
Can Crises Be Predicted?

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INTRODUCTION AND SUMMARY

In 2008, the global economy was hit by a crisis unrivalled since the Great Depression in the 1930s. The onset of the crisis was unexpected after a period of exceptionally favourable conditions with solid growth rates and low inflation in the major economies. This period was even referred to as "the Great Moderation" due to the notably more stable economic environment compared with previous decades.

From the summer of 2007, it became increasingly clear that all was not as well as previously assumed. In record time, a problem with US mortgages – that had seemed relatively limited on the surface – had caused liquidity problems for financial institutions all over the world. This quickly escalated into a full-blown financial crisis with serious economic repercussions. The crisis and the subsequent economic slowdown took virtually all economists in Denmark and abroad by surprise.¹ Their pre-crisis forecasts later came to reflect badly on them.

Against this backdrop, the question is why practically no economists saw that a worldwide crisis of this magnitude was looming. This article first discusses the Danish experience. Neither Danmarks Nationalbank, the Ministry of Finance, the Economic Council or the banks, nor the international organisations predicted that Denmark would be hit by a financial crisis. Once the crisis had set in, its real economic consequences were consistently underestimated. From a narrow Danish perspective, it can be tempting to view the crisis as the result of external factors that could not be predicted. But there is likely to be more to it than that.

The crisis seems to be the outcome of two interconnected imbalances that had been accumulating for some time. One was the prevailing global imbalances, i.e. mainly a large current-account deficit in the USA, while Germany and a number of Asian economies, notably China and Japan, posted large surpluses. Secondly, it is now clear that the financial system suffered from serious imbalances. The US mortgage problems

¹ A few prominent economists pointed out the risks associated with growing global imbalances, notably Raghuram G. Rajan, former Chief Economist at the IMF, Rajan (2005), William R. White, former head of the Economic Department at BIS, White (2006 and 2008), and Nouriel Roubini, professor at New York University and founder of Roubini Global Economics, Roubini (2006).

were presumably only the trigger of a crisis that would have come in any case.

Economic forecasts will always be subject to considerable uncertainty, not least in turbulent times. The typical forecasting models are based on a number of economic correlations that have held up over time. Nevertheless, the economy is sometimes affected by sudden reversals often related to financial market events. This was the case with the financial crisis. These reversals cannot be predicted by macroeconomic forecasting models.

Hence, a key issue is how to improve the ability to identify imbalances generating substantial corrections of e.g. house and stock prices and ultimately resulting in an economic downturn. Studies by the Bank for International Settlement, BIS, and the International Monetary Fund, IMF, among others, have attempted to identify indicators of financial imbalances. These studies find that factors such as strong credit growth, increasing residential investment and large current-account deficits may be indicators of imbalances that will, in the slightly longer term, lead to a correction with negative economic consequences.

However, the relationship between indicator signals and subsequent crises is far from perfect. And although the indicators may give early warning about financial imbalances, they cannot say exactly when a possible crisis will erupt. Consequently, it is not really possible to predict sharp economic reversals with a reasonable degree of certainty. However, if the indicators point to an increased risk of a financial crisis, they may prompt further analyses. Moreover, in periods when the indicators are in warning mode, a correction of financial imbalances should be included in risk scenarios.

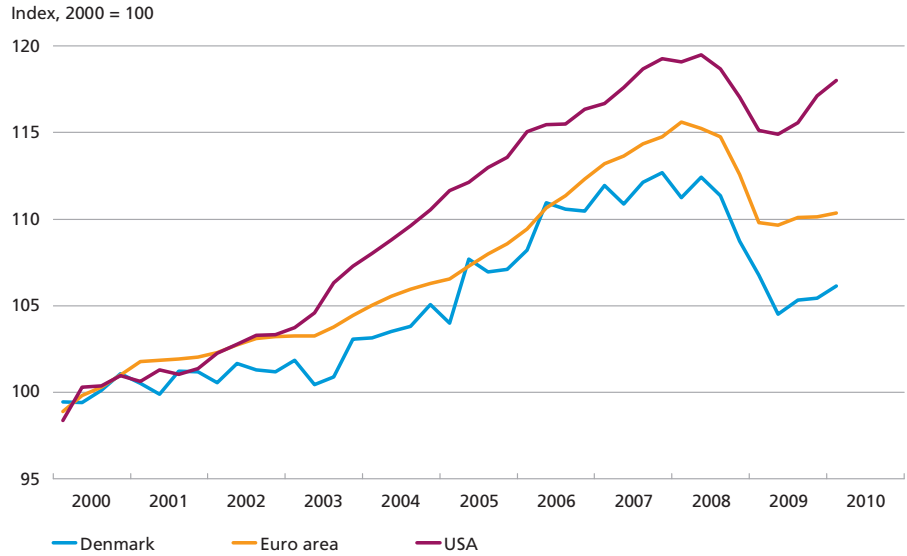
THE DOWNTURN IN DENMARK

Like most other countries, Denmark has been severely hit by the international crisis. Activity dropped by 7 per cent from the 2nd quarter of 2008 to the 2nd quarter of 2009, cf. Chart 1. Although growth has been back in positive territory in the last three quarters, the gross domestic product, GDP, has not risen above the level seen at the beginning of 2007. Denmark has not experienced a downturn of this magnitude since World War II. In terms of GDP, the downturn has been slightly more pronounced in Denmark than in the USA and the euro area, cf. Chart 1. The likely cause is that the Danish economy was overheated prior to the financial crisis due to the strong expansion in the preceding years.¹

¹ See Sørensen (2010) for an analysis of the downturn in Denmark.

GROSS DOMESTIC PRODUCT

Chart 1

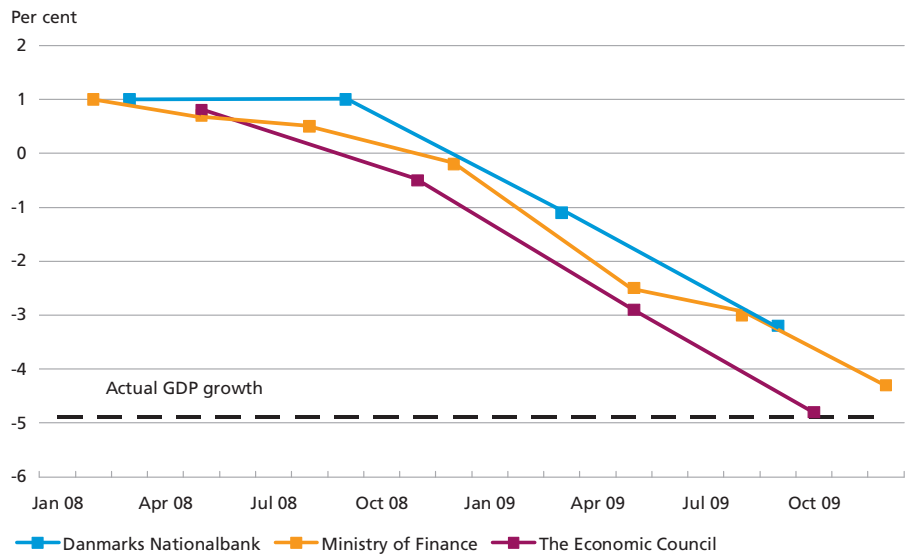


Note: Seasonally adjusted data.
Source: Reuters EcoWin.

The strength of Denmark's cyclical downturn caught all forecasters by surprise. Danmarks Nationalbank, the Ministry of Finance and the Economic Council reduced their growth estimates for the Danish economy in 2009 as the crisis evolved, cf. Chart 2. At the beginning of 2008, forecasters agreed that growth in 2009 would be relatively moderate at

GDP GROWTH FORECASTS 2009

Chart 2



Source: Danmarks Nationalbank, Ministry of Finance, the Economic Council and Statistics Denmark.

around 1 per cent. The modest expectations reflected the assessment that at that time the Danish economy was stretched considerably beyond its capacity limit.¹

This entailed pressure on the production resources, which was not sustainable in the longer term, and a period of low growth was found to be unavoidable. But it turned out that GDP fell by 4.9 per cent in 2009 compared with the forecast increase of 1 per cent. Instead of gradual adjustment to more sustainable capacity utilisation, the Danish economy went through a sharp correction, resulting in a far stronger downturn than a mere correction of an excessive capacity pressure.

WHY WERE THE FORECASTS WRONG?

A brief outline of the forecasting process is useful for better insight into how the forecasts could be so misguided. Like most other institutions producing macroeconomic forecasts, Danmarks Nationalbank uses an economic model, MONA, which is a quarterly model. MONA describes economic relations by means of a large number of equations estimated on historical data for the Danish economy.²

An economic model is merely a tool. It can generate a prediction on the basis of a number of assumptions, but it cannot capture all relevant aspects. Hence, it is up to the model users to find out how the final forecast should look. The users also incorporate information not included in the model, such as confidence indicators. Moreover, all forecasts have a strong element of judgement.

The economic variables of MONA can be divided into two main categories, endogenous and exogenous variables. Endogenous variables are determined by the model, while the user chooses the values of the exogenous variables in the projection period. Some of the key exogenous variables are export market growth, interest and exchange rates and oil prices.

In order to produce a forecast, the model user must choose the trajectory of these variables over the projection period. Usually, the development is not assumed to diverge dramatically from the historical path. This also applied when Danmarks Nationalbank compiled an internal forecast in May 2008. But at that time, export market growth had become subject to considerable uncertainty. Against this backdrop, an alternative scenario was discussed, in which export market growth was assumed to be weaker than what was regarded as the most likely path.³

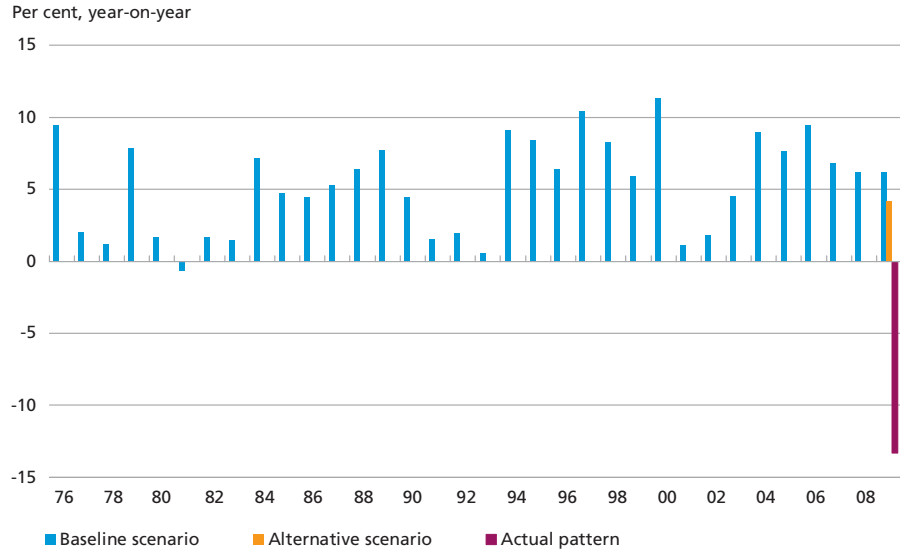
¹ See e.g. Danmarks Nationalbank (2008), p. 25f.

² See Danmarks Nationalbank (2003).

³ See Danmarks Nationalbank (2008), p. 27.

EXPORT MARKET GROWTH

Chart 3



Source: MONA data bank.

The actual development in export market growth was much weaker than Danmarks Nationalbank had envisaged, cf. Chart 3. Since a large part of the goods and services manufactured in Denmark is for export, a significant weakening of export markets will have a negative impact on economic growth in Denmark.

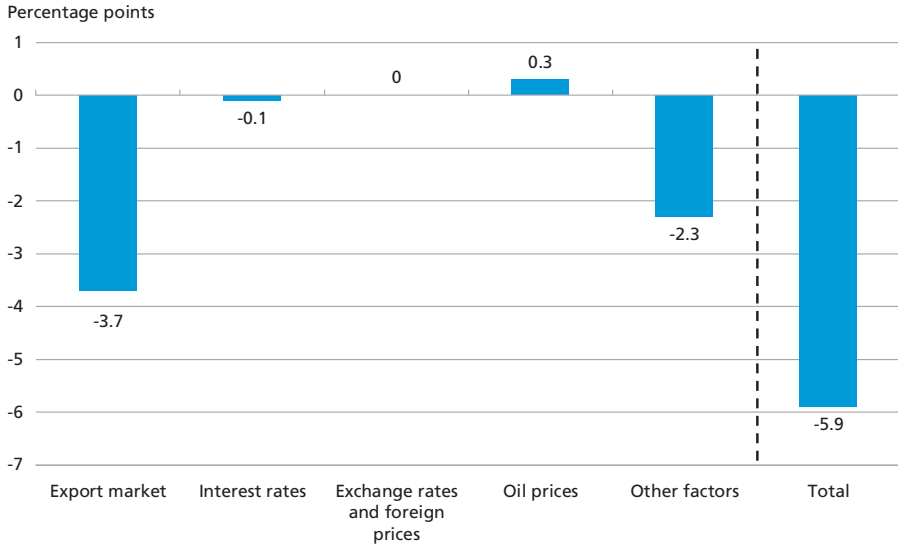
In MONA, the evolution of some of the economic variables is regarded as exogenously given. As mentioned above, it is up to the model user to choose the trajectory for these variables over the forecast period. A different realisation compared with that expected at the time of forecasting may be one factor explaining why the development in the endogenous variables also differed from the expected path. Consequently, MONA may be used to identify the assumption errors that led to the erroneous estimate of the variables explained by the model, such as GDP growth.

According to Statistics Denmark's preliminary estimates, GDP growth in 2009 was 5.9 percentage points lower than the projection in Danmarks Nationalbank's spring forecast from the 1st quarter of 2008. Using MONA, Danmarks Nationalbank has broken down the deviation by exogenous factors. According to the mechanical breakdown in MONA, the substantial drop in export market growth accounts for almost two thirds of the forecast error for 2009, cf. Chart 4. Interest rates, exchange rates, foreign prices and oil prices all play an insignificant role. Instead, the remaining third is explained by "other factors".

"Other factors" potentially cover a wide range of factors, e.g. fiscal policy, changes in the consumption and investment behaviour of the

BREAKDOWN OF FORECAST ERROR

Chart 4



Source: MONA data bank and own calculations.

private sector as well as revisions of previously released data. The cause of the substantial contribution from "other factors" may be that the financial crisis resulted in a strong drop in consumer and business confidence in future developments. This may have led to a stronger contraction of demand compared to a normal cyclical downturn.

CAN CRISES BE PREDICTED?

One possible interpretation is that the crisis was primarily caused by external factors. Denmark's Nationalbank's projection for economic developments outside Denmark is primarily based on forecasts from international organisations such as the OECD, the IMF and the European Commission. None of them expected a strong global downturn prior to the onset of the crisis. A natural conclusion is therefore that Denmark's Nationalbank's forecasting error can be attributed to the erroneous estimates of the international organisations.

Yet it is too simple to place all responsibility for the forecast error on the international organisations. Some of the factors that triggered the international crisis also characterised the Danish economy. For example, the Danish banks encountered difficulties remarkably early in the downturn. This points to imbalances in the Danish financial system that would inevitably lead to a correction.

The overriding question is why almost nobody saw the crisis coming. All was calm on the surface. For a prolonged period the global economy

had enjoyed favourable conditions with solid growth rates and low inflation. The fact that central banks kept interest rates fairly low supported the favourable development. Risk premia in financial markets fell as investor confidence in economic stability strengthened. At the same time, risk appetite increased as low interest rates induced investors to chase higher yields.

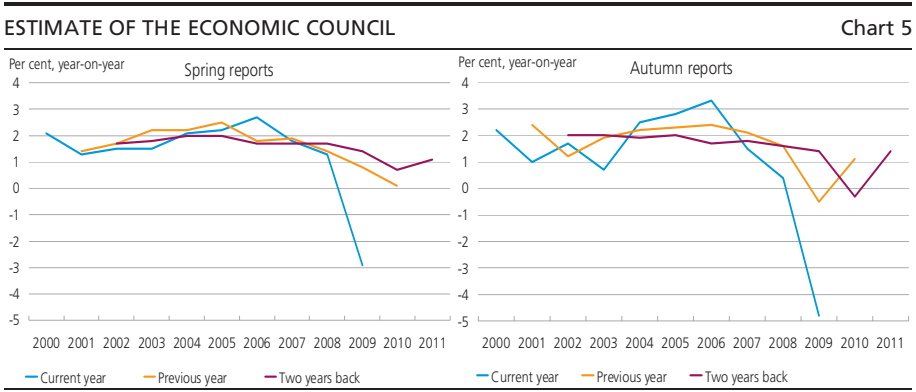
Today it is clear that all was not as well as it seemed. Much evidence indicates that the crisis was the outcome of two interconnected imbalances that had been accumulating for some time. One was the prevailing global imbalances, i.e. mainly a large current-account deficit in the USA, while Germany and a number of Asian economies, including China, posted large surpluses. These imbalances attracted a fair amount of attention before the outbreak of the crisis, but their significance in the longer term was far from clear. Secondly, it has become evident that the financial system suffered from serious imbalances. These imbalances would presumably have resulted in a crisis anyway at some point. It could be a mere coincidence that the crisis was triggered by US mortgage problems.¹

If major forecasting errors are to be avoided in future, it is paramount to find the best method of identifying imbalances that will at some point lead to a correction with consequences for the real economy. It is clear that traditional economic forecasting models are not suitable for analysing macroeconomic imbalances. Nor are they suitable for predicting strong economic reversals. They operate with economic relations that seem to hold in "normal" times when the economy is slowly moving towards its long-term growth trend in the absence of major fluctuations.

This gradual return to trend growth will typically be accepted as the most likely result. The reason is that not much is known about what will happen two years ahead. Consequently, there is rarely any substantial reason to assume that the economy will develop either more strongly or more weakly than its historical trend. That is why e.g. the Economic Council's growth estimate two years ahead is, in most cases, close to the estimate of annual trend growth of just under 2 per cent, cf. Chart 5.² However, the probability of growth matching trend growth two years ahead is relatively small because in the meantime, the economy will be affected by events with positive or negative impacts. It is not possible to predict events several years ahead, but if the numbers of positive and

¹ See Kramp (2009) for a discussion of the role of the imbalances in the financial crisis.

² This point is illustrated by estimates from the Economic Council since Danmarks Nationalbank's own forecasts were not published until 2007. However, a chart based on Danmarks Nationalbank's estimate would present a similar picture.



negative surprises are equal, the forecasts should, on average, be right over time.

The traditional models are primarily useful when the economy is in "normal" conditions, whereas they fail in case of more unusual events that suspend the known correlations. For example, a financial crisis may have such a strong impact on consumer confidence that consumer demand will fall more sharply than during a normal cyclical downturn. Moreover, economic and financial globalisation may cause the crisis to spread faster across borders than previously. As a result, the estimated relations in the models no longer hold, so the model users have to add their own assessments of the expected path of the economy.

Another aspect of the current crisis is that the economic forecasting models typically used by central banks and other institutions take the financial sector into account only to a very limited extent. Hence, financial crises cannot arise in these models. In addition, the existing models do not provide for satisfactory analysis of the relations between the financial sector and the real economy. Alternative methods are therefore called for if crises are to be foreshadowed.

Indicators of financial crises

In order to predict financial crises that cause strong economic reversals it is necessary to supplement the traditional macroeconomic models with tailored methods. For example, a number of studies have attempted to identify indicators of financial imbalances. The typical method is to identify a number of financial crises for various countries as the first step. The second step is to examine whether there are relations between the crises and the evolution of certain economic variables in the period up to the outbreak of the crisis. If such relations can be identified, they can potentially be used as warning indicators of future crises.

For a number of years, senior BIS employees have focused on how to identify financial imbalances, see e.g. Borio and Lowe (2002 and 2004). Their key message is that financial crises have often arisen after periods of strong credit growth combined with rising asset prices. It seems that this particular combination can be damaging to the real economy, whereas a strong increase in asset prices, for example, has a less pronounced effect if it is not associated with above-normal credit extension.

Borio and Lowe have constructed indicators of financial imbalances that give early warning when simultaneous credit growth and increases in asset prices exceed a certain limit, which has been determined on the basis of two opposing considerations. If the limit is set too high, the signal will be given only rarely and the indicator will not predict many crises. On the other hand, if the limit is set too low, there will be a large number of false alarms. According to Borio and Lowe (2004), these indicators could have predicted almost three quarters of the identified crises with a horizon of 4-5 years. Moreover, the number of false alarms is low; only around 2 per cent would have been "noise".

The crisis has reinforced focus on the subject. For example, the IMF has studied potential indicators of financial crises.¹ The study is based on data for 21 industrialised countries, including Denmark, for the period 1970-2008. The IMF defines a crisis as a decline in the 4-quarter moving average of either house prices or stock prices in excess of 5 per cent for house prices and 20 per cent for stock prices. On this basis, they have identified 47 corrections in the housing market and 98 in the stock market. In the first year after a correction of house prices, GDP on average falls by 4.25 per cent below the trend, while the corresponding decline after a correction in stock prices is 1.25 per cent. It follows that both types of correction have important real economic consequences.

Overall, the IMF finds that the period before a correction in the stock or housing market is typically characterised by strong lending growth, a considerable increase in investment as a ratio of GDP and soaring prices of financial assets. On the other hand, the IMF could not identify any specific pattern of inflation and growth prior to a correction. The IMF's conclusions on this issue are thus very close to those of BIS. On the basis of the established correlations, the IMF has constructed an indicator of a forthcoming correction. This indicator will give early warning if a combination of credit, current-account deficit and residential investment reaches a certain level.

This indicator is to give early warning if there is a supernormal probability that a correction will soon take place in the housing or stock

¹ See IMF (2009).

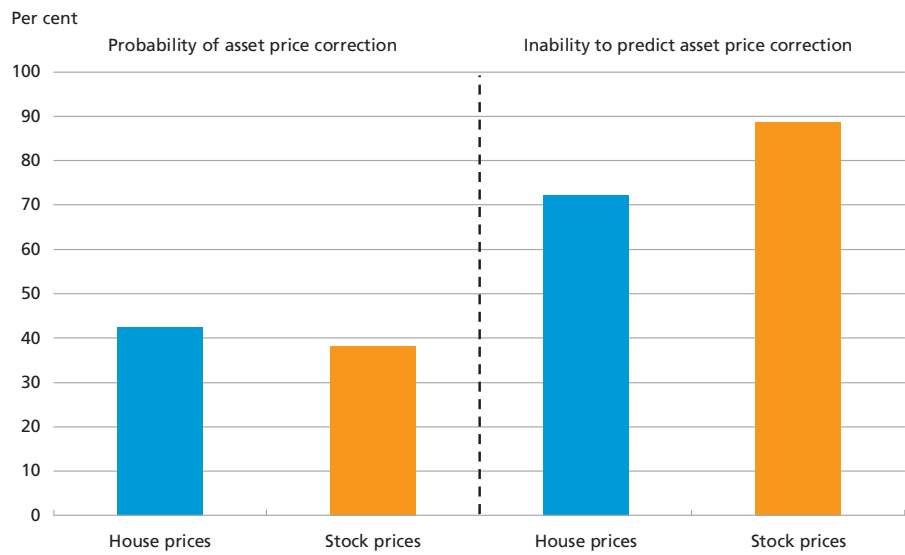
market. With or without early warning, the probability of a correction within a horizon of 1-3 years is approximately 14 per cent for house prices and 29 per cent for stock prices. Hence, the probability of a correction if early warning is given must be higher than 14 per cent and 29 per cent, respectively, for the indicator to be useful.

Based on data for 1985-2008, the IMF finds that an early warning increases the probability of a correction by around 40 percentage points for both house prices and stock prices, cf. the two bars on the left-hand side of Chart 6. The probability of correction is thus significantly higher if the indicator has given early warning. As a minimum, an early warning should therefore prompt the authorities to be even more alert to any accumulating imbalances.

Not all crises are captured by the indicator. It misses more than 70 per cent of house price corrections and almost 90 per cent of stock price corrections, cf. the two bars on the right-hand side of Chart 6. It follows that the indicator is fairly weak, and the IMF results do not seem to support the BIS' more optimistic view on finding ways to predict financial crises, although there is general agreement on which indicators should be looked into. In addition, it can be argued that a horizon of 1-3 years is not exactly precise.

The results of other studies seem to be even less promising. For example, on the basis of a comprehensive study of more than 60 poten-

INDICATORS OF ASSET PRICE CORRECTION Chart 6



Note: The bars on the left indicate the increase in the probability of a correction within a horizon of 1-3 years with early warning, compared with the probability of a correction irrespective of early warning. The bars on the right indicate the probability of the indicator, in a given quarter, failing to capture a crisis arising 1-3 years later.

Source: IMF.

tial indicators for 107 countries, Rose and Spiegel (2009) have examined whether country-specific factors can explain the extent to which the individual countries have been affected by the recent crisis. Based on the IMF and BIS results, it would seem that countries with strong credit growth would have been relatively hard hit by the crisis. But Rose and Spiegel find no correlation between the value of the indicators and the extent to which the individual countries were affected by the crisis.

The study by Rose and Spiegel is different from the analyses by BIS and the IMF in several respects. Among other things, Rose and Spiegel focus on the most recent crisis only, while also including a larger set of countries. Furthermore, the different conclusions can be explained by differences in methodology. In view of their results, Rose and Spiegel are sceptical about the possibilities of developing indicators of financial crises. However, interest in this issue can be expected to increase in future.

DANISH INDICATORS OF IMBALANCES

As appears from the discussion above, there is no general agreement on the ability to identify financial crises. On the basis of the empirical studies, interest focuses on lending growth, the investment-to-GDP ratio, stock prices and house prices. In the following, the development in these factors in Denmark in the time leading up to the outbreak of the crisis will be compared with previous expansions.¹

Rising house prices have been identified as a possible indicator of financial imbalances. In Denmark, house prices rose almost continually from 1993 to 2007, but the increase was particularly strong in the years up to the outbreak of the crisis, cf. Chart 7.

Stock prices almost doubled over a 4-year period up to the onset of the crisis, cf. Chart 8. This is a strong increase compared with developments during previous booms and can be viewed, alongside the increases in house prices, as a signal of potential imbalances.

The BIS studies mentioned above have concluded that rising asset prices are particularly risky when they coincide with soaring credit. During the most recent boom, the surge in total lending as a ratio of GDP was far stronger than in previous expansions, cf. Chart 9.

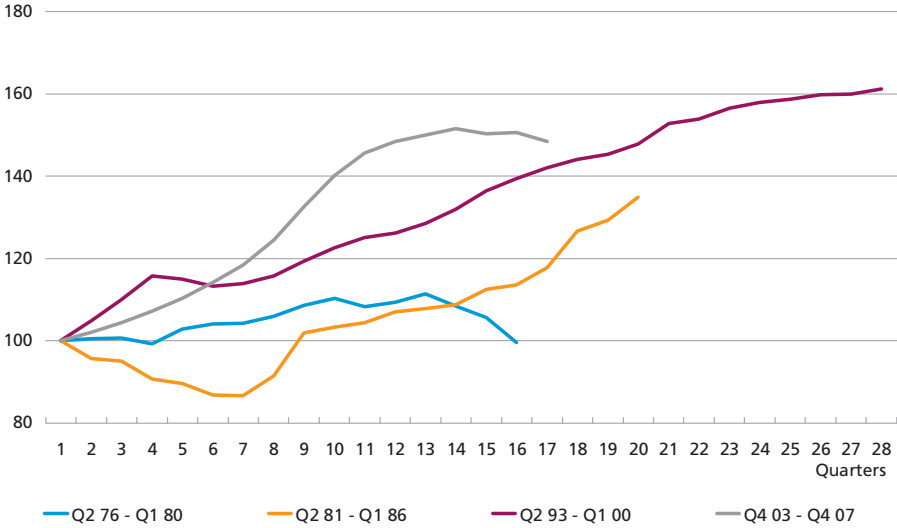
In Denmark, bank lending rose concurrently with a strong rise in the banks' customer funding gap. In 2003, total bank deposits almost matched total lending, but in 2008 the banks had a customer funding gap

¹ See also Pedersen and Sørensen (2009).

REAL HOUSE PRICES

Chart 7

Onset of upswing = 100



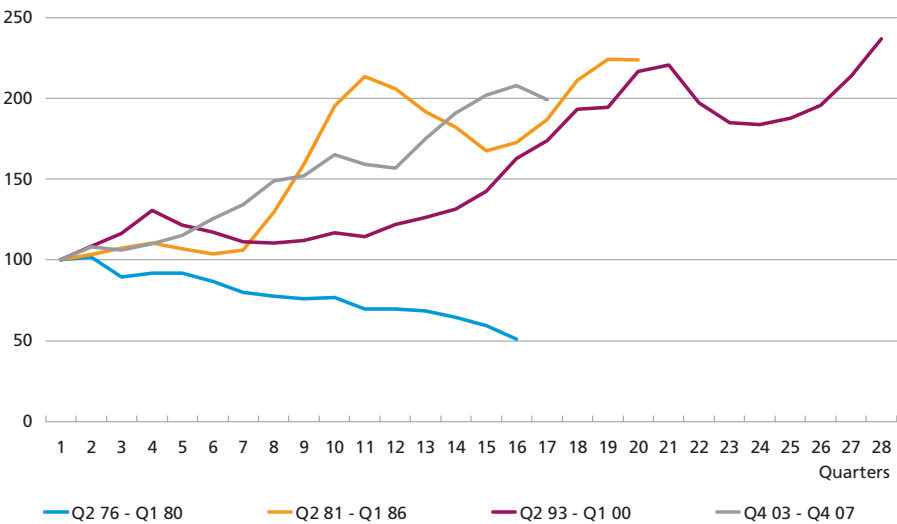
Note: The X axis shows the number of quarters since the onset of the upswing.
Source: MONA data bank.

of approximately 25 per cent of total lending, cf. Chart 10. The substantial gap was probably one of the reasons why the banks so soon experienced problems when it became difficult to obtain market-based financing.

STOCK PRICES

Chart 8

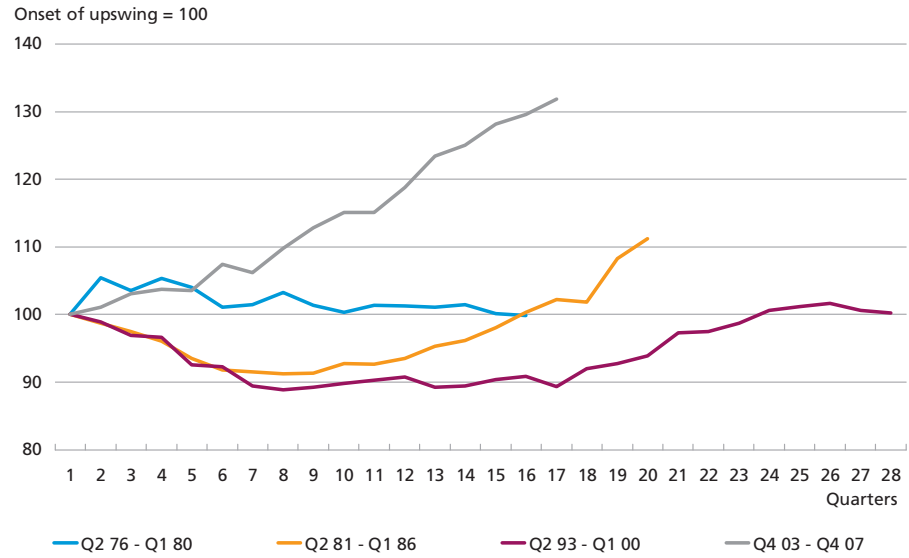
Onset of upswing = 100



Note: The X axis shows the number of quarters since the onset of the upswing.
Source: MONA data bank and own calculations.

TOTAL LENDING RELATIVE TO GDP

Chart 9

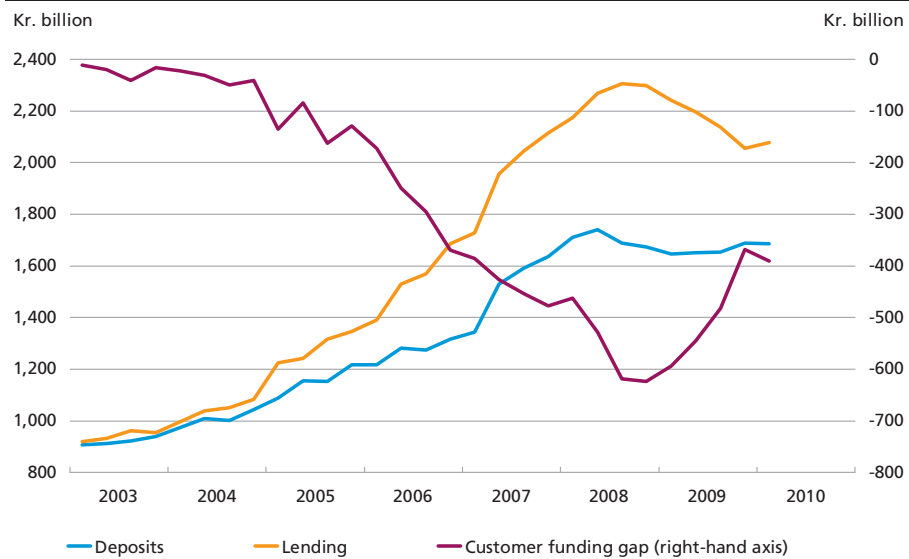


Note: The X axis shows the number of quarters since the onset of the upswing.
 Source: Statistics Denmark, Danmarks Nationalbank and own calculations.

Hence, it is clear that in the period up to the outbreak of the crisis the Danish economy was characterised by a number of the features that have been identified in BIS and IMF studies as potential indicators of financial imbalances. But as discussed above, these factors far from always lead to a crisis.

DEPOSITS AND LENDING, DANISH BANKS

Chart 10



Source: Danmarks Nationalbank.

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