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STAFF MEMO

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RAGNA ALSTADHEIM



NORGES BANK

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BANKS' WHOLESALE
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VULNERABILITY

BANKS' WHOLESALE FUNDING SHARE AS AN INDICATOR OF FINANCIAL VULNERABILITY*

RAGNA ALSTADHEIM[†]

Norges Bank,
August 2020

Abstract

A review of theoretical links between the wholesale (or market) funding share of banks (WFS) and financial vulnerability is provided. The vulnerability may both be within the financial system, and in the non-financial sector. The historical development of the WFS in Norway is described. In light of theory and history, we provide an intuitive interpretation of why the WFS works well as an indicator of excessive credit growth in the non-financial sector and as a predictor of financial crises. We argue that other indicators, such as net aggregate household savings and households' net financial investments, may have more intuitive links to excessive gross credit growth. These indicators predict the WFS in Norway.

*This note should not be reported as representing the views of Norges Bank. The views expressed are those of the author and do not necessarily reflect those of Norges Bank. I thank Elif Arbatli Saxegaard, Henrik Borchgrevink, Monique Erard, Karsten Gerdrup, Torbjørn Hægeland, Arild Lund, Lisa Reiakvam, Magdalena Riiser, Haakon Solheim, Ylva Søvik and Sindre Weme for discussions and comments. Remaining errors are my own.

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1 INTRODUCTION AND SUMMARY

An increase in banks' wholesale funding as a share of total assets (WFS) is widely recognized as an early warning indicator for financial crises in the empirical literature. By wholesale funding, we mean everything else than deposits and equity. Hahm, Shin, and Shin (2013), Drehmann and Juselius (2014) and Anundsen, Hansen, Gerdrup, and Kragh-Sørensen (2016) document the predictive properties of the WFS. In this note we argue that although the WFS has well documented empirical properties, the surveillance of alternative indicators with more straightforward structural interpretation is useful. Some of these predict the WFS.

One interpretation of the WFS is that it is associated with lax credit supply and "less benign" credit growth. Merrouche and Nier (2017) find that the build-up of market-funded credit from banks ahead of the global financial crisis in many countries tended to be driven by capital inflows from abroad. A different interpretation of the WFS, is that it may instead capture banks' balance sheet risk. Vazquez and Federico (2015) show that banks' liquidity risk ahead of crisis is associated with more bank failures. Thus, a large wholesale funding share may be associated with a higher likelihood of a crisis (and deeper crises) for different reasons:

On the one hand, a higher WFS may be a symptom of unsustainably high credit growth among households and firms. Lax credit supply conditions (and we argue, combined with strong credit demand) may drive up banks' wholesale funding share.

On the other hand, a higher WFS may signal higher crisis probability because of increased funding vulnerability and an increased likelihood of a market run against banks. Related to this point, is the fact that a higher market funding share may indicate stronger interconnectedness (cross ownership) within the financial sector (see e.g. Norges Bank (2015)), so that if a run is triggered it will be systemic and the consequences more severe.

Thus, different indicators may enhance and provide more detail on the information contained in the WFS, depending on the question at hand: If the purpose is to assess the sustainability of non-financial gross credit growth, it is of interest to follow indicators providing information on the development of household savings, net financial investments (loosely speaking, credit demand conditions), or banks' lending margins (excessive credit supply conditions). This is the case, for example, regarding decisions to change the "Countercyclical Capital Buffer" (CCyB).¹ Measures of maturity mismatch of assets and liabilities, and measures of interconnectedness, are more relevant when assessing banks' vulnerability to liquidity stress (but are not discussed in depth in this note).

We provide a short review of main theories of how banks' funding is related to financial stability in Section 2. Next, the historical development of the wholesale funding share of Norwegian banks is presented and interpreted (Section 3). We present some empirical links between the WFS and alternative indicators in Section 4. Concluding remarks are provided in Section 5.

¹See the framework for Norges Bank's advice on the CCyB in Norges Bank (2019a).

2 LINKS BETWEEN BANKS' FUNDING AND FINANCIAL STABILITY

2.1 BACKGROUND: WHAT TO EXPECT REGARDING LINKS BETWEEN THE MACROECONOMY AND THE WFS

We may note that wholesale funding is the balance sheet item that (by pure accounting) establishes a wedge between money (or deposit) growth and credit growth. Since in practice the absolute value of equity is slow-moving and relatively stable, banks' balance sheets increase and shrink over the financial cycle as credit and either deposits and/or wholesale funding changes, see figure 1. Hence, money growth will tend to be lower when growth in wholesale funding is higher. But credit growth may in principle be very strong, or very weak, even with a constant WFS.

Figure 1: *Credit funded by Deposits, Wholesale funding or Equity.*

Banks' balance sheet		
Liquid assets	Wholesale funding	
Credit		Deposits (=Money)
		Equity

We may also note that there are potential links between the WFS and a country's income and use of resources: From National Accounts, the current account (CA) is equal to a country's net accumulation of financial claims on other countries, or net financial investments (NFI).² That is ($CA = S_t - I_t = Net\ Financial\ Investments\ (NFI)$), and the current account is therefore typically a useful (although very broad) indicator for a nation's financial sustainability. It is plausible that in a bank-dominated financial system, banks will borrow more abroad (lend less abroad) when the current account is weak and

²Value changes may also contribute to changes in the value of net financial assets.

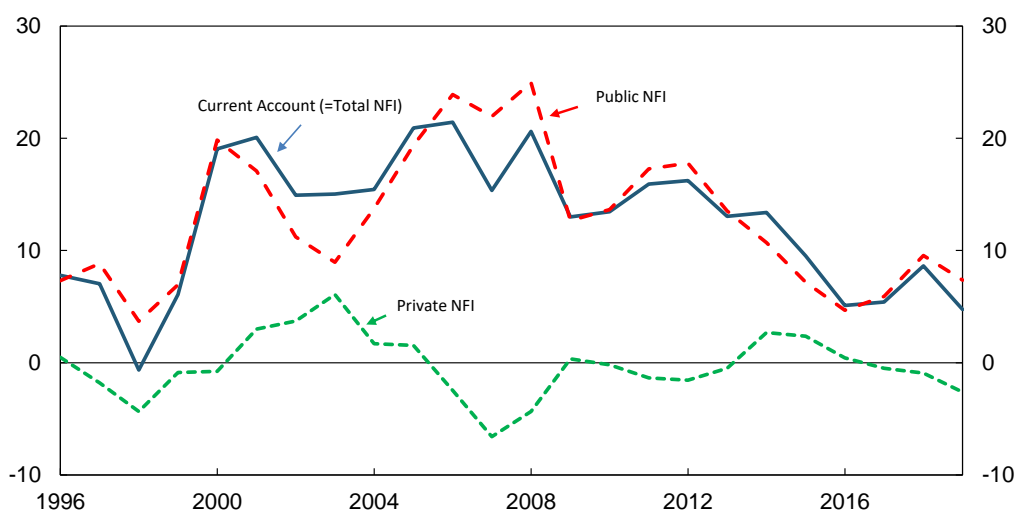
net financial investments are low; Banks themselves typically have low net financial investments (they are intermediaries), but they may channel funds from abroad to domestic borrowers who consume and invest. If so, banks' foreign lending (borrowing, if negative) will tend to move up and down together with a country's total NFI:

$$\text{Banks' net foreign lending} \propto \text{NFI (or CA)}.$$

To the extent that banks' foreign funding (negative lending) mainly consists of market funding (foreigners purchase securities but do not hold that much deposits), the WFS should then also be higher when the current account and total net financial investments are weaker, and banks therefore borrow more abroad.

However, the public sector may dominate a country's net international capital flows, and disturb such a pattern - either because of large public deficits or surpluses that are funded or invested abroad. Figure 2 shows that net *public* accumulation of financial assets alone is closely aligned with the total NFI (the current account) in Norway. The country has been running "twin surpluses" for many years. This mirrors the build-up of the "oil-fund",³ and shows that fiscal policy has to a large extent insulated the domestic economy from variations in revenues from the petroleum industry. The flip side of this is that the current account is not fully informative regarding net *private* financial sustainability (private *NFI*) or the business cycle of the domestic economy (although also the private sector benefits when public finances are in good shape).

Figure 2: *The current account and public versus private NFI, Norway. Shares of Mainland GDP. Percent. 1996-2019*



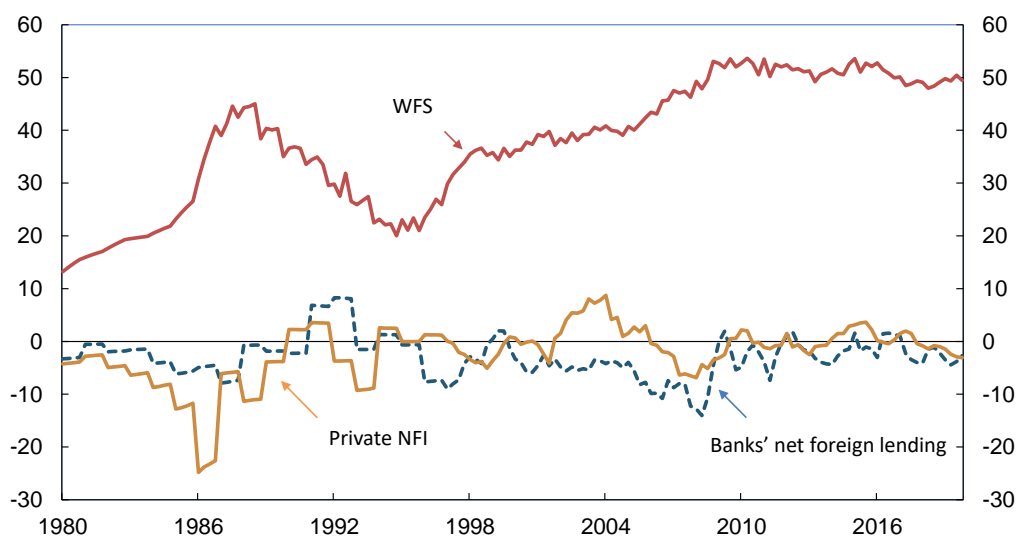
It may therefore be more useful to consider the accumulation of private NFI (instead of the current account) as a broad indicator of private financial sustainability in Norway's

³The Government Pension Fund Global, managed by Norges Bank Investment Management, or NBIM.

case. Figure 2 indicates that private NFI were low before the global financial crisis, and high during the Norwegian recession in the early 2000s. The current account and total NFI instead seem to reflect oil price changes.

Figure 3 below again shows private (that is corporate, household and non-profit) NFI, but now with quarterly data instead of annual, and together with banks' net lending in foreign currency. In a bank dominated financial system, banks' net foreign lending would tend to be low (banks' borrowing abroad high) when private NFI is low. We find some evidence for this in Norway's case.⁴ The contemporaneous correlation between private NFI and banks' foreign lending is positive (although not very high), and private NFI significantly predicts banks' foreign lending (see table 3 on page 14 in section 4). Furthermore, to the extent that foreign bank funding mainly consists of market funding, the WFS will be high when banks borrow more abroad. This is also a pattern we see in Norwegian data - there is a negative contemporaneous correlation between banks' foreign lending and the WFS. Also, banks' foreign lending leads the WFS and significantly predicts it - again see table 3.

Figure 3: *Norwegian banks' net foreign lending and private NFI. Percent of Mainland GDP. Banks' wholesale funding as a share of total assets (WFS). 1980-2019. Norway.*



We should note that the WFS could increase or fall for many other reasons than savings, investments and capital flows. The WFS depends on the structure of financial intermediation in the economy, and changes in this structure will lead to changes in the WFS. For example, if banks borrow and lend more to each other in the interbank market, the WFS will be higher, everything else equal. Furthermore, regulations will be important. For example, with a more generous deposit insurance scheme (and a shift in preference among

⁴The link is of course not exact. For example, non-financial firms borrow directly abroad and not only via banks. Also, the private sector may not only borrow or lend internationally, but also invest in or borrow from the public sector.

investors towards more deposits in their portfolios), the WFS will change independently of savings, investments and capital flows.

2.2 THREE CONCERNS REGARDING A HIGH WFS IN THE LITERATURE⁵

2.2.1 LAX CREDIT SUPPLY AND RISK-TAKING BY BANKS

Bruno and Shin (2015) describe a global liquidity cycle or leverage cycle, where banks' wholesale funding might be the channel through which capital from global banks flow into small open economies when risk premia in international markets are low. A "carry trade" in international banking may push capital into small open economies, see Miranda-Agrippino and Rey (2015). The idea is that global banks may tend to invest in countries with a higher interest rate and borrow where rates are low (in spite of exchange rate risk). The focus in this literature is on supply-driven gross credit growth. The causality in figure 3 then is interpreted as going from the WFS to savings and/or real investments (and hence to private net financial investments).

Alstadheim and Blandhol (2018) do not find evidence that the share of foreign funding in the WFS of Norwegian banks increases when global risk premia are low and the global credit cycle is peaking. One reason might be that banks typically do not take foreign exchange risk, and hence foreign exchange funding does not become particularly more attractive for them when international borrowing conditions are favorable. Risk premia on funding from local sources also tend to follow global risk premia, since risk premia often move synchronized across borders (and across currencies), see recent data on the US Dollar and the Euro in Jondeau, Mojon, and Sauhuc (2020) and a discussion of the Norwegian money market in Bernhardsen and Kloster (2012).

Easier access to low-cost funding for banks, from abroad or domestic sources, is anyway likely to contribute to stronger credit growth. If the supply of market funding is more elastic than the supply of deposit funding, it seems likely that additional credit supply will be funded in the market - at home or abroad. In this case, an increasing WFS might be a sign of excessive credit supply. Relative stickiness of deposit funding might be related to pricing practice: attracting new deposits by offering higher interest rates may be expensive if the higher rate needs to apply also to existing deposits.

2.2.2 LOW DOMESTIC SAVINGS AND RISK-TAKING BY HOUSEHOLDS AND FIRMS

Not only the supply side, but also domestic credit demand, might create a link between the WFS and high credit growth: If low savings is facilitated by capital inflows through banks, a high WFS might be a symptom of low domestic savings, large investments and risk-taking by households or firms, and more vulnerable non-financial balance sheets.⁶

⁵The selection of references here is intended to span out different perspectives, rather than to provide a comprehensive review of the literature. This is not a literature review.

⁶Although banks typically do not take exchange rate risk, there will have to be capital inflows if domestic net financial investments are low. The banks will need to find counterparties for hedging operations. One could imagine that local final borrowers would take exchange rate risk so that the banks could pass on

Also for these reasons, a high WFS may be associated with a higher risk of financial crisis, even though the causality would go from low net financial investments to a high WFS in figure 3, and not the other way around. A negative current account and excessive domestic consumption is well known as predictors of financial crises, see for example Davis, Mack, Phoa, and Vandenabeele (2014). Thus, a high WFS may contain information about unsustainably high (net) domestic credit demand, rather than - or in addition to - lax credit supply from banks. The results in Alstadheim and Blandhol (2018) suggests that this effect might be more important, relative to international conditions, in the case of Norway.

2.2.3 BANKS' FUNDING VULNERABILITY AND RISK OF CONTAGION

There is in addition a quite different concern regarding a high WFS. A worry is that market funding, and in particular short term market funding, may quickly disappear if confidence in a bank disappears. This would be the market run counterpart to a classic deposit run. Huang and Ratnovski (2011) indicate that relationship banking (loans and deposits) is less vulnerable to runs than market-funded banking, and Gertler, Kiyotaki, and Prestipino (2016) presents a model where wholesale funding creates vulnerability. Additional or adjusted measures of the WFS might be useful in order to assess funding risks. For example, one might want to monitor the short term part of the WFS, along with liquid assets (see figure 4). One might also want to know who the creditors are: are they institutional investors, and are they local or foreign? In the regulatory regime for banks, liquidity requirements and requirements for stable funding aim to prevent funding problems, and do indeed include both the asset- and liability side of balance sheets. A related and additional reason to be concerned about a high WFS, is that a high WFS could be related to a deeper financial crisis if a crisis occurs, because a higher WFS may reflect stronger interconnectedness and the potential for a faster spread of funding problems within the financial sector (see a discussion of this topic in Norges Bank (2019b) and Bjørland and Kockerols (2020)).

2.3 CONCERNS ABOUT HIGH MONEY (DEPOSIT) GROWTH, RATHER THAN CONCERNS ABOUT A HIGH WFS

2.3.1 THE RISK OF A CLASSIC BANK RUN AND MONETARIST VIEWS

Money growth acceleration and contraction, causing instability, is a classic topic in macroeconomics. One concern for high money growth, is based on the risk of a bank run, where customers withdraw their deposits when they become uncertain about bank solvency. This would be the case in a world with little deposit insurance and no regulation of banks. In Friedman and Schwartz (1963), the great depression is interpreted as a result of monetary contraction. Parts of the macroeconomic literature still emphasizes monetary aggregates as determinants (that is, good predictors) of macroeconomic outcomes, see Baker, López-Salido, and Nelson (2018). These authors contrast their emphasis on monetary aggregates with the emphasis on credit aggregates as determinants of growth in Schularick and Tay-

credit in foreign currency, but that has not been seen to a large extent in Norway

Figure 4: *Liquidity risk assessments must include assets.*

Banks' balance sheet	
Liquid assets	Short-term wholesale
Credit	Long term wholesale
	Deposits
	Equity

lor (2012).⁷ To the extent that one is concerned about high money growth because it might be associated with overheating and a later bank run, one would be concerned about a low WFS, not a high WFS. Today's system with bank regulation and deposit insurance may make policymakers less concerned about a classic bank run than in the past, though.

2.3.2 TOO EASY FOR BANKS TO FUND CREDIT GROWTH BY CREATING MONEY?

Some of the literature emphasizes that banks can create their own deposits, and therefore are not constrained by first attracting deposits or issuing bonds in order to extend loans, see e.g. Werner (2014). For this reason, some may regard unconstrained money creation by banks as more of a potential threat to financial stability than market funding.⁸

But issuing loans by creating deposits is not a “free lunch” - the funding costs will have to be paid anyway. And as noted by e.g. Disyatat (2011), the volume of lending is constrained by equity requirements (market imposed or by regulations).⁹ Banks create deposits (i.e. money) when they extend loans, but in general equilibrium the volume of deposits relative to market funding (as well as the funding costs for the various balance

⁷See also an historical overview of views on the importance of monetary aggregates for macroeconomic development provided in Bernanke (2006).

⁸This is discussed in the blogosphere, see <http://positivemoney.org/what-we-do/magic-money-tree/>.

⁹The traditional “bank lending channel” of monetary policy has at its core the “money multiplier”. With a removal of credit rationing, and with the interest rate as the monetary policy instrument, the money multiplier itself is today no longer relevant, see e.g. Disyatat (2011).

sheet items) will be a function of the portfolio preferences of those who fund the banks. It will also be a function e.g. of banks' preferred funding profile and business model. Credit growth financed by money is thus limited both by regulatory constraints and market determined funding costs. Too much deposit money creation by banks does not seem to be a concern among policymakers in practice.

2.3.3 LACK OF DISCIPLINE IMPOSED ON BANKS BY DEPOSIT HOLDERS

A lack of discipline imposed on banks if their creditors are (insured) depositors is also considered a problem. Khan, Scheule, and Wu (2017) study the impact of a larger degree of deposit funding (and less market funding) on various measures of US banks' risk taking. This study is inspired by a theoretical literature that suggest that more deposits are associated with incentives to take on risk (overconfidence when liquidity risk is perceived low and moral hazard problems associated with deposit insurance). The authors use panel data to find that an increase in bank deposits indeed increases risk taking by banks, but this effect is muted for banks with higher equity.

In the spirit of this concern for lack of discipline imposed on banks by depositors, there is a literature on "narrow banking", see e.g. Kumhof and Benes (2012). This literature suggests that market funding of risky credit is preferred to deposit funding of risky credit, and the idea is then that this will provide more financial stability - more active creditors will create better incentives for banks to limit their risk-taking. In this type of financial regime, deposits should ideally exclusively be held in "narrow banks", which invest in safe assets (central bank reserves or government debt). A low WFS in banks that issue risky loans would, given the arguments here, indicate higher financial vulnerability.

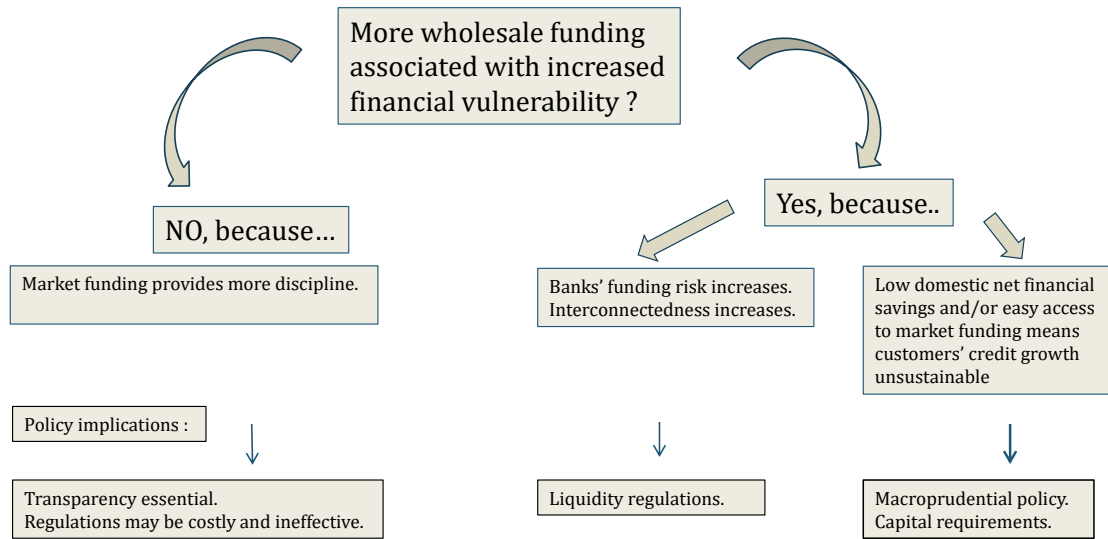
2.4 NO FULL CONSENSUS VIEW ON MARKET FUNDING BEING "BAD"

The policy consensus today very clearly supports regulation and the existence of banks that finance risky credit with both deposits and in the market. This is expressed e.g. through the internationally agreed "Basel Framework". Thus, there is a consensus that market discipline of credit intermediation is not enough; A model of "narrow banking" with full market funding of credit (while banks that are funded by deposits hold only safe assets) has not been chosen.

But the chosen regime after the financial crisis also shows that policymakers want to encourage market forces to discipline banks. For example, the crisis resolution regime and bail-in approach are designed to create healthy incentives for investors, where they carry their share of losses in case of bank failure. Thus, policymakers might not be content with full deposit funding of credit via banks either.

Implicitly, revealed preference among policymakers thus neither clearly supports the "low market funding is better"-view, nor the "full market funding of credit"-view. (What is clear, is that more capital is considered better.) Policymakers' different concerns when it comes to funding with deposits versus in the market are illustrated in figure 5. Some of the theoretical concerns about high money growth (sections 2.3.1 and 2.3.2) are left out, because they do not seem to be mainstream concerns.

Figure 5: *The impact of wholesale funding on financial stability.*

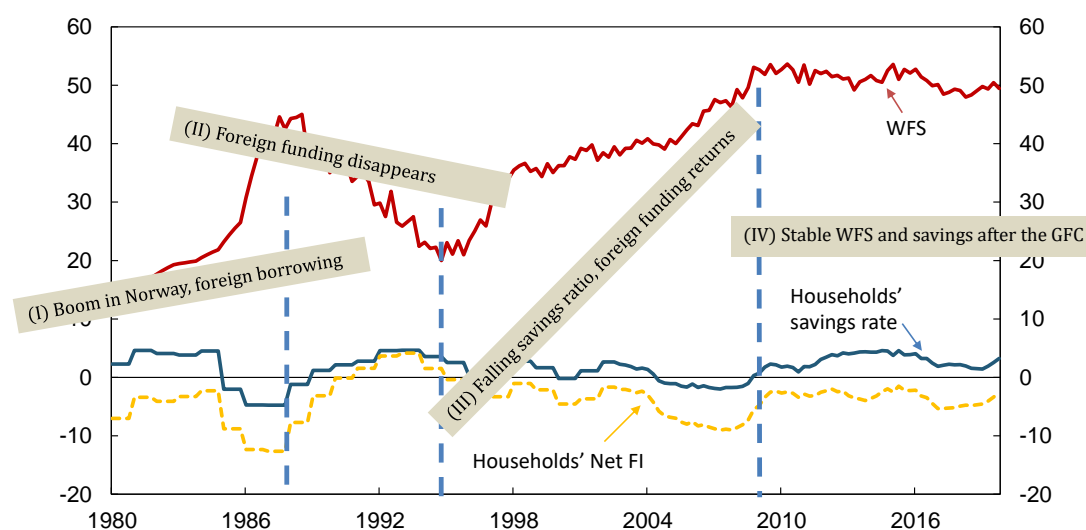


The concerns captured by the far right hand small arrow (and described in sections 2.2.1 and 2.2.2) are closely linked to excess credit growth and has been a motivation for the WFS as an indicator for the countercyclical capital buffer in Norway.

3 THE WHOLESAL FUNDING RATIO OF BANKS IN NORWAY

We consider four periods of change in the wholesale funding ratio of Norwegian banks since 1980, see figure 6. The indicator is regarded from the perspective of macroeconomic development (concerns discussed in sections 2.2.1 and 2.2.2), rather than from a structural perspective (such as interconnectedness, disciplinary effects of more market funding, or regulatory changes). We aim to highlight how alternative indicators may be relevant for the assessment of excessive credit growth, in addition to the WFS.

Figure 6: Wholesale funding share of banks' total assets. Households' savings and their NFI (shares of disposable income). Percent. 1980-2019. Norway.



The first period covered in figure 6 is one where the WFS increased. The early- to mid 1980s was a boom period in the Norwegian economy, with credit deregulation and expansionary monetary and fiscal policy, including a tax system that subsidized borrowing quite heavily. The funding of banks that fuelled high credit growth during this period was mainly foreign funding. Norges Bank also stepped in as a lender when foreigners disappeared (see table 1 below). Capital markets had just been deregulated, and monetary policy and the banking industry had not yet adjusted to a world with free capital movements.

Private banks' lending margins were quite low in this period, as shown in figure 7; Credit had been tightly regulated, and the interest rate both set by the central bank and those set by the private banks were determined or at least heavily influenced by political authorities, see Gjedrem (2010). There was a belief that sterilized exchange rate interventions could safeguard the fixed exchange rate policy while the domestic key policy interest rate could be determined at the national level. As can be seen in figure 6, the lending boom was mirrored in a low and falling savings rate (and low NFI) for households, as credit was cheap and ample. The development for households described here is consistent with the low private NFI and high foreign borrowing by banks that was shown in figure 3.

The second period covered in figure 6 is one where the WFS fell. Macroeconomic turbulence characterized the Norwegian economy in the late 1980s and the early 1990s. A trigger was the negative oil price shock in 1986. Banks' had problems holding on to their foreign funding (see figure 3), and the WFS fell. In order to reestablish trust, both monetary and fiscal policy was tightened, having procyclical effects in the short run. A peg of the exchange rate was established at a new level, and it was now defended by the

Table 1: *Funding of banks' lending growth 1983-87*

	3 large comm. banks		10 large sav. banks	
Tot. assets (NOK) 1983	130 200 mill		82 798 mill	
Asset growth 1983-87	149.6%		121.0%	
	Mill NOK	% of ass.gth	Mill NOK	% of ass.gth
Growth, Liabilities:				
Deposits	40 998	21.0	38 023	37.9
Special dep.	14 974	7.7	6 060	6.0
Loans from Norges Bank	35 606	18.3	26 405	26.3
Foreign debt*	72 292	37.1	13 949	13.9
Other debt	17 492	9.0	13 586	13.6
Subordinated debt	13 435	6.9	2 199	2.2
Growth, Assets:				
Lending	135 996	69.8	81 580	81.3
Other assets	58 811	30.2	18 722	18.7

*) Foreign debt excluding foreign subordinated debt capital.

Source: NOU 1992:30 (1992). Table V9 in appendix.

interest rate and by interventions.¹⁰ Banks' lending margins increased (see 7) and the savings rate increased as households and banks repaired their balance sheets (figures 6 and 3). The largest banks were declared insolvent. **The third period of change in figure 6** is one with an increase in the WFS again. As the economy recovered during the 1990ies, confidence returned and banks' foreign funding increased, see a discussion of this in Gerdrup, Lund, and Weme (2000).

The increase in the WFS continued through the pre-2008-crisis period. Banks' lending margins were low (figure 7) and private savings fell in the lead-up to the financial crisis in 2008-2009 (figure 6)¹¹. Also, the development of the covered bond market started in this period, and may have contributed to a higher WFS.

Finally, during the years since the global financial crisis in 2008, the market funding share of Norwegian banks was quite stable while credit growth continued. Table 2 shows how the composition of banks' balance sheets changed. The stability, or tentative decline, of the market funding share can be viewed against the background of a relatively stable lending margin, reasonably stable savings, and a stable deposit coverage ratio (figures 6, 7 and 3). Hence, banks' credit to households increased while the funding side of banks grew in a balanced fashion.

¹⁰For an overview of Norwegian exchange rate regimes, see Alstadheim (2016).

¹¹The global financial crisis impacted the Norwegian economy and banks' funding markets, but it did not manifest itself as a solvency crisis in Norway. Norwegian banks were relatively well capitalized and the size of the banking sector relative to GDP was more modest than in some other countries, perhaps reflecting modest risk taking before the crisis

Figure 7: *Banks' lending margin (mortgage lending rate minus Nibor) and the WFS. Percent. 1980-2019. Norway.*

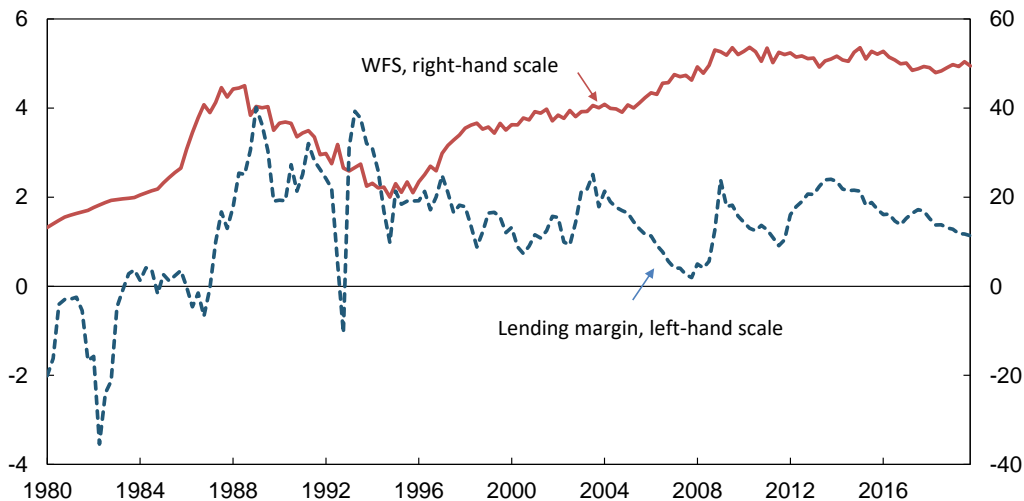


Table 2: *Norwegian banks' balance sheets (domestic banks combined) show a stable WFS after the financial crisis. Percent of total assets.*

	2008 (Dec.)		2019 (June)	
	Ass. (%)	Liab. (%)	Ass. (%)	Liab. (%)
Lending to ‡ Deposits from cust.	56.7	37.1	65.0	40.0
Other assets ‡ Market funding*)	43.3	56.2	35.0	50.0
Equity (incl. subordinated debt)		6.7		10.0

*) Includes deposits from financial institutions.

The narrative presented in this section underscores that the WFS picks up information about private savings and net financial investments. Either lax credit supply or strong credit demand may lie behind low savings in some periods - the causality is hard to determine. But the very low bank lending margins ahead of the banking crisis in Norway probably reflects relatively strong credit supply at the time.

4 INDICATORS FOR EXCESSIVE CREDIT GROWTH IN THE NON-FINANCIAL SECTOR

The narrative for macroeconomic development in Norway provides one intuitive story for *why* the WFS can help predict financial crises (the predictive value of the WFS for financial crises is documented in e.g. Anundsen et al. (2016)). This intuition is confirmed

by the empirical relationships between the WFS and macroeconomic variables (see table 3 below); Both households' savings and net financial investments help predict the WFS. Furthermore, total private sector NFI predict banks' foreign lending.

However, we may note that banks' lending margin is predicted by the WFS, and not the other way around. How well the lending margin represents credit supply conditions is not clear.¹²

Table 3: *Pairwise Granger causality (GC) tests. 6 lags.**

Null hypothesis	Obs	F-statistic	Prob.
Banks' Lending Margin			
Lending Margin does not GC WFS:	154	1.02655	0.4106
WFS does not GC Lending margin:		4.27232	0.0005
Household Savings			
Household Savings does not GC WFS	160	4.10412	0.0008
WFS does not GC Household Savings		0.66710	0.6763
Households' NFI			
Households' NFI not GC WFS:	160	4.85295	0.0001
WFS does not GC Households' NFI:		0.85958	0.5263
Banks' net foreign lending			
Banks' net foreign lending does not GC WFS	154	4.49276	0.0003
WFS does not GC Banks' net foreign lending		1.55203	0.1656
Private NFI			
Banks' net foreign lending not GC Private NFI	154	0.21299	0.9722
Private NFI not GC Banks' net foreign lending		3.62428	0.0022

**) Most results are robust to fewer or more lags. Causality in both directions with fewer lags.*

We have seen here that some alternative indicators that predict the WFS may be useful to monitor. There are additional reasons to consider supplements to the WFS:

The market funding share of banks is an outcome of multiple forces that may disturb the information value of the WFS - it is affected by e.g. the chosen business model of banks, by regulations and public policy, and by structural change in financial markets. Empirically, Schularick and Taylor (2012) emphasize a structural long term development where bank assets relative to GDP have grown much faster than monetary aggregates relative to GDP. Bank *lending* has grown more in line with money, but still somewhat faster than money (some of the difference then e.g. being made up of portfolio investments by

¹²The identification of credit supply versus credit demand is hard, and we use informal references to credit supply and demand here. It is beyond the scope of this note to discuss the empirical evidence, or literature, on the explanatory power of private savings, net financial investments and banks' lending margins for financial crises.

banks). Consistent with this, there was a long-run trend in the direction of a higher WFS from the 1950ies and until the global financial crisis in 2008-2009, see Richter, Óscar Jordá, Taylor, and Schularick (2017). Higher competition in the market for deposits may lower banks' preferences for deposit funding. Very low market interest rates and a difficulty of transferring low rates to customers, and a more developed market for covered bonds, may at times pull in the same direction.

Regarding regulations and government policy, a higher activity of state banks that replaces private lending will lead to a lower WFS if deposits stay in the private banks. The flip side of this is that a decline in the role of state banks in Norway might have led to a higher WFS. Should one e.g. consider less comprehensive deposit insurance schemes, that might pull in the same direction.

The ESRB includes variables such as external imbalances (the current account) and measures capturing the private sector's debt burden (e.g. the debt-service to income ratio), as well as mispricing of risk in its recommendation for variables to be considered as complements to the credit-to-GDP-gap in the assessment of excessive credit growth.¹³ We noted earlier, that due to the "twin surpluses" in Norway, private net financial investments may be more relevant as an indicator than the current account in Norway's case. Aggregate households' savings, or the savings of the whole private sector (like in figure 6) also represents cross-checks on the direction in which the solvency of the aggregate private sector is heading. Typically, aggregate data are available much more timely and with a higher frequency than microdata.

The ESRB also recommends considering measures of mispricing of risk when assessing the build-up of system-wide risks. "Too low" risk premia may indicate too high risk taking and too aggressive credit supply. Judging mispricing is inherently very hard, but a starting point is to supervise the empirical development of risk premia. Banks' lending margins is one such potential indicator, but its properties remains to explore. We have seen that the WFS predicts the lending margin.

5 CONCLUDING REMARKS

The wholesale funding share (WFS) of banks is well established as a predictor of financial crises. In this note, a Norwegian historical narrative and structural interpretation of this predictive value is provided. Here, the WFS is regarded from a macroeconomic perspective and a concern for excessive credit growth. It is argued that alternative measures, such as savings and net financial investments, are intuitive indicators for the sustainability of credit growth. But a high WFS may also signal other types of risk, such as strong interconnectedness, which is not covered by the alternative measures discussed here.

¹³See ESRB guidance for setting countercyclical buffer rates (ESRB (2014)). The WFS of banks is not included among suggested indicators. We are not aware of any national authorities who use the WFS for the purpose of assessing potential excessive credit growth in the non-financial sector. Instead it is regarded as an indicator of vulnerability in the financial sector. This is also how the Norwegian Ministry of Finance, which is the macroprudential authority in Norway, regards this indicator, see Norwegian Ministry of Finance (2019).

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