

Macro-effects of higher
capital and liquidity
requirements for banks

Empirical evidence for
the Netherlands

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I Introduction

The crisis has demonstrated that the ability of banks to absorb shocks needs to be strengthened. The financial tensions that have emerged repeatedly since 2007 could assume such serious proportions because the exposure of the banks was too high and too risky in relation to their capital reserves. As a result, they had too little capacity to absorb the losses on the market positions they had taken and on the loans they had granted. Banks were forced to respond by reducing their high-risk positions. The liquidity buffers held by banks were also generally inadequate, making them vulnerable when market liquidity dried up. Against this backdrop, investors lost confidence at the height of the crisis in the autumn of 2008, and governments had to step in by recapitalising some banks and guaranteeing bank debts. Central banks made liquidity more readily available because the banks were unable to raise funding in the markets, including the interbank market.

To prevent a repetition of such problems, the Basel Committee has developed a raft of measures designed to strengthen the banking system. The intention is to improve the resilience of individual banks whilst also improving the stability of the financial system as a whole. The measures will have an impact on the financial position of banks, which will be required to raise and hold more and better-quality capital, thereby increasing their funding costs. The asset side of banks' balance sheets will also change, for example if banks hold more liquid assets.

The influence of such developments on the functioning of banks will also have macroeconomic consequences, both in the transitional phase and in the new 'steady state' in the longer term. Precisely how these effects will manifest themselves is difficult to predict, and depends among other things on how banks behave, on supply and demand in the money and capital markets (e.g. the supply of new liquid bonds) and the strategy of other financial institutions, which could take over part of the maturity transformation. The Basel Committee is examining the potential consequences of the new standards before adopting them definitively. The challenge will be to phase in the capital reinforcement measures in such a way that lending is not unnecessarily constrained and that economic recovery is not stifled. The exploration of the outcomes for the Netherlands in this study forms part of a broader investigation by the Basel Committee of the macroeconomic effects of heightened supervisory standards (BCBS, 2010 and BIS, 2010).

The design of the new standards is discussed further in section 2. The channels through which those standards could impact on bank behaviour, lending and the economy during the transitional phase form the subject of section 3. Section 4 quantifies the potential macro-effects of the transitional process for the Netherlands. Section 5 focuses on the new steady state, in which banks meet the new standards and have adapted their business models. This paper only addresses the effects of the new quantitative standards, and does not consider the potential interaction with new qualitative standards.

2 New regulatory standards

The banking industry was consulted on the outlines of the new regulatory standards at the end of 2009 (BCBS, 2009), and these standards were ratified by the Group of Governors and Heads of Supervision, the supervisory body of the Basel Committee (see Box 1), in July 2010. A key objective of the new measures is to raise the quality and amount of capital held by banks. For example, a higher proportion of the capital of banks must consist of core capital, especially paid-up share capital and retained earnings. The capital requirements to cover market risk, securitisation and counterparty credit risk (mainly interbank exposures) will also be raised. An additional leverage ratio will also be introduced to control the relationship between banks' assets and capital reserves. In order to constrain pro-cyclical behaviour by the banks, a higher target capital ratio will be introduced over and above the minimum capital requirement. Restrictions on profit distribution will encourage banks to build up this additional buffer in good times, so that they can fall back on it during periods of economic downturn. The buffer may also be temporarily increased if lending in a given country accelerates to exceptionally high levels. Forward looking provisioning for non-performing loans could also help prevent pro-cyclical activity.

The Basel Committee and the Committee of European Banking Supervisors (CEBS) have also developed internationally harmonised standards for liquidity risk. The Liquidity Coverage Ratio (LCR) is intended to enable a bank to survive a severe stress scenario lasting one month. To make this possible, the liquid assets held must be sufficient to cover the assumed net cash outflow. The composition of the assets is important, and notably the proportion of assets that is highly marketable or can serve as collateral for central bank borrowing, or that can be rapidly turned into cash in some other way. The Net Stable Funding Ratio (NSFR) has also been developed to reduce banks' maturity mismatch. Under this standard, longer-term bank lending must be covered by long-term stable funding, such as savings and wholesale funding with a term to maturity of more than one year.

In addition to the quantitative capital and liquidity standards developed by the Basel Committee, several other initiatives, most of them more qualitative in nature, have been considered in order to limit the systemic risks of large, complex financial institutions. These include greater independence for group entities and measures to facilitate an orderly break-up of financial institutions, for example by making it

mandatory for institutions to formulate a 'living will'. Policymakers are also considering the introduction of restrictions on the extent and nature of banking activities and a bank tax. These initiatives may provide added value, but should not distract from the core need for a fundamental strengthening of the financial system in terms of capital and liquidity requirements. The new regulatory framework will be phased in gradually in order to prevent overly abrupt changes in the sector. The intention is that most of the quantitative standards will be implemented from 2013 onwards. The leverage ratio and the NSFR will be introduced after a longer transition period.

Box 1 New Basel Committee measures

In the wake of the financial crisis, the Basel Committee on Banking Supervision announced a comprehensive raft of measures aimed at strengthening the banking sector. The measures supplement and reinforce the Basel II Capital Accord for banks, which was introduced in 2008. Basel II introduced important new elements to banking supervision compared with the first Accord from 1988. A more risk-oriented approach was deliberately chosen in Basel II, in which banks are required to hold more capital for high-risk activities than for activities with a low level of risk. The Basel II rules for the 'banking book' incorporate capital requirements to cover the credit risk on lending and securitisation operations. These activities represent the lion's share of bank balance sheets. To date, Basel II has stuck to the rules introduced since 1996 to deal with the trading book and market risk. In addition, in contrast to the old Basel I, Basel II incorporates capital requirements to cover operational risk.

Under the new measures, which were ratified by the Committee's oversight body on 26 July 2010, banks in the future will be required to hold larger capital and liquidity buffers. First and foremost, the measures will improve the quality of capital, through a tightening up of the admission criteria for capital instruments which do not form part of core capital. The introduction of new tax allowances will ensure that capital elements of insufficient quality are deducted from total capital.

The Committee planned to make a statement in the autumn of 2010 on the required quantity of capital to be held by banks. In the first place, this entails a new minimum capital requirement, i.e. the amount of capital that an institution needs to hold in order to be regarded as viable by the markets. In addition, banks must maintain a buffer over and above the minimum, the aim being to enable them to survive a period of stress without falling below the minimum capital requirement. This buffer will take two forms. First, the capital conservation mechanism will encourage banks to grow towards a target capital ratio above the minimum; as long as this target has not been reached, profit distributions such as dividends will be reduced. A second element of the buffer is linked to the growth in national credit:

a bank must allow its buffer to increase whenever credit growth is excessive. Banks will be able to address both buffer elements during bad years. The existing capital requirements to cover market risk and risks related to complex financial products are also being raised; during the crisis it became apparent that banks had suffered particularly large losses on these activities.

The risk-weighted capital requirements are being supplemented with a non-risk-weighted capital criterion, known as the leverage ratio. This ratio, which compares unweighted total assets to capital held, is intended to set a limit to the build-up of excessive debt positions, one of the causes of the crisis. The proposed leverage ratio of 3 percent is intended to serve as a 'back-stop' for the risk-weighted requirements and thus to limit the growth of the balance sheet.

Major progress has also been made in the area of liquidity supervision. The Liquidity Coverage Ratio (LCR) is intended to enable institutions to survive a severe stress scenario during a period of one month. To this end, the liquid assets held must be sufficient to cover the presumed net cash outflow. In addition, a Net Stable Funding Ratio (NSFR) has been developed to reduce the maturity mismatch of banks. Under this measure, longer-term bank lending must be covered by long-term, stable funding such as savings and wholesale finance with a term of more than one year.

3 Channels through which the new standards will operate during the transitional phase

3.1 Direct consequences

During the transitional phase, the higher regulatory standards will impact on banks' balance sheets and profitability in various ways (see Figure 1). In order to achieve the higher capital ratio, banks will either have to raise more equity or retain more of their profits. Another option would be to reduce the size of the balance sheet by selling assets or reducing risk-weighted assets. In order to meet the liquidity standards, banks will have to limit their maturity mismatch, for example by enhancing the liquidity profile of assets or extending the term to maturity of funding. Taken together, these measures would increase the cost of funding and reduce interest income; all things being equal, this will lead to a fall in profitability.

3.2 Effect on lending via interest rate channel

In order to maintain profitability, banks will seek to counter the dip in their profits by raising the interest rates charged on loans and reducing the rates paid on deposits where possible, i.e. increasing the 'lending wedge'; see Figure 1. This means that

Figure 1 Effects of new supervisory standards

Requirement	Consequence	Reaction	Transmission	Economy / market	
Capital & Liquidity	Funding costs ↑ Interest margin ↓	Profits ↓	Lending wedge ↑	Interest rate channel	Credit demand ↓ via price
	Risk weights exposures ↑	Portfolio risk ↓	Risk premiums ↓ ↑	Risk channel	Credit demand sectors ↓ ↑
	Capital surplus ↓ Liquidity surplus ↓	Raise new capital Adjust (r-w) assets	Capital channel Lending channel	Capital channel Lending channel	Credit supply via volume ↓
		Bond purchases ↑ Demand LT funding ↑	Yield curve	Yield curve	Bond market: price, volumes ↓ ↑

the interest rate channel, traditionally the main monetary transmission channel, will be influenced by the new regulatory standards. The cost of capital will increase for households and businesses, while demand for credit will fall (via price rationing). According to a study by Elliot (2009), if the capital ratio is increased from 4 percent to 10 percent, the permanent interest rate effect will be limited to around 50 basis points, because the costs of higher capital buffers will be distributed among shareholders, lenders and borrowers. Barell et al. (2009) also model the lending wedge and use it as input for a macro-model to calculate the impact of higher regulatory standards on the British economy. In their approach, a one percentage point increase in the capital and liquidity ratios of banks would push up the costs of capital for households and businesses by just under 1 percent. This, they argue, would have a negative impact on investment and consumption.

3.3 Effect on credit supply via bank capital channel

The higher liquidity and capital requirements will limit the excess capital and liquidity of banks. This could lead to adjustments on the assets side of the balance sheet, such as a reduction in the risk grade of assets or restrictions on the availability of credit. This may be caused by constraints on funding, via the bank lending channel, or on equity via the bank capital channel (ECB, 2009). This latter channel can become active if regulators or the market impose higher capital requirements. This reduces the surplus between available capital and required capital, forcing banks to de-risk their balance sheet if they are unable to compensate for this by retaining earnings or raising capital externally. Empirical research confirms that a falling capital surplus prompts banks to modify their behaviour (Alfon et al., 2004). The bank capital channel is described in the literature in relation to monetary transmission, with undercapitalised banks being more sensitive to a rise in interest rates because they have fewer funding alternatives (Peek and Rosengren, 1995) and are more vulnerable to a reduction in the interest rate margin (Van den Heuvel, 2002). Other studies view the bank capital channel in relation to deleveraging and the risk of credit rationing.¹ This manifests itself in a reduction in lending capacity or credit limits. Studies carried out for the US and the UK suggest that a one percentage point reduction in surplus capital corresponds with a decline in lending of between 0.1 and 2.5 percent (Bayoumi and Melander, 2008; Berrospide and Rochelle, 2008; Francis and Osborne, 2009). The supply of credit could also be restricted through modification of lending standards such as collateral requirements and covenants. Since the state of banks' balance sheets can have an impact both via the interest rate channel and the bank lending and capital channels, the effects on lending will overlap.

¹ For the US, see e.g. Bayoumi and Melander (2008) and Berrospide and Rochelle (2008), and for the UK Francis and Osborne (2009).

3.4 Influence on risk behaviour of banks

Supervisory standards also influence banks' risk behaviour. In principle, the new requirements are intended to mitigate the risks that banks are inclined to take, owing to the limited financial liability of bank owners, who moreover have more information about the business than deposit-holders, and also because of the deposit insurance scheme. One counter to the propensity of banks to take risk is their fear of losing charter value if they should fail. Competition also reduces the risk appetite. Theoretical and empirical research does not produce uniform findings on the impact of higher capital requirements on risk behaviour (for a detailed literature review see Stolz, 2002). On the one hand, banks with higher buffers have less scope for high-risk lending, especially if the capital requirements match the risk profile of the loans (in other words, are risk-weighted). On the other hand, higher capital requirements provide an incentive for banks to compensate for the costs involved by taking risky positions, especially if the risk weights imposed by the regulator are not in line with the actual risks. As regards the transmission to the economy, increasing the risk-weighted capital requirements can be accompanied by a relative change in risk premiums between sectors in the economy, with additional effects on demand for credit from those sectors (Figure 1).

3.5 Broader effects of liquidity requirements

Stricter liquidity requirements could also have negative volume effects on lending. The Liquidity Coverage Ratio (LCR) increases the need of high-grade government bonds and other liquid assets, and this can crowd out lending. Apart from changes on the assets side of the balance sheet, the LCR and the Net Stable Funding Ratio (NSFR) will encourage banks to reduce their maturity mismatch by raising more stable funding, for example in the form of longer-term bonds or retail deposits. This will increase the funding costs for banks, which they may pass on to customers through a higher lending wedge. The effects of this on banks and the economy cannot simply be added together with those of the higher capital standards, because they are communicating vessels. This means that an increase in liquid assets could be accompanied by a decrease in more risky assets such as loans, thereby improving the capital ratio. Conversely, a stronger capital position will lead to a higher Net Stable Funding Ratio (NSFR) and thus to a reduction in liquidity risk. The extent of this offset depends on balance sheet ratios, how binding the new standards are and the response of individual banks.

Finally, there is an interaction between the liquidity standards and the monetary operations of central banks. Extending funding maturities could lead to higher bids in the long-term refinancing operations of central banks. This has implications for the implementation of monetary policy, among other things through changes in

the relationship between the demand for liquidity in short and longer-term tender operations. The reduced demand for short-term funding is likely to result in reduced activity in the short end of the money market. Increasing demand for term liquidity could result in a steeper money-market curve. These factors could have consequences for (the transmission of) monetary policy and the intermediary target variable (currently the overnight rate EONIA).

3.6 Impact on markets

The stronger regulatory framework will also affect the financial markets during the transitional phase. Banks will be forced to turn more to the equity markets to strengthen their capital position. It is estimated that the 20 biggest banks in the euro zone will have to raise approximately EUR 115 billion in Tier 1 capital in order to meet a two percentage point increase in the capital ratio (BIS, 2010). The liquidity requirements could also have major consequences for the fixed-income market, though it is difficult to be precise here (Figure 1). On the one hand, there will be greater demand for government bonds from banks as they seek to increase their liquidity buffers. This will put downward pressure on bond yields. The asset purchasing programmes of the US Federal Reserve give an indication of the interest rate effects of large-scale bond purchases; a study by the New York Fed estimates that total asset purchases (USD 1,800 billion) have pushed down ten-year Treasury yields by 50 basis points (Sack, 2009). On the other hand, the requirement to reduce the maturity mismatch (via the NSFR) will create greater demand from banks for long-term funding. This additional funding demand could drive up yields on bank bonds. As regards monetary transmission, this means that the effect of monetary policy on long-term interest rates during the transitional phase will become (temporarily) less predictable.

The impact of the new supervisory requirements on financial markets in the euro-zone could be limited, especially if a sufficiently long transitional period is adopted. The euro area equity markets (total amount outstanding EUR 3,500 billion, of which almost EUR 400 billion has been issued by banks) and government bond markets (total amount outstanding EUR 5,500 billion) appear to be deep enough to absorb the demand for additional issues of equity and debt securities. In some countries, such as Australia, government bonds are relatively less readily available.

4 Effects during the transitional phase: model outcomes for the Netherlands

In order to assess the impact on the lending wedge, lending and economic growth in the Netherlands during the transition period, a number of modelling methods were used. This provides a more complete picture of the effects. When one single model is used, the method chosen can influence the outcomes; a multiple-model approach accommodates this uncertainty. First, simple regression techniques ('satellite models') are used to explain developments in balance sheet variables and the lending wedge out of liquidity and capital ratios, macroeconomic and bank-specific variables. The outcomes can then be used in DNB's macro-econometric model to simulate the impact on gross domestic product (GDP). Finally, a Vector Autoregression (VAR) model was used to estimate the relationship between macroeconomic variables and bank variables. The macro-effects during the transitional phase depend on how far the standards are raised and on the length of the period over which they are implemented. For this reason, the outcomes are presented below in the form of scenarios.

4.1 Scenarios

The scenarios on which the simulations of the macro-effects of the new capital and liquidity standards are based assume different levels of the standards and different implementation periods (Table 1); these are only examples – the Basel Committee will fix the prescribed levels at a later date – but they enable the effects to be simulated of each percentage point increase in the target capital ratio. This means that the target capital ratio rises under the influence of stricter regulatory requirements and market pressure. For the capital ratio, the scenarios use the core capital relative to the risk-weighted assets (RWA). Core capital is defined as Tangible Common Equity (TCE), consisting of ordinary share capital and retained profits, reflecting the fact that the new standards are aimed at this highest-quality capital because it offers the best guarantee that a bank will be able to absorb any losses.

The liquidity scenarios assume that the relationship between liquid assets (consisting mainly of cash and government bonds) and total assets increases by 25 percent.²

² At the end of 2008, the liquid asset ratio of Dutch banks averaged 3.5 percent (liquid assets measured on the basis of cash, government bonds, high-grade corporate bonds and covered bonds).

Table 1 Scenarios

Capital scenarios	TCE/RWA ratio increases	per percentage point
Liquidity scenarios	Liquid assets / total asset ratio increases	25%
	Maturity wholesale funding increases by 1 year	
Implementation period all scenarios	Changes implemented	within 2 years within 4 years within 6 years

This reflects a change in the Liquidity Coverage Ratio (LCR). Changes in the Net Stable Funding Ratio (NSFR) are estimated on the basis of the assumption in the scenarios that banks will extend the maturity of their wholesale funding by one year (compared with the present average of around six years for the Dutch banking industry). This will increase funding costs. For the implementation periods, it is assumed that the higher standards will be phased in gradually over a period of two, four or six years. This means that banks will seek to achieve higher capital and liquidity ratios and will do so at the end of these periods.

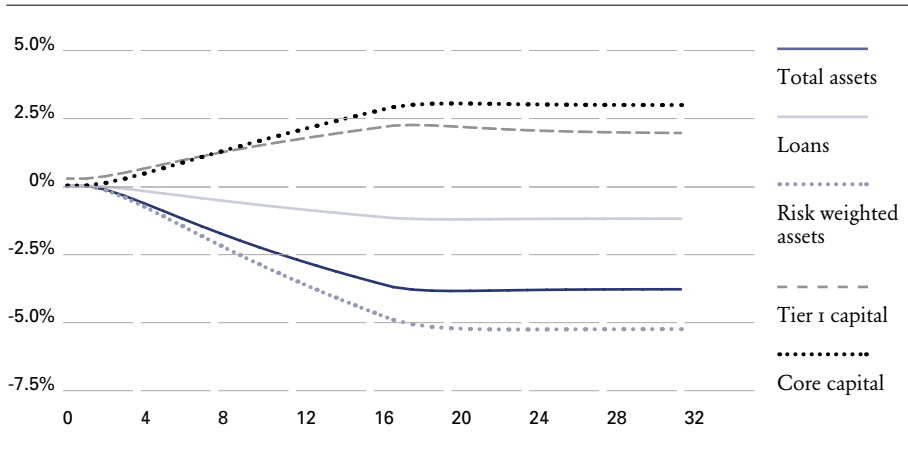
4.2 Satellite models

Simple regression techniques were used in the form of satellite models in order to estimate the relationship between capital and liquidity ratios on the one hand and balance sheet items (such as total assets, loans and capital reserves) and the lending wedge on the other. These relationships give an impression of the speed with which banks adjust their balance sheets and loan rates in order to meet the higher capital and liquidity targets. The estimates are based on historical data from the five largest Dutch banks, which together represent around 90 percent of the sector.

To simulate changes in balance sheet items in response to the higher target capital ratio, it is assumed that banks will respond to changes in their surplus capital (see the model specification in Annex 1, which is based on Francis and Osborne, 2009). The surplus, or the difference between available capital and target capital, falls as the target ratio rises. Our estimates show that banks compensate for two-thirds of their declining capital surplus by reducing (the level of risk of) assets and the other third by raising additional capital (see Figure 2, in which assets and liabilities are

Figure 2 Balance sheet adjustments, percentage point higher TCE/RWA ratio

Deviation from baseline, time on x-axis in quarters, implementation period 4 years



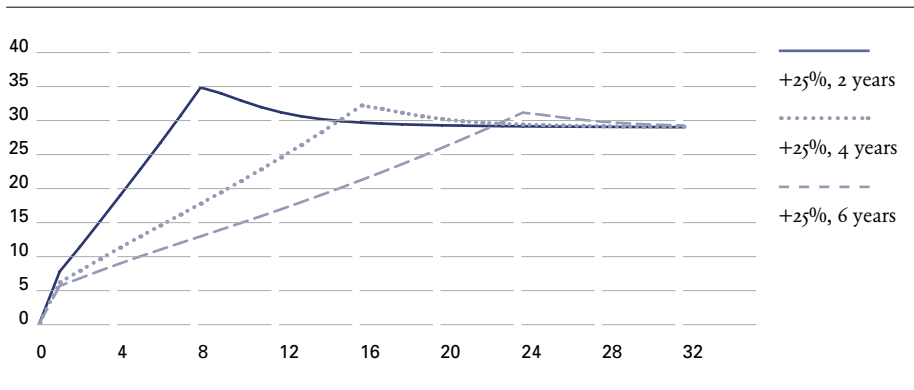
modified on the basis of the relationship with the surplus capital ratio as modelled in Annex 1; the Figure shows the outcomes for each percentage point increase in the target capital ratio). Banks will mainly raise core capital in the form of ordinary shares, because under the new requirements it will be mainly this category of capital that is lacking.

In scenarios involving higher capital requirements, the change in lending is limited. One reason for this is the historically low elasticity between lending and the capital ratios of banks, which is one of the determining factors in the satellite model. In scenarios where the capital ratio requirement rises by several percentage points, the volume of lending by Dutch banks would be between 3 and 6 percent lower at the end of the implementation period than in the baseline scenario. The reduction in total assets compared with the baseline is more than three times as great. This difference can be explained by the pecking order applied by banks in adjusting their balance sheets in response to shocks in the capital ratio. This means that loans are adjusted after other asset items have been modified, such as trading book and real estate exposures. This is in line with experiences in the recent crisis, when lending by Dutch banks continued to grow slightly on an annualised basis despite the sharpest downturn in the economy for 80 years and despite the pressure on the capital position of the banks.

In addition to the capital requirements, the new higher liquidity requirements will have an impact on bank balance sheets. The model assumes that banks will respond by substituting loans for liquid assets, so that the lion's share of the balance sheet adjustment is accounted for by loans (in a scenario where the ratio of liquid assets to total assets rises by 25 percent, lending falls by around 4 percent compared with

Figure 3 Impact on loan spread of rising liquidity ratio

Deviation from base line, time on x-axis in quarters



the baseline level). This is a rather conservative assumption, however: during the crisis, lending held up reasonably well, partly thanks to the crisis measures taken by governments and central banks. It is plausible that part of the balance sheet adjustment will be achieved through an increase in the lending wedge. The wedge increases if banks pass on the fall in return due to the substitution of less liquid items for liquid assets and the raising of longer-term funding to their customers (see model specification in Annex 1³). The model outcomes show that the wedge could increase by several tens of basis points due to the higher liquidity requirements, depending on the scenario considered (Figure 3). The effect on the wedge of a two percentage point increase in the target capital ratio is of the same order. As expected, a longer implementation period limits the increase in the wedge during the early years of the scenario, although this has virtually no impact on the ultimate outcomes.

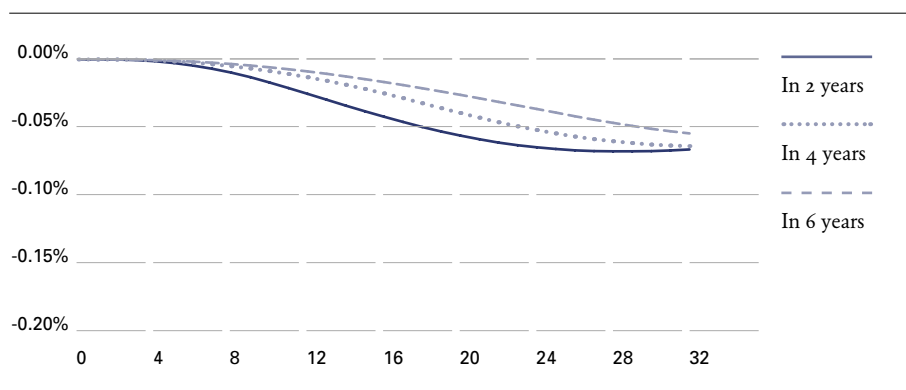
4.3 Simulations using macro-econometric model

The effect of a higher lending wedge on the Dutch economy was simulated using DNB's macro-model (DNB, forthcoming). In this model, changes in the lending wedge influence the cost of finance and therefore investment and consumption. The model simulations show that scenarios for higher capital and liquidity requirements involving changes in the lending wedge have a limited effect on GDP volume. The negative cumulative deviation from the baseline scenario per percentage point increase in the capital ratio is around 0.05 percent, and an increase in the liquidity ratio of 25 percent would mean that GDP volume was around

³ For the purposes of this study, the analysis is deliberately limited to the partial effects of the capital and liquidity scenarios; the analysis abstracts from structural factors which can influence the lending wedge, such as the degree of concentration in the banking sector.

Figure 4 GDP impact percentage point increase TCE/TWA ratio

Deviation from baseline, time on x-axis in quarters



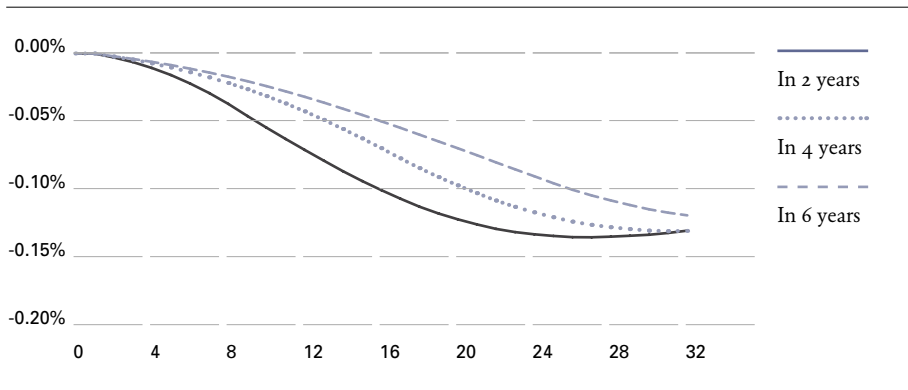
0.1 percent lower (Figures 4-5). This means that GDP would be lower because of temporarily slower growth; it does not mean that the potential economic growth would be lower (the volume effect would be permanent as long as the interest rate margin would not fall). It should be noted that the simulated GDP effects are surrounded by uncertainties. The effects of the scenarios cannot simply be added together because higher capital and liquidity requirements partially offset each other. For example, substitution of liquid for illiquid assets would lower the average risk level of the assets. As a result, a bank would need to hold less capital (this effect was not included in the analysis in order to maintain a clear view of the individual effects). One limitation of the macro-model is that it mainly simulates the effects on demand for credit (via the price of credit), and not so much the effects on the supply of credit. Model outcomes for other countries suggest that supply constraints – insofar as they lead to stricter lending conditions (other than the interest mark-up) – could have an additional negative effect on GDP.⁴ Certain sectors, such as small and medium-sized enterprises, which have virtually no access to other external funding sources, are particularly susceptible to restrictions in the availability of bank lending. Moreover, the calculations for the Netherlands take no account of international spill-over effects: if banks worldwide adjust their capital and liquidity positions, national economies will also be influenced from abroad.

The Figures show that a longer implementation period mitigates the impact in the short term. Moreover, an implementation period of six years reduces the cumulative effect slightly. A monetary policy response could also mitigate the impact on GDP (the outcomes shown here assume that no policy response takes place). Calculations

⁴ According to BIS (2010), an increase in the target capital ratio of one percentage point could lower GDP via that channel by around a further 0.16 percent compared with the baseline scenario (median outcome of several model calculations). The supply effects are expressed in the time series analysis in the next section.

Figure 5 GDP impact increase liquidity ratio with 25%

Deviation from baseline, time on x-axis in quarters



using DNB's macro-model show that the GDP effect in the Netherlands would be reduced by roughly one fourth if interest rates react mechanically to developments in the economy. The calculated effects could also be an overestimation if banks have already partially anticipated the higher standards. If capital buffers have already been strengthened and funding profiles adjusted under pressure from the markets, smaller adjustments would be needed in the future in response to the actual implementation of the higher regulatory standards.

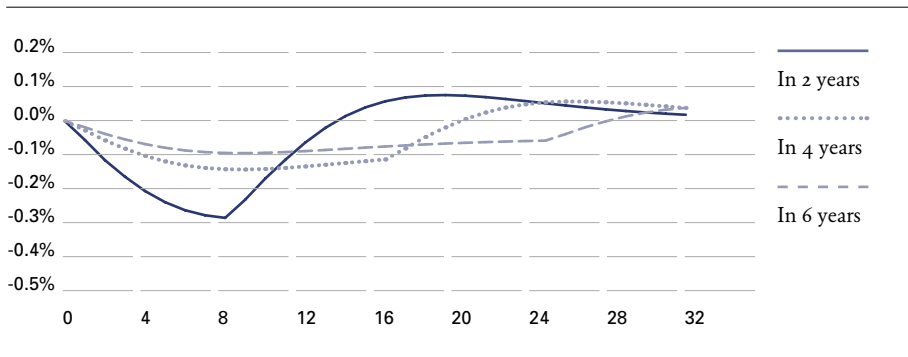
4.4 Time series analyses using VAR model

An alternative method for simulating the GDP effects of higher capital requirements is a time series analysis using Vector Autoregression (VAR). VAR describes the dynamic of variables based on their historical relationships. The VAR model estimated for this study is based on short-term relationships, because this proved to be the most robust model.⁵ The model, which is described in Annex 2, comprises six variables for the Netherlands: GDP volume, inflation, lending wedge, bank lending, the surplus capital ratio of banks and the bank lending standards. The four latter variables say something about the interaction between the economy and the banking sector and align with the 'credit view' of monetary transmission in which credit supply constraints play a role. For example, a shortage of capital can prompt banks to begin deleveraging. A change in the lending wedge or lending criteria could also impose constraints on lending. These transmission channels mean that a falling capital surplus has an impact on lending and on GDP in the VAR simulations. The

⁵ By way of alternative, a Vector Error Correction Model (VECM) was also estimated, but this produced very volatile outcomes (both upwards and downwards) and was left out of consideration for substantive and statistical reasons.

Figure 6 GDP impact percentage point increase TCE/TWA ratio

Deviation from baseline, time on x-axis in quarters



effect of the bank lending standards says something about the bank credit supply constraints, which are translated into stricter lending criteria; see also Annex 2.

Model simulations show that each percentage point increase in the capital requirements reduces GDP volume by between 0.1 and 0.3 percent compared with the baseline scenario (Figure 6). That is higher than the simulation outcomes using the macro-econometric model, because the VAR approach takes account of supply effects. The maximum negative effect manifests itself after two to three years. GDP thereafter returns to the baseline level, though this is due mainly to the statistical properties of time series models, in which shock effects disappear over time. The model outcomes show that a short implementation period leads to a relatively sharp fall in GDP volume, concentrated in the first two years of the scenario. In scenarios with a longer transitional period, the negative effects on the economy are spread out over more years.

4.5 International perspective

The economic effects calculated for the Netherlands are in line with outcomes for other countries as studied by the Basel Committee's Macroeconomic Assessment Group (MAG) (BIS, 2010). The MAG calculated that lending wedges would rise by 15 basis points if the target capital ratio were to increase by one percentage point, while lending volumes would fall by 1.4 percent compared with the baseline scenario (outcomes as the median of different model outcomes for several countries, with a four-year implementation period). The negative impact on GDP is limited: a one percentage point increase in the target capital ratio has a negative impact of between 0.07 and 0.31 percent compared with the baseline scenario, with a median of just below 0.2 percent (model outcomes in different countries with a four-year implementation period after 18 quarters, calculated using structural macro-models).

This includes international spill-over effects which could occur in the event of simultaneous implementation of the new standards in multiple countries. These effects are not included in the outcomes for the Netherlands. A scenario where the liquidity ratio rises by 25 percent would lead to an increase of 14 basis points in the lending wedge and would depress GDP by 0.08 percent compared with the baseline scenario (median of model outcomes in different countries with a four-year implementation period, after 18 quarters). The calculated outcomes show some divergence across countries due to differences in the model methods used assumptions and the different starting position of the banking sector in the various countries.

The macro-impact as calculated by the MAG is substantially lower than that calculated by the Institute of International Finance (IIF, 2010), an organisation which represents financial institutions. The IIF estimates that the new regulatory standards, assuming an increase in capital requirements of two percentage points, could have a negative GDP effect of between 1.9 percent (Japan) and 4.3 percent (eurozone) compared with the baseline scenario. Lending rates could increase by more than 130 basis points in the eurozone. The differences compared with the outcomes as calculated by the MAG are due to a number of factors:

- Capital scenario. The MAG includes only an increase in capital and liquidity ratios in its scenario, whereas the IIF also allows for other national reforms which banks could face, such as restrictions on their size and activities and the introduction of a bank tax.
- Baseline scenario. The IIF assumes low retention of profits by banks in the coming years, so that large amounts of capital will have to be raised. The MAG implicitly assumes a return to higher, historically long-term profit retention. The IIF also assumes a rising return on equity (ROE), while the MAG generally assumes no change.
- Methodological differences. The IIF uses an approach in which GDP is a direct function of lending. By contrast, the MAG approach is based on models used by central banks and the IMF, which allow for the complex interactions between financial and economic variables (including alternative sources of funding).
- Responses. The IIF assumes that banks will only achieve the NSFR by extending wholesale funding maturities. This places heavy demands on capital markets and causes interest rate spreads to rise much more strongly than in the MAG simulations. In practice, however, banks will also adapt in other ways, such as by raising more retail funding or shortening the maturities of assets.

5 Effects in a new steady state with higher buffers

This section discusses the situation after all the changes following the introduction of the higher minimum requirements have settled down (the new ‘steady state’). There is much more uncertainty about this than about the transitional phase, especially when it comes to quantifying the ultimate effects. Nonetheless, it is possible to say something about the most likely directions of change for a number of factors. It is for example quite plausible that the increasing lending wedges during the transitional periods – see sections 3 and 4 – will acquire a degree of permanency, as compensation for the higher funding costs faced by banks. On the plus side, the higher buffers will make a future financial crisis less likely and less profound, while economic growth will be more stable. This section looks at the costs and benefits of higher buffers in the new steady state.

5.1 Higher buffer requirements: costs and benefits

The costs of maintaining higher capital and liquidity buffers in the new steady state are to some extent comparable with the costs during the transitional period. Higher capital buffers with a sizeable equity component will drive up funding costs, since the return on equity (ROE) demanded by equity investors will be relatively high. The same applies for the liquidity risk: a reduction in the maturity mismatch implies a lower profit margin on average for the traditional banking business, while the increased exposure to high-quality liquid assets will dent profits. Logically, these costs will be passed on to borrowers in the form of a higher lending wedge.

However, these cost increases can be kept limited: over the longer term there are also other options that can be used to the full in the new situation. For example, companies could substitute bank borrowing for alternative means of financing, via other financial intermediaries, or raise funds directly in the capital market (though this is less of an option for smaller companies). Banks could also adapt their behaviour and business models. The new regulatory standards could provide an incentive for banks to lower their cost base by adopting a different business strategy, or offering products with a more stable and fee-based income stream. This would reduce the risk-weighted assets and the funding requirement, thus making the new standards less binding. Furthermore, higher capital and liquidity buffers

could also have a negative impact on equity costs; this would create scope for keeping the increase in the lending wedge within bounds. Higher buffers reduce the risk and shareholders will therefore be prepared to accept lower returns.⁶ All in all, it is likely that the costs of the new minimum requirements as estimated in the preceding two sections will form an upper limit to the economic costs in a new steady state. Additionally, a shift towards a somewhat less risky funding structure for banks would not be abnormal from an historical perspective: a few decades ago, banks held substantially more equity on average than they do nowadays (see Box 2).

It is not just the costs that will become apparent in the new steady state, but also the benefits of the new capital and liquidity requirements. For example, a financial crisis would probably be less likely and would cause less economic damage if it should occur. Viewed over a long period, countries are hit by a banking crisis on average once every 20 to 25 years. While this is not very frequent, given the potential damage it is worth taking steps to counter it. In a recent IMF study, the costs of a financial crisis for taxpayers are estimated at around 15 percent of GDP, while the loss of national income is even higher, at 20 percent.⁷ Bearing in mind the possibility that the economy could end up on a permanently lower growth trend after a severe crisis, the costs could escalate far beyond this. Several studies estimate the cumulative loss of welfare in such cases at between 60 and more than 100 percent of GDP.⁸

Higher buffers reduce the probability of crises and the amount of damage they cause. The extent to which this is related to regulatory standards is difficult to quantify precisely: crises are generally highly diverse and clustered in time. Examples include the Asian crisis at the end of the 1990s and the global credit crisis in recent years. Using various models, the Basel Committee recently estimated the relationship between capital levels and the risk of a systemic crisis, in which a number of measures were also included to reduce the liquidity risk (BCBS, 2010). Figure 7 summarises some of the outcomes of this study: if equity increases from 6 percent to 8 percent of the risk-weighted assets, the probability of a crisis is more than halved. A further increase to over 10 percent reduces the risk to less than one percent. If the liquidity risk is also reduced, in addition to the higher capital buffer, the risk of a crisis declines much more quickly. The outcomes presented here are based on reduced-form models, but prove to be robust if different model types and

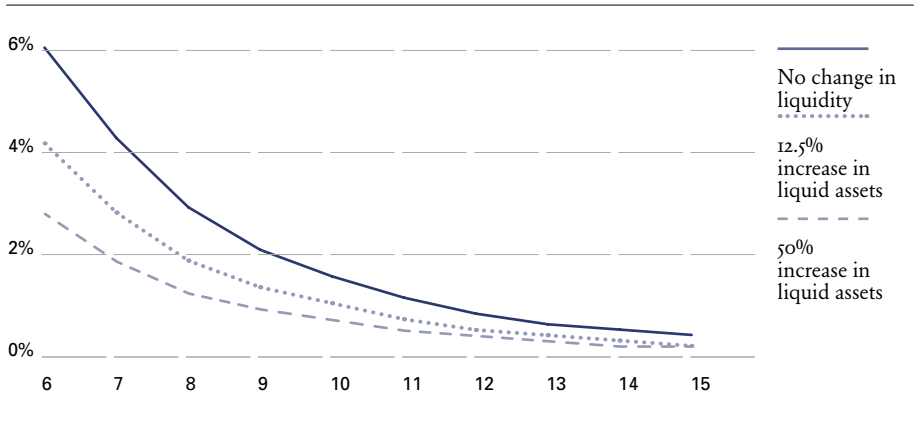
6 This would be consistent with the Modigliani-Miller conditions (Box 2). See also Miller (1995), who argues that the (expected) return on equity and borrowed funds should be comparable if a correction is applied for the risk profile.

7 See Laeven and Valencia (2008). The fiscal costs were calculated over the five years following the outbreak of the crisis. The loss of national income relates to the deviation of real GDP from the extrapolated trend over the three years following a crisis. Both Figures are averages; the crises studied contain substantial upward and downward outliers. See also Reinhart and Rogoff (2009), for a historical overview of financial crises.

8 This is the present value of permanent losses. See e.g. Boyd et al. (2005) and Haldane (2010).

Figure 7 Risk of systemic crisis reduces as buffer levels increase

Percentage; x-scale TCE/RWA ratio



Probability of crisis at various levels tangible common equity and liquid assets, simulated with reduced form models.
Source: BCBS.

liquidity risk criteria are used.⁹ There is ultimately a trade-off between the costs of additional capital and liquidity buffers and the economic benefits they produce: the probability of a crisis at certain capital and liquidity levels is so low that the costs of a further tightening of the regulatory requirements dominate.

⁹ In addition to reduced-form models, similar calculations have been made using portfolio models and stress-testing models. Alternative ways of reducing liquidity risk are an increase in deposit funding and a more balanced liquidity profile of assets and liabilities. See BCBS (2010).

Box 2 Minimum regulatory requirements and the funding structure of banks

A sizeable body of literature has grown up in recent decades dealing with the factors that influence the financial structure of businesses. An important starting point was the influential article by Modigliani and Miller (1958), in which they demonstrate that – under specific conditions – the financial structure is irrelevant for the value of a business. In practice, however, there are several reasons why the Modigliani-Miller conditions do not apply and financial structure – including equity versus debt and liquid versus illiquid balance sheet items – does make a difference.

For example, the degree of leverage is influenced by the tax system: in most countries interest payments are tax-deductible, which means that borrowed capital is treated more favourably than equity. Other factors have the opposite effect, constraining the leverage. For example, businesses with a high risk profile are required

to hold a relatively high capital buffer. Governance aspects may also co-determine the financial structure – shareholders are after all the owners of the firm – but it is ambiguous whether this will increase or reduce the leverage.

The financial structure of banks differs markedly from that of other enterprises (see Table 2): banks have much more debt, which is moreover highly liquid, whereas bank lending is relatively illiquid. This imbalanced financial structure is a direct result of the traditional function of banks as intermediaries, in which they meet a social need for liquidity and maturity transformation. The mismatch of banks' balance sheets is facilitated by safety net schemes, such as the deposit guarantee scheme and central bank facilities to resolve temporary liquidity problems. These safety nets reduce the financial risks for equity investors and therefore encourage more leverage and a greater maturity mismatch. Banks are moreover under supervision: this further reduces the risk of financial problems and gives equity investors less reason to demand a solvency buffer. On the other hand, the regulator sets minimum requirements for solvency and liquidity.

Table 2. Equity of banks versus other enterprises

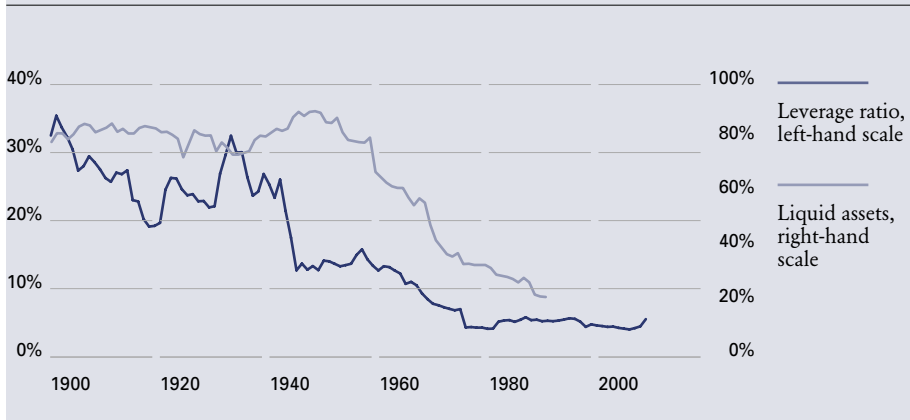
Type of business	Equity
Non-financial enterprises	44%
Insurers	
Life	14%
Non-life	26%
Banks	3%

Note: the Table shows equity as a percentage of the balance sheet total of Dutch enterprises, averaged over the years 2000-2008, as published by Statistics Netherlands (CBS) (finances of large companies) and DNB (balance sheets of insurers and banks, based on supervisory reports). For life insurers, technical provisions held at the risk of the policyholder have been deducted from the balance sheet total; if this is not done, the equity would amount to 10 percent.
Source: CBS, DNB.

All in all, banks have a much greater incentive than other businesses to maintain a risky financial structure with a relatively high proportion of debt with a short maturity. In a new steady state, this will still be the case. Nonetheless, Figure 8 shows that a few decades ago Dutch banks were financed much more with equity and also had more liquid assets on their balance sheets. This shift is an international phenomenon which can be attributed partly to the growing national and international competition between banks.¹⁰ It also illustrates that a return to a less risky funding structure would not be abnormal from an historical perspective.

¹⁰ See e.g. Berger et al. (1995) and Greenspan (2010) for discussions of the changed financial structure of the US banking system, which is comparable with the picture outlined here for the Netherlands.

Figure 8 Solvency and liquidity of Dutch banks in historical perspective



Note: Data before 1990 are taken from DNB (2000). Data up to 1982 relate to sub-category ‘trading banks’, later called ‘general banks’; from 1982 onward these are all banks (since 1990 only consolidated institution). The series contains several trend breaks (1946, 1950, 1976, 1978, 1982), of which only 1976 (downward) and 1982 (upward) are substantial. Leverage-ratio defined as capital plus reserves as percentage of balance sheet total. Liquid assets include short-term receivables plus securities as percentage of total assets.
Source: DNB.

5.2 More stable economic development

The stricter standards also offer benefits even when there is no crisis. For example, banks with higher capital and liquidity buffers are better able to support businesses and households in bad times. Buffers enhance the capacity of banks to absorb losses and uphold lending during a downturn. In a booming economy, the stricter regulatory framework gives banks an incentive to reduce risk. This can help prevent the banks from feeding excessive asset price developments, thereby moderating the fluctuations in the economic cycle and reducing volatility in financial markets.

The Basel Committee proposals devote special attention to reducing pro-cyclical effects. The new regulatory framework encourages banks to build up an extra capital conservation buffer in good times by means of restrictions on profit distributions (including dividend payouts, share repurchase programmes and bonus payments to staff). The restrictions will be designed in such a way that they become stricter as the capital ratio approaches the minimum level, whereas at around the target value they will lose most of their binding capacity, so as to avoid ‘cliff effects’. As the restrictions will be linked to profitability, banks will be encouraged to build up extra capital when they are in the best position to do so. In bad times – when the banks are making losses – they will be able to address these buffers and may therefore move less quickly to tighten up their lending criteria.

A fixed target value will be set for the capital conservation buffer, but this could be raised temporarily depending on the macroeconomic conditions. The ratio between total credit and GDP is an important criterion here; empirical research shows this to be a key leading indicator for financial imbalances and crises (Drehmann et al., 2010).

The intention is that this mechanism should prevent excesses during good times and help banks maintain their lending in bad times and therefore to stabilise economic growth. Research on the benefits of counter-cyclical capital buffers suggests that this regime does indeed reduce the volatility of GDP. Several studies suggest that the standard deviation of GDP reduces by around a fifth compared with a baseline scenario in which there is no counter-cyclical buffer (BCBS, 2010).

6 Conclusion

Several national and international model calculations indicate that the negative impact on GDP during the transitional phase to higher capital and liquidity buffers will be limited to a few tenths of a percent. Lending wedges are likely to be permanently higher, but the impact of this on credit volumes will be limited to a few percent because banks will have more options to adapt to the new requirements. The model outcomes for the Netherlands are in line with research for other countries. A sufficiently long transitional period will help limit the costs in the early years, because it will give banks more scope to adapt. It will also make it easier for markets to absorb the additional demand for capital and liquidity. Once the banks have adapted to the new situation, the benefits of a more solid financial system will outweigh the disadvantages. The higher buffers will make a financial crisis in the future both less likely and less deep. Furthermore, economic growth will be more stable, including in normal times, because the new regulatory standards will make the banks' reactions less pro-cyclical. The BCBS (2010) accordingly concludes that, all in all, the benefits of stricter capital and liquidity requirements far outweigh the costs.

Annex I Satellite models

The satellite model assumes that changes in banks' assets and liabilities are determined by movements in the surplus capital ratio. The surplus ratio $Z_{i,t}$ is defined as the ratio between the available capital ratio ($k_{i,t}$) with a one-period lag, and the target ratio ($k^*_{i,t}$) for bank i , measured in percentage points:

$$Z_{i,t} = 100 * \frac{k_{i,t-1}}{k^*_{i,t}} - 1 \quad (1)$$

The target ratio ($k^*_{i,t}$) is approximated by the long-term average capital ratio and the external rating of the banks ($Rat_{i,t}$), as a proxy for the market demand for capitalisation:¹¹

$$k^*_{i,t} = \frac{\frac{1}{n} \sum_{t=1}^n k_{i,t}}{Rat_{i,t}} \quad (2)$$

The elasticities (β) between assets and liabilities and the surplus capital ratio ensue from the following panel regression model:

$$\begin{Bmatrix} A_{i,t} \\ C_{i,t} \end{Bmatrix} = \alpha + \beta Z_{i,t} + \sum_{j=1}^2 \delta_{1,j} GDP_{t-j} + \sum_{j=1}^2 \delta_{2,j} INF_{t-j} + \sum_{j=1}^2 \delta_{3,j} RL_{t-j} + \sum_{s=1}^4 \rho_s Q_s + \varepsilon_{i,t} \quad (3)$$

where $A_{i,t}$ represents the total assets, risk-weighted assets and loans of bank i and $C_{i,t}$ represents the total capital and the Tier 1 capital. The balance sheet items are included as percentage changes. The explanatory variables, in addition to the surplus capital ratio $Z_{i,t}$, are the percentage change in real gross domestic product (GDP), inflation (INF) and long-term interest rates (RL), as an approximation of interest rates on loans (Q_s quarterly dummies).

The estimation outcomes of equation 3 are shown in Table A. The coefficients of $Z_{i,t}$, are generally significant or almost significant, and have the expected sign. This implies that banks will reduce their assets in response to a falling surplus ratio (caused either by a reduction in the existing capital reserve in the numerator of $Z_{i,t}$, or by a higher target capital in the denominator of $Z_{i,t}$). The coefficient of lending growth is not significant, indicating the reluctance of banks to reduce their loan

¹¹ The rating was determined by converting the Moodys 'letter rating' for each bank into a numerical value (where AAA is equal to 19 and C to 1). The numbers were then divided by the long-term average rating of Dutch banks. The result is a ratio of around 1.

book in the event of a falling capital surplus. The significant or almost significant positive sign of the coefficient of total assets and risk-weighted assets suggests that Dutch banks prefer to reduce assets other than loans. The significant negative sign of the coefficient of total capital and Tier 1 capital shows that banks respond to a fall in the surplus ratio $Z_{i,t}$ by raising additional capital.

It is assumed that banks will increase the lending wedge – the difference between interest rates charged on loans and rates paid on deposits – in order to compensate for rising funding costs and declining revenues due to the stricter capital and liquidity requirements. The relationships between the lending wedge ($WEDGE_{i,t}$) and the capital and liquidity ratios were estimated using the following model (based on the example of Barell et al., 2009),

Table A Estimation outcomes satellite model for balance sheet adjustments

Based on 1998q1-2009q4 period and panel of 5 large Dutch banks

	Growth in:	Loans	Assets	RWA	BIS cap	Tier 1 cap
$Z_{i,t}$		0.07 (1.12)	0.23 ² (2.51)	0.21 ² (2.32)	-0.13 (-1.60)	-0.17 ¹ (-1.62)
GDP_{t-1}		0.91 ¹ (1.76)	2.55 ³ (2.74)	2.14 ² (2.36)	1.24 (1.44)	1.89 ¹ (1.71)
GDP_{t-2}		0.79 (1.10)	1.14 (1.19)	2.23 ² (2.37)	0.83 (0.93)	-0.5 (-0.43)
INF_{t-1}		-1.16 ¹ (-1.73)	-1.91 (-1.42)	-2.45 ¹ (-1.84)	-1.02 (-0.80)	-2.55 ¹ (-1.78)
INF_{t-2}		-0.96 (-1.28)	-2.59 ¹ (-1.77)	-3.20 ² (-2.23)	-2.85 ² (-2.09)	(-0.52) (-0.31)
RL_{t-1}		-0.02 ¹ (-1.66)	-0.06 ³ (-2.91)	-0.02 (-1.16)	-0.04 ² (-2.14)	-0.02 (-0.72)
RL_{t-2}		0.02 ¹ (1.85)	0.06 ³ (3.04)	0.03 (1.47)	0.04 ² (2.31)	0.02 (0.67)
Constant		0.02 (0.75)	0.03 (1.06)	-0.02 (-0.83)	0.02 (0.84)	0.04 (0.72)
R^2		0.09	0.14	0.16	0.06	0.05
Prob (F stat)		0.05	0.00	0.00	0.03	0.36
DW stat		1.98	2.09	2.10	1.98	2.33

3, 2, 1 significant at 1%, 5%, 10% confidence level, t-values between brackets. Quarterly dummies not reported.

$$WEDGE_{i,t} = \alpha + \delta_1 (RL_t - RS_t) + \delta_2 CAP_{t-1} + \delta_3 LIQ_{t-1} + \delta_4 PROV_{t-1} + \delta_5 STD_{t-1} + \varepsilon_{i,t} \quad (4)$$

Here, (RL-RS) is the difference between ten-year interest rates on government bonds and three-month EURIBOR. CAP is the Tier 1/RWA ratio and LIQ the liquid assets/total assets ratio. PROV are the provisions for non-performing loans as a percentage of total loans and STD are the bank lending standards (the net percentage of banks that tighten up their lending criteria).

Table B shows the estimations results of equation 4, with a breakdown of the lending wedge for loans to companies and households. The estimated coefficients are significant and have the expected sign. The sign for LIQ and CAP is positive, which means that higher ratios are associated with a higher lending wedge. Changes in the lending wedge in response to higher capital and liquidity requirements was then simulated on the basis of the estimated coefficients for CAP and LIQ ($\tilde{\delta}_2$ and $\tilde{\delta}_3$) and the costs of liquidity associated with an assumed extension of wholesale funding maturity and the loss of profit because loans are substituted by liquid assets.

Table B Estimation outcomes satellite model for loan spread

Based on 1998q1-2009q4 period and panel of 5 large Dutch banks

	WEDGE total	WEDGE companies	WEDGE households
$RL_t - RS_t$	0.45 ³ (14.91)	0.47 ³ (7.78)	0.23 ³ (4.25)
RL_t		0.64 ² (11.85)	0.54 ² (3.06)
CAP_{t-1}	22.18 ³ (6.57)	10.88 ³ (3.19)	18.66 ³ (2.55)
LIQ_{t-1}	5.34 ³ (4.82)	3.71 ³ (3.52)	6.54 ³ (2.79)
$PROV_{t-1}$	0.00 ³ (5.65)	0.00 (1.26)	0.00 (0.71)
STD_{t-1}	-0.00 ¹ (-2.23)	-0.00 ³ (-6.12)	-0.00 ¹ (-0.63)
Constant	-2.99 ³ (-6.18)	-3.49 ³ (-5.68)	-4.62 ³ (-4.24)
R^2	0.98	0.94	0.77
Prob (F stat)	0.00	0.00	0.00
DW stat	1.98	1.70	1.62

3, 2, 1 significant at 1%, 5%, 10% confidence level, t-values between brackets.

Annex 2 VAR model

The following VAR model was used to simulate the scenarios for an increase in capital requirements:

$$X_t = \Gamma(L) X_t + \mu + \varepsilon_t \tag{5}$$

Figure A Response to Cholesky One S.D. Innovations ± 2 S.E.

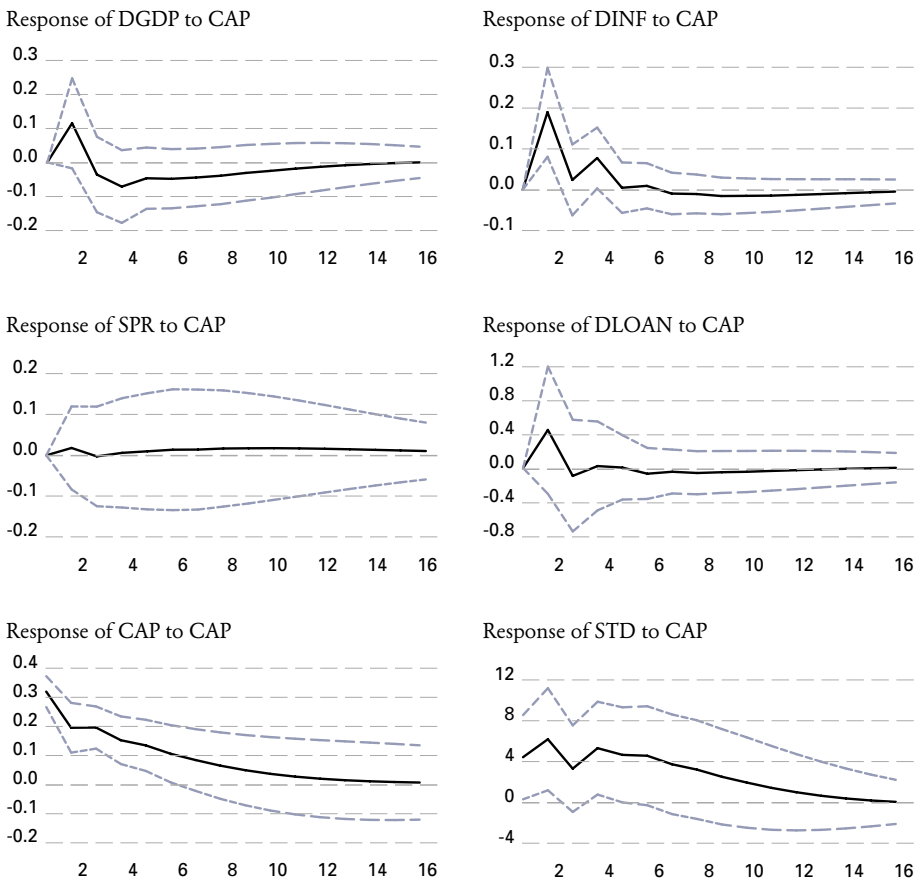
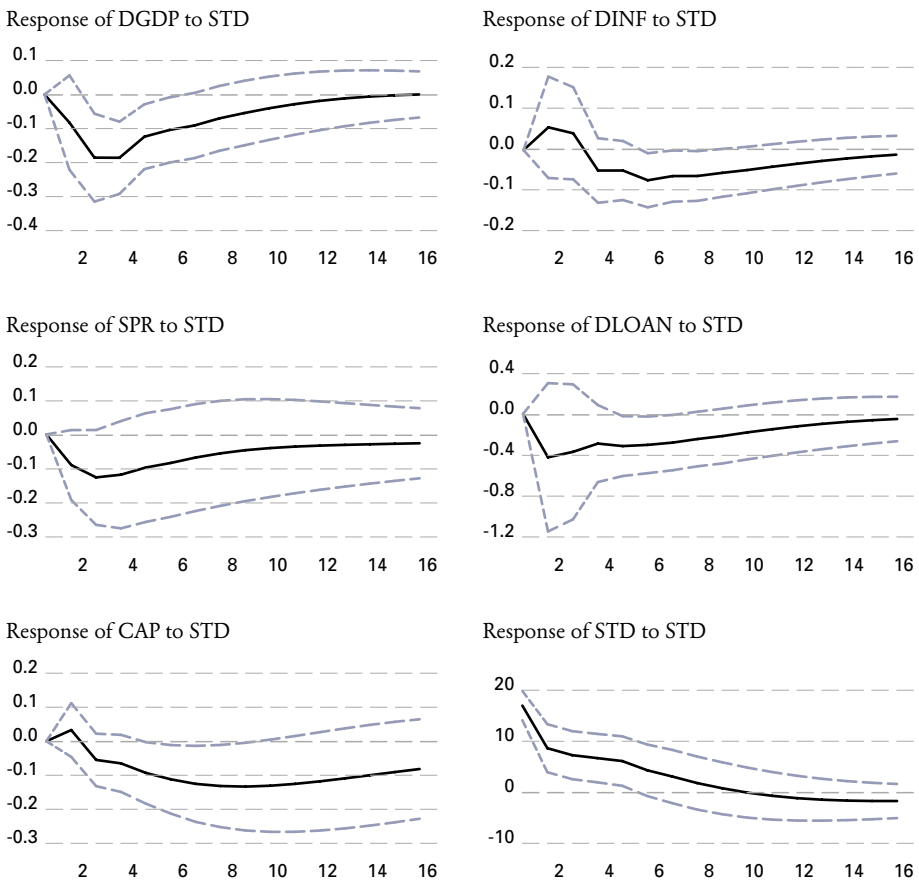


Figure B Response to Cholesky One S.D. Innovations ± 2 S.E.



where $\Gamma(L)$ is the matrix of estimated parameters, L the lag operator (the model incorporates two lags), vector $X_t = (\log(GDP_t), \log(INF_t), SPR_t, \log(LOAN_t), CAP_t, STD_t)$ and μ is a vector with constants. The model therefore contains the standard variables of VAR models from the monetary transmission literature, namely real GDP (GDP), inflation measured in terms of the GDP deflator (INF) and an interest rate (the lending wedge SPR). The supply variables included in the model are total bank lending ($LOAN$), the surplus bank capital (CAP) measured as available capital less required capital as a percentage of risk-weighted assets, the bank lending wedge (SPR) and the net lending standards (STD)¹². The model was estimated with $\log(GDP)$, $\log(LOAN)$ and $\log(INF)$ as quarter-on-quarter changes and SPR , CAP

¹² Data on lending standards are only available from 2003. We have therefore back-forecast them based on a model with the interest charged on loans to corporates and the credit spread on corporate bonds.

and *STD* in levels. *SPR* was calculated as the difference between the average interest rate on loans to businesses and the three-month money market rate. *CAP* was based on core capital and risk-weighted assets calculated on the basis of MFI balance sheet data. The model was estimated using quarterly data for the period 1990Q1-2009Q4.

The outcomes of equation 5 are presented in the form of ‘impulse response functions’ in Figures A and B.¹³ Although few responses are statistically significant, the growth in lending is found to respond positively to an increase in the capital surplus (*CAP*); see Figure A. The net lending standards rise and are tightened up, possibly because banks with high capital buffers are more critical in accepting loans. The lending wedge barely responds to a shock movement in *CAP*. The Figures do not show that the capital surplus of the banks responds positively to an upward movement in GDP growth and lending wedge (which contributes to higher profits) and negatively to a positive shock in inflation and net lending standards (the latter effect is shown in Figure B). A positive shock in lending standards means there is a net tightening of banks’ loan criteria. As Figure B shows, this has a negative impact on lending and GDP, and this provides an indication of the effect of supply constraints.

¹³ The impulse responses are based on Cholesky decomposition, whereby the inverse of the Cholesky factor of the covariance matrix of residues was used to make the shocks orthogonal.

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