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**The Bank of Finland's
banking sector forecast
model**

Hanna Putkuri

The opinions expressed in this paper are those of the author and do not necessarily reflect the views of the Bank of Finland.



Bank of Finland

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Abstract

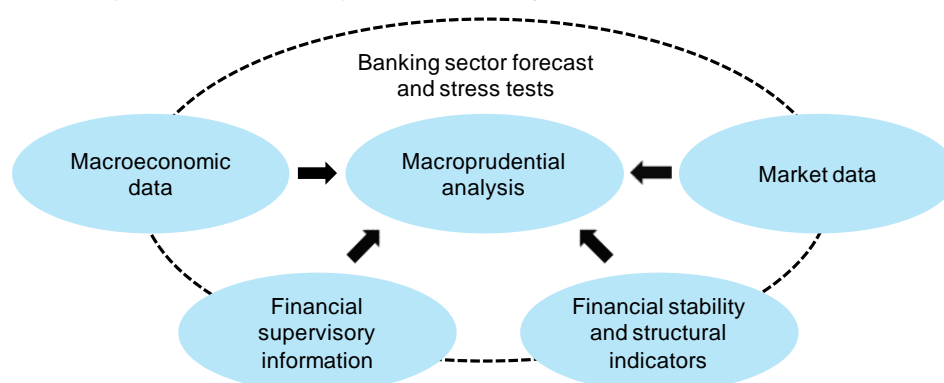
This paper documents the present "state of the art" of the Bank of Finland's banking sector forecast model. The purpose of the model is to assist in forecasting the aggregate profitability and solvency of the Finnish banking sector over a two- to three-year horizon. The banking sector forecast procedure is an integral part of the Banks' macroprudential and financial stability analysis. It incorporates into one framework both the supervisory information of the Finnish Financial Supervisory Authority and the forecast for the Finnish economy based on the Bank's macroeconomic model. Further development of bank analysis models is one of the Bank's key development projects. This is a long-term process in which several alternative approaches can be put forward.

1 Introduction

The Bank of Finland's strategic goal is to promote stability both as Finland's monetary authority and as a member of the Eurosystem.¹ The Bank's statutory tasks include the participation in the maintenance and development of a reliable and efficient payment system and overall financial system.² The Bank exercises this role by providing reliable and timely financial stability analysis, embracing the entire financial system and integrated with the Bank's macroeconomic analysis and contingency planning against financial crises. There is no single established definition of financial stability, but a stable financial system is widely seen as a prerequisite for price stability, the primary objective of the Eurosystem, and the broader macroeconomic goals of economic growth and employment.

In pursuance of financial stability, central banks have become increasingly active in developing tools for so-called macroprudential analysis. According to the ECB (2004), the purpose of this analysis is "to assess the stability of the financial system as a whole and to describe the threats to it that could result from common shocks that affect either many or all financial institutions at the same time, or from shocks that could spread from one institution to another" (ie contagion). One key aspect of this overall surveillance and analysis of the financial system is combining quantitative and qualitative information on the financial markets, macroeconomic developments and individual financial institutions (Chart 1).

Chart 1. Data components of macroprudential analysis



Source: Modification of IMF (2001), figure 1.

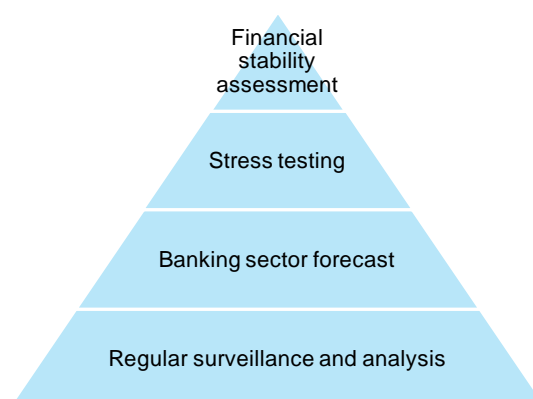
¹ For more on the Bank of Finland's strategy, see http://www.bof.fi/en/suomen_pankki/tehtavat/strategia.htm.

² See the Act on the Bank of Finland (214/1998) and the Statute of the European System of Central Banks and of the European Central Bank.

At the Bank of Finland, macroprudential analysis of the domestic banking sector largely consists of four main components (Chart 2):

1. Regular surveillance and analysis of financial market developments
2. Banking sector forecast
3. Stress testing of the financial system
4. Financial stability assessment (on the basis of components 1–3)

Chart 2. Banking sector forecast as part of macroprudential analysis



The aim of this paper is to document and take stock of the current situation regarding the second component, ie the forecast of the aggregate profitability, and to some extent, solvency of the Finnish banking sector.³ The forecast is produced four times a year, in close connection with the Bank's macroeconomic forecast and in close cooperation with the Finnish Financial Supervisory Authority (FSA).

The main purpose of the banking sector forecast is to provide a coherent picture of the present state and near-term prospects of the Finnish banking sector. The forecast focuses on the aggregate banking sector developments but the analysis combines both macro- and microprudential aspects. The written forecast report reviews recent economic and financial market trends and presents the expected outlook for the present and two subsequent calendar years. The forecast itself describes the most probable developments, but key uncertainties relating to the outlook are also discussed in the report.

The banking sector forecast framework also lends itself for aggregate level macro stress testing, which aims at measuring the ability of the banking system to withstand exceptional but plausible macroeconomic shocks or simulated risk scenarios (Sorge and Virolainen 2006). At the Bank of Finland, these stress tests are conducted regularly in cooperation with

³ When applicable, the paper builds on prior documentation by Andersen et al (1999), Mörttinen (2001) and Virolainen (2001).

the FSA (previously with the Financial Supervision Authority and the Insurance Supervision Authority), so as to enable to obtain a picture of the stress-bearing ability of the financial sector as a whole. The key purpose of stress testing is to help the authorities to identify structural vulnerabilities and overall risk exposures that could lead to systemic problems. The Bank's macroeconomic model provides input for both the baseline forecast and the analysis of alternative risk scenarios.

Last but not least, an important aspect of the banking sector forecast framework is that it serves as a useful educational tool. By participating in the forecast process, it is relatively easy for new staff to become acquainted with the functioning of the banking sector and its relationship with key macroeconomic developments.

The origins and development of the present banking sector forecast procedure date back to the early 1990s when the Finnish economy underwent an exceptionally severe recession. The following banking crisis was much deeper than in the other Nordic countries, and at that time, there was an obvious need for ex ante contemplation of developments in the banking system.⁴ Although forecasts of profitability and solvency were initially based almost entirely on qualitative analysis, it soon became evident that it would be useful to have a more structured forecast procedure. In 1993, when the FSA was established as an independent authority in connection with the Bank, the FSA adopted a computational framework for forecasting disaggregated profitability and solvency items, such as bank-level credit losses and non-performing loans. It was contemplated that eventually behavioural econometric equations would be used to augment the model, but this was never done in a systematic way. In the mid-1990s, the bank-level model gradually diminished in importance, and the forecast procedure evolved so as to focus on industry-level developments. (Andersen et al 1999)

Globally, the Financial Sector Assessment Program (FSAP), a joint IMF and World Bank initiative introduced in 1999, has acted as an important driving force for the development of financial stability analysis with a more quantitative approach. The main focus has been on indicators of financial sector soundness and their links to macroeconomic developments.⁵ Recently, motivated by the ongoing global financial and economic crisis, the need for macroprudential supervision has been stressed both by academics and policymakers (see eg Brunnermeier et al 2009 and de Larosière Group 2009).

⁴ For further details on the Nordic financial crises, see eg Honkapohja (2009).

⁵ For further details, see eg World Bank and IMF (2005). For updated information, see <http://www.imf.org/external/NP/fsap/fsap.asp>.

The remainder of this paper is organised as follows. Section 2 provides a general description of the forecast procedure and the various steps involved. Sections 3–5 describe the forecast process in more detail by focusing on key interest rates, balance sheet items and profit and loss account items, respectively. Finally, section 6 concludes.

2 General description of the forecast procedure

2.1 Overview

The banking sector forecast is prepared at the Bank of Finland's Financial Stability Division in collaboration with an expert team from the Finnish Financial Supervisory Authority (FSA). The forecast report is confidential, and it is distributed only within a specified group of people at the Bank and the FSA. In practice, the forecast procedure takes about 2 to 4 weeks and involves several steps, as listed in Box 1.

The basic idea behind the forecast is to assess the impact on the Finnish banking sector of recent and expected developments in banks' operating environment, including both macroeconomic and regulatory aspects. Twice a year, in spring and autumn, the forecast is conditional on the Bank's public forecast for the Finnish economy, prepared at the Banks' (macro) Forecasting Division with assistance of the Bank's macroeconomic model.⁶ In summer and winter, the banking sector forecast is revised only qualitatively, ie the forecast report gives only a non-quantitative assessment on how plausible the latest forecast appears based on new macro and financial market information and in which direction the forecast should be revised, if necessary.

The forecast process can be briefly summarised as follows (Chart 3). Starting from the end, the target forecast variables are the aggregate profitability, and to some extent, solvency of the Finnish banking sector. Profitability is measured by the aggregate pre-tax profit (loss) of the banking sector, while solvency is discussed in terms of capital adequacy and buffers against losses.

Forecasts for the main target variables are produced using a set of sub-target forecast variables, including the key profit and loss account items: (1) net interest income, (2) non-

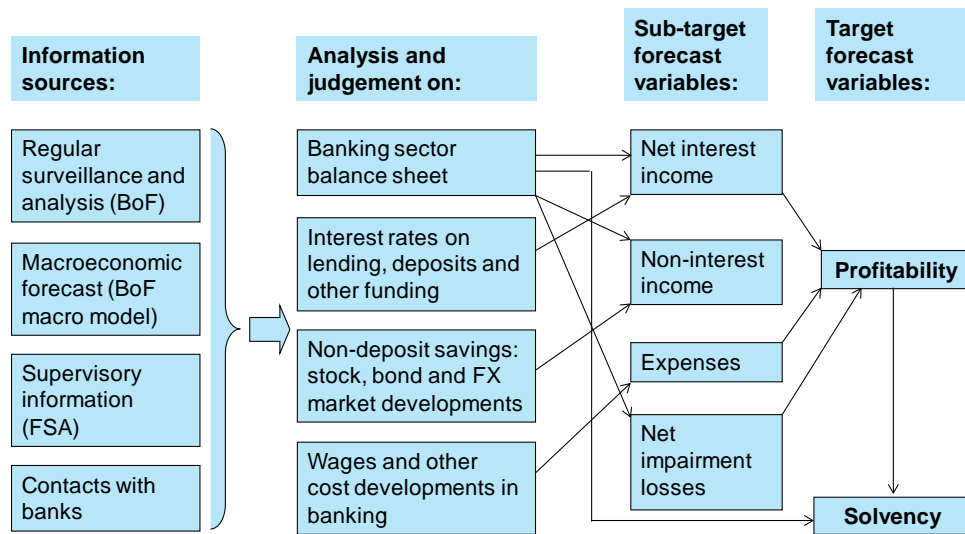
⁶ For a general description of the Bank of Finland's DSGE model Aino, see Kilponen et al (2004).

interest income, (3) expenses, and (4) net impairment losses on loans and other receivables. Forecasts are based on a mixture of qualitative and quantitative information on individual banks and broader financial market developments. Key components of the analysis include market interest rate expectations and forecasts on bank balance sheet developments. The P & L account is discussed in greater detail in section 5, while the key interest rates and balance sheet items are discussed in sections 3 and 4.

Box 1. Forecast process in practice

1. Establish a forecast team (incl. experts from the Bank's Financial Stability Division and the FSA's Financial Analysis Division) and a steering group (incl. respective department and division heads)
2. Set up a timetable
3. Update data files (average interest rates, aggregate balance sheet, and aggregate profit and loss account)
4. 1st round
 - Run estimations based on the latest macro forecast: bank interest rates, deposits
 - Hold a meeting among the forecast team to discuss eg profit and loss account items
 - Draft the forecast report and distribute the first version to the steering group
 - Hold a meeting among the forecast team and steering group to discuss the first version of the forecast
5. 2nd round
 - Run new estimations in case the macro forecast has been revised
 - Revise the forecast numbers and redraft the forecast report based on comments and new data
 - Distribute the second version to the steering group for (written) comments
6. 3rd round
 - Finalise the forecast report based on comments and new data
 - Distribute the final digital version of the report to a specified group of people within the Bank and the FSA

Chart 3. Banking sector forecast process



2.2 Scope of the forecast

In the context of the forecast, the Finnish banking sector is defined to consist of Finnish banks and banking groups and foreign credit institution branches that engage in deposit banking in Finland. The forecast population, by and large, corresponds to the Finnish monetary financial institution sector.⁷ Some banking groups offer also a range of asset management and insurance services which are currently included in the forecast. At present, the forecast covers:

- Nordea Bank Finland Plc (Group); a subsidiary of Swedish Nordea Bank AB (publ)
- OP-Pohjola Group
- Sampo Bank Plc (Group); a subsidiary of Danish Danske Bank
- Aktia Plc (Group)
- Savings banks (solo basis)
- Local cooperative banks (solo basis)
- Bank of Åland Plc (Group)
- A number of smaller domestic banks (Groups)
- Branches of foreign banks entitled to take deposits in Finland

⁷ MFIs (excl. Bank of Finland) comprise deposit banks, other credit institutions and money market funds, as laid down in ECB regulations.

The relative size of the banks and banking groups is depicted in Chart 4 and Chart 5 in terms of their balance sheet totals and income. The banking sector is highly concentrated as the three largest groups account for more than 80 % of the market. In terms of loans and deposits, the market share of the three largest is slightly less than 80 %.⁸

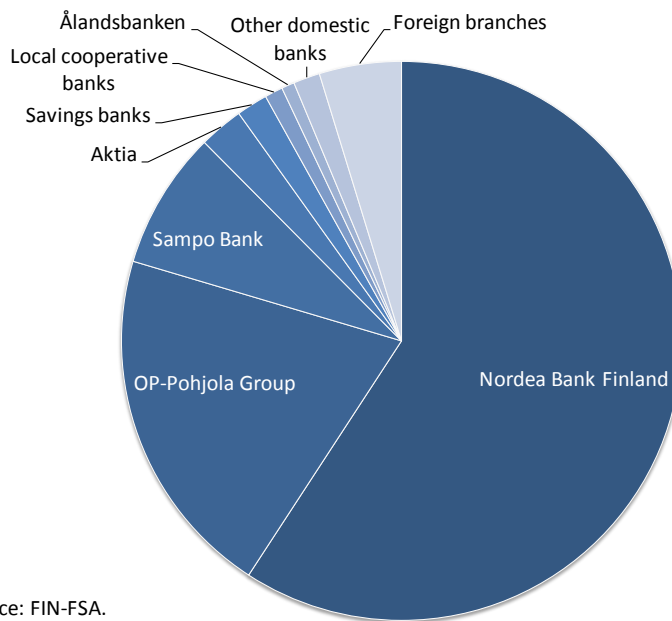
The Finnish banking sector has undergone considerable changes since the banking crisis of the early 1990s. Likewise, the forecast population has been revised several times in the past, along with consolidation and restructuring of the banking sector. The current forecast aggregate has been in use since 2005, when the foreign credit institution branches and subsidiaries were first taken into account. Since then the aggregate has only been complemented with some new banks established in recent years.

Apart from analysing the banking system as a whole, it is also important to detect any vulnerabilities arising from individual bank behaviour and performance of different business areas. Cross-industry (banking and insurance) and cross-border (Nordic-Baltic) integration has given rise to financial conglomerates which operate in several countries. Separate group-level forecasts for the biggest financial groups operating in Finland were introduced in 2004 to supplement the aggregate banking sector forecast.⁹

⁸ The year-end market shares of Finnish MFIs in euro-denominated loans and deposits are published by the Federation of Finnish Financial Services.

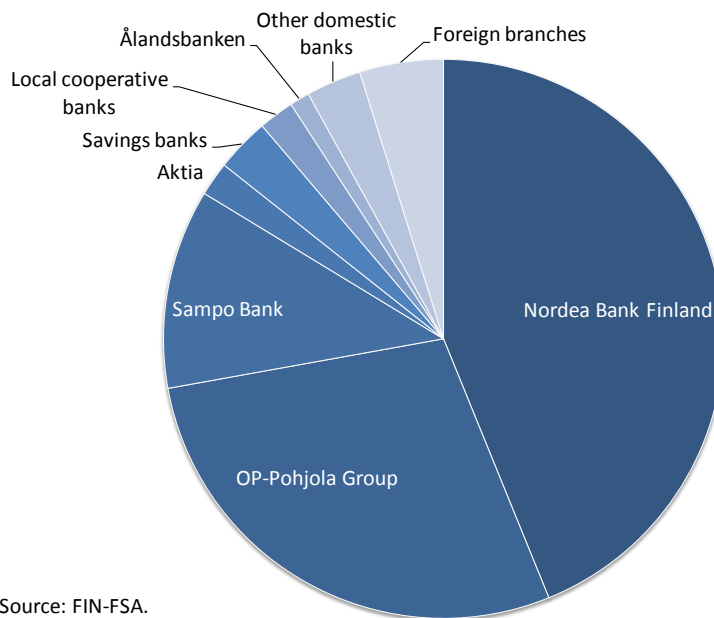
⁹ At the time, Nordea Bank Finland was not included in the aggregate banking sector forecast due to previous data-related problems. This was due to the fact that in 2001–2002 the banking activities of the holding company Nordea were concentrated in Nordea Bank Finland Group, ie Nordea Bank Danmark, Nordea Bank Norge and Nordea Bank Sverige were Nordea Bank Finland's subsidiaries.

Chart 4. Relative size of deposit banks in terms of total assets, 31 Dec 2008



Source: FIN-FSA.

Chart 5. Relative size of deposit banks in terms of total income, Jan-Dec 2008



Source: FIN-FSA.

3 Interest rates and interest rate margins

The banking sector forecast is based on the same view of future market interest rate developments as the Bank of Finland's baseline macroeconomic forecast. The macro forecast is market-based in that the interest rate assumptions are estimated from market expectations on the basis of publicly quoted interest rate futures on a specific date. As this assumption is purely technical, it does not reflect the forecast team's expectations on the interest rate policy of the ECB Governing Council.

In Finland, the majority of private sector loans are granted at variable rates (Chart 6). Most loans are Euribor-tied, the 3- and 12-month rates being the most commonly used. The second most used reference rates are banks' own prime rates, which also reflect market conditions and usually follow market interest rates with a short lag (Chart 7). Consequently, the pass-through from money market rates to lending rates is relatively rapid in the short run and rather complete in the long run (Chart 8).

Average deposit rates are usually stickier than lending rates both in the short and long run, and as a result, the overall margin (ie difference between average lending and deposit rates) is positively correlated with the market interest rate level. The short-term market interest rate level is thereby a key determinant of the profitability of traditional retail banking.

Lending and deposit rate forecasts are based on quarterly OLS regression models, coupled with expert judgement.¹⁰ Apart from the short-term fluctuation stemming from the volatility of market interest rates, loan and deposit margins can be taken to reflect microeconomic factors related to banks' risk premia, market power and other bank-specific pricing behaviour. Thereby, changes in economic activity, risk factors, regulation and competitive forces are also taken into account in the forecast.

Interest rates on other interest-bearing assets and liabilities are approximated on the basis of short- and long-term market interest rates. The interest rates on banks' money market assets (liabilities) are approximated on the basis of Euribor rates (+ a risk premium), while

¹⁰ The econometric analysis is based on unconsolidated money and banking statistics and interest rate statistics, compiled by the Bank of Finland. The data describes the Finnish banking or MFI sector. The seasonally adjusted macroeconomic data, compiled by Statistics Finland, is consistent with the Bank's macroeconomic model. For a more detailed description of the early versions of the models, see Kauko (2005).

the interest rates on banks' capital market assets (liabilities) are approximated on the basis of the 5-year government bond yield (+ a risk premium).¹¹

Chart 6. Stock of lending by deposit banks by interest rate linkage

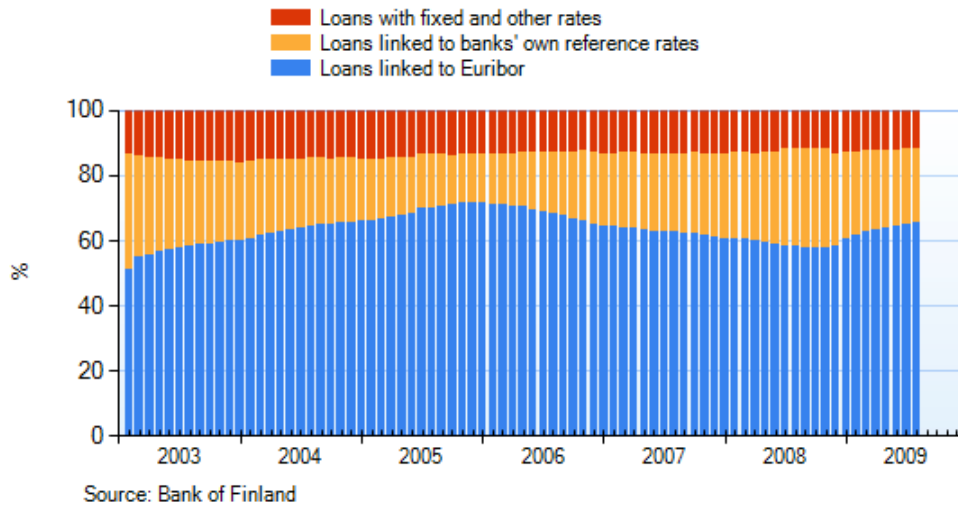
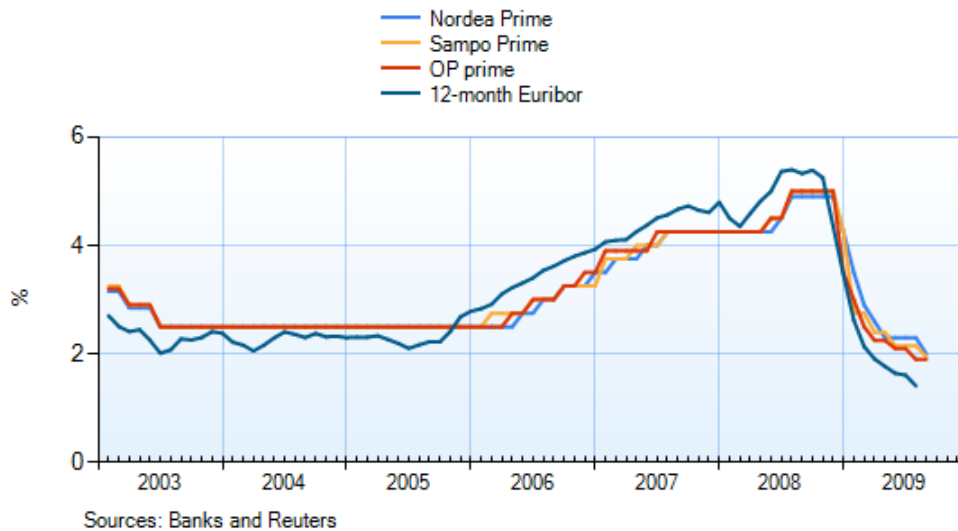
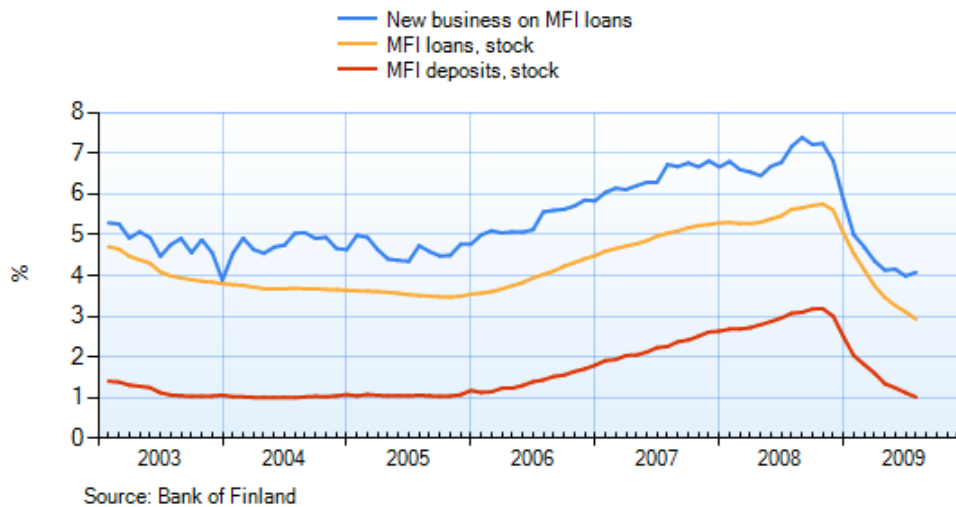


Chart 7. Deposit bank reference rates and 12-month Euribor



¹¹ Expectations on government bond yields are derived using a Nelson-Siegel method (1987).

Chart 8. Average MFI interest rates on non-MFI loans and deposits



4 Balance sheet items

The banking sector balance sheet analysis is one of the key components in forecasting net interest income and other sub-target and target forecast variables. The balance sheet forecast procedure is based on a simple spreadsheet system for the aggregated balance sheet of the Finnish banking sector and related interest rates (Table 1). The balance sheet forecast numbers are produced on a quarterly basis for the forecast period but only year-end forecasts are presented in the forecast report.¹²

The structure of the sector-level balance sheet (on a non-consolidated basis) is shown in Chart 9. Forecasts for the two key items, loans and deposits, are discussed further in section 4.1.¹³ Forecasts for other balance sheet items (than loans and deposits) are based on the forecast team's view on banks' funding and investment prospects. The amount of money market assets is assumed to adjust so as to satisfy the balance sheet identity.

¹² Most of the actual (ie realised) data comes from the Bank of Finland's money and banking statistics, compiled on a monthly basis. For some balance sheet items there are no data on interest payments; respective interest rates are approximated using other available information.

¹³ The large share of "other assets" and "other liabilities" is for the most part due to Nordea Bank Finland's derivative contracts (evaluated at fair value).

Table 1. Assets and liabilities by type (EUR bn) and related interest rates (%)

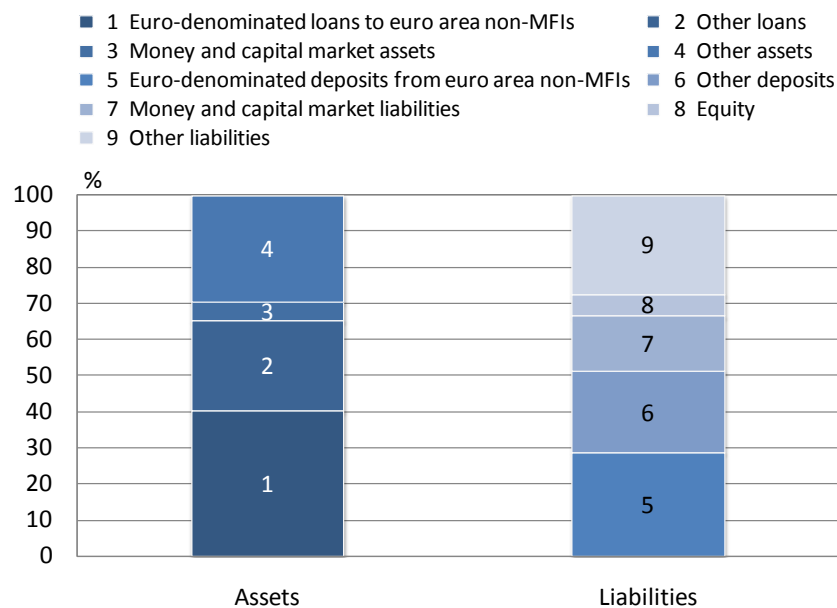
ASSETS	2008	Forecast 2009	Forecast 2010	Forecast 2011
LOANS (WIDE)	242,440			
LOANS, TOTAL	152,186			
Average interest rate, %	5.0			
EURO-DOMINATED LOANS	149,376			
Avg interest rate, %	5.1			
HOUSEHOLD LOANS	92,619			
Avg interest rate, %	5.2			
CORPORATE LOANS	53,689			
Avg interest rate, %	4.9			
OTHER LOANS	3,068			
Avg interest rate, %	4.3			
FOREIGN-CURRENCY LOANS	2,810			
Avg interest rate, %	4.0			
OTHER LENDING	90,254			
Avg interest rate, %*	3.5			
LIQUID ASSETS	327			
MONEY MARKET INSTRUMENTS	9,340			
Avg interest rate, %*	4.2			
CAPITAL MARKET INSTRUMENTS	9,206			
Avg interest rate, %*	3.2			
SHARES AND PARTICIPATIONS	5,444			
FIXED ASSETS	693			
REMAINING ASSETS	103,246			
Avg interest rate, %*	4.2			
ASSETS, TOTAL	370,696			

LIABILITIES	2008	Forecast 2009	Forecast 2010	Forecast 2011
DEPOSITS (WIDE)	189,525			
DEPOSITS, TOTAL	108,143			
Average interest rate, %	2.5			
EURO-DENOMINATED DEPOSITS	106,555			
Avg interest rate, %	2.5			
FOREIGN-CURRENCY DEPOSITS	1,588			
Avg interest rate, %	1.3			
OTHER DEPOSITS	81,381			
Avg interest rate, %*	3.5			
MONEY MARKET INSTRUMENTS	30,458			
Avg interest rate, %*	4.3			
CAPITAL MARKET INSTRUMENTS	26,674			
Avg interest rate, %*	3.6			
EQUITY	22,625			
REMAINING LIABILITIES	101,414			
Avg interest rate, %*	3.9			
LIABILITIES, TOTAL	370,696			

* Approximation (no statistical data available)

Source: Bank of Finland.

Chart 9. Balance sheet structure, 31 Dec 2008



Source: Bank of Finland.

4.1 Loans and deposits

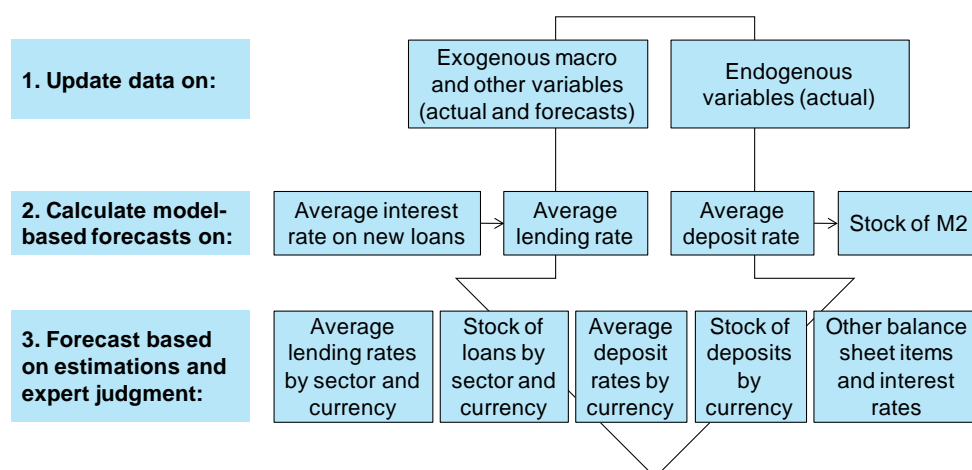
Forecasts for household, non-financial corporate and other loans are based on expected macroeconomic developments (including market interest rates and house prices), discussions with bank managers, latest surveys, and the forecast team's view as to overall developments in the banking sector.¹⁴ For example, the quarterly Bank Barometer, published by the Federation of Finnish Financial Services, contains survey-based information on the expected lending and deposit-taking developments. The barometer supplements business cycle information by giving the view of bank managers responsible for household and (mainly small and medium-sized) corporate customers at the branch level. An annual survey on manufacturing and service firms' financing arrangements, jointly undertaken by the Bank, the Confederation of Finnish Industries (EK) and the Ministry of Employment and the Economy is also utilised in the process.

The forecast for the aggregate deposits is based on a conventional M2 money demand function. In the first stage, the long-run equilibrium has been estimated using the Johansen multivariate method and assuming that the elasticity of M2 with respect to GDP (scale

¹⁴ There is no single standard approach to estimate bank lending, or more generally, credit. Some preliminary analyses using Finnish data have been documented in Putkuri (2003a) for household loans and Putkuri (2005) for corporate loans.

variable) is equal to 1. Also a trend variable, a short-term market interest rate and the average deposit rate are included in the model. In the second stage, the short-run adjustment behaviour has been estimated using the OLS method and data on the average deposit rate and the deviation of M2 from the estimated long-run equilibrium level. Finally, other relevant factors, such as competition, are taken into account based on the team's judgment (Chart 10).

Chart 10. Key steps in banking sector balance sheet analysis



5 Profit and loss account items

The aggregated profit and loss account is a key tool for forecasting the aggregate net operating profit (or loss) of the Finnish banking sector. The various profit and loss account items are divided into different categories according to a standard P & L formula (Table 2).¹⁵ Some key indicators, such as the cost-to-income ratio, are also calculated on the basis of the P & L account. Forecasts are presented on an annual basis.

¹⁵ The P & L data is collected by the Finnish Financial Supervisory Authority. The detailed classifications and definitions used in the data collecting are based on the so-called Virati classifications and definitions (joint co-ordinating task force of the FSA, Bank of Finland and Statistics Finland).

Table 2. Profit and loss account (EUR m)

	2008	Forecast 2009	Forecast 2010	Forecast 2011
<i>Net interest income</i>	4,587			
<i>Income from equity investments</i>	23			
<i>Net fee and commission income</i>	1,136			
<i>Net income from securities transactions and FX dealing</i>	256			
<i>Net income from available-for-sale financial assets</i>	-70			
<i>Net income from investment real estate</i>	38			
<i>Other operating income</i>	397			
TOTAL OPERATING INCOME	6,367			
<i>Staff costs</i>	-1,670			
<i>Other administrative expenses</i>	-1,071			
<i>Depreciation and write-downs</i>	-243			
<i>Other operating expenses</i>	-581			
TOTAL OPERATING EXPENSES	-3,564			
<i>Share of profit (loss) of undertakings included in the consolidated accounts</i>	-6			
<i>Impairment losses on loans and other receivables</i>	-293			
NET OPERATING PROFIT (LOSS)	2,504			

Source: FIN-FSA.

Non-interest income seems to have increased in importance relative to net interest income over the long term, but the relative shares (as a percentage of total operating income) can vary substantially from year to year, or even from quarter to quarter. Traditionally about two-thirds of the total operating income of Finnish banks and banking groups has originated from net interest income and one-third from other income sources, such as net fees and commissions.

5.1 Net interest income

Net interest income refers to the difference between total interest income and total interest expenses. The majority of both interest income and expenses are attributable to a rather large and fixed component, namely the stock of loans and deposits (respectively). A bank can affect the demand for new loans (deposits) by adjusting the margin it charges (pays), but in the short term this has a relatively small impact on the aggregate interest income on loans (interest expenses on deposits).

As regards the volatility of net interest income, the major factor is the level and steepness of the yield curve. Basically, the higher the interest rate level, the higher is the overall interest rate margin (ie average lending rate - average deposit rate) and the higher is net interest

income (and vice versa, other things being equal). This structural income risk is due to the usual mismatch in banks' balance sheets.

The forecast for the annual net interest income (*NII*) of the banking sector is approximated as the difference between the forecasted annual interest income (*I*) and annual interest expenses (*E*). Forecasts for the annual interest income and annual interest expenses are calculated as weighted averages of respective quarterly forecasts, which both are functions of relevant interest rates, (r_i) and (r_j), and interest-bearing assets (less write-offs) (A_i) and liabilities (L_j) of different categories, (i) and (j). The following formulas are used:

Equation 1. Net interest income

$NII_y = I_y - E_y$, where y denotes year and

$$\begin{aligned} I_y &= 0.5 * I_{(y-1)q4} + I_{yq1} + I_{yq2} + I_{yq3} + 0.5 * I_{yq4} \\ &= 0.5 * \sum_{i=1}^a (r_{i,(y-1)q4} * A_{i,(y-1)q4}) + \sum_{i=1}^a (r_{i,yq1} * A_{i,yq1}) + \sum_{i=1}^a (r_{i,yq2} * A_{i,yq2}) \\ &\quad + \sum_{i=1}^a (r_{i,yq3} * A_{i,yq3}) + 0.5 * \sum_{i=1}^a (r_{i,yq4} * A_{i,yq4}) \end{aligned}$$

$$\begin{aligned} E_y &= 0.5 * E_{(y-1)q4} + E_{yq1} + E_{yq2} + E_{yq3} + 0.5 * E_{yq4} \\ &= 0.5 * \sum_{j=1}^l (r_{j,(y-1)q4} * L_{j,(y-1)q4}) + \sum_{j=1}^l (r_{j,yq1} * L_{j,yq1}) + \sum_{j=1}^l (r_{j,yq2} * L_{j,yq2}) \\ &\quad + \sum_{j=1}^l (r_{j,yq3} * L_{j,yq3}) + 0.5 * \sum_{j=1}^l (r_{j,yq4} * L_{j,yq4}) \end{aligned}$$

5.2 Non-interest income

Other income, usually referred to as non-interest income, is generated from various sources. Net fee and commission income is clearly the most important component, usually accounting more than half of all non-interest income. It is also a relatively stable source of income, although asset price changes and changes in demand for loans and asset management services can create some cyclical variation.

Other non-interest sources of income include income from equity investments, net income from securities and currency transactions, net income from available-for-sale financial assets, net income from investment real estate and net insurance income, some of which are very volatile or one-off by nature. Rough forecasts are mainly based on discussions with FSA representatives and bank managers, banks' own projections, extrapolation of trends, as well as on general views on macroeconomic developments. Currently, no econometric models are used to support the analysis of these items.

5.3 Expenses and depreciation

Forecasts for staff and other expenses and depreciation are based on banks' budgets, extrapolation, expected wage developments, investment needs, and the forecast team's view on the general cost-driving factors in the banking sector.¹⁶

5.4 Net impairment losses on loans and other receivables

Net impairment losses on loans and other receivables are forecasted based on model estimations, forecast team's judgement and banks' own projections. The value of nonperforming assets and the number of bankruptcies and payment difficulties also tend to reflect the amount of loan losses in the near future.

The econometric model used is based on the idea that banks' credit risks will be realised because of the joint effect of borrowers' financial fragility (high risk exposure of banks) and unexpected economic shocks. In the model, banks' net loan losses relative to lending are assumed to depend negatively on the cross-product term of an income shock and lagged aggregate indebtedness of the private sector and positively on the cross-product term of an interest rate shock and lagged aggregate indebtedness. The shock variables are constructed using macroeconomic forecasts for the underlying income and interest rate variables.¹⁷

¹⁶ Some exploratory panel estimations have been made using data on administrative expenses.

¹⁷ For further details, see Pesola (2005). The macroeconomic causes of loan losses are also discussed in Pesola (2001) at the aggregate level, in Putkuri (2003b) on household lending and in Putkuri (2005) on corporate lending in Finland.

6 Concluding remarks

More and more attention has recently been devoted to the study and monitoring of financial stability issues. Repeated financial crises in different parts of the world have increased the need and motivation to develop tools for conducting in-depth evaluations of financial system developments and related system-wide risks.

This paper has documented the present state of the Bank of Finland's banking sector forecast model. The forecast procedure is an integral part of the Bank's financial stability analysis as it incorporates into one framework both the microprudential supervisory information and the Bank's view on macroeconomic developments. The sub-models for net interest income and loan losses are currently the most advanced parts of the model, and they are regularly used in stress testing exercises, also.

Forecast accuracy of the model has naturally changed over time, but not in a particularly systematic way. Forecast uncertainty, however, typically increases at cyclical turning points, when the information at hand is exceptionally uncertain as well. Yet the largest forecast errors in the past have resulted from significant non-recurring income and cost items, recorded in connection with major institutional or structural changes in the Finnish financial sector.

The banking sector forecast model is continuously updated and upgraded in order to improve its usability and diversity. Possible future trends of development may include several alternative options. So far the model has been complemented with a stochastic simulation model (not documented here), where the focus is shifted from point estimates to interval estimates and underlying distributions in order to take uncertainty better into account. Further development of the model is a key development project, aiming at a better understanding of the various links between banking and the real economy.

Despite recent practical and academic progress in financial stability analysis, it is still in a formative stage when compared with macroeconomic and monetary analysis. The various literatures taken together do not yet provide any generally accepted framework for analysing systemic financial stability issues (see eg Schinasi 2006). Thereby, a question yet to be answered is whether, and how, the current banking sector forecast model fits in with the different approaches put (and to be put) forward.

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