



# The traffic-light,

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- Final version

# 1. Design of the traffic-light model

The changes in the model compared with the proposal sent for referral are:

1. The floor in the credit-risk scenario has been reduced from 50 basis points to 25 basis points.
2. In the measurement of interest-rate risk, the companies must allow all interest rates to change in the same direction.
3. An explicit correlation assumption between the euro interest rate and the Swedish real interest rate is introduced into the model. The correlation is assumed to be 0.5.

At present, these three changes have small effects on the measurement results in the life insurance companies and occupational pension funds that have to report in accordance with the model. However, they could become significant if the companies change their portfolio compositions in the future.

Reducing the floor in the credit risk scenario increases the potential to use interest-bearing assets other than government bonds for handling the significant interest-rate risk that life insurance companies and retirement pension funds normally face. The reason for reducing the floor in the credit risk scenario is that the previous level was regarded as too severe by several referral organizations, in view of the way collateral relationships are developing for, primarily, swaps in recent years.<sup>1</sup>

The reason for changing the measurement of the interest-rate risk is to simplify understanding of the model. Several referral organizations believe that permitting, for example, the euro interest rate and the Swedish interest rate to change in different directions in the measurement of interest-rate risk could be regarded as intuitively difficult. In the new instructions, all interest rates are to change in the same direction. This does not affect the measurement results, as long as the companies do not hold fixed-income options in foreign currencies.

The reason for introducing the explicit correlation assumption between the euro interest rate and the Swedish real interest rate is to enable the model to also handle the currently hypothetical situations, when companies have combined interest-rate exposure on the asset side in euro bonds and real interest-rate bonds that starts to approach the size of Swedish nominal interest-rate exposure in the company. At present, however, this has only a marginal impact on measurement results in the companies.

The new supervisory tool will identify with great accuracy companies with exposure to financial risk that is excessive in relation to their capital buffer. All life-insurance companies and occupational pension funds must use the

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<sup>1</sup> See "Prudent assumptions..." with an updated (8 of November 2005) guideline for the choice of discount interest rate when calculating technical provisions at realistic value. The principal change of significance to the traffic light system is that the interest on government bonds – either actual or theoretical – no longer constitutes an absolute ceiling for the chosen discount interest rate.

traffic-light model in their reporting. This means that even unit-linked insurance companies and term life insurance companies must report. Purely unit-linked insurance companies, however, may be exempted from further reporting after the first report. Very small occupational pension funds with a good risk buffer may also be exempted after the first report. Pension foundations will not report using the traffic-light model.

The model should be as fair as possible, while at the same time being a simple model that can be applied by all companies obligated to report. In principle, FI could accept measuring interest-rate risk, equity risk and real-estate risk for both assets and liabilities without further breaking down these three risk factors. At present, such a solution would yield the same results as the somewhat more detailed model being proposed in this draft. Foreign interest-bearing securities and inflation-linked bonds would then be considered equivalent to Swedish interest-bearing securities. Credit risks and exchange-rate risks would then be ignored. Such a model has the advantage of being simple and clear.

However, in order to obtain a better impression of the financial risks to which a portfolio is exposed, FI has elected to also include simplified measurements of the foreign interest-rate risk, the real interest-rate risk and the credit risk. On the other hand, FI has deliberately refrained from measuring a specific risk in equities, real estate and credit exposures. The equity risk, however, is divided into a Swedish and a foreign equity risk. Even the exchange-rate risk is treated schematically, in that the model measures the risk as the total net exposure to all foreign currencies.

The model measures how both assets and liabilities are affected by asset price changes, which means that it is the companies' net risks that are being studied. Furthermore, the model assumes zero correlation between the various asset classes, which means that it takes into consideration diversification effects between asset types.

Risk reduction and risk increases through the use of financial derivatives are captured by the model in a simplified manner.

The traffic light model is only one of several supervisory tools used by FI. Since not all financial risks are measured by the model, it needs to be supplemented by other supervision.

FI is interested in the companies' actual risk profile. The traffic light model is only an approximation of the risk profile, which means that financial instruments or investment strategies that do not result in any measurement results in the traffic light model, despite constituting a financial risk for the company, are not regarded as risk free by FI. The opposite applies to financial instruments or investment strategies that *de facto* reduce the risk, but whose risk reduction is not indicated by the traffic light model. Accordingly, the traffic light model, like other supervisory tools, is used to sort out companies for more in-depth investigation.

The traffic-light model is a supervisory tool and measures the companies' resistance to sharp asset-price changes over the short term. The traffic light is not an ALM model or a portfolio optimization model. Neither is the model

designed to be used as an internal risk management tool. The companies are themselves responsible for developing models for these purposes that take their own operations into consideration.

The model is designed so that it will not need to be updated continuously. It should be possible to use the same scenarios for several years. This is a new supervisory tool, however, and experience from use of the model may indicate that changes need to be made. Even changes in the financial regimen in which the model is used may result in changes needing to be made in the model. For reporting during 2006, however, no changes in the scenarios are planned. In conjunction with insurance risks being included in the model in 2007 and against the background of experience from reporting in 2006, an evaluation of the model will take place.

### 1.1 Valuation of assets and liabilities

In the traffic light system, the fair value of assets and liabilities is used as the starting values for measurement. This means that surplus and deficit values in assets (including shares in subsidiaries) must be included. The capital buffer used in the traffic-light model consists of subordinated debt, untaxed reserves and shareholders' equity.

The traffic light is intended to capture the most relevant financial risks from a supervisory standpoint. It specifies scenarios for asset-price changes, such as how the most important asset prices change, interest rates, equity prices, property prices, currencies and the price of interest-rate instruments with credit risk.

Based on the specified asset-price changes, the companies calculate how their capital buffer is affected. If it is completely eroded by the scenario, this is signaled with a red light in the model.

In the traffic light system, an insurance company that is a parent company must take into account the risks arising in subsidiaries whose core operations consist of owning or managing real estate, equities, participating rights or other securities. These risks are to be included in proportion to the percentage shareholding under the particular risk. The value of the shares in these subsidiaries is not to be included in the equity price risk. Currently, the value of shares and participations in subsidiaries that conduct operations other than those mentioned in this paragraph, for example insurance operations, will be included in the equity price risk. Accordingly, the risks in these subsidiaries will not be allocated among the various risk categories.

The measurement takes place for both assets and liabilities in the balance sheet. It is thus the net effect of asset-price changes that is taken into consideration. The net effect of a decline in interest rates is a change in the value of assets minus the change in the value of liabilities resulting from the interest-rate change. The same applies to all asset prices.

A decline in equity prices normally only affects assets in the balance sheet. However, if the company has a *conditional bonus* in its actuarial provisions that depends on the value of its shareholdings, for example, the reduction in

actuarial provisions resulting from the decline in the share price must be included. The same applies to all asset-price changes that affect both assets and liabilities.

The asset and liability items for which insurance policy holders bear the financial risk (unit-linked insurance) may be excluded from the traffic-light measurement.

The same asset may be measured for several different risks. For example, a foreign corporate bond must be included in the measurement of interest-rate risk, credit risk and exchange-rate risk.

With regard to the change in value of composite products, options, funds and similar assets, the principle is that the change in value must be calculated based on how these items are affected by the changes in value for the respective risk factors (interest rates, equities, etc.). The change in the value of an equity option is derived from how the value is affected by a decline in the underlying share (index) that is specified for the equity risk in the scenario.

Valuation of the companies' liabilities is difficult. Valuing them at realistic values, which is intended to take place in accordance with the occupational pension directive, is new. It is thus also difficult to measure how the value of liabilities is affected by changes in asset prices, primarily interest-rate changes. Moreover, the traffic-light model does not calculate the change in value for the companies in this case. Instead, it is up to the companies themselves to calculate the change in value as a result of the asset-price changes used in the red scenario. FI has published on its website certain guidelines for how such a realistic valuation should be performed.

## **1.2 Interest-rate risk**

Most of the undertakings of insurance companies are exposed to interest-rate risk. This applies particularly to the traditional life-insurance companies and occupational pension funds. The traffic-light model assumes four categories of interest-rate risk: nominal SEK interest, real SEK interest, EUR interest and other foreign interest rates. When performing measurements using the traffic light model, the companies must take into account the effect on the company's capital of the fact that all interest rates in the four interest-rate categories will either rise or fall. The companies report the change in interest rate that is least favorable for the company.

Because there is a relatively strong positive correlation between the nominal SEK interest rate, the real SEK interest rate and the EUR interest rate, these correlations are taken into consideration in the total interest-rate risk.

The interest-rate scenarios are expressed as a parallel shift of the interest-rate curves. The magnitude of the shift is expressed as a percentage of the ten-year interest rate, which means that the shift in percentage points is less when interest rates are lower.

The interest-rate change is the same for both assets and liabilities.

As a rule, an interest-rate decline will be least advantageous for the companies, since the companies normally have a higher sensitivity to interest-rate changes for liabilities than for assets. A decline in interest rates means that the interest-bearing assets increase in value, but also that the companies' insurance commitments increase. It is the net effect of these two changes that is measured by the traffic light.

### **1.2.1 EUR interest-rate risk and other foreign interest-rate risk**

In the traffic-light model, it will be possible to match nominal undertakings in SEK with nominal interest-bearing assets in EUR. There is a risk, however, that the EUR interest rate and the Swedish interest rate will not move identically, meaning that matching is not without risk. The model measures the risk by degree of correlation, meaning how well the Swedish and EUR interest rates co-vary. Other foreign interest rates generally have significantly lower correlation with the Swedish interest rate. In the traffic-light model, their correlation with the Swedish interest rates is assumed to be zero, meaning that they are independent.

When foreign interest-bearing products are used, there is an additional exchange-rate risk to the extent that the foreign assets are not currency hedged.

### **1.2.2 Real interest-rate risk**

Like the EUR interest rate, the real interest rate is strongly correlated with the nominal interest rate, and it is possible to match nominal undertakings in the same manner. The real interest rate's matching characteristics with the nominal interest rate are also measured with a correlation.

The traffic light ignores inflation-indexed undertakings and assets in currencies other than SEK. At present, this is a very minor portion of the companies' balance sheets. These items will be treated as nominal from a scenario perspective. If they should occur to any significant extent in any company, the matter will be addressed separately with the company.

### **1.2.3 Total interest risk**

The total interest risk is thus:

The square root of

(Nominal net SEK interest risk)<sup>2</sup> +

(Real net SEK interest risk)<sup>2</sup> +

(Nominal net EUR interest risk)<sup>2</sup> +

(Other net foreign interest risk)<sup>2</sup> +

(2 x correlation<sub>[nom SEK, real SEK]</sub> x nominal net SEK interest risk x real net SEK interest risk) +

(2 x correlation<sub>[nom SEK, nom EUR]</sub> x nominal net SEK interest risk x nominal net EUR interest risk)

(2 x correlation<sub>[real SEK, nom EUR]</sub> x real net SEK interest risk x nominal net EUR interest risk)

## 1.3 Equity risk

Equity exposure is divided into Swedish and foreign shares. The correlation between Swedish and foreign shares is assumed to be one. The companies may choose between two different alternatives for measuring equity risk.

### 1.3.1 *Alternative 1*

The measurement of equity risk assumes that it is not possible to reduce the exchange-rate risk in foreign shareholdings through hedging. The magnitude of the asset-price change for the foreign shares is calibrated in SEK, however. This means that the extra risk attributable to the fact that the shares are denominated in a currency other than SEK is included in the design of the scenario but that it cannot be reduced through currency hedging. It is thus also not possible for the companies to factor in exposure to foreign currency through foreign shareholdings in their total exchange-rate exposure.

### 1.3.2 *Alternative 2*

The assumption here is that it is possible to reduce the exchange-rate risk in foreign shareholdings through currency hedging. This means that the companies must include the exposure to foreign currency that has arisen through the company's ownership of shares denominated in foreign currency in the total exchange-rate exposure. If the holding is currency hedged, the exchange-rate risk does not need to be included as an exposure.

The total equity risk is equal to the sum of the Swedish equity risk and the foreign equity risk.

## 1.4 Real estate risk

The traffic light measures the real estate risk as a percentage decline in the market value of the real estate portfolio.

## 1.5 Credit risk

The credit risk test measures the risk that the price of assets subject to credit or counterparty risks will change. The measurement assumes that the companies have a well-diversified portfolio of corporate bonds and other instruments subject to credit risk. The traffic light measures the risk for a decline in value solely in the form of the risk for increased spreads between fixed-income instruments subject to credit risk and the risk-free interest rate.

Exposure of the companies to credit risk is measured by the companies calculating how the value of their assets (interest-rate instruments) subject to credit risk changes if the average credit spread<sup>2</sup> increases by a certain percentage according to the scenario.<sup>3</sup> This assumes that the companies know the average duration-weighted spread<sup>4</sup> in their interest-rate portfolios.

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<sup>2</sup> The difference between the risk-free interest rate and the interest on fixed-interest products subject to a credit risk.

<sup>3</sup> The spread change always amounts to at least 50 basis points, however.

<sup>4</sup> Duration-weighted spread is calculated for example as follows: sum (spread per holding x duration per holding x value of holding) / sum (duration per holding x value per holding).

Taking the average spread as the starting point reflects the quality of the company's portfolio with credit risk. The quality thus determines the risk for price changes, in that it is a percentage change in the spread that determines the measure.

However, the test is designed in such a way that it has a floor for the lowest increase in the spread in basis points that a company can manage, regardless of the average spread. The floor is the result of the possibility that changes in the spread, expressed as a percentage, would have to increase when the spread approaches zero, in order to correctly reflect the risk of changes in the spread.

## 1.6 Exchange-rate risk

The traffic light measures the exchange-rate risk based on the companies' total net positions in foreign currency. If Alternative 1 is used for the equity risk, however, exchange-rate exposure to equities should not be included. Consideration must be taken to any currency hedges.

## 1.7 Derivative products and volatilities

For derivatives, the risk is measured through changes in the underlying asset in accordance with each scenario. For an equity option, the change in value is thus calculated on the basis of the change in value of the underlying share (index) in accordance with the red scenario.

In conjunction with the stress scenarios tested in the traffic-light model, it is probable that volatilities will increase significantly. In the traffic-light measurement, the companies themselves must make assumptions regarding how volatilities that affect their derivative products may change with each scenario. The difference in the change in value in relation to an assumption of unchanged volatility must always be specified, however.

## 1.8 Correlation

The traffic-light model includes assumptions about correlation. The correlation should reflect the correlation under the stress-correlated circumstances measured by the tool. These correlations are difficult to calculate and can only be very approximate, FI therefore intends to work with simplified correlation assumptions. Within the traffic-light system, the various risk factors are assumed to be independent, with the exception of the various interest-rate risks, which are correlated with each other (see the section on interest-rate risk above) and the Swedish and foreign equity risks.

Total effect on the capital buffer =  $[(\text{total net interest-rate risk})^2 + (\text{net equity risk})^2 + (\text{net real-estate price risk})^2 + (\text{net credit risk})^2 + (\text{net exchange-rate risk})^2]^{0.5}$

## 1.9 Summary of traffic-light model

*Magnitude of asset-price changes within the traffic light:*

|   | Scenario  |
|---|---|
| <b>Interest-rate risks</b>                              |   |
| Interest-rate risk, nominal interest rate, SEK          | +/- 30% of 10-year interest                             |
| Interest-rate risk, real interest rate, SEK             | +/- 30% of longest real interest                        |
| Interest-rate risk, nominal interest rate, EUR          | +/- 25% of 10-year interest                             |
| Interest-rate risk other foreign interest rates         | +/- 30% of 10-year interest for largest other exposure* |
| <b>Credit risk (increase in spread)</b>                 | Max of (100%; 25 basis points)                          |
| <b>Equity risk</b>                                      |   |
| <b>alt 1.</b> (no exchange-rate risk added),<br>Swedish | - 40%   |
| Foreign   | - 37%   |
| <b>alt 2.</b> (exchange-rate risk added),<br>Swedish    | - 40%   |
| Foreign   | - 35%   |
| <b>Real estate price risk</b>                           | - 35%   |
| <b>Exchange rate risk</b>                               | +/- 10%   |

\* Meaning that the same base-point shift in the yield curve is applied for all the other currencies' interest-rate curves.

*Correlation assumptions:*

| <b>Interest-rate risks</b>                          | Interest rate risk,<br>nominal interest rate<br>SEK | Interest-rate risk, real<br>interest rate, SEK |
|---|---|--|
| Interest-rate risk, real interest<br>rate, SEK      | 0.8   |  |
| Interest-rate risk, nominal in-<br>terest rate, EUR | 0.8   | 0.5  |
| Interest-rate risk, other foreign<br>interest rates | 0.0   | 0.0  |
| <b>Equity risks</b>                                 | Swedish equity risk                                 |  |
| Foreign equity risk                                 | 1.0   |  |

The net effect in SEK of each asset-price change is added together according to the square-root formula. If the company's capital buffer becomes negative from the results of the scenarios, this corresponds to a red light.