

STAFF MEMO

How to assess the systemic risk buffer for banks

NO. 11 | 2019

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NORGES BANK

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ISSN 1504-2596 (online)

ISBN 978-82-8379-122-8 (online)

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Since 2013, Norwegian banks have been required to hold a systemic risk buffer (SyRB) of 3 percent. The reason for the buffer is to address structural vulnerabilities in the economy and the financial system. The Ministry of Finance has proposed an increase in the buffer requirement to 4.5 percent. A framework for the use of the buffer has not been established in Norway or the EU. The countries that have introduced the buffer have used different indicators and cited different reasons. In this paper, we assess indicators and a possible framework for the systemic risk buffer in Norway. We find that a number of structural features of the banking sector indicate that systemic risk is high in Norway, and there are many indications that structural systemic risks have risen in recent years.

Key terms: Systemic risk buffer, structural systemic risk, indicators.

1. Introduction

The systemic risk buffer (SyRB) is one of several capital requirements facing banks. The capital requirements have various purposes. The SyRB is a macroprudential instrument and is intended to address long-term systemic risk, while the purpose of the countercyclical capital buffer (CCyB) is to enhance banks' resilience in periods when financial imbalances are building up. The capital conservation buffer, which is a fixed buffer, is designed to prevent breaches of minimum capital requirements in the event of large losses. Banks designated as systemically important are required to hold an additional buffer because problems at systemically important banks can lead to serious, negative consequences for the wider economy.

The Norwegian SyRB is set at 3 percent of risk-weighted assets, and was introduced in 2013. The buffer applies to all banks. The Ministry of Finance has set the SyRB against the background of structural vulnerabilities in the economic and the financial system.² The Ministry

¹ The views and conclusions in this publication are those of the authors and do not necessarily represent those of Norges Bank. They should therefore not be reported as Norges Bank's views. We are grateful to Henrik Andersen, Per Atle Aronsen, Henrik Borchgrevink, Karsten Gerdrup, Torbjørn Hægeland, Tord Krogh, Nina Larsson Midthjell, Lisa Reiakvam, Nicolas Stefano and Hanna Winje for useful comments and input, and to Maja Olderskog Albertsen, Sara Midtgaard and Adnan Muneer for assistance with background information, and help with charts and tables.

² See, eg, Ministry of Finance (2018).

notes that the Norwegian economy is characterised, inter alia, by a less diverse industry structure than other countries, relatively wide cyclical fluctuations and high household debt levels. Furthermore, the Ministry points to the close interconnectedness of the financial system and its reliance on foreign capital.

The Ministry of Finance has proposed an increase in the SyRB from 3 percent to 4.5 percent.³ When the EU capital framework (CRR/CRD IV) is implemented in the EEA Agreement, the Basel I floor will be removed and the SMB discount will be introduced in Norway.⁴ In isolation, this eases the capital requirements for most banks without reflecting a change in risk in the banking sector. The increase in the SyRB will contribute to maintaining the capital requirements for Norwegian banks.⁵ The Ministry of Finance further proposes that the SyRB be assessed every two years. In its consultation response, Norges Bank broadly endorsed the proposals.⁶

Guidelines as to the decision basis for the SyRB have, as yet, not been established in Norway or the EU. The purpose of this paper is to look at indicators and a possible framework for assessing the Norwegian SyRB. A framework will also help make a clearer distinction between the SyRB buffer and other capital requirements, in particular the CCyB.

In this paper, we review the regulation on the SyRB, a report from the European System Risk Board (ESRB) on the use of the SyRB and the distinction between the SyRB and the CCyB (see Section 2). In Section 3, we look at the use of the buffer in other countries, and find that their use and reasons for their use vary widely across countries. We do not find any common indicators used in assessing the buffer. Section 4 assesses the types of systemic risk and associated indicators that can be used to assess the Norwegian SyRB, with reference to the ESRB report. We take a closer look at the areas that indicate high structural systemic risk in Norway. In Section 5, we argue that the assessment of the SyRB should also comprise stress tests featuring network models and estimations of optimal capital requirements. Based on the framework presented in this paper, Section 6 concludes that structural

³ See Ministry of Finance website for [“Consultation – Adjustments to capital requirements for banks”](#) of 25 June 2019 (in Norwegian only).

⁴ The rules for banks using internal ratings-based models to calculate capital requirements (IRB banks) will be relaxed, since they will no longer have to apply the Basel I floor to risk-weighted assets when calculating capital adequacy. Furthermore, the capital requirement for loans to small and medium-sized enterprises (SME discount) for all Norwegian banks will be reduced.

⁵ In the proposal, the buffer will, in principle, only apply to exposures in Norway. The Ministry of Finance also proposes establishing mutual recognition of SyRB requirements in Norway and other countries.

⁶ See Norges Bank website for consultation response [“Consultation – Adjustments to capital requirements for banks”](#) of 30 September 2019 (in Norwegian only).

systemic risk is high, and that there are signs that it has increased in recent years.

2.A buffer for structural systemic risk

The CCyB is designed to address cyclical systemic risk, while the SyRB is designed to address structural systemic risk. The SyRB is part of the EU capital framework (CRR/CRD IV), but is not included in the recommendations from the Basel Committee. No European framework has been established for assessing the SyRB, but in its report on structural buffers, the ESRB (2017) has assessed what a decision basis should include.

In this section, we first present the EU regulations on the SyRB. We then describe the main features of the ESRB report on structural buffers, and finally we discuss the distinction between the SyRB and the CCyB.

2.1. The EU capital framework

The objective of the SyRB is to ensure that banks hold capital against long-term non-cyclical risks. The SyRB can also be used to address systemic risk that is not addressed by other CRR tools. The SyRB requirement can be implemented in a differentiated manner for individual banks. A requirement exceeding 3 percent must in principle be authorised by the European Commission.⁷ The level of the SyRB may vary across institutions depending on their contribution to systemic risk and the geographical location of their exposures. In principle, banks designated as systemically important are subject to either the buffer rate for systemically important institutions or the SyRB rate, whichever is higher.⁸ Specific criteria for assessing the SyRB have not been established, but the SyRB must address risks not adequately covered by other capital requirements. In addition, the country's macroprudential authorities must review the SyRB at least every two years.

Under CRD IV, the authorities in each country may decide whether to recognise other countries' SyRB rates (reciprocity) and thus allow their banks' exposures in other countries to be subject to these countries'

⁷ For SyRB rates between 3 percent and 5 percent, the European Commission issues an opinion, and the relevant country's macroprudential authority must comply with that opinion or explain why not. However, this is not the case if the SyRB rate applies only to domestic exposures. For buffer rates above 5 percent, an application for authorisation must be made to the European Commission.

⁸ The buffer rate for systemically important institutions can be set up to 2 percent of total exposures, and the requirement should as a minimum be assessed by the banks size, importance for the economy, cross border activity or interlinkages with the rest of the financial system. The SyRB and the buffer for systemically important institutions are additive when the SyRB only applies to domestic exposures.

SyRB requirements. A country that has introduced a SyRB may request the ESRB to issue a recommendation to other countries to recognise its buffer. To date, the ESRB has issued only one such recommendation, to recognise Estonia's SyRB of 1 percent. The ESRB recommendations are not legally binding ("soft law"). Norway has not yet requested other countries to recognise its SyRB. However, foreign banks with the largest exposures in Norway are subject to their home countries' SyRB rates of 3 percent, which apply to all exposures, including exposures in Norway.

The EU has revised its capital framework (CRR II/CRD V). For example, the revisions entail increased flexibility in the use of the SyRB to enable it to target specific sectors, such as residential or commercial real estate exposures. Moreover, the requirement for the SyRB to address structural systemic risks has been removed. On the other hand, the new framework prohibits the SyRB from being used to mitigate risk that can be addressed by other tools, such as the CCyB and the buffer for systemically important institutions. Furthermore, the SyRB and the buffer for systemically important institutions will be deemed additive. This means that the SyRB will always be in addition to the buffer for systemically important institutions, whereas this requirement only applies as an exception under the current CRD IV. Notification and authorisation of the SyRB rate at the EU level has also been simplified. The majority of the revisions to the framework will enter into force in the first half of 2021, but it is uncertain when the revisions will be implemented in the EEA Agreement and Norwegian law. This paper is therefore based on CRD IV.

2.2. The ESRB report on structural buffers

The ESRB (2017) report on structural buffers describes the application of and provides advice on the assessment of the SyRB and the buffer for systemically important institutions. To assess the SyRB, the ESRB divides structural systemic risks into three broad risk categories and related subcategories.

The first risk category is risks stemming from the propagation and amplification of shocks within the financial system, which may reflect homogeneity of bank assets and business models and banks' interconnectedness. The second risk category is systemic risks stemming from the structural characteristics of the banking sector as a whole. The banking sector can be large and important for an economy, with a large number of foreign institutions and other structural characteristics that give rise to systemic risk. The third and last risk category is the risk of negative shocks to the banking sector stemming

from the real economy, for example because the economy is open and thus vulnerable to external shocks or because households and non-financial enterprises are vulnerable owing to high debt levels.

The ESRB proposes a number of metrics that may be relevant for the assessment of the various risk categories (see Annex 1 for an overview). The ESRB also suggests a number of models that can be used to assess the SyRB, including stress tests featuring network models and analyses of optimal capital requirements.

The report emphasises that the analyses and the process of assessing and setting the SyRB should be publicly available. This will help economic agents make informed decisions quickly and efficiently. The report also recommends publishing a strategy for the use of the SyRB to increase predictability and enhance agents' understanding of changes to the buffer rate. Furthermore, the report recommends the subsequent evaluation of the SyRB in order to assess the impact of the buffer in the light of its objective.

2.3. The distinction between the SyRB and the CCyB

Systemic risk is not only structural but can also be cyclical (time-varying). Structural systemic risks are more permanent vulnerabilities in the financial system, while cyclical systemic risks increase when financial imbalances are building up. Cyclical systemic risks usually increase in periods of strong credit growth and property price inflation, when banks and borrowers often take on considerable risk.

The objective of the CCyB is to strengthen the resilience of the banking system by requiring banks to build an extra capital buffer when cyclical systemic risks build up in good times.⁹ In the event of a downturn with large bank losses, the CCyB rate can be reduced to mitigate the risk that banks will amplify the downturn by over-tightening their lending to meet capital requirements.

In principle, there should be a clear difference between the assessments of the SyRB and the CCyB. The assessment of the CCyB should capture the cyclical element of the vulnerabilities, while the assessment of the SyRB should capture the structural element. In practice, however, making a clear distinction between the structural and cyclical dimensions of systemic risk is difficult. Systemic risks are

⁹ Norges Bank has recently published an updated countercyclical capital buffer framework (see Norges Bank 2019b), which describes the principles and information basis for Norges Bank's advice on the countercyclical capital buffer, including the indicators used.

generally partly structural and partly cyclical, and structural and cyclical systemic risks can be mutually reinforcing.

The assessments of the SyRB and the CCyB should primarily differ in the risk categories they address. Assessing the development of financial imbalances, such as risk appetite and vulnerabilities in the property market, is an important part of the information basis for the CCyB. These areas are less relevant for a SyRB for structural systemic risks, as discussed in this paper.

The risk category covered to the greatest extent by both buffer requirements is household and corporate sector vulnerabilities. These vulnerabilities are included in Norges Bank's decision basis for the CCyB and in the ESRB recommendations for assessing the SyRB. Nevertheless, the information on these vulnerabilities should be used differently in the two assessments. For the CCyB, developments in indicators are analysed and the current situation is compared with historical trends and averages. For the SyRB, on the other hand, the analysis focuses on the level of the indicators and may include comparisons across countries, for example.

There is no mechanical relationship between developments in indicators and Norges Bank's advice on the level of the CCyB. Norges Bank's advice builds on broad-based judgement in addition to indicators and analyses. The same should apply to the assessment of the SyRB.

3. Application of the SyRB across countries

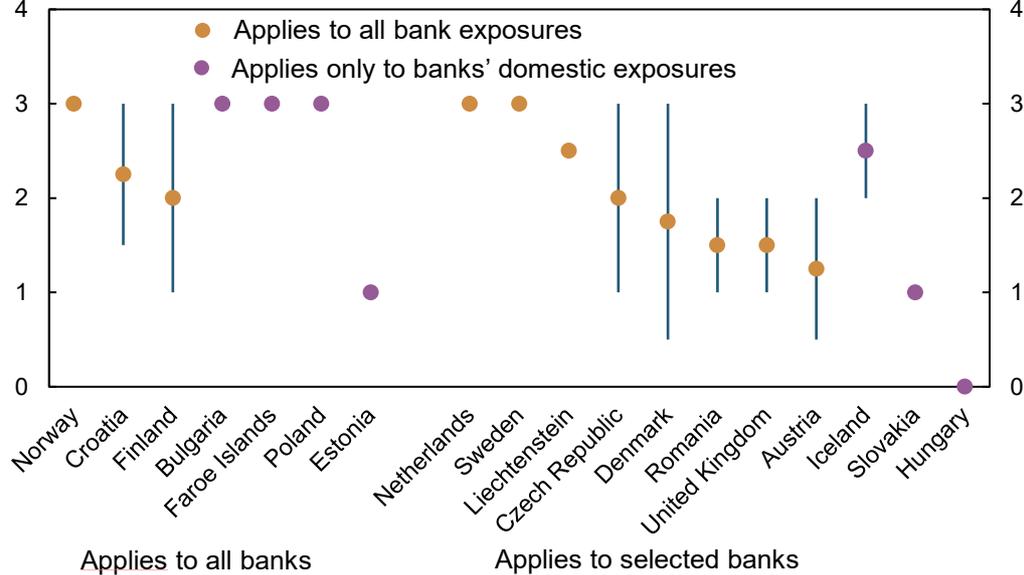
A total of 18 European countries have introduced a SyRB. The level and scope of the buffer requirements vary widely. In most of these countries, the SyRB applies only to selected banks, and in many cases, differentiated SyRB rates have been set for individual banks within a jurisdiction (see lines in Chart 1). In the majority of countries with a SyRB for individual banks, the SyRB applies to all exposures (yellow dots in Chart 1). In most countries with a SyRB for all banks, the SyRB applies only to domestic exposures (purple dots in Chart 1).¹⁰ Eleven countries have set a SyRB rate of 3 percent for one or more banks, but no country has set a SyRB rate higher than 3 percent.¹¹ If the SyRB in

¹⁰ If the June proposal from the Ministry of Finance is implemented, Norway's SyRB will also, in principle, apply only to domestic exposures.

¹¹ In reports submitted to the ESRB, Norway has notified a SyRB of 5 percent for DNB and Kommunalbanken and 3 percent for all other banks. The higher buffer requirement for DNB and Kommunalbanken reflects the designation of these banks as systemically important institutions. See eg [the press release from the Ministry of Finance, 23 May 2019](#) (in Norwegian only).

Norway is increased to 4.5 percent, Norway's SyRB will be the highest in Europe by a clear margin.

Chart 1: Level¹⁾ of the SyRB in EU/EEA countries. Percent. October 2019



1) The lines show variation in SyRB rates across banks, and the dots show the average of the highest and lowest SyRB rate
Sources: Countries' notifications to the ESRB, the Ministry of Finance and Norges Bank.

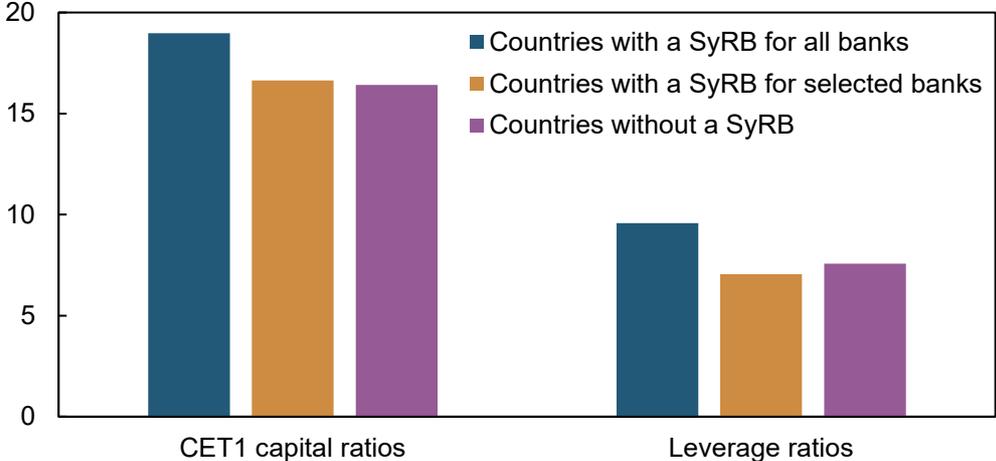
Banks' capital ratios are higher in countries with SyRBs for all banks than in countries without a SyRB. Banks' CET1 capital ratios, ie CET1 capital¹² as a share of risk-weighted assets, average 2.6 percentage points higher in countries that have implemented a SyRB for all banks¹³ than in EU countries without a SyRB (Chart 2). At the same time, leverage ratios, ie equity as a share of total assets, are 2.0 percentage points higher. Of the countries with a SyRB for all banks, the SyRB rate has been set at 3 percent of risk-weighted assets in Bulgaria, Norway and Poland, while in Estonia, Finland and Croatia, the SyRB rate is between 1 and 3 percent (Chart 1). Total buffer requirements for all six countries are also high compared with other EU countries.

In countries that have implemented a SyRB only for selected banks, banks' CET1 capital ratios average only slightly higher than in countries without a SyRB, while leverage ratios are somewhat lower (Chart 2). There may be a number of reasons for this. One is that countries without a SyRB have set buffers for systemically important institutions,

¹² CET1 capital is banks' equity less eg intangible assets, such as goodwill and deferred tax assets.
¹³ These countries are Bulgaria, Croatia, Estonia, Finland, Norway and Poland. The EBA does not publish capital ratios for the Faroe Islands.

while many of the countries with SyRBs for selected banks do not have an extra buffer for systemically important institutions.

Chart 2: CET1 capital ratios and leverage ratios. Average for groups of EU/EEA countries with and without a SyRB. Percent. 2019 Q1



Sources: European Banking Authority (EBA), ESRB and Norges Bank

Looking more closely at the application of the SyRB across countries, there are few commonalities other than the reasons given and the use of metrics, which are fairly similar in some countries (Table 1). This reflects cross-country variation in structural systemic risk and the lack of a common framework for applying the SyRB in the EU. However, the comparison is limited, as few countries have published an assessment of the SyRB. This section is therefore based on the notifications sent by countries to the ESRB, which include a description of the SyRB, the main reasons for the SyRB rate and the metrics used for activation of the SyRB.¹⁴

¹⁴ See the [ESRB website](#) for notifications and an overview of the SyRBs in the EU/EEA countries. Norway has not submitted notification on the Norwegian SyRB to the ESRB.

Table 1: Main reasons and metrics used for the SyRB in EU/EEA countries. At October 2019

Scope	Country (buffer rate)	Main reason	Metrics
All banks	Norway (3%)	Structural vulnerabilities in the economy and the financial system	No published list of metrics
	Estonia (1%)	Small open economy	Several metrics, eg volatility of GDP growth, concentration of exports, bank loan portfolios and household financial assets
	Faroe Islands (3%)	Small open economy dependent on fisheries and aquaculture	Five metrics, eg export of various species of fish, GDP growth and bank lending to various sectors
	Poland (3%)	Uncertain economic outlook	Stress test
	Finland (1% - 3%)	Bank balance sheets	11 metrics, eg banks' exposures to different sectors and debt in the household and non-financial sectors
	Bulgaria (3%)	Banking sector structure and activities	Several metrics, eg bank assets and liabilities, concentration, capital adequacy and profitability, and macroeconomic developments
	Croatia (1.5% – 3%)	Debt, concentrated banking sector and systemically important institutions	Several metrics, eg public, private and foreign debt, concentration of banks, unemployment and individual banks' total assets
Selected banks	Denmark (0.5% – 3%)	Systemically important institutions	Individual banks' total assets, exposures and deposits
	Netherlands (2.5%)	Systemically important institutions	EBA scoring system ¹
	Slovakia (1%)	Systemically important institutions	EBA scoring system ¹
	United Kingdom (1% – 2%)	Systemically important institutions	Individual banks' total assets
	Czech Republic (1% – 3%)	Systemically important institutions	EBA scoring system ¹
	Sweden (3%)	Large, homogeneous and interconnected banks	Eg exposures and funding of the largest banks and the banking sector's total assets as share of GDP
	Iceland (2% – 3%)	Small open economy	Several metrics, eg volatility of GDP growth, consumption and exchange rates, household debt and concentration of exports
	Austria (0.5% – 2%)	Size of the banking sector, exposures and ownership	12 metrics, eg banks' total assets, banks' exposures in Central and Eastern Europe and public ownership of banks
	Liechtenstein (2.5%)	Small open economy with a concentrated and large banking sector	Several metrics, eg size and openness of the economy, size of banks, importance of the banking sector
Romania (1% – 2%)	Non-performing loans	Banks' share of non-performing loans and coverage ratio ²	
Hungary (1% – 2%)	Non-performing commercial real estate (CRE) project loans	Six metrics, eg different measures for banks' share of non-performing CRE loans	

¹ Based on weighting of ten mandatory indicators for bank size, importance, complexity, cross-border activity and interconnectedness, plus a number of optional indicators (see EBA (2014))

² Impairment losses as a percentage of non-performing loans

Sources: Countries' notifications to the ESRB, the Ministry of Finance and Norges Bank

Of the seven countries that apply the SyRB to all banks, Estonia and the Faroe Islands have cited their small open economies as the main reason for implementing the SyRB as their banks are vulnerable to external shocks. Estonia uses a broad set of metrics to calibrate the SyRB, including volatility of GDP growth, exports and imports as a share of GDP, concentration of exports and household financial assets. In the reasons for its intended SyRB given by Estonia, these indicators are compared with those of other countries.¹⁵ Estonia also uses stress testing in its calibration of the SyRB. The reasons given by Poland are its open economy and uncertain economic developments ahead, partly owing to Brexit and global trade tensions, which are taken into account in the stress test conducted to calibrate the SyRB.

The main reasons given by Finland and Bulgaria for their SyRB rates are vulnerabilities related to banks' balance sheets, as reflected by many of the indicators they use. Moreover, Bulgaria uses metrics for, for example, bank profitability and macroeconomic developments, while Finland uses indicators for household debt and non-financial corporate debt. Finland compares the indicators with their historical averages and corresponding indicators for other European countries. Croatia has included high levels of debt, both public, private and foreign, a concentrated banking sector and macroeconomic conditions among the reasons for its general SyRB rate of 1.5 percent for all its banks. The largest banks in terms of total assets also have a higher SyRB, which is in effect an extra buffer for systemically important institutions. Finland also has such an add-on for its largest banks.

Of the 11 countries that have introduced the SyRB for selected banks, five countries have introduced the SyRB for systemically important institutions only (the Czech Republic, Denmark, the Netherlands, Slovakia and the United Kingdom). In the Czech Republic, Netherlands and Slovakia, the decision basis for the SyRB is based on a scoring system developed by the EBA for assessing systemically important institutions.¹⁶ In Denmark and the United Kingdom, the size of the SyRB depends on eg a bank's total assets.

The other countries that have imposed a SyRBs only on their largest banks have different reasons for introducing the SyRB. Sweden applies the SyRB to its three largest banks because these banks are fairly homogeneous and interconnected. Thus, a shock affecting one bank

¹⁵ See Eesti Pank (2018).

¹⁶ See EBA (2014).

will most likely affect or spread across all three banks. In addition, the banking sector in Sweden is large and the three largest banks are a crucial part of it.¹⁷ The reasons given by Iceland, as by Estonia and the Faroe Islands, are its small open economy. A number of the indicators used by Iceland are similar to those used by Estonia, and Iceland also compares the indicators it uses with those used by other countries and uses stress testing.¹⁸ Austria also argues that the size of its banking sector indicates systemic risk. The Austrian SyRB varies across banks according to their exposures in emerging markets in Eastern Europe. Moreover, the SyRB varies with banks' ownership structures because a bank's ownership structure can make recapitalisation difficult in a crisis. Liechtenstein argues that as a small open economy, shocks can be amplified by a large and concentrated banking sector. In Romania and Hungary, the SyRB only applies to the banks with the highest shares of non-performing loans. However, in Hungary, no banks are currently subject to the SyRB because all the banks are below the thresholds set for non-performing loans.

4. Indicators for the SyRB in Norway

In this section, we assess indicators for the Norwegian SyRB based on structural features of the banking sector as well as financial system vulnerabilities and characteristics of the economy that may amplify systemic risk. We assess the ESRB's three main categories of structural systemic risk (see Section 2.2), and identify the most important structural features in Norway.

The first main category comprises risks stemming from the propagation and amplification of shocks within the financial system. The largest Norwegian banks are quite similar. The largest banks have large real estate exposures and wholesale funding accounts for a significant share of funding. Shocks can thus affect banks in the same way and at the same time. These banks are also closely interconnected, which allows the shocks to propagate and amplify. Similarity among banks and interconnectedness is discussed in greater detail in Section 4.1.

The second main category comprises systemic risk stemming from structural characteristics of the banking sector. The Norwegian banking

¹⁷ Sweden requires a buffer for systemically important institutions of 2 percent for its three largest banks, but considers the buffer insufficient for addressing the risk banks pose to the financial system. This may partly explain why Sweden has imposed a SyRB of 3 percent on the same banks. Moreover, these banks are subject to a Pillar 2 requirement of 2 percent because a higher SyRB requires EU authorisation.

¹⁸ Iceland's Financial Stability Council (2016).

sector is fairly large, and shocks to banks may thus have serious consequences for the real economy. The banking sector is further concentrated in a few large institutions. Problems in one of these may significantly reduce credit supply and add to systemic risk. This is discussed in greater detail in Section 4.2.

The third main category comprises structural risks to the banking sector stemming from the real economy. In Norway, household debt is particularly high. Given this vulnerability, a shock to households or the banking sector could amplify systemic risk. Moreover, Norway is a small, open economy, and external shocks may propagate in the Norwegian banking sector. This is discussed in greater detail in Section 4.3.

An assessment of the SyRB in Norway should include a set of indicators for each of these risk categories.¹⁹ The indicators that we suggest are best suited to motivate the use of the SyRB and changes in the buffer requirement. Moreover, the indicators should be assessed over time because structural systemic risk often changes slowly. These indicators are less suited for assessing an appropriate level for the SyRB. To assess the level, model-based analyses are more relevant (see Section 5).

4.1. Banks are similar and interconnected

Shocks can propagate and amplify within the financial system. When banks' balance sheets are fairly similar in terms of both exposures and funding, market shocks can affect most banks' assets and funding in the same way and at the same time, thus increasing systemic risk.

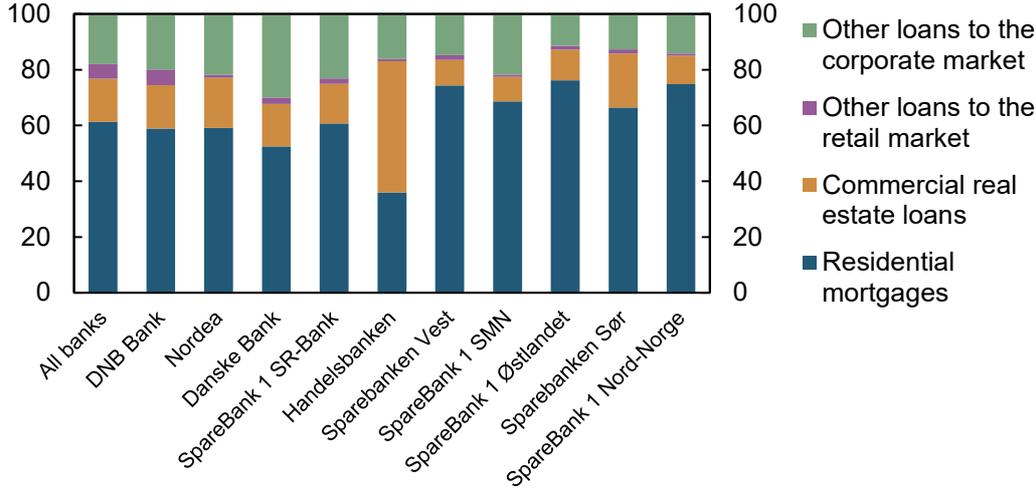
If banks are closely interconnected, shocks may quickly spread between banks even if only one or a few of them face difficulties. Problems at one bank may result in direct contagion when the bank defaults on loans issued by other banks. Contagion may also spread indirectly, for example through falling asset prices, resulting in bank losses. Banks could then find it difficult to raise funding and would need to sell assets, amplifying the fall in prices and leading to even greater losses. The risk of indirect contagion increases when banks have similar assets or funding.

An important feature in Norway is that the ten largest banks, which account for most of total lending (see Section 4.2), have similar

¹⁹ See Appendix 1 for an overview of all of the ESRB's suggested metrics, including those we consider irrelevant for the assessment of the Norwegian SyRB.

exposures. These banks have a large share of mortgage exposures, both residential and commercial. For most banks, 75 percent or more of their Norwegian exposures are in real estate (Chart 3). Banks' residential exposures are clearly larger, while commercial real estate (CRE) is the single largest sector among corporate exposures. Banks' share of real estate exposures has increased somewhat in recent years.

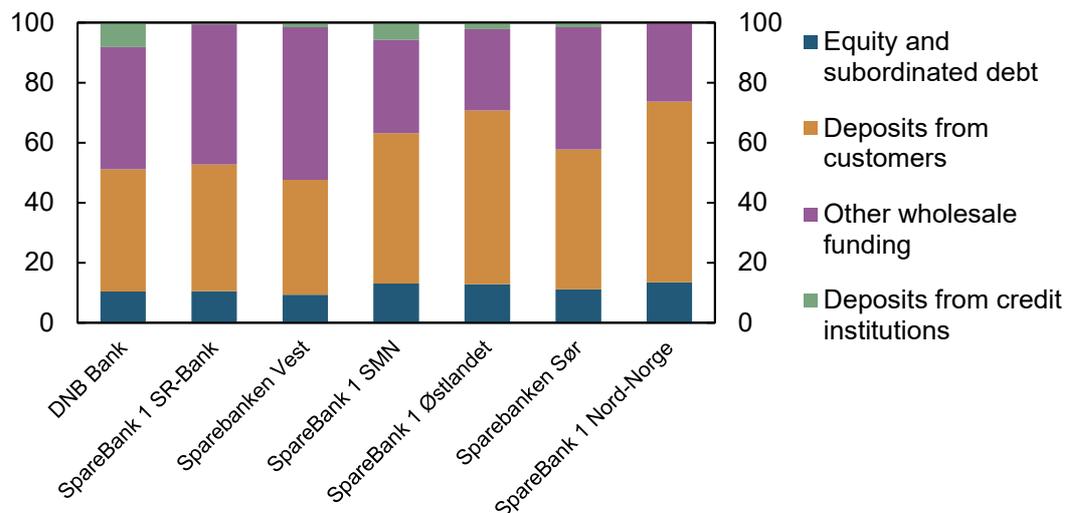
Chart 3: Lending from the ten largest banks and all banks in Norway.¹⁾ Percent of Norwegian retail and corporate market lending. 2018



1) Residential mortgage lending from covered bond mortgage companies is included. Santander Consumer Bank is excluded. "All banks" mean all banks and covered bond mortgage companies in Norway
 Source: Norges Bank

Another important feature is that the largest Norwegian banks rely on wholesale funding (Chart 4). The high wholesale funding share (deposits from credit institutions and other wholesale funding in Chart 4) makes banks vulnerable to disturbances in financial markets. However, much of the wholesale funding comprises long-term bonds, and the Norwegian banks fulfil regulatory liquidity requirements (see Norges Bank 2019a). As a result, banks are less vulnerable to brief episodes of funding market turbulences but are nevertheless vulnerable if the turbulence persists over some time. In ESRB (2017), similar funding structures is interpreted as a sign of commonality of bank business models, entailing higher systemic risk. The wholesale funding share of Norwegian banks increased substantially ahead of the financial crisis in 2008 but over the past ten years has remained fairly stable.

Chart 4: Funding sources for the seven largest Norwegian banks.¹⁾ Percent. 2018



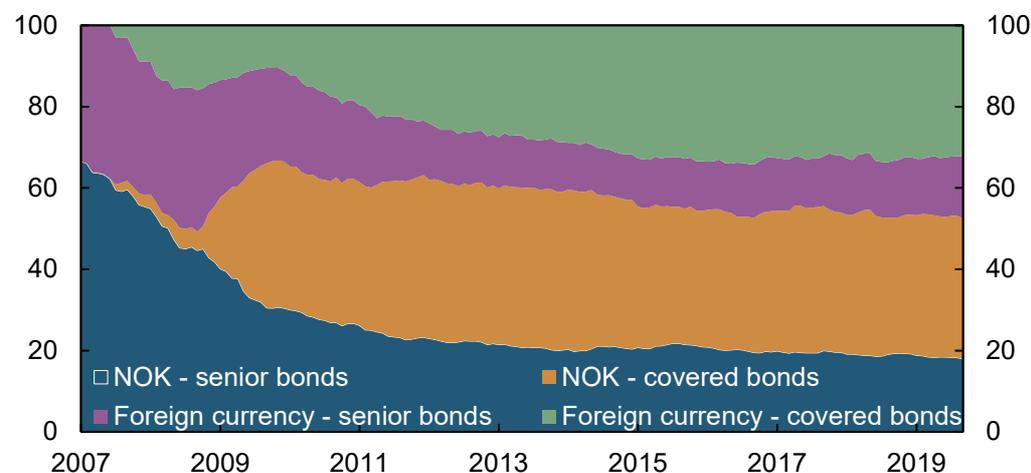
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1) Foreign branches in Norway and Santander Consumer Bank are excluded.
Consolidated figures
Source: SNL/S&P MI

Much of banks' wholesale funding is in the form of covered bonds (Chart 5), where the houses being financed serve as collateral for the bondholders. Banks may face funding constraints if investor demand for covered bonds falls, for example as a result of a sharp decline in house prices. Norwegian banks' foreign currency bond market funding has also increased over several years and is now almost equivalent to their NOK funding (Chart 5). Access to foreign markets and investors contributes to a greater diversification of banks' funding. At the same time, this access ties banks more closely to international financial markets, making them more vulnerable to turbulence in these markets.

Chart 5: Banks' and covered bond mortgage companies' bonds outstanding by bond and currency. Percent. January 2007 - September 2019

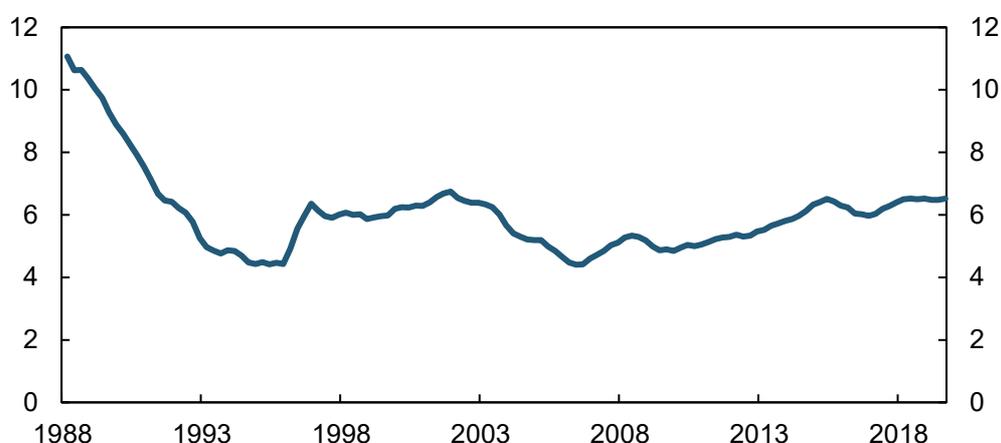


Sources: Bloomberg and Stamdata

Norwegian banks are closely interconnected through cross-holding, increasing the risk of rapid contagion of interbank turbulence. A default by a single bank could inflict direct losses on other banks. The cross-holding of Norwegian banks (including mortgage companies) and their exposures to other financial institutions have increased somewhat since the financial crisis, but are lower than before the banking crisis in the early 1990s (Chart 6). The rise after the financial crisis primarily reflects banks' considerable cross-holding of covered bonds, which has increased over several years (Chart 7).²⁰ Simultaneous fire sales of large covered bond holdings by a large number of banks may quickly push down the value of these holdings and be a source of indirect losses for many banks. A concurrent fall in house prices may worsen problems and prompt further fire sales of covered bonds. Indirect losses will typically be considerably larger than direct losses (see Section 5.1 and Norges Bank 2019a).

Summing up, we consider the following five indicators as suitable for assessing the risk of shocks propagating and amplifying within Norway's financial system (Table 2): (i) largest banks' share of exposures in different segments, (ii) largest banks' funding shares by funding source, (iii) banks' foreign currency wholesale funding, (iv) interbank cross-holdings and (v) banks' holdings of bonds issued by mortgage companies. Developments in some of these indicators, particularly the increase in banks' real estate exposures and banks' covered bond holdings, suggest somewhat higher structural systemic risk in recent years.

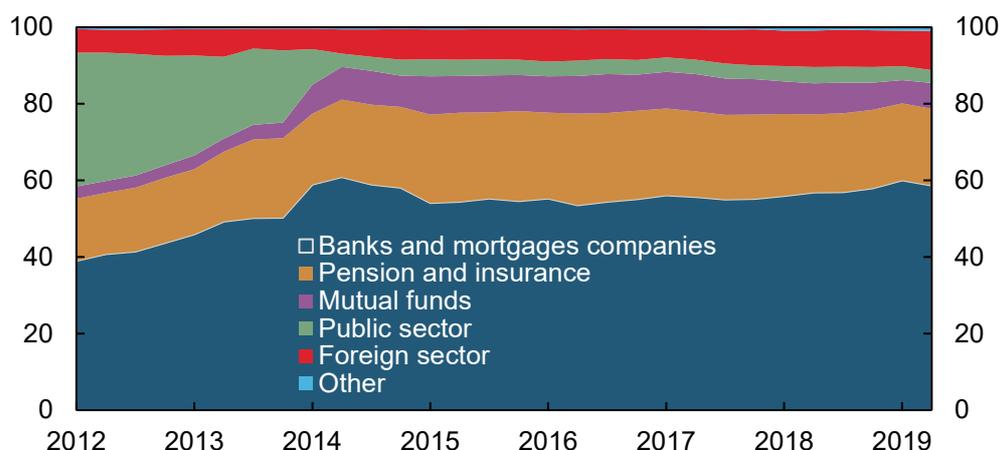
Chart 6: Banks' cross-holdings and exposures to other financial institutions as a share of banks' total assets. Sum of the previous four quarters. Percent. 1988 Q1 – 2019 Q3



Source: Norges Bank

²⁰ See Lind (2016) for an analysis of the interconnectedness of Norwegian banks.

Chart 7: Outstanding bonds issued by mortgage companies in NOK. Ownership composition by sector. Percent. 2012 Q1 – 2019 Q2



Source: Statistics Norway (VPS)

4.2. The banking sector is large and concentrated

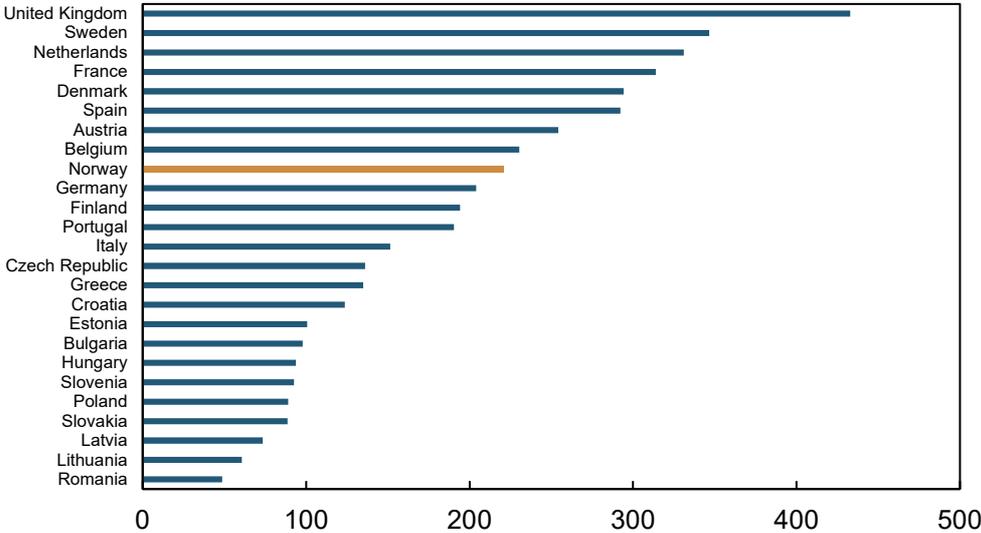
A large banking sector that accounts for a significant share of the credit supply and financial services in the economy may amplify economic downturns if banks tighten lending when faced with the prospect of large losses. A high degree of banking sector concentration also adds to systemic risk. A financial sector comprising a small number of large financial institutions is more vulnerable to problems in individual institutions.

The Norwegian banking sector is fairly large and important for the economy. Banks are the most important source of credit in Norway, accounting for over 80 percent of the provision of domestic credit to the non-financial sector.²¹ The Norwegian banking sector's total assets as a share of GDP are also fairly high compared with other countries (Chart 8). Loans account for most of Norwegian banks' assets, and bank loans are equivalent to over 160 percent of mainland GDP.²² Bank lending has increased faster than GDP for several years. Moreover, nearly all bank lending is to Norwegian borrowers, virtually unchanged over several years at 95 percent of banks' total lending. Since the Norwegian banking sector is fairly large and an important source of credit for Norwegian borrowers, problems in the sector may have a significant impact on the real economy.

²¹ All banks and mortgage companies in Norway including Eksportfinans. Non-financial sector includes households, non-financial enterprises and local government.

²² Lending to the non-financial sector from banks, foreign branches and mortgage companies at 30 June 2019.

Chart 8: Total assets of selected countries' banking systems. Percent of GDP¹⁾. Consolidated figures. 2018 Q3

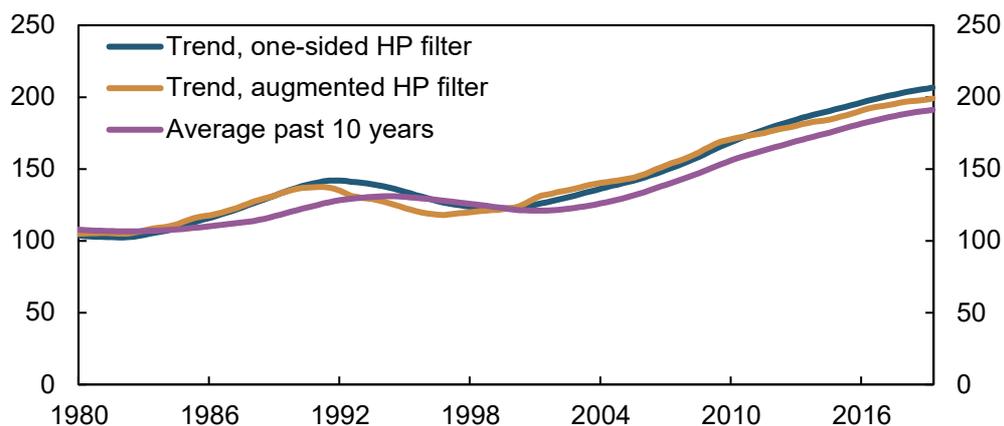


1) Mainland GDP is used for Norway
 Source: Norges Bank

A high total debt level in the economy means that problems in the banking sector have the potential to impose serious negative consequences on the real economy. An indicator for assessing systemic risk over time is the trend in total credit-to-GDP, which by the way is not among the ESRB's suggested metrics (ESRB 2017). In Norway, this trend is at a historically high level and has been rising for a long period (Chart 9). By assessing the trend, we remove some of the cyclical variations. In contrast, we are particularly interested in the cyclical variations when we assess the CCyB.²³

²³ The same trend is used in the estimation of the credit gap in assessments of the CCyB (see Norges Bank 2019b).

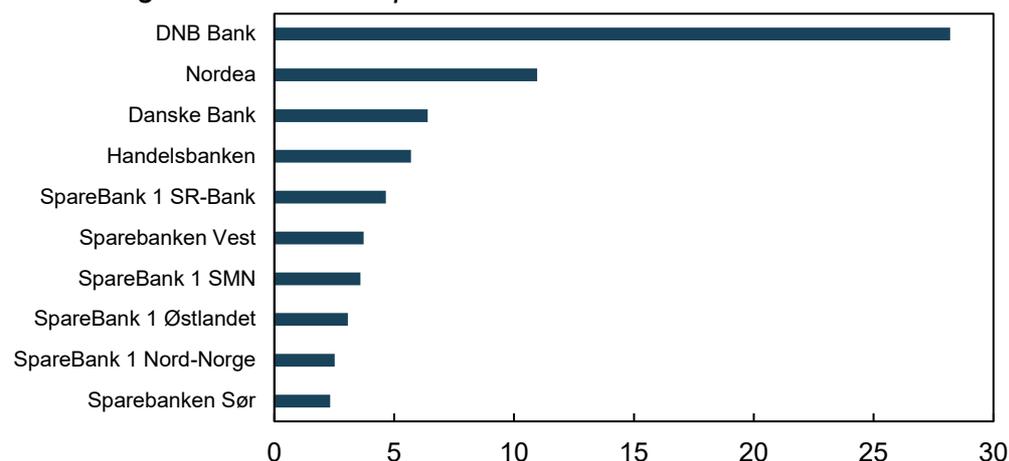
Chart 9: Estimated trends¹⁾ for total credit to mainland Norway. Percent of mainland GDP. 1980 Q1 – 2019 Q2



1) One-sided Hodrick-Prescott filter with $\lambda = 400\,000$; the same filter estimated on data augmented with a simple projection and the average for the past 10 years
Sources: IMF, Statistics Norway and Norges Bank

The Norwegian banking sector is concentrated. As a metric for assessing systemic risks, the ESRB (2017) suggests the five largest banks' share of total lending. In Norway, the five largest banks account for over half of total lending, while the 10 largest banks account for approximately 70 percent of total lending and total mortgage lending. The concentration is partly due to the domination of a single bank, DNB, which accounts for approximately 30 percent of total lending (Chart 10).²⁴

Chart 10: Market shares of the largest banks in Norway.¹⁾ Gross lending to Norwegian retail and corporate markets. Percent. 2018



1) Banks include subsidiary and affiliated covered bond mortgage companies
Source: Norges Bank

²⁴ A similar metric is used for identifying systemically important banks. A bank is considered to be systemically important when its total assets are greater than ten percent of Norwegian mainland GDP and when market share of lending to the non-financial sector in Norway is above 5 percent. However, the assessment is made of banks on an individual basis, while for the systemic risk buffer concentration is assessed for the market as a whole.

The market for lending to non-financial corporates is also concentrated. Corporate loans are composite products, unlike mortgage loans, which are fairly uniform and offered by most banks. If a bank stops lending to the corporate market, finding a replacement lender may be difficult. Reduced access to corporate loans can potentially have severe real economic consequences. An indicator for concentration in the corporate lending market is the sum of the second-, third-, fourth-, and fifth-largest banks corporate exposures relative to that of the largest bank.²⁵ The motivation for this indicator is that the lower the level, the more difficult it is to replace corporate loans from the largest bank, and thus the higher the systemic risk. This indicator is fairly low in Norway. The sum of the second-, third-, fourth- and fifth-largest banks' corporate exposures is only one-fourth larger than the corporate exposures of the largest bank. This indicator is not included among the ESRB's recommendations, but we are of the opinion that it may be useful in assessing the Norwegian SyRB.

The ESRB (2017) also recommends assessing foreign ownership in the banking sector and other structural features, such as loan defaults and bank capital ratios. Three of the 10 largest banks in Norway are branches of foreign banks (Nordea, Danske Bank and Handelsbanken (Chart 10)). The branches accounted for 19 percent of retail lending and 35 percent of corporate lending at 30 June 2019. The branches may have a stabilising effect on the Norwegian economy if shocks are isolated to the Norwegian banking sector and foreign banks have the capacity and willingness to maintain credit supply when such shocks occur. However, situations may arise in which foreign banks restrict their activity in Norway in order to focus on other markets. Problems from other countries could then spread to Norway in the form of reduced credit supply to households and businesses.²⁶ In this situation, the banking sector needs to have sufficient capital to maintain the supply of credit to households and businesses that can no longer get loans from branches of foreign banks. According to the ESRB, other potential structural risks to the banking sector include structurally high levels of non-performing loans or low bank capital ratios. The Norwegian banking system currently has neither high levels of non-performing loans, nor low bank capital ratios, but we include capital ratios in the set of indicators so that any structural changes may be captured and assessed further.

Summing up, we consider the following eight indicators suitable for assessing structural features of the banking sector in Norway (see

²⁵ The indicator was used in Dahl et al (2011).

²⁶ See Turtveit (2017).

Table 2): (i) banking sector's share of domestic credit to the non-financial sector, (ii) total banking sector's assets as a percentage of Norwegian mainland GDP, (iii) banking sector lending as a share of Norwegian mainland GDP, (iv) trend in total credit as a percentage of Norwegian mainland GDP, (v) largest banks' market shares (share of total lending and total mortgage lending), (vi) next largest banks' corporate lending relative to the corporate lending of the largest bank, (vii) market shares of branches of foreign banks and (viii) capital ratio in the banking sector. Total banking sector assets and the trend in total credit have increased more rapidly than GDP for several years, which may be an indication of somewhat higher structural systemic risk. The other indicators do not indicate particular changes in systemic risk in recent years.

4.3. Household debt is high

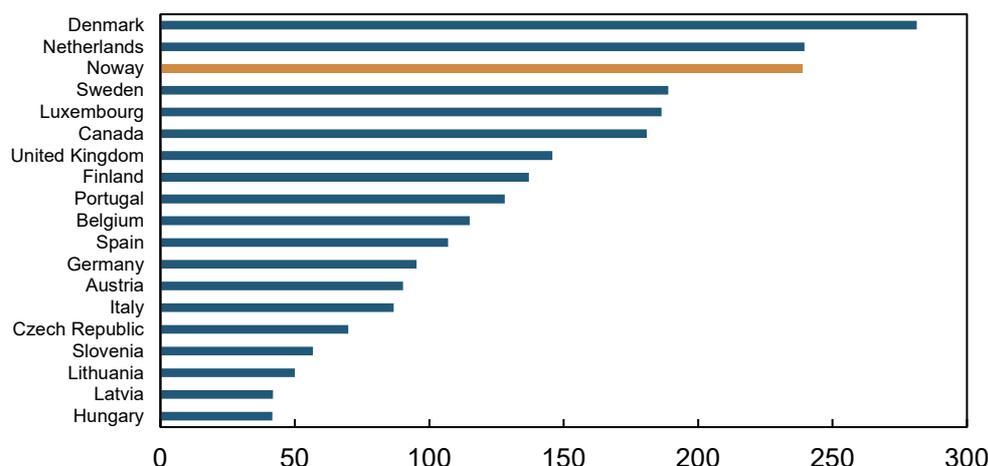
Shocks to the financial sector may originate elsewhere in the economy. The risk of such shocks depends on vulnerabilities outside the financial sector, such as households, non-financial enterprises and the public sector. High vulnerabilities in one or more of these sectors may cause even small shocks to weaken borrowers' debt-servicing capacity and demand. Shocks can also originate abroad. The risk of shocks from abroad also increases according to the proportion of the economy dependent on foreign trade and the concentration of foreign trade in individual sectors and with individual countries.

In Norway, household debt is a source of systemic risk. Norwegian households' debt-to-income (DTI) ratios are historically high and among the highest compared with other countries (Chart 11). High household debt reflects high house prices. Furthermore, most Norwegian household debt is in the form of variable-rate mortgages, and the share of new variable-rate loans is among the highest in Europe (Chart 12).²⁷ Owing to the combination of high debt and variable rates, Norwegian households are particularly vulnerable to both a decline in income and higher interest rates. Disposable income will fall in either case, which may force households to tighten consumption. A knock-on result may be debt-servicing problems among businesses, resulting in higher bank losses. How debt is distributed is also important for assessing household vulnerabilities. Household-level data up to end-2017 show that the share of households with debt over five times gross income is high and rising, as is share of debt held by these households.²⁸

²⁷ The share of variable rate debt is not one of the ESRB's suggested metrics.

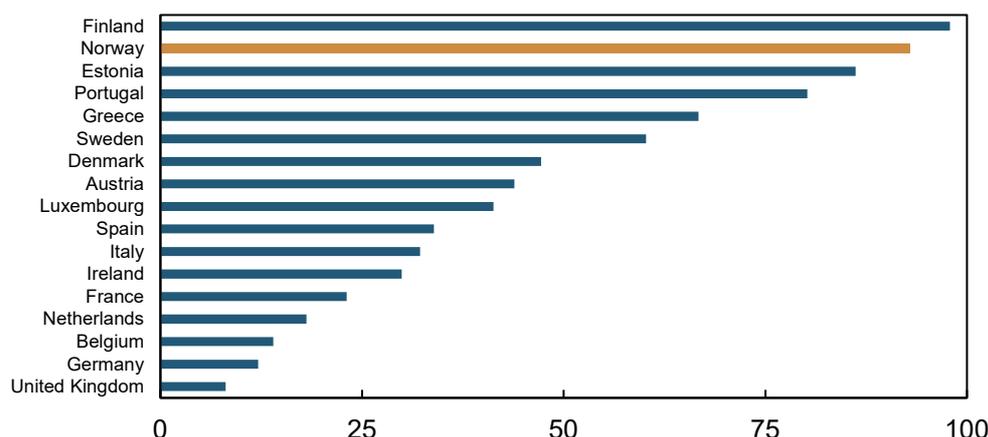
²⁸ See Norges Bank (2019a), box on higher share of highly leveraged households on page 18.

Chart 11: The ratio of household debt to disposable income. Percent. 2018



Source: OECD

Chart 12: New variable-rate household loans as share of all new household loans. Percent. 2019 Q1



Source: ESRB (2019)

Among non-financial enterprises, commercial real estate (CRE) in particular represents a vulnerability in the Norwegian financial system.²⁹ This reflects the high share of banks' CRE lending, as shown in Section 4.1, and the potential for substantial CRE losses during downturns, as history shows. In addition, commercial property prices have risen substantially for a long period, and the profitability of CRE companies is sensitive to changes in interest rates.

Measured as a share of GDP, the debt of the corporate sector as a whole is not particularly high compared with other countries.³⁰ Even though this sector is not currently considered a particular source of structural systemic risk, this may change over time. Non-financial

²⁹ See Norges Bank (2018), Section 4.

³⁰ See Norges Bank (2018), Section 4.

corporate debt relative to mainland GDP is therefore included in our set of indicators. Furthermore, the public sector, whose debt relative to GDP is low, holds substantial financial assets. The public sector's financial position is unlikely to represent a systemic risk in the foreseeable future and is therefore not included in our set of indicators.

Norway is a small, open economy and therefore dependent on international developments. An indicator of the degree of economic openness is exports and imports as a share of GDP. In 2018, Norwegian exports overall accounted for 38 percent of GDP and Norwegian imports accounted for 33 percent of GDP. One of the ESRB's metrics for how dependent a country's economy is on individual markets is the geographical breakdown of exports. Estonia, Iceland and the Faroe Islands use this metric in their SyRB assessments. This metric also indicates concentration of Norwegian exports, where Norway's six most important export partners account for half of mainland goods exports.³¹ Owing to this high degree of concentration, Norwegian exporters are vulnerable to economic developments in individual countries, with problems in the export sector possibly spreading to the wider Norwegian economy and financial system. The Norwegian economy is heavily dependent on the oil and gas sector, which accounts for the most important export products. The concentration of exports is therefore even more pronounced when oil and gas exports are included. Banks' direct exposures to the oil sector are nevertheless limited. The fall in oil prices in 2014 showed that banks' solvency would not be weakened until the oil downturn had resulted in substantial spillovers and higher losses in other industries.³²

Summing up, we consider the following six indicators as suitable for assessing whether systemic risk can be amplified by conditions outside of the banking sector in Norway (see Table 2): (i) ratio of household debt to disposable income, (ii) share of households' debt with variable interest rate, (iii) share of banks' lending to the CRE sector, (iv) credit to non-financial enterprises as a percentage of Norwegian mainland GDP, (v) exports and imports as a percentage of GDP and (vi) geographical breakdown of exports. We do not find a clear indication that this risk category has changed structural systemic risk in recent years. Household debt and CRE lending in particular have increased over several years, but a large share of the increase is likely to be cyclical.³³

³¹ According to data from Statistics Norway on mainland exports in 2018, the six countries are the Netherlands (12 percent of total exports), Sweden (10 percent), the UK (8 percent), the US (8 percent), Germany (7 percent) and Denmark (7 percent).

³² See Norges Bank (2016), Section 5.

³³ This is also part of the reason for the increase in the CCyB to 2.5 percent from the end of 2019, see eg [Norges Bank's letter of 12 December 2018 with advice on the CCyB 2018 Q4](#).

Table 2. Categories of structural systemic risk and our suggested set of indicators for the assessment of the Norwegian SyRB

Section	Main category	Subcategories	Suggested indicators for the Norwegian SyRB
4.1 Banks are similar and inter-connected	Propagation and amplification of shocks within the financial system	Exposure concentration/asset commonality	The largest banks' share of exposures in different segments
		Commonality in bank business models	The largest banks' funding shares by funding source Banks' foreign currency wholesale funding
		Financial interconnections and contagion	Interbank cross-holdings Banks' holdings of bonds issued by mortgage companies
4.2 The banking sector is large and concentrated	Structural characteristics of the banking sector	The banking sector's size, importance and concentration	The banking sector's share of domestic credit to the non-financial sector Total banking sector's assets as a percentage of Norwegian mainland GDP Banking sector lending as a share of Norwegian mainland GDP Trend in total credit as a percentage of Norwegian mainland GDP Largest banks' market shares Concentration in the banks' corporate lending
		Foreign ownership	Market shares of branches of foreign banks
		Other potential structural risks	Banking sector capital ratio
4.3 Household debt is high	The real economy's impact on the banking sector	Sectoral risks related to the private non-financial sector, households and the public sector	The ratio of household debt to disposable income Share of households' debt with variable interest rate Share of banks' lending to the CRE sector Credit to non-financial enterprises as a percentage of Norwegian mainland GDP
		Economic openness	Exports and imports as a percentage of GDP Geographical breakdown of exports

Sources: ESRB (2017) and the authors of this *Staff Memo*

5. Model analyses confirm the need for an SyRB

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A number of models can be used to assess the level of the SyRB. The ESRB (2017) mentions eg stress tests featuring network models. It is important to assess the social benefits of the total sum of capital requirements against the social costs. The SyRB should be set to ensure that total capital requirements are at the socially optimal level.

In this section, we first explore how stress tests featuring network models can be used to assess the level of the SyRB. We then discuss the relationship between the SyRB and a socially optimal level of capital requirements.

5.1. Network models illustrate the need for a SyRB

Banks are interconnected via bilateral exposures (direct interconnectedness) and common exposures (indirect interconnectedness). As a result, funding problems in one bank can spread to other banks and amplify losses in the banking sector. The risk that interbank contagion will lead to financial instability and shocks to the economy can be mitigated by a SyRB requirement to ensure that banks have sufficient loss-absorbing capital.

Norges Bank has developed a model framework to quantify possible contagion effects in the banking sector.³⁴ The analysis is based on bank losses of the same magnitude as in Norges Bank's annual stress test of the banking sector as a whole. Contagion effects owing to the structural characteristics of some banks may increase overall losses. In the stress test, this is shown by assuming that some banks incur larger losses than other banks and that banks with high losses experience funding problems. These banks will seek to shed securities to improve their liquidity. Such fire sales lead to a fall in asset prices. This triggers indirect contagion because all the banks holding these securities incur further losses. Direct contagion arises if losses owing to indirect contagion are so high that they force banks into resolution. Banks with direct exposures to other banks must then absorb losses or have their exposures converted into equity in line with the bail-in rules.

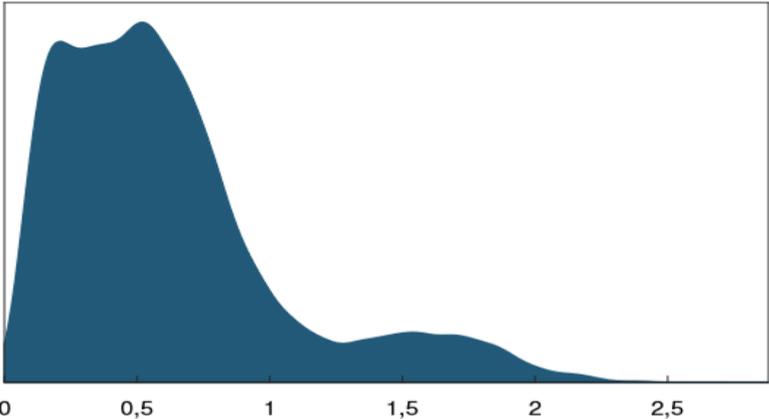
Banks' direct linkages are fairly small, while indirect linkages are larger. The model is based on the preliminary assumption that exposures that

³⁴ See further discussion in the box on assessment of contagion effects in the banking sector on page 45 of Norges Bank (2019a).

may be used for bail-ins amount to 12 percent of banks' CET1 capital. This percentage overstates the potential for bail-in losses as the data do not provide information on whether the exposures are covered by the bail-in rules. However, in the sample, securities exposures amount to 118 percent of banks' CET1 capital. Banks are important investors in the covered bond market (Chart 7 in Section 4.1) and covered bonds comprise more than 60 percent of the securities exposures of the banks in the sample. This means that fair value losses as a result of fire sales can have a significant impact on banks' CET1 capital ratios.

The results from most of the model simulations show losses owing to contagion effects related to fire sales and bail-ins of about a 0.5 percentage point fall in CET1 capital (Chart 13). In some cases, the losses lead to a more than 2 percentage point fall in CET1 capital.

Chart 13: Estimated probability distribution of losses owing to banking sector contagion.¹⁾ Percentage point fall in CET1 capital ratio (horizontal scale)



1) The shaded area sums to one.
Source: Norges Bank (2019a)

The losses mainly result from indirect contagion and are generally driven by a decline in covered bond and central and local government bond prices. Since banks have substantial exposures to these securities, even a modest price decline can result in relatively high losses. The largest losses arise when an economic downturn forces large banks to resort to fire sales. Even though the share of exposures that can be used for bail-ins is overstated in this analysis, the losses from these exposures are small.

At this stage, the analysis featuring network models is best suited to showing the importance of different mechanisms. Nevertheless, the results illustrate the need for a SyRB to ensure that banks hold enough capital to cover the losses owing to contagion effects. As the analysis is developed further, it may contribute more to the assessment of the

SyRB. For example, better estimates of contagion-related losses may provide supporting information for assessing the level of the SyRB.

5.2. SyRB for reaching optimal capital requirements

The SyRB should be set with a view to bringing the total capital requirements for banks to an economically optimal level. In other words, so that banks' capital levels under the combined capital requirements are high enough for banks to absorb losses in turbulent times, but not so high as to limit access to credit unnecessarily in normal times. The ESRB (2017) mentions calculation of the optimal level of capital as a possible method for calibrating the SyRB. Moreover, using the SyRB to achieve the optimal level of capital makes sense because it is the only buffer requirement that can be set to address systemic risks not covered by other instruments.

The current capital requirement for Norwegian banks is about 15 percent³⁵, including a 3 percent SyRB. If the economically optimal capital requirement deviates from this, the SyRB should be recalibrated accordingly. The optimal capital requirement can be calculated in a number of ways. The results vary between the different methods and assumptions, and therefore involve uncertainty.

Stress tests can be used to estimate the capital banks need to withstand a shock, in order to mitigate the consequences for the banking sector and the real economy. The results, and hence the estimated necessary capital level, will be sensitive to assumptions about the shock and behavioural reactions.

One stress test method is to examine bank losses during previous crises and assess whether banks currently have sufficient capital to absorb corresponding losses. In an estimate from 2015, Norwegian banks incurred losses were assumed to correspond to three different periods of crises and turbulence. The estimate showed that such losses could reduce the capital of Norwegian banks to such an extent that they would face serious difficulties.³⁶ Since 2015, banks' capital ratios have increased, so that the same analysis today would likely indicate less severe difficulties for banks. Norges Bank conducts an annual stress test that is reconciled with its assessment of financial imbalances. The stress test is therefore best suited for assessing the CCyB. Stress tests

³⁵ Minimum and buffer Common Equity Tier 1 (CET1) requirements amount to 12 percent of risk-weighted assets for most banks and 14 percent for systemically important banks. In addition, Finanstilsynet (Financial Supervisory Authority of Norway) has also set additional requirements for most Norwegian banks, and the requirements amount to between 1.5 and 2 percent for the larger banks.

³⁶ See box on page 27 of Norges Bank (2015) on the leverage ratio based on losses in three previous crises.

with greater relevance for the SyRB are those in which structural vulnerabilities are materialised with the help of, for example, network models that show potential losses resulting from interbank connectedness (see Section 5.1).

Unlike stress tests, which only assess banks' loss-absorbing capacity, a more holistic estimation of the optimal capital level will take account of both benefits and costs of higher bank capital levels. In the wake of the financial crisis, Basel Committee (2010) quantified the benefits and costs of higher proposed Common Equity Tier 1 (CET1) requirements. The Committee's premise is that the benefits of higher capital requirements occur through the reduced crisis probability. As crises generally result in a substantial fall in GDP, reduced crisis probability will increase expected GDP. The analysis assumes that the cost of higher capital requirements occurs in the form of higher lending rates. For banks, equity funding is assumed to be more expensive than debt funding, so that funding costs increase when the capital requirement is raised. This is passed through to higher lending rates, which reduces economic activity and GDP. The optimal capital level will be one that provides the highest expected net benefit (benefits less costs).

In the cost-benefit calculation, three uncertain factors in particular determine the level of the optimal capital requirement: i) the effect of higher bank capital ratios on crisis probabilities, ii) the extent of the fall in GDP during crises (crisis severity) and iii) the reduction of GDP in normal times in response to higher bank capital ratios. Crisis probability is normally assumed to decrease as capital ratios increase. Crisis severity is also lessened when banks have built up capital³⁷, but this is not taken into account by Basel Committee (2010). The net benefit of increasing capital ratios will be positive as long as the reduction in the risk of a crisis provides a greater increase in expected GDP (crisis severity multiplied by the changed crisis probability) than the reduction in normal GDP resulting from higher capital ratios.

Based on Basel Committee's (2010) main results, the optimal capital ratio is somewhere between 10 and 15 percent, measured as total equity capital as a share of risk-weighted assets.³⁸ Most Norwegian capital requirements for banks, including the SyRB, are measured as the ratio of CET1 capital to risk-weighted assets. Converted to CET1

³⁷ See eg Jorda et al (2017) and Castro (2019).

³⁸ Basel Committee (2010) did not refer explicitly to an optimal capital level, which, however, may be derived from the results (see Basel Committee 2019).

capital, the estimated optimal capital ratio is on the order of between 8 and 12 percent.³⁹

A similar estimate of the optimal capital ratio based on Norwegian data finds that the optimal capital requirement is a CET1 capital ratio of somewhere between 13 and 23 percent (see Kragh-Sørensen 2012). Owing to both lower costs in normal times and steeper falls in crisis probability resulting from increased capital ratios, the estimated optimal capital ratio is higher than the Basel Committee's estimates.

Newer studies have generally concluded that the optimal capital ratio is just as high or higher than the estimates based on Basel Committee (2010), and some are even higher than Kragh-Sørensen (2012) (see Basel Committee 2019). The results are a CET1 capital ratio of between 10 and 25 percent, which deviates somewhat from Basel Committee's (2010) estimates, owing to a number of factors. Basel Committee (2019) points out, however, that the estimates continue to be shrouded in considerable uncertainty and that further work is needed to improve the results. For example, little is known about the effect on a future crisis of new liquidity requirements and bank recovery and resolution rules. The Committee further points out that the analyses may be improved by better identification of financial crises and improved estimates of how much more expensive for banks equity funding is than debt funding.

In addition to these cost-benefit analyses, DSGE models can also be used to estimate the long-term benefits and costs of higher bank capital ratios. An example of using DSGE models for assessing the SyRB can be found in Brennani et al (2017), where the optimal capital ratio in France is estimated at about 10 percent. The paper points out that this is lower than the total capital requirement for the largest French banks, and the result is used to indicate that a SyRB is not needed in France. A review of many studies based on all the different methods for estimating optimal capital requirements (stress tests, cost-benefit analyses and DSGE models) finds a median of the estimate of the CET1 capital ratio of 13 percent.⁴⁰ There is, however, a larger range around the median than what Basel Committee (2019) found, and DSGE model-based studies provide some of the lowest estimates, a CET1 capital ratio of about 10 percent.

³⁹ Based on Fender et al (2016). Converting the Basel Committee's estimate measured as tangible common equity (TCE) as a share of risk-weighted assets (RWA) under Basel II to a CET1 capital ratio as a share of RWA under Basel III, is sensitive to country and time period. Other conversions of results from Basel Committee (2010) show a CET1 capital ratio of between 9 and 19 percent (see Firestone et al 2017 and Brooke et al 2015).

⁴⁰ See Cline (2017).

Since estimates of the optimal capital requirement are uncertain, they should be used cautiously in assessing the SyRB. Current capital requirements for Norwegian banks are at around 15 percent, which is well within the range of estimated optimal capital requirements from studies in Norway and other countries. The estimates themselves do not provide any reason to change the overall capital requirement for banks. If estimates of optimal capital requirements become more precise ahead, the extent to which they are given weight in the assessment of the SyRB may increase.

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6. Conclusion

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In this paper, we analyse indicators that we believe should be used to assess the systemic risk buffer. All the largest banks have substantial real estate exposure and a high proportion of wholesale funding, also in foreign currency. In addition, banks are closely interconnected, particularly through cross-holding of covered bonds. The Norwegian banking sector is also concentrated and relatively large. In addition, household debt is high, and Norway is a small, open economy dependent on international developments. The indicators we examine suggest high structural systemic risk in Norway, and there are signs that structural systemic risk has increased in recent years. This warrants a high systemic risk buffer in Norway.

The assessment of the systemic risk buffer should include a further analysis of how bank losses may spread and amplify owing to banks' interconnectedness. Analyses conducted by Norges Bank, using stress tests with network models, illustrate the need for a systemic risk buffer. Improving the analyses ahead may further support the assessment of the level of the buffer.

The systemic risk buffer should contribute to ensuring that the total capital requirements for Norwegian banks are at an economically appropriate capital level. We find that the current requirements are within estimated intervals for an optimal capital level. Although the intervals are wide and the estimations can be improved ahead, we consider that the analyses provide support for using the systemic risk buffer to maintain the total capital requirements for banks at the current level.

The systemic risk buffer is to be assessed every two years. The authorities should establish a framework so that the assessments are transparent and consistent over time. The framework can build on the risk areas, indicators and methods described in this paper. The framework should be developed over time, for example in response to changes in the structure of the financial sector and when methods and data are improved. We believe that the work on assessing structural systemic risk should be further pursued and a framework should be established for the next assessment of the systemic risk buffer in 2021.

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Appendix

The table below contains a complete list of the metrics suggested in ESRB (2017) for measurement of structural systemic risk. In the table, we have also included our assessment of whether the metric is important for assessing the systemic risk buffer (SyRB) in Norway. As new risks may arise over time, changes to the set of metrics may be necessary.

Table A1: Metrics for measuring risks stemming from the propagation and amplification of shocks within the financial system

Specific risk factor	Metrics	Important for assessing the SyRB in Norway?
Exposure concentration/ asset commonality	Banks' CRE/RRE loans as a % of total assets	Yes; part of our set of metrics
	Domestic and foreign general government debt as % of total assets	No
	Off-balance sheet items (guarantees etc) as % of total assets	No
	Herfindahl Index of asset classes	No
	Herfindahl Index of banks' turnover in particular markets	No
	Banks' international claims as % of total assets	No
	Banks' international claims broken down by country and counterparty sector	No
	Banks' securities holdings as % of CET1 broken down by country and counterparty sector	Yes; similar metric included in our set of metrics
	Share of forex loans as % of total loans	No
	Share of households' loans in foreign currency as % of total loans	No
	Share of foreign currency deposits	No
Herfindahl Index of currency exposures	No	
Commonality in bank business models	Structure of banks' liabilities – equity, deposits, other non-core liabilities	Yes; included in our set of metrics
	Non-core liabilities ratio	No
	Share of gross loans as % of total assets	No
	Size of trading book	No
	Securities	Yes; similar metric included in our set of metrics
	Maturity mismatch indicators	Yes, but these indicators are difficult to interpret
Financial interconnections and contagion	Leverage ratio	No
	Banks' intra-financial sector linkages	Yes; similar metric included in our set of metrics
	Banks' cross-holdings of securities	Yes; similar metric included in our set of metrics
	Banks' ranking in terms of network centrality metric	Yes, but difficult calculations that may be difficult to interpret
	Mean geodesic distance (shortest path) between banks in the network	Yes, but difficult calculations that may be difficult to interpret
Model-based estimates of financial contagion	Yes; stress test using network model	

Tabell A2: Metrics for measuring risks stemming from structural characteristics of the banking sector

Specific risk factor	Metrics	Important for assessing the SyRB in Norway?
Size and importance for the financing of the economy, and concentration of the domestic banking sector	Total assets as % of GDP	Yes; included in our set of metrics
	Total retail deposits as % of GDP	No
	Share of bank credit to the private non-financial sector (PNFS) of broad credit	Yes; included in our set of metrics
	Share of top five banks as % of total assets	Yes; similar metric included in our set of metrics
	Herfindahl Index of banks assets	Yes, but calculation is limited by data
Foreign ownership	Share of foreign ownership	No
	Structure of foreign bank ownership	No
	Share of lending to the PNFS by foreign branches and subsidiaries	Yes; included in our set of metrics
	Share of lending to the PNFS by foreign non-banks	No
	Contribution of host country deposits to the financing of the entire banking group	No
	Share of contribution of host countries' subsidiaries of profit of parent bank	No
Other potential structural risks	Aggregate banks' non-performing loans	No
	Aggregate banks' coverage ratio	No
	Aggregate securities	No
	Aggregate leverage ratio	Yes; included in our set of metrics

Table A3: Metrics for measuring structural risks to the banking sector stemming from the real economy

Specific risk factor	Metrics	Important for assessing the SyRB in Norway?
Economic openness	Trade openness ((Export+Import) as % of GDP)	Yes; included in our set of metrics
	Concentration of exports/imports	Yes; similar metric included in our set of metrics
	Current account balance	No
	Indicators of financial soundness of the sovereign	No
	Foreign currency reserves of the financial system	No
Sectoral risks to the private non-financial sector (PNFS), households and the public sector	Identification of relevant sectors (size, debt etc)	Yes; similar metric included in our set of metrics
	Identification of bank exposure concentration for each sector	Yes; similar metric included in our set of metrics
	Identification of high-risk sectors	Yes; relevant for assessment of PNFS
	Share of credit risk originating from each sector	Yes; relevant for assessment of PNFS