices – stand out as specific factors of the probability of default. In particular, the growth in prices on the residential real estate market (measured by HREPI) is linked to the increase in both income and value of collateral, which facilitates debt repayment of debtors in the segment of project finance enterprises. On the other hand, inflationary pressures will diminish these capacities of SMEs as they will affect their cost structure, with parallel negative impacts on the demand side.

1 See Moral-Benito, E. (2012): *Model Averaging in Economics: An Overview*, Banco de Espana Working Paper, August.

2 BIC is the information criterion that indicates an optimum between a model quality improvement (by adding variables to the model) and a sufficient number of the degrees of freedom (reduction of model variables). Its lower value indicates that the model better describes the data.

A separate analysis of accounting indicators shows that greater caution in financing short-term assets, lower debt and a higher share of own funding reduce the probability of corporate default to banks. Furthermore, the probability of default decreases as cost-effectiveness of an enterprise increases. In contrast to the segment of state owned and large enterprises, an increase in the ratio of depreciation to long-term assets in the SPV segment raises the probability of default, which is understandable if one bears in mind that this refers to the construction sector, which is characterised by a large share of tangible assets and which has been hit the hardest by the crisis.

As the segment of SMEs is characterised by high costs of capital, their investment activities are much more elastic to macroeconomic shocks. This is why the coefficient of the dummy for the crisis period (the period after 2008) is positive and significant in this segment alone.

Finally, the statistical and economic significance of macroeconomic variables in all segments confirms the fact that the macroeconomic environment plays an important role in predicting the probability of default.

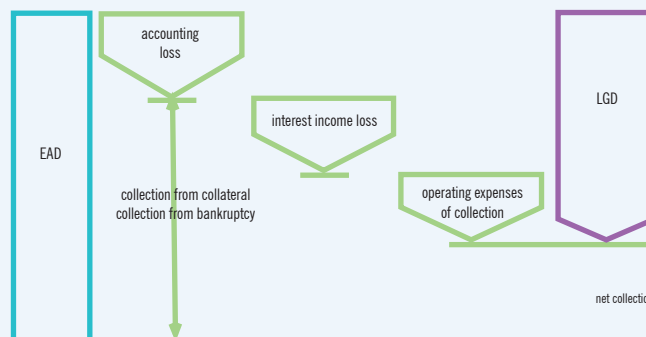
### Use of the model in stress testing

The probability of default by itself does not indicate much about the banking sector’s risk exposure, but it is a key factor in the calculation of expected loss (EL), a measure which represents potential loss of a bank resulting from its exposure to clients in the portfolio, after activating and exercising all collection and collateral instruments. According to the definition  $EL = PD * LGD * EAD$ . PD for each business entity is calculated by means of the model, with the exception of non-performing clients, for which PD equals 1 (100%).

Exposure at default (EAD) is exposure assessed at the moment of default. It will be assumed that EAD corresponds to total balance sheet exposure (loans, interest, other assets), i.e. placements.

Loss given default (LGD) is an assessment of receivables that represent economic loss at the moment of default. The amount of a placement is reduced by discounted cash flows arising from collection of receivables

Figure 1 Procedure of estimating LGD



Source: CNB.

Table 2 Expected losses and NPPR

For a year T+1	Client risk	Placements T0	Value adjustments T0	Average PD	Expected loss	Expected NPP	NPPR T0	Expected NPPR
2012	NPP	28,723	9,740	100.00%	7,334	25,506		
2012	PP	97,429	4	4.88%	1,060	6,825		
<b>2012</b>		<b>126,152</b>	<b>9,744</b>		<b>8,395</b>	<b>32,330</b>	<b>22.8%</b>	<b>25.6%</b>
2013	NPP	30,123	10,857	100.00%	8,039	26,824		
2013	PP	76,094	103	3.41%	793	4,344		
<b>2013</b>		<b>106,217</b>	<b>10,960</b>		<b>8,832</b>	<b>31,168</b>	<b>28.4%</b>	<b>29.3%</b>
2014	NPP	33,346	13,759	100.00%	9,693	28,631		
2014	PP	72,185	1,251	2.88%	481	3,411		
<b>2014</b>		<b>105,530</b>	<b>15,010</b>		<b>10,175</b>	<b>32,042</b>	<b>31.6%</b>	<b>30.4%</b>
2015	NPP	35,085	16,895	100.00%	12,584	30,637		
2015	PP	66,116	1,503	3.98%	589	3,551		
<b>2015</b>		<b>101,201</b>	<b>18,398</b>		<b>13,173</b>	<b>34,188</b>	<b>34.7%</b>	<b>33.8%</b>
2015 ST <sup>a</sup>	NPP	35,085	16,895	100.00%	13,593	33,313		
2015 ST <sup>a</sup>	PP	66,116	1,503	4.07%	754	4,625		
<b>2015 ST<sup>a</sup></b>		<b>101,201</b>	<b>18,398</b>		<b>14,347</b>	<b>37,938</b>	<b>34.7%</b>	<b>37.5%</b>

<sup>a</sup> The model results are based on the adverse scenario (Table 5 in the Stress testing of credit institutions section) and the banks' statistical balance sheets (as at 31 December 2014).

Source: CNB calculations.

on the basis of collateral and other means of collection, loss of interest income and operating expenses arising from the process of collection. In view of the absence of high quality data, the coverage ratio (of placements by provisions) may be used as a proxy for LGD. The share of non-performing placements (NPPs) that recovers is the recovery rate (RR). Total expected loss of a bank is the sum of expected loss on the portfolio of performing placements ( $EL_{PP} = PD * LGD_{PP} * EAD_{PP} = PD * CR_{PP} * EAD_{PP}$ ) and expected loss on non-performing placements ( $EL_{NPL} = 1 * LGD_{NPP} * (1 - RR) * EAD_{NPP}$ ), including a correction of non-performing placements (NPPs) by the estimated recovery of NPPs (1-RR).

The expected loss calculated in this way is a projection of charges for value adjustments which is used in stress testing in the income statement as additional cost arising from events in the adverse scenario. Macroeconomic shocks and scenarios are included in the analysis directly through changes in GDP, exchange rate and other macroeconomic indicators included in the formula for calculating PD. The results are given in Table 2 and are based on data for the previous periods, which would correspond to the baseline scenario, while data on placements as at 31 December 2014 were used to make a trial calculation of EL under the adverse scenario.

Under the baseline scenario, the non-performing placement ratio (NPPR) is expected to increase by -0.9 percentage points (i.e., to de-

crease) in 2015, while it is expected to grow by 2.8% under the adverse scenario. The adverse scenario excludes the impact of recovery (RR = 0%) of non-performing placements. Increases in the intensity of changes in macro variables simulate stresses and, indirectly, their impact on additional charges for value adjustments. Charges for additional value adjustments as a result of the adverse scenario raise the costs in the income statement, which reduces a credit institution's profit and increases its losses. Such losses spill over to capital and reduce the rate of its adequacy. Furthermore, the rise in NPPs diminishes interest income, thereby affecting the credit side of the income statement.

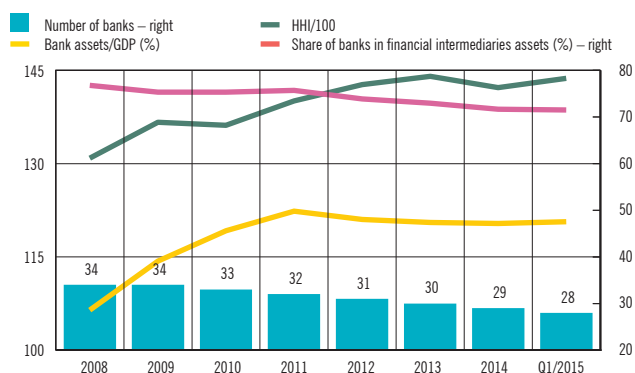
#### Conclusion and further guidelines for development

The results of the developed models suggest that the probability of default is significantly correlated not only with micro-indicators of an enterprise but also with developments in some macroeconomic variables.

The sample includes the period of growth followed by recession, which ensures better robustness and stability of the model results and sensitivity to various scenarios of economic developments. Nevertheless, the models will have to be validated in the post-recession period to examine the impact of a positive shift in macroeconomic developments on the riskiness of individual corporations, but this will be possible only after economic growth is recorded for several consecutive years.

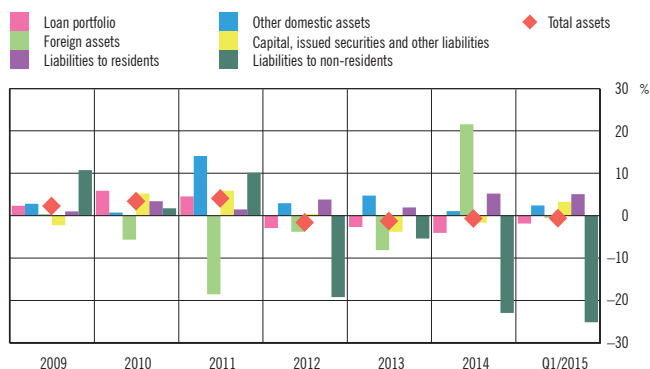
# Banking sector

Figure 67 Selected developments in the banking sector



Source: CNB.

Figure 68 Year-on-year growth in major banking sector balance sheet items



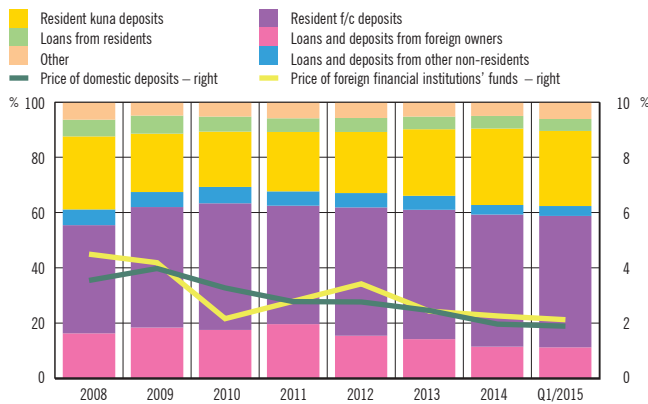
Source: CNB.

The current pace of economic growth is insufficient to reverse unfavourable trends in the banking sector. This is why credit risk continues to accumulate, though at a somewhat slower pace, while private sector demand for loans remains subdued, and banks increasingly turn to a local business model that assumes greater reliance on domestic funding sources. As a result, bank assets have been decreasing, which, coupled with the increase in assets of other financial intermediaries, in particular pension funds, has led to a continued decline both in the share of bank assets in assets of the financial sector and in the number of banks themselves (Figure 67). In such conditions, the external deleveraging of banks continues, reflecting the scarcity of business opportunities on a market characterised by persistently high currency and interest rate risks. In the meantime, the resolution of the issue of non-performing loans is progressing slowly and requires coordinated action on the part of economic policy makers.

## Balance sheet vulnerabilities

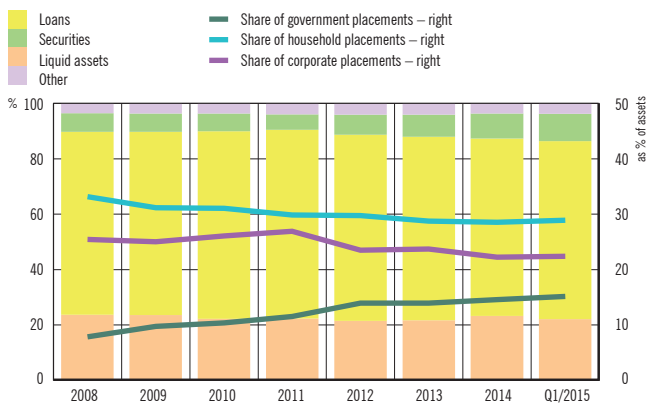
The increase in household foreign currency deposits, the main source of bank financing, slowed down over the past year, so that lending to the government and the ongoing deleveraging abroad were financed by liquidation of a portion of previously accumulated liquid assets (Figure 68). Household deposits re-

Figure 69 Structure and price of banking sector liabilities



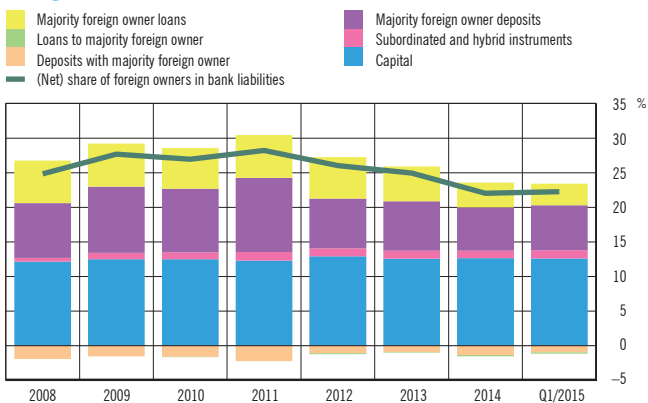
Source: CNB.

Figure 70 Banking sector assets



Source: CNB.

Figure 71 Net financial position of banks with respect to foreign owners



Source: CNB.

recorded an annual increase of 2.1%<sup>10</sup> at the end of March 2015, which is close to the average interest rate on household deposits. Therefore, the steady external deleveraging was financed mostly by liquidation of deposits with non-residents, which dropped by around 5% on an annual basis at the end of March 2015. As a result of such developments, bank assets decreased by 2.7% in effective terms in the year to March 2015 (Figures 68 and 69).

Bank loans grew by 1.0% in effective terms from end-September 2014, mostly as a result of loans to the government, while loans granted to the domestic private sector decreased in effective terms. The signs of a reversal of the deleveraging trend did not put an end to the fall in loans, which was of 2.7% on an annual basis (Figure 70). The share of placements to the government, which grew both in the segment of loans and debt securities, amounted to 15.2% of total bank assets at end-March 2015. In addition to the rise in concentration risk, the increase in the share of government securities exposes banks to risks of changes in the prices of fixed-yield instruments, which are strongly dependent on the trends in the risk premium for the Republic of Croatia and the actions of the European Central Bank (Figure 70 and the Macroeconomic environment section).

The share of owners in the liabilities of banks continued to decrease in late 2014 and early 2015, so that their (net) share in bank balance sheets dropped to 22.3% at end-March (Figure 71). In addition to the cost management side, the reduction in exposure to owners should be viewed from the aspect of capital management at the level of international financial groups. On the one hand, the banking sector in Croatia is not a “problematic area” for foreign owners as it remains profitable. However, as the price of capital grew strongly after the onset of the crisis (for more details, see the Macroeconomic environment section, Figure 5), the owners want to optimise capital use, i.e., move it to areas where it is deficient or areas that promise larger return per unit of risk.

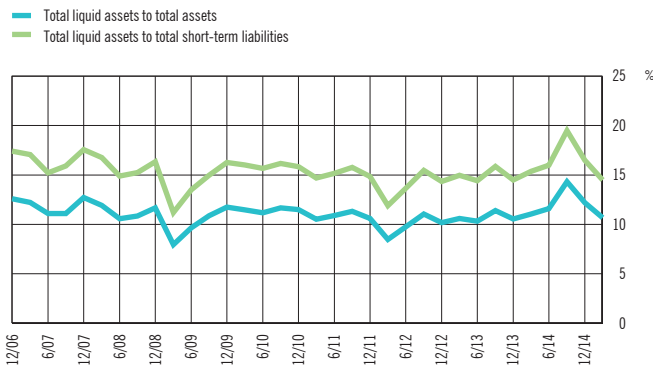
External deleveraging of banks was in part driven by low deposit rates in the domestic market. Foreign sources of financing are generally more volatile, which makes domestic deposits a more desirable funding source (Figure 69), particularly at times of subdued loan demand. In addition, the process of decreasing foreign exposures also reduces the risks arising from financing on the international market, which materialised during the crisis through episodes of considerable rises in their costs.

Having grown sharply in late 2014, indicators of bank liquidity dipped as banks used their foreign liquid assets for deleveraging purposes (Figure 72). However, such volatility over the year is usual, and banks still hold significant surplus liquidity which could be used to finance loan growth should loan demand pick up. Therefore, the source of impediments to loan growth is not

<sup>10</sup> At the end of March 2015, the exchange rate of the kuna against the euro was similar to that at the end of March 2014, so that the exchange rate did not influence annual growth in these deposits.

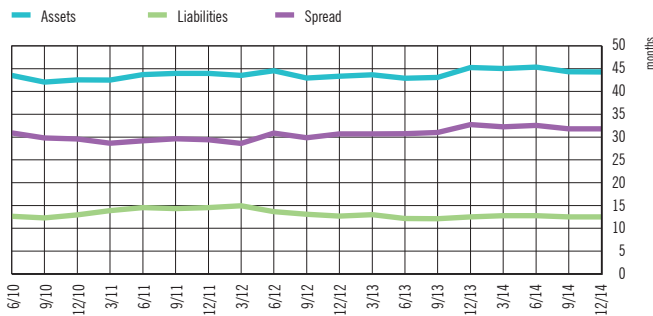


Figure 72 Liquidity indicators



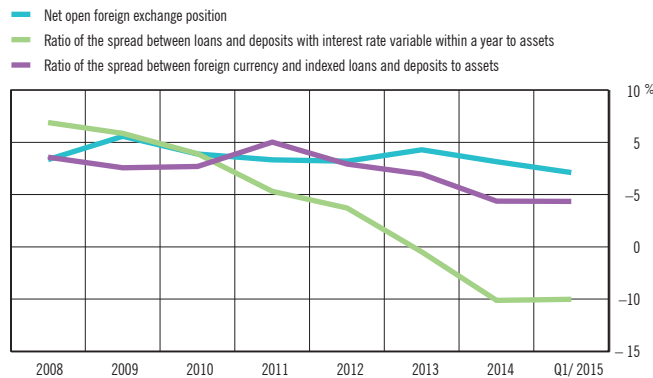
Source: CNB.

Figure 73 Weighted average maturity of bank assets and liabilities and their spread



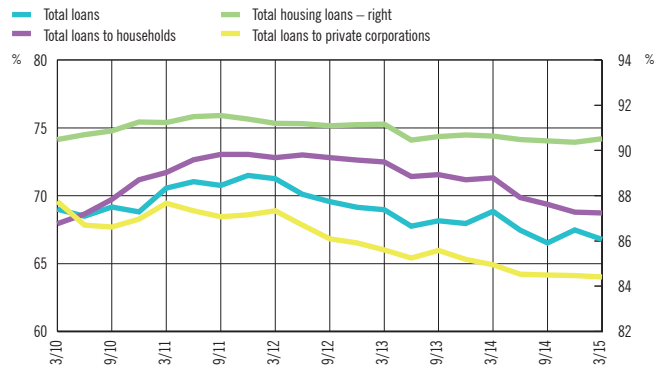
Note: Assets and liabilities are weighted by the remaining maturity bands to calculate their maturity.  
 Source: CNB.

Figure 74 Bank exposure to direct risks



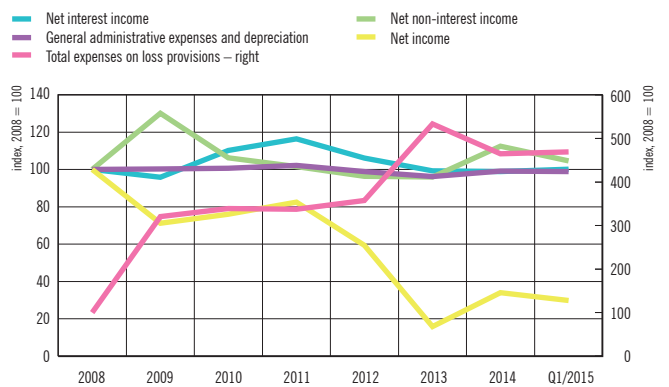
Source: CNB.

Figure 75 Share of unhedged loans in total loans exposed to CICR



Source: CNB.

Figure 76 Change in selected business performance indicators

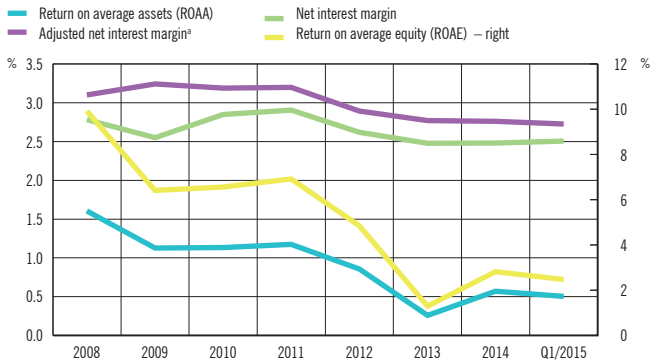


Source: CNB.

the balance sheets of the banking sector, but expectations of the banks and their clients regarding future developments and their aversion to risk.

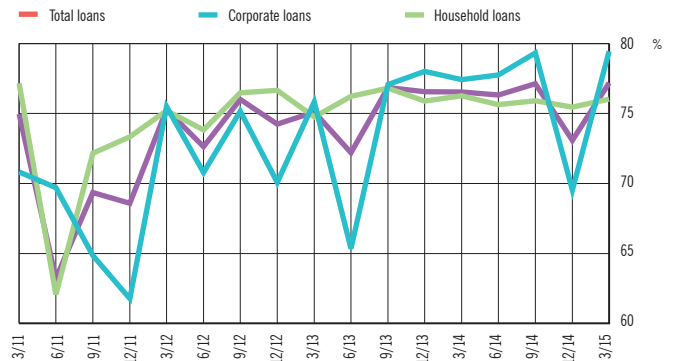
In the absence of growth in credit to the private sector, maturity transformation activities of banks are mostly influenced by lending to the government (Figure 73). The intensity of maturity transformation by banks remained mostly stable during the crisis, which reflects the inability of banks to invest funds for long-term periods in the context of persistently high risk aversion and the absence of private investments. The low economic growth rates that are expected in the forthcoming period will probably be insufficient to trigger a complete shift in the trends present since the onset of the crisis, so that the government sector will continue to exert a dominant influence on changes in banks' balance sheets. However, the relationship between banks and the government could change in the future due to limitations associated with the excessive deficit procedure, while limits to government financing in the medium run

Figure 77 Indicators of returns



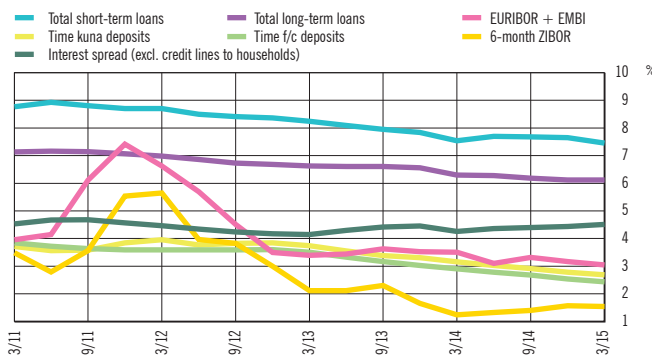
\* Net interest income of banks is adjusted by income from trading activity and calculated exchange rate gains and losses. Source: CNB.

Figure 80 Share of short-term loans in total newly-granted loans (quarterly average)



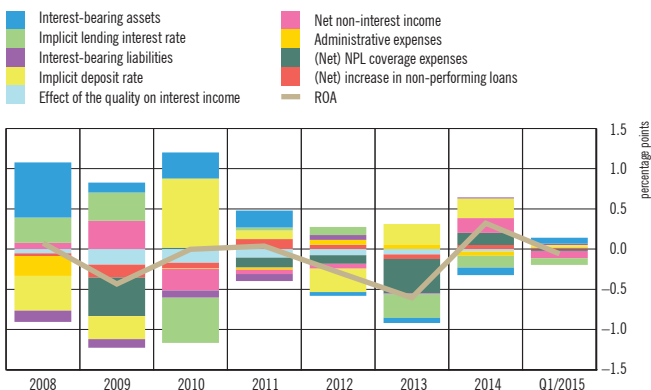
Source: CNB.

Figure 78 Selected interest rates (quarterly average of monthly interest rates)



Note: Methodological break in bank interest rates series after January 2011. Source: CNB.

Figure 79 Decomposition of the change in the return on assets



Source: CNB.

could arise from the expected stricter regulatory treatment at the EU level.

In the period of loan stagnation, banks' exposure to direct currency risk continued to be stable and low, while direct interest rate risk remained stable, after having grown since 2008 (Figure 74). However, indirect risks, which arise primarily from the unhedged foreign currency and interest rate risk exposure of clients, continue to pose a threat to banks. Despite the increase in both kuna consumer loans and the protection against CICR for corporate loans, which had a dampening effect on banks' exposure to CICR, banks' exposure to this risk remained large (Figure 75). By contrast, interest rate-induced credit risk (IRICR) was stable at a high level due to the high share of loans with variable interest rates. Notwithstanding the absence of an administrative interest rate and the fixing of the interest rates in part of the loan portfolio (housing loans indexed to the Swiss franc), potential growth in reference interest rates would push up interest rates on a significant portion of loans, which would lead to the materialisation of interest rate risk for clients, and thus implicitly to the materialisation of credit risk for banks (for more details on interest rate risk, see Box 2 Interest rate risk in the Republic of Croatia).

### Strategic risks<sup>11</sup>

The dynamics of banks' performance continues to be determined largely by the dynamics of charges for value adjustments, while their operating earnings are relatively stable. Although a decrease in value adjustment costs of 13% from 2013 triggered a slight increase in bank profitability, it remained at very low levels. During the crisis banks have been using operating earnings to cover value adjustment costs, but net interest income,

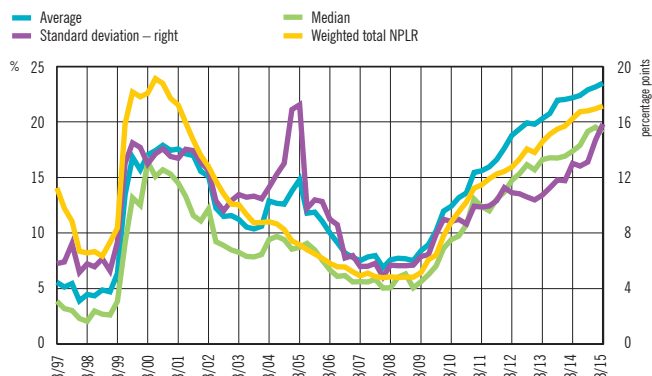
<sup>11</sup> Income statement items up to March 2015 were annualised to be comparable with those for the preceding whole year periods. This was made by summing up banks' business results in the last three quarters of 2014 and the first quarter of 2015.

Figure 81 Structure of banks' net operating income by sectors, end-2014



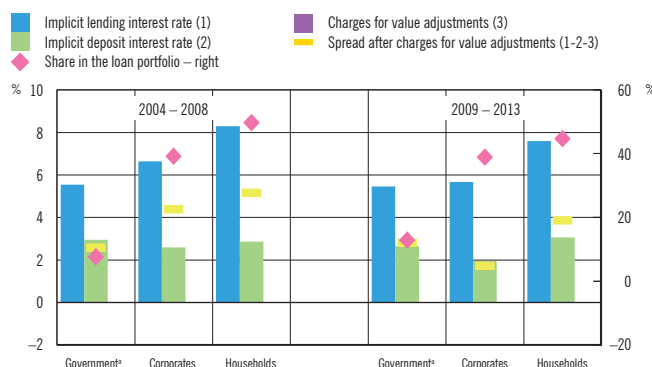
Note: Administrative expenses by sectors are estimated.  
Source: CNB.

Figure 84 Distribution of the ratio of non-performing loans



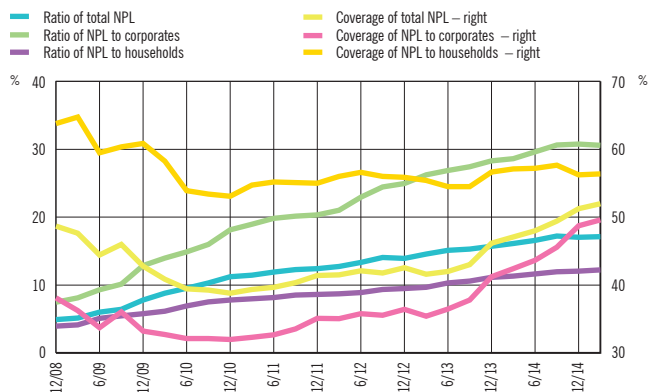
Source: CNB.

Figure 82 Change in bank profitability in various segments of financing in the period of crisis



Note: General and administrative expenses and depreciation are excluded.  
Source: CNB.

Figure 83 Ratio of non-performing loans to total loans by sectors



Source: CNB.

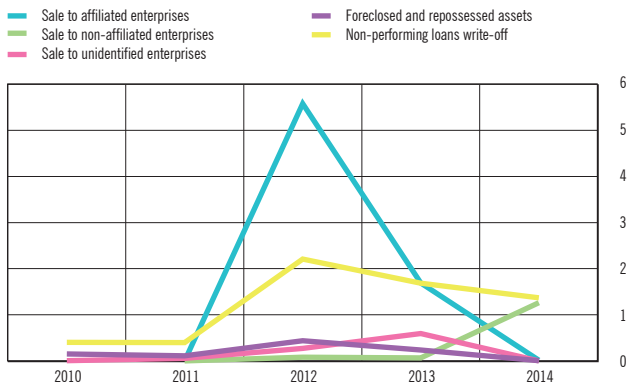
which is the most important component of operating earnings, is constrained by lower implicit lending rates, which are a result of both credit risk and the increase in the share of loans at lower interest rates (loans to the government and housing loans). As banks are no longer able to make significant operating savings, commissions and fees alone provided a boost to earnings (Figures 76 to 79).

The decomposition of changes in profitability of bank assets suggests that the negative contribution to earnings was due equally to the volume and the price of loans granted, while the positive contribution came from the fall in deposit rates. Such trends reflect the situation in the persistently sluggish economy and the adverse influence of the high ratio of non-performing loans and the Consumer Credit Act. This Act capped the interest rate (to 3.23% as of January 2014) and the HRK/CHF exchange rate (6.39 as of January 2015) applied to housing loans at a level significantly below the market level. By contrast, a positive contribution to earnings came mostly from the steady decline in deposit rates.<sup>12</sup> In such conditions, the marginal increase in the interest rate spread, triggered by the fall in nominal deposit rates and the parallel stagnation in nominal lending rates, failed to induce an increase in the interest margin calculated on the basis of generated income and expenses.

Differences in the composition of the credit portfolio continued to be the main determinant of differences in bank profitability. The household sector requires substantial investments in the distribution network and tangible assets, for which capital strength is needed. Nevertheless, in return, this sector provides cheap financing and relatively good recoverability of loans. The second most profitable sector, and the only one whose demand for long-term bank financing remains stable, is the government, which compensates for lower interest rates by the lack of distribution costs. Finally, lending to the sector of non-financial corporations may assume the characteristics of lending to the gov-

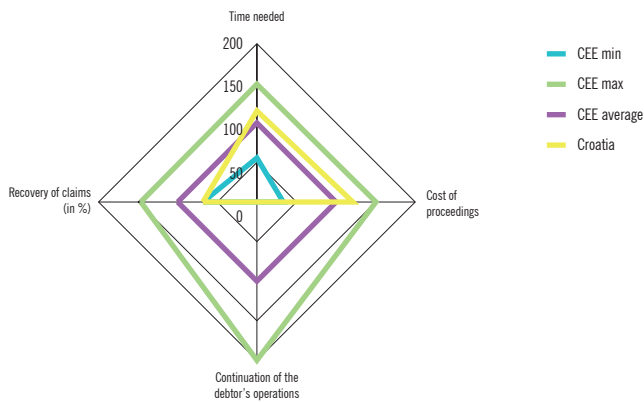
12 For more details on the decomposition of bank profitability, see Box 4 A new approach to the decomposition of return on bank assets, *Financial Stability*, No. 14.

Figure 85 Resolution of the issue of non-performing loans in banks



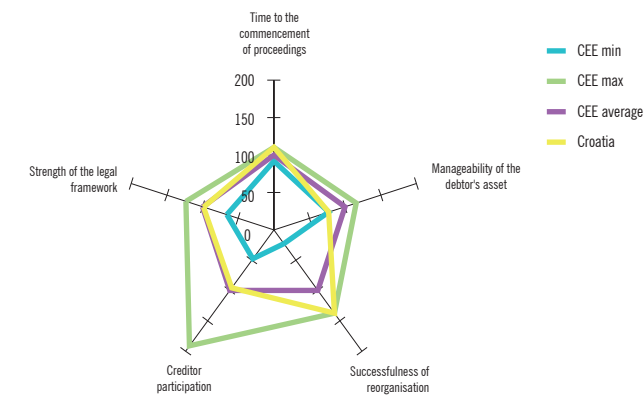
Source: CNB.

Figure 86 Assessment of the percentage of the recovery of claims on corporates and its components, as % of CEE average



Source: CNB.

Figure 87 Assessment of the strength of the legal framework for resolving insolvency of corporates, as % of CEE average



Source: CNB.

ernment. This particularly refers to large (public) enterprises. This sector requires individual creditworthiness assessments, but also provides an opportunity for cross-selling among small entities, which can also be profitable to banks. Nevertheless, although the non-financial corporate sector requires a smaller distribution network, risk assessment of clients still has to be made on an individual basis (Figures 81 and 82).

In addition to materialised credit risk, banks are still facing significant potential credit risk, while strategic risk for the banks also lies in their steadily decreasing interactions with the private sector. As a result, notwithstanding a somewhat lower debt repayment burden, which is the result of the deleveraging process and currently lower interest rates, bank clients continue to be exposed to significant currency and interest rate risks that may spill over to bank costs (for more details, see Box 2 Interest rate risk in the Republic of Croatia and the sections on the household sector and the non-financial corporate sector).

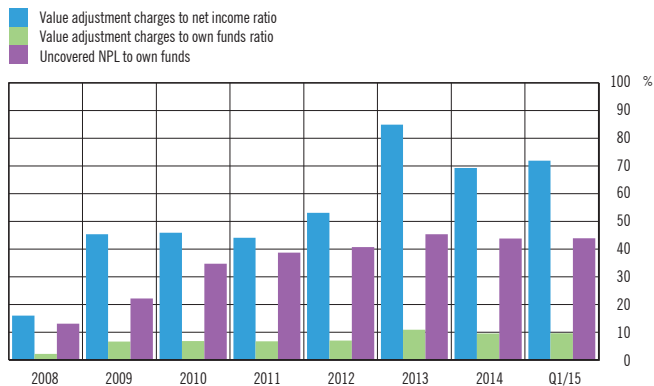
### Credit risk and capital adequacy

As a result of the growth in loans to the government, as well as the end of the rise in non-performing corporate loans, the non-performing loans ratio (NPLR) has held steady from September 2014 (Figure 83). The rise in non-performing loans slowed down after September 2014 and followed the rise in total loans, so that the NPLR held steady. This was mostly influenced by the growth in the share of loans to government units in total loans, which increased total loans, while the amount of non-performing loans remained stable. The amount of non-performing corporate loans ceased to grow so that the increase in loans to this sector triggered the fall in the NPLR in early 2015. By contrast, non-performing household loans steadily increased, as did their share in total loans. As a result of such developments, the total NPLR stood at 17.1% at end-March 2015; it was 30.6% in the corporate sector and 12.2% in the household sector (Figure 83).

The coverage of non-performing loans continued to grow due to ageing of existing non-performing loans and the application of amended rules on loan classification (after 2013). At end-March 2015, the coverage of total non-performing loans stood at 52.0%. As with the quality of the credit portfolio, the largest impact on the increase in the coverage of non-performing loans continued to be made by the corporate sector, where the NPL coverage has been steadily growing since the end of 2010. By contrast, the coverage of non-performing loans to the household sector remained within the range of 56% to 58%, where it has been ever since the end of 2013 (Figure 83). At the same time, differences across banks with regard to the quality of credit portfolios increased steadily, and were primarily a result of differences in portfolio structure and the inability of some banks to diversify their credit portfolios (Figure 84).

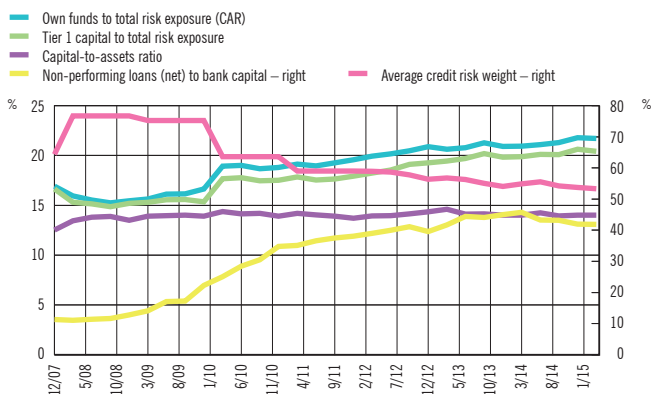
The resolution of the issue of non-performing loans continued to progress mostly through individual sales of parts of non-performing loans portfolios. As a result of the activities

Figure 88 Burden of value adjustment charges on bank income and capital



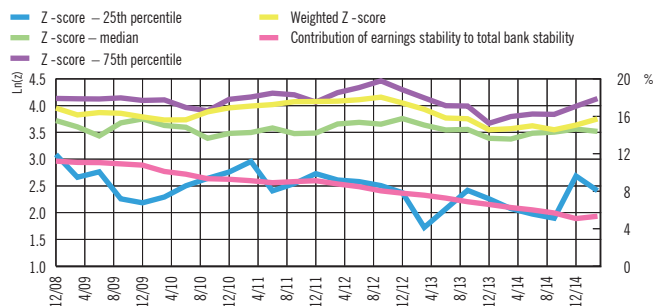
Source: CNB.

Figure 89 Capital adequacy ratios



Source: CNB.

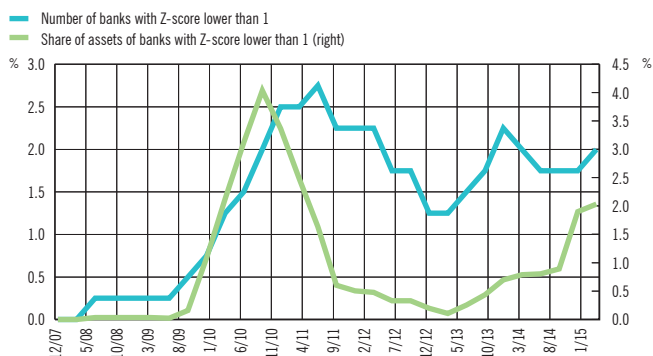
Figure 90 Structure and distribution of Z-score



The Z-score is a widely accepted indicator of the individual stability of banks and is calculated as:  $Z = (k + \mu) / \sigma$  in which  $k$  is the equity and assets ratio,  $\mu$  is the average indicator of ROA (in the last two years) and  $\sigma$  is the volatility of earnings (standard deviation of profitability of assets for the last two years). A higher score denotes a higher stability of the bank, i.e. a lower risk of bank failure. Also, the score can be divided into two components: earnings stability index and equity stability index.

Source: CNB.

Figure 91 Average number and share of assets of banks with a weakened solvency in the last year



Note: The value of Z-score of 1 was set as the threshold of a weakened solvency of banks. At this value, the level of earnings volatility is 100% of the sum of equity and bank's earnings which should provide hedge against this volatility.

Source: CNB.

taken so far, the burden on bank capital exerted by non-performing loans was reduced substantially. For example, had some non-performing loans not been sold, the NPLR would have been around 19.8% at the end of March 2015 (Figure 85). Still, it should be remembered that around 70% of all activities related to the resolution of non-performing loans relates to the sale to affiliated enterprises, while the share of “market solutions”, though increasing in 2014, remained relatively modest.

The international comparison of the World Bank<sup>13</sup> indicates that efficiency in the resolution of the issue of non-performing loans in Croatia is lower than elsewhere in Central and Eastern Europe (CEE); Croatia lags behind with regard to the recovery rate, while the strength of its legal framework is average. Although Croatia received the average score with regard to the cost and time of insolvency proceedings, its debt recovery rate received a below-average score due to the fact that insolvency proceedings are mostly commenced in relation to enterprises that discontinue operations. By contrast, Croatia was ranked as an average Central and Eastern European country with regard to the strength of its legal framework. However, although this publication provides a comparison of practices in the Republic of Croatia and similar countries, its results should be interpreted with caution as they are based on estimates, while the practical implementation of the regulations assessed may be different (Figures 86 and 87).

A better resolution of the issue of non-performing loans requires a comprehensive strategy that will not only stimulate banks to intensify their efforts in this area, but will also expedite the process and protect creditors in practice. The reasons for the relatively slow resolution of the issue of non-performing loans in Croatia are to be found in several circumstances. First, notwith-

13 The World Bank calculates the distance to frontier score for insolvency proceedings within its publication *Doing Business*. The index is composed of two components: the recovery rate and the strength of the legal framework. Croatia stands out among the Central and Eastern European countries as a country with a worse distance to frontier score.

standing the increase in the NPL coverage in the preceding two years, the net value of non-performing loans remained relatively high, which means that banks would have to suffer additional losses in the short run if the process of NPL resolution gains momentum. In addition, credit growth that would somewhat “dilute” the NPLR and stimulate bank earnings and capital has yet failed to materialise, while the relatively high current indebtedness of corporations and households leaves open the question of how high growth rates will be once lending activities gain momentum. Therefore, it is particularly important to continue work on the regulatory framework related to this process. In addition to more effective court practice, this refers to legal solutions regarding the process of pre-bankruptcy settlements and bankruptcy of natural persons, which are currently being drafted and which could be helpful in this process.

Value adjustment costs, though much lower than in 2013, remained at high levels. The annual value adjustment costs amounted to around 70% of the net income of banks, but the

potential shock of uncovered non-performing loans to capital has decreased since 2013 (Figure 88). In this way, the stable capital level and the rise in the coverage of non-performing loans have a favourable impact on financial stability. The stable capital level in the period of high materialised and potential risks is largely underpinned by current earnings of banks.

The sector capitalisation, measured in terms of the equity-to-assets ratio, supports the process of external deleveraging of banks and the continued lending to the government, which reduces the average risk weight. Coupled with value adjustment costs that are lower than in 2013, these processes led to the growth in medial bank stability measured by insolvency risk, and the growth in the contribution of stability of bank earnings to total stability (Figure 90). Nevertheless, at the same time the number and the share of banks with a Z-score below the defined threshold of weakened solvency increased in late 2014 and early 2015, so that the gaps between the banks continued to widen (Figure 91).

# Stress testing of credit institutions

Table 5 Macroeconomic scenarios

Macro scenario	Baseline scenario		Adverse scenario	
Indicators	2015	2016	2015	2016
Financing conditions on the foreign market				
ECB reference rate, %	0.05	0.05	0.05	0.05
EURIBOR (3M), %	0.01	0.06	0.81	0.86
GDP (real growth EU), %	1.80	2.10	-0.70	-1.40
Financing conditions on the domestic market				
Bond yields, change in p.p.	-0.15	0.29	1.62	0.29
Long-term interest rates, change in p.p.	-0.10	-0.01	-0.02	0.44
Short-term interest rates, change in p.p.	0.00	-0.01	0.34	1.49
Money market interest rate, change in p.p.	-0.13	0.05	3.52	2.40
Exchange rate				
EUR	7.63	7.63	8.01	8.40
CHF	7.26	7.30	7.65	8.09
Real sector				
Investment (private), real (yoy, %)	0.5	2.6	-1.4	0.0
Personal consumption, real (yoy, %)	0.4	0.3	-0.8	-2.4
GDP, real (yoy, %)	0.5	0.9	-0.5	-1.2
Unemployment rate (%)	18.6	18.4	18.7	19.1
Real estate prices (yoy, %)	-1.5	-3.3	-3.8	-5.7
Consumer prices (yoy, %)	0.0	1.2	0.3	5.0

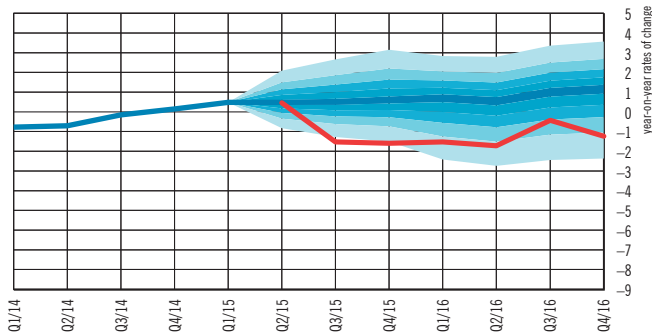
Source: CNB.

The results of integrated solvency and liquidity tests indicate that the domestic financial system is capable of withstanding highly unlikely but plausible shocks that could threaten the business continuity of credit institutions. This means that the current regulatory measures for protection against systemic risks are well calibrated and there is no need for instrument-tuning towards stricter capital and liquidity requirements. Nevertheless, the existing vulnerabilities in simulated stress conditions reveal that the reduction in individual sector risks is partly due to their reallocation, the transformation of their form and possible effects of their potential materialisation.

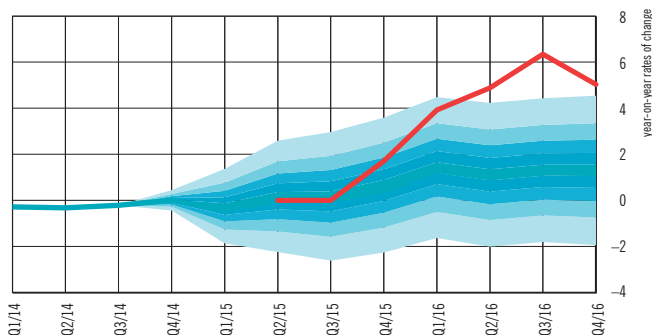
The CNB conducts stress testing of credit institutions on a semi-annual basis in order continuously to monitor changes in business conditions and systemic risks, and the ability of credit institutions to withstand unexpected losses that could generate those risks and thus threaten system stability. In the consistent macroeconomic framework, external and domestic market shocks simulated in this iteration do not represent simulation conditions significantly different to those in the previous version of the test. However, some specifics limit the possibility of comparison between the current and previous results, but at the same time enable more precise measurements of current risks. This primarily relates to: (i) a shorter simulation horizon, which now covers the period from the third quarter of 2015 to the end of 2016; (ii) the resulting different temporal distribution of shocks, of equal duration of four quarters, i.e. the distribution of the simulated shock to solvency and liquidity of banks in the

Figure 92 Adverse scenario probability

a) GDP dynamics under the adverse scenario relative to the risks of materialisation of the baseline scenario



b) Consumer price dynamics under the adverse scenario relative to the risks of materialisation of the baseline scenario



Note: The baseline scenario is in line with the monetary projection of the CNB; the red colour represents the path of the underlying variable under the adverse scenario.

Source: CNB.

second quarter of 2015 and the first half of 2016; and (iii) minor adjustments to the methodological framework<sup>14</sup>.

The expected developments in the economy, which inform the baseline scenario used in this test, are based on the CNB's monetary projection<sup>15</sup> and on the assumption of stable financing conditions in foreign markets and stable growth of the European economy, which is expected to have a positive impact on domestic real activity as well. However, these stimuli are still in-

<sup>14</sup> The model for bank earnings was amended for the purpose of this simulation so as to achieve a greater degree of harmonisation with the credit risk models and liquidity parameters, while the impact of exchange rate fluctuations was transferred more precisely to provisioning costs in the income statement, which arise from old non-performing placements for which provisions for potential losses had already been set aside (for basic methodological remarks, see *Financial Stability*, No. 14, Box 5 New methodological approach to stress testing).

<sup>15</sup> CNB Bulletin, No. 216, Year XXI (<http://www.hnb.hr/publikac/bilten/arhiv/bilten-216/ebilt216.pdf>).

sufficient to reverse recessionary trends, i.e. to restrain strongly the disequilibrium processes in the economy, particularly in private sector capital investment and employment, which would provide a stronger boost to aggregate demand. This is also reflected in a relatively high level of risk premium for Croatia compared with its Central and Eastern European peers. Furthermore, the projection implies a reduction in current government consumption and the continuance of relatively favourable borrowing conditions in international markets (EDP).

The simulation of stress conditions in this iteration also reflects a sudden decline in the global risk appetite associated with financial turbulence and accompanied with the unsuccessful expansionary monetary policy measures of the ECB. In particular, the extended bond purchase programme in the secondary market and the potential continuance of tensions related to the solution of the Greek crisis could lead to rapid cross-currency changes, significantly raise financing costs and, in view of larger liquidity and uncertainty, create additional inflationary pressures that would spill over directly to peripheral economies. These processes would weaken domestic demand in the euro area countries, some of which would also experience a fall in foreign demand as well as potential economic consequences of geopolitical conflicts, such as the one between Ukraine and Russia. A renewed economic contraction expected in the euro area, characterised by new tensions in financial markets, would considerably and immediately diminish prospects for a Croatian economic recovery, the beginning of which remains burdened by numerous structural vulnerabilities.

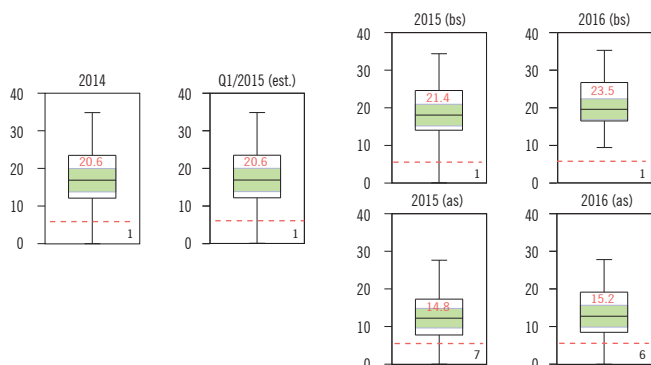
The consequent decrease in aggregate income in the domestic economy would average  $-0.9\%$  in the simulation horizon (compared with the expected slight growth of  $0.7\%$ ) and thus lead to lower tax revenues, which would imply deficit growth in the absence of rapid and significant cuts in budget expenditures. The growth of the already high budget deficit coupled with the accumulated relatively high public debt becomes a significant source of instability, with a probable spillover onto the private sector. These vulnerabilities are evident in the existing differences in risk premiums, which would suddenly increase in newly-created circumstances. This implies an increase of 177 basis points in yields on government bonds under the adverse scenario, which corresponds to a haircut of the government portfolio of 7% on average, and potential banking sector losses on this basis.

The intensity of financial stress under the described scenario would be high and further enhanced by potential capital outflows from peripheral European Union economies, the impact of which was simulated by larger net outflows from subsidiary banks to parent institutions outside Croatia. These imbalances would affect foreign exchange liquidity, while the growing lack of confidence in the domestic currency would also create significant exchange rate volatility. An exchange rate shock of 10% for the euro and of 28% for the Swiss franc in the third quarter of 2015 was simulated (based on the previous most unfavourable ratio of the Swiss franc to the euro induced by the shift in the Swiss central bank's policy in early 2015). At the



Figure 93 Solvency and liquidity of credit institutions under the baseline and adverse scenario

a) Capital adequacy



b) Liquidity coverage



Note: a) The red line shows the threshold value of the capital adequacy ratio of common equity tier 1 capital (6.5%), i.e. the liquidity coverage ratio (100%); b) The red colour represents the liquidity coverage ratio, i.e. the capital adequacy ratio on system level (based on the consolidated balance sheet, while for individual institutions, the negative accounting values of capital were reduced to zero); c) The number of institutions which have not passed the test (in the solvency and liquidity block) is shown in the lower right angle. Source: CNB.

same time, the interest rates on the money market would jump, initially by 730 basis points in the third quarter of 2015, which implies that the average increase through to the end of the year would exceed 350 basis points.

These developments would push upwards the costs of financing corporate and household sectors, which, though deleveraging, still carry a relatively high debt burden. This would in turn weaken domestic aggregate demand and increase the snowball effect risk, and significantly impair recently improved market sentiment (of both the household and the corporate sector). Such developments would also be supported by balance sheet effects in view of the fact that private sector exposure to currency risk, though decreasing, is still relatively high. In contrast to the baseline scenario, the adverse scenario conservatively assumes that the interested parties in the case of Swiss franc loans would be unable to reach a swift agreement, which would create a new risk for regular repayment of such loans should a market exchange rate be applied in 2016. All this would con-

siderably negatively affect the financial availability of residential real estate, which would further deepen the illiquidity in the real estate market. However, as the indicators of real estate overvaluation still do not show that there is a potential problem of such nature, the price correction is relatively mild (-2.4% on average). However, it should be borne in mind that this reduces the function of real estate as high quality collateral, with a negative feedback on real developments.

The joint probability of a thus-formulated adverse scenario (quantitative elements are shown in Table 5) is acceptably small, as the probabilities of materialisation of negative risks for the expected economic growth and inflation in the projection horizon are in the lower part of the distribution (Figure 93). The stress conditions are similar to those in the preceding simulation exercise. In particular, the testing is being conducted on credit institutions whose capital reserves have been exhausted by the blows of the crisis for seven years. This resulted in bankruptcy proceedings in three banks (the last one was in 2014), while two institutions until recently had significant difficulties in complying with own funds standards and needed capital injections. Around one third of credit institutions continue to report losses, which diminishes their capacities to absorb new shocks. The opposite effect was made by macroprudential and supervisory measures in 2014, coupled with the policy of accelerated provisions introduced in 2013, which still ensures higher coverage of non-performing placements by value adjustments and thus diminishes the negative effects of a potentially inadequate internal asset quality assessment, also reducing the risks of underestimation of losses that may arise as a result of portfolio ageing. The strategic orientation towards lending to the government stabilised earnings in most institutions and reduced the share of risky assets, and temporarily lifted the burden on capital and strengthened liquidity, but opened at the same time a channel for the transmission of potential market risks.

The simulated stress conditions result in a deterioration of the quality of the bank credit portfolio, which mostly burdens own funds and, since the testing excludes the potential effects of an asset increase (dilution effect), recapitalisation and write-offs or sale of non-performing loans, the NPLRs continue to increase under both scenarios, though, as expected, at a different pace. Under the baseline scenario, the ratios of total non-performing loans thus go up from 17.1% in the first quarter of 2015 to 18.8% in 2015 and to 20.5% by the end of 2016. This certainly reflects slower economic growth and relatively large imbalances, as well as the absence of credit growth that could reduce the NPLR through the dilution effect. By contrast, the NPLR is some 4 percentage points higher under the stress scenario, standing at 24.5% at the end of the simulation horizon. Such dynamics of non-performing loans is largely generated by a deterioration in the quality of the corporate portfolio, where the NPLR would grow to 38.6% under the baseline scenario and to 47.3% under the adverse scenario by the end of 2016. Consumer and housing loans react much slower. Under the baseline scenario, the ratio of non-performing consumer loans grows from 15.0% to 15.6% by the end of 2016, and by an additional 2 percentage points under the adverse scenario. A

somewhat weaker effect is observed for housing loans, which have so far exhibited the lowest degree of risk and for which the NPLR would grow from 9.1% in the first quarter of 2015 by less than 1 percentage point through to the end of 2016. The most recent amendments to the Consumer Credit Act also contributed to the lower elasticity of such loans. However, under the adverse scenario they would for the first time exceed the 10% NPLR threshold (amounting to 10.6% at end-2016).

Value adjustment costs grow moderately under the baseline scenario (less than the costs recorded in 2014), while gross earnings remain relatively stable and effectively protect the level of bank capitalisation, which drifts up from 20.6% in the first quarter of 2015 to 21.4% in 2015 and to 23.5% in 2016. Under the adverse scenario, earnings decline cumulatively in 2015 and 2016 by approximately one-third compared to the baseline scenario, while provisions are doubled, though primarily in the period of the initial application of real and financial shocks in 2015.

The stress testing exercise shows that credit institutions still demonstrate satisfactory capacities to absorb potential losses as capitalisation of the system remains above 15% on average. Nevertheless, a small number of institutions show certain weaknesses and indicate the need for special attention from the regulator. Under the projected adverse conditions, the adequacy rate of the Common Equity Tier 1 capital would drop to below the critical value (6.5%) in seven credit institutions.

At the end of 2014, the domestic financial system was assessed as highly liquid, as the new prudential requirement (LCR), introduced in the second half of 2015, stood at a satisfactory 190%, which is similar to the currently available alternative indicators of short-term liquidity. However, for one fifth of credit

institutions, in that period surplus liquidity outflows relative to inflows exceeded the value of the currently available liquidity buffer. Parallel to the previously mentioned decrease in capitalisation under stress conditions, the number of such institutions steadily grows during all phases of the simulation, and doubles by the end of the one-year stress period. At system level, the LCR falls to 95% towards the end of the first half of 2016. The initial liquidity shocks are, by means of changed market conditions, transferred endogenously to the balance sheets of all banks in the system causing secondary, systemic effects (indirect contagion risk). Alongside systemic effects, a certain number of banks would be faced with the materialisation of idiosyncratic reputation risk. The mentioned secondary systemic effects in the simulation, among other things, depend on the number of banks that become more vulnerable in terms of liquidity after the initial shocks. This number would grow much more than in the previous iteration of the stress testing exercise, which means that liquidity shocks were somewhat stronger. Finally, the strongest decrease is recorded in estimated outflows of credit institutions.

The adverse scenario presented may serve as a basis for an assessment of the amount and quality of existing capital and liquidity buffers. The results of integrated solvency and liquidity tests indicate that the domestic financial system is capable of withstanding highly unlikely but plausible shocks directly threatening the business continuity of credit institutions, on the basis of both solvency and liquidity risks. This means that the current regulatory measures for protection against systemic risks are well calibrated and there is still no need for instrument-tuning towards stricter capital and liquidity requirements. The quantification of capital deficit within the system shows that additional capital and liquidity requirements to compensate for the simulated deficits are still not significant.

## List of figures and tables

Figure 1 Financial stability map	7	Figure 27 Maturity breakdown of public debt	20
Table 1 Economic growth, exports and industrial production in selected developed and emerging market countries	10	Figure 28 Currency breakdown of public debt	20
Figure 2 Economic sentiment and business confidence indices	10	Table 4 Thresholds of the fiscal sustainability risk indicator in 2015	20
Figure 3 Key interest rates of the main central banks and leading market interest rates	10	Figure 29 Yield on primary issue of euro and euro-indexed securities	21
Table 2 Fiscal balance and current account balance in selected developed and emerging market countries	11	Figure 30 General government deficit	21
Figure 4 CDS spreads for 5-year bonds of selected euro area countries	11	Figure 31 Financing needs	21
Figure 5 CDS spreads for 5-year bonds of selected banks	11	Figure 32 Projection of public debt under various scenarios	21
Figure 6 CDS spreads for 5-year bonds of selected emerging market countries	11	Figure 33 Public debt growth rate (2009 – 2015)	22
Figure 7 Yields on Croatian and benchmark German bonds maturing in 2018 and their spread	12	Figure 34 Average remaining maturity of general government debt	22
Figure 8 Capital inflows to European emerging market countries	12	Figure 35 General government interest expenses	22
Figure 9 Foreign capital inflows and GDP growth in Croatia	12	Figure 36 Change in and stock of household debt	23
Table 3 Public and external debt in selected European emerging market countries	12	Figure 37 Change in and stock of household financial assets	23
Figure 10 GDP growth pattern (contribution to growth)	13	Figure 38 Household financial assets	24
Figure 11 Savings and investment – total and by sector	13	Figure 39 Household loans by purpose	24
Figure 12 External debt by domestic institutional sector	13	Figure 40 Annual rate of change in debt and loans	24
Figure 13 Total external debt by creditor	14	Figure 41 Maturity breakdown of newly-granted household loans, adjusted by seasonal fluctuations	25
Figure 14 Short-term external debt	14	Figure 42 Newly-granted long-term household loans by purpose, adjusted by seasonal fluctuations	25
Figure 15 Selected indicators of external vulnerability	14	Figure 43 Change in household lending criteria in the last three months	25
Figure 16 Projection of external debt principal payments in 2015 by sectors	14	Figure 44 Employment and wages (seasonally adjusted)	25
Figure 17 Yield curves of Croatian bonds issued on the domestic and foreign markets by currency	14	Figure 45 Currency breakdown of household loans	25
Figure 18 Optimal international reserves – contribution of individual components	14	Figure 46 Household loans by interest rate variability	25
Figure 19 Real kuna/euro exchange rate	15	Figure 47 Household debt and debt burden	26
Figure 20 Unit labour cost	15	Figure 48 Indicators of vulnerability in the household sector	26
Figure 21 Total debt by sector	15	<b>Box 2</b>	
Figure 22 Kuna/euro and kuna/Swiss franc exchange rates and overnight interest rates	15	Figure 1 Trends in selected rates	28
Figure 23 Changes in employment registered with the Croatian Employment Service (CES)	15	Figure 2 Structure of household loans according to interest rate variability (left) and reference rates at end-February 2015 (right)	29
<b>Box 1</b>		Figure 3 Trends in reference interest rates according to the trends in the overall level of deposit rates	29
Figure 1 Three-dimensional examination of systemic risks	17	Table 1 Advantages and disadvantages of the NRR and EURIBOR from the perspective of clients and banks	29
Table 1 Risk assessment based on individual indicators	17	Table 2 Loans according to level of exposure to interest rate risk	30
Figure 2 Exposure of the domestic economy to systemic risks	18	Figure 4 Interest rate risk in the non-trading book	30
Figure 24 General government debt	19	Table 3 Measures which banks may take to reduce clients' exposure to interest rate risk in Croatia	31
Figure 25 General government deficit	19	Figure 49 Annual change of the real estate sector debt	32
Figure 26 Public debt	20	Figure 50 Household debt, unemployment rate, consumer optimism and real estate market expectations	32
		Figure 51 Housing loans and HREPI on a quarterly basis	33
		Figure 52 Comparison of interest rates on newly-granted housing loans in Croatia and the euro area	33
		Figure 53 Financial availability of residential property	33

Box 3		Figure 72 Liquidity indicators	47
Figure 1 Number of realised purchases and number of completed dwellings	34	Figure 73 Weighted average maturity of bank assets and liabilities and their spread	47
Figure 2 Average time on the residential real estate market	35	Figure 74 Bank exposure to direct risks	47
Figure 3 Comparison of the constructed index with survey data on market liquidity	35	Figure 75 Share of unhedged loans in total loans exposed to CICR	47
Table 1 Results of the assessed model	36	Figure 76 Change in selected business performance indicators	47
Figure 54 Indebtedness of the non-financial corporate sector	37	Figure 77 Indicators of returns	48
Figure 55 Change in and stock of non-financial corporate debt	37	Figure 78 Selected interest rates (quarterly average of monthly interest rates)	48
Figure 56 Annual growth rate of non-financial corporate debt	38	Figure 79 Decomposition of the change in the return on assets	48
Figure 57 Year-on-year growth rates of domestic banks' external debt and loans by activity in the period from 31 March 2014 to 31 March 2015	38	Figure 80 Share of short-term loans in total newly-granted loans (quarterly average)	48
Figure 58 Change in credit standards and demand for loans to corporates	38	Figure 81 Structure of banks' net operating income by sectors, end-2014	49
Figure 59 Newly-granted bank loans and absolute change in the stock of gross loans	38	Figure 82 Change in bank profitability in various segments of financing in the period of crisis	49
Figure 60 Breakdown of newly-granted loans to non-financial corporations by maturity and currency	39	Figure 83 Ratio of non-performing loans to total loans by sectors	49
Figure 61 Share of corporate non-kuna debt in total loans	39	Figure 84 Distribution of the ratio of non-performing loans	49
Figure 62 Currency exposure in March 2015	39	Figure 85 Resolution of the issue of non-performing loans in banks	50
Figure 63 Breakdown of bank loans to non-financial corporations by interest rate variability	40	Figure 86 Assessment of the percentage of the recovery of claims on corporates and its components, as % of CEE average	50
Figure 64 Interest rates on long-term loans to non-financial corporations in Croatia and the euro area	40	Figure 87 Assessment of the strength of the legal framework for resolving insolvency of corporates, as % of CEE average	50
Figure 65 Interest rates on short-term loans to non-financial corporations in Croatia and the euro area	40	Figure 88 Burden of value adjustment charges on bank income and capital	51
Figure 66 Indicators of vulnerability in the corporate sector	40	Figure 89 Capital adequacy ratios	51
Box 4		Figure 90 Structure and distribution of Z-score	51
Table 1 Model results by segments	42	Figure 91 Average number and share of assets of banks with a weakened solvency in the last year	51
Figure 1 Procedure of estimating LGD	43	Table 5 Macroeconomic scenarios	53
Table 2 Expected losses and NPPR	44	Figure 92 Adverse scenario probability	54
Figure 67 Selected developments in the banking sector	45	Figure 93 Solvency and liquidity of credit institutions under the baseline and adverse scenario	55
Figure 68 Year-on-year growth in major banking sector balance sheet items	45		
Figure 69 Structure and price of banking sector liabilities	46		
Figure 70 Banking sector assets	46		
Figure 71 Net financial position of banks with respect to foreign owners	46		

## Abbreviations and symbols

### Abbreviations

bn	– billion
CAR	– capital adequacy ratio
CBS	– Central Bureau of Statistics
CCE	– Croatian Chamber of Economy
CDCC	– Central Depository & Clearing Company
CDS	– credit default swap
CEE	– Central and Eastern European
CES	– Croatian Employment Service
CICR	– currency-induced credit risk
CIHI	– Croatian Institute for Health Insurance
CM	– Croatian Motorways
CNB	– Croatian National Bank
CPII	– Croatian Pension Insurance Institute
DAB	– State Agency for Deposit Insurance and Bank Resolution
EAD	– exposure at default
EBA	– European Banking Authority
EBITDA	– earnings before interest, taxes, depreciation and amortisation
EC	– European Commission
ECB	– European Central Bank
EFSF	– European Financial Stability Facility
EIZG	– Institute of Economics, Zagreb
EMBI	– Emerging Market Bond Index
EMU	– Economic and Monetary Union
EONIA	– Euro Overnight Index Average
ERM	– Exchange Rate Mechanism
ESM	– European Stability Mechanism
EU	– European Union
EULIBOR	– Euro London Interbank Offered Rate
EUR	– euro
EURIBOR	– Euro Interbank Offered Rate
f/c	– foreign currency
FDI	– foreign direct investment
Fed	– Federal Reserve System
FINA	– Financial Agency
FRA	– Fiscal Responsibility Act
FSI	– financial soundness indicators
GDP	– gross domestic product
GFS	– Government Finance Statistics
HANFA	– Croatian Financial Services Supervisory Agency
HBS	– Household Budget Survey
HH	– households
HREPI	– hedonic real estate price index
HRK	– Croatian kuna
IBIR	– interbank interest rates

ILO	– International Labour Organization
IMF	– International Monetary Fund
LTIR	– long-term interest rates
m	– million
MoF	– Ministry of Finance
MRR	– marginal reserve requirements
NFC	– non-financial corporations
NPLR	– ratio of non-performing loans to total loans
OECD	– Organisation for Economic Co-operation and Development
ON USLIBOR	– overnight US dollar London Interbank Offered Rate
pp	– percentage points
RC	– Republic of Croatia
ROAA	– return on average assets
ROAE	– return on average equity
RR	– reserve requirements
SDR	– special drawing rights
yoy	– year-on-year
ZIBOR	– Zagreb Interbank Offered Rate
ZSE	– Zagreb Stock Exchange

### Two-letter country codes

BA	– Bosnia and Herzegovina
BG	– Bulgaria
CZ	– Czech Republic
EE	– Estonia
HR	– Croatia
HU	– Hungary
LT	– Lithuania
LV	– Latvia
MK	– The former Yugoslav Republic of Macedonia
PL	– Poland
RO	– Romania
SI	– Slovenia
SK	– Slovak Republic

### Symbols

–	– no entry
....	– data not available
0	– value is less than 0.5 of the unit of measure being used
Ø	– average
a, b, c,...	– indicates a note beneath the table and figure
*	– corrected data
( )	– incomplete or insufficiently verified data





