# What influences the number of bankruptcies?

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**After having remained relatively stable from the mid-1990s, the number of bankruptcies rose sharply in 2002 and 2003, but then fell again last year and in the first six months of 2005. Using an empirical model, we analyse factors underlying developments in bankruptcies. We find that changes in profit margins, competitiveness and real interest rates, as well as cyclical fluctuations in the Norwegian and international economy, have been among the most important driving forces since 2002. The analysis indicates that deteriorating competitiveness in 2002 as a result of a strong krone exchange rate and high wage growth contributed in particular to the marked increase in the number of bankruptcies. The depreciation of the krone exchange rate in 2003 and into 2004, combined with moderate wage growth from 2003, helped to improve competitiveness in Norwegian enterprises. This explains a considerable portion of the recent fall in the number of bankruptcies.**

## 1 Introduction

One of Norges Bank's primary responsibilities is to promote a robust and efficient financial system. Norges Bank therefore monitors trends that may threaten stability in the financial sector. A substantial increase in the number of corporate failures could constitute such a threat, as a higher number of bankruptcies normally results in higher loan losses in banks.

Although the bulk of banks' lending is to households, experience shows that banks normally incur greater losses on loans to enterprises than on loans to households. This was particularly true during the banking crisis from 1988 to 1992. From the mid-1990s until 2002, the bankruptcy rate, i.e. the number of bankruptcies in relation to the number of enterprises, was relatively low and stable (see Chart 1). In 2002, however, the bankruptcy rate rose considerably. It was substantially lower than during the banking crisis, but banks' loan losses rose markedly. There was an increase in losses on loans to the manufacturing sector in particular.[2] Loan losses continued to

rise into 2003 and resulted in poorer earnings in banks. Since end-2003, the bankruptcy rate has fallen again and banks' profits have improved, primarily due to lower loan losses.

Norges Bank has previously developed an empirical model for estimating individual bankruptcy probabilities for Norwegian limited companies.[3] Among other things, the model includes idiosyncratic accounting variables as explanatory factors. The accounting variables capture changes in each limited company's profitability, financial strength and liquidity. Movements in such accounting variables will often closely follow macroeconomic developments in Norway and abroad. Furthermore, many macroeconomic variables are often published both earlier and more frequently than accounts figures. Norges Bank therefore also monitors macroeconomic variables in its assessment of banks' credit risk. The purpose of this article is to increase our understanding of the relationship between macroeconomic conditions and changes in the number of bankruptcies by means of an empirical model. The model was previously presented in *Financial Stability* 1/05. In this article we will look more closely at the driving forces underlying developments in bankruptcies. In particular, we will try to answer the following questions:

- What are the most important macroeconomic explanatory factors for the number of bankruptcies in the period 1991–2004?
- How swiftly and strongly do changes in these factors influence the number of bankruptcies?
- What has driven changes in the number of bankruptcies since 2002?
- What will the bankruptcy rate be in the period ahead if the Norwegian economy develops in line with the analyses in *Inflation Report* 2/05?

The estimated model contains effects of:
- Domestic demand and activity level
- Foreign demand and activity level



**Chart 1** Banks' loan losses as a percentage of gross lending and number of bankruptcies (seasonally adjusted) as a percentage of number of enterprises[1)]
Quarterly figures. 1991 Q1 – 2005 Q2

Bankruptcy rate (right-hand scale)

Loan losses (left-hand scale)
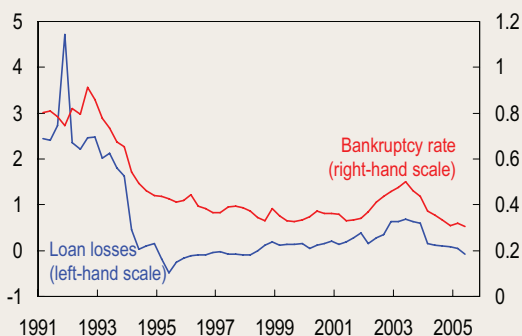
[1)]Number of enterprises in 2005 Q1 and Q2 is based on estimates from *Inflation Report* 2/05.

Sources: Statistics Norway, the Brønnøysund Register Centre and Norges Bank

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[2]  See *Financial Stability* 1/03.

[3]  See Sæther and Larsen (1999), Bernhardsen (2001) and Eklund, Larsen & Bernhardsen (2001).

- Competitiveness
- Real interest rates
- Real labour costs
- Real material input costs
- Enterprises' real gross debt
- Real price of commercial property
- Number of enterprises

The macroeconomic factors that may influence changes in the number of bankruptcies are discussed in the next section. The empirical model is presented in section 3 and in section 4 we discuss the most important macro-economic driving forces underlying developments in bankruptcies since 2002.

## 2 Changes in the number of bankruptcies and macroeconomic factors

The purpose of this empirical analysis is to identify the macroeconomic factors underlying changes in the number of bankruptcies. We will start by discussing which variables might be expected to be of importance to developments in bankruptcies on the basis of economic theory. First we will look at a profit-maximising enterprise and consider general factors that influence the probability of that enterprise going bankrupt. The presentation in this section largely follows Wadhwani (1986):[4]

(i) The enterprise produces a product using labour (L), material inputs (V) and real capital (K). The company wage level is W and the input price is Q. Real capital, K, is given in the short term, and for the sake of simplicity is excluded in the further derivation of the model.

(ii) The only source of uncertainty is the product price, which is a stochastic variable with an expected value equal to $\tilde{P}$ and a standard deviation of σ. The enterprise has to take the product price as given.

(iii) The enterprise has borrowed the sum D to finance the real capital that is necessary for production. The enterprise has interest expenses equal to iD in each period, where i is the interest rate.

(iv) NV expresses the expected present value of the enterprise's future cash flow and is therefore equal to the value of the enterprise. S expresses its equity. If the enterprise cannot meet current commitments for a period, it will be able to finance itself with the amount S = NV - D, as long as NV ≥ D.

Under these assumptions, it is optimal for the enterprise to choose the amount of labour and material input that maximise the expected profit:

(1) max $\ E(\Pi) = \tilde{P}G(L,V) - WL - QV$ with respect to L and V,

where E is the expectations operator, Π is the profit and G( ) is the production function. An enterprise will normally be bankrupt if the value of its assets is less than its liabilities and it cannot meet its current commitments. On the basis of this definition, the enterprise we are considering would be bankrupt if the realised price, P, was such that the sum of the enterprise's profit and equity in this period was negative:

(2)
$$PG(L,V) - WL - QV - iD + S < 0$$
$$\Leftrightarrow$$
$$PG(L,V) - WL - QV - (1+i)D + NV < 0.$$

However, creditor(s) will often be better served by continued operations if the costs of initiating bankruptcy proceedings are greater than the expected loss in the event of continued operations, or if there is some probability that the negative value will return to a positive value in later periods. Such assessments are probably closely linked to the cyclical situation, i.e. developments in total demand and the activity level in the economy. We can therefore express the probability of the enterprise going bankrupt as:

(3)
$$\mu = \Pr\left[\tilde{P}G(L,V) - WL - QV - (1+i)D + NV < 0 \big| AD\right]$$

where μ denotes the probability of bankruptcy and Pr[ ] is the probability function. The probability of the enterprise going bankrupt is now conditional on total demand, AD.[5] By combining (1) and (3), the amount of labour that maximises the expected profit can be expressed as:

(4) $\ L = L\left(W, Q, i, D, NV, \tilde{P}, \sigma\right),$

and similarly for material inputs:

(5) $\ V = V\left(W, Q, i, D, NV, \tilde{P}, \sigma\right)$

By inserting (4) and (5) into (3), L and V can be substituted out of the equation for the probability of bankruptcy:

(3') $\ \mu = \mu\left(\tilde{P}, \sigma, W, Q, i, D, NV, AD\right)$
where
$$\mu_{\tilde{P}} < 0, \ \ \mu_{\sigma} > 0, \ \ \mu_W > 0, \ \ \mu_Q > 0,$$
$$\mu_i > 0, \ \ \mu_D > 0, \ \ \mu_{NV} < 0, \ \ \mu_{AD} < 0.[6]$$

$\mu_j$ expresses the partial derivative of $\mu$ ( ) with respect to factor j.

Higher demand, AD, will generally boost an enterprise's earnings through increased sales and/or a higher price, $\tilde{P}$.

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[4] Davis (1995) and Vlieghe (2001) also follow a similar (theoretical) approach to that of Wadhwani (1986) in the specification of their empirical models.

[5] According to Wadhwani (1986) AD can also be included in the expression for the probability of bankruptcy if one assumes imperfect competition in the product market: the enterprise chooses a production level to maximise profit and takes the other enterprises' production as given. AD will then be included in equations (4) and (5) and the probability of bankruptcy is thus also a function of AD.

[6] See Wadhwani (1984) for a derivation of the signs for the partial derivatives.

Increased earnings will improve the enterprise's ability to pay its costs, service debt and strengthen its equity. Conversely, for a given productivity level and product price, higher input prices, *W* and *Q*, will increase the enterprise's costs and thus weaken its profitability and ability to service debt. Hence, higher earnings result in a lower probability of bankruptcy for the enterprise, whereas higher costs have the opposite effect.

The probability of bankruptcy increases in step with the variation in the product price, σ, as higher price variation entails a greater probability that the sum of the profit and equity in a period is negative.

Higher interest rates, *i*, raise the enterprise's debt servicing costs. At the same time, higher interest rates reduce the value of the enterprise through a lower present value of future earnings. Higher interest rates will therefore result in a higher probability of bankruptcy. The more debt, *D*, an enterprise has relative to the value of its assets, *NV*, the more likely it is that the enterprise will go bankrupt. The probability of bankruptcy therefore increases with debt, but decreases with the value of the enterprise.[7]

*Other possible explanatory factors*

Equation (3') shows the probability of bankruptcy for a single, profit-maximising enterprise. An empirical model for the number of bankruptcies is presented in the next section. In the specification of the empirical model, we have used aggregated sizes of variables that are included in the function in equation (3'). We have also taken into account that other macroeconomic factors may influence the number of bankruptcies. Equation (3') is therefore extended to include competitiveness, *E*, commercial property prices, *PN*, inflation, $\dot{P}$, and the number of enterprises, *F*. μ is now interpreted as the average probability of bankruptcy for all enterprises:

(6) $\mu = \mu\left(\widetilde{P}, \sigma, W, Q, i, D, NV, AD, E, PN, \dot{P}, F\right)$

where

$\mu_{\widetilde{P}} < 0, \ \mu_{\sigma} > 0, \ \mu_{W} > 0, \ \mu_{Q} > 0, \ \mu_{i} > 0,$

$\mu_{D} > 0, \ \mu_{NV} < 0, \ \mu_{AD} < 0,$

$\mu_{E} < 0, \ \mu_{PN} < 0, \ \mu_{P} > 0, \ \mu_{F} > 0.$

In an open economy, many domestic enterprises compete with foreign producers in both domestic and export markets. When we look at enterprises as a whole, the (average) probability of bankruptcy will increase if foreign demand for the home country's products declines. We must also take into account that the probability of bankruptcy for internationally exposed enterprises will be influenced by their competitiveness in relation to foreign companies. If domestic factor prices (per unit produced) rise faster than the foreign competitors' factor prices (per unit produced), competitiveness will deteriorate. An approximate measure of this factor is hourly labour costs in manufacturing in Norway relative to its trading partners, measured in local currency. However, competi-tiveness will also depend on the krone exchange rate. Relative labour costs calculated in a common currency are therefore used as a measure of competitiveness (equal to a real exchange rate) in the empirical analysis. If the krone exchange rate appreciates, international product prices measured in NOK will fall. This will result in lower earnings in both export-oriented and import-competing industries. The effect may be reduced somewhat if domestic demand shifts from sheltered to exposed products. This would then contribute to a deterioration in profitability in sheltered industries. We would therefore expect weaker competitiveness, *E*, as a result of higher domestic cost inflation compared with other countries or a stronger krone exchange, to increase the probability of bankruptcy.[8]

It is widespread practice for enterprises to use commercial property as collateral for loans. Such loans will normally be extended at a lower interest rate than other loans with weaker or no collateral. Banks' and other creditors' lending policies depend on the customers' (expected) ability to pay and collateral values.[9] If commercial property prices, *PN*, fall, collateral values may fall below the value of some loans. Creditors may then demand that loans without sufficient security are paid back and, more generally, banks may be more reluctant to extend loans. A number of enterprises may therefore be faced with such unfavourable borrowing terms that they no longer want to raise loans. An enterprise with a limited ability to pay may therefore go bankrupt if it does not have enough collateral to finance its activities with a new loan. Changes in property prices will also have a direct effect on profitability in the real estate and construction industries.

According to Wadhwani (1986), changes in inflation can influence developments in bankruptcies. An enterprise with a loan that has a variable interest rate and is not price-indexed may experience a reduction in earnings when inflation rises, if the increase in interest expenses is greater than the increase in earnings.[10] For higher

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[7] We could also express the probability of bankruptcy as a function of the enterprise's equity instead of its value (see equation (2)).

[8] The appreciation of the krone exchange rate may be partly offset by an increase in total demand if the price level falls. Another possible offsetting effect on the probability of bankruptcy is that debt raised in foreign currency, calculated in NOK, declines when the krone exchange rate appreciates. If enterprises' earnings are (primarily) in the domestic currency, it will be easier to service debt. However, a survey carried out by Norges Bank indicates that enterprises with debt in foreign currency will also often have assets in foreign currency, see Børsum & Ødegaard (2005).This indicates that the probability of bankruptcy is only influenced to a small extent by changes in the krone exchange rate via debt in foreign currency.

[9] See Stiglitz (1992, sections 6.2-6.3) for a theoretical discussion.

[10] Debt in Norwegian non-financial firms is normally not price-indexed. Wadhwani (1986) illustrates the hypothesis with an example: If $i = 0.01$ and $D = 1000$, the enterprise's interest expenses are equal to 10 in each period. With an (expected) inflation rate of zero, $i = r$, where r is the real interest rate. Inflation is expressed by $\dot{P}$ and $i$ is determined by the formula $(1 + i) = (1 + r)(1 + P) \Leftrightarrow i = r + \dot{P} + r\dot{P}$. If inflation rises from 0 to 10%, the nominal interest rate will increase to 11.1% and interest expenses will rise to 111. Based on the assumption that the enterprise's (product price and therefore) earnings increase by 10 per cent, higher inflation will result in a lower cash flow. With a price-indexed loan, on the other hand, real earnings and real interest expenses would increase by the same amount. If debt is not price-indexed, or if the enterprise cannot borrow an amount equal to 100 to index the loan itself, higher inflation will reduce the cash flow, which increases the probability of bankruptcy.

## Box A model of the number of bankruptcies

$$\Delta b_t = \begin{array}{c} 2.03 \\ (1.9) \end{array} + \begin{array}{c} 1.76\,\Delta_3\,(w-p)_t \\ (3.7) \end{array} - \begin{array}{c} 1.32\,\Delta_3\,e_{t-2} \\ (4.6) \end{array} - \begin{array}{c} 0.74\,\Delta_2\,(pn-p)_{t-1} \\ (3.2) \end{array} - \begin{array}{c} 0.06\,\Delta\,y_{t-5} \\ (2.8) \end{array} + \begin{array}{c} 0.48\,\Delta_2\,(d-p)_{t-2} \\ (2.8) \end{array}$$

$$- \begin{array}{c} 0.93\,[(k_{t-1}-f_{t-3}) \\ (9.6) \end{array} - \begin{array}{c} 3.44\,R_{t-1} \\ (4.5) \end{array} - \begin{array}{c} 0.36\,u_{t-2} \\ (6.4) \end{array} - \begin{array}{c} 2.77\,(w-p)_{t-3} \\ (3.5) \end{array} - \begin{array}{c} 2.10\,(q-p)_{t-1} \\ (5.4) \end{array} + \begin{array}{c} 1.90\,e_{t-4}] \\ (7.9) \end{array} + \varepsilon_t.$$

$R^2 = 0.90$, $\sigma = 0.05$, $AR_{1-4} : F(4, 36) = 2.02$, $ARCH_{1-4} : F(4, 32) = 0.34$, $NORM\,\chi^2(2) = 0.28$, $HET : F(26, 13) = 0.46$, $RESET : F(1,39) = 1.01$.

Estimation period: 1991 Q1 – 2004 Q4.

Estimation method: least squares method.

Absolute *t-values* are shown in brackets under the estimates. The equation satisfies the requirements (diagnostic tests) that are relevant for a well-specified model. It also passes (recursive) Chow tests for structural breaks at a 1% significance level over the last five years of the estimation period.

$\varDelta$ is a difference operator: $X_t = (X_t - X_{t-1})$, $\varDelta_2 X_t = (X_t - X_{t-2})$, $\varDelta_3 X_t = (X_t - X_{t-3})$.

The variables are defined as (small letters indicate that a variable is measured on a logarithmic scale):

$b$ = Number of bankruptcy proceedings initiated. Source: Statistics Norway.

$w$ = Unit labour costs in mainland Norway, excluding the public sector. Source: Statistics Norway.

$p$ = Price deflator for mainland GDP. Source: Statistics Norway.

$e$ = Real exchange rate (competitiveness) measured by the trade-weighted exchange rate index and hourly labour costs in manufacturing for Norway and trading partners, respectively. The trade-weighted exchange rate index measures the Norwegian krone exchange rate against the currencies of Norway's 25 most important trading partners. Sources: The Technical Reporting Com-mittee on Income Settlements, The Ministry of Finance and Norges Bank.

$pn$ = Price index for office and commercial property. The time series prior to 1996 has been extended backwards using the rate of increase in the real estate sector's house price index. Sources: Statistics Norway, the Norwegian Association of Real Estate Agents (NEF), the Association of Real Estate Agency Firms (EFF), FINN.no, ECON and Norges Bank.

$y$ = Output gap for the OECD area. Source: OECD.

$d$ = Gross debt in non-financial enterprises. Source: Norges Bank.

$f$ = Number of enterprises (register count). Sources: Statistics Norway and the Brønnøy-sund Register Centre.

$R$ = Real interest rate measured by banks' average lending rate to private non-financial enterprises less average four-quarter rise in p over four quarters. Source: Norges Bank.

$u$ = Unemployment rate. Source: Directorate of Labour.

$q$ = Cost index for material input. Source: Statis-tics Norway.

$\varepsilon$ = Regression residuals (unexplained variation in left-hand variable).

$R^2$ = Share of variation in left-hand variable that is explained by the model.

$\sigma$ = Standard deviation of regression residuals.

$AR_{1-4}$ = A test for fourth-order autocorrelation in the residuals.

$ARCH_{1-4}$ = A test for fourth-order ARCH residuals.

$NORM$ = A test to see if residuals are normally distributed.

$HET$ = A test for heteroscedasticity.

$RESET$ = A test of the functional form of the model.

The expression in square brackets measures the deviation from an estimated long-term relationship between the number of bankruptcies and the number of enterprises, real interest rate, the unemployment rate, real labour costs, real material input costs and competitiveness. The model also contains effects of seasonal variations and a dummy variable for 1993 Q4. The dummy variable must be viewed in connection with new registration rules for personal bankruptcies introduced at year-end 1993.

[11] The model used by Norges Bank to predict bankruptcy probabilities for Norwegian limited companies includes the enterprises' age as an explanatory factor (Bernhardsen, 2001; Eklund, Larsen and Bernhardsen, 2001). According to these analyses, enterprises with an age of 1-3 years have the greatest probability of bank-ruptcy, all else being equal.

inflation to impact earnings, it is a prerequisite that the enterprise has no opportunity to raise a new loan so that it can price-index its debt. According to Wadhwani (1986), higher inflation, $\widetilde{P}$, may therefore increase the probability of bankruptcy if the enterprise's debt is not price-indexed and the enterprise no longer has access to borrowing as a result of credit rationing.

If the number of enterprises, $F$, increases, the number of bankruptcies can also be expected to increase. New enterprises normally have a higher probability of bankruptcy than older enterprises.[11] This may, for example, be because demand for their products has proved to be lower than expected at the time they were established, or relevant skills in newly-established enterprises are of a lower standard than skills in older enterprises, or because new enterprises to a lesser extent have access to external funding.

## 3 An empirical model of the number of bankruptcies

We have estimated a model of the number of bankruptcies. Equation (6) in the previous section was the starting point for the specification of the empirical model. The time series for the number of bankruptcies is published quarterly by Statistics Norway and includes all legal objects where bankruptcy proceedings are initiated. Most bankrupt entities are either private limited companies or sole proprietorships, with limited companies accounting for the highest share. The model, shown in the box, is estimated on quarterly data over the period 1991–2004 (2004 Q4 was the last available observation when the model was estimated).

We tested for effects of the following variables (see section 2):
- Domestic demand (measured by GDP, the output gap or the unemployment rate)
- Foreign demand (measured by the output gap for the OECD area)
- Competitiveness (measured by the real exchange rate)
- Real interest rate
- Real labour costs (per unit produced)
- Real material input costs (measured including and excluding energy goods)
- Non-financial enterprises' real gross debt (from domestic and foreign lenders) and the (gross) debt to equity ratio
- Number of enterprises/new business start-ups
- Inflation (changes in producer prices measured by the percentage change over four quarters in the price deflator for mainland GDP)
- Product price variation (measured as the standard deviation of the price deflator for mainland GDP)

The list of potential explanatory factors is long compared with the number of observations during the sample period. It was therefore not possible to include all the variables in a single equation with any meaningful result. We therefore estimated a number of alternative models where we only included some of the variables. We then simplified the models by imposing restrictions on the coefficients that were not rejected by the data and that simplified the interpretation of the dynamics. The preferred model is presented in the box.

Both inflation and price variation had coefficients and t-values close to zero.[12] The insignificant effect of inflation indicates that enterprises have been credit-rationed to a very limited extent over the estimation period (see discussion in section 2). An alternative interpretation is that enterprises with weak profitability have been credit-rationed, but as inflation has been sufficiently stable over the estimation period, no (significant) effect on bankruptcies figures has been identified.[13] This may also explain the insignificant effect of price variation. Furthermore, it may be difficult to identify the possible effect of inflation when unemployment is included in the model. Higher inflation normally covaries negatively with a rise in unemployment, and unemployment is included in the model to capture the effect of domestic demand. Even though a change in inflation would have an effect on the number of bankruptcies in the short term, the inflation level would not be expected to affect the number of bankruptcies in the long term. We would initially not expect the inflation level to be of any significance to real prices or other real variables over time. As the number of bankruptcies is a real economic variable, in isolation inflation will not influence changes in the number of bankruptcies in the long term.

Models with real material input costs, excluding energy products, had a better fit than models with real input costs including energy goods. This may be because fewer enterprises with energy-intensive production have been declared bankrupt during the estimation period and/or changes in bankruptcies are due to conditions other than energy prices. The unemployment rate as a measure of domestic demand gave a better fit than developments in GDP, mainland GDP and the domestic output gap. We therefore included the unemployment rate as a measure of developments in domestic demand.[14]

An enterprise must normally have lost its equity in order to go bankrupt. However, the variable for the debt to equity ratio had insignificant t-values in the different models. This may indicate that the macroeconomic factors that explain developments in bankruptcies also capture the effect of changes in the debt-equity ratio. In line with the discussion in section 2, a permanently higher debt level could also be expected to have an effect on the number of bankruptcies over time. However, enterprises' real gross debt only has a short-term effect in the model.

The model is an error correction model of the logarithm of the number of bankruptcies (see box). Chart 2 shows that the model fits well over the estimation period. The expression in brackets in Table 1 shows the long-term relationship between the number of bankruptcies,

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[12] Wadhwani (1986) finds an effect from inflation, but not from variation in product prices. The model is estimated using data from 1964 Q1 to 1981 Q4.

[13] Average year-on-year rise in the price deflator for mainland GDP in the period 1991-2004 was 2.6%, with a standard deviation of around 1%.

[14] In an empirical model for the liquidation rate for US enterprises, Platt and Platt (1994) also use unemployment as a proxy variable for aggregate demand.

**Chart 2** Actual and fitted number of bankrupties. Quarterly figures. 1991 Q1– 2004 Q4
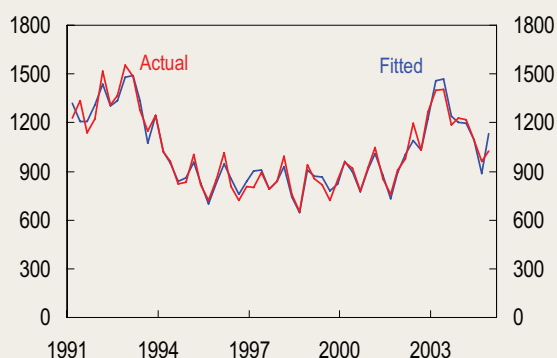


Sources: Statistics Norway and Norges Bank

**Chart 3** Change in number of bankruptcies when the real interest rate increases permanently by one percentage point. Percentage change over time. Quarterly figures
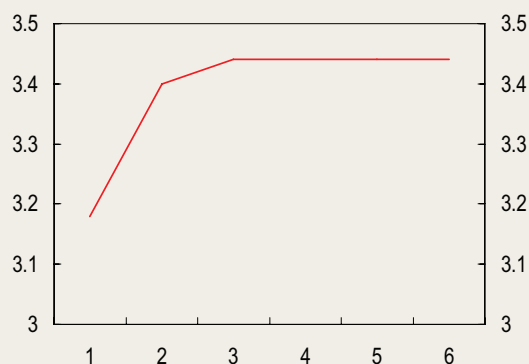


Source: Norges Bank

the number of enterprises, the unemployment rate, real interest rate, real labour costs and real material input costs as well as competitiveness. The model also includes real prices for commercial property, enterprises' real gross debt and changes in foreign demand, but these factors only have short-term effects on the number of bankruptcies. The cofficient of -0.93 in front of the long-term relationship in brackets indicates that the number of bankruptcies increases (falls) by 0.93% cent in quarter *t* if the number of bankruptcies was 1% under (over) the estimated long-term relationship in quarter *t-1* (all else being equal).

## *How do changes in the explanatory factors influence the number of bankruptcies?*

According to the model, the number of bankruptcies will increase if unemployment rises. If, for example, unemployment rose from 4% to 5% of the labour force and the other explanatory factors remained unchanged, the number of bankruptcies would increase by around 8¼% over time. A change in the unemployment rate has an effect on the number of bankruptcies after two quarters and the full effect is reached after one year. Unemployment is assumed to capture the effect of domestic demand. Husebø and Wilhelmsen (2005) show, among other things, that the negative covariation is strongest between unemployment in the current quarter and real mainland GDP two quarters earlier. The effect of a change in domestic demand on the number of bankruptcies is therefore probably sluggish, with the full impact coming around 1½ years later. According to the model, a change in foreign demand has an effect after 1¼ years, but this effect is only temporary and unwinds after two years. The lag in the impact of a change in demand may indicate that lower demand probably has a rapid impact on earnings, but that this takes time to translate into a deterioration of financial strength.

According to the model, the number of bankruptcies will increase by close to 3½ % in the long term if the real interest rate, i.e. the cost of servicing debt, increases by 1 percentage point (see Chart 3). Most of the impact is in evidence in the course of two quarters. Increased real debt will also push up the number of bankruptcies after two quarters, but according to the model, the effect is only temporary. After 6-7 quarters, the higher debt level has no effect on the number of bankruptcies.
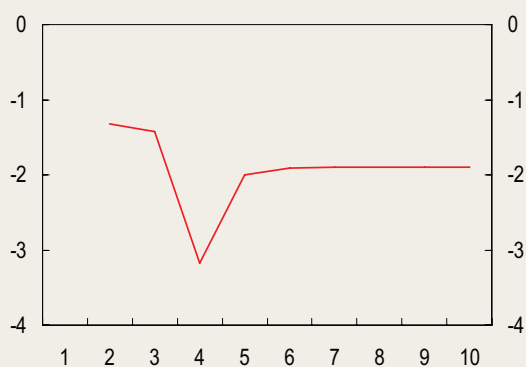
The model indicates that the number of bankruptcies increases by about 1¾ % in the first quarter and by close to 2¾ % over time if real unit labour costs increase by 1%. Similarly, the number of bankruptcies will rise by around 2% in the long term if real material input costs increase by 1%. The effect is achieved within one year. The analysis indicates therefore that changes in enterprises' profit margins have a relatively swift effect on the number of bankruptcies.

Competitiveness deteriorates if wage growth in the internationally exposed sector is stronger than among our trading partners or if the krone exchange rate appreciates. The model implies that the number of bankruptcies will increase by nearly 2% in the long run if competitiveness deteriorates by 1% (see Chart 4).[15] The effect after four quarters is 1¼ % stronger than the long-term effect. This indicates that many exposed enterprises are vulnerable in the event of a sustained deterioration in competitiveness. The somewhat weaker effect in the long term may be because exposed enterprises can (i) to a greater extent demand input factors other than labour if the deterioration in competitiveness is due to high domestic wage growth and (ii), make greater use of natural hedging techniques, such as buying inputs in the same currency as that in which they sell products, if competitiveness has been weakened by a stronger krone.

The model indicates that a fall in the real price of commercial property will result in more bankruptcies, but

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[15] Jacobson and Lindé (2000) find that the real exchange rate affects bankruptcy developments in Sweden. The empirical analysis is based on data from 1993 Q2 to 1998 Q1. Vlieghe (2001) also tests for effects of the real exhange rate using British quarterly data over the period 1975–1999, but finds no statistically significant effect on the rate of corporate business failures.

**Chart 4** Change in number of bankruptcies when competitiveness (measured by a real exchange rate) improves permanently by 1 per cent. Percentage change over time. Quarterly figures



Source: Norges Bank

**Chart 5** Number of bankruptcies and competitiveness. Competitiveness measured as hourly labour costs for manufacturing in Norway relative to trading partners, in common currency. Index: 1991=1. Annual figures. 1991-2004



1) A rising value denotes improved competitiveness

Sources: Statistics Norway, Technical Reporting Committee on Income Settlements, Ministry of Finance and Norges Bank

the effect is only short-term: one and two quarters after the fall in prices, the number of bankruptcies will increase by around ¾ % and then the effect will diminish and disappear after 6-7 quarters.[16]

An increase in the number of new business start-ups will fuel a rise in bankruptcies over time. The model implies that the number of bankruptcies increases by 1% over time if the number of enterprises rises by 1% and the full effect is achieved within four quarters.[17] Hence, in the long term, the bankruptcy rate will be constant for given values of the other explanatory factors.
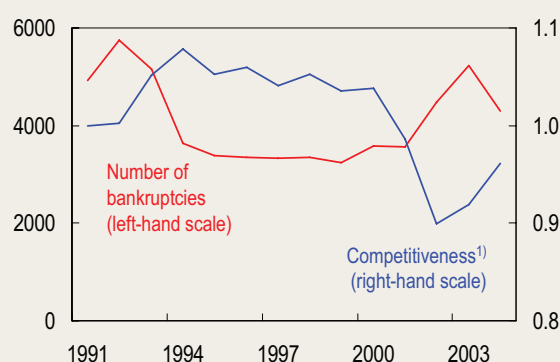
# 4 What has driven recent changes in the number of bankruptcies?

In this section we will discuss factors that have driven developments in the number of bankruptcies over the past 3½ years, and how the rate of corporate business failures will develop in the period ahead, if the Norwegian economy develops in line with the projections in *Inflation Report* 2/05.[18] The number of bankruptcies rose sharply in 2002, after having remained at a low and relatively stable level since the mid-1990s. Banks' loan losses increased, with higher losses on loans to manufacturing industry in particular. Chart 5 indicates that changes in competitiveness may have been an important explanatory factor for the number of bankruptcies in recent years.

## *Decomposition of changes in the number of bankruptcies*

Chart 6 shows the calculated contributions from the model's explanatory factors to the annual increase in the

number of bankruptcies in the period from the first half of 2002 to the first half of 2005.[19] The decomposed contributions are based on the estimated model and changes in the explanatory variables.[20] Changes in profit margins, competitiveness and the real interest rate, as well as cyclical fluctuations in both the Norwegian and the international economy, were among the most important driving forces in this period. For example, weaker competitiveness pushed up the annual increase in the number of bankruptcies by 16–17 percentage points in 2002. With the exception of real labour costs, which also have an effect on the number of bankruptcies in the same quarter that there is a change in real labour costs, the other explanatory factors influence the number of bankruptcies with a (varying) time lag.

A number of our trading partners experienced sluggish economic growth in the period 2001–2003. This resulted in lower demand for goods from the Norwegian export industry. However, at the beginning of 2002, capacity utilisation in the Norwegian economy was still high and the turnaround only came towards the end of the year. The overall contribution from domestic and foreign demand pushed up the number of bankruptcies from 2002 and into the first half of 2004. It was not until 2004 that economic growth picked up markedly again in both the Norwegian and the international economy, and this helped to reduce the number of bankruptcies in the first half of 2005.

Changes in enterprises' profit margins (measured as the relationship between factor prices and product prices) also help to explain changes in the number of bankruptcies over the past 3½ years. Real material input

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[16] Vlieghe (2001) also identifies a short-term effect from real prices for commercial property, with an estimated coefficient value of -0.76.
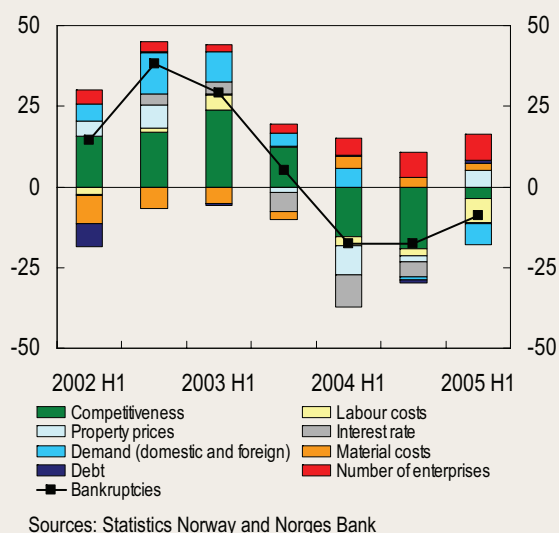
[17] This (long-term) homogeneity is a tested restriction that was not rejected by the data.

[18] The model passes tests for structural breaks over the last five years of the estimation period (see box). The parameters are relatively stable and we use the model to look more closely at the explanatory factors' contribution to changes in the number of bankruptcies in the recent past.
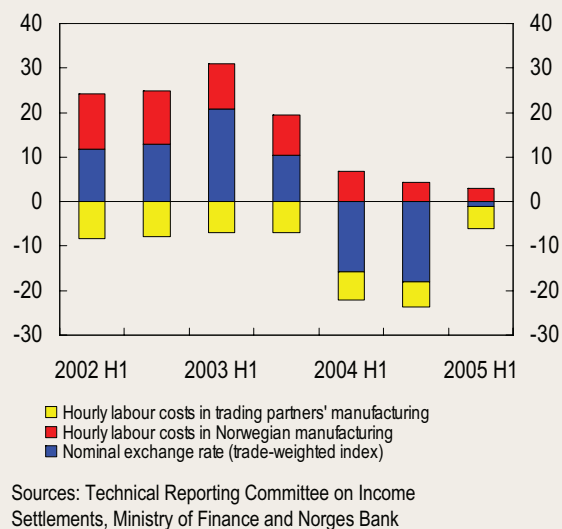
[19] Figures for commercial property prices in 2005 Q1 and for unit labour costs and the price deflator for mainland GDP in Q2 of the same year are based on projections in *Inflation Report* 2/05.

[20] The decomposition method is described in Jacobsen and Naug (2004).

**Chart 6** Annual percentage change in bankruptcies and calculated contributions from explanatory variables in percentage points. Measured in real terms. 2002 H1 – 2005 H1



- Competitiveness
- Property prices
- Demand (domestic and foreign)
- Debt
- Bankruptcies
- Labour costs
- Interest rate
- Material costs
- Number of enterprises

Sources: Statistics Norway and Norges Bank

**Chart 7** Calculated contribution of decomposed competitiveness to bankruptcies. Contribution to annual change. Percentage points. 2002 H1 – 2005 H1



- Hourly labour costs in trading partners' manufacturing
- Hourly labour costs in Norwegian manufacturing
- Nominal exchange rate (trade-weighted index)

Sources: Technical Reporting Committee on Income Settlements, Ministry of Finance and Norges Bank

costs helped to reduce the number of bankruptcies from the first half of 2002 until end-2003, but had the opposite effect last year and in the first six months of this year. The sharp growth in real wages in 2002 pushed up the number of bankruptcies in the second half of that year and first half of 2003. Wage growth has been moderate since 2003, which has contributed to a reduction in the number of bankruptcies in the past eighteen months.

In addition to the effect on enterprises' margins, wage growth is also important to developments in bankruptcies via its effect on competitiveness. The competitiveness variable comprises the nominal exchange rate and domestic labour costs relative to trading partners' labour costs. In Chart 7, we decompose the calculated effect of competitiveness on changes in the number of bankruptcies.

Charts 6 and 7 show that a deterioration in competitiveness can explain a considerable portion of the increase in the number of bankruptcies in 2002 and 2003. In addition to high domestic wage growth, a strong krone contributed to the deterioration in competitiveness, pushing up the number of bankruptcies, particularly in the first half of 2003. The appreciation of the krone was in part due to a widening interest rate differential against other countries. The widening of the interest rate differential and the appreciation of the krone through 2002 must be seen in the light of the high level of activity and strong wage growth in Norway compared with trading partners.[21] The fall in interest rates from December 2002 to March 2004 contributed to a depreciation of the krone exchange rate, and wage growth has slowed since 2003. Competitiveness therefore improved again somewhat in 2003 and 2004. This made a substantial contribution to the decline in the number of bankruptcies last year.

Interest rates influence several of the other explanatory factors in the model, including domestic demand and competitiveness. Movements in the interest rate also have a direct effect on the number of bankruptcies. Following the cut in interest rates in December 2002, the real interest rate contributed to a fall in the number of bankruptcies in the second half of 2003 and in 2004. The real interest rate was probably also an important factor behind changes in commercial property prices. The fall in real commercial property prices in 2002 pushed up the number of bankruptcies that year. Following the cut in interest rates, property prices picked up again in the course of 2003, which helped to reduce the number of bankruptcies last year. However, commercial property prices fell somewhat from the first to the second half of 2004 and this pushed up the number of bankruptcies in the first half of 2005.

Higher growth in the Norwegian economy in 2004 also led to a pick-up in the number of new business start-ups and the contribution from new businesses has increased in the past eighteen months. The calculations show that changes in corporate debt have had little direct effect in the period as a whole.

## Bankruptcies in different industries

Chart 8 shows the number of bankruptcies by industry as a percentage of the total number of bankruptcies, from 2000 Q1 to 2005 Q2. As a deterioration in competitiveness can explain a considerable portion of the rise in the number of bankruptcies in 2002 and 2003, it might be reasonable to expect that exposed manufacturing enterprises would account for a large share of the total number of bankruptcies in those two years. However, Chart 8 shows that the share of manufacturing

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[21] For a more detailed discussion, see Naug (2003) and *Inflation Report* 1/03: "Factors behind movements in the krone exchange rate". These analyses show that special conditions in the international economy also contributed: the fall in prices on international stock markets and smaller fluctuations between main currencies contributed to the appreciation of the Norwegian krone because the interest rate differential was positive. The strengthening of the krone was also related to the rise in oil prices and the fact that the krone functioned as a geo-political safe-haven currency.

bankruptcies has been stable in recent years (at an average of around 8%): although the number of manufacturing bankruptcies rose sharply in 2002 and the first half of 2003, the number of bankruptcies in other industries also increased in the same period. Among the industries shown in the chart, the number of bankruptcies particularly increased in manufacturing, the construction industry, the hotel and restaurant industry and property management and commercial services.

The stable and relatively low share of bankruptcies in manufacturing industry and the strong effect of changes in competitiveness on the number of bankruptcies in the same period indicate that industries other than manufacturing are also exposed. For example, both the fish farming industry and enterprises competing with imports in industries other than manufacturing are directly exposed to competition from abroad. Other enterprises, such as subcontractors to the export industry, will also be indirectly exposed to changes in competitiveness. Enterprises that are normally considered to be sheltered may also be affected. One example could be property enterprises that rent premises to exposed enterprises, or retail trade enterprises with premises near the Swedish border. Enterprises in the hotel and restaurant industry may also find that profitability is affected. For example, an appreciation of the krone will make it relatively cheaper to be a tourist abroad than in Norway.

## An open economy

Enterprises can hedge against fluctuations in the krone exchange rate, using currency derivatives and through natural hedging, such as buying inputs in the same currency as that in which they sell their products. In



Chart 8 Number of bankruptcies by industry as a percentage of the total number of bankruptcies. Quarterly figures. 2000 Q1– 2005 Q2

- Manufacturing
- Retail trade*
- Property management**
- Other
- Building and construction
- Hotel and restaurant
- Transport and communication

*Includes repair of vehicles and household appliances
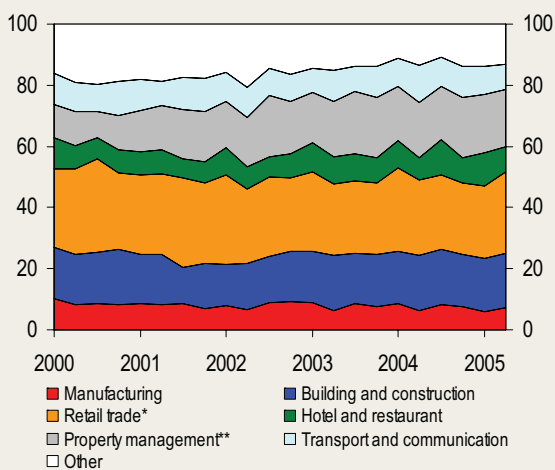**Includes commercial services and rental activities

Source: Statistics Norway

summer 2004, Norges Bank carried out a survey among Norwegian enterprises regarding their currency hedging practices (see Børsum and Ødegaard (2005)). The survey indicates that currency hedging using derivatives is widespread, particularly among larger enterprises, but natural hedging is also frequently used. Natural hedging is, however, not really an option for enterprises that use specific Norwegian inputs in their production process. Furthermore, derivatives contracts are largely short-term with maturities of up to one year. One of the conclusions in Børsum and Ødegaard is therefore that enterprises – beyond the scope of natural hedging – are as a whole vulnerable to a relatively sustained appreciation of the krone. This conclusion is supported by the empirical analysis presented above.

Monetary policy in Norway is oriented towards low and stable inflation. When Norges Bank sets the interest rate, the krone exchange rate is important as it influences inflation and total production.[22] With shifting themes in the foreign exchange market, the conditions that influence the krone exchange rate in the short term can easily become unstable. As the krone exchange rate is the price of our money measured in foreign currency, conditions in other countries may also be of significance to the krone exchange rate. Over time, however, a number of fundamental forces influence the krone exchange rate, including the phasing-in of petroleum revenues and business cycles. In the long term, competitiveness will be determined by real economic factors. Furthermore, the real exchange rate has a tendency to revert if there is a deviation over a longer period of time.[23]

## Future developments in the number of bankruptcies

Chart 9 shows that if the explanatory factors move in line with the projections in *Inflation Report* 2/05, the model implies that around 0.4% of all enterprises will go bankrupt each year in the next three years. According to calculations based on the model and the projections in the *Inflation Report*, changes in demand, real interest rates and competitiveness will be the most important driving forces in the period ahead. If interest rates rise gradually, as projected in the *Inflation Report*, and inflation develops as anticipated, real interest rates will increase somewhat through the projection period. The krone exchange rate is assumed to remain stable in the next 3½ years and wage growth is expected to be stronger than wage growth among our trading partners. Competitiveness will therefore deteriorate somewhat in the period to end-2008. Higher real interest rates and weaker competitiveness will, in isolation, lead to an increase in the number of bankruptcies. However, the gradual tightening of monetary policy reflects strong growth in the Norwegian economy, and capacity utilisation is projected to be above normal in the projection

[22] See, for example, Gjedrem (2003).

[23] See for, example, Akram (2002) and Sarno and Taylor (2002).

**Chart 9** Number of bankruptcies (seasonally adjusted) as a percentage of number of enterprises. Quarterly figures. 1991 Q1 – 2008 Q4[1]
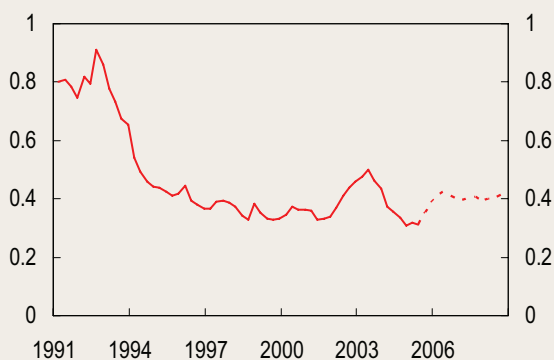


[1] Projections for 2005 Q3 – 2008 Q4

Sources: Statistics Norway, the Brønnøysund Register Centre and Norges Bank

period. According to the *Inflation Report*, such a path for interest rates would provide a reasonable balance between the objective of bringing inflation up to target and the objective of stabilising developments in output and employment. Growth in total demand contributes to reducing the number of bankruptcies. Overall, contributions from the explanatory factors will therefore result in stable and moderate developments in bankruptcies in the period ahead.

## 5 Conclusion

After having remained relatively stable since the mid-1990s, the number of bankruptcies rose substantially in 2002 and 2003, but has since declined. We have analysed the factors underlying developments in bankruptcies, based on an empirical model. According to the analysis, changes in profit margins, competitiveness and real interest rates, as well as cyclical fluctuations in both the Norwegian and the international economy, have been among the most important driving forces in the past 3½ years. We find that changes in competitiveness, in particular, may explain a considerable portion of developments in bankruptcies since 2002. In 2002, competitiveness deteriorated as a result of both strong wage growth and an appreciation of the krone exchange rate. Competitiveness therefore pushed up the number of bankruptcies in both 2002 and 2003. The krone depreciated through 2003 and into 2004 and wage growth has slowed in the past two years. Competitiveness has therefore improved somewhat and contributed to the recent fall in the number of bankruptcies.

An increase in the number of bankruptcies normally leads to higher loan losses for banks. The empirical analysis therefore shows that changes in the krone exchange rate and domestic production costs in relation to costs abroad may be important to financial stability.

If the explanatory factors develop in line with the projections in *Inflation Report* 2/05, the estimated model implies that the number of bankruptcies in relation to the number of enterprises will stabilise at around 0.4% over the next three years. The calculations indicate that the most important driving forces in the period ahead will be changes in demand, real interest rates and competitiveness. Overall, the explanatory factors result in stable and moderate developments in bankruptcies to end-2008.

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