

Comparing Norwegian banks' capital ratios

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To improve the basis for comparing banks' financial strength, in this article I employ the same approach to calculate capital ratios in all Norwegian banks. Basel II allows banks to choose between various approaches for calculating their capital ratios. The use of different approaches reduces the comparability of banks' reported capital ratios. The reported Tier 1 capital ratios of banks using the internal ratings-based approach (IRB banks) are lower than those of banks applying the standardised approach. When I use my calculations rather than banks' reported capital ratios, the difference between the average Tier 1 capital ratio of IRB banks and that of banks using the standardised approach more than doubles. Deviations between reported and estimated ratios vary among IRB banks. This may be because banks' risk models generate different capital requirements for comparable assets. In that case, banks' reported capital ratios are an inaccurate measure of their financial strength. However, the deviations between reported and estimated capital ratios may also vary because my calculations did not manage to capture differences in bank risk.

1. Introduction

The objective of the current capital adequacy framework (Basel II) is improved risk management and more efficient use of capital than under the previous framework (Basel I).² Basel II is intended to ensure that the risk that banks assign to their exposures in calculating their capital ratios better reflects actual risk than under Basel I.³ Basel II allows banks to choose among various approaches to calculate their capital ratios.⁴ For that reason, comparisons of reported capital ratios may give a misleading picture of banks' relative financial strength. The largest banks⁵ calculate their capital requirements using internal risk models based on data regarding their own borrowers (internal ratings-based (IRB) approach), whereas smaller banks use the simpler, more standardised approach (the standardised approach⁶).⁷ Capital requirements calculated using the IRB approach are normally assumed to reflect actual risk better than capital requirements calculated using the standardised approach. The assumptions under-

lying capital ratios calculated using the IRB approach often vary widely.

Banks obtain lower risk weights for most of their exposures when they change over from the standardised to the IRB approach.⁸ The Basel II framework has been calibrated to create incentives to apply the IRB approach in order to improve risk management. By itself, improved risk management will increase banks' financial strength. However, smaller banks often lack resources to develop internal models. The result is higher risk-weighted assets and thus lower reported capital ratios. Consequently, the solvency of banks that apply the standardised approach may often be underestimated compared with that of IRB banks when using reported capital ratio. This makes it difficult to compare banks' financial strength on the basis of reported figures.

It is also difficult to compare the capital adequacy of different IRB banks. Most IRB banks are still working

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² Capital requirements are imposed on banks calculated as a percentage of their risk-weighted assets. Risk-weighted assets are calculated by multiplying banks' exposure at default for various assets with attendant risk weights. A bank's Tier 1 capital must equal at least 4% and total regulatory capital at least 8% of these risk-weighted assets. Tier 1 capital is primarily the bank's common equity, whereas regulatory capital also includes subordinated debt.

³ Under Basel I, banks used fixed and standardised risk weights to calculate capital requirements.

⁴ The coming capital adequacy framework (Basel III) will be based on the same framework for calculating risk as Basel II, but capital requirements will be tightened (see last paragraph in section 6).

⁵ DnB NOR Bank, Nordea Bank Norge, SpareBank 1 SR-Bank, Sparebanken Vest, SpareBank 1 SMN, SpareBank 1 Nord-Norge and Bank 1 Oslo.

⁶ The standardised approach is primarily Basel I, but this approach divides exposures into a number of risk classes, allows for the use of external credit ratings from approved credit rating agencies and takes into account the effects of derivatives and the like.

⁷ Finanstilsynet (Financial Supervisory Authority of Norway) approves internal models that each bank uses for capital adequacy purposes.

⁸ See footnote 2 for an explanation of risk weight.

to expand the use of internal risk models. The proportion of the portfolio covered by internal risk models varies among banks.⁹ It will be somewhat easier to compare IRB banks' capital adequacy once they have all finished putting in place risk models approved in accordance with the Basel II framework.

Even when all IRB banks have risk models that cover approximately the same segments of the portfolios there will be differences in risk weights for virtually identical assets. At the end of 2008, risk weights for residential mortgages averaged between 9% and 17% for the largest Nordic banks. Banks using the standardised approach instead of internal risk models must apply a 35% risk weight to residential mortgages with loan-to-value ratios under 80%.

An important source of differences in internal risk models may be variations in the length of the time series used to calculate risk. Some countries permit the use of substantially shorter time series than set out in the requirement that an ideal time series should cover an entire business cycle. The reason may be that longer time series are unavailable or deemed insufficiently representative of the current risk picture. Risk weights will be substantially lower if time series do not contain data from downturns, see Andersen (2010). To calculate risk, Norwegian banks are required to use data that include the banking crisis of the early 1990s.¹⁰

There is an additional problem related to banks' current transition process from Basel I to the Basel II capital adequacy framework. The transitional rules currently state that capital requirements calculated under the Basel II framework cannot be lower than 80% of what they would be under Basel I. The Ministry of Finance has decided that the transitional rules shall apply to Norwegian banks until the end of 2011. This means that a number of IRB banks continue to report regulatory capital adequacy figures that in reality depend on the Basel I framework. Definitions of capital and risk-weighted assets also differ across borders.¹¹ In addition, the transitional arrangements are interpreted differently from country to country.¹²

The credit rating agency Standard & Poor's has exam-

ined the problem of the lack of comparability of banks' capital ratios and has developed its own risk-adjusted measure – the Standard & Poor's risk-adjusted capital (RAC) ratio (see Standard & Poor's (2009a)). The aim of the RAC ratio is to better enable credit rating agencies to analyse and compare banks' capital adequacy. In calculating the RAC ratio, the agency uses the same approach to calculate the capital base and risk-weighted assets of various banks.¹³ Both the definition of capital and risk-weighted assets used in the RAC ratio are considerably more restrictive than Basel II.¹⁴ On 23 November 2009 Standard & Poor's published a comparison of the RAC ratios, Tier 1 capital ratios and leverage ratios of 45 large banks (see Standard & Poor's (2009b)). Standard & Poor's concluded that Tier 1 capital ratios and leverage ratios do not give a sufficiently adequate picture of banks' capital position. Banks with identical leverage ratios or Tier 1 capital ratios had very different RAC ratios. For example, Nordic banks¹⁵ had lower leverage ratios than US banks, but higher RAC ratios. No comparable analyses comparing the capital position of Norwegian banks have been published.

Following the same line of reasoning, I use a uniform approach to calculate comparable capital ratios in all Norwegian banks. I utilise the advanced IRB approach and more detailed data than Standard & Poor's used in calculating risk weights for banks' assets. The analysis can provide information on how important the choice of approach is for banks' reported capital adequacy – both the choice between the standardised approach and the IRB approach and the use of various risk models under the IRB approach.

Section 2 addresses the particular portions of the Basel II framework that are relevant to my analysis. Section 3 describes developments in Norwegian banks' reported capital ratios. Section 4 provides an overview of the data used in my analysis, and section 5 describes how I approximate exposures and risk parameters included in the calculation of banks' capital adequacy ratios. The article concludes by comparing my calculated capital ratios with the banks' reported capital ratios.

⁹ For example, DnB NOR used the standardised approach for just over half of its exposures at the end of 2009.

¹⁰ The banking crisis years are to be included in calculating the long-term average estimated probability of default (PD). The banking crisis years are also to be included in calculating the lower floor of the estimated loss given default (LGD).

¹¹ See footnote 2 for an explanation of risk-weighted assets.

¹² In Norway and Sweden the floor is interpreted as a lower limit for risk-weighted assets. In Denmark the floor is interpreted as a lower limit for the capital ratio.

¹³ The RAC ratio is based on public financial reporting data and data that Standard & Poor's receives from banks.

¹⁴ The basis for calculating the RAC ratio includes risk parameters for credit risk estimated from data from a downturn. Basel II allows banks to estimate risk parameters over a period that also includes other phases of the economic cycle. In calculating the RAC ratio the risk weights for trading portfolios and equity in the banking book are far higher than are required under Basel II. The RAC also treats concentration risk and diversification effects differently from Basel II. In the definition of capital in the RAC ratio, the treatment of hybrid capital, postretirement benefit obligations, share premium accounts and intangible assets is more conservative than under Basel II.

¹⁵ DnB NOR Bank was the only Norwegian bank included in the analysis.

2. The Basel II framework

The Basel II framework rests on three pillars: minimum capital requirements (Pillar 1), supervisory review (Pillar 2) and market discipline (Pillar 3).¹⁶ This article focuses only on Pillar 1. Pillar 1 allows banks to use one of three different approaches for calculating capital requirements on the basis of credit risk: the standardised approach, the foundation IRB approach and the advanced IRB approach. Basel II also requires banks to hold capital reserves to address market risk and operational risk under Pillar 1.

Under the IRB approach, bank portfolio exposures are categorised into six broad asset classes: *corporate*, *sovereign*, *bank*, *retail*, *equity exposures*, as well as *purchased receivables* and *securitisation exposures*. With the exception of exposures classified as *retail*, risk weights shall be calculated for each exposure within the particular class. *Retail* covers loans to small and medium-sized entities (SMEs) and households including residential mortgages and revolving credits. Loans to larger enterprises are included in *corporate*. *Bank* covers loans and other exposures to financial institutions. *Sovereign* covers loans and other exposures to government authorities.

IRB banks must use a separate formula for calculating capital requirements for credit risk (see Appendix). The formula has been calibrated to a solvency margin of 99.9%, that is, the estimated probability that a bank's regulatory capital will not cover its losses the following year is less than 0.1%. The formula is a function of probability of default (PD), loss given default (LGD), exposure at default (EAD) and effective maturity (M). The formula also includes parameters for maturity adjustment (b) and correlation (R) between exposures, as well as a factor for systemic risk.

Banks using the advanced IRB approach must apply their own estimates of PD, LGD, EAD and M. These estimates must be grounded in historical experience. The Basel II framework does not specify whether more recent observations should be weighted more than observations further back in time. The historical observation period used to estimate PD must be at least five years. PD for *corporate*, *retail* and *banks* may never be set below

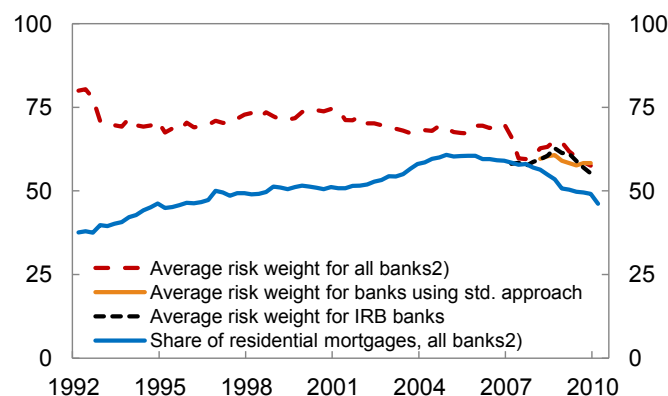
0.03%. Estimates for LGD and EAD must be based on a minimum data observation period of seven years (five years for *retail*) that contains at least one complete economic cycle. LGD may not be lower than the long-run default-weighted average.¹⁷

3. Norwegian banks' reported capital ratios

Since the mid-1990s, Norwegian banks' reported Tier 1 capital ratios have been relatively stable. At the same time, average risk weights for banks' assets have fallen from around 80% in the early 1990s to around 60% at the end of 2009 (see Chart 1).

The fall in the average risk weight is largely due to an increase in the share of residential mortgages in banks' loan portfolios, from around 35% at the end of 1990 to over 60% at the end of 2005. Residential mortgages have a low risk weight.¹⁸ In recent years the proportion of residential mortgages has fallen because banks have transferred some of their highest-quality residential mortgages to mortgage companies that issue covered bonds.¹⁹ In isolation, this implies a higher average risk weight for banks. At the same time, the transition to Basel II has resulted in lower risk weights for banks since the begin-

Chart 1 Average risk weight¹⁾ and residential mortgages as a share of gross lending. Per cent. 1992 Q1 - 2010 Q1.



¹⁾ Average risk weight is calculated by dividing total risk weighted assets by total assets. Since risk-weighted assets include off-balance sheet items, in practice banks' average risk weights will be somewhat lower than our calculations show

²⁾ All banks excluding branches of foreign banks in Norway

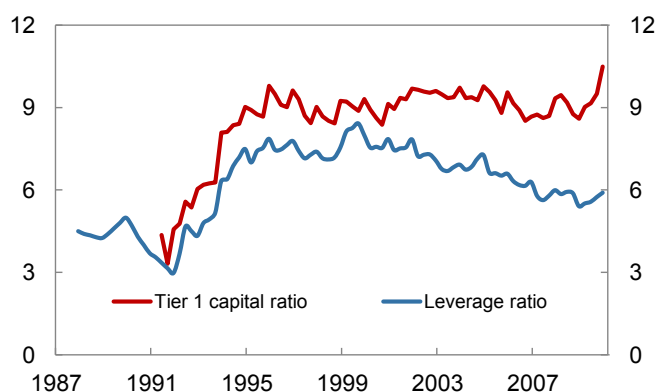
¹⁶ For a detailed description of the framework, see Basel Committee on Banking Supervision (2006b).

¹⁷ The number of defaults occurring each year is used to weight the final calculated average over the observation period. Thus, the calculation gives greater weight to years with a large number defaulted loans than years with a small number.

¹⁸ Norwegian IRB banks operate with risk weights of 10–15% for their residential mortgages. Banks using the standardised approach may use a risk weight of 75% for residential mortgages with a loan-to-value ratio above 80% if the requirements for retail are met. If the requirements for retail are not met, banks must use a risk weight of 100%. With a loan-to-value ratio below 80%, the risk weight is 35%. Under Basel I the risk weights for residential mortgages with loan-to-value ratios below 80% and above 80% were 50% and 100%, respectively, for all banks.

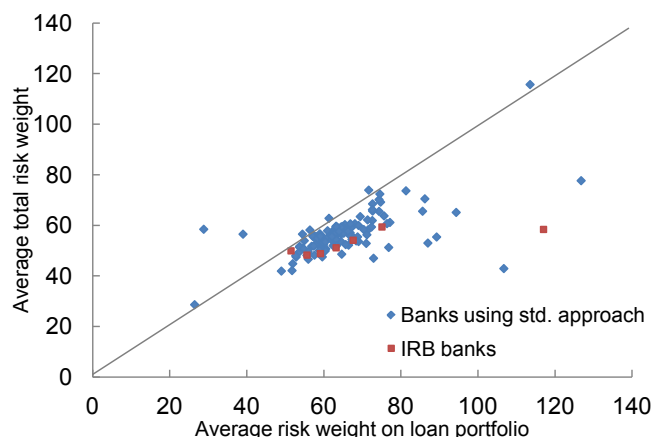
¹⁹ By the end of 2009 banks in Norway (except for foreign branches) had transferred 35% of their residential mortgages to mortgage companies that issued covered bonds.

Chart 2 Banks' ¹⁾ Tier 1 capital and leverage ratios. Per cent. 1987 Q4 – 2009 Q4.



¹⁾ All banks excluding branches of foreign banks in Norway. Leverage ratio prior to 1990 is for all banks

Chart 3 Banks' ¹⁾ average risk weight for loan portfolios ²⁾ and for banks' total exposures ³⁾. Per cent. 2009 Q4



¹⁾ All banks excluding branches of foreign banks in Norway
²⁾ Average risk weight for banks' loan portfolios is calculated by dividing the risk-weighted assets for credit risk by gross lending
³⁾ Average risk weight for banks' total exposures is calculated by dividing total risk-weighted assets by total assets

ning of 2007. Risk weights for IRB banks in particular are lower. Seen in isolation, the fall in risk weights has helped keep banks' capital ratios high, even though leverage ratios have fallen in the past decade (see Chart 2).

The average risk weights for banks' exposures vary widely across banks in Norway (see Chart 3).

Some of the variation in average risk weights in Chart 3 can be explained by the variation in actual risk positions across banks. For example, most banks with the lowest average risk weights hold a high proportion of residential mortgages and other highly secured loans with low risk weights.²⁰ On the other hand, banks with the highest average risk weights hold few or no residential mortgages, but have a large share of equity exposures and corporate loans in their balance sheets. Equity exposures and high-risk corporate loans generally have risk weights above 100%. However, another reason for different average risk weights across banks may also be that the approaches banks use to calculate their risk positions yield different outcomes for identical risk.

4. Data

I use more detailed data than Standard & Poor's used in its calculations. My calculations are based on enterprise data from Dun & Bradstreet²¹ and banking statistics from Norges Bank, Statistics Norway and Finanstilsynet. The

bank database contains detailed financial reporting data and capital adequacy reports for all Norwegian banks over the period 1991–2010.²² While I have no information on particular banks' individual borrowers, detailed data on borrowers in various sectors and industries can be combined with data on banks' exposure to these sectors and industries.

The data set for enterprises contains accounting figures for all Norwegian limited companies in the period 1988–2009. These enterprises' total bank debt at the end of 2009 accounted for around 95% of the Norwegian banking sector's overall corporate lending.

5. Calculating Basel II exposures and Basel II risk parameters

5.1 Basel II exposures

I calculate banks' overall Basel II exposures to corporate, household, bank and sovereign. In all, banks' exposures are categorised into 50 different risk classes. Corporate lending accounts for 45 of these risk classes.

Individual banks' exposures to the corporate sector are approximated on the basis of data from banking statistics

²⁰ Several of these banks also have a certain percentage of financial instruments exposed to market risk in their balance sheets, at the same time as their risk-weighted assets are equal to zero. This serves to lower the average risk weight for the overall exposure. Section 31-5 of the Regulation relating to capital requirements exempts banks from calculating risk weighted assets for market risk if the trading portfolio is relatively small. If capital requirements are not calculated for credit risk in the exempt trading portfolio, banks will have to hold additional capital reserves for market risk under Pillar 2 in the form of a higher internal capital requirement.

²¹ Dun & Bradstreet's data for Norwegian enterprises have been obtained from the Brønnøysund Register Centre.

²² The database does not contain capital adequacy reports for branches of foreign banks in Norway.

and Norges Bank's enterprise database. At the end of 2009 lending to the corporate market accounted for 26% of Norwegian banking sector assets. In the banking statistics, banks' corporate loans are broken down into 15 sectors.²³ Allowance is made for the fact that banks are unequally exposed to these 15 sectors.

Turnover data for individual enterprises allow me to assign enterprises in the statistics for enterprises to the borrower categories *corporate*, *small and medium-sized enterprises (SMEs)* and *retail* within each of the 15 sectors. Whereas all enterprises with turnover below NOK 2m are classified as *retail*, all enterprises with turnover above NOK 400m are classified as *corporate*. The remaining enterprises are classified as *SMEs*. This agrees with the classification in the Basel II framework. Based on this classification, 13% of corporate lending at the end of 2009 was *corporate* exposures, 36% was *SME* exposures and 51% was *retail* exposures.

The underlying data do not permit a distinction between the quality of individual borrowers in the various risk categories. Some banks have borrowers with higher credit risk because they are less risk-averse or have poor risk management. The breakdown of *corporate*, *SME* and *retail* exposures within each of the 15 sectors is assumed to be identical for all Norwegian banks. In reality, small banks are less exposed to large corporate borrowers than large banks. The Basel II formula has been designed so that the risk weight seen in isolation increases with the size of the undertaking.²⁴

Household exposures appear in the banking statistics. *Residential mortgages* (including home equity lines of credit) accounted for 24% of Norwegian banking sector assets²⁵ at the end of 2009. The remaining exposures to households are assumed to be *revolving credits*, for example, credit card facilities. These exposures accounted for 4% of Norwegian banking sector assets at the end of 2009.

Bank and *sovereign* exposures are reported in the banking statistics. While *bank* exposures accounted for 14% of Norwegian banking sector assets at the end of 2009, *sovereign* exposures accounted for below 1%. *Equity exposures* accounted for 2% of Norwegian banking sector assets at the end of 2009.

Under Basel II, held-to-maturity securities shall be

classified according to counterparty. I break down banks' held-to-maturity securities as *corporate*, *sovereign* and *bank* exposures based on statistics of bond investors at the end of 2009.²⁶ I assume an identical breakdown of held-to-maturity securities for all Norwegian banks.

I have no data on *purchased receivables* and *securitisation exposures* in the banking statistics. This has a trivial impact on the results. According to Pillar 3 reporting, only a couple of the largest banks held purchased receivables and/or had securitisation exposures at the end of 2009. In addition, these exposures accounted for a tiny fraction of these banks' total risk-weighted assets.

5.2 Basel II risk parameters

I use the advanced IRB approach to calculate capital requirements for all exposures identified in section 5.1. Under the advanced IRB approach, banks are supposed to use own estimates for all risk parameters. I use a corporate sector model that Norges Bank has developed (SEBRA) to calculate PD for all corporate loans.²⁷ The corporate sector model estimates the probability of bankruptcy of Norwegian enterprises based on key figures from enterprise financial reporting, including earnings, liquidity and financial strength. Other variables, such as industry sector and the enterprise's size and age, are also included. The corporate sector model's estimation period is from 1990 to 2002. Bernhardsen and Syversten (2009) find that the probability of default (PD) is approximately twice as high as the probability of bankruptcy. This allows me to derive PD based on probabilities of bankruptcy from the corporate sector model. I use average PD from the corporate sector model over the period from 1988 to 2009 to calculate capital requirements for *corporate*, *SME* and *retail* loans within each of the 15 sectors in the banking statistics (see Table 1 in the Appendix). PD for each sector is calculated by weighting the PD of the enterprises in that sector by debt. Over time, the corporate sector model has proved to have high and stable predictive power for Norwegian corporate bankruptcies. This indicates the model's suitability for estimating PD for banks' corporate loans.

The PD of *bank*, *sovereign*, *residential mortgage* and *revolving credit* exposures is set equal to the average PD

²³ Agriculture and forestry, Fishing and fish farming, Manufacturing and mining, Electricity, gas and water supply, Construction, Wholesale and retail trade, Hotels and restaurants, Sea transport, Other transport, Telecommunications, Real estate, Business activities, Welfare services, Oil service industry and Oil and gas extraction.

²⁴ Seen in isolation, both the adjustment for maturity (b) and correlation (R) yield a higher risk weight for *corporate* than for *SMEs* and *retail*.

²⁵ All banks excluding branches of foreign banks in Norway.

²⁶ According to VPS statistics on NOK-denominated fixed-income securities, 10% of bonds held by Norwegian banks were issued by *sovereigns*, 72% by *banks* and 18% by *corporate* entities.

²⁷ For a more detailed description of the corporate sector model, see Bernhardsen and Larsen (2007).

that Basel II banks in EEA countries reported in the Bank for International Settlements' (BIS) Quantitative Impact Study 5 (QIS5) (see Basel Committee on Banking Supervision (2006a)) and Table 2 in the appendix.²⁸ I also use average LGD from QIS5 for all risk classes. Since Norway is an open economy, the risk parameters reported in QIS5 are relatively consistent with the average risk parameters used by Norwegian banks. However, owing to peculiarities of the Norwegian economy, industry structure and legislation, the average risk parameters from QIS5 may not always be in line with the credit risk of the Norwegian banking sector's exposures.

For all exposures in my underlying data, EAD is set equal to the balance sheet value reported in the banking statistics. Our data do not make it possible to address effects of netting of positions to mitigate banks' risks. However, this is of little significance for my results. Netting of positions has little effect on Norwegian banks' risk weighting. Except for fixed-income securities in the bank portfolio, there is little netting by Norwegian banks of positions with capital requirements for credit risk. Moreover, the fixed-income securities in the bank portfolio are generally long.

Banks using the advanced IRB approach are required to use future contracted payments when measuring the effective maturity (M) of their exposures. Under Basel II M may not be set greater than 5 years and, with the exception of certain short-term exposures, may not be less than one year. For banks using the foundation approach, M will be 2.5 years for corporate exposures, except for repo-style transactions. I have no data on banks' future contracted payments. As an estimate, I set M equal to 2.5 years for all exposures in my calculation.

I use the simple risk weight method to calculate capital requirements for *equity exposures*. Under the simple risk weight method, exposures are assigned to three different risk classes based on the exposures' characteristics.²⁹ As I do not have detailed data on banks equity exposures, I assume an even distribution among the three risk classes. This yields a risk weight of just over 280%.

The use of average risk parameters for categories of borrowers is a potential source of measurement error because the Basel II formula is concave – that is, a given increase in an exposure's risk parameter does not result

in an equally large percentage increase in the exposure's capital requirements. Owing to the concavity, the sum of capital requirements for a given group of individual exposures will not normally be equal to the capital requirement calculated for the sum of these positions and their average risk parameters. However, under Basel II banks are urged to calculate capital requirements for retail exposures based on average risk parameters for categories of borrowers.³⁰ In my calculations, retail exposures account for over 50% of Norwegian banks' total exposures. For that reason, the use of average risk parameters is likely to be a fair approximation.

5.3 Other Basel II capital requirements

Capital requirements for loans to foreign enterprises and other borrowers not identified in section 5.1 are approximated by using the average risk weight for loans to Norwegian shipping enterprises (73%). This is probably a satisfactory approximation, since $\frac{2}{3}$ of banks' loans to foreign enterprises are for shipping and Norwegian and foreign shipping companies compete in the same markets.

Owing to limitations in our data set, I use figures that banks report to Finanstilsynet (COREP) for capital requirements for off-balance sheet positions, derivatives and deductions from capital requirements. Capital requirements for off-balance sheet items accounted for just over 12% of the Norwegian banking sector's total capital requirements. Different methods for calculating capital requirements for off-balance sheet items may therefore impair the comparability of banks' capital ratios. Capital requirements for derivatives, repurchase agreements and deductions from capital requirements accounted overall for under 2% of total capital requirements.

I also use banks' reported capital requirement figures for market risk and operational risk. Capital requirements for market risk accounted for just over 2% of the Norwegian banking sector's total capital requirements, and capital requirements for operational risk just under 6% of overall capital requirements. Differing methods for calculating capital requirements for market and operational risk are probably not among the most important reasons for the reduced comparability of banks' capital ratios.

²⁸ I use reported averages for banks in the Committee of European Banking Supervisors (CEBS) Group 1. These are banks that are located in EEA member states, have Tier 1 capital in excess of EUR 3bn, are well diversified and are internationally active.

²⁹ IRB banks may use two different methods: the simple risk weight method and the PD-LGD method. Under the simple risk weight method, the risk weight is set at 190% for unlisted exposures with low risk in well diversified portfolios, 290% for exposures traded on an exchange, authorised marketplace or equivalent regulated market abroad, and 370% for other equity exposures.

³⁰ Under the Basel II framework, each retail exposure shall be assigned to a large pool of exposures. Banks are required to estimate PD and LGD for each such pool. Norwegian regulations permit banks that use statistical models to estimate PD for each counterparty in a risk class to set that risk class's PD as the unweighted average of these PDs.

6. Calculating comparable capital ratios

Based on the approximations in section 5, I calculate comparable risk-weighted assets and comparable capital ratios for all Norwegian banks.

If I use my calculations instead of the banks' reported risk weights for credit risk, the average risk weight of IRB banks' loan portfolios increases by nearly 8 percentage points (see Chart 4). At the same time, the average risk weight for loan portfolios of banks using the standardised approach falls by over 9 percentage points.

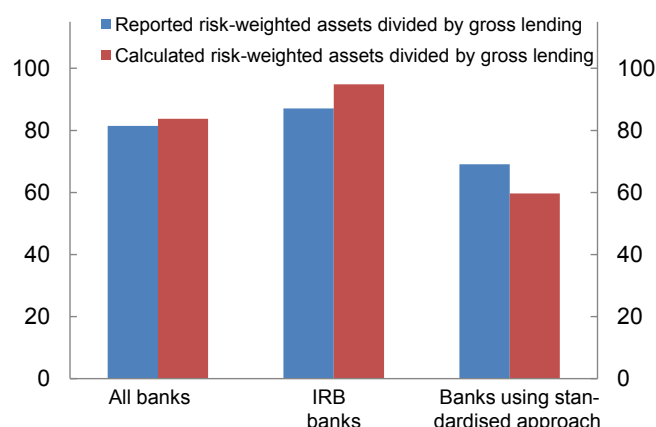
The impacts on risk-weighted assets that I obtain using my approach also affect banks' capital ratios. Under my approach, the Tier 1 capital ratio of IRB banks is just one percentage point lower than what they reported at the end of 2009 (see Chart 5.³¹). At the same time, the calculated Tier 1 capital ratio for banks using the standardised approach is over 3 percentage points higher than what they reported. The deviation between average Tier 1 capital ratios of banks using the standardised approach and those of IRB banks widens from just over 3 percentage points to over 7 ½ percentage points when I make a comparison using my calculated capital ratios instead of the banks' reported capital ratios. These results are generally robust to alternative values of PD and LGD (see Table 3 in the Appendix).³²

Chart 6 also shows that the deviation between reported and estimated capital ratios varies considerably across banks, even across IRB banks.

Banks above the diagonal axis in the chart obtain higher Tier 1 capital ratios from my calculations than what they reported. Most banks lie above the diagonal axis. However, five of the seven IRB banks obtain lower Tier 1 capital ratios from my calculations than what they reported. The deviation between reported and estimated figures varies among IRB banks. The Tier 1 capital ratio of one of the IRB banks falls by over 2 percentage points. At the same time, the calculated Tier 1 capital ratio of another IRB bank is nearly 2 percentage points higher than its reported Tier 1 capital ratio.

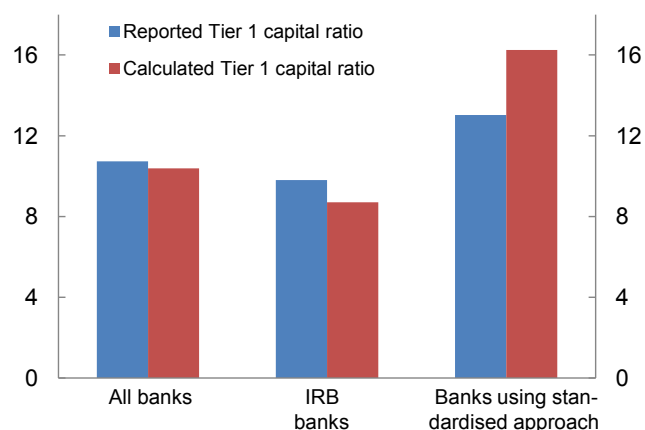
There may be several reasons for the wide deviation between reported and estimated capital ratios among IRB banks. One may be that banks' risk models yield different risk weights for virtually identical assets. In those instances, banks' reported capital ratios are imprecise measures of their financial strength. Another reason for deviations between reported and estimated capital ratios may be bank-to-bank variation in risk in my 50 risk classes. The underlying data do enable a distinction

Chart 4 Banks¹⁾ reported²⁾ and our estimated average risk weight for their loan portfolios³⁾. Per cent. 2009. Q4



- 1) All banks excluding branches of foreign banks in Norway
- 2) Effect of transitional arrangements from Basel I to Basel II not included in the calculation
- 3) Average risk weight for banks' loan portfolio is calculated by dividing risk-weighted assets for credit risk by gross lending

Chart 5 Banks¹⁾ reported²⁾ and our estimated Tier 1 capital ratio. Per cent. 2009. Q4



- 1) All banks excluding branches of foreign banks in Norway
- 2) Effect transitional arrangements from Basel I to Basel II not included in the calculation

between the quality of individual borrowers within the various risk classes. In addition, I assume an identical distribution of *corporate*, *SME* and *retail* exposures for all Norwegian banks. In reality, small banks are less exposed than large banks to large enterprises. Since our risk weights are higher for *corporate* (106%) than for *SMEs* (92%) and *retail* (51%), the calculated capital ratios of small banks may be too low.

³¹ I use banks' reported Tier 1 capital when calculating Tier 1 capital ratios under my approach.

³² It is only when using very high LGD values for commercial real estate loans (over 0.67) that the deviation between average Tier 1 capital ratios of banks using the standardised approach and IRB banks narrows when using my approach.

Another possible explanation for the deviation between reported and estimated capital ratios is that all Basel II exposures could not be included in my calculations. I do not have data on purchased receivables, securitisation exposures or the risk-mitigating effects of netting of positions. As explained above, this is probably of little significance for my results.

A further explanation may be variation among banks in the proportion of their portfolios covered by internal risk models. My analyses indicate that banks' reported capital ratios increase substantially as they use internal risk models for their exposures. According to Standard & Poor's, different risk weights are just as much a function of banks' risk models as of differences in bank risk.

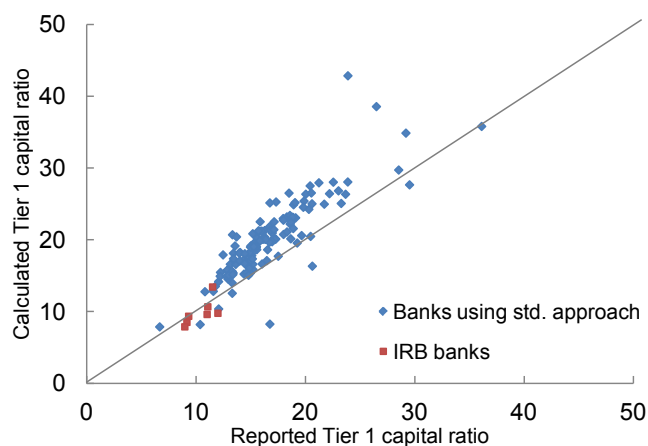
In September 2010 the Basel Committee published recommendations for revising the capital adequacy framework (Basel III). Basel III is to be incorporated into national legislation by the end of 2012, but transitional arrangements will ensure a gradual phase-in of the new framework. The Basel Committee has recommended raising the minimum requirement for common equity from 2% to 4.5% and the Tier 1 capital requirement from 4% to 6% by the end of 2014. Under Basel III two different buffers above the minimum requirement for common equity – a capital conservation buffer and a countercyclical buffer – will also be introduced by the end of 2018. Together, these two buffers can amount to 5% of risk-weighted assets. Moreover, under Basel III capital requirements for counterparty risk and banks' risk in the trading book and securitisation exposures will be higher than under Basel II. The minimum standards for the instruments allowed in capital (numerator) are also stricter under Basel III. Moreover, rules for deductions from capital for intangible assets are to be harmonised by the end of 2017. Harmonising the definitions of capital will simplify cross-border comparisons of banks' capital adequacy. However, the new framework will not enhance the comparability of Norwegian banks' reported capital ratios.

7. Summary

The transition from Basel I to Basel II was intended to bring banks' capital requirements in better alignment with banks' risks. However, under the Basel II rules, a comparison of reported capital ratios may still provide a misleading picture of banks' solvency. Basel II permits banks to choose among various approaches for calculating their capital adequacy. The use of different approaches reduces the comparability of banks' reported capital ratios.

To obtain a better basis for comparing banks' financial strength, I use a single approach to calculate capital ratios

Chart 6 Banks¹⁾ reported²⁾ and estimated Tier 1 capital ratios. Per cent. 2009.Q4



- 1) All banks excluding branches of foreign banks in Norway
 2) Effect of transitional arrangements from Basel I to Basel II not included in the calculation

for all Norwegian banks. I compare my calculated capital ratios with banks' reported figures. IRB banks' reported Tier 1 capital ratios are lower than those of banks using the standardised approach. Even so, my calculations indicate that the financial strength of IRB banks is over-estimated compared with the banks using the standardised approach in their reported capital ratios. The deviation between average Tier 1 capital ratios in IRB banks and those of banks using the standardised approach more than doubles when I use my calculated capital ratios rather than banks reported capital ratios. The deviations between reported and estimated ratios also vary among IRB banks. The reason may be that banks' risk models generate different risk weights for comparable assets. In that case, banks' reported capital ratios are an inaccurate measure of their financial strength. Another possible reason for varying deviations between reported and estimated capital ratio is that my calculations did not manage to capture differences in bank risk.

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Appendix

Formula for calculating Basel II capital requirements for credit risk

The formula for calculating the risk weights (RWA) for *corporate, sovereign, bank* and *retail* assets is

$$RWA = 12.5 * EAD * \left[LGD * N \left(\frac{G(PD) + \sqrt{R} * G(0.999)}{\sqrt{1-R}} \right) - (PD * LGD) \right] \frac{(1 + (M - 2.5)b)}{(1 - 1.5b)}$$

where N is the cumulative standard normal distribution and G its inverse. Maturity adjustment (b) is given by $b = [0.11852 - 0.05478 * \ln(PD)]^2$, except for *retail*, where b is 0. RWA increases with M, because the risk increases with the maturity of the exposure. In addition, the probability is greater that PD will increase during the term to maturity when PD is low at the outset. Maturity adjustment is therefore a function of PD.

For *corporate, sovereign* or *bank* exposures, the correlation factor (R) is given by:

$$R = 0.12 \left(\frac{1 - e^{-50PD}}{1 - e^{-50}} \right) + 0.24 \left(1 - \frac{1 - e^{-50PD}}{1 - e^{-50}} \right) - c \left(1 - \frac{S - 5}{45} \right)$$

where c is 0 for all exposures, except for SMEs, where the parameter is 0.04. S is the enterprise’s turnover in millions of EUR. For residential mortgages and revolving credits, R is 0.15 and 0.04, respectively. For all other exposures, R is given by:

$$R = 0.03 \left(\frac{1 - e^{-35PD}}{1 - e^{-35}} \right) + 0.16 \left(1 - \frac{1 - e^{-35PD}}{1 - e^{-35}} \right)$$

The formula only deals with the correlation between each exposure and a factor for systemic risk. The correlation among the various exposures is ignored. Thus, the formula assumes that all idiosyncratic risk can be diversified away. The formula is based on the assumption that small enterprises are less correlated with the factor for systemic risk than large enterprises. A low PD yields a high R because the PD for largest enterprises is assumed to be low.

Table 1 Average PD¹ used in the calculation of capital requirements for *corporate*, *SME* and *retail* loans with- in each of the 15 industries in the banking statistics

	PD
Agriculture and forestry	0.0540
Fishing and fish farming	0.0929
Manufacturing and mining	0.0175
Electricity, gas and water supply	0.0040
Construction	0.0396
Wholesale and retail trade	0.0340
Hotels, restaurants and tourism	0.0848
Sea transport	0.0160
Other transport	0.0208
Telecommunications	0.0623
Real estate	0.0155
Business activities	0.0414
Welfare services	0.0606
Oil service industry	0.0334
Oil and gas extraction	0.0160

¹ Average PD is calculated on the basis of annual PD from the corporate sector model for each industry over the period 1988 – 2009. The annual PD for each sector is calculated by weighting the probability of default of the enterprises in that sector by their debt.

Table 2 PD and LGD used in the calculation of loans classified as *bank*, *sovereign*, *residential mortgages* and *revolving credits*¹

	PD	LGD
Bank	0.0022	0.377
Sovereign	0.0013	0.277
Residential mortgages	0.0152	0.161
Revolving credits	0.0369	0.550

¹ The parameters are taken from the BIS's Quantitative Impact Study 5 (QIS5), see Basel Committee on Banking Supervision (2006a).

Table 3 Deviation¹ between the average capital ratios of banks using the standardised approach and IRB banks and my approach and alternative values for PD and LGD. Percentage points

	PD reduced by half	PD doubled	LGD reduced by half	LGD doubling
Agriculture and forestry	7.7	7.3	8.3	6.3
Fishing and fish farming	7.6	7.4	8.3	6.2
Manufacturing and mining	7.5	7.5	8.5	6.0
Electricity, gas and water supply	7.5	7.5	7.7	7.2
Construction	7.6	7.5	7.9	6.8
Wholesale and retail trade	7.6	7.5	8.4	6.0
Hotels and restaurants	7.6	7.5	7.8	7.1
Sea transport	7.5	7.6	8.5	6.0
Other transport	7.6	7.5	7.9	6.9
Telecommunications	7.5	7.5	7.7	7.2
Real estate	7.9	7.2	15.4	1.2
Business activities	7.6	7.5	7.9	6.9
Welfare services	7.6	7.4	8.0	6.6
Oil service industry	7.5	7.5	7.7	7.2
Oil and gas extraction	7.5	7.5	7.6	7.5
Bank	7.4	7.7	7.3	7.9
Sovereign	7.5	7.5	7.5	7.6
Residential mortgage	8.7	6.2	9.2	5.3
Revolving credits	8.0	6.9	8.2	6.4

¹ The deviation is the average Tier 1 capital ratio of the banks using the standardised approach less the average Tier 1 capital ratio of IRB banks. The deviation is calculated by changing one parameter at a time, while the other parameters are kept equal to the values appearing in Tables 1 and 2.