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European Department

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ENABLING TIMELY MACROPRUDENTIAL ACTION[1]

The Swedish financial supervisory authority has adopted a number of macroprudential measures under its mandates for financial stability and consumer protection. However, the adequacy of its legal mandate came into question when it sought to introduce a measure primarily directed toward macroeconomic stability. As a result, the adoption of amortization requirements on mortgages entailed a process for government and parliamentary approvals that notably delayed implementation. Other measures under consideration could face similar delays. This paper considers why the delegation of macroprudential policymaking could be challenging and seeks guidance from the practices of selected countries on approaches to help overcome those challenges. The main themes revolve around establishing processes that build and maintain a better shared understanding of current financial stability issues and that support confidence in the design and implementation of new macroprudential tools.

As noted in paragraph 9, the Swedish authorities announced on October 26, 2016 that broad political agreement had been reached on a shorter process for implementing possible new macroprudential requirements. This paper was prepared before that announcement.

A. Sweden's Macroprudential Policy Framework and Experience

1. The Swedish financial supervisory authority (FI) is the designated authority for macroprudential policy in Sweden. Since 1995, the objectives of FI are to safeguard the stability of the financial system as a whole and also to ensure comprehensive consumer protection. FI coordinates with other authorities in promoting financial stability (Box 1). In 2013, FI was given authority for macroprudential policy (effective from 2014) through an amendment to its government instruction ordinance. In particular, the ordinance added a third task of "taking measures to counteract financial imbalances with a view to stabilizing the credit market, but taking into consideration the effect of the measures on economic development."

2. In recent years, the FI has adopted a series of measures with a macroprudential character to fulfill its objectives of consumer protection and financial stability. Under its consumer protection objective, for example, the FI imposed a loan-to-value limit of 85 percent for new mortgage loans in 2010, with the soundness principle as legal basis for this measure.[2] Under its financial stability mandate, it also set floor on risk weights for Swedish mortgages, which was raised from 15 percent to 25 percent in September 2014.

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[1] Prepared by Rima A. Turk. The paper has benefitted from comments by Craig Beaumont and the Swedish authorities. All remaining errors are my own.

[2]There is no provision for some portion of mortgages to exceed the limit, unlike some more recent macroprudential instruments in Ireland, New Zealand, and the U.K. Nonetheless, the limit does not apply to uncollateralized loans, which are shorter duration and more expensive. In practice, only some 4.9 percent of new mortgages had an LTV exceeding 85 percent in 2015, with the weighted average LTV at 68.3 percent.

Following an expansion of the regulatory toolkit, a range of capital buffers have been established and subsequently expanded.[3] To help boost bank resilience to recession or other shocks that could hit lending, the Countercyclical Capital Buffer (CCB) was activated at 1 percent in September 2014, raised to 1.5 percent in June 2015, and then to 2 percent in March 2016 (FI, 2016a), with each decision taking effect 12 months after the announcement.[4] Other capital measures that were introduced include a capital conservation buffer of 2.5 percent of risk-weighted assets (2014), a pillar II add-on of 2 percent of risk-weighted assets for the four largest banks (2014), and a systemic risk buffer of 3 percent for these banks (January 2015). In contrast with other measures, capital instruments have a legal basis that allows safeguarding macroeconomic stability as well as financial stability.

Countercyclical Capital Buffer in European Countries (in percent)

Austria	0	Greece	0	Norway	1.5
Belgium	0	Hungary	0	Poland	0
Croatia	0	Ireland	0	Romania	0
Czech Republic	0.5	Italy	0	Slovakia	0
Denmark	0	Latvia	0	Slovenia	0
Estonia	0	Lithuania	0	Spain	0
Finland	0	Luxembourg	0	Sweden	2
France	0	Malta	0	United Kingdom	0
Germany	0	Netherlands	0		

Source: European Systemic Risk Board, 2016, "A Review of Macroprudential Policy in the EU in 2015", May 2016.

3. However, despite the broadening of FI's responsibilities to include macroprudential policies, its legal powers proved to be inadequate to adopt a new measure to address macroeconomic risks related to household indebtedness. The FI had identified that the proportion of households with loan-to-value (LTV) ratios over 50 percent was growing, noting that international experience showed that households with such levels of indebtedness often react strongly to changes in economic conditions, which may amplify cyclical fluctuations. To reduce these risks, it sent out in November 2014 a proposal to introduce an amortization requirement on mortgages with high LTV ratios, consistent with its expanded mandate to counteract financial imbalances (FI, 2014).[5] But, as discussed below, this proposal was withdrawn five months later.

[3] This expansion of the toolkit followed the transposition of the fourth Capital Requirements Directive into Swedish law, with the new Capital Requirements Regulation coming into force in 2014.

[4] As a point of departure for determining the size of the CCB, FI monitors a number of indicators, including a buffer guide that is calculated in accordance with the Basel Committee's standardized approach and which rests on the credit-to-GDP gap.

[5] The proposal required that that new mortgage holders make annual repayments of at least 2 percent of the principal of loans with an LTV ratio of over 70 percent, and at least 1 percent on loans with LTV above 50 percent by below 70 percent.

B. A Lengthy and Complex Process to Adopt New Tools

4. The introduction of amortization requirements on mortgages revealed the inadequacy of the FI's legal mandate to take measures that it considers to be primarily directed toward supporting macroeconomic stability. In April 2015, an Administrative Court Appeal as well as some other consulted parties questioned whether the legislative provision on soundness provided the legal base to introduce a regulation that is principally aimed at ensuring macroeconomic stability. Although such doubt cast by an Administrative Court of Appeal is not conclusive, FI shared the view that there should not be any uncertainties regarding rules that affect many households for a long period of time. FI therefor withdrew its proposal for the amortization requirement and requested the government to clarify its mandate in this area.

5. The government proposed a specific authority rather than strengthening FI's legal powers for macroprudential policy in general. Later that year, the government proposed legislative amendments specifically limited to the authority to introduce an amortization requirement. Moreover, the amortization requirement was subject to government approval, where it signaled particular interest in the treatment of newly constructed housing. Accordingly, in December 2015, FI circulated a second proposal which was similar to the earlier proposal aside from including an exception that banks can use for mortgages related to newly-built homes (FI, 2015). In May 2016, the parliament approved legislation for the amortization requirement, which was then introduced from June 2016, over 18 months after it was first proposed.

6. Following this process to introduce new macroprudential tools to safeguard macroeconomic stability is time consuming. The main steps in the implementation of the amortization requirement were:

- After identifying risks of financial nature, FI sent a proposal for a new regulation to introduce am amortization requirement for public consultation. After receiving criticism on the legal basis of the proposal, FI decided not to go forward and adopt the regulation.
- The government proposed a legislative amendment to provide FI with specific legal authority to implement the new regulation.
- The government's proposal was reviewed by the Council of Legislation for advice on compliance with the Constitution, advising whether it was possible for the government to delegate the right to adopt the regulation.
- The government's legislative proposal was approved by Parliament and entered into force.
- The government issued an ordinance whereby FI was given the mandate to issue regulations listing the details of the instrument. The ordinance entered into force the same day as the legislative proposal.

- FI submitted a proposal for new regulations specifying the recently approved instrument.
- The government approved FI's regulation.
- FI's regulations entered into force a month after the legislative proposal and ordinance entered into force.

7. Such a lengthy process does not allow for the timely handling of risks. Although the process provides the authority needed to adopt a new macroprudential tool, a period of over a year would appear to be at odds with the recommendation by the European Systemic Risk Board (ESRB, 2011) that, in defining the tasks and powers of the macroprudential authority, "… the procedures to assign instruments to the macro-prudential authority should allow—within the principles of the relevant legislative framework—for timely adjustments of the policy toolkit in response to innovation and change within the financial system and to the changing nature of risks to financial stability." In Sweden, the stop and go process in the adoption of mortgage amortization requirements generated market uncertainties.

8. Further, such a process also closely involves the government and parliament in the design of the regulation, potentially compromising effectiveness. Anticipating the need for government approval, the FI will need to ensure proposed regulations are designed in a way that will be acceptable to the government. Similarly, when proposing the authorizing legislation to parliament, the government will want to be sure that parliamentary concerns about the regulation are addressed by consulting with relevant parliamentary committees and other parties from whom support may be needed. This is a potential source of amendments that could undermine the effectiveness of the regulation. In the case of the mortgage amortization requirement, the proposal provides the potential for special treatment of newly-constructed dwellings. Such an exception may not be especially damaging, especially if it is not used in practice, but this process could undermine the effectiveness of regulation in other cases.

9. The Swedish authorities announced political agreement on addressing these issues on October 26, 2016 which is not reflected in the following discussion. Following broad political discussions, the Government has agreed to expand the ability of FI to take macroprudential measures. In particular, the agreement offers a clearer and shorter process for implementing possible new requirements on the credit market, enabling FI to act quickly should there be a sharp increase in household indebtedness. The government will propose new legislation to provide the FI with a formal mandate to make proposals for measures that will then be approved by the government. Although details are not yet available, this would appear to enable adoption of new tools without specific authorizing legislation, as was necessary for the amortization requirement. The following discussion does not incorporate this new announcement, but may still be relevant, such as for the forthcoming review of the FSC.

C. Challenges to Delegating Macroprudential Policy Authority

10. The Swedish government have expressed concerns that macroprudential measures include powerful tools that need close political oversight. The Swedish government has noted that some macroprudential instruments, such as the amortization requirement, are powerful instruments with large potential effects on the Swedish economy and public finances. It therefore considers that it is appropriate for the government to have a role in their adoption to ensure that such requirements are well-balanced both in design and in the timing of their introduction. There appears to be a particular sensitivity around measures affecting household borrowing such as the mortgage amortization requirement.

11. This situation contrasts with the ability of the Swedish authorities to delegate the setting of interest rates to the Riksbank. Monetary policy has large economic impacts, including substantial effects on indebted households through mortgage rates, which follow the Riksbank's repo rate quite closely. Yet, delegation of authority is feasible because an inflation-targeting framework for monetary policy features a clear policy objective, together with sound governance, high transparency, and strong accountability (Kamber, Karagedikli, and Smith, 2015).

12. Monetary policy and macroprudential policy differ regarding the clarity of objectives. Macroprudential policies are intended to achieve financial stability, which has many definitions (Box 2). In contrast with the monetary policy objective of price stability, financial stability is not directly observable (Schinasi, 2005). Financial risks can be apparent in the form of higher risk premia or higher non-performing loans on balance sheet for example. But they can also be disguised when systemic risk builds up such as when asset prices increase and leverage becomes excessive. Financial stability risks can also arise in different parts of the economy, including banking, shadow banking, insurance, household, or corporate sectors. In sum, financial stability objectives are "multidimensional" and it is hard to identify which changing financial conditions are risky and which are benign (Archer, 2016).

13. Inability to readily measure financial stability makes it challenging to monitor the performance of the responsible authorities, thereby impeding accountability. There is no single financial stability metric (Kamber, Karagedikli, and Smith, 2015), unlike the use of inflation in monetary policy (Woodford, 2003). Hence, it can be hard to track progress on actions to mitigate financial stability risks, potentially reducing the effective accountability of a macroprudential authority compared with a monetary authority (Bean, 2015).

14. Challenges in relation to accountability raise questions around delegating macroprudential authority. Under the framework for monetary policy, discretion is constrained by a clear objective as well as by external analyses and market pricing that provide an assessment of the consistency of the monetary stance with that objective. In contrast, limited experience with macroprudential policies makes it difficult to clearly articulate the circumstances in which policy powers would be used, to what extent, and when their use is

inappropriate (Archer, 2016). Since rules are not feasible, macroprudential policies are supported by "guided discretion" (IMF, 2013).[6] In turn, unavoidable discretion increases the political reluctance to delegate authority (Bean, 2015).

15. In addition to the difficulty defining the macroprudential policy objective, hesitance to delegate authority in this area may arise for more operational reasons:

- As macroprudential tools are relatively new, there is greater uncertainty around their effects on financial risks and about their macroeconomic impacts.
- As new risks emerge, the development of tools that were not previously foreseen may be required, some of which may not be welcome to government or parliament.
- Some macroprudential tools may have concentrated distributional impacts, also motivating close oversight and limiting delegation of powers.
- Multiple agencies may be involved in financial stability and there may be concerns about delegating authority if inadequate coordination results in suboptimal measures.

16. Country practices may offer guidance on how challenges to the delegation of macroprudential authority can be tackled. A number of countries have grappled with these complex issues in the process of establishing macroprudential frameworks in recent years. The next sections examine country approaches to enabling the delegation of authority for macroprudential policies, through ongoing efforts to build a shared understanding of current financial stability issues, together with confidence around new macroprudential tools, while ensuring policy coordination across agencies involved in financial stability. Although these efforts may not allow the government and parliament grant full independence to a macroprudential authority, they can enable more timely procedures for adopting new tools, which is key for macroprudential policy effectiveness.

D. Building a Basis for Accountability and Delegation

17. This section discusses international approaches to addressing the challenge of defining financial stability objectives sufficiently to enable delegation of authority. A practical approach to the difficulty of defining the objective of macroprudential policies is to have a process for developing a sufficiently shared understanding of the current nature of financial stability issues. Such a process involves on-going engagement with the government, the parliament, and the public to provide a more specific basis for assessing performance, thereby ensuring accountability as required for the delegation of authority. The practices of three countries—Australia, New Zealand, and the United Kingdom (U.K.) —are outlined in relation to (a) providing legal mandates for macroprudential policies, (b) granting

[6] Even calibration of the CCB, which is guided by credit-GDP ratio deviations from trend, requires discretion.

macroprudential powers, (c) ensuring continued engagement with the government, and (d) reporting to parliament and the public.[7]

Legal Mandates for Macroprudential Policies

18. The mandates of the macroprudential authorities in Australia, New Zealand, and the U.K. are laid out in legislation or other vehicles in a manner that allows for the multi-dimensional nature of financial stability. IMF papers (IMF, 2013) recommend that macroprudential mandates should allow the pursuit of three interlocking policy objectives: (a) increasing the resilience of the financial system to shocks (cross-sectional dimension of systemic risk), (b) containing the build-up of systemic vulnerabilities from pro-cyclicality between asset prices and credit (time dimension of systemic risk), and (c) controlling structural vulnerabilities from interlinkages that render institutions systemically important. The legal mandate for macroprudential policies in the U.K. provides an example of an elaborate statement of responsibilities that allows for such a combination of policy objectives. In Australia and New Zealand, legal mandates for macroprudential policies are less elaborate but they are complemented by other vehicles for setting objectives (see further below) such as Statements of Expectations (SOE) and Memoranda of Understanding (MOU):

- The Australian Prudential Regulation Authority (APRA) has an explicit legislative mandate to promote financial system stability set out by the APRA Act 1998, also balancing the objectives of financial safety and efficiency, competition, contestability, and competitive neutrality. The government reinforced the legislated mandate of APRA in 2007 via the Treasurer's Statement of Expectations (Treasurer, 2007).

- The Reserve Bank of New Zealand (RBNZ) has an explicit and broad mandate for macroprudential policies, albeit not provided by law but anchored by a Memorandum of Understanding with the Minister of Finance (MoF) since 2013. Its mandate reads:

  > *The objective of the Bank's macro-prudential policy is to increase the resilience of the domestic financial system and counter instability in the domestic financial system arising from credit, asset price or liquidity shocks. The instruments of macro-prudential policy are designed to provide additional buffers to the financial system (e.g. through changes in capital, lending and liquidity requirements) that vary with the macro-credit cycle. They may also help dampen extremes in the credit cycle and capital market flows.*

- In the U.K. legislation establishes detailed objectives and responsibilities for the Financial Policy Committee (FPC) of the Bank of England. The primary objective of the FPC is to protect and enhance the stability of the U.K. financial system and, subject to that, it has a secondary objective to support the government's economic policy, including its objectives for growth and employment. In achieving these objectives, legislation clarifies that the FPC's responsibility relates primarily to identifying, monitoring, and taking action to

[7] Country practices covered in this section are based on the background provided the Appendices.

remove or reduce systemic risks with a view to protecting and enhancing the resilience of the U.K. financial system. The legislation notes that systemic risks include:

a) *Systemic risks attributable to structural features of financial markets, such as connections between financial institutions;*

b) *Systemic risks attributable to the distribution of risk within the financial sector; and*

c) *Unsustainable levels of leverage, debt or credit growth.*

Ongoing Engagement with the Government

19. In these countries, expectations for macroprudential policy are laid out in annual official correspondence with the government, providing a firmer basis for accountability while protecting operational independence:

- In Australia, the government's Statement of Expectations (SOE) reasserts, among other points, the role and responsibilities of APRA, its independence from the government and accountability to Parliament. In turn, APRA responds to the areas mentioned in the SOE with a Statement of Intent, where it also covers its relationships with the government, the Minister, and the Treasurer, committing to consult with the government when making material changes to its prudential framework and also to provide relevant ministers with accurate, considered, and timely advice on significant issues in its core areas of business. To strengthen regulatory accountability, the Financial System Inquiry in 2014 recommended providing clearer guidance to regulators in the SOE and facilitating/enabling the use of indicators for assessing regulator performance.

- In New Zealand, a Letter of Expectations from the Minister of Finance to the Governor of the Reserve Bank outlines broad expectations of the RBNZ's relationship with the Minister and areas of particular interest for the year, including with respect to macroprudential policies. The Letter also informs the Statement of Intent, where the RBNZ commits to inform the government about its thinking on significant policy developments, notably in areas where legislation may be required, and to provide assessments of regulatory impacts of proposed developments. In addition, the MoU between the MoF and the RBNZ requires consultation with the MoF ahead of making decisions--which entails more frequent informal discussions between RBNZ and Treasury officials--although the final decision rests with the Governor of the RBNZ.

- In the U.K. remit and recommendations letters by HM Treasury specify the economic policy of the government for growth and employment and make recommendations for the FPC's responsibility in supporting it as well as the FPC's priorities for the year. The chair of the FPC (the Governor of the BoE) then formally responds to the recommendations, outlining its responsibility for ensuring financial stability and towards supporting the government's economic policy objectives, as well as considerations for the interactions between

monetary policy and macroprudential policy and making any recommendations to the Treasury including for changes to the regulatory perimeter.

Mix of Macroprudential Powers

20. The macroprudential authorities in these countries have a combination of soft and hard powers, which can help limit inaction bias and avoid implementation delays. The powers of the macroprudential policy authority can vary from "hard" (direct control over macroprudential tools or ability to direct other regulatory agencies) to "semi-hard" (formal recommendations to other agencies supported by a 'comply or explain' mechanism) and "soft" (expressing an opinion/warning/recommendation not subject to comply or explain) (IMF, 2013). Macroprudential policy frameworks benefit from a combination of these powers, as use of hard powers may ultimately be necessary, and even if not used, they provide incentives that make soft powers more effective, while the availability of soft powers provides options that facilitate earlier action than a regulation (CGFS 2010, IMF 2013):

- In Australia, APRA has the power to directly change the behavior of entities to achieve macroprudential outcomes following an assessment of risks at individual or system level. If involving other agencies, that assessment might be discussed in the Council of Financial Regulators (CFR) or in the regular Coordination Committee meetings. APRA's main tool is to vary the intensity of supervision through the cycle, such as dampening risky behavior in the home lending market (RBA, 2012). It also has moral suasion powers via communications with financial entities, the industry, or the public at large, including engagement with boards of entities to set expectations of performance.[8]

- In New Zealand, the RBNZ's soft powers are complemented in the MoU governing macroprudential policies with hard powers that allow for the deployment of four instruments—LTVs on mortgage credit loans, a core funding ratio, a countercyclical capital buffer, and sectoral capital requirements.

- In the U.K. legislation assigns clear roles and responsibilities for macroprudential supervision and regulation to the FPC, providing it with hard, semi-hard, and soft powers. The FPC can make recommendations to other bodies to take measures to mitigate risks, including on a comply-or-explain basis to the PRA and the FCA. It can also give directions to the PRA and FCA to deploy some macroprudential tools. Additional powers include recommending changes to the Treasury or other bodies.

Reporting to Parliament and the Public

21. All three countries hold parliamentary hearings on macroprudential policy, strengthening the accountability framework needed for the delegation of authority:

[8] Engagement with boards has increased in three areas of systemic risk importance: risk appetite, executive remuneration, and credit standards (RBA, 2012)

- APRA operates as part of the government and is accountable to parliament—and ultimately to the public—through the Treasury Ministers, the Parliamentary Committee process, and the formal discussion of its annual report.

- The RBNZ is accountable to the Minister of Finance for its macroprudential policy advice and decisions. Its Board of Directors ensures that legislative responsibilities are met while powers are exercised in appropriate consultation with the government. Further, the RBNZ communicates and explains its views on systemic risks to the public and to parliament, reporting to the parliament's Finance and Expenditure Committee biannually at the time of publication of its Financial Stability Report.

- Members of the FPC regularly give evidence at the House of Commons' at Treasury Select Committee hearings, where they are required to explain their assessment of risks and policy actions. There are also appointment hearings for FPC members by the Treasury Committee. Further, the FPC must publish a record of its formal meetings and a biannual financial stability report.

E. Building Confidence in Macroprudential Tools

22. This section summarizes country approaches to facilitating timely adoption of new macroprudential tools by building confidence around their design and calibration. It covers practices for (a) approving new tools for unforeseen emerging risks, (b) assessing the financial and macroeconomic impacts of such tools, (c) designing tools in a manner that mitigates concentrated distributional impacts, and (d) bringing together multiple agencies involved in financial stability to promote a shared view on risks while allowing timely action.

Approving New Tools for Emerging Unforeseen Risks

23. Ongoing assessment of risks and dialogue among the relevant agencies helps to facilitate the adoption of new tools in a timely manner, even where government and parliamentary approvals are needed.[9,10] Macroprudential measures are often designed closely with the government, but the process of introducing such tools—most evidently in the U.K.—is considerably less lengthy relative to the Swedish experience with the introduction of amortization requirements on mortgages.

[9] Another example of flexibility in expanding the macroprudential policy toolkit is from Germany, where the Financial Stability Committee issued a recommendation to the federal government to create a legal basis for the deployment of macroprudential tools for the residential property market.

[10] In Ireland where the central bank has a range of macroprudential instruments at its disposal including credit-based tools, national legislation provides the basis to introduce tools such as LTV, loan-to-income, debt-service-to-income, and loan-to-deposit ratio targets. The process of introducing new tools requires consultation with the Department of Finance but does not mandate incorporation of comments in the details of the new regulation. The regulation becomes effective on its submission to parliament, which then provides the option for parliament to reject the regulation within a period of 21 days.

- APRA's approach to macroprudential oversight, which is inextricable from the supervision of individual institutions, is proactive and systemic. APRA uses industry-wide stress tests, horizontal reviews, and thematic analysis of emerging risks to motivate prudential action, either of a supervisory or policy nature.

- In New Zealand, in cases where new risks are better addressed by tools not already included in the toolkit, the MoU governing macroprudential policies allows for the development of an additional instrument in consultation with the Treasury. The MoU requires the RBNZ to keep the government regularly informed of its thinking on macroprudential policies and to consult with the Minister and Treasury prior to making any decision on the deployment of a new tool. To illustrate, the RBNZ identified housing risks among the major challenges in its Statement of Intent and it is considering a new debt-to-income (DTI) speed limit to complement the loan-to-value ratios (LVR) currently in place, helping improve the resilience of household balance sheets to income or interest rate shocks. Whereas hard powers allow the RBNZ to tighten the LVR, a DTI would need to be agreed with the Minister of Finance under the MoU. Its adoption would also require more analysis and consultation with the banks on its viability and data issues before making a decision on implementation.

- In the U.K. macroprudential tools of the FPC are designated by the Treasury and approved by parliament, yet the process can be timely. To illustrate, the FPC was recently granted new powers (HM Treasury, 2014). After the Chancellor officially committed to guarding against risks in the housing market, the FPC made a recommendation to government that it be granted additional powers over housing tools. The FPC's original powers of direction that target bank health were expanded by the government and parliament to include housing tools such as limits on debt-to-income and loan-to-value ratios. The legal process of approving new tools took just over 6 months. To further contain vulnerabilities in the housing market, the FPC also requested from the government additional powers of direction over the buy-to-let market, and the government has recently completed a consultation in that respect to later send it to parliament (HM Treasury, 2015).

Reducing Uncertainty Around Impacts from Tools

24. A number of communication tools provide a fuller basis for the public and parliament to assess policy impacts and effectiveness, helping promote confidence that tools will be calibrated appropriately. These communication tools include financial stability reports, policy statements, cost and benefit analyses of proposed and implemented measures, and meeting records. Financial stability reports (FSR) become not only a means to identify risks but a device to build understanding of financial stability risks as basis to accountability and also a basis for external challenges to the authorities' thinking.

- In Australia, the APRA and RBA use consistent data in financial risk assessment to examine different aspects of financial stability while considering policy trade-offs. Also, risk registers—which record elevated but not normally seen systemic risks—act as both a

communication and risk management tool for APRA. Further, the Financial Stability Review publishes APRA's views on financial stability risks, how they have evolved, and the actions taken to moderate them.

- The RBNZ regularly reviews the appropriateness and effectiveness of macroprudential policy decisions. It also conducts and publishes regulatory impact assessments for any macroprudential policy that is to be deployed, in addition to initiating public consultation on those measures. Examples are the publication of estimates of the expected effect of LVR restrictions on the housing market, housing credit, and bank resilience (RBNZ, 2013) and of material monitoring their effectiveness (RBNZ, 2014). In its FSR, it publishes macro- prudential indicators to assess systemic risk, helping to assist in appraising whether a policy response is appropriate.

- In the U.K. the FPC is required to prepare and maintain policy statements outlining how it intends to exercise its powers of direction in relation to each macroprudential tool, also considering the impact on financial stability and growth. The FPC is similarly required to communicate the costs and benefits from the deployment of macroprudential tools. The FSR summarizes the FPC's assessment of the developments and outlook of the stability of the UK financial system along with the extent to which its policy actions have succeeded.

Design and Calibration of Tools to Mitigate Distributional Impacts

25. Australia, New Zealand, and the U.K. are seeking to design macroprudential tools in a manner that achieves financial stability goals while containing efficiency costs. Macroprudential tools could have distributional consequences that are more concentrated among a group of individuals, firms, or institutions. For example, a hard ceiling on a particular lending ratio will fall heavily on all new borrowers that would have borrowed more, without regard to circumstances that may limit the resulting contribution to stability risks. To limit push-backs from lenders, borrowers, and politicians (Bean, 2015), countries have sought to build a degree of flexibility into the design of macroprudential tools, seeking to achieve financial stability goals while binding on fewer economic agents.[11]

- APRA has not introduced across-the-board increases in capital requirements or caps on particular loan ratios for macroprudential purposes. Rather, prudential supervision pays particular attention to specific areas of concern, including mortgage lending with high loan-to-income and loan-to-value ratios, interest-only loans to owner-occupiers, and loans with very long maturities.[12] This supervisory approach to addressing macrofinancial risks

[11] The proposed new instruments for the residential market in Germany are also subject to exemptions, including a pro rata new loan quota for the application of the loan-to-value restriction and a "de minimis threshold".

[12] For instance, in the context of historically low interest rates, high levels of household debt, strong competition in the housing market, and accelerating credit growth, APRA targeted specific higher risk mortgage lending practices in December 2014 (APRA, 2014). It tightened mortgage lending standards for portfolios with strong growth in lending to property investors (above 10 percent) and required maintaining

leaves discretion with banks to make exceptions where they consider it appropriate based on the particular transaction or customer, thereby addressing concerns from potential concentrated impacts.

- In New Zealand, with concerns that the housing market may pose a threat to financial stability, the RBNZ introduced the so-called "speed limits" to restrict the share of high LVR lending that banks can make overall (RBNZ, 2016).[13] The speed limit approach meant some borrowers could go over the threshold while still providing a brake on high lending in aggregate to contain vulnerabilities. Flexibility in the framework allowed for adjustments to the LVR ratio two years after the limit was first introduced—such as varying the ratio by property location (e.g., Auckland) and investor type (e.g., property investors). Applying these more targeted measures (by region and borrower category) limited the need to tighten limits more broadly. It further exempted some classes of loans from the new regulation.[14] Such a flexible and targeted approach to implementing macroprudential instruments is expected to mitigate efficiency costs of containing financial risks.

- In the U.K. a 15 percent limit was introduced in 2014 on the proportion of new mortgage loans with loan-to-income (LTI) at or above 4.5 that relevant lender can issue. The limit was not designed to capture all aspects of credit risk associated with the lending decision nor was it intended to halt the extension of mortgage loans with high LTIs, but rather to restrict such lending to contain risks from excessive household indebtedness.

Ensuring Policy Coordination Across Agencies

26. Australia and the U.K. promote confidence that policies are based on robust analysis, in part through mechanisms for cooperation and information sharing between agencies involved in financial stability. Where different agencies are involved, a robust discussion toward achieving a common understanding on financial stability risks can strengthen the governance of macroprudential policy, helping provide stronger basis for timely action. To achieve this goal, arrangements in Australia and the U.K. (where the monetary policy authority is different from the macroprudential policy authority) ensure continued interaction between agencies involved in financial stability.

- In Australia, analyses of financial stability risks are done separately by the RBA and APRA. But the results are often circulated between the agencies ahead of meetings, publication of

buffers above serviceability metrics (at least 2 percent above the loan rate with a floor of at least 7 percent) in conducting new loan affordability tests. It also provided larger discounts on interest rates for some owner-occupier lending, contributing to a pick-up in such lending while moderating investor credit growth (RBA, 2016).

[13] There are two speed limits in New Zealand: for loans to owner-occupied homes, the share of banks' new residential mortgage lending with high LVR (above 80 percent) cannot exceed 10 percent; for loans to investors, the share of banks' new lending with high LVR (above 60 percent) is limited to 5 percent.

[14] There is special treatment for low-deposit first-home loans made under Housing New Zealand's Welcome Home Loan scheme. Other exemptions include refinancing of existing high-LVR loans, bridging finance, and loans made to borrowers who are moving house but not increasing the size of their mortgage.

reports, and communication, with the RBA's public backing of APRA's actions. Further, coordination between agencies takes a formal (e.g., Coordination Committee meeting every 6 weeks, analysts' meetings) and informal (e.g., recognition of building and maintaining relationships across agencies) shape. Adding to that, data sharing arrangements between the 2 agencies ensure RBA's access to supervisory data on individual institutions, allowing for risk assessments based on consistent information.

- In the U.K. overlapping membership of the FPC with other policy bodies—the Prudential Regulation Authority (PRA), the Financial Conduct Authority (FCA)—are key to promoting the formation of a broadly shared view on financial stability risks. The ability to build a broadly similar understanding is supported by using supervisory intelligence and data from the PRA and the FCA.

27. Where the monetary policy authority is different from the macroprudential policy authority as in Australia and the U.K. the central bank plays an important role in systemic risk identification. While different governance models for macroprudential policies have emerged across countries, it is important to harness central bank expertise in identifying, monitoring, and reporting on systemic risks (BIS, 2011; CGFS, 2012; IMF, 2011; IMF, 2013). A strong role for the central bank also ensures better coordination with monetary policy, provision of liquidity, and payment systems oversight. It could also help shield macroprudential policy from political bias toward inaction.

- In Australia, APRA is the agency with powers over macroprudential tools. Yet, both APRA and the RBA are involved in macroprudential analysis and policy as part of the Council of Financial Regulators, a non-statutory central coordinating body for financial stability that is chaired by the RBA Governor.[15]

- Being chaired by the Governor of the BoE and having other overlapping memberships, the FPC harnesses agency expertise in macroeconomic analyses for the conduct of macroprudential policy, notably in systemic risk identification, monitoring, and reporting, also enhancing among others communication and understanding of interactions across monetary and macroprudential policies.

[15] As mentioned previously, APRA's relationship with the government is clearly outlined in the Statements of Expectations.

F. Some Considerations for Sweden

28. This exploration of how other countries are tackling the challenges involved in designing frameworks for macroprudential policy suggests some areas for further consideration. Experience with macroprudential policy frameworks is limited so at this stage there is no clear best practice on how to enable timely policy action while meeting appropriate accountability standards. The recent agreement to enable FI to adopt macroprudential tools through a clearer and shorter process could address the key issue discussed in this paper. Nonetheless, the country cases discussed suggest consideration of the following issues could be useful to support this step forward:

- *Legal mandate*. The BoE has an elaborated legal mandate, and it should be considered whether such elaboration would assist in Sweden's case in providing FI with a more timely process for adopting new tools. In principle, a more elaborated mandate could enable parliament to focus on ex post review of analysis and measures, rather than relying on ex ante approval of each macroprudential tool for which powers are not in place.

- *Continued engagement on objectives*. A notable feature of the country practices is the regular exchanges between the government and macroprudential policy authority in relation to policy objectives while respecting the operational independence of the authority. Such exchanges could provide a clearer basis for accountability that is needed to allow the delegation of adequate powers to take timely action. A similar transparent and interactive engagement process between the Swedish NDO and the government was developed a few years ago, resulting in on-going evaluation of the management of central government debt, despite the latter being also guided by a hard-to-assess target (FI, 2016).[16]

- *Financial stability risk assessment*. Confidence in allowing timely adoption of new tools is enhanced if there is a robust process for assessing risks drawing on the expertise across agencies. The FSC provides an important forum for bringing together different perspectives on financial stability risks, but views on the scale of risks and the urgency of action have diverged among the agencies in some areas. This may not be avoidable but efforts should continue to use the FSC to strengthen risk analysis and support the design of effective tools.

- *Accountability and transparency*. Sweden's strong arrangements and practices in the area could be reviewed to ensure parliament has the arrangements needed assess the performance of the FI and other agencies, including by remaining well informed about the nature and scale of financial risks, the design of new policy measures, and the evaluation of the effectiveness of existing measures.

[16] The difficulty of evaluating the NDO's target—long-term cost minimization taking into account risk and the requirements of monetary policy—parallels with challenge of assessing the goal of financial stability.

Box 1. Agencies Responsible for Financial Stability in Sweden

Four agencies have main responsibilities for financial stability across different areas.

- FI exercises supervision over financial companies and is responsible for macroprudential policy.
- The Riksbank oversees the financial system as a whole to ensure safe and efficient payments. In exceptional circumstances, it also provides liquidity assistance to banking institutions and Swedish companies supervised by FI.
- The National Debt Office (NDO) is responsible for crisis management, as the resolution authority and the guarantee authority for the deposit insurance, and investor protection systems. The NDO can also provide support to financial institutions to remedy serious disturbances in the economy and to financial stability.
- The Ministry of Finance (MoF) is responsible for financial sector legislation ensuring stability, efficiency, and consumer protection. As the fiscal authority, it also has a role to play for crisis management.

A number of agreements govern coordination among these agencies. A memorandum of understanding (MOU) established guidelines for consultation and exchange of information in areas of financial stability and crisis management, without altering the responsibilities or decision-making powers of the respective parties.[1] The MOU specifies the extensive cooperation between FI and the Riksbank on financial stability. In 2012, both agencies signed a MOU for the establishment of a council for cooperation on macroprudential policy, which was replaced in 2013 by the Financial Stability Council (FSC). The FSC is a forum for monitoring financial stability and discussing among all agencies concerned the need for measures to prevent financial imbalances and for crisis management measures. The FSC is not a decision-making body and does not have powers. It is chaired by the minister of financial markets and normally meets twice a year.

[1] Originally covering the MoF, the Riksbank and FI, with NDO included from May 2009.

Box 2. Definitions of Financial Stability

Financial stability became a new policy objective already in the 1990s and was defined as the absence of financial crises. The importance of making financial stability an explicit policy objective was outlined post the Asian crisis as new policies and instruments sought to maintain financial stability in crisis-hit countries.

One definition of financial instability characterizes it by three criteria (Ferguson, 2002):

- Important financial asset prices seem to have diverged sharply from fundamentals.
- Market functioning and credit availability have been significantly distorted.
- Aggregate spending deviates significantly from the economy's ability to produce.

Since then, most definitions of financial stability have focused on either the efficient and smooth functioning of financial system or the resilience of the financial system to adverse shocks. For instance, the Riksbank's definition of financial stability is that the financial system must be able to maintain its fundamental functions and also be resilient to shocks or disruptions that threaten these functions.

An early definition of financial stability refers to a situation in which the financial system is satisfactorily performing three functions (Schinasi, 2005):

- Facilitating the efficient inter-temporal allocation of resources from savers to investors and the allocation of economic resources generally for wealth accumulation and output growth.
- Assessing, accurately pricing, and relatively well managing forward-looking financial risks.
- Absorbing comfortably, if not smoothly, financial and real economic surprises and shocks.

Other definitions of financial stability include:

- Financial stability can be defined as a condition in which the financial system—comprising of financial intermediaries, markets and market infrastructures – is capable of withstanding shocks and the unravelling of financial imbalances, thereby mitigating the likelihood of disruptions in the financial intermediation process which are severe enough to significantly impair the allocation of savings to profitable investment opportunities (European Central Bank, Financial Stability Review June 2009)
- Financial stability is a situation where the financial system operates with no serious failures or undesirable impacts on the present and future development of the economy as a whole, while showing a high degree of resilience to shocks (Czech National Bank, Financial Stability Report 2010/2011).
- The Bank of England defines financial stability as public trust and confidence in financial institutions, markets, infrastructure, and the system as a whole.
- The European Central Bank's definition is The condition in which the financial system—comprising financial intermediaries, markets and market infrastructures—is capable of withstanding shocks and the unravelling of financial imbalances, thereby mitigating the likelihood of disruptions in the financial intermediation process which are severe enough to significantly impair the allocation of savings to profitable investment opportunities.

Appendix I. Macroprudential Arrangements in Australia

Separate agencies responsible for the regulation and supervision of the Australian financial system are brought together in a coordinating body for the main financial regulatory agencies. Macroprudential policy in Australia is subsumed within the broader and more comprehensive financial stability policy framework. Financial stability involves more than one body that come together in the Council of Financial Regulators (CFR), similar to Sweden. The CFR comprises the Reserve Bank of Australia (RBA), the Australian Prudential Regulation Authority (APRA), the Australian Securities and Investments, and the Australian Treasury. The CFR is a non- statutory coordinating body that is chaired by the RBA Governor and which meets quarterly or more often if needed.

Whereas the CFR is not a decision-making body but a central coordination body, discussions are not limited to financial stability. The CFR has a mandate to contribute to the efficiency and effectiveness of regulation and the stability of the financial system. Its members share information, discuss regulatory issues, and consult on arrangements for the handling of threats to system stability. In cases where the responsibility of agencies overlaps, the CFR is also a venue to resolve such instances. Coordination across all CFR members is governed multilaterally by a number of Memoranda of Understanding and bilaterally between APRA and the RBA.[1] Further, inter-agency relationship at the CFR is maintained through a range of informal structures, including regular secondments of staff and forums for the presentation of work.

In addition to its central coordinating function, the CFR plays an advisory role to the government. It advises the government on the adequacy of the financial regulatory architecture in light of ongoing developments. It can also make recommendations that go beyond the legislative powers of a single CFR constituent, which is useful in case the regulatory perimeter needs adjustment via legislation.

Data sharing arrangements between APRA and RBA allow for risk assessments based on consistent information. In Australia, data collection from financial institutions is legally vested with APRA, which has a robust framework for the exchange and protection of information. Data centralization is also supported by cost-sharing agreements with the RBA and it is governed by a tripartite steering committee including the Australian Bureau of Statistics. The RBA has access to the collected data, including confidential prudential data on individual institutions. Data sharing arrangements allow for the use of consistent information in financial risk assessments by agencies that examine financial stability from a different perspective. While analyses are done separately by

[1] Coordination among agencies is a central feature of the Australian financial system, which helped cool the housing market following the large run up in house prices in the early 2000s.For instance, whereas the National Consumer Credit Code in Australia requires lenders to meet responsible lending standards, both APRA and RBA caution banks about maintaining tight lending standards, encouraging them to improve their internal risk management processes in areas such as collateralization and serviceability. A suasion approach is also used by APRA when it identifies concerns, with communication with management and boards central to the approach.

the RBA and APRA, the results are often circulated between the agencies ahead of meetings and communication.[2]

Inter-agency consultation and coordination processes promote financial stability. Formal coordination between the RBA and APRA takes place as part of the Coordination Committee every six weeks, with the venue and chair alternating between the two bodies. Representation in the Coordination Committee is at the Assistant Governor (RBA) and Head of Financial Stability (APRA) level, among others. Other vehicles for coordination include meetings between analysts from the two agencies to share findings of mutual interest and RBA senior staff presentation of the financial stability report to APRA staff. In addition, informal coordination between staff of the two agencies at both senior executive and working levels is recognized as a professional duty, where members are expected to build and maintain relationships and to demonstrate approachability.

An effective communication strategy supported by a cooperative relationship between APRA and the RBA enhances accountability and influences risk taking. As set out in a joint APRA-RBA paper, the RBA can use its own communication tools to support APRA's decisions in relation to overall financial stability. Public backing by the RBA of actions by APRA strengthens the effectiveness of supervision. Further, in periods of financial fragility, coordinated and consistent communication by both agencies is regarded as essential for maintaining confidence in the financial system.

The government's Statement of Expectations (SOE) strengthens APRA's accountability framework. It outlines the government's expectations about the role and responsibilities of APRA, its relationship with the government, issues of accountability and transparency, and operational matters.

- APRA is expected to continue to act independently and objectively in performing its functions and exercising its powers. At the same time, it should also take into account the government's broad policy framework such as its deregulation agenda.
- The government's preference is for a principles-based regulatory framework—that identifies outcomes rather than prescribes how to achieve them—and a risk-based supervisory approach.
- APRA is expected to operate as part of an integrated regulatory framework, collaborating with other regulators, avoiding the duplication of supervisory activities, and minimizing compliance costs.
- APRA operates as part of the government. It is accountable to the Parliament—and ultimately to the public—through the Treasury Ministers, the Parliamentary Committee process, and the formal discussion of its annual report.

[2] The RBA's Financial Stability Review is reviewed by the CFR agencies prior to its release.

- APRA responds to the SEO with a Statement of Intent to ensure a stable, efficient, and competitive financial system.

The government plans to further strengthen financial regulator accountability and capabilities. The report of the Financial System Inquiry from 2014 highlighted, among others, that financial regulator accountability and capabilities could be strengthened. In response, the government set out an agenda to improve Australia's financial system, which includes updating its SOE in 2016. Notably, financial regulators will be required to report on their capabilities and how they balance different elements of their mandates, and their performance will be monitored by the Financial Sector Advisory Council. The government will also consider enhancing APRA's funding and operational flexibility.

Appendix II. Macroprudential Arrangements in New Zealand

A Memorandum of Understanding (MoU) between the MoF and the RBNZ plays a critical role in anchoring macroprudential policy. The MoU, which sets outs expectations of accountability and transparency, governs the relationship between the macroprudential policy authority (the RBNZ) and the MoF. It defines macroprudential policy and the operating guidelines for the RBNZ, formalizing the objectives, instruments, and governance of the macroprudential policy framework.

Under the RBNZ Act 1989, the macroprudential authority consults with the MoF well ahead of making policy decisions. It also keeps the Minister regularly informed of conditions warranting a macroprudential policy response. A Letter of Expectations by the Minister of Finance provides expectations for engagement with the RBNZ. The Letter also informs the Statement of Intent, which sets the Bank's strategic priorities while committing to inform the government about its thinking on significant policy developments, notably in areas where legislation may be required. The final decision on macroprudential policies rests with the Governor of the RBNZ, thereby limiting the potential for inaction bias. To illustrate, despite its political sensitivity, the RBNZ was able to introduce loan-to-value ratio (LVR) restrictions as they were one of the four tools that make up the RBNZ's macroprudential toolkit.[1]

Legislation in New Zealand establishes the instruments of macroprudential policy. In the macroprudential policy framework, the RBNZ has legal powers to implement and adjust four policy instruments: countercyclical capital buffers, the minimum core funding ratio, sectoral capital requirements and restrictions on loan-to-value ratios for residential lending. To balance timely action fashion so as to reduce the potential for pre-emptive avoidance while providing reasonable time for banks to meet requirements, the RBNZ Act also mentions the indicative notice periods for each of the four macroprudential policy instruments.

The design of macroprudential policy in New Zealand takes into account specific features of the country. The macroprudential framework was designed having in mind a small open economy that is heavily exposed to capital flows, with a financial system that is dominated by four banks, and where around half of domestic bank lending is concentrated in the housing market. As a result, the choices of the macroprudential policy reflect, in addition to considerations from international developments, specific risks such as those arising from off-shore funding and mortgage lending.

The RBNZ communicates and explains its views on systemic risks to the public and to parliament. The bi-annual publication of its annual financial stability is reviewed by the parliament's Finance and Expenditure Committee. In addition, the RBNZ regularly reviews the

[1] Introduced in October 2013, LVR were initially seen as hitting home buyers at least as hard as Auckland property investors. Since then, LVR limits have targeted more the latter group of buyers.

appropriateness and effectiveness of macroprudential policy decisions. It also publishes its assessment of the regulatory impact of any macroprudential policy that is deployed, and initiates public consultation on those measures. For instance, to accompany the decision to adopt LVR restrictions, the RBNZ laid out the detailed thinking behind the decision in a regulatory impact assessment analysis.

Checks and balances other than parliamentary hearings include accountability to the government. Under the Act, the RBNZ is also accountable to the Minister of Finance for its macroprudential policy advice and decisions. As agent for the MoF, the Board of Directors of the RBNZ monitors and oversees how well the macroprudential policy authority meets its legislative responsibilities. It also publishes its review in the RBNZ's annual report, ensuring that macroprudential powers are exercised in appropriate consultation with the government. The macroprudential policy framework is reviewed each five years.

Flexibility in the framework provides scope for a broader implementation of measures as the need would arise. The RBNZ Act specifies areas not falling under the base framework but which may be part of a future work program for the macroprudential policy authority. These include, among others, allowing (or not) exemptions for some borrowers such as first-home buyers, applying LVR on a regional basis, and incorporating debt-servicing capacity into the macroprudential framework. To illustrate, flexibility in the framework allowed for adjustments to the LVR two years after the limit was first introduced —such as varying the ratio by property location and investor type. With concerns that the housing market may pose a threat to financial stability, the RBNZ regionally differentiated the share of banks' new residential mortgage lending that has an LVR exceeding 80.

Flexibility also helps address financial stability risks efficiently. As macroprudential policy is a developing area, the framework allows for the expansion of the MoU between the RBNZ and the Ministry of Finance for the timely introduction of a new instrument. Indeed, whereas income-based lending restrictions are not part of the macroprudential toolkit, the base framework allows for possible additions to the array of macroprudential instruments in consultation with the government. As illustration, the RBNZ is discussing with the MoF the introduction of a debt-to-income ratio to address new concerns from overheating in the housing market, despite concerns surrounding its adverse effects.[2]

[2] Unintended consequences of a DTI cap could include increasing apartment rents as first home buyers would no longer afford living in houses.

Appendix III. Macroprudential Arrangements in the United Kingdom

The revamped regulatory framework assigns clear mandate for macroprudential supervision and regulation to the Financial Policy Committee (FPC). A distinct FPC within the Bank of England (BoE) was established under the Bank of England Act 1998 as amended by the Financial Services Act 2012 (The Act) with a view to contributing to achieving the financial stability objective of the BoE. The FPC is charged with a primary objective of protecting and enhancing the stability of the U.K. financial system and, subject to that, its secondary objective is to support the government's economic policy, including its objectives for growth and employment.

Policy coordination and information sharing are central features of the new framework. Meeting at least quarterly, the FPC draws on diverse experience and a wide range of information to assess threats to financial stability. It is composed of the Governor of the BoE as Chair, the chief executives of the Prudential Regulation Authority (PRA) and the Financial Conduct Authority (FCA), three other members from the BoE, and four external members appointed by the Chancellor, with non-voting representation of the Treasury.[1] Overlapping membership of the FPC with other policy bodies enhances communication and understanding of policy interactions, while external membership brings in independent expertise that guards against group think. Alongside other information, the FPC uses market intelligence from the BoE as well as supervisory intelligence and data from the PRA and FCA to assess systemic risks. It also releases information with a view to reinforcing financial stability, at times working with the British Bankers Association.

Legislation set forth in the Financial Services Act 2012 gives the FPC two sets of powers: Recommendations and Directions. Raising awareness about systemic risk is insufficient to reduce vulnerabilities, so the FPC has two main types of power. It can make recommendations to anyone in furtherance of its objectives without targeting an individual regulated entity. Recommendations to the PRA and the FCA may be made on on a comply-or-explain basis.[2] In addition, the FPC has a distinct power to give directions to the PRA and FCA to deploy certain macroprudential tools, with this set of tools being designated by the Treasury and approved by Parliament. It is required to communicate how it plans to use its direction powers, weighing both their costs and benefits. Additional powers include giving recommendations to the Treasury or regulators, including for outdated regulation, for macroprudential measures, or for activity that has moved beyond the regulatory perimeter.[3] The FPC must consult with the Treasury before giving a recommendation.

[1] Decisions are made based on consensus. If the latter cannot be found, FPC members can vote to reach a decision.

[2] For other bodies like the BoE or the Treasury, there is no statutory obligation to respond to the FPC's recommendations.

[3] The FPC can provide recommendations on activities that should (should not) be regulated, alert the Monetary Policy Committee on threats to financial stability, and cooperate closely with overseas counterparts.

There is a transparent process to broaden the powers of direction of the FPC as new risks emerge. The FPC can make a recommendation to the Treasury at any time for an additional power of direction. The Chancellor responds to the FPC's recommendation with a proposal for draft legislation, seeking to gather the opinions of stakeholders and other parties. The consultation ensures that both the public and parliament are given the opportunity and time to scrutinize and examine the document, and the responses inform the final legislation. There is also a statutory requirement for the FPC to prepare and maintain a general policy statement that sets out how it proposes to use its power of direction, with consideration for the impact of the tools on financial stability and growth.

The FPC's macroprudential toolkit was originally targeted directly at bank health, but it is being expanded to target housing vulnerabilities.[4] The FPC's powers of direction include sectoral capital requirements (including on mortgage exposures), countercyclical capital buffers, and more recently a leverage ratio and buffers for lenders. In April 2015, the government granted the FPC additional powers of direction over housing tools—limits on debt-to-income and loan-to-value ratios—targeting household vulnerabilities.[5] The decision followed the FPC recommendation made in June 2014 to guard against risks arising from the housing market. More recently, the FPC has requested power over additional tools in the buy-to-let market to mirror those over the owner-occupied market. The Treasury expects to follow up on its recently completed consultation on the matter in the coming months.

The process of approving housing-related macroprudential tools took just over 6 months, and involved a number of steps. The FPC first issued a recommendation to the Treasury that it be granted new housing tools including a qualitative cost-benefit analysis. HMT then issued a consultation to gather the opinions of stakeholders and other interested parties concerning the new tools over a one-month period. In response to the FPC's recommendation, the government proposed a draft legislation for granting powers of direction for the new tools, while consulting separately on these recommendations to ensure that both the public and parliament are given ample opportunity to scrutinize and examine the proposal. HMT used responses to the consultation to inform the final legislation, and it laid the final legislation before Parliament a few months later. Finally, it published a consultation response document and impact assessment alongside the legislation.

Accountability, transparency, and parliamentary oversight are key elements underpinning the macroprudential policy framework. The Act requires the government to give a remit and

[4] Original tools included setting sectoral capital requirements (including on mortgage exposures) and countercyclical capital buffers for lenders, to which the power to introduce a time-varying leverage ratios was also added.

[5] In June 2015, the FPC issued a recommendation for the PRA and FCA to apply a 15 percent limit on the proportion of new mortgage loans with loan-to-income at or above 4.5 that any lender can issue. The objective is to help address excessive household indebtedness while allowing flexibility to lend to households with low current, but high prospective, incomes or other assets.

recommendations written notice at least once a year for the FPC, which in turn provides a formal response. The letter outlines the government's economic policy and makes recommendations about the FPC's responsibility in relation to supporting it as well as the exercise of its functions. The FPC must explain the decisions it has taken, publish a record of its formal meetings and a bi-annual financial stability report.[6] Further, FPC members appear regularly before the Commons' Treasury Select Committee hearings where they are required to explain their assessment of risks and policy actions. There are also appointment hearings for FPC members by the Treasury Committee.

[6] The FPC monitors, reviews, and publishes a set of core indicators to explain its actions and enhance predictability, albeit no single set of indicators provides a perfect guide to systemic risk and appropriate policy responses.

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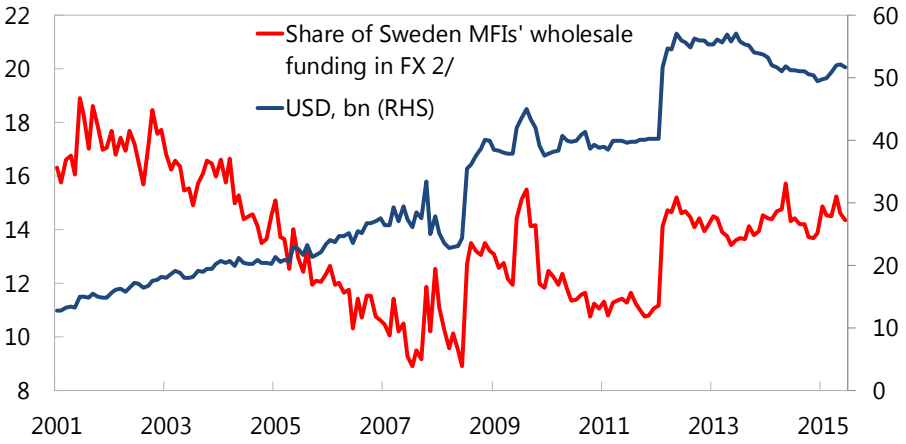
THE ADEQUACY OF SWEDEN'S FOREIGN RESERVES[1]

A. Introduction

1. The global financial crisis reminded policy makers in advanced economies about the importance of foreign exchange reserves. Policy makers in advanced economies (AEs) did not consider their economies to be exposed to a "sudden stop" in capital flows and they also expected the government to retain access to market financing even under adverse conditions, together reducing their motivation to hold foreign exchange (FX) reserves as a precautionary buffer. The carrying cost associated with holding reserves also discourages AE reserve holdings despite these costs usually being smaller for AEs than for emerging market economies. However, shortages of FX liquidity severely affected many European financial institutions in the Global Financial Crisis (GFC), as they often had significant funding from abroad. The lender of last resort role of central banks was therefore put to the test in FX as well as in domestic currency.

2. The Riksbank increased its FX reserves in recent years. Foreign currency reserves have risen to about US$54 bn in September 2016 mostly due to two large increases by about SEK 100 bn (roughly US$14 bn) each in 2009 and 2012. The Riksbank borrowed this FX from the Swedish National Debt Office (SNDO) which issued an equivalent amount of FX government debt. Yet, the increase should be kept in perspective, as FX reserves as a share of the FX wholesale funding of monetary and financial institutions (MFIs) remained roughly stable compared with the early 2000s at about 30 percent.

Foreign Exchange Reserves 1/
(excl. gold)

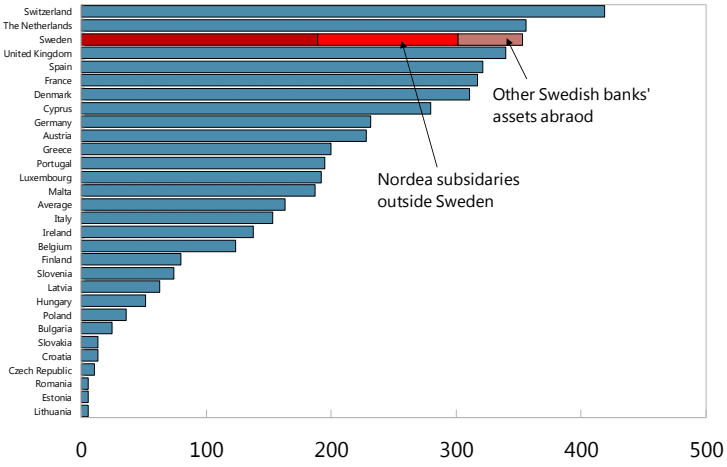


Sources: Statistics Sweden, IFS, and fund staff calculations.
1/ The figure does not include the Swedish banks' foreign subsidaries.
2/ Wholesale funding inlcudes foreign MFI's deposit, money market papers, bonds and subordinated loans in FX.

[1] Prepared by Jiaqian Chen. I would like to thank Craig Beaumont, Kelly Eckhold, Diarmuid Murphy and the Swedish authorities for the very useful comments and discussions.

3. Yet reliance on foreign currency funding by the large Swedish banks that operate in the region remains large. Swedish banks are large, with total assets amounting to about 400 percent of GDP including their branches outside the country. Their foreign currency funding has doubled since 2001 to 120 percent of GDP in 2015, even excluding the branches outside Sweden.

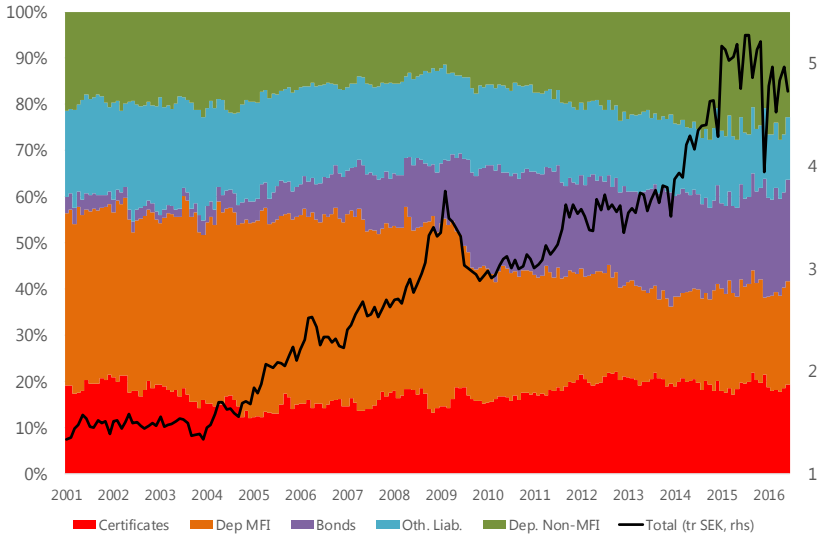
Bank Assets
(December 2014, Percent of GDP)



Sources: Sveriges Riksbank.

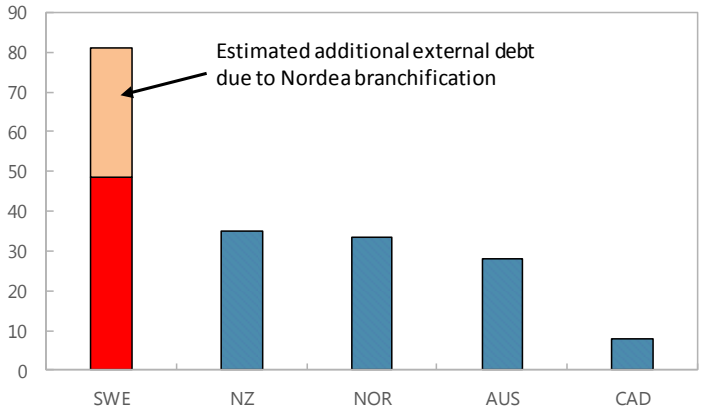
4. The majority of this foreign currency funding comes in the form of short term certificates, unsecured bonds, covered bonds and deposits by non-Swedish MFIs. The maturity structure of this funding varies significantly by currency, with U.S. dollar denominated funding having the shortest maturity, with over 55 percent maturing in less than one year. This FX funding is used to cover part of bank loans, both in FX and also in krona—in the latter case the bank typically hedges in the swap market. This FX funding also supports banks' FX forward transactions with pension funds and other institutions hedging FX investments together with banks' own holdings of FX bonds. In times of market turmoil, banks should first draw on their own FX liquidity if they face difficulties rolling over FX funding. To the extent that is not sufficient, the large FX funding in relation to GDP suggests a sizable need for FX emergency liquidity support would arise, which the Swedish authorities need to stand ready to address to prevent a credit crunch in the real economy or defaults on FX funding that would likely intensify financial instability.

Bank Funding in Foreign Currency



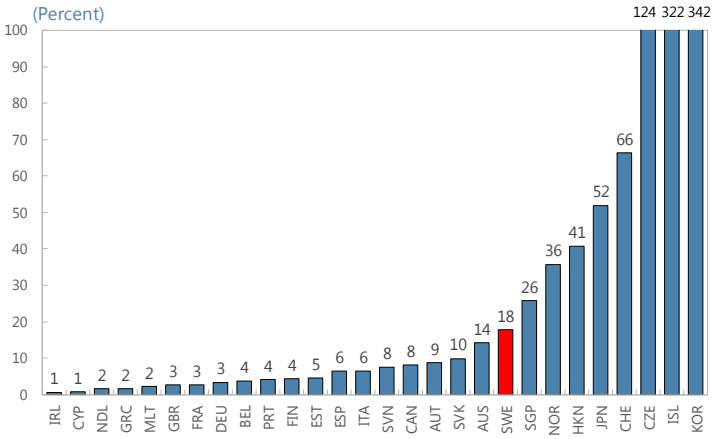
5. The planned Nordea "branchification" would clarify the Swedish authorities' responsibility for providing emergency FX liquidity for its operations outside Sweden. Nordea, the largest financial group in the Nordic region, has total assets of almost EUR 650 bn (140 percent of Sweden GDP). It is planning to covert most of its Danish, Norwegian, and Finnish bank subsidiaries to international branches of its Swedish parent. Sweden's Finansinspektionen (FI) has[2] already granted approval to Nordea, which is now awaiting responses from the authorities in the other three countries. If the plan does go forward, it would add 30 percent of GDP in private external debt to Sweden's international investment position. However, this change in accounting need not itself imply a proportional increase in reserves is needed, as previous assessments of reserves were made using data at the group level of banks, which covers their subsidiaries outside Sweden. Nonetheless, this earlier analysis only considered potential FX needs in U.S. dollars and euro, and did not include other foreign currencies such as NOK, DKK and GBP. Depending on banks' liquidity in those three currencies, branchification could increase potential needs for Swedish FX liquidity support to the extent that arrangements for liquidity support by the host country central bank are not in place.

Short-term External Debt of the Swedish Banking System (Percent of GDP, 2015Q4)



6. This paper explores the adequacy of Sweden's FX reserves focusing on the potential needs to provide FX support to banks in a crisis as a means to protect the real economy. The standard reserve adequacy metrics, i.e., ratios to imports, broad money, or short term external liabilities, offer little guidance for AEs (IMF 2016). Moreover, experiences in other small open economies with a large banking sector, such as the U.K. Switzerland or Canada, don't provide useful case studies as they either can issue a reserve currency or have standing facilities with the Federal Reserve or ECB. While recognizing that a buffer for other purposes is needed, we focus the analysis on potential needs of banks for FX liquidity support over the near-term given the large

Reserves to Short-Term Debt, 2016
(Percent)



Sources: IMF IFS data, Haver Analytics and IMF staff calculations.

[2] In Sweden's case FX intervention has not happened for some years, and in a major crisis it seems unlikely that large scale intervention to support the krona would be a priority. Other possible sizable uses of FX reserves include meeting Sweden's obligations to the IMF and the Riksbanks' potential support to regional central banks.

scale of bank balance sheets. But the diverse composition of assets and liabilities and the limited experience with liquidity shocks make it difficult to determine the most suitable assumptions. A range of outcomes for different assumptions is provided to convey these uncertainties.

7. We proceed in the following steps. First, we briefly describe Sweden's experience with supporting the FX liquidity of banks during the GFC. Second, we estimate the scale of potential FX shortages under stress scenarios using maturity ladder data. Then the FX needs are calculated as the differences between the FX shortages and the FX liquidity that banks can mobilize from disposing their high quality liquid assets (HQLA) in the market. These needs could be met by drawing down FX reserve holdings, but in AEs there is a question as to how much to hold in advance, and how much to rely on raising FX liquidity when the needs arise. Options to raise FX liquidity include central bank swap lines, private sector credit lines, providing state guarantees to banks for their FX funding, or issuing FX government debt to replenish reserves.[3] Although foreign reserves give greater confidence of being available to meet FX needs, covering all potential needs in this way would entail large carrying costs. Hence, the third section explores the appropriate mix between holding FX reserves and raising FX during a crisis. Lastly, drawing on results from the first exercise, we discuss policy measures that would further strengthen banks' FX liquidity by reducing their FX shortages and/or enhancing the FX liquidity they can obtain in the market.

B. Sweden's FX Liquidity Support Experience During the GFC: 2007–2011

8. Foreign currency liquidity shortages emerged following Lehman Brothers' collapse. Although banks had difficulties raising long-term debt from the Autumn of 2008, the interbank money market continued functioning. The real stress came with Lehman Brothers' bankruptcy filing causing a sharp decline in the liquidity of covered bond markets around the world. Investors sought safer and more liquid assets such as government securities and sold covered bonds heavily including those issued by Swedish banks. In their role as market makers, Swedish banks faced a substantial buildup in their covered bond holdings even as the liquidity of the secondary market deteriorated sharply. At the same time, markets for short-term funding were strained, so that banks had difficulty funding their major holdings and the situation quickly became unsustainable (see Sandström and others, 2013).

9. At the peak of the GFC, the Swedish authorities provided 14 percent of GDP in FX liquidity support to banks, including through guarantees. On September 29, 2008, the Riksbank announced a new U.S. dollar loan facility. Between the autumn of 2008 and September 2009, the Riksbank offered a gross amount of US$130 bn at these auctions, of which about 75 percent was taken up by the banks (see Molin 2009). Since Autumn 2008, the Riksbank increased its lending to the banks by the equivalent of more than US$65 bn, including loans in U.S. dollars which peaked at about US$35 bn in spring 2009. Moreover, the SNDO guaranteed the FX bonds issued by certain

[3] The analysis does not incorporate large scale FX purchases either by the central bank or the banks during a crisis as these may result in disruptive exchange rate adjustments given reduced FX market liquidity. Such illiquidity could be greatly exacerbated if markets fear further large scale FX purchases if banks face further FX needs.

banks, substituting for borrowing from the Riksbank. Adding the two together, the authorities provided the equivalent of roughly US$65 bn in foreign currency support.[4] Since the Spring of 2009 the banks' interest in borrowing dollars from the Riksbank declined as it became cheaper to borrow dollars in the market as financial market conditions gradually improved, and the Riksbank has terminated this lending.

10. To ensure continuity in its FX liquidity support, the Riksbank strengthened FX reserves and established swap agreements. It became evident that the FX reserves held by the Riksbank prior to the crisis were not sufficient to cover the FX support to banks (Goodhart and Rochet, 2011). In December 2007, Riksbank entered a swap agreement for EUR 10 bn (about US$15 bn) with the ECB. On September 24, 2008, the Riksbank announced that it—along with few other central banks—had instituted a swap facility with the Federal Reserve which was later extended to US$30 bn. Subsequently, the swap line was extended twice to February 2010. At the same time, in May 2009, FX reserves were raised by about US$13 bn through Riksbank borrowing from the SNDO.

11. Banks have since strengthened their FX liquidity, but if banks can't liquidate their HQLA they may need early support. In anticipation of the 2013 regulatory requirements for a liquidity coverage ratio (LCR) of 100 percent in all currencies as well as separately in US dollar and euro, the major Swedish banks increased their holdings of US dollar denominated liquid assets (cash and balances with central bank) by about US$40 bn during the first half of 2011 funded by a corresponding increase in longer-term US dollar liabilities. Yet, for some banks, covered bonds still contribute to a significant share of their HQLA. In 2011, a Riksbank study found FX shortages in the four major banking groups in the range of US$19 bn to US$115 bn in the first month of a crisis, depending on the extent to which banks can quickly liquidate their HQLA. Such shortages would increase over a longer period, as the LCR requirements only apply over a 30-day horizon, and banks meet the overall Net Stable Funding Ratio (NSFR) but not separately in FX.

12. In December 2012, the Riksbank increased its FX reserve by a further US$15 bn although alternative options were discussed. The Riksbank's decision was motivated by the large liquidity risk in the banking system and the increasing uncertainty abroad, together with a parliamentary decision on an increased commitment to IMF of about US$10 bn in 2012 (see Ekelund and Mannefred, 2012). However, two Riksbank Board members expressed views against this decision, citing the high cost of precautionary FX reserves (Executive Board Meeting 121206, Annex B). They suggested an alternative would be to enter an agreement with the SNDO that FX reserves would be replenished within short period after a decision has been made to use the reserves for liquidity assistance, a proposal that received support from the SNDO and Flam (2013). Martin Flodén also expressed opposing views, arguing in particular that precautionary reserve accumulation involves costs which should be carried by banks rather than the Swedish population, either through a smaller FX liquidity mismatch or fees related to such mismatches.

[4] The loans from the Riksbank together with Swedbank's borrowing under the state guarantee program meant that the State provided more or less all of the banking sector's borrowing in the last few months of 2008. At the end 2009, nine financial institutions had received loan guarantees through the SNDO amounting to about US$45 bn.

C. FX Liquidity Needs of Banks Under Stress

13. Potential FX shortages are calculated using supervisory maturity ladder data. The dataset covers the four major Swedish banks at the consolidated group level,[5] and contains detailed information on banks' cash inflows and outflows in the major currencies over time including from foreign currency swaps. For the purpose of this exercise, we focus only on cash flows in five major foreign currencies for Swedish banks, i.e., USD, euro, DKK, NOR and GBP. The dataset was then grouped into the following buckets: less than 1 week, 7 to 30 days, 31 days to 3 months, 3 to 12 months, and more than 12 months. Importantly, the data allows us to calculate the net cash outflows beyond the 30-day window of the LCR. Moreover, it contains information on the banks' liquid assets including their cash position and unencumbered central bank collateral.

14. The stress scenario is consistent with that used in Sweden's 2016 FSAP aside from the assumption that banks rollover a larger share of their retail loans to protect the real economy. Two sets of assumptions were required on the cash flows: first, roll-off rates on the outflow (i.e., share of outflows falling due that are rolled over such that this portion does not result in a liquidity outflow); and, roll-off rate on inflows (i.e. share of inflows falling due that will actually be paid, so that they can be used to meet outflows). To summarize, the scenario assumes a large share of maturing FX outflows are not rolled over resulting in a large FX drain, together with a smaller FX drain from retail deposits. On the inflow side, we assume 90 percent of the maturing FX loans to customers are rolled over, compared with 50 percent assumed in the FSAP liquidity stress test. On a net basis, no new FX loans are granted by banks, even as some corporates could seek additional bank loans owing to difficulties rolling over existing FX bonds, as there may also be a portion of FX lending that does not need to be rolled over, e.g., if corporates draw down their liquidity. Overall, this implies a gradual reduction in the stock of FX retail loans by 10 percent of amortization and interest payments due, which is likely manageable in the short term. Any FX loans to other MFIs are not rolled over. Roll-off rates on outflows due are initially very high as other parties demand funds but the rate of deposit outflows is assumed to slow as the time horizon increases. Table A1 in the appendix provides a summary of the roll-off rate assumptions.

15. FX shortages are predominantly driven by the large cash outflows in US dollars and euros faced by some banks under stress. FX shortages varied quite significantly among the four banks included in the analysis, in part reflecting the different business models and geographic exposures. At the aggregate level, shortages in US dollar and euro account for over four-fifths of the total. Yet some banks have relatively larger shortages in the other three foreign currencies.

16. Allowing banks to completely drain their liquidity would likely deepen a crisis, so it is appropriate to provide support earlier, requiring assumptions on HQLA floors. During the GFC national authorities eased conditions for credit facilities as a backup source of liquidity (the Federal Reserve) and provided liquidity assistance and guarantees before financial institutions sold a

[5] The shortages and HQLA of Swedish bank subsidiaries abroad i.e., in Finland, Norway and Denmark are aggregate assuming there is free mobility of liquidity between parts of the group.

significant share of their assets (see Domanski and others, 2014). The motivation was to limit contagion from the liquidity shock, prevent fire sales of assets in a crisis that would have adverse spillovers on the valuation of these assets, and maintain banks' access to market funding. Similarly, in determining the amount of FX liquidity support it provides, the Riksbank would wish to ensure that banks maintain a buffer against short-term volatility in cash flows and are also able to demonstrate their liquidity to market counterparts in a manner that helps shorten the duration of net outflows. We explore banks' FX needs under three scenarios: the first scenario assumes banks meet their shortages by depleting all their HQLA, while the second and third scenarios assume the Riksbank ensures that banks retain enough HQLA to cover 50 and 100 percent of the net outflow during the first month. This is conceptually similar to a LCR floor of 50 and 100 percent, which still allows for a substantial draw down of HQLA, as the LCR in FX starts from above 200 percent. [6]

17. Assuming that HQLA is fully liquid in market, FX needs are concentrated in the 1– 3 month maturity bucket, and larger support from the central bank would be needed to improve banks' chance to regain market access. Consistent with the fact that banks are all exceeding the LCR requirements in FX, they were able to withstand the severe liquidity shock for one-month without central bank support, so long as they can quickly realize their high quality assets in the market. However, if a crisis lasts beyond 1 month, a need for FX support of about 4 percent of GDP can develop if it is considered appropriate to keep bank liquidity relatively strong.

FX Needs for the 4 Major Banks (% GDP)					
	<=1W	<=1M	<=3M	<=1Y	>1Y
min 'LCR' of 0	**0**	**0**	**0**	**-1**	**-1**
min 'LCR' of 50	**0**	**0**	**0**	**-1**	**-1**
min 'LCR' of 100	**0**	**0**	**-4**	**-5**	**-5**

18. FX needs increase considerably if banks can't dispose HQLA in market. A large share of HQLA consists of securities that may not be liquid in a crisis (i.e. covered bonds, highly rated corporate paper, and MBS). If these assets cannot be realized quickly, it is necessary to obtain FX liquidity via the Riksbank as these assets are eligible as collateral for central bank support. Making the other extreme assumption, that no part of HQLA except sovereign bonds can be disposed in the market, FX needs during the first month of the crisis increase from 0 up to a range of 4 to 9 percent of GDP. These liquidity needs again rise by about 4 percent of GDP when moving from a 1-month to a 3-month horizon.

FX Needs for the 4 Major Banks (% GDP)					
	<=1W	<=1M	<=3M	<=1Y	>1Y
min 'LCR' of 0	**0**	**0**	**0**	**-1**	**-1**
min 'LCR' of 50	**-1**	**-4**	**-7**	**-8**	**-8**
min 'LCR' of 100	**-6**	**-9**	**-13**	**-14**	**-14**

[6] No haircuts were applied to the HQLA in these calculations.

19. Bank's ability to dispose assets in the market would depend on the intensity of the crisis. In the early stages of a crisis, where uncertainties abound and authorities may be struggling to restore functioning financial markets, it might be most difficult to sell assets. But as a crisis continues, market liquidity may improve. In this vein, it may be prudent to assume that little or no HQLA (other than sovereign papers) can be liquidated in the market in the first month, implying FX needs in the range of 4–9 percent of GDP depending on the extent to which bank liquidity is protected. For shortages beyond a month, a portion of HQLA could be assumed to be liquidated to reduce support needs. Calibrating such assumptions would require closer analysis of the composition of HQLA and experience with the liquidity of such assets under stress.

D. Holding Reserves Versus Raising FX Liquidity in Crisis

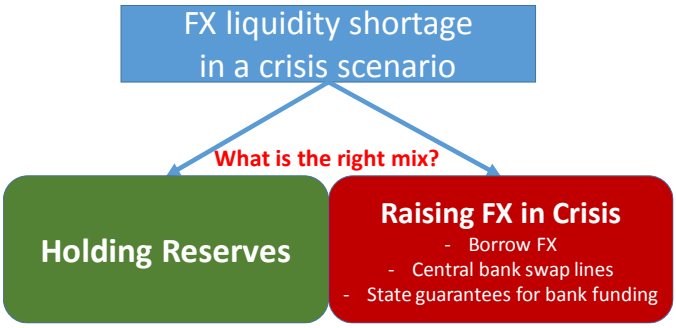
20. To meet the FX needs discussed above, Sweden must choose a mix between:

- *Holding FX reserves:* holding reserves gives the most certain protection during a crisis, up to the limit of reserves held, yet it comes with an insurance premium i.e., the carrying cost during non-crisis times.

- *Raising FX liquidity in crisis:* alternatively, the authorities can wait and react when the needs arise in crisis. During the GFC, Sweden raised FX liquidity via swap agreements with the Fed and the ECB, and its creditworthiness was sufficiently strong that it could borrow FX and provide guarantees to help banks to regain market access. Such an approach involves no cost during normal times, but, depending on the nature of a crisis, there are uncertainties around the both the timeliness and amounts of FX liquidity available. Central bank swap lines are at the discretion of foreign central banks, and experience during the GFC may not be a guide to future availability. There are also potential conditions where a large volume of sovereign borrowing in FX during the initial phases of a crisis could be difficult or unduly costly. Similar constraints would apply to large scale issuance of bank debt securities, even if backed by a state guarantee, which itself may some time to organize and gain the approvals necessary.

A Simple Insurance Model

21. A simple insurance model yields some important insights on the trade-offs. In the model, a representative household maximizes utility subject to a resource constraint.[7] The economy has two states: normal and crisis. In the crisis state, the household loses part of its endowment that is proportional to the size of foreign



[7] Alternatively, one could consider this household as the social planner who maximizes the utility of the economy that is derived from aggregate consumption.

borrowing. There are two contracts that allow the household to insure against losses in the crisis state. The first contract carries an insurance premium but it provides better protection in the crisis state, i.e. holding reserves, up to the amount held. The second contract incurs no premium but the amount of protection provided is uncertain, reflecting uncertainties for Sweden to raise FX liquidity in crisis (¶20). The household chooses a mix of these two contracts to insure the part of resources that will be lost in a crisis. The analytical results in Appendix 1 show that the optimal share of reserve holding is:

- Increasing with the probability of crisis as this contract offers better protection
- Increasing with the size of FX shortage to protect
- Decreasing with the degree of access to market financing in a crisis
- Decreasing with carrying cost

An Extension

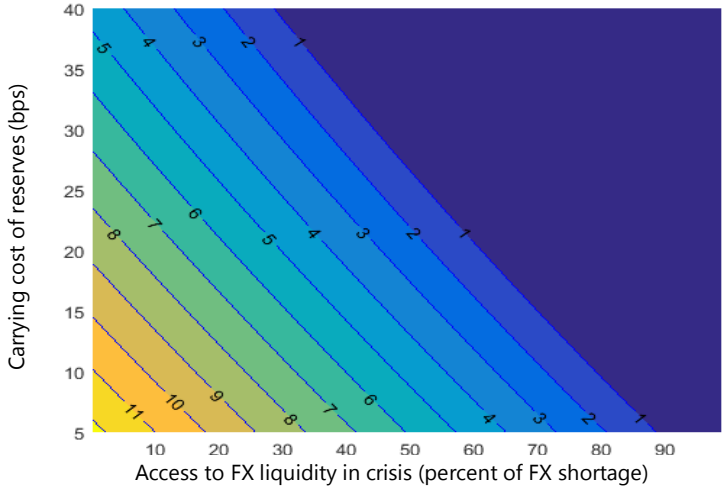
22. We calibrate an extended version of the model to give some quantitative estimates on the size of reserves held ahead of a crisis. The model is described in detail in Appendix II. The text table shows the key parameters for calibration. As it is difficult to pin down some of these parameters precisely, we explore a range. For example, we consider a range for the carrying cost of FX reserves of between 5 to 40 basis points which includes the estimates by the SNDO of 20 to 30 basis points.

Calibration

Probability of crisis (percent)	2
Carrying cost (basis point)	5 - 40
Size of runnable debt (percent GDP)	13
Access to debt in crisis (% runnable debt)	0 - 100
Risk aversion	2 or 4

23. The baseline simulation points to higher reserve holdings the more difficult it is to issue debt during a crisis or the lower are the carrying costs. Figure 1 displays optimal reserves implied by the model for a combination of the carrying cost (y-axis) and degree to which FX liquidity can be raised during crisis (expressed in percent of FX shortages). As argued above, higher reserve holdings are warranted the lower the carrying costs or the lower ability to raise FX liquidity in a crisis.

Figure 1. Optimal Reserves
(Percent of GDP)



24. Further simulations suggest higher reserve holdings are appropriate if crises are expected to be more frequent and if the household is more risk adverse. In Figure 2, the blue set of lines shows the baseline calibration as above, and the red set of lines corresponds to simulated optimal reserves for the same set of parameters except assuming a higher probability of crisis at five percent. In Figure 3, the simulation suggests more risk averse households prefer to hold higher reserves to insure against the shock. Although the appropriate degree of risk aversion is not easily tied down, it may be appropriate to consider a relatively high parameter, to reflect the fact that the costs of a reserve shortfall may have a sizable fixed element in terms of reputation or domestic confidence, if shortfalls impact banks or if banks pass these shortfalls on to customers.

Figure 2. Optimal Reserves and Probability of Crisis
(Percent of GDP)

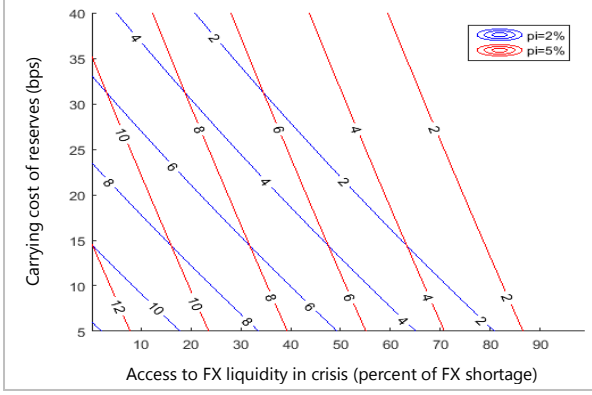
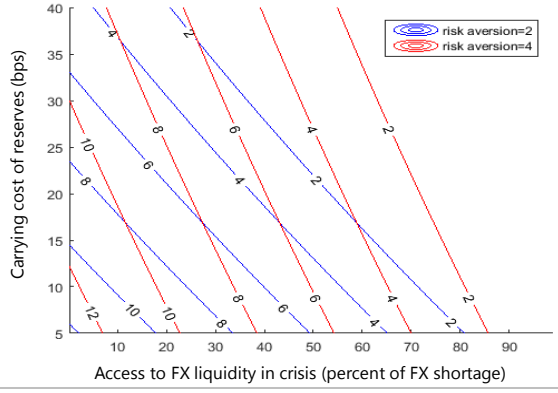


Figure 3. Optimal Reserves and Risk Aversion
(Percent of GDP)

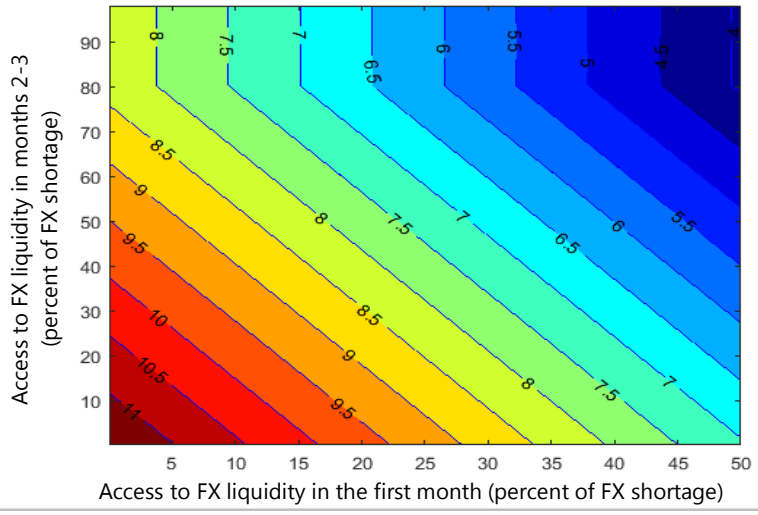


25. The access to FX liquidity could also vary over different phases of a crisis. In the early phases of a crisis, when assessments are still being made of its scale and possible duration, and when even sovereign debt markets could be impacted, it would seem prudent to not rely unduly on the various options to raise FX liquidity (swap lines, borrowing, guarantees). Over the same period, banks could face difficulties in disposing their HQLA in market (¶18). For example, it may be appropriate to hold reserves covering a large share of the identified FX needs for the first month, especially if Sweden is risk averse or the cost of a shortfall is considered to be high. But, assuming that Sweden remains highly creditworthy, it would seem reasonable to anticipate that markets for its debt recover more rapidly than those for most assets. If such a recovery emerged in the 1–3 month period, there would be more scope to issue FX debt or to provide guarantees, possibly covering most or all of the additional need in that period—on the order of 4 percent of GDP—although potentially at significant additional cost. If, however, the nature of the crisis threatened Sweden's creditworthiness itself, the situation would be substantially more difficult, a risk that should be weighed in evaluating the extent of buffers over potential FX support needs.

26. Putting these elements together, the model can be used to provide illustrative guidance on appropriate reserve coverage of banks' potential FX needs. Figure 4 illustrates the approach by assuming that after three months, all additional FX liquidity support needs can be met by the various options to raise FX. It allows for a range of assumptions to be made on access to FX liquidity (as share of the FX shortages) in the first month of a crisis (x-axis) and months 2–3 (y-axis). On the simple assumptions that no FX liquidity can be raised in the first month of the crisis, but half of FX shortages can be raised in the next two months, the model indicates appropriate coverage is about 9½ percent of GDP. Cover would be lower, at 8½ percent of GDP, if it were judged reasonable to assume 10 percent access in the first month and 60 percent in the next two months. An additional buffer over these amounts would be needed to cover other possible uses of reserves and to ensure that reserves were not depleted after three months.

Calibration	
Probability of crisis (percent)	5
Carrying cost (bps)	20
Risk aversion	4
Phase I: first month of the crisis	
FX shortage (percent of GDP)	9
Phase II: 1-3 month period	
FX shortage (percent of GDP)	4

Figure 4. Optimal Reserves and Probability of Crisis
(Percent of GDP)



27. Nonetheless, these calculations are sensitive to a range of assumptions, requiring further consideration. The above analysis assumes that the FX liquidity of banks is maintained at a relatively high level ("LCR"=100) and none of banks HQLA (aside from sovereign bonds) can be liquidated in the market. Arguably, these assumptions could be relaxed, which would tend to reduce appropriate reserve cover for banks' potential liquidity needs. On the other hand, the assumption on official access to FX liquidity returning relatively quickly to substantial levels would need more complete consideration based on experience and analysis of how future crises might look.

28. For example, larger depletion of liquidity by banks could be allowed, although this saving in reserve use would be partly offset if it is assumed that all FX needs are covered. Allowing for a greater depletion of banks FX liquidity buffers, leaving them with 50 percent of the net outflow in the first month, would cut the use of FX reserves to support banks by about 5 percentage points of GDP. Nonetheless, in the model, even with risk aversion of 4, it is not optimal to cover the full FX liquidity need. For example, under the first set of assumptions of no access in the first month and 50 percent in the next two months, needs for FX liquidity total some 11 percent of

GDP, exceeding the 9½ percent of GDP reserve cover from the model.[8] Covering the full amount needed would require higher reserves by some 1½ percent of GDP.

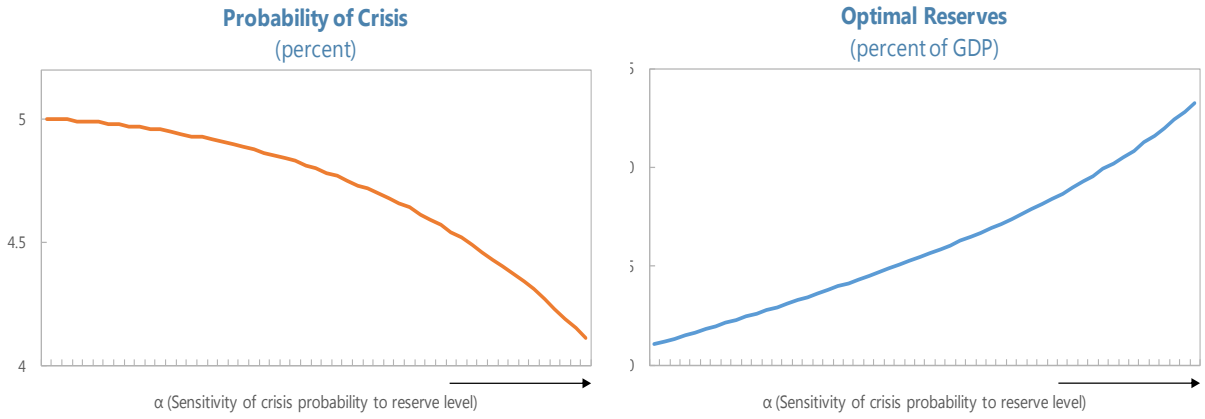
Reserve Coverage Ratio and Crisis Prevention

29. We further extend the model by allowing the crisis probability to endogenously react to the reserve coverage ratio. The central bank could demonstrate its ability to protect domestic banking system by holding reserves. This would provide confidence to foreign investors reducing probability or size of liquidity withdrawals. We modify the model trying to capture this idea (see Appendix III). In particular, we assume the probability of crisis is a decreasing function of the reserve coverage ratio, i.e. ratio between reserves and FX needs:

$$\pi = F\left(b - \alpha \frac{reserves}{FX\ needs}\right)$$

The parameter α governs the sensitivity of the probability to the reserve coverage ratio, i.e., higher α implies larger gains in reducing the probability suggesting higher reserves all else equal.

30. It is desirable to hold higher reserves if they reduce the likelihood of a crisis. The two figures below illustrate the probability of crisis (left chart) and the corresponding optimal reserves. The baseline calibration assumes a crisis probability of 5 percent and the state can issue 90 percent of the FX needs in crisis suggesting very little prefunded reserves is desirable when α is zero. Yet, as α increases, i.e., additional gain from holding more reserves arises, higher reserves become optimal. Note that this exercise is indicative as it rests crucially on the assumed probability distribution.



[8] Based on gross needs of 13 percent of GDP (see table on page 9) net of access to FX liquidity in the second and third months of 2 percent of GDP.

E. Conclusion

31. Three key results emerged from the maturity ladder exercise in the stress scenario:

- Larger FX support needs to be provided if the Riksbank seeks to ensure that banks retain significant liquid assets to limit contagion from the liquidity shock, contain fire sales of assets, and help banks regain access to market funding more rapidly.
- Larger FX needs emerge if banks can't dispose their FX HQLA (except sovereign bonds) in markets during the first month of the crisis. A significant portion of banks' HQLA consists of assets such as covered bonds. To the extent that banks need to use them as collateral for central bank liquidity, they are a means to obtain rather than reduce FX liquidity support.
- Potential FX needs grow if the crisis persists beyond one-month. The Swedish banks met the LCR requirements in USD and euro, which are assessed over a 30-day period, with liquidity gaps emerging after that period.

32. Making assumptions that seek to be on the prudent side, the model-based analysis suggests that current FX reserves provide a relatively modest buffer over potential needs, although results are sensitive to assumptions. At 11 percent of GDP, the current level of FX reserves is modestly above model-based estimates of the appropriate reserve cover for banks FX liquidity needs, which were about 8½ to 9½ percent of GDP assuming very limited access to additional FX liquidity in the first month and more substantial but still less than complete access in the next two months. A buffer on top of such amounts is needed for other potential uses of reserves in a crisis, such as making interest payments on FX debts and meeting obligations to the Fund.

33. Allowing for a larger decline in bank liquidity would imply a larger reserve buffer, but there would also be some increase in the buffer needed to promote stability. Although the model allows for a substantial depletion of bank liquidity, a further depletion could be considered, with half the liquidity buffer in the model-based analysis. On the other hand, it may also be appropriate to meet all FX needs arising, at least in the near-term, as shortfalls could be more costly than allowed for in the model. Making similar assumptions on the liquidity of HQLA and on access to raising FX liquidity in a crisis, such an approach implies a lower need for FX reserves to support banks in the first 3 months of 5–6 percent of GDP, making the current level of reserves of 11 percent of GDP appear more comfortable. But with banks in a weaker liquidity position at the end of three months, the risks of ongoing needs would be greater. Hence a larger FX reserve buffer would be appropriate to support market confidence in the liquidity of the system, in addition to being ready to meet other potential uses of reserves.

34. Options to further strengthen the FX liquidity of banks should be evaluated before considering an increase in reserves. Requiring the composition of banks' HQLA to have a larger portion of assets that are more reliably tradable in a crisis could reduce FX support needs substantially. For instance, a rough calculation suggests that potential FX needs could be reduced by four percent of GDP if half of the HQLA is reallocated. Secondly, monitoring an LCR with a three-

month horizon in foreign currency (i.e., USD and euro) could help to close the gaps in the 1– 3 month period, although further analysis is needed of the appropriate coverage over such a period. An approach based on tighter regulation would ensure banks covered the cost of maintaining adequate FX liquidity, and it is arguably fair as potential FX needs vary across banks.

35. Charging banks a fee to cover the carrying costs of FX reserves would to provide better liquidity management incentives. Although being prepared to protect the banking system is necessary given the potentially high cost to the economy if a bank has FX liquidity difficulties, banks may only comply with liquidity regulation to the minimum standard required if further narrowing FX liquidity gaps would reduce their profitability. A solution would be for the banks to bear the cost on carrying reserves through a fee. The amount of the fee should be based on the estimated FX needs by individual banks, thereby providing incentives for banks to reduce FX needs. Assuming a unit carrying cost of about 20–40 bps, preliminary estimates suggests it would only cost 1–2 percent of bank profits in 2015 to fund the carrying cost of the current level of reserves.

Appendix I. Stress Test Assumptions on the Cash Flows

Table A1: Stress Test Assumptions on the Cash Flows

OUTFLOWS (roll-off rate indicates the fraction is converted into cash outflow)	>= 1W	1W < ~ <= 1M	1M < ~ <= 3M	3M < ~ <= 1Y	>1Y
Liabilities from securities issued					
Unsecured bonds	100	100	70	43	4
Hybrid bonds	100	100	70	43	4
Covered bonds	87	87	62	41	7
Short term paper	100	100	70	43	4
Liabilities from secured lending and capital market driven transactions as defined in Article 192 of CRR, collateralised by:					
Central Bank eligible assets					
Covered bonds	35	35	23	17	10
Govt. and others	31	31	20	16	7
non-central bank eligible but tradable assets	100	100	70	43	4
Deposits by non financial customers					
Retail deposits	15	12	10	8	5
NFC and other deposits	43	34	32	26	8
Central bank	0	0	0	0	0
Deposits by financial customers	100	100	75	58	4
Other	100	100	100	100	100
INFLOWS (roll-rate indicates the fraction of theamount maturing that is converted into a cash inflow, i.e. NOT rolled over)					
Securities					
Central Bank eligible assets					
Covered bonds	100	100	100	100	100
Govt. and others	100	100	100	100	100
Non-central bank eligible but tradable assets	100	100	100	100	100
Loan maturing from non-financial customers					
Retail loans	10	10	10	10	10
NFCs loans	10	10	10	10	10
Central bank & other (public sector)	100	100	100	100	100
Loan maturing from financial customers	100	83	70	70	70
Other (wholesale)	100	100	100	100	100

Appendix II. A Simple Insurance Model

Consider a small open economy that is populated by a representative consumer, who maximizes its utility:

$$U_t = \frac{C_t^{1-\sigma}}{1-\sigma}$$

subject to a resource constraint

$$C_t = Y_t + Z_t$$

where Y_t is goods purchased with domestic income and foreign borrowing, and Z_t is transfer from insurance contracts.

The economy can be in two states: crisis (denote by c) or non-crisis (denote by n). In crisis time, foreign creditors stop lending to the consumer thus, its consumption reduces by FX_t.

However, the consumer can smooth its consumption by buying insurance contracts. The contract signed at time t stipulates contingent payments to consumer at time t+1. Two such contracts exit, and one unit of the contracts specifies a transfer schedule as below:

$$\mathrm{Z}^1 = \begin{cases} -\mathrm{x} & if\ no\ crisis \\ 1 & if\ crisis \end{cases}$$

$$\mathrm{Z}^2 = \begin{cases} 0 & if\ no\ crisis \\ 1-\epsilon & if\ crisis \end{cases}$$

In the first contract (Z^1), consumer pays an insurance premium of x in non-crisis times, but he receives 1 per unit of contract in crisis (i.e. holding reserves). In the second contract (Z^2), he pays nothing when there is no crisis but only receives $1-\epsilon$ in crisis (i.e. replenish reserves in crisis). And, we assume x and ϵ are both positive but less than 1, thus the first contract transfers purchasing power from non-crisis to crisis state. The consumer will fully hedge against the potential consumption shortfall (FX_t) but he optimally chooses the mix of the two contracts. Let η be the share of the first contract it purchases, thus the expected payoff from the insurance contracts can be written as:

$$\mathrm{Z}_{t+1} = \begin{cases} -\mathrm{x}\eta\ \mathrm{FX} & if\ no\ crisis \\ \eta\ \mathrm{FX} + (1-\eta\ )(1-\epsilon)\mathrm{FX} & if\ crisis \end{cases}$$

The consumer chooses the share η to maximize the expected utility in period t+1:

$$\eta = argmax\ (1-\pi)u(c_{t+1}^n) + \pi u(c_{t+1}^s)$$

Where $c_{t+1}^n = Y_t + z_{t+1}^n$ and $c_{t+1}^s = Y_t - FX_t + z_{t+1}^s$ and π is the probability of crisis. The first order condition yields:

$$(1-\pi)u'(c_{t+1}^n)\frac{\delta z_{t+1}^n}{\delta \eta} + \pi u'(c_{t+1}^s)\frac{\delta z_{t+1}^s}{\delta \eta} = 0$$

After some simplification, it can be shown that:

$$\eta^* = \frac{\pi}{xf} - \frac{1}{\epsilon \mathrm{f}} + \frac{\pi}{\epsilon \mathrm{f}} + 1 - \pi$$

where f denotes foreign borrowing as share of total output (i.e. FX_t/Y_t).

$$\frac{\delta \eta}{\delta \pi} = \frac{1}{x\,f} + \frac{1}{\epsilon \mathrm{f}} - 1 > 0$$

$$\frac{\delta \eta}{\delta \epsilon} = -\left(\frac{\pi}{\mathrm{f}} - \frac{1}{\mathrm{f}}\right)\epsilon^{-2} > 0$$

$$\frac{\delta \eta}{\delta x} = -\frac{\pi}{f}\mathrm{x}^{-2} < 0$$

$$\frac{\delta \eta}{\delta f} = -\left(\frac{\pi}{x} - \frac{1}{\epsilon} + \frac{\pi}{\epsilon}\right)\mathrm{f}^{-2} = \left(\frac{x(1-\pi) - \epsilon\pi}{x\epsilon}\right)\mathrm{f}^{-2}$$

Thus, the optimal share of contract 1 (i.e. holding reserves) is increasing in π and ϵ but decreasing with x. Intuitively, as crisis becomes more frequent, the option of a better protection becomes more valuable, thus the consumer would prefer hold the first contract. Similarly, the second insurance contract is less attractive if it offers less protection in crisis (i.e., higher ϵ).

Appendix III. An Extension

We build on the simple model in Appendix I.

Banks

Banks face perfect competition and raise funding through foreign wholesale market (B_t) and domestic deposits (D_t) to provide loans to domestic households (L_t). We assume deposit rate is positively correlated with deposit:

$$r_t^d = \lambda^d \left(\frac{D_t}{Y_t}\right)$$

And, we assume the cost of foreign funding is positively related to the share of foreign lending:

$$r_t^b = \lambda^b \left(\frac{B_t}{Y_t}\right)$$

In equilibrium:

$$r^{d*} = r^{b*}$$

$$\frac{D_t}{B_t} = \frac{\lambda^b}{\lambda^d}$$

$$D_t = \frac{\lambda^b}{\lambda^d} B_t$$

Let $\alpha = \frac{\lambda^b}{\lambda^d}$ and assume a simple bank balance sheet structure: $L_t = B_t + D_t = (1+\alpha)B_t$

Zero profit condition implies:

$$r_l = \frac{D_t}{B_t + D_t} r^d + \frac{B_t}{B_t + D_t} r^b$$

Household

The economy is populated by a representative infinitely lived household who maximizes utility:

$$U_t = E_t \left(\sum_{i=0,\ldots,\infty} (1+r)^{-i} u(c_{t+i}) \right)$$

subjects to a budget constraint:

$$C_t = Y_t + L_t = (1 + r_l) L_{t-1}^h + Z_t$$

Where, Y_t is domestic output, L_t^h is bank loan, and Z_t represents transfers from an insurance contract.

State of the Economy

The economy can be in two states: crisis (s) and non-crisis (n).

- Non-crisis state: output, loan, deposit and foreign funding grow at a constant rate g which is smaller than r.
- Crisis state: foreign investors pull away their financing, the banks can't raise more domestic deposit to compensate the funding losses, thus we assume, for simplicity, loan supply collapses to D_{t-1}:

$$B_t^s = 0$$

$$L_t^s = D_{t-1}$$

We assume it takes a certain number of periods Θ for the banks to regain the full amount of foreign funding. For simplicity, we start by assuming Θ=1, i.e. crisis only lasts for one period.

Insurance Contract

Household can smooth consumption by entering an insurance contract which is designed following Jeanne and Ranciere (2011)[1]. A contract $(\mathrm{R_t}, \mathrm{x_t})$ singed at time t stipulates contingent payment to the household at time t+1:

$$\mathrm{Z_{t+1}} = \begin{cases} -\mathrm{x_t}\,\mathrm{R_t} & if\ no\ crisis \\ (1-\mathrm{x_t})\mathrm{R_t} & if\ crisis \end{cases}$$

Thus, household pays an insurance premium $\mathrm{x_t}\,\mathrm{R_t}$ when there is no crisis but receives a transfer $(1-\mathrm{x_t})\mathrm{R_t}$ if there is a crisis.

This insurance contract can be easily replicated if household can issue a contingent debt based on the occurrence of a crisis. Let's assume household can issue debt whose principal is repaid only if there is no crisis. One unit of this debt issued in time t has a face value of 1, and yields $1+\mathrm{r}+\mathrm{x_t}$ if there is no crisis in period t+1, and $\mathrm{r}+\mathrm{x_t}$ if there is a crisis. The household sells this debt to foreign investors at a unitary price of 1 and invests the proceeds in reserves (safe assets) that yield the risk free interest rate r. Assume the household issues $\mathrm{R_t}$ units of debt in period t, the net payoff in period t+1 is:

$$(1+\mathrm{r})\mathrm{R_t} - (1+r+\ \mathrm{x_t})\mathrm{R_t} = \ -\mathrm{x_t}\mathrm{R_t}\ \text{ if no crisis in time t+1}$$

[1] Jeanne Olivier, and Romain Ranciere, 2011, "The Optimal Level of International Reserves for Emergening Market Countries: A New Formula and Some Applications." The Economic Journal, Vol. 121, issue 555, September 2011.

$$(1 + \mathrm{r})\mathrm{R_t} - (r + \mathrm{x_t})\mathrm{R_t} = (1 - \mathrm{x_t})\mathrm{R_t} \text{ if crisis in time t+1}$$

Note that the payoffs are exactly the same as those of the insurance contract. We can re-write the expected payoff of the contingent debt by:

$$(1 - \pi)(1 + r + \mathrm{x_t}) + \pi(r + \mathrm{x_t}) = 1 + \mathrm{r} + \delta_t$$

Where $\delta_t = \mathrm{x_t} - \pi$ is the expected excess return or the opportunity cost of holding reserves.

Household's Optimization Problem and Optimal Reserves

Household chooses size of the insurance/reserves $\mathrm{R_t}$ to maximize the expected utility of period t+1 consumption:

$$\mathrm{R_t} = argmax\ (1 - \pi)u(c_{t+1}^n) + \pi u(c_{t+1}^s)$$

Where c_{t+1}^n and c_{t+1}^s are given by household budget constraint, given on the term $\mathrm{Z_{t+1}}$ is dependent on the reserve level $\mathrm{R_t}$, we have:

$$(1 - \pi)u'(c_{t+1}^n)\frac{\delta Z_{t+1}^n}{\delta \mathrm{R_t}} + \pi u'(c_{t+1}^s)\frac{\delta Z_{t+1}^s}{\delta \mathrm{R_t}} = 0$$

$$\frac{u'(c_{t+1}^n)}{u'(c_{t+1}^s)} = \frac{\pi_t^{-1} - 1}{x_t}$$

Let $p_t = \frac{\pi_t^{-1} - 1}{x_t}$ and $\rho_t = \frac{R_t}{Y_t}$

Moreover, household's consumption in the two states are:

Non-crisis:

$$C_{t+1}^n = Y_{t+1}^n + L_{t+1}^n - (1 + r^l)L_t^n - D_{t+1}^n + (1 + r^d)D_t^n + Z_{t+1}^n$$

In crisis state, only loans that funded by domestic deposit are rolled over:

$$C_{t+1}^{s} = Y_{t+1}^{n} + D_{t}^{n} + \epsilon B_{t}^{n} - (1 + r^{l})L_{t}^{n} + Z_{t+1}^{s}$$

and we can derive a closed form solution forρ_t (reserves as share of GDP)

$$\rho_t = \frac{p^{1/\sigma} - 1 - \frac{b_{t+1}}{1+g}\left(p^{\frac{1}{\sigma}}(r-g) - 1 - r^{l} - \alpha r^{l} + \epsilon\right)}{1 - x_t + x_t p^{1/\sigma}}$$

Appendix IV. Crisis Prevention

Crisis prevention benefits can be captured by writing the probability of a crisis as a decreasing function of reserves as share of GDP i.e. $\pi(\rho_t)$. More specifically, we assume $\pi(.)$ decreases with the ratio between reserves (R_t) and FX needs (FX_t).

$$\pi_t = F\left(b - a\left(\frac{R_t}{FX_t}\right)\right)$$

where $F(.)$ is the CDF of a standard normal distribution. In this specification the probability of a crisis is a smoothly decreasing function of the reserve coverage ratio. The computation of the optimal reserves (ρ_t) is done by solving a standard fixed-point problem.