

MEMORANDUM



Date **2008-10-15**
Author Masih Yazdi

Finansinspektionen
Box 7821
SE-103 97 Stockholm, Sweden
[Brunnsgatan 3]
Tel +46 8 787 80 00
Fax +46 8 24 13 35
finansinspektionen@fi.se
www.fi.se

Finansinspektionen stress tests large banks

Finansinspektionen does not make in-house macroeconomic forecasts. Instead, we use economic forecasts from the National Institute of Economic Research and the Riksbank (the Swedish central bank) as the main scenarios for future macroeconomic development in our stability assessments of the financial sector. Despite this basis, stability assessments also need to be supported by studying alternative scenarios. How would the earnings, capital requirements and credit losses of banks be affected if the macroeconomic situation becomes significantly worse than what is laid out in the main scenarios of these economic forecasts? To illustrate this, FI conducts stress tests on the four large banks.

There are other financial events and risks than just a downturn in the business cycle that can have negative effects on earnings and credit losses. For example, problems may arise that are characteristic of the turbulence the market is experiencing now, i.e. non-functioning markets, rumour risks and growing counterparty risks. FI's stress tests do not take these types of financial events and risks directly into account. However, it is possible, for example, for counterparty risks and the credit losses they incur to be included to a limited extent in the market developments simulated by the stress tests.

Stress tests are a valuable tool for bank supervision. At the same time, it is important to not over-interpret these results. Stress tests are not about creating an alternative forecast with a deep recession, but rather should be seen as an indication of how credit losses, earnings and capital requirements could be affected given a specific FI-constructed scenario that has disadvantageous economic circumstances. They can also be used to gain an understanding for how resistant the banks are to certain types of risk and how their capital adequacy is affected by different assumptions.

Assumptions and conclusions

The stress tests indicate that the four large banks are all well-equipped for managing significantly worse economic scenarios and credit losses than what is presented in the main scenario. By stressing credit loss levels and the banks' earnings to levels that could arise during a credit crisis in the Baltic region and a strong recession in Sweden, FI was able to assess how the banks' capital would be affected by such negative assumptions. Our assessment is that

the banks have the ability to manage the credit losses that arise and even meet the capital adequacy requirements stipulated by law. The outcome can vary significantly depending on which assumptions are made about how the banks will apply their internal models. However, all of the banks were within the range of what they should be able to manage.

Two scenarios were tested, individually and in aggregate. It is Finansinspektionen's assessment that the aggregate scenario had a degree of stress that falls within the definition most frequently used within the context of supervision, i.e. an "extreme but possible" development. Compared with the main scenario, these simulated scenarios are consistently and significantly much more negative.

Key macroeconomic figures such as growth and unemployment and their financial consequences in the form of credit losses are assumed to follow approximately the same trend as during the Swedish banking crisis at the beginning of the 1990s. However, our scenario for Sweden is somewhat milder to reflect the structural modifications the banks have implemented since then, the most significant of which being sounder lending policies and greater diversification. The credit losses in the Swedish operations are assumed to be at the most two per cent of borrowing, which can be compared with the current level of 0.1 per cent.¹

The negative trend in the Baltic region is assumed in relative terms to be more powerful than the downturn during the Swedish banking crisis. In our stress test scenario, credit losses are assumed to rise to at the most eight per cent of total borrowing in the Baltic region, which corresponds to approximately double the credit losses during the Swedish banking crisis. This can also be compared with today's credit loss level of around 0.5 per cent in the Baltic region.²

Background

Stress tests have increasingly moved into the spotlight in recent years within risk management. There are a number of different approaches and methodologies for stress tests. On a general level, these include sensitivity analyses, which analyse what happens in a firm if one or a few risk factors are subject to a specific change, and scenario analyses, in which a number of risk factors are changed simultaneously. Scenario analyses can also be divided into historical and hypothetical scenarios. The former uses an actual sequence of events that occurred at a previous point in time to test how the firm would be affected given current conditions. Hypothetical scenarios use a constructed scenario and the effects of this scenario on the firm are then analysed. The

¹ On 30 June 2008

² On 30 June 2008

stress tests conducted by Finansinspektionen fall under the category *hypothetical scenarios*.

Stress tests often test two types of risk. The first is insolvency risk, which means that the banks are tested to determine whether their own funds fall below the levels stipulated by law. If an individual bank finds itself in this type of situation, it would most likely experience liquidity issues. There is a risk that its competitors and customers, who to a large extent also provide liquidity, would not be willing to lend money to the bank in question in such a situation.

The second risk is that the bank in question would have insufficient capital to cover the total credit losses that could arise. It is highly improbable that this would occur as the regulations require that the bank hold capital for credit losses that can occur once every 1,000th year. In practice, testing this risk is also less relevant because a scenario in which a bank's capital is totally consumed would have meant that the bank in all probability would have entered into bankruptcy much earlier due to liquidity problems, among other things. Accordingly, Finansinspektionen's stress tests are intended to determine whether the banks, given different scenarios, would have sufficient capital to meet the requirements stipulated by law.

Stress test scenarios

To test the ability of the four large banks to withstand a sharp downturn in the economy and a continued credit crunch, Finansinspektionen has conducted stress tests on the banks' earnings, credit losses and capital requirements. These tests were based on a future scenario that we judge to be "extreme but possible" in accordance with the definition most frequently used within the context of supervision on an international level. FI would like to emphasise that the scenarios used in the stress tests are not the main scenarios for future macroeconomic developments, but rather are alternative, extreme scenarios that are intended to demonstrate how well-capitalised the Swedish banks are under current conditions in the event such a scenario would occur.

A bank's financial resistance depends to a large extent on the capital it holds in relation to the risks it is exposed to. The scope of these risks depends on the extent and type of the bank's exposures, as well as their internal correlation. The reaction of the bank's earnings to a stressed scenario affects the amount of capital that will be available³, while the risk accumulation that arises from the same scenario determines the capital adequacy requirements placed on the bank.⁴ The purpose of FI's stress tests is to test whether the large Swedish

³ And any dividends, new share issues and other measures that affect equity.

⁴ Other stakeholders also place requirements on the bank's capital. These stakeholders are not considered in our stress tests, but in practice can play an important role in the amount of capital the bank chooses to maintain.

banks will have sufficient capital to guarantee financial stability during a stressed scenario.

The stress tests FI has chosen to use assume a strong recession in Sweden and a credit crisis in the Baltic region. These two scenarios have been tested both individually and in aggregate.

In the stress scenario for Sweden, it is assumed that the current financial turbulence, characterised by increased risk aversion and a credit crunch, will continue and its effects will impact the real economy. Real estate prices are assumed to fall by up to 25 per cent. Combined with higher lending rates from the banks, this will lead to a lower demand for loans from businesses and private households and thereby lower financial activity. A weaker macroeconomic trend combined with higher lending rates makes it more difficult for borrowers to repay their loans, which leads to more problematic loans and, in the end, higher credit losses. At the same time, it is assumed that the current rate of inflation will remain unchanged. This will force the Riksbank (the Swedish central bank) to raise the repo rate sharply, which will also increase interest expenses for businesses and private households. If the liquidity shortage on the market continues and, as a result, the banks' lending costs continue to increase, the scenario of increased interest expenses for businesses and private households can occur even if the rate of inflation decreases.

Key macroeconomic figures such as growth and unemployment and their financial consequences in the form of credit losses are assumed to follow approximately the same trend as during the Swedish banking crisis at the beginning of the 1990s. However, our scenario is somewhat milder to reflect the structural modifications the banks have implemented since then, the most significant of which being sounder lending policies and greater diversification.

In the scenario in the Baltics, it is assumed that the market downturn in the Baltic countries is extreme and, as a result, their markets are characterised by negative growth, higher unemployment and steep declines in real estate prices. It is also assumed in this scenario that there is high inflation combined with a credit crunch. The credit losses in the Baltics are assumed to double in comparison with the bank crisis in Sweden, up to eight per cent. The assumed development in the Baltic region is much more negative than the scenario constructed for Sweden. This is because the situation at the starting point for the Baltic states⁵ is worse than in Sweden and these countries have structural problems that do not exist in Sweden.

As the banks currently have a large share of their operations in countries other than Sweden, it has become important to make assumptions about trends in areas of the world where the banks are operational. Our assumption is that the negative development in these areas, excluding the Baltics, will be half as

⁵ The starting point in the stress test is the actual situation on 30 June 2008.

strong as in Sweden. This means that the credit losses for the banks' exposures outside of Sweden, as well as the assumptions made for the effects on the capital requirement, will be half as large in the foreign operations.

Historically, the link between the development of various macroeconomic key figures and credit losses is weak. During the last decade, credit losses have held steady, low levels while GDP growth fluctuated sharply. One explanation for the weak link between GDP growth and credit losses is that the Swedish banks have implemented structural changes to their lending policies, which has contributed to the decrease in credit losses. For this reason, any relationship that arises between the presented macro scenarios and the credit losses should be interpreted with caution. These macro scenarios *can* lead to the same results as the stress tests, but the effects could be weaker as well as stronger.

Assumed credit losses (% of lending) in the stressed scenarios			
	Year		
	1	2	3
Sweden	0.75	1.00	2.00
Baltic region	4.00	8.00	3.00
Other countries	0.38	0.50	1.00

Assumed macroeconomic development in Sweden and the Baltic region

Sweden

Year ⁶	0	1	2	3
Growth	0.7	-1.2	-2.0	0.8
Inflation	4.3	6.0	4.0	3.2
Unemployment	6.0	8.5	9.5	10.0
Repo rate ⁷	4.50	6.50	6.25	6.00
Real estate prices (index)	100	82	75	75
Stock exchange index	100	90	80	80

Baltic region

Year	0	1	2	3
Growth ⁸	2.0	-4.0	-2.0	2.0

⁶ Year 0 is the actual situation on 30 June 2008. Year 1 consequently represents a period of one year after this date, July 2008 to June 2009.

⁷ Alternatively that the risk premiums increase and thereby the banks' lending rates.

Inflation	14.0	18.0	15.0	10.0
Unemployment ⁹	4.0	8.0	10.0	12.0
Inter-bank rates	6.0	10.0	10.0	10.0
Real estate prices (index)	100	70	55	50

Methodology

Finansinspektionen's methodology for measuring the banks' credit risks is based on a portfolio model and information from the banks' regular capital adequacy reports. These reports include information about exposures for different portfolios, their probability of default (PD) divided into risk classes and their loss given default (LGD). The greatest advantage of using this data is that the starting point is the banks' own assessment of the risk in their portfolios. To conduct an aggregate stress test on all of the banks helps FI, in its role as the supervisory authority, more objectively evaluate financial stability as a whole and the risk development among the banks themselves.

Because credit risk is the risk that will be most affected by this type of scenario, the most central question from a methodology perspective is how the scenario will be translated into effects on the relevant credit risk measurements – primarily risk-weighted assets and credit losses. The risk-weighted assets for IRB banks¹⁰ are primarily controlled by the internal ratings assigned to each borrower, which are based on calculation of the borrower's probability of default.

In order to analyse how the scenarios affect the risk-weighted assets, and thereby the capital requirement, FI has used a well-known model, CreditRisk+. This model is based on expected credit losses and stresses this value to produce a total capital requirement at the chosen significance level. This approach differs in certain aspects from the method used to calculate the capital requirement under the IRB regulations, but can still be considered to provide a good estimate.¹¹

In order to take into consideration the different characteristics of each counterparty, we have divided the banks' credit portfolios during the stress tests into lending to private households, businesses and financial institutions. Assumptions also needed to be made regarding the size of the losses that would arise within each sub-portfolio. Here the assumption is that the largest losses occur in the business portfolio followed by the private household portfolio, and that the institution portfolio basically does not have any losses at all. These assumptions are to a large extent based on the developments during the

⁸ Average for the Baltic countries based on GDP for each country in relation to the Baltic region as a whole.

⁹ Adjusted for the population in each country in relation to the Baltic region as a whole.

¹⁰ Banks that have received permission to use an internal ratings-based approach to calculate the capital requirements

¹¹ Under the IRB approach, the capital requirement is instead calculated by stressing the PD values at the chosen significance level.

banking crisis at the beginning of the 1990s, where lending to commercial properties mainly represented the largest share of losses.

Increased credit losses are the main reason why the banks' operating profits are impacted negatively during the stress tests. Each individual bank's share of these credit losses depends on their distribution of lending to private households, businesses and financial institutions, and the original PD values of the ratings for each portfolio. If the average PD level for a bank is twice as high in a specific portfolio than for another bank, it is assumed to have double the credit losses at a given point in time.

The banks' profits are also weakened as it is assumed that the net provision is worsened and that costs in relation to income increase. At the same time, dividends are assumed to be zero in Year 2 and Year 3 in the scenario since this is usually the first measure banks implement during sharp downturns in the economy.

Effects on capital adequacy

The effects of the stress tests on capital adequacy are presented using three primary measurements: risk change, capital requirements with a scheduled rollout and capital requirements without a rollout. *Risk change* is the actual change in risk in the banks' portfolios caused by the CreditRisk+ model during the three years of the scenario. This measurement best describes how the actual credit risk for the bank has changed. *Capital requirements with a scheduled rollout* means that we assess how the total capital requirement changes for the risks included in Pillar 1¹², given that the banks roll out the portfolios that are currently not rated using an internal ratings-based approach in accordance with the implementation plan provided to Finansinspektionen. The most important portfolios in this respect are Nordea's private household portfolios, SEB's business and private household portfolios in Estonia and a large portion of Hansabank's portfolios at Swedbank. Capital requirements without a rollout means that the capital requirements for these portfolios will continue to be calculated as they are now, i.e. in accordance with the standardised approach, which is less sensitive to fluctuations in the economy.

The stress tests applied three separate assumptions when calculating the capital requirement for the banks. The first assumption was that increased risk does not increase the capital requirement. In such a case, only own funds are weakened when items in the profit and loss statement are impacted negatively and credit losses increase. The second assumption was that the cyclicalities in the models leads to an increase in the capital requirement due to migrations of exposures to higher risk classes (see the explanation below). The third assumption was that the banks' capital requirements are affected not only by cyclicalities, but also by the changes the banks made to their initial PD values in their models.

¹² Credit risk, operational risk and market risk

Cyclicality in the models arises when the banks' risk rating is not completely independent of the business cycle. The input variables that determine which risk class the exposures are assigned will to some extent be affected by the business cycle, which means that the exposures will migrate to higher risk classes when the business cycle takes a downturn. This has also been demonstrated in different studies where it has been shown that the cyclicality can lead to capital requirement increases of between 20 and 80 per cent for credit risks depending on which degree of stress is tested.¹³

The PD values may need to be adjusted if the values resulting from the stress scenario will significantly exceed the PD values the capital requirement is currently based on. The capital adequacy regulations state that the PD values shall be long-term, and the period this stress test uses can lead to a change in the perception of the banks and FI of what constitutes long-term PD values. This can mean that the PD values for each risk class will need to be adjusted upwards, which would increase the banks' capital requirements. At the same time, it is important to be aware that the PD values for any given year can exceed the PD values used to calculate the capital adequacy requirements.

It is important that the capital requirement is calculated both with the scheduled rollout and without since applying an internal-ratings based approach to these portfolios means that, in general, the capital requirement is lowered significantly and will fluctuate widely with the business cycle. In general, the stress tests show that the effects of lowering the capital requirements by applying IRB to the portfolios are stronger than the increase in capital requirements for these portfolios when the business cycle turns downward. In other words, the banks benefit from calculating the portfolios' capital requirements using IRB even when the business cycle has worsened significantly.

Another aspect to take into consideration is the transition rules that regulate how much the total capital requirement may be lowered in the years 2007-2009. The minimal capital requirement for each bank is 95 per cent, 90 per cent and 80 per cent of the capital requirement under Basel I for each respective year, independent of the capital requirement calculated using an internal ratings-based approach.¹⁴ The extra capital the banks add on during this transition period varies widely across the banks and to a considerable extent affects their resistance to the stress tests that were conducted.

¹³ See **Benford and Nier**, 2007, "Monitoring cyclicality of Basel II capital Requirements", Bank of England, Financial Stability Paper No. 3. **Kashyap and Stein**, 2004, "Cyclical implications of the Basel II capital standards", Federal Reserve Bank of Chicago, Economic Perspectives, Vol. 28(1). **Catarineu-Rabell, Jackson and Tsomocos**, 2003, "Procyclicality and the new Basel Accord—Banks' choice of loan rating system," Bank of England, working paper, No. 181

¹⁴ The Basel Committee is currently discussing postponing lowering the floor due to current market conditions.

Results

The results of the study are presented as effects on the banks' profit and loss statement, balance sheet and capital adequacy. Finansinspektionen does not consider it possible to report the outcome of the study in detail. For this reason, the following discussion is a general overview of the results.

Credit losses increased dramatically in the aggregate scenario of a recession in both Sweden and the Baltics. At most, they reached almost SEK 68 billion for the four banks as a whole over a period of one year. This can be compared with the operating profit of SEK 84 billion the four banks reported in total in 2007. Each bank's share of these credit losses was dependent on the distribution of their lending between private households, businesses and financial institutions, and what PD values in Year 0 were for the various risk classes in each portfolio. In general, the increase in credit losses resulted in decreased profits for the banks in the scenario and in some cases even led to the total elimination of profits.

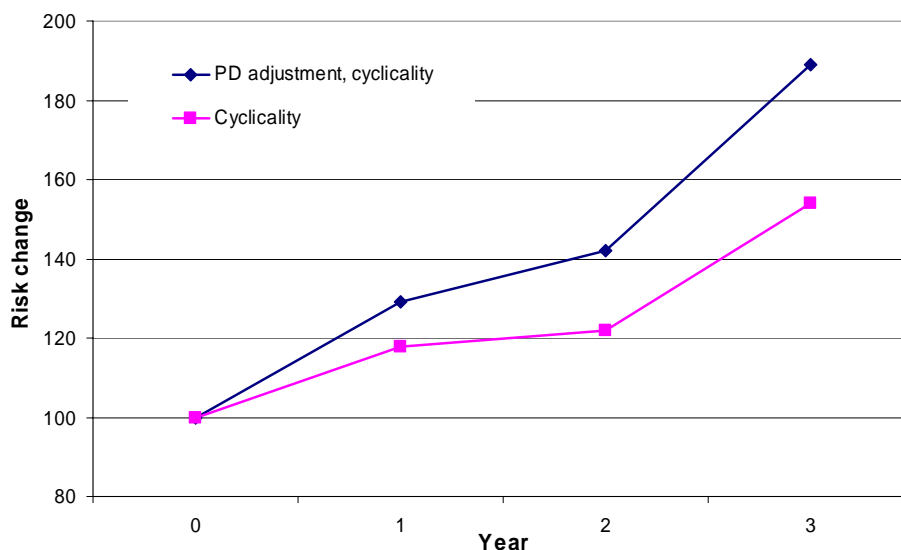
It is important to note that the credit loss level is an input in this model, i.e. that the credit losses that arise have been determined by FI based on the degree of stress we want to test. This means, for example, that credit losses of 2 per cent in Sweden are not a given development based on the macro scenarios that were described, but rather that these scenarios *can* lead to the credit loss level that was the aim of our test.

Recession in Sweden and extreme market downturn in the Baltics

As to be expected, the scenario that includes both a recession in Sweden and an extreme market downturn in the Baltics represents the largest risk accumulation and the largest increase in the capital requirement.

However, it is interesting to note that even though risk almost doubles the increase in the capital requirement only increases by at most 20 per cent, under the assumption that the rollout does not take place. In Year 3, the capital requirement with a rollout is only 10 per cent higher than at Year 0. This is primarily due to the disappearance of the transition rules, which significantly decrease the capital requirement, and that the total capital requirement consists of more than just the capital requirement for credit risk and therefore does not increase at the same rate as the economy contracts. In addition, the rollout of Nordea's private household portfolio using an IRB-approach results in a significant decrease of its capital requirement.

Figure: Recession in Sweden and extreme market downturn in the Baltics



The figure shows how the risk in the large banks' portfolios will change depending on assumptions of cyclicity and adjusted PD values. Indexed to 100 at Year 0. Source: Finansinspektionen

Distribution of risk accumulation across the banks is relatively small. The two banks with large operations in the Baltic region – SEB and Swedbank – have a somewhat larger risk accumulation. The differences otherwise depend primarily on how geographically diversified the banks are. Consequently, Nordea has the smallest risk accumulation and Swedbank the largest in this respect.

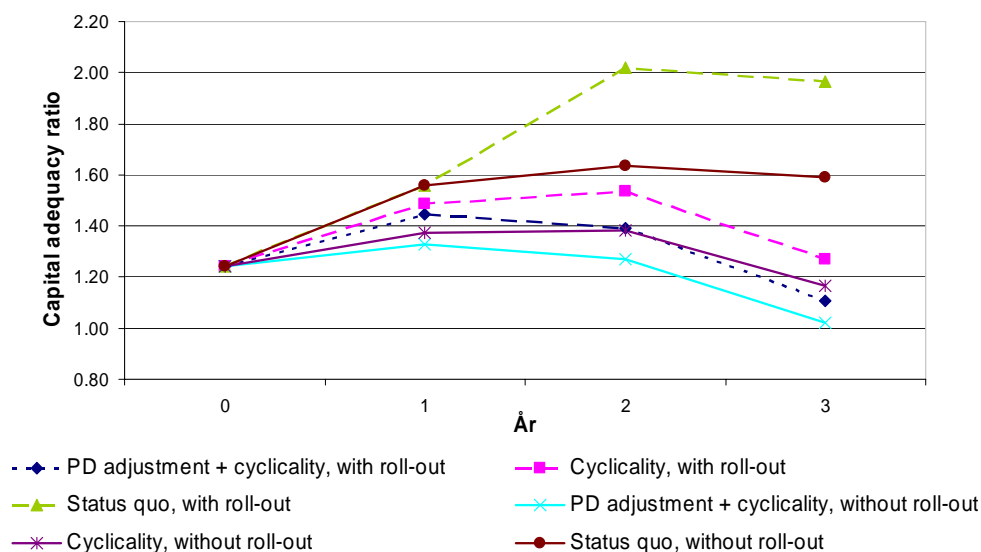
However, the differences in capital requirements between the banks are large. This is due to a number of factors, such as how much extra capital each bank had to maintain under the transition rules, which is an important factor, as well as the Year 0 risk level and any rollouts of new portfolios.

In terms of the capital adequacy ratio, the banks' profits in the scenarios are very important. The banks that suffer large credit losses, and thereby also experience negative profit, see their own funds decrease at the same time as the capital requirement increases. If the bank reports a profit, it is possible that the own funds increase at the same extent or even more than the capital requirement, which leads to an improved capital adequacy ratio.

As a group, the large banks have capital adequacy ratios that exceed the requirements stipulated by law, even under the most conservative assumptions on cyclicity and adjustment of PD values. Under the least conservative assumptions, the capital adequacy ratios in the aggregate scenario will exceed Year 0 after three years. This means that the banks are well-equipped to manage such a scenario as they also have the opportunity to implement measures which the stress test does not take into consideration that can further help them withstand such a scenario. Examples of potential

measures include decreased lending, disposal of assets that are capital-intensive and raising new capital.

Figure: Recession in Sweden and extreme market downturn in the Baltics



The figure demonstrates how the aggregated capital adequacy ratios for the four large banks will develop under the various assumptions on cyclicity and any adjustments to the PD values. Source: Finansinspektionen

Recession in Sweden and extreme market downturn in the Baltics as separate events

The major difference between the scenario of only a recession in Sweden and the aggregate scenario is that the credit losses are significantly lower. This means that banks' capital adequacy ratios do not develop as negatively as in the aggregate scenario. However, there is not a large difference in risk accumulation and the change in the capital requirement. This is mainly due to the fact that lending in the Baltic region is still a small portion of total lending. As a result, the effect on the capital requirement from cyclicity in the Baltic portfolios and any adjustments to the PD values is small.

An extreme market downturn in the Baltic region by itself does not result in a material increase in the risk of the portfolios or the total capital requirement. At most, the risk increases approximately 30 per cent during Year 2 of the scenario. The capital requirement decreases every year in the scenario because the effects from the disappearance of the transition rules are larger than the risk accumulation and the resulting increase in capital requirements. This also means that the capital adequacy ratios steadily improve during the three years analysed by the scenario. The banks will experience significant credit losses in this scenario, but not to the extent that they will pose a threat to the capital adequacy, or that the banks' annual profits will be eliminated, since the operations are in general assumed to generate good profits.