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IMPACT OF THE FINAL BASEL III FRAMEWORK IN SWEDEN

Effects on the banking market and the real economy

SWEDISH BANKERS' ASSOCIATION
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF BOXES

PREFACE

The Basel Accord of December 2017, also called the 'Final Basel III Framework', is one of the most debated regulatory frameworks in recent years. The accord was supported by the G20 Finance Ministers and Central Bank Governors Meeting under the condition: "*We confirm our support for the Basel Committee on Banking Supervision's (BCBS) work to finalise the Basel III framework without further significantly increasing overall capital requirements across the banking sector, while promoting a level playing field.*"

The accord sets out revised international standards, which are now to be implemented on a European level. A recent impact assessment from the European Banking Authority (EBA) has shown that the Final Basel III Framework could lead to a significant increase in capital requirements for European banks. On that basis, the European Banking Federation invited Copenhagen Economics to conduct a macroeconomic impact assessment. The resulting study was published in November 2019.

This report is a follow-up, specifically covering the impact of the final Basel III reform in Sweden, and was commissioned by the Swedish Bankers' Association. In the report, we estimate the impact of the Final Basel III package in Sweden on the banking sector, bank customers and the real economy. We then evaluate the implementation against two criteria:

1. Does the package lead to better alignment between risk and capital requirements?
2. Does the implementation deliver net benefit to society, based on an economic cost-benefit analysis?

Finally, we will examine different options for implementation that could increase net economic benefits.

EXECUTIVE SUMMARY

In December 2017, the Basel Committee agreed on a new regulatory framework denoted the 'Final Basel III Framework'. The accord was subsequently supported by the G20 Finance Ministers and Central Bank Governors Meeting. The background for the framework was notably an identified variability in internal capital adequacy models that was not seen as being driven by a corresponding variation in underlying risks facing different banks. In other words, banks might not have enough capital to keep the financial system stable in a crisis because they underestimate potential losses.

To address this, the Basel Committee proposed to e.g., implement floors on the risk weights of banks, providing a minimum capital requirement for different exposures. In this way, the variability of the risk-weight estimation is reduced, as it gives a lower bound for the required capital.

Based on a mandate from the EU Commission, the European Banking Authority (EBA) has provided a first assessment of how the Basel agreement can be implemented in the EU. In their main scenario, EBA estimates that the package would increase *minimum capital requirements* by some 50% for Sweden, compared to an EU average of 24%.[1]

The EBA estimate for Sweden might overlook the impact of the existing Swedish mortgage floors. Based on bank-specific data from Swedish banks, we find the impact of the package in Sweden is more likely to be around 31%, in line with the estimate by the Swedish FSA.[2] Although lower than the EBA estimate, this is still a significant amount and not consistent with the original G20 mandate behind the package of no significant increase in capital requirements. Translated into absolute levels, the 31% increase in capitalisation corresponds to some SEK 200 bn.

Alignment between internal models and underlying risks

The main purpose of the Final Basel III Framework is to ensure better alignment between capital requirements based on internal models and underlying risks. However, we find that the package is more likely to have the opposite effect in Sweden.

The impact in Sweden is above EU average, and for the corporate portfolio the impact is among the highest in the EU. However, we find no evidence that the Swedish banking sector in general, and the corporate portfolio specifically, should be particularly vulnerable so as to justify this significant increase in capital requirements:

- The Swedish banking sector has historically had low credit losses – over the past ten years losses have been around ¼ of the EU average.
- In EBA's stress test, the Swedish banking sector comes out in the very top, with a capital ratio of 18% in an adverse scenario with a severe economic crisis – this is higher than the starting point for most countries.[3] The adverse scenario implies a GDP decline of some

[1] Note that EBA updated their estimated increase in capital requirements of 24.4% in the impact assessment from August 2019 to 23.6% in December 2019. The impact in Sweden was revised down from 53% to 50%.

[2] The Swedish Financial Supervisory Agency (FSA) estimates the impact to be around 30%; see the note on the impact of the revised Basel standards for Swedish banks from December 2019, available at https://www.fi.se/en/published/news/2019/clarification-on-the-impact-for-swedish-banks-from-revised-basel-standards/.

[3] Note that the capital ratio used in this stress test still includes the retail mortgage floor in Pillar 2 (and not Pillar 1) and is therefore higher than current actual capital ratios.

10% – more than double the decline in GDP during the banking crisis of the 1990s and the recent financial crisis.

- Finally, empirical research shows that any variability in the predictions of internal models is not biased towards lower capital requirements. In fact, banks generally use conservative assumptions in their internal models.

Thus, the package will further the distance between capital requirements and underlying risks of portfolios of Swedish banks.

Impact on Swedish bank customers

Higher capital requirements increase the required share of the more expensive equity funding for banks. This is passed on to bank customers in terms of higher interest rates and fees. This is widely accepted in the economic literature, e.g., from Bank of England, IMF and ECB.

We estimate that the package will increase the total annual costs for Swedish banking customers with some SEK 30 bn, equivalent to more than one fifth of the annual corporate tax revenue (SEK 140 bn). Particularly Swedish corporate customers will be affected by this, carrying approximately two thirds of the costs. This corresponds to an increase in the interest rate for Swedish corporates of some 0.5 percentage points or an increase in the cost of lending in the magnitude 40%-50% at current low interest rates. We estimate that SMEs will experience an increase in the interest rate of some 0.15 percentage points. It is important to note that the estimated impact is permanent and will sustain across business cycles – thus not to be compared with ordinary interest rate fluctuations.

Looking at the corporate segment, the impact of the package varies significantly. For example, we find that newly established SMEs with high leverage will experience little impact from the package. In contrast, large, unrated corporates with a long track record of no default will be highly affected; capital requirements could increase by a factor of 3-5. This will imply increases in interest rates in the magnitude of 1-1.2 percentage points – with the current interest rates, this is close to a doubling in lending costs.

We fail to see the economic rationale or justification from a risk perspective behind this differentiation of impact between different businesses.

Note that this is not an issue in jurisdictions, such as the US, where it is common for larger corporates to fund themselves via capital markets and therefore being rated. However, in Sweden, as well as many other European countries that rely more on bank financing, the impact on unrated corporate can be substantial.

Macroeconomic cost-benefit analysis

The international debate on reforming financial regulation in the aftermath of the financial crisis has systematically been based on the premise of decreasing benefits to increasing levels of capitalisation, while real-economy costs are increasing. A wide range of international studies, e.g. by IMF and BIS, suggest that regulatory-induced increases in capital ratios for advanced economies above 15% have little to no net benefit to society.

Macroeconomic costs

In terms of costs, the higher interest rate for businesses will cause a decline in the credit demand, reducing their investments (fewer investments will be profitable). This leads to a decrease in productivity and eventually reduces GDP. Concretely, we expect the package will lead to a permanent decline in the Swedish GDP level of around 0.8%, corresponding to around SEK 40 bn (2017-level). For example, after a ten-year period, the accumulated GDP reduction would correspond to SEK 400 bn. The estimate is based on a macroeconomic model for the EU economy, of the same type as used by BIS in preparation for Basel III.

We estimate that the decline in GDP will gradually appear the ten years following implementation. In this transition period, investments will be subdued. Concretely, we estimate that investments will be some SEK 30 bn lower every year, corresponding to a decline of around 2.7%. Accumulated over the ten-year period, the Swedish economy sees a reduction in investments of around SEK 300 bn.

In this context, note that the higher capital requirements could also be a drag for Swedish banks in terms of the finance investments needed for the transition to a low-carbon economy. To be compliant with the Paris agreement, we estimate that Swedish banks each year would need to finance more than SEK 20 bn of investments supporting the green transition.[4] Viewed in isolation, this would mean that Swedish banks with the current rules would need to raise some SEK 1.3 bn additional capital for green loans to businesses. With the Final Basel III Framework, that number increases to around SEK 2 bn.

Macroeconomic benefits

Since the financial crisis in 2008, the Swedish banking sector has increased solvency to a point where further general increases in capitalisation bring very little benefits in terms of reducing the risk of a crisis. Concretely, we estimate that the benefits from the Final Basel III Framework correspond to a permanent increase in GDP of around 0.05%.

Note that this does not rule out that financial or economic crises could happen in Sweden. Capital requirements for banks are not the only parameter determining the risk of a crisis. For example, ill-advised fiscal or monetary policies could still build up financial bubbles, with a following burst. We merely point out that the benefits from higher capital requirements have been exhausted.

Putting costs and benefits together, we find the Final Basel III Framework will contribute with net economic costs to the society corresponding to around 0.75% of GDP.

Policy conclusions: options for implementation

Our conclusion is that a one-to-one implementation of the Final Basel III Framework, as outlined in EBA's main scenario, will significantly increase financing costs for Swedish businesses, which will bring about costs far exceeding potential benefits. The point is that the package will widen – not narrow – the gap between capital requirements and the actual underlying risks.

4 Bank finance corresponds to around 50% of the entire investment financing in Sweden, cf. appendix in Copenhagen Economics (2016a).

To mitigate this, we have identified three concrete implementational options to make the package more suited to Swedish financial structures:

1. *Output floor* is the most crucial aspect of the implementation. Implemented in the manner outlined in EBA's main scenario, the output floor alone – i.e., disregarding all other initiatives – can lead to a substantial increase in capital requirements for businesses. Alternatively, the output floor can be implemented as a separate capital requirement where only internationally agreed capital buffers are applied, the so-called parallel stack approach.[5] This will greatly diminish the impact of the output floor and to a greater extent maintain the risk sensitivity of capital requirements that a binding output floor largely removes.
2. *Unrated corporates* will, as mentioned, be significantly affected, and we strongly recommend finding a solution to avoid 3-5 time increases in capital requirements. We suggest an option which, to a larger extent, keeps the risk-based capital requirement for unrated corporates, reducing the impact by around 8-10 percentage points.
3. *The EBA impact assessment provides several options* on how the impact on capital requirements can be limited, e.g., with a lower impact from credit valuation adjustment (CVA) risk and by keeping the SME supporting factor. Together, these could reduce the impact by 1-2 percentage points.

Including the above options, we assess the increase in capitalisation in Sweden could be kept below 5%.[6]

In addition, we also suggest focusing on the work undertaken through EBA's IRB roadmap and the ECB's targeted review of internal models (TRIM) to streamline and verify the properties of internal risk models. Ultimately, financial institutions that have 1) solid, verifiable models identifying their forward risks and 2) can document their solidity through stress tests, even in very adverse economic conditions, should be able to use these models to determine their capital adequacy.

5 Also referred to as 'backstop approach'.

6 Note that the different options have cross effects, meaning that the sum of the marginal impacts does not equal the total impact if all options are included.

IMPACT ON THE SWEDISH BANKING SECTOR

In December 2017, the Basel Committee agreed on a new regulatory framework to address identified shortcomings of the original Basel III agreement denoted the 'Final Basel III Framework'. In a European context, the European Commission has asked the European Banking Authority (EBA) for an impact assessment of its implementation in the EU.

Chapter 1 sets out to explore how the Final Basel III Framework will impact the Swedish banking sector. First, we describe the measures in the framework (section 1.1). We will then assess the impact on the Swedish banking sector (section 1.2). Finally, we will analyse whether the package leads to a better alignment between underlying risks and capital requirements (section 1.3).

1.1 THE FINAL BASEL III FRAMEWORK

The key objective of the reform is to reduce excessive variability of internal capital adequacy models of banks.[7]

Banks with an advanced risk model framework estimate a part of their capital requirements using internal models. These models produce risk weights that determine the level of capital the bank is required to hold for different assets, cf. Box 1. The key concern for policy makers is the identified variability in the risk weights produced by the internal models (i.e., variability in capital requirements) that does not depend on variation in the underlying risks. Consequently, the G20 summit gave the mandate to the Basel Committee to finalise the post-crisis reforms of the financial regulatory system to reduce the variability of internal models.[8]

To address this, the Basel Committee has suggested to implement floors on the risk weights of the banks, thus providing a minimum capital requirement for the different exposures.[9] In this way, the variability of the risk-weight estimation is reduced, as it gives a lower bound to capital requirements.

7 See BIS (2017)
8 BCBS (2015)

Box 1 Capital requirements for banks depend on risk weights

The required capitalisation of banks is not only determined by the total amount of exposures but also by the level of risk to these exposures. For example, a SEK 100,000 unsecured corporate loan entails a larger risk than a SEK 100,000 government bond exposure. Concretely, the required capital for an exposure depends on so-called risk weights. If a bank has a required capital ratio of 10% and an exposure has a risk weight of 50%, the required capital the bank should hold for that loan will be 10%*50%=5%.

For banks with an advanced risk model framework, the risk weights are estimated using internal models of the banks, based on certain risk parameters. For example, a company with a high debt compared to revenue is normally a relatively risky exposure and would typically be assigned a larger risk weight than exposures to less leveraged companies. Consequently, capital adequacy for banks is measured as a share of risk-weighted assets (denoted REA), which essentially is the sum of exposures multiplied by their risk weights. In this way, there are fundamentally two ways a bank can reduce their capital requirements, either by reducing exposures in absolute levels or by decreasing the risk of the exposures to get lower risk weights.

Banks without an advanced risk model framework instead use the standardised risk weights. These weights are determined for buckets of assets, based on broad characteristics such as type of assets or ratings. For example, typical residential real estate exposures (under the whole loan approach) with a loan-to-value ratio between 60% and 80% have a risk weight of 30% (with the Final Basel III Framework).

The internal models of banks are subject to certain restrictions on how to model the risks. Nevertheless, empirical research has found significant variability in the internal models of banks.

This main concept of the package has been translated into numerous different measures, including:

- *Input floors and other restrictions* that set minimums for the parameter estimates going into the risk-weight functions and restricting the use of the more advanced approaches using own estimates of loss given default.
- *The output floor* providing a minimum risk exposure amount (REA) for banks using internal models set at 72.5% of the REA, calculated using the standardised approaches, i.e., without the use of internal models (cf. Box 1).
- *A revised standardised approach for credit risk* with the aim of increasing the risk sensitivity of the standardised approach for credit risk. This includes a more granular risk weighting approach for residential real estate exposure (where risk weights now depend on the loan-to-value ratio).
- *Revisions of the market risk and credit valuation adjustment (CVA) risk framework*. These limit the use of internal models for market risk and entirely remove the possibility of modelling CVA risk based on internal models. Also, the standardised approaches for market and CVA risk have been revamped.
- *A new framework for operational risk* that replaces approaches based on internal models as well as the original three standardised approaches.

- *Other measures* include a leverage ratio requirement for global systemically important institutions (G-SIBs) and revisions to the calculation of counterparty credit risk exposures stemming from securities financing transactions (SFTs).[10]

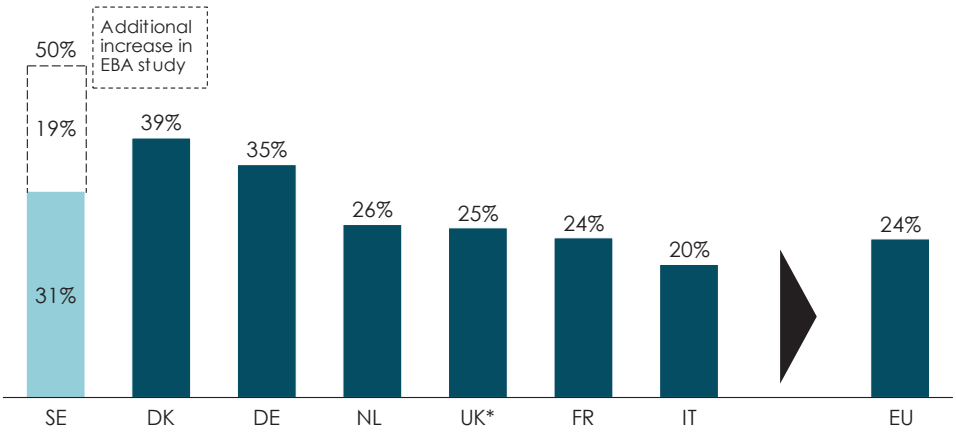
1.2 IMPACT ON CAPTITALISATION OF THE SWEDISH BANKING SECTOR

On request by the European commission, the European Banking Authority (EBA) has conducted a comprehensive impact assessment of the Final Basel III Framework, based on detailed microdata from 189 European banks.

The main scenario in the EBA impact assessment corresponds to "*a scenario of a strict implementation of the Final Basel III Framework*".[11] This is mainly due to an output floor calculation applied to all buffers and not just the ones agreed on internationally, making the impact relatively high in the EU, as discussed in section 1.3. Other rather strict interpretations in the EBA main scenario include a removal of the preferential SME treatment and a new treatment of CVA risk.

Based on these premises, the EBA finds that the minimum required capital (MRC) of EU banks will on average increase by some 24%, cf. Figure 1.

Figure 1
Increase in capital requirements (MRC)
% of original MRC



Note: In our estimation, we have included Nordea in our sample of Swedish banks, even though it relocated its headquarters to Finland in 2018. This is because Nordea remains one of the largest banks active on the Swedish market. The impacts estimated by EBA are the updated numbers from the impact assessment published in December 2019 which accounts for the 2019 FRTB revisions.
* The impact in the United Kingdom is based on our balance sheet model since no data are available for the UK in the EBA report. Note that the impact in the UK is somewhat smaller than in our previous study due to an updated methodology of the estimation for the UK.
Source: EBA Impact assessment and own calculations for the United Kingdom and Sweden.

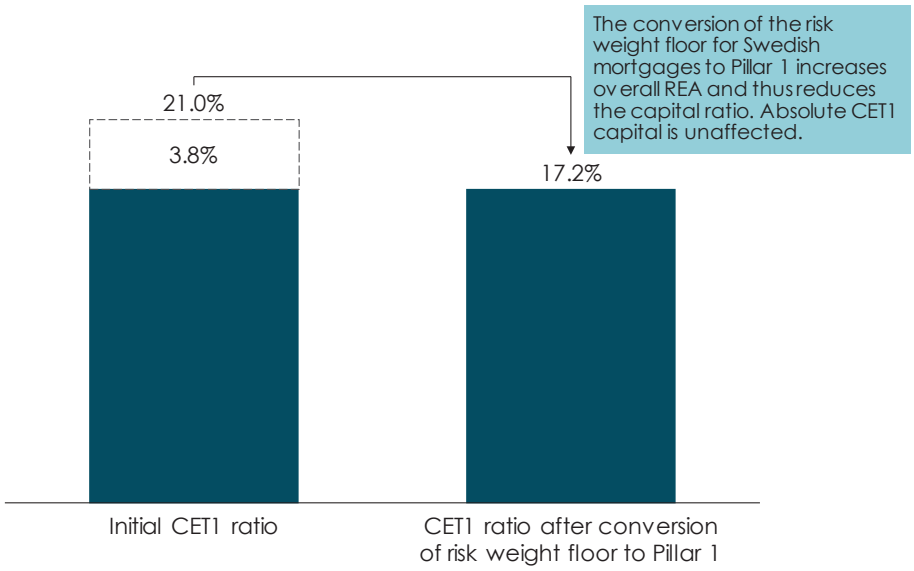
[10] The revision of the leverage ratio framework requires banks to be identified as G-SIBs to hold a leverage ratio buffer equal to 50% of the bank's higher-loss absorbency requirement. The package also entails refinements to the leverage ratio exposure measure (the denominator of the leverage ratio). The changes to the calculation of counterparty credit risk exposures stemming from SFTs introduce minimum haircut floors for non-centrally cleared SFTs and imply a recalibration of the supervisory haircuts.

[11] See p. 20.

In preparation for this report, we have received bank-specific data for the Swedish banking sector. Based on this, we find that the Final Basel III Framework will increase MRC in Sweden by around 31%, a somewhat lower impact than the 50% impact EBA finds, but in line with the impact estimated by the Swedish FSA[12], cf. Figure 1. One reason for this difference is that we account for the conversion of the risk weight floor of 25% for Swedish mortgages from Pillar 2 to Pillar 1, which entered into force in the fourth quarter of 2018. Capital requirements are unaffected by this conversion, but it implies an increase in REA and a corresponding decrease in the capital ratio, cf. Figure 2.

It should be noted that the Swedish FSA has proposed to implement a risk weight floor for commercial real estate exposures as a Pillar 2 requirement. This would be expected to increase the capital requirement (in percentage of risk-weighted assets) by around 0.7 percentage points.[13]

Figure 2
CET1 ratio in Sweden before and after conversion of the risk weight floor
% of total REA



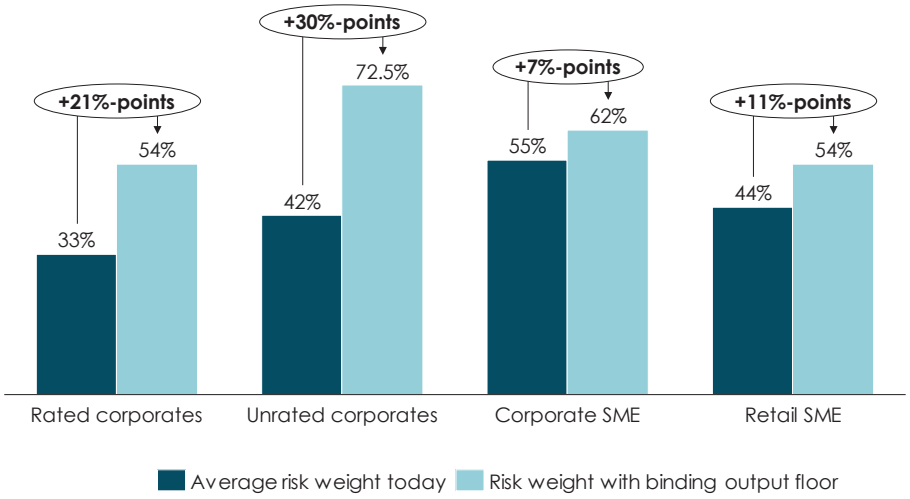
Note: Based on our sample of five Swedish banks and Nordea.
Source: EBA transparency exercise and own calculations.

Different portfolios will be affected in different ways by the Final Basel III Framework. Estimates by the three largest Swedish banks and Nordea show that particularly risk weights for the corporate portfolio will increase due to an implementation of the reform. Average risk weights for unrated corporates, for instance, could rise by more than 30 percentage points, cf. Figure 3. This is an increase in capital requirements by more than 70%.

[12] The Swedish FSA estimates the impact at around 30%; see the clarifying statement from December 2019 available at https://www.fi.se/en/published/news/2019/clarification-on-the-impact-for-swedish-banks-from-revised-basel-standards/.

[13] See Finansinspektionen (2019) – Stability in the Financial System, p. 19.

Figure 3
Selected risk weights before and after the reform
REA in % of exposure value



Note: See section 2 for a short description of the different exposure classes.
Source: Estimates by the three largest Swedish banks and Nordea.

1.2.1 Required increase in capitalisation

To be compliant with the minimum required capital, the EBA estimates that EU banks are required to increase the core equity (CET1) by some SEK 890 bn (EUR 83 bn) if no deleveraging takes place. For the Swedish banking sector, we estimate this number to be around SEK 130 bn.

However, the actual increase in core equity due to the framework can be expected to be larger, as banks cannot operate on the absolute minimum required capital; banks typically have buffers to the minimum capital requirements.[14] This is due to several reasons:

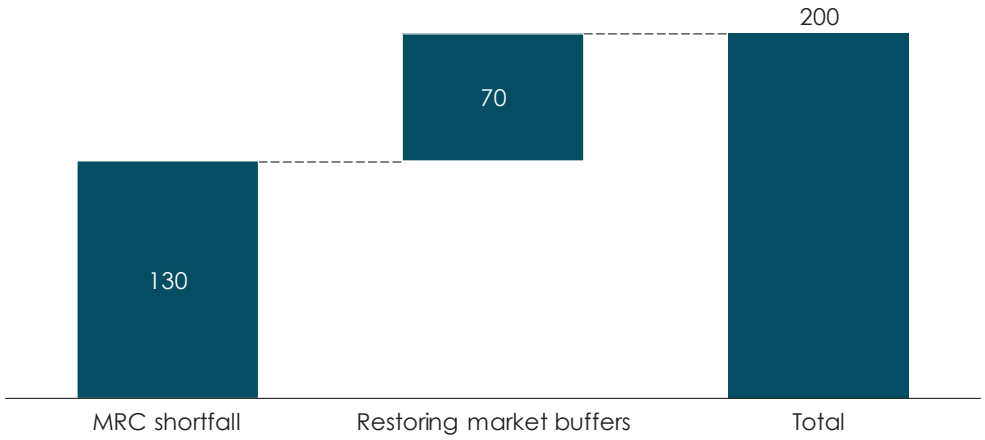
- Capital ratios fluctuate as part of the daily business; running on minimum levels would mean that the bank would often run into capital inadequacy and thus face supervisory restrictions on dividend payments, etc.
- The financial markets expect banks to run with buffers to requirements. Exactly meeting the required capital ratio could signal that the bank is in trouble, which would result in decreasing ratings and higher funding costs. Thus, it is profitable for banks to have capital buffers.
- Supervisors expect banks to hold capital above the official minimum requirements to be able to absorb potential losses in stressed scenarios (Pillar 2 guidance). In addition, supervisors might influence banks' own buffers on top of the Pillar 2 guidance.

After the implementation of the Final Basel III Framework, banks would still need to run with a buffer to the minimum requirements. Assuming that Swedish banks will keep the current average

[14] The Swedish Financial Supervisory Authority (*Finansinspektionen)* publishes capital requirements as well as actual capital ratios for the largest Swedish banks on a quarterly basis. The capital buffers that banks hold on top of the minimum are therefore directly visible from these publications. For the Swedish banks in our sample, the average capital buffer is currently (using Q3 2019 data) around 1.5 percentage points.

core equity (CET1) ratio at around 16%[15], this implies an increase in core equity of 31% for Sweden (equivalent to the increase in minimum capital requirement). This means that the Swedish banking sector would need to raise around SEK 200 bn to sustain the current balance sheet, cf. Figure 4. In terms of total capital (which can also consist of other types of equity than CET1, such as equity instruments), we expect the Swedish banking sector would need to increase capitalisation by around SEK 260 bn.

Figure 4
Estimated required increase in CET1 capital, without deleveraging
SEK bn



Note: The minimum required capital consists of 4.5% of common equity tier 1 (CET1), the combined buffer requirements (countercyclical and capital conservation buffer plus the systemic risk buffer, G-SII buffer and O-SII buffer, if applicable) and the Pillar 2 requirements. For this estimation we use Q3 2019 capital ratios and REAs.
Source: EBA transparency exercise, Finansinspektionen, Nordea Q3 financial report and own calculations.

Note, that part of the current capital buffers could be a consequence of banks starting to build up capital now to meet the required increase from the Final Basel III Framework. Thus, banks could run with lower buffers than they currently do after implementation – to the extent this is the case, the required increase in capitalisation would be lower than stated above. Nonetheless, it seems safe to say that the amount of additional capital needed would be significantly higher than the EBA estimate.

The above estimate assumes that banks sustain their current balance sheet, i.e., no deleveraging (the so-called static balance sheet assumption). The other end of the scale is that banks do not increase capitalisation at all and adjust to the Final Basel III Framework by reducing assets (while keeping their current capital ratios). In that extreme case, we estimate a required decrease in total

[15] For this estimation we use the current capital ratios and REA from Q3 2019 which explain the difference to the average capital ratio in our sample of 17.2% resulting from end of 2017 EBA transparency data adjusted for the conversion of the mortgage floor to Pillar 1.

assets of around SEK 3,200 bn (EUR 300 bn).[16] Looking at lending to private customers, it will lead to a reduction in credit of SEK 2,300 bn (EUR 210 bn).[17]

As we will outline in the next two chapters, we expect the actual impact on capitalisation to be somewhere in the middle of the two cases; the higher capital requirements will increase the cost of lending, which will decrease credit demand, thus reducing assets and therefore the required increase in capitalisation.

1.3 ALIGNMENT BETWEEN CAPITAL REQUIREMENTS AND UNDERLYING RISKS

As described above, the Final Basel III Framework leads to higher capital requirements, both on a European level as well as in Sweden. This average impact contains a large heterogeneity between portfolios – some portfolios have their risk weights doubled, whereas others are unaffected. This begs the question: are the risk weights that are required to increase significantly currently biased downwards? As we will outline below, we find no evidence that this is the case.

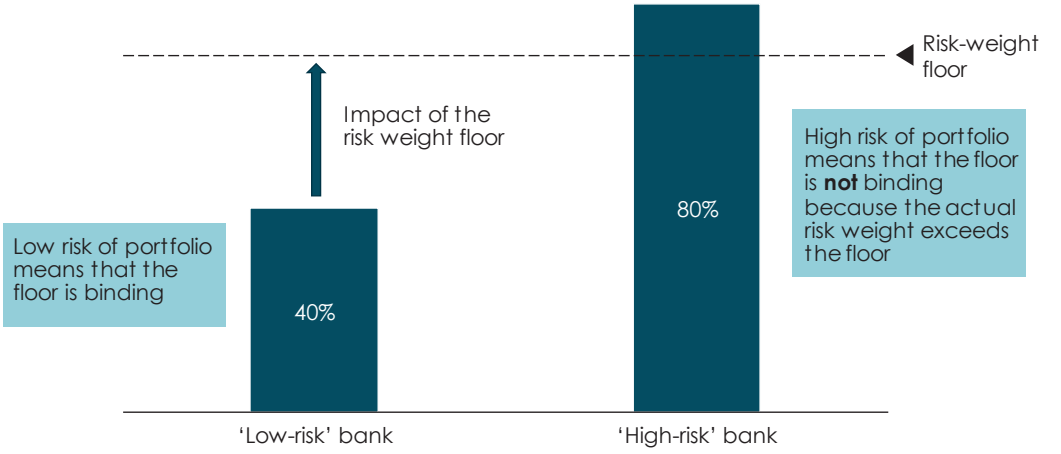
1.3.1 How the Final Basel III Framework limits the risk sensitivity of capital requirements

As mentioned, the Final Basel III Framework puts an upper limit on the risk sensitivity of capital requirements. Consequently, we expect portfolios with low risk weights compared to the standardised approach to be most affected by the package. Without the package, banks with 'safe' exposures face low capital requirements as the data of their portfolios signals low risk, e.g., low historical loss rates, low leverage of customers, high income/earnings of customers compared to loan size, etc. This typically results in lower risk weights for the portfolio when using internal models compared to the risk weights implied in the less granular standardised approach. The Final Basel III Framework limits the extent to which the low risk of the portfolios leads to lower capital requirements, cf. illustrative example in Figure 5.

16 Assuming banks reduce assets uniformly across all asset types and using data from the SNL database for the sample of banks included in our analysis.

17 Swedish banks have around SEK 450 bn allocated capital to their private customer credit portfolio, supporting credit of some SEK 9,600 bn. That corresponds to a leverage ratio of around 21. An increase in capital requirement of 31% would reduce the leverage ratio to 16, meaning that capital of SEK 450 bn can support credit worth SEK 7,300 bn – a reduction of around SEK 2,300 bn.

Figure 5
Illustrative example of the impact on risk sensitivity
Risk weight



Note: Example is purely illustrative and the average risk weights are hypothetical. A 'low-risk' bank represents a bank with less risky portfolios.
Source: Copenhagen Economics

1.3.2 No evidence that Swedish risk weights are currently underestimated

The Swedish banking sector is a good case of how we see that the Final Basel III Framework misses the target in terms of improving the alignment between capital requirements and underlying risks, even though this was the main purpose of the package as laid out in the G20 mandate.[18]

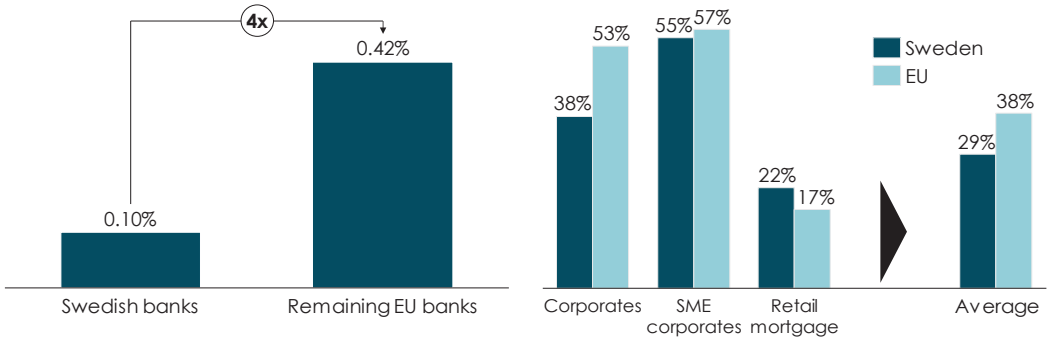
First, Swedish banks generally incur lower credit losses and thus are exposed to less risk compared to their European peers: average impairments for Swedish banks are around ¼ of the remaining European banks in the sample, cf. Figure 6. In this context, note that Swedish banks already hold considerably more capital than their European peers. With a CET1 ratio of around 17.2%, Swedish banks exceed the average CET1 ratio in the EU by around 3 percentage points (end 2017). With unrestricted risk weights (disregarding risk weight floors) the difference to the EU average is around 7 percentage points.

[18] See BIS(2014) and the Communiqué of the G20 Finance Ministers and Central Bank Governors Meeting on 17-18 March 2017, available at http://www.g20.utoronto.ca/2017/170318-finance-en.pdf.

Figure 6
Swedish banks' credit losses and risk weights

Average credit losses in the period 2007-2017
Impairments in % of financial assets

Average risk weights
REA in % of exposure values



Note: Impairments are averaged over the period 2007-2017 and expressed in percentage of financial assets, averaged over the same period. Note that the mortgage floor in Sweden implies a minimum risk weight of 25% on Swedish mortgages. Since we simulate the conversion of the mortgage floor to Pillar 1 requirements, this mortgage floor is included in the risk weights presented above. The risk weight is not exactly 25% because the mortgage floor only applies to Swedish mortgages.
Source: SNL database, EBA transparency exercise and own calculations.

In addition, empirical research on the prediction of internal models does not suggest that they should be biased towards lower capital requirements.[19] There is some variability in internal models, although the majority of the variation in capital requirements is explained by fundamental factors (estimates suggest around 15%-20% of variability in capital ratios are due to model variability). But the variability is not biased towards lower capital requirements. In fact, a paper by the EBA finds that banks are somewhat conservative with assumptions in their internal models. This means that affecting low-risk corporate portfolios in particular does not lead to a better alignment between underlying risks and capital requirements; low-risk portfolios would on average obtain too high capital requirements compared to what fundamentals would entail, cf. Box 2.

This also means that the work on improving internal models, such as the TRIM exercise by ECB, would not lead to increasing capital requirements like the Final Basel III Framework does; for some banks, capital requirements will *increase* – but for others, they will *decrease*. This is backed up by a paper by IMF that finds: "*it is possible to harmonise risk weights without significant impact on bank capital*".[20]

[19] Note that while country-specific results are not disclosed in these studies, the major Swedish banks are part of the sample of institutions that submitted data in all of the studies.

[20] IMF (2017)

Box 2 Technical studies on variability of internal models

As mentioned, the background for the framework is an identified variability in predictions of internal models. For example, a paper by BIS from 2013 found that:

- For wholesale exposures, unwarranted variation can explain around 15-20% of variations in capital ratios. This means that the remaining 80-85% are explained by fundamentals.
- The variation due to model variability goes in both directions, i.e., is not biased towards lower capital requirements.

A more recent study by the EBA, analysing mortgage, SME and corporate portfolios – the so-called high-default portfolios – largely confirms this:

- 82% of the variability can be explained by observable factors, such as default status, country of the counterparty and portfolio mix, etc. The remaining 18% is either due to variability in credit risk within each portfolio or because of variability of the internal models.
- Model variability is not biased towards lower capital requirements. In fact: "*estimated values for PDs and LGDs are, in general, higher than the observed default rates and loss rates, which suggests that banks are, on average, conservative*"
- Expressing capital ratios based on observed default rates (rather than PD estimates) would only have a minor impact, i.e., the internal model-based capital adequacy ratios seem in line with observed default rates.

A paper by BIS from 2016 also finds that model variation does not lead to capital ratios being biased:

- Estimates of PDs for retail and SME exposures are closely aligned with actual outcomes and tend to be higher than the actual long-run default rates for about two thirds of banks in the sample.
- Average LGD and EAD estimates are generally higher than the average actual loss rate and defaulted exposure outcomes.

Finally, a paper from IMF from 2017 finds "*that it is possible to harmonise risk weights without significant impact on bank capital*", "*is also in line with the ECB's most recent TRIM program*".

Source: BCBS (2013): Analysis of risk-weighted assets for credit risk in the banking book, *EBA (2017): Results from the 2016 High Default Portfolios (HDP) Exercise, BCBS (2016):* Analysis of risk-weighted assets for credit risk in the banking book and IMF (2017): Heterogeneity of Bank Risk Weights in the EU.

CHAPTER 2

IMPACT ON SWEDISH BANK CUSTOMERS

In this chapter, we turn our analysis to the real economy, analysing how the customers of the Swedish banking sector are likely to be affected.

First, we will analyse how the higher capital requirements increase the cost of banking and how this is passed on to customers (section 2.1). We will outline our estimates for the specific impact on lending rates for Swedish banking customers (section 2.2). Finally, we briefly discuss how the higher lending rates could increasingly make customers seek funding outside the regulated banking system (section 2.3).

2.1 FINANCIAL REGULATION IMPACTS THE COSTS OF BANK PRODUCTS

Fundamentally, a bank has two sources of funding: equity and debt. As mentioned, there are many different initiatives in the Final Basel III Framework. Nevertheless, most of the measures lead to the same end result: higher capital requirements. This entails that banks are required to increase the share of equity funding, and, consequently, they will have a lower share of debt funding.

The higher required share of equity will increase the cost of capital for banks, as equity funding is significantly more expensive than debt funding. The main reason being that equity is subordinated to debt in case of default – i.e., there are higher entailed risks from holding equity, giving rise to a higher required return. In addition, bank debt is used by households and businesses as a medium to store value; temporary surplus liquidity is usually stored in deposits, whereas more long-term savings can be stored as fixed-term deposits or bonds. This makes bank debt an attractive asset for investors, whereas bank equity does not have these properties.[21]

Concretely, we assume a cost of equity (after taxes) of 10%, based on several studies on the cost of equity for European banks.[22] In comparison, the average debt finance costs for Swedish banks is currently around 0.6%.[23]

2.1.1 Higher costs are passed on to customers

The higher costs will be passed on to customers. Investors demand a certain return on their invested equity which corresponds to the risk they are running by investing in banks. Thus, the investors – i.e., the owners of the banks – cannot be expected to accept permanently lower earnings due to stronger financial regulation but will pass these costs on to customers. This is widely accepted in the related literature, e.g., BIS, IMF, ECB and Bank of England.[24]

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21 This is also one of the reasons why Modigliani-Miller does not hold for banks, as we discuss below.

22 Corresponding to a before-tax cost of equity of around 13%. BIS (2010) uses a cost of equity of around 15%.

23 The debt funding rate is calculated on a bank level using SNL data on bank interest expenditure and total financial liabilities, based on the sample of banks in our balance sheet model. ECB finds the average funding cost for the banks under their supervision to be 1.7%. The debt funding rate for the Swedish banks in our sample is around 0.6% on average.

24 See, for instance, BIS (2010), Miles et al. (2011), The Riksbank (2011), IMF (2016a), ECB (2016) and Bank of England (2016b).

It should be noted that this is a long-term or structural consideration. In this study, we primarily consider long-term effects as The Final Basel III Framework is a permanent regulation, intended to be in effect for many years. In the short-to-medium term, the competitive dynamics on the banking market could affect how banks adjust to the changing costs, and typically imply a lower pass-through of costs.

2.1.2 Higher capital requirements could to some extent lower the cost of equity

In this study, we assume that increases in capital requirements will, to some extent, lead to a reduction in the costs of equity for banks; the risk an investor is running from investing in a bank is reduced when capital requirements increase, as the risk of default decreases. This is the so-called Modigliani-Miller effect. All other things being equal, this would imply that overall funding costs of banks are not affected by the funding mix. However, in reality, corporate taxation, implicit and explicit guarantees for deposits, the high liquidity of bank debt and a number of frictions on the financial markets all imply that the Modigliani-Miller theorem only holds true in part. In the appendix, we discuss Modigliani-Miller in banking in more detail.

Nevertheless, as we will show in chapter 3, the current capitalisation of the Swedish banking sector has reached a level where there is little gain in terms of reducing the risk of a default from further increasing capitalisation. We therefore assume a modest decline in the equity cost rate of 0.15 percentage points for each percentage point increase in equity over total assets.

2.2 THE IMPACT ON BUSINESS CUSTOMERS

Banks allocate their costs of banking to customers through complex cost-allocation models. Exactly how this takes place depends on several factors, including which types of customers primarily drive the increase in capital requirements.

In this study, we use our banking balance sheet model, containing the five largest Swedish banks plus Nordea, covering around 80% of the Swedish banking market, cf. appendix for methodology. The model mimics the cost-allocation procedures of Swedish banks and can thus be used to simulate how costs of the framework will be allocated to different customer groups. It should be noted that the estimation focuses on Swedish *banks*, including any cross-border exposures they have.

In total, we estimate that higher capitalisation will increase annual capital costs for Swedish banks by around SEK 25-30 bn, which will be passed on to customers in terms of higher interest rates and fees.[25] This relates to both typical lending activities to private customers, as well as other activities that banks are involved in, such as financial market operations, equity holding and sovereign exposures, cf. Table 1. The cost is equivalent to a price increase of around 7% – corresponding to some 0.6% of Swedish GDP.

[25] Assuming a return rate on equity of 13% and a Swedish average debt-funding cost of 0.6%. We assume that the percentage-point increase in funding costs will lead to an equivalent percentage-point increase in interest rates. Moreover, this estimation assumes that the remaining Swedish banks face the same price increase as the banks that are part of our sample. Total capital costs for only the banks in our sample increase by around SEK 20-25 bn.

Table 1
Total increase in costs for customers of Swedish banks (main estimate)
SEK bn.

CORPORATES	SME	RETAIL MORTGAGE	OTHER PORTFOLIOS AND SERVICES	**EU TOTAL**
19	4	-2	8	**30**

Note: The numbers are based on our banking balance sheet model which covers around 80% of the Swedish credit market. We assume that the rest of the banking sector follows the price increase of the banks in our model. The small cost decrease on the retail mortgage portfolio results from the inclusion of the risk weight floor for Swedish mortgages of 25%. The impact on capital costs for banks related to other exposure classes, such as lending to banks, sovereigns, equity exposures as well as costs related to the revised rules for operational risk, market risk and credit valuation adjustment (CVA) risk, are pooled within the group of other portfolios and services.
Source: Copenhagen Economics based on data from EBA transparency exercise and SNL.

As mentioned above, we expect the package to have little effect on the retail mortgage market, due to the Swedish risk-weight floors on mortgages.

However, business customers will be significantly affected by the package and every year incur higher interest expenditures of some SEK 23 bn in total. The impact on business customers (corporates and SMEs) corresponds to a permanent increase in the effective lending rate of 0.4 percentage points.[26] With an average interest rate for businesses of around 1.3%, this corresponds to a price increase of 29%.

Of businesses, corporate clients will be most affected, with a price increase of 0.53 percentage points – this corresponds to an increase in lending rates of around 46%. SMEs will have interest rates increased by 0.15 percentage points, corresponding to a price increase of 10%, cf. Figure 7.[27]

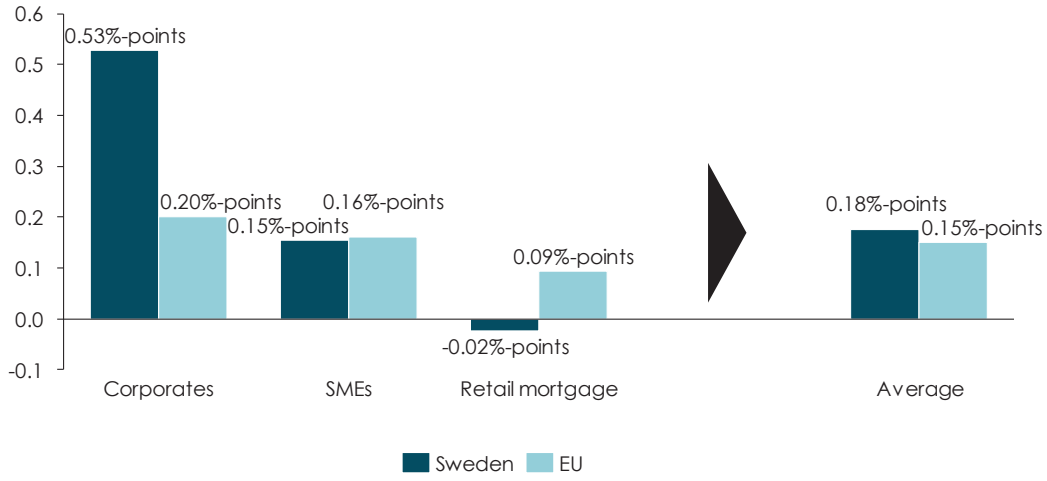
Within each customer segment, we expect that it will be the most solvent and low-risk companies that will experience the largest increase in interest rates. The reason being that the most solvent companies will have lower risk weights, being more susceptible to limitations of the risk sensitivity. In contrast, highly leveraged companies with large inherent risks can expect to see a much smaller impact.

We base our estimation on somewhat conservative assumptions, for example:

- We assume that the interest rate is only increasing as a result of an increase in cost of capital for that particular asset.[28] It could be the case that higher costs from other activities not related to private customers, e.g., interbank lending or sovereign exposures, would be passed on to the lending portfolios considered.
- We only consider increases in core equity (CET1), and do not include other equity instruments banks would need to increase to comply with the total capital requirements.
- Finally, we do not include increases in debt funding costs via the MREL/TLAC requirement.

[26] The term 'effective interest rates' is used here to indicate that this increase in the cost of credit could include increases in fees instead of the lending rate for the portfolios considered.
[27] The calculation of the relative increase in interest rates is based on average SME lending rates and lending rates for large firms in Sweden, taken from the OECD Scoreboard on SME and entrepreneurship finance database. The average lending rate for large firms in Sweden is around 1.1%, for SMEs it is around 1.5%.
[28] Although, costs related to operational risks are distributed equally across all assets.

Figure 7
Impact on business lending rates
Percentage point change



Note: In an alternative scenario we assume a debt funding rate of 4% for all countries. This reduces the impact on additional costs due to increased capitalisation in Sweden to around 0.12pp on average (0.38pp, 0.11pp and -0.02pp for lending to corporates, SMEs and retail mortgage lending, respectively).
Source: Own calculations, EBA transparency exercise and data input from the three largest Swedish banks and Nordea.

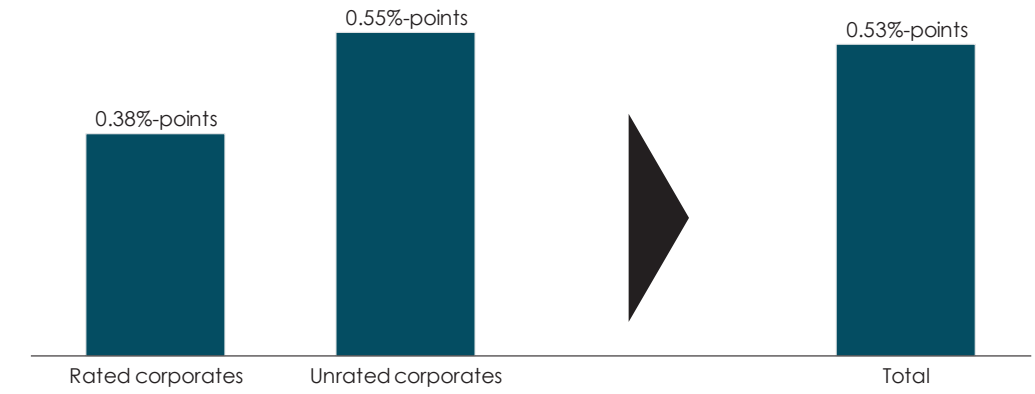
Note that the increase in borrowing costs outlined above is permanent and will endure across business cycles. Thus, the impact is not comparable to ordinary interest rate hikes but should rather be interpreted as a permanent wedge in capital allocation between lender and borrower.

Below, we take a closer look at the impact on different business customer groups.

Corporate

As explained above, we estimate that corporate customers will be most affected by the package, bearing around two-thirds of the total costs. The impact is primarily driven by higher capital requirements to unrated corporates, whereas rated corporates are less affected, cf. Figure 8.

Figure 8
Impact on lending rates for corporates
Percentage point change



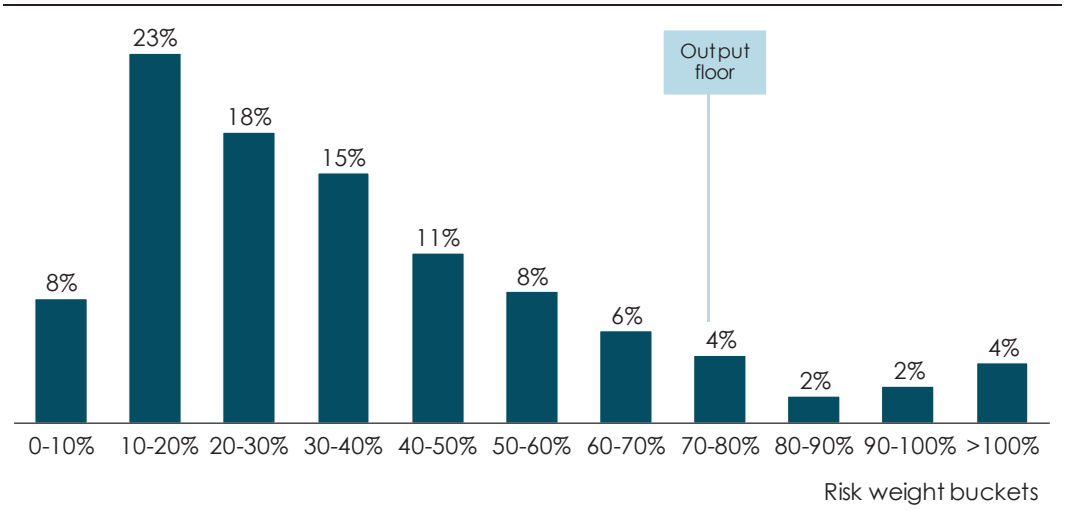
Source: Own calculations, EBA transparency exercise and data input from the three largest Swedish banks and Nordea.

From a regulatory perspective, a distinction is made between lending to *rated* corporates, i.e., companies that have requested an external assessment by a credit-rating agency, and lending to *unrated* corporates, which have not obtained such a rating.

The way the Final Basel III reform is designed means that particularly unrated corporates will be affected. The technical explanation is as follows: under the output floor, exposure to unrated corporates obtains a flat risk weight of 72.5%, irrespective of the risk level of the exposure. This is much higher than the typical risk weight of an unrated corporate (cf. Figure 9), implying a large increase in capital requirements. The impact is smaller for rated corporates, as standardised risk weights are partly risk sensitive and depend on the credit rating of the company.

Within the unrated corporate segment, there is large divergence in impact. For example, around 30% of exposures to unrated corporates are assigned risk weights below 20%, cf. Figure 9. Such corporates are often very large, with low leverage and no history of default. Since a binding output floor would entail a risk weight of 72.5% for unrated corporate exposures, it would imply risk weights that are between around 3-5 times larger for such low-risk corporates. This would lead to a corresponding increase in capital requirements, cf. Box 3.

Figure 9
Distribution of risk weights for unrated corporate exposure
% of lending volume



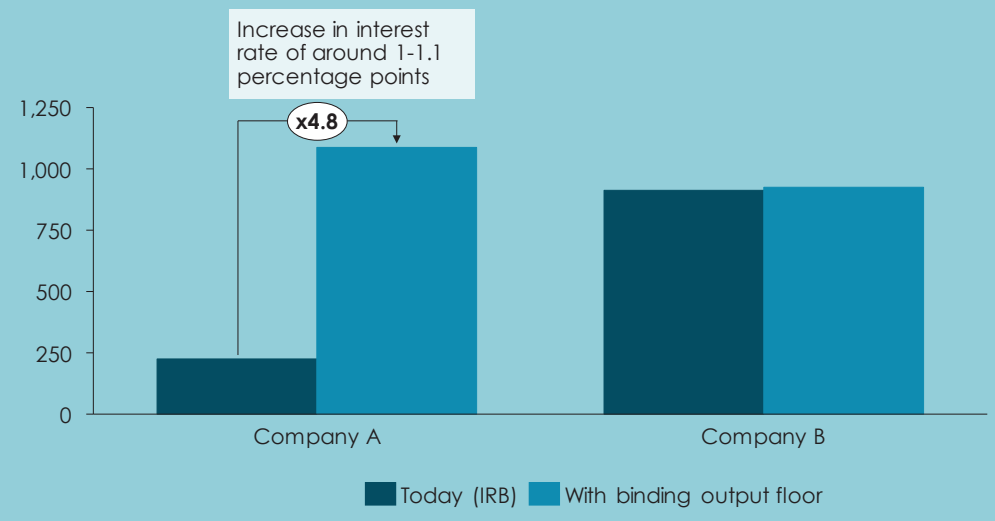
Source: Data from the three largest Swedish banks and Nordea.

Box 3 Two cases of impact on unrated businesses

To illustrate the disproportionate impact of the package, we have constructed a case of two Swedish unrated companies. One large corporate with very good performance over the past decades and a corresponding low risk of default (company A), and a recent start-up company (SME) with a riskier business model and uncertain economic outlook (company B). According to banks' internal models, these companies would be assigned different risk weights because of different probabilities of default. The rather safe exposure to company A might obtain a risk weight of around 15%, whereas company B is a considerably riskier counterparty with, say, a risk weight of 80%.

If the respective bank was restricted by the output floor, the risk weight for exposure to company A would, viewed in isolation, increase to 72.5%. This implies an almost fivefold increase in capital requirements for exposures to company A and would lead to an increase in the interest rate of around 1-1.1 percentage points. In contrast, exposure to company B would not be significantly affected by the output floor and neither would the interest rate company B is facing change due to the output floor, cf. the figure below.

Capital requirements associated with a loan of SEK 10 million
Thousand SEK



Note: In this illustrative example, we assume a capital ratio of 15% along with a loan of SEK 10 million to each of the respective companies. For completeness, the SME supporting factor of 0.7619 is included in the calculation for company B (SME). This explains the small difference in capital requirements for company B, since we assume that the SME supporting factor is abolished with the introduction of the revisions to the Basel III Framework. The other assumptions are as stated in the text in Box 3.

Source: Own calculations, EBA transparency exercise and data input from the three largest Swedish banks and Nordea.

The impact on unrated corporates is significant in Sweden, as company ratings are rather uncommon with only around 11% of exposure to corporates being rated. Most corporates rely on banks to finance their business. This means that credit ratings are not necessary, as banks carry out the credit assessment themselves. In contrast, ratings for companies are much more

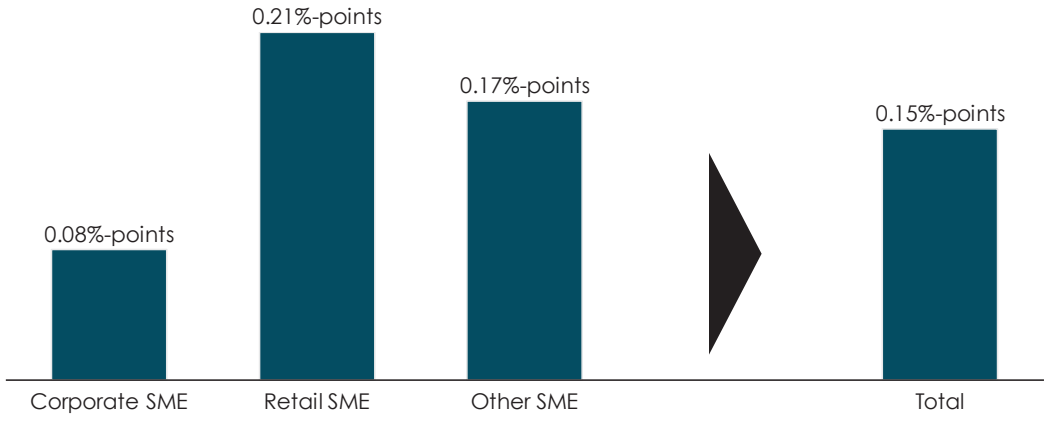
frequent in the US, where businesses to a larger extent finance themselves on the capital markets. The credit assessment that banks usually carry out before lending funds is thus substituted by the assessment through a rating agency.

SME

We have also examined the impact on three different types of SME exposure; exposure to so-called corporate SMEs, retail SMEs and a residual SME category.

Corporate SMEs are defined as businesses with an annual turnover of less than EUR 50 million, but which are not considered as retail exposure. Lending to SMEs qualifies as retail exposure if, among other things, the total amount owed by the company does not exceed EUR 1 million.[29] It therefore typically covers exposure to smaller companies, which need a smaller amount of funds. The category 'other SME' includes SME lending secured by real estate as well as exposure to Swedish real estate entities such as housing cooperatives (so-called *Bostadsrättsföreningar*) or housing companies that invest in residential real estate.[30]

Figure 10
Impact on lending rates for SMEs
Percentage point change



Note: The 'other SME' class includes SME lending related to mortgages as well as lending to real estate entities such as *Bostadsrättsföreningar* and lending for the construction of rental properties (*Hyresfastigheter*).
Source: Own calculations, EBA transparency exercise and data input from the three largest Swedish banks and Nordea.

The increase in lending rates for SMEs in Sweden is considerably smaller than the impact for corporates, cf. Figure 10.[31] This is mainly due to two reasons: first, corporate SMEs and retail SMEs obtain preferential standardised risk weights of 85% and 75%, respectively, in the framework. This means that the impact of the output floor is reduced compared to the impact on corporates, where the standardised risk weight is 100%. Second, the Swedish banks in our sample already have higher risk weights for SME corporate (55%) and SME retail (42%) exposures compared to the risk weights for corporates. While banks currently have very low risk weights on SME exposure secured by real

29 Cf. Capital Requirements Regulation, Article 147.
30 We used data from the three largest Swedish banks and Nordea together with the data from EBA's transparency exercise to group exposures within the respective classes.
31 For the estimation of the impact on interest rates for the different SME exposure classes, we complement our balance sheet model with data on the risk weights after the Final Basel III package from the three largest Swedish banks and Nordea.

estate, the new standardised risk weights are more granular and depend on the loan-to-value ratio, which implies a smaller impact from the reform in Sweden for these exposure classes.[32]

2.3 MOVE OF CREDIT INTERMEDIATION AWAY FROM BANKS

The large impact of the Final Basel III Framework on corporate lending rates could provide a strong incentive to bypass the traditional banking system and seek finance elsewhere, especially for unrated corporates that often are quite low-risk exposures.

Consequently, these low-risk businesses might shift to other sources of funding, such as financing themselves on the capital markets. SMEs and other smaller unrated corporates, on the other hand, cannot obtain cheaper funds elsewhere and would therefore keep funding themselves through banks. The resulting riskier corporate and SME portfolio that the banks hold means higher overall risk on the bank's balance sheet, which – viewed in isolation – implies negative ramifications for financial stability.

There is also a risk that credit will flow to less-regulated institutions, often referred to as shadow banking.[33] This could include (but is not limited to): credit hedge funds, limited-purpose finance companies and the rapidly growing FinTech industry.

Shadow banking appears to have been growing in the light of the previous tightening of the financial regulation. According to the European Systemic Risk Board's 'Shadow banking monitor', shadow banking, broadly measured, expanded by around 75% in the eurozone between 2010 and 2017.[34] While the shadow banking sector in Sweden is still relatively small compared to other EU countries, shadow banking has also been increasing in Sweden.[35]

The migration of activities to shadow banking could result in the build-up of new systemic risks since 1) a smaller part of the credit flow would be under supervision, and 2) the credit flow and interdependencies in the financial sector would be less transparent to market participants and supervisors.

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32 Note that the relative impact on lending to *Bostadsrättsföreningar*, in turn, is very large and implies a more than doubling of the risk weights. However, since the current risk weight for this exposure class is very low (around 6%), the absolute impact in percentage points is rather small.

33 See Plantin (2014): Shadow Banking and Bank Capital Regulation.

34 https://www.esrb.europa.eu/pub/pdf/reports/esrb.report180910_shadow_banking.en.pdf.

35 See Hansson et al. (2014): Shadow Banking from a Swedish Perspective.

CHAPTER 3

NET-ECONOMIC IMPACT ON SOCIETY

In the previous chapter, we analysed how the Final Basel III Framework could impact the banking sector and estimated the resulting impact on banking customers. In this chapter, we widen the scope and present a general societal cost-benefit analysis of the framework.

Optimal capitalisation in banking is a topic that has been extensively researched over the past years, especially in preparation for the regulatory overhaul of the financial sector needed in light of the global financial crisis. The cost-benefit analysis in this chapter is based on the framework established in this research – in particular BIS (2010), also called the LEI study[36], which provided the analytical foundation for the original Basel III Framework.

In this chapter, we will first analyse the real-economy costs of the Final Basel III Framework (section 3.1). We will then analyse the benefits (section 3.2), which we will bring together in a coherent societal cost-benefit analysis (section 3.3). Finally, we will discuss what the package could entail for green lending (section 3.4).

3.1 REAL-ECONOMY COSTS

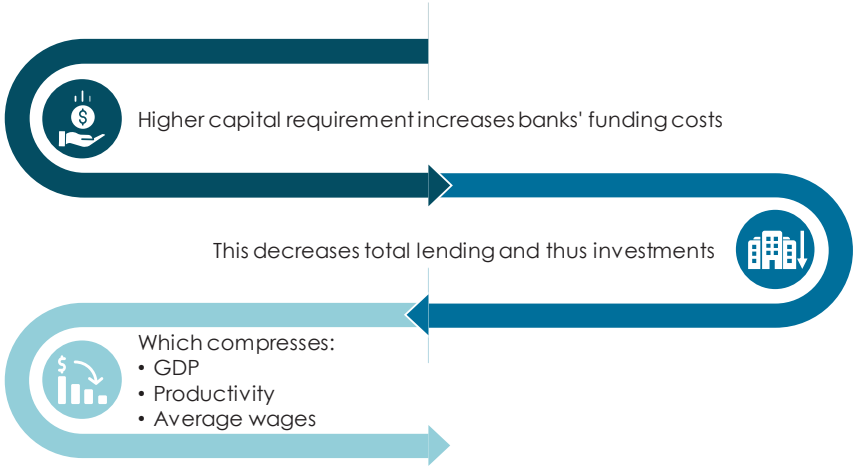
To estimate the costs, we implement the increase in capital requirements resulting from the EBA's preferred implementation (estimated in chapter 1) in a structural macroeconomic model of the European economy (a so-called DSGE model). The model has been calibrated to Swedish macro-economic and financial data, allowing us to estimate the impact on investments and GDP.[37]

The causality of the real-economy impact goes as follows: higher capital requirements increase the funding costs of Swedish banks (as equity is a more expensive source of funding than debt). The higher capital costs are passed on to customers through higher interest rates, which reduces credit demand. This curbs investment activity, causing a decline in overall productivity that eventually contracts GDP.

36 Named after the working group in BIS, called Long-Term Economic Impact.

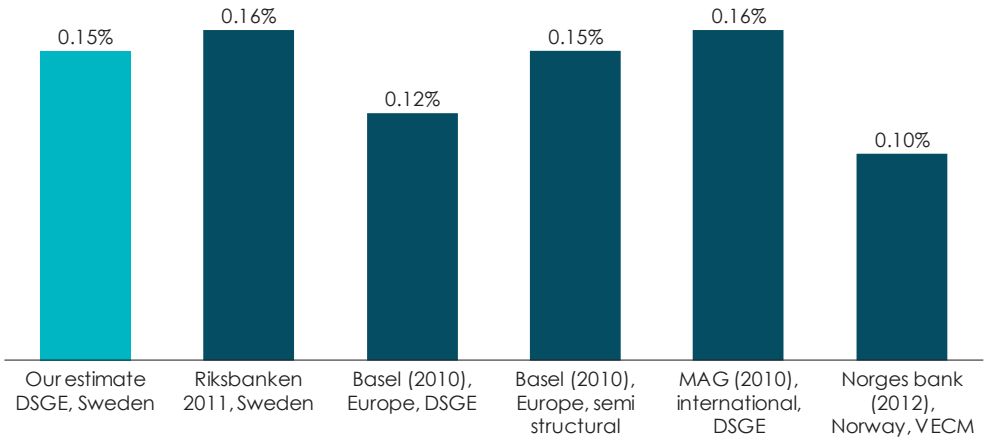
37 The model was originally developed by Meh Moran (2010). See Copenhagen Economics (2016) for a description of the model for the Swedish economy.

Figure 11
How the Final Basel III Framework impacts the real economy



Concretely, we estimate that structural GDP declines around 0.15% for every percentage point increase in the CET1 ratio. The result is in line with previous research on the topic, cf. Figure 12. This is unsurprising, as we use the same general model framework to estimate the impact, cf. appendix.

Figure 12
Decline in GDP of higher capital requirements
Decline in long-run GDP from a one-percentage-point increase in CET1 ratio



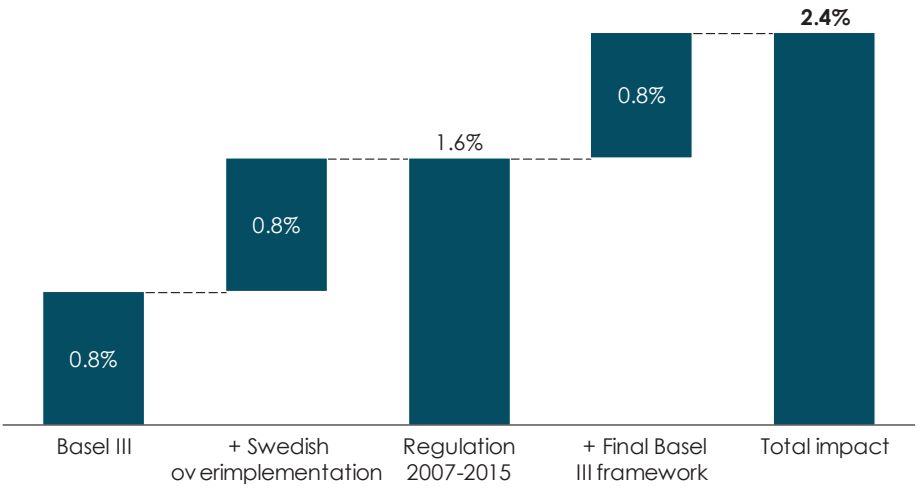
Source: Own calculation based on referenced papers.

Assuming capital requirements will increase by around 31% as described in chapter 1, we estimate that the GDP level in Sweden will permanently decline by around 0.8%, corresponding to around SEK 40 bn (2017-level). In other words, the GDP level will, every year, be 0.8% lower than it otherwise would have been.

Note that the costs to society related to the implementation of the Final Basel III Framework in Sweden add to costs incurred by previous financial regulation. In a report from 2016, we estimated the costs of the implementation of the original Basel III package in Sweden at around 1.6% of long-

run GDP. The implementation of the Final Basel III reform would add to that, implying a total (gross) cost of post-financial crisis regulation of around 2.4%, cf. Figure 13.[38]

Figure 13
Cumulative costs of entire Basel III implementation
% of long-run GDP



Note: The cost impact of financial regulation in Sweden between 2007 and 2015 is based on data from 2016 and taken from a previous report prepared for the Swedish Bankers' Association (Copenhagen Economics (2016) – *Cumulative impact of financial regulation in Sweden*).
Source: Copenhagen Economics (2016a) and own estimation.

3.1.1 Impact on investments

We estimate that the decline in GDP will gradually appear the ten years following initial implementation. In this transition period, the higher interest rates will give rise to subdued investments (which eventually will result in the lower structural GDP). Concretely, we estimate that, every year, investments will be some SEK 30 bn lower, corresponding to a decline of around 2.7%. Accumulated over the ten-year period, the Swedish economy sees a reduction in investments of around SEK 300 bn.

3.1.2 Uncertainty of estimates

It should be noted that these types of calculations entail significant uncertainty due to several factors. One uncertainty factor often discussed in the relevant literature is how the real-world capital requirements feed into the simplified model framework.

[38] See Copenhagen Economics (2016a) for details of the estimation of the cost of financial regulation in Sweden between 2007 and 2015.

Another debated question is whether a higher level of equity will reduce the required return on equity and debt (especially the riskiest parts of debt funding). In other words, if banks are more well-capitalised, then the expected loss by investing in the bank should fall and hence also the required rate of return (the so-called Modigliani-Miller effect). However, it is by no means obvious that banks that are already well-capitalised, as is the case for the banks with the largest capital shortfalls, will in reality be able to get lower funding costs in the different funding classes. In this respect, we also note that some large international studies of the real-economy impact of capital requirements, e.g. BIS (2010)[39], did not include the Modigliani-Miller effect. We discuss this in more detail in appendix B.

In our estimation, we have built some of these uncertainty elements into our calculation, reducing our GDP impact by some 20%.

How do banks accommodate the increase in capital requirements?

How banks accommodate the increase in capital requirements is also not clear-cut. Recall from chapter 1 that the reduction in total credit as a result of the Final Basel III Framework would be:

- SEK 2,300 bn: if banks do not increase capitalisation at all.
- Zero: if banks fully increase capital corresponding to the increase in capital requirements.

In our model, we do expect a reduction in total assets, following a decline in demand as a result of the higher interest rates. The deleveraging is hereby not an active choice by the banks, but a result of lower credit demand. As such, the estimates in our model framework lie somewhere between the two extremes.

Short-term impact could be higher

In the short-to-medium term, it could be that banks prefer partly to solve their capital shortfall by directly cutting back on credit rather than just passing on the higher cost of capital. One reason for this being that the capital shortfall would be so massive for the involved banks that they risk facing unfavourable funding conditions in a longer-term perspective.

Such a cut-back in credit would entail stronger short- to medium-term effects on the real economy, including a decline in employment, as it would subdue economy-wide demand. There is some evidence for this being a likely scenario:

- The Macroeconomic Assessment Group estimates that the negative short- to medium-term effects are, at their greatest, around 50% greater than the permanent effects (derived as an average of several models).
- The Riksbank (2014) finds that the negative effects reach their maximum after eight years (with a phase-in period of four years).

3.2 REAL-ECONOMY BENEFITS

Having established the costs, we now turn our attention to the benefits. First, we establish a theoretical basis for why banks need to be regulated. We then estimate the benefits of the Final Basel III Framework using a model framework developed in BIS (2010).

3.2.1 Why are banks regulated?

Banks have an important role in the economy. They act as financial intermediaries, allocating credit so it yields the highest return for investors and society. A well-functioning bank sector is therefore

[39] BIS (2010): *An assessment of the long-term economic impact of stronger capital and liquidity requirements*.

crucial to ensuring a sufficient flow of investments and for economic growth in general. On the other hand, bank failures can result in a credit crunch with severe consequences for the overall economic activity, as amply illustrated by the financial crisis. In addition, this could lead to a taxpayer-financed bailout in order to restore credit transmission.

As any other company, banks have a self-interest in being sufficiently capitalised to avoid default. Nevertheless, there are several so-called economic imperfections on the banking market entailing that market-determined capital and liquidity buffers may be too low from a socio-economic point of view: When deciding on the level of capitalisation, owners of the bank only consider their private costs in the case of bank failure and not the total cost imposed on society. Because of banks' crucial role in society, the societal costs of bank failure are likely to be higher than the private costs to bank owners. Consequently, banks may have capital levels that are below the optimal level for society, which creates a scope for the regulation of banks, cf. also Box 4.

Box 4 Moral hazard in banking

Moral hazard arguments also call for regulation that ensures a minimum level of capital. There is generally imperfect (or asymmetric) information on the capital markets, implying that market participants cannot perfectly monitor the riskiness of bank portfolios. When there are low equity levels (i.e., low capitalisation), equity holders have little 'skin in the game' and may consequently try to influence management to increase the risks of the bank's portfolio in order to increase the upside of their equity. Higher capital requirements can reduce this moral hazard issue. It will increase the potential loss for equity owners in the event of a bank failure. As a result, they will be less likely to try to increase the risk of the portfolio. This factor is compounded by government insurance of depositors, since their required return will not increase as the probability of default increases. This gives banks a further incentive to increase their leverage.

Source: See Meh and Moran (2010) or Myers and Majluf (1984).

3.2.2 Declining benefits of bank regulation

As outlined above, there are clear benefits of certain minimum levels for capital ratios. The benefits are nevertheless declining – and beyond a certain point, the positive effects are very small: with higher capital levels, it will take an increasingly strong economic setback to disrupt financial stability, and beyond a certain point, the risk of a banking crisis – as a result of too low capital ratios – becomes so small that the benefits are negligible.

Concretely, the BIS (2010) finds that the additional benefit for advanced economies of increasing capital ratios[40] above 15%, in terms of reducing the risk of a crisis, is small. Similarly, the IMF estimates that 85% of all banking crises in OECD countries since 1970 could have been avoided with total capital ratios of 15%. They find that, "*the marginal benefit of additional capital declines rapidly after that*" as further capital increases only have marginal effects on preventing crises.[41] It should be mentioned that the estimates are subject to uncertainty. The assumptions behind the estimation are laid out in appendix B.

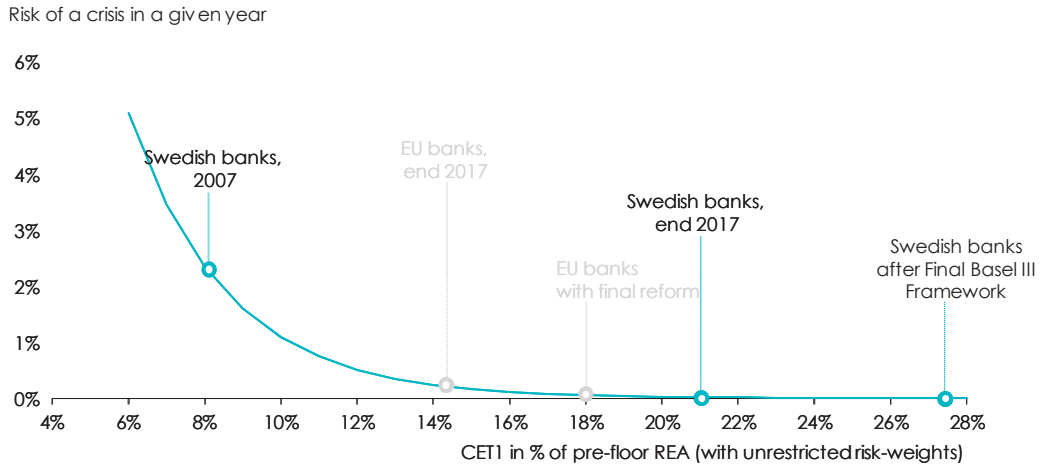
[40] Measured as CET1 / Total REA.

[41] See IMF (2016): Benefits and Costs of Bank Capital p. 15.

3.2.3 Currently limited marginal benefits of increasing capitalisation

Since the financial crisis, the Swedish banking sector has moved from a situation where there were still clear benefits of higher capitalisation to a situation today, where the effect of further increasing the capital requirements are quite small, cf. Figure 14. This means that the gross benefits of the increasing capitalisation in general are limited.

Figure 14
Estimated risk of a crisis as a result of too low capitalisation



Note: 'Swedish banks after The Final Basel III Framework' is measured in % of original REA. Note that the CET1 ratios as depicted here are expressed in % of REA based on unrestricted risk weights, which means that the mortgage floor is not part of REA. The graph is an extrapolation of the estimates from BIS (2010), assuming an exponential form. The original estimates are reported in Tangible Core Equity divided by risk-weighted assets (RWA), which are converted to a CET1 ratio with a conversion factor of CET1=0.92•TCE.
Source: BIS (2010), page 15 and own calculations.

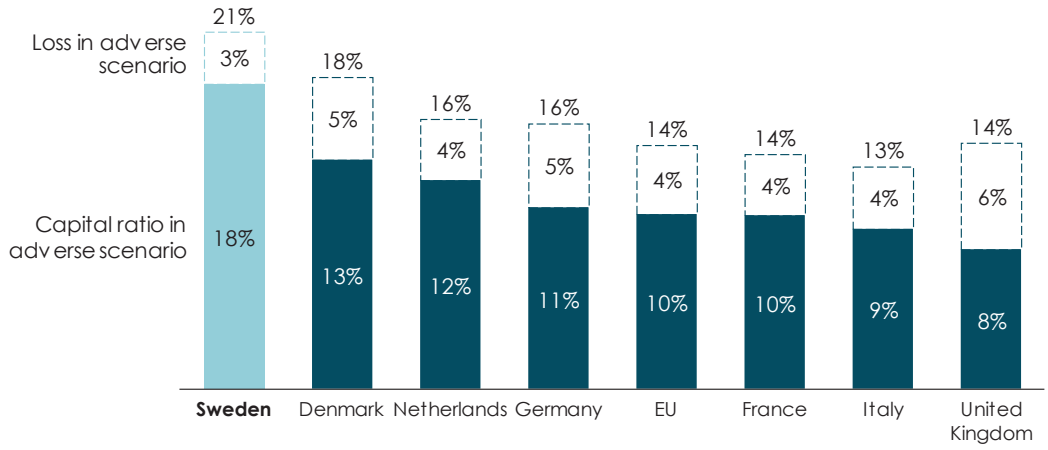
Note that in Figure 14 we are presenting the result as a share of REA with the original risk weights, i.e., 'pre-floor' REA[42], because the original studies referenced are analysing the topic using a REA that is risk-based, i.e., not floored by measures in the Final Basel III Framework. In other words, from an economic perspective, it does not matter whether the capitalisation is increased by increasing the risk weights or by increasing the capital ratio – the economic impact is the same.

The reduction in the risk of a crisis, as displayed in Figure 14, can be transformed to a benefit in percentage of GDP, based on assumptions on the GDP costs of a crisis, cf. appendix. Using the model framework from BIS (2010), we estimate that the gross benefit of the Final Basel III Framework corresponds to a permanent increase of 0.05% in the GDP level. In other words, the reduced risk of a crisis from the Final Basel III Framework corresponds to GDP being 0.05% higher every year.

The low gross benefit of further capitalisation is confirmed by the European stress test by EBA, showing that the Swedish banking sector would have a solid capitalisation after a severe economic recession, avoiding a government-sponsored bail-out, cf. Figure 15. Concretely, EBA estimates that the Swedish banking sector would still have a capital ratio of around 18% (without accounting for the transition of the risk weight floor to Pillar 1) – which is higher than the starting level for most countries.

[42] As defined in the EBA impact assessment p. 176.

Figure 15
Actual and estimated capital ratios before and after severe economic recessions: results from EBA stress test
CET1 ratio in % of risk exposure amount (not floored)

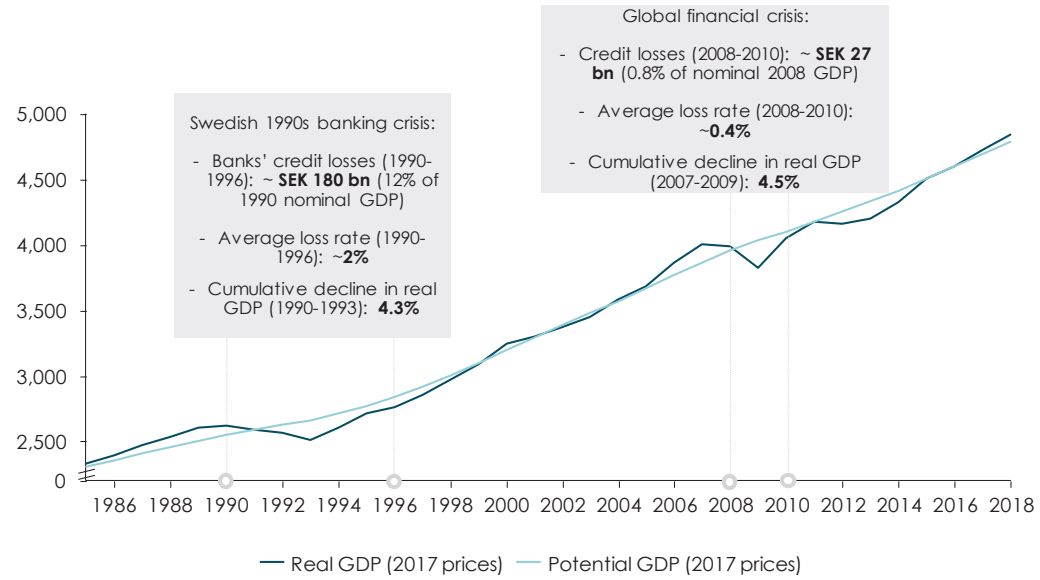


Source: EBA EU-wide stress testing 2018. Note that the CET1 ratio here does not account for the conversion of the mortgage floor to Pillar 1.

It should be noted that EBA's adverse scenario implies a very large decline in real GDP in Sweden of around 10% (accumulated over three years).[43] That is more than double the size of the accumulated fall in real GDP during either the Swedish banking crisis of the 1990s (around -4.3%) and the global financial crisis (around -4.5%), cf. Figure 16.[44] The adverse scenario in the stress test therefore seems to be extreme in Sweden compared with past crises. This suggests that the impact on bank capital in Sweden resulting from the EBA stress test could rather be an upper bound and might be lower in future crises more comparable to previous crises in terms of GDP impact.

43 See ESRB (2018) for a description of the adverse scenario used in EBA's 2018 stress test.
44 Based on real GDP data from the OECD's Economic Outlook database.

Figure 16
Development of real GDP during the recent banking crises
SEK billion



Note: The loss rate is expressed in % of lending to the public.
Source: Sveriges Riksbank, Financial Stability Report 2019:1, Barr and Pierrou (2015) and Copenhagen Economics, based on data from the OECD Economic Outlook dataset.

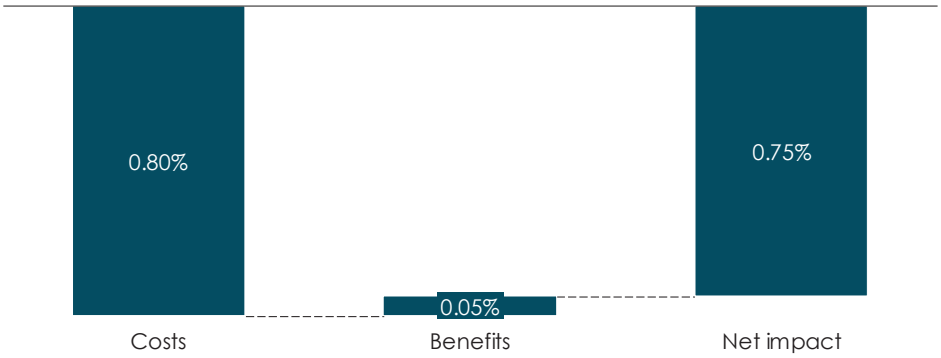
The above benefit estimation has not taken into account that the reduced risk sensitivity of capital requirements is likely to increase the risk appetite for banks. Using internally based risk weights, there is a clear incentive to reduce the risk within each asset class; if the risk of an asset increases, the average risk weight of that particular asset will also increase, and the bank is required to hold more (costly) capital. However, if there is a floor on the risk weight and it is binding, increased risk-taking will not lead to higher capital requirements. In this way, risk-taking will become 'cheaper' for banks with currently low-risk portfolios.

3.3 NET SOCIETAL IMPACT

As described, there are increasing costs and declining benefits of higher capital requirements. The task for policy makers is to balance these costs and benefits to provide a net benefit for society.

Considering the Final Basel III Framework, we find that the costs clearly outweigh the benefits. As described, we estimate the benefits to the Swedish economy to be equivalent to 0.05% of GDP, compared to the estimated GDP reduction of 0.8% of GDP. This leaves a net cost of 0.75% of GDP, cf. Figure 17.

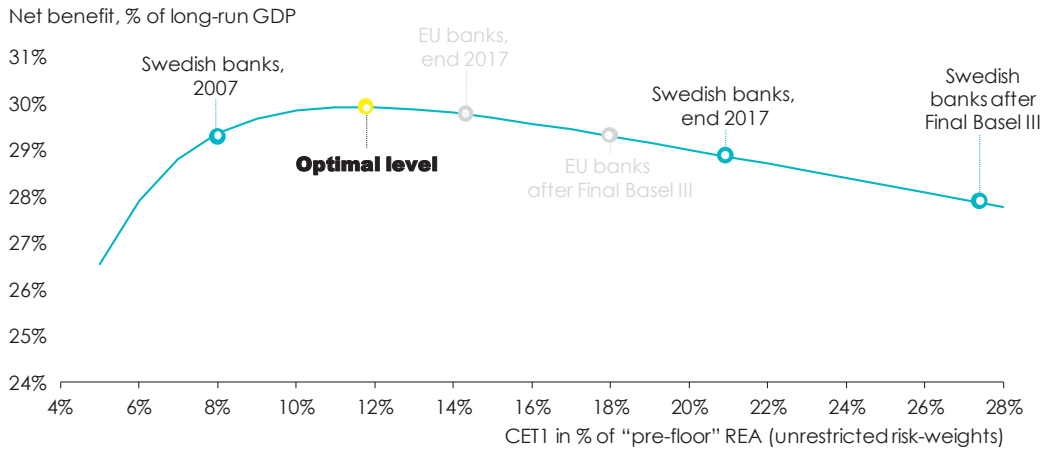
Figure 17
Costs and benefits from the Final Basel III Framework
% of long-run GDP



Source: Own estimations

In general, we find that the average capitalisation in Sweden of around 21% (end of 2017 data and unrestricted risk weights) is above the optimal level of capitalisation of 12-13%, cf. Figure 18. Thus, an additional increase in capitalisation does not bring net benefits to society.

Figure 18
Net real-economy benefits for different levels of capitalisation



Note: The CET1 ratios as depicted here are expressed in % of REA based on unrestricted risk weights, which means that the mortgage floor is not part of REA.
Source: Own calculations based on BIS (2010).

This is confirmed by a recent literature review on optimal capitalisation by BIS; Swedish banks' capital ratios are within or above all of the recent estimates on the optimal level of capital, except for one estimate for the US banking sector.[45] In particular, the CET1 ratio is in the upper part of the range of optimal capital ratios estimated in an updated study by the Swedish central bank.[46]

45 See BIS (2019b), Table 1 for an overview.
46 See The Riksbank (2017).

3.3.1 Macroeconomic assessment in the EBA study

As part of the impact assessment of the Final Basel III reforms, EBA has assessed the macroeconomic costs and benefits. Using several different approaches, EBA finds substantial macroeconomic net benefits from the package, implying that the current level of capitalisation of the European banking sector is too low from a societal perspective.

The findings of EBA is a divergence from the original LEI report[47], made in preparation for the first Basel III package, which finds an optimal capital ratio for European banks of around 13% of REA (with unrestricted risk weights).[48] The current capitalisation of the European banking sector is today above this level, and even more so for the Swedish banking sector. The estimate in the LEI report is based on a fairly transparent economic analysis of the correlation between banks capitalisation and the risk of a crisis, which we also base our benefit estimation on.

EBA's new study[49] suggests that an increase in capitalisation of around 24% provides clear net benefits to society. This new result raises questions – both in terms of methodology but also in terms of what this result implies for the overall direction for EU financial regulation. We will start with the latter.

As accepted in all major impact assessments from EBA, IMF and ECB, there are declining net benefits from increasing capitalisation of the banking sector, as depicted in Figure 18. Following EBA's new study, the possibility of achieving net benefit to society of higher capital requirements have clearly not been exhausted from the original Basel III package. This begs the question of what the optimal capitalisation for the European banking sector is, and whether further increases in capitalisation can provide extra net benefits.

EBA's assessment – that the package provides clear net benefits – is based on an EU-wide analysis. However, it is uncertain whether EBA assesses that the package provides clear net benefits within each EU country. For example, does the approx. 30% increase in capital requirements in Sweden provide clear net benefits to the Swedish society?

The Final Basel III Framework has a very heterogenous impact across countries, banks and portfolios. If we accept the premise that further increasing capitalisation has net benefits, there are many ways capitalisation of the European banks can be increased. We are for example quite sceptical that the more than 70% increase in capitalisation – and the resulting 0.55 percentage point average increase in lending rates – for Swedish unrated corporates provides net benefit.

The point is, when embarking on such a major reform of the regulatory system, with significant increase in capitalisation, policy makers have a responsibility to make sure not only that the package provides benefits on an average EU level, but also on a country and portfolio level. If not, alternative implementation models should be considered.

Turning to a methodological discussion, we fail to see the argument behind the major shift in net benefits from increasing capitalisation, compared to the original LEI report.

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47 See BCBS (2010): An assessment of the long-term economic impact of stronger capital and liquidity requirements.

48 See Table 8 in BCBS (2010): An assessment of the long-term economic impact of stronger capital and liquidity requirements. Measured as TCE/RWA, where CET1=0.92•TCE, meaning that the optimal CET1 ratio is around 12%.

49 EBA (2019b) - *Basel III reforms: Impact study and key recommendations – Macroeconomic assessment, credit valuation adjustment and market risk*.

First, note that the benefit of reducing the risk of a crisis with one percentage point is unchanged from the original report and is also the estimate we use in this report.

However, the estimated correlation between the risk of a crisis in a given year and capitalisation is significantly altered. Using estimates from the original LEI report, the capitalisation level of the current EU banking sector implies that the risk of a crisis in a given year is minor – below 0.3%.[50] In the new study, EBA suggests that the Final Basel III reform *decreases* the risk of a crisis in any given year with 1.2%. Naturally, the risk of a crisis cannot be negative, implying that EBA has revamped the assumptions behind the estimation.

The original LEI applies a correlation estimation between risk of a crisis and capitalisation, using a range of different model specifications. In contrast, in the new study, it appears that EBA does not use actual crises as the dependent variable but instead an estimated dummy variable for "*vulnerable states of the economy that can lead to a systemic banking crisis*". It is not clear to us why this more indirect approach would lead to more precise estimates of the benefit of increasing capitalisation.

EBA has in their new study also revamped the cost estimations, compared to the LEI report. In the new study, EBA expects the initial impact on GDP to be quite large – around 0.8% (due to around 0.2% lower growth rate in four years). However, in the following years, the costs in fact turn negative, due to substantial Modigliani-Miller effects, i.e., banks have lower funding costs due to the higher capitalisation. This means that the net costs for the European economy end up at around 0.2% of GDP, significantly below our estimate of 0.5%, which follows the original LEI report. The major shift in the cost estimation appears to be an introduction of significant Modigliani-Miller effects, compared to the LEI report, which included no such effects.

3.4 IMPACT ON GREEN LENDING

Transforming to a low-carbon economy compliant with the Paris agreement requires a massive amount of investments by Swedish businesses. On an EU level, the European commission assesses that this requires additional annual investments of some SEK 2800 bn (EUR 260 bn) each year, of which SEK 1500 bn (EUR 140 bn) are attributable to green investments by businesses.[51] Evenly distributed according to GDP, this corresponds to additional annual private investments of close to SEK 45 bn in Sweden. With the current funding mix in Sweden, this would imply new green bank loans of more than SEK 20 bn each year, corresponding to some 1.5% of the current lending stock to non-financial corporations.[52]

This is a major task for the Swedish banking sector. Fortunately, they seem to be up for the task – for example, all the Swedish banks signed up for UNEPFI's Principles for Responsible Banking.[53] But in doing so, the elevated capital requirements in the Final Basel III Framework could be a drag, entailing fewer green investments. The reasons are the same as with the general decline in

50 See table 3 in BCBS (2010): An assessment of the long-term economic impact of stronger capital and liquidity requirements.

51 See page 17 in the European Commission's communication on delivering the Energy Union and Climate Action, available at https://ec.europa.eu/energy/sites/ener/files/documents/recommondation_en.pdf.

52 Bank finance corresponds to around 50% of the entire investment financing in Sweden, cf. appendix in Copenhagen Economics (2016a).

53 This initiative aims at aligning the banks' business strategy with the UN's Sustainably Development Goals and the Paris Agreement to thus to make the banking sector more sustainable. See also https://www.unepfi.org/banking/bankingprinciples/.

investments described in section 3.1.1. The higher lending rates imply that fewer (green) investments are profitable, which means that fewer (green) investments will be carried out, cf. example in Box 5.

Concretely, we estimate that the new bank loans required in a scenario compliant with the Paris agreement mean that Swedish banks, with the current capital rules, need to raise up to SEK 1.3 bn additional capital for green loans to businesses each year. With the Final Basel III Framework, that number increases to around SEK 2 bn additional capital each year.

Box 5 Example of a green investment for an unrated corporate

To illustrate the impact of the package on green investment, assume an unrated corporate which considers a green investment. It could, for example, be a transportation company that considers electrifying its car fleet. For this investment to be profitable, the average financing cost cannot be higher than 4.5% (so-called WACC). The company wants to use 25% equity and 75% bank debt to finance the investment. The company has a required return on equity of 10%.

The company normally has an interest rate of 2.5%, giving rise to an average financing cost of just below 4.4%, meaning that the investment is profitable.

However, with the Final Basel III package the interest rate increases to just above 3% (as seen in Figure 8) and the average financing costs increase to just below 4.8%, making the investment unprofitable.

CHAPTER 4

DIFFERENT OPTIONS OF IMPLEMENTATION

The previous chapter concluded that the Final Basel III Framework does not bring net benefits to society if implemented in the form laid out in the EBA's main scenario. In addition, it was documented in chapter 1 that the framework will lead to a significant increase in capital requirements – without being justified from a risk perspective.

This raises the questions of how the Final Basel III Framework can be implemented in a way more in line with real-economy considerations and the financial structures of the Swedish economy. These questions will be explored in this chapter.

First, we will provide some alternative options of how the framework can be implemented and what these options would entail for the net benefit of the framework (section 4.1). We will then discuss the implications for the real-economy net benefits (section 4.2).

4.1 MAIN PRIORITIES IN THE IMPLEMENTATION OF THE FINAL BASEL III FRAMEWORK

In this section, we consider options on how the Basel III Framework can be implemented – taking structures of the Swedish financial system into consideration. This means, on one hand, avoiding the broad-brush increase in capital requirements in EBA's main scenario, while keeping EU's commitment to follow global standards in banking regulation.

Output floor

A high impact of the output floor is the main driver for the strong impact on Swedish businesses. Thus, an appropriate implementation of the output floor is a key task in achieving an implementation that is more suited to Swedish financial structures.

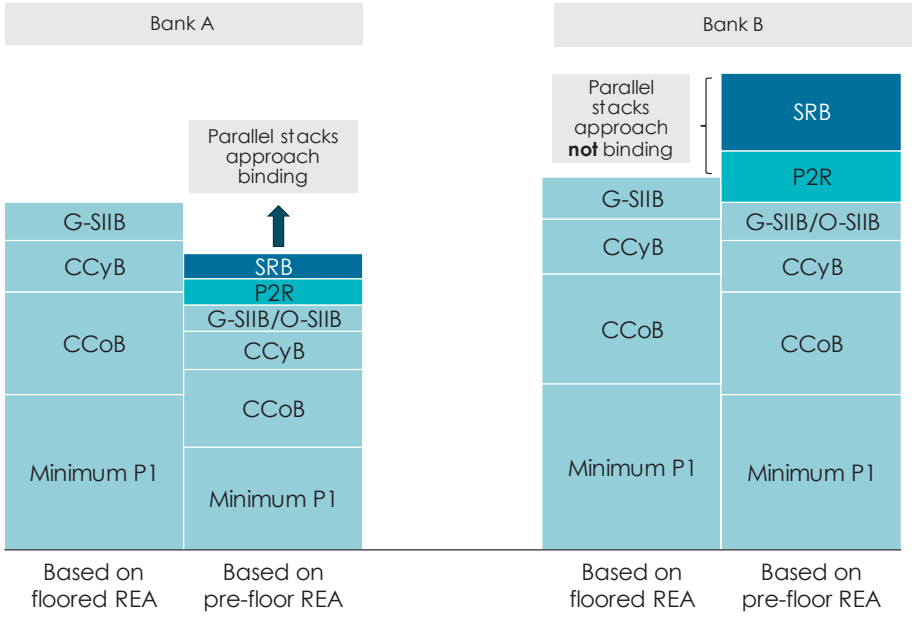
Such an approach has in fact been put forward, the so-called 'backstop' approach or 'parallel stacks' approach.[54] The approach would entail that EU banks are subject to three different capital requirements:

1. *Leverage ratio:* equity should be above 3% of total assets.
2. *Pre-floor REA:* based on risk weights unrestricted by the output floor, with all capital buffers included – similar to what is binding for most banks today.
3. *Floored REA:* the floored REA are used to determine internationally agreed capital requirements only, i.e., the minimum requirement, the buffer for global systemically important banks (G-SIB), the countercyclical buffer and the capital conservation buffer. Buffers that are set at EU level, such as Pillar 2 requirements (P2R), the systemic risk buffer (SRB) and the buffer for Other Systemically Important Institutions (O-SIIs), would be excluded.

This approach to the output floor would not be binding for Swedish banks: in general, it would only restrict banks with very low risk weights compared to the standardised approach, as well as banks in countries with low national capital buffers (P2R, SRB and O-SIIB), cf. Figure 19.

54 See EBA impact assessment p. 175.

Figure 19
Illustrative example of the parallel stacks approach
Capital requirements (CET1)



Note: For Bank A, floored REA is considerably larger than pre-floor REA. Capital requirements from the application of the SRB (and/or the O-SIIB) and the P2R on top of the international buffers do not exceed the requirements based on applying only the international buffers but to *floored* REA. The parallel stacks output floor is therefore binding. For Bank B, floored REA is only slightly larger than pre-floor REA and does not compensate for the inclusion of the national buffers in the calculation of capital requirements. The parallel stacks output floor is therefore not binding.
Source: Copenhagen Economics based on EBA (2019a).

We see this implementation as being more in line with real-economy considerations: first, it will ensure a more level playing field for Swedish banks compared to banks in the US and other European countries, as the output floor REA would apply to the same capital buffers. It will also mitigate the impact on capital requirements.

It should be noted that while EBA considers the parallel-stacks approach to be non-compliant with Basel III standards, a report published by the Legal High Committee for Financial Markets of Paris in December 2019 is of a different opinion. The authors conclude that, from a legal standpoint, the parallel-stacks approach to the output floor is compatible with the Final Basel III Accord.[55]

Unrated corporates

Corporates that do not have a rating are significantly impacted in Sweden as all banks are restricted by the output floor, where an unrated corporate is assigned a risk weight of 72.5%. This is substantially above what an internal model typically predicts.

There are some exceptions to the requirement of the 100% risk weight. In jurisdictions where external ratings are not recognised – and if the company is listed on an exchange – banks can

[55] The report is available at https://www.banque-france.fr/sites/default/files/rapport_28_a.pdf.

assign a 65% risk weight to so-called investment grade corporates[56], which is closer to predictions of internal models. However, in its current form, these exceptions are rare and have little impact on the risk weights, among other things because a relatively small share of companies are listed on exchanges compared to, e.g., the US.

One option to adjust the framework to fit the Swedish financial system better would be to remove the requirement that the company should be listed on an exchange as well as to allow the application of the investment grade classification for all unrated corporates (and not only for corporates in jurisdictions where external ratings are not recognised). This would ensure a level playing field across jurisdictions irrespective of whether external ratings are permitted or not and irrespective of the funding structure of companies. This could be achieved by, for instance, relying on a certain size, turnover, etc.

We estimate that allowing a 65% risk weight to be assigned to investment grade exposures in Sweden would amount to a reduction in the increase in capital requirements of around 9 percentage points.[57]

EBA options to avoid a broad-based increase in capital requirements

The EBA impact assessment also provides options on how the impact on capital requirements could be mitigated compared to their main scenario:

- **Maintaining the SME supporting factor:** the Final Basel III Framework introduces a preferential risk weight for corporate SME exposures. Currently, there is also an SME supporting factor that applies to all SME exposures. In the EBA's main scenario, the EU SME supporting factor is removed due to the new preferential risk weights. We estimate that keeping the SME supporting factor in the EU legislation would reduce the total impact on capital requirements by around 1.5 percentage points in Sweden.[58]
- **Excluding the historical loss component:** in the Final Basel III Framework, the calculation of capital for operational risk REA might be based on their past losses, depending on the jurisdiction the bank operates in. Excluding this historical loss component from the capital calculation would increase the total impact by around 2 percentage points in Sweden.[59]
- **Keeping the Credit Valuation Adjustments (CVA) exemptions:** the package could also impact the cost of risk management for corporates. Currently, corporates use derivatives to hedge financial risks. With the Final Basel III Framework, the current EU-specific arrangement to limit these costs – the so-called CVA charge exemption – is removed.[60] Keeping the CVA exemptions would reduce total impact in Sweden by around 2.5 percentage points.

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56 An investment-grade corporate is an entity with "adequate capacity to meet its financial commitments in a timely manner and its ability to do so is assessed to be robust against adverse changes in the economic cycle and business conditions" (EBA impact assessment, p. 74).

57 For this estimation we assume a share of investment-grade corporate exposures of around 72% for all corporates, using data from the three largest Swedish banks and Nordea.

58 Our estimations for the impact in Sweden are based on EBA's estimate of the EU impact of the different options (see EBA impact assessment, p. 24). The EBA assessment most likely underestimates the impact of keeping the SME supporting factor, as it is based on a less comprehensive applicability of the SME supporting factor compared to the final regulation (see p. 77 of the EBA impact assessment).

59 Institutions in Sweden have reported internal loss multipliers smaller than one, meaning that exercising the discretion to exclude the historical loss component results in an increase in capital requirements (cf. EBA impact assessment, p. 159).

60 See also Allen & Overy (2014) – *Capital Requirements Directive IV Framework, Credit Valuation Adjustment*

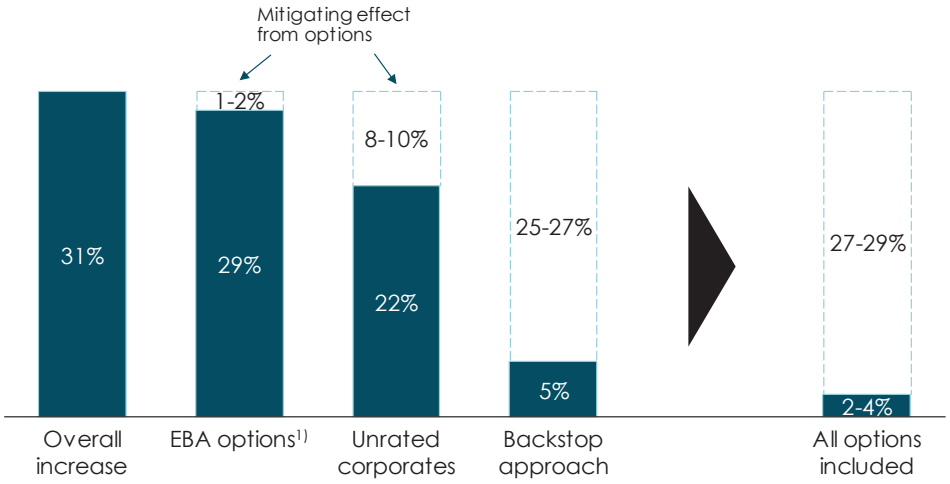
Reduction of EU-specific capital buffers

The implementation of the Final Basel III Framework could also be an occasion to consider a recalibration of the capital buffers introduced specifically to the Swedish banking market. These requirements include the buffer for other systemically important institutions (O-SII), the systemic risk buffer (SRB), the countercyclical capital buffer and the Pillar 2 requirements (P2R) to be implemented by the national authorities. This is not included in our estimation.

4.1.1 Total impact on capital requirements

Following the above options, we assess that the impact of the Final Basel III Framework in Sweden could be limited to an increase in capital requirements below 5%, cf. Figure 20.

Figure 20
Increase in capital requirements with different options of implementation
Increase in CET1 requirement



Note: The EBA options include the following: "Maintaining the SME supporting factor", "Excluding the historical loss component" and "Keeping the CVA exemptions".
Source: Own calculations.

This implementation would mitigate the negative real-economy impact of the framework. Concretely, we estimate that GDP would decline in the below 0.1%, i.e., 0.7 percentage points lower net costs than from EBA's main scenario.

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OECD (2013): Financing SMEs and Entrepreneurs 2013: An OECD Scoreboard
OECD (2016): Economic Outlook No. 99 – June 2016
Ospina and Uhlig (2017): Mortgage-backed securities and the financial crisis of 2008: a post-mortem
Plantin (2014): Shadow Banking and Bank Capital Regulation
The Riksbank (2011): Appropriate capital ratio in major Swedish banks
The Riksbank (2013a): Financial Stability Report 2013:1.
The Riksbank (2013b): Financial Stability Report 2013:2
The Riksbank (2014a): Penningpolitisk Rapport
The Riksbank (2014b): Financial Stability Report 2014:1
The Riksbank (2014c): Lower neutral interest rate in Sweden?
The Riksbank (2015a): Financial Stability Report 2015:2
The Riksbank (2015b): Supply of housing in Sweden
The Riksbank (2016a): Monetary Policy Report, October 2016
The Riksbank (2016b): Financial Stability Report 2016:1.
The Riksbank (2017): Appropriate capital ratios in Swedish banks – new perspectives
The Riksbank (2019): Financial Stability Report 2019:1
Schmitz, Sigmund, and Valderrama (2016): Bank Solvency and Funding Cost: New Data and New Results
Shafer (2018): The foreign capital flow and domestic drivers of the US financial crisis and its spread globally
Woodford (2011): Inflation Targeting and Financial Stability
Wyman (2016): Real-economy cost of regulation in the Swedish banking system
Uluc and Wieladek (2015): Capital requirements, risk shifting and the mortgage market
ZEB (2018): European Banking Study

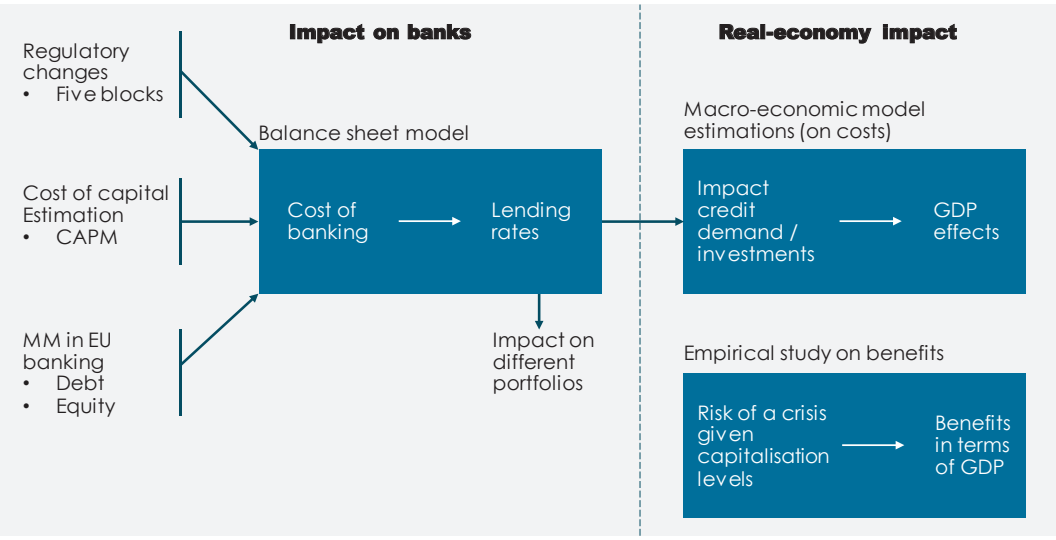
APPENDIX A

THE BANKING BALANCE SHEET MODEL

The appendix describes both the balance sheet model we use to estimate the impact of The Final Basel III Framework on different interest rate portfolios as well as the impact on demand, investment and GDP estimated with our macroeconomic model (see Figure A.1 for an overview).

In Appendix A, we explain our estimations of the balance sheet model. The estimation of the macroeconomic effects is described in Appendix B.

Figure A.1
Overview of the model framework



DATA AND SAMPLE

For our estimations, we use three primary sources of data:

- **The results from the EBA transparency exercise:** the EBA transparency exercise contains detailed information on the regulatory capital for 130 banks across 25 European countries. The data includes information on original exposures, exposure values (exposure at default in BIS terminology) and risk-exposure amounts for credit risk split across different asset classes. This data forms the basis for the calculations within the balance sheet model. The data are from the end of 2017.
- **The S&P Global Market database (SNL database):** the SNL database contains granular information from banks' financial statements, such as total assets, interest expenditure, profits, impairments and so on. We primarily use this data in the estimation of the debt funding rates and loss rates. The data are for the year 2017.

- **EBA impact assessment:** the EBA impact assessment provides a detailed analysis of the expected impact of the Final Basel III Framework. We closely follow the results obtained in the EBA impact assessment in that we calibrate the country-average impact obtained in our model to the numbers estimated by EBA for all countries but Sweden.[61]
- **Data input from the three largest Swedish banks and Nordea:** in order to obtain more precise results on a country level, we have obtained data inputs from the four largest banks active on the Swedish market. The data covers, among other things, the distribution of exposure as well as current risk weights across corporate exposure classes, the share of corporates that would be considered as investment grade and risk weights implied by the reform for corporate exposures.

Additionally, we use data from the European Systemic Risk Board to obtain information on additional European capital buffers currently in place (e.g., the countercyclical capital buffer or the systemic risk buffer) as well as the results from the EBA Basel III impact study to infer changes in the standardised risk weights.[62]

Our sample initially consists of the 130 banks available from the EBA 2018 transparency exercise. After matching these with the banks for which data is available in the SNL database, 115 banks remain in the sample. From this sample we further exclude seven banks which are public or do not have a traditional commercial businesses model.[63] These banks have CET1 capital ratios above 50% and could distort the average results.

This leaves us with a sample of 107 banks in total, covering 22 European countries. The EU countries which are not represented in our sample are: Bulgaria, Croatia, Czech Republic, Latvia, Lithuania and Slovakia.

The Swedish banks covered in our sample are: Nordea, Svenska Handelsbanken, Skandinaviska Enskilda Banken, Swedbank, SBAB as well as Länsforsäkringar. We included Nordea in our sample of Swedish banks even though it has relocated its headquarters to Finland. This is because it remains one of the largest banks on the Swedish market.

In our estimations we accounted for the conversion of the mortgage floor of 25% for Swedish mortgages from Pillar 2 (buffer requirement) to Pillar 1 by increasing REA for the retail mortgage portfolio accordingly. This reduces the impact of the reform as it implies a higher REA for Swedish banks to begin with (while effectively facing the same capital requirements).

ESTIMATION OF THE IMPACT ON CAPITAL REQUIREMENTS OF THE FINALISATION OF BASEL III

The finalisation of Basel III can impact banks' capital requirements through different channels such as the revision of the standardised approach to credit risk (CR-SA) as well as the internal ratings-based approach, adjustments in the calculation of CVA, market risk and operational risk capital requirements and the output floor.

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61 Note that we use the updated results from EBA's December 2019 impact assessment, where available.

62 EBA (2019) – Basel III Reforms: Impact Study and Key Recommendations

63 The excluded banks are: the Belgium branch of The Bank of New York Mellon, DEPFA bank Plc (Ireland), Municipality Finance (Kuntarahoitus Oyj, Finland), Nederlandsche Waterschapsbank (Netherlands), Banco de Crédito Social Coperativo (Spain), Volksbanken Verbund (Austria) and Kommuninvest (Sweden).

Our estimation is carried out in five steps:

- Step 1: Original exposure values and risk exposure amounts
- Step 2: Implementing the measures of the package, except output floor
- Step 3: Implementing output floor
- Step 4: Calibration to EBA country-specific MRC impact
- Step 5: Simulating impact on interest rates.

Step 1: Original Portfolios

First, we calculate the exposure values, risk exposure amounts (REA) and average risk weights for our portfolios (both for exposure classes under the CR-SA and the IRB approach):

- **SME**: including SME retail exposure, SME mortgage exposure as well as exposure to SME corporates. For Swedish banks, we distinguish between exposure to SME corporates, retail SME exposure as well as remaining SME exposure (including, for instance, exposure secured by real estate), using data from the three largest Swedish banks and Nordea.
- **Mortgage** is only composed of mortgage exposure to households.
- **Corporate**: exposure to corporates excluding corporate SMEs. We break down exposure to corporates for Swedish banks into unrated and rated corporates.
- **Public sector:** exposures to central banks, central government and other public sector entities.
- **Bank:** exposures to financial institutions is contained within.

The remaining credit portfolios (equity, securitisation and non-credit-obligation assets) are left unchanged and correspond to the exposure classes in the EBA transparency exercise.

Apart from the credit-risk portfolios we also include REA for market risk, operational risk, CVA as well as other remaining non-credit-risk portfolio REAs.

Step 2: Impact of the measures other than the output floor

In this part of the calculation, we estimate the impact on the individual banks' REA of the revision of the standardised as well as the IRB approach, adjustments in the calculation of CVA, market risk and operational risk capital requirements.

In a first step, we estimate the revised standardised risk weights due to the finalisation of Basel III. Specifically, the current SA risk weights are calculated as the ratio of portfolio REA over portfolio risk exposure amount for each bank (giving the current portfolio risk weight) and are then adjusted according to the increase in exposure class standardised REA estimated in the EBA impact study.

The impact of the revision of the IRB approach is based on the portfolio impact in the EBA study and calibrated to match the total change in REA due to the IRB revision on an EU level.
We conduct these calculations for each of the different portfolios in our model.

Increase in REA due to CVA, market risk and operational risk is approximated by using the EU-average impact provided in the EBA study. This implies that CVA REA increases by 572% for each bank in the implementation of the framework, as recommended in the EBA impact study. Market risk and operational risk are assumed to increase by 200% and 139%, respectively. We adjust the

impact in Sweden to the country-specific results estimated in the EBA impact assessment, cf. EBA (2019b).

Step 3: Implementing the output floor

The output floor is implemented as the last requirement and it limits the impact of internal models for the determination of banks' risk exposure amount by restricting the capital requirements to be at least 72.5% of the capital requirements calculated under the standardised approaches. The output floor is applied on an aggregate level.

For the output-floor estimation, we assume the following risk weights for the IRB portfolio:

- **Retail mortgage exposures: 30%:** corresponding to an average LTV ratio of 60%-80% as suggested in a study by the EMF.[64]
- **Corporate exposures: 92%**: this risk weight is calculated as the weighted average of 80% unrated corporate exposure (not considering potential investment grade classification, such exposure is assigned a risk weight of 100%) and 20% rated corporates with an average rating between A- and BBB- (approximated from EBA report, p. 75). It is very similar to the EU-average risk weight under CR-SA of 91%. For Swedish banks the high share of unrated corporates implies a somewhat larger risk weight (97%).
- **SME exposures**: **75%:** weighted average of preferential risk weight of 85% for SME corporates, a risk weight of 75% for retail SME exposures and a risk weight for exposure to SMEs that are secured by real estate of around 45%.
- **Central banks and central government exposures**: **8%**: inferred from the EU-average SA risk weight. No impact from the Final Basel III package.
- **Financial institutions (banks) exposures**: **24%**: this is the EU-average risk weight for IRB exposure of 20% adjusted for the average expected increase in EBA impact assessment. Note that short-term interbank exposures get a 20% weight in the Final Basel III package.
- **Other retail**: **75%**: EU-average SA risk weight.
- **Securitisation**: **58%**: EU-average SA risk weight. No impact from the Final Basel III package.
- **Equity**: **314%:** we assume that current EU-average IRB risk weight will be equal to the new standardised risk weight.
- **Covered bonds** (only under SA portfolio): **11%**: average EU SA risk weights. No impact from the Final Basel III package.
- **Other exposures** (only under SA portfolio): **81%:** no impact from the Final Basel III package.

In addition, we also assume that all non-credit risk REA is equal to the value under the standardised approaches. This does not have any direct effect on the estimation of the impact on the cost of additional capital requirements for the mortgage, SME and corporate exposure classes, but it affects the portfolios indirectly in the calibration and when determining whether the output floor will be binding.

To determine the impact of the output floor, we calculate the 'hypothetical' REAs by applying the above risk weights to the banks' IRB exposures and then floor total REA by multiplying by 72.5%. The binding REA will be the largest of either the output floor REA or the pre-floor REA from step 2.

Swedish banks already face a risk-weight floor of 25% on their mortgage exposure. This is taken into account in this study. The impact of the output floor on the Swedish mortgage portfolio is therefore limited considerably.

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64 See: https://hypo.org/app/uploads/sites/3/2017/09/HYPOSTAT-2017.pdf, p. 26.

Step 4: Calibration to EBA country-specific MRC impact

In a fourth step, we calibrate the new REA obtained from our model to the country-average results in the EBA report from December 2019. In particular, we calibrate the increase in REA to the increase in MRC in the respective country (except for Sweden).

Step 5: Impact of a change in capital requirements on interest rates

The impact on the portfolio interest rates is generated by the change in the bank-funding structure after the Final Basel III Framework implementation. Banks will now need to finance a larger share of their credit portfolio with equity, which is more expensive than debt. We assume that banks hold the same CET1 ratio as before the implementation of the Final Basel III Framework. This means that banks are not able to use any buffer they might hold on top of the capital requirements to compensate for increased capital requirements.

Basically, impact on funding costs for a portfolio is calculated as:

Increase in risk weight • capital ratio • (equity cost rate – debt cost rate)

We assume that the percentage point increase in funding costs will lead to an equivalent percentage point increase in interest rates. In the calculations, we assume a required return on equity of 13% (10% after taxes). This estimate is aligned with a recent study conducted by the EBF, covering the 50 largest banks in Europe. In comparison, the assumed cost of equity in BIS (2010) is 14.8%.

The debt-funding cost rate is estimated for each bank using data on bank interest expenses and liabilities from SNL.

In our estimation, we also account for so-called 'Modigliani-Miller' effects. We assume that when the capital ratio increases by 1 percentage point, the cost of equity decreases by around 0.15 percentage points. The impact on interest rates from an increase in capital is thus mitigated by MM-effects. For a discussion on MM-effects, see Appendix B or Copenhagen Economics (2016a): "*Cumulative impact on financial regulation in Sweden*".

Finally, we distribute the impact from operational risks according to the share of portfolio REA in total credit risk REA.

APPENDIX B

ESTIMATION OF THE MACROECONOMIC EFFECTS OF THE FINAL BASEL III FRAMEWORK

MACROECONOMIC COSTS

To estimate the macroeconomic costs, i.e., the impact on GDP and investments, we use a model developed by Meh and Moran (2010). It is a so-called Dynamic Stochastic General Equilibrium (DSGE) model, which is a structural macroeconomic model. The model has a well-specified financial sector, which enables us to analyse the effects of higher banking costs.

There are several reasons why Meh and Moran (2010) is our preferred macro model:

1. The micro-foundation enables a modelling of banks' response to changing financial regulation. This includes adjustments, both on the asset and liability side, as well as the effects on lending rates.
2. The general equilibrium effects of the model allow for continuous feedback between the real economy and the financial sector. When higher capital requirements are introduced, this increases lending costs, which reduce investments and hereby compress GDP. This, in turn, decreases asset values, making lending even more costly, which reduces investments and thereby GDP further. This cycle continues until the economy has reached a new equilibrium. This is the so-called financial accelerator mechanism.
3. Finally, the paper by Meh and Moran (2010) is respected in academic literature, with numerous citations. The framework constitutes the theoretical foundation of applied models in many economic institutions. For instance, the Swedish Riksbank has used the framework to estimate the effects of Basel III in a paper from 2011. The method is thus a proven way to analyse the relationship between the real economy and changes in the capitalisation of banks.

The model is calibrated to fit the Swedish economy, as described in the appendix of Copenhagen Economics (2016a) - *Cumulative impact of financial regulation in Sweden*.

How our macroeconomic model works

In the model, there is a moral hazard issue between the households that hold deposits in the banks and the owners of the banks, called 'bankers'. The households cannot monitor whether the bank is monitoring their loans. If the bank does not monitor their loan, there is a risk that borrowers will choose a bad investment project which has a higher risk of default. Monitoring implies a cost to the bankers. Therefore, the households demand that the bankers hold equity to ensure that they have an incentive to monitor their loans – that they have 'skin in the game'.

If the monitoring costs increase, the incentive for the bankers not to monitor their loan increases (since it is costly) – therefore, the capital requirements from the households increase to ensure that the bankers have enough 'skin in the game' to monitor the loans. As a result, the capital requirement in the model can be increased through increasing the monitoring costs.

Capital requirements and cost of capital

Fundamentally, a bank has two sources of finance, namely equity and debt. Of these, equity has the highest required return. If capital requirements increase, banks are forced to hold more of the expensive equity and their funding costs increase. The increase in funding costs is mitigated by – viewed in isolation – a decline in the required return on both equity and debt, since more equity implies a lower risk of bank failure.

In fact, taking a very simplistic view on finance – disregarding taxes, asymmetric information and regulation – if the capital requirements increase, the required return on debt and equity is reduced exactly so much that the overall funding costs of banks are unchanged. This is the so-called Modigliani-Miller irrelevance theorem. However, when tested empirically, this simplistic perception does not hold true, *cf. Box B.1 below*.

Box B.1 Why the Modigliani-Miller theorem does not hold true

1. **Tax shield**
   In contrast to equity, debt payments are tax exempt, and shifting to more equity will increase funding costs. Put simply, a bank needs to provide a larger return on investment simply to pay more in corporate taxes.

2. **Explicit guarantees**
   Through the deposit guarantee, the risk to private depositors is guaranteed, i.e., the required return on this part of the debt will not react to the funding structure.

3. **Implicit guarantees**
   When banks are too big to fail, the government implicitly takes on a part of the default risk, especially for 'unsecured' debt and equity holders. However, we think this plays a minor role now because banks are fairly well-capitalised.

4. **Creditors value bank debt highly**
   Liquidity production is a major element of banks' business models. Creditors tend to value bank debt highly due to its high liquidity, which implies that debt is a relatively cheap source of funding for banks. When banks are forced to replace debt with equity, this is undermined.

Thus, when capital requirements increase, the required return on debt and equity might decline, but overall funding costs will increase. The extent to which funding costs increase depends on factors such as the initial capitalisation level of the bank and the economic activity:

- *With low levels of equity*, an increase in equity will represent a significant reduction in the risk of bank failure. This will imply a significant reduction in the required return on equity and debt, which will curb the increase in the overall funding cost.
- *With high levels of equity*, the reduction in the risk of failure is already quite small and the required return will not decline very much. Equity finance will nevertheless still be more expensive than debt finance due to aforementioned reasons and the overall funding cost will increase.

The required return also depends on the level of activity in the economy:

- *In normal times*, the required return is hardly affected by higher capitalisation as investor sensitivity to default risk is low. Acquiring new equity or readjusting the portfolio is more costly than taking on debt leading to an increase in overall funding cost.

- *In crisis times*, a reduction in default risk can have a large impact on funding costs. Investors will, to a larger extent, discipline banks, as they are less prone to take on risks. Consequently, higher capital requirements will be somewhat offset by the decline in overall funding costs.

In general, the results in the literature are very fragmented and dependent on the data sample used. A study including banks in a 'normal situation' provides results different to one including thinly capitalised banks during the financial crisis. When including the latter, the stressed banks might have a strong influence on the overall results.

A main conclusion from the literature is that higher capitalisation has a distinct, non-linear impact on overall funding costs; above a certain threshold, investors will not consider a bank less risky if it increases the level of equity so overall funding costs will rise.[65]

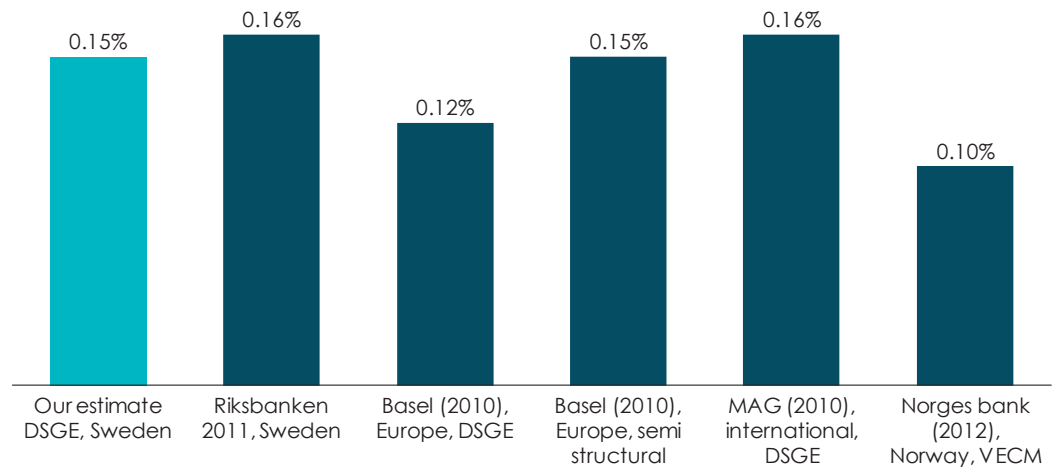
Adjustment of macro-model impact

Our model impact on GDP from higher capital requirements might be in the high end. First, it does not include any Modigliani-Miller effects and second, and perhaps more importantly, there are no alternative funding sources that companies can switch to when banking financing becomes more costly. As discussed, this is particularly important for large corporates that can more easily switch to bond financing.

To incorporate this, we adjusted our macro-model estimate of 20% downward, giving rise to an estimate of a 0.15% decline in GDP for an increase in CET1 ratio requirement of 1 percentage point.

[65] See the appendix of Copenhagen Economics (2016): Cumulative impact of financial regulation in Sweden, for a more thorough discussion of the topic.

Figure B.1
Our estimate compared to those of other institutions
Decline in long-run GDP due to 1 percentage point increase in CET1 ratio requirements



Source: Copenhagen Economics.

MACROECONOMIC BENEFITS

The macroeconomic benefit arises from reducing the risk of a crisis due to too low capital ratios.

To estimate the benefits, we need an estimate of 1) the impact of higher capital requirements on the risk of a crisis and 2) the macroeconomic costs of a crisis if it were to occur. The macroeconomic benefits can then be estimated as:

GDP benefit = 'Reduction in risk of crisis' • 'GDP cost of a crisis'

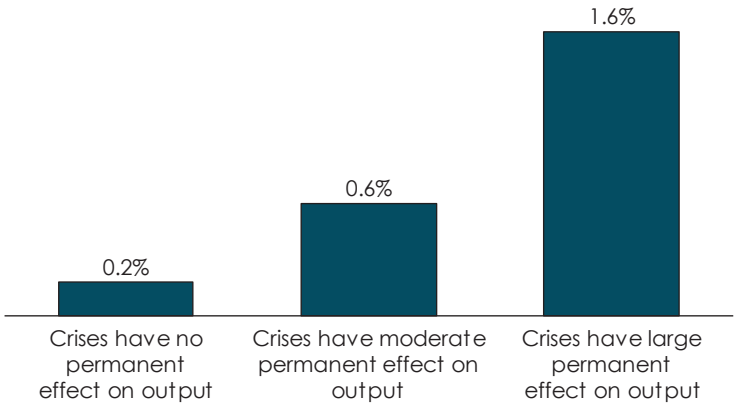
1) Cost of a crisis

The estimated benefits of reducing the risk of a crisis naturally depend on the assumed social and economic costs of a financial crisis. Although it is clear that the costs are immense, they are difficult to estimate and depend on several assumptions.

The estimated benefits of reducing the risk of a financial crisis depend largely on the assumptions made about the long-run effects on productivity. Standard macroeconomic theory suggests that shocks to the economy only have temporary effects and that the economy will eventually recover to its structural long-run level (i.e., that there is a 'steady-state' path unaffected by financial crises).

Basel (2010) summarises the results from several papers. They find that the benefit of reducing the risk of a crisis by one percentage point corresponds to a permanent increase in GDP of around 0.19% to 1.58%, depending on the assumptions, cf. Figure B.2 on the next page:

Figure B.2
Benefit of reducing the risk of a financial crisis by one percentage point
% of GDP



Source: Basel (2010).

In our estimations documented in chapter 3, we have assumed that financial crises have moderate permanent effects on the output (estimate of 0.6%). This entails that after a crisis, GDP will at some point pick up the pre-crisis growth rate *but at a lower level*. The permanent loss in output stems partly from a lower level of business innovation during the crisis, due to an elevated number of bankruptcies and a deteriorated credit transmission impairing investment infrastructure.[66]

2) Risk of a crisis

Our results, described in section 3.2, is based on work from BIS (2010). BIS estimates the relationship between the probability of a banking crisis and the sector-wide average capital ratio. They find a clear non-linear relationship, with benefits converging towards zero. Given the capitalisation of the current EU banking sector, they find that an additional percentage point increase in the capital ratio decreases the risk of a crisis by 0.08 percentage points.

The estimations are based on six different statistical models, which, overall, reduce the risk of outlier results. Nevertheless, it should be mentioned that all six models are (at least to some extent) based on historical correlations under Basel I and II rules. This increases the uncertainty when the estimated relationships are used to assess capital adequacy under Basel III (which is higher and thus out of sample).

[66] See OECD (2012): Innovation in the crisis and beyond.

Copenhagen Economics

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