The rise, the fall, and the resurrection of Iceland

Sigriður Benediktsdóttir, Gauti B. Eggertsson, Eggert Þórarinsson[1]

Abstract

This paper documents how the Icelandic banking system grew from 100 percent of GDP in 1998 to 9 times GDP in 2008 when it failed. We base the analysis on data from the banks that was made public when the Icelandic parliament lifted among others bank secrecy laws to investigate the run up to the financial crisis. We document how the banks were funded, and where the money went with a comprehensive analysis of their lending. The recovery from the crisis is based on policy decisions which in hindsight seem to have worked well. We will analyze some of these policies, including emergency legislation, capital control, alleviation of balance of payment risks and preservation of the financial stability. We also estimate the output costs of the crisis, which was about average relative to the 147 banking crisis documented Laeven and Valencia (2012) and the 100 banking crisis documented by Reinhart and Rogoff (2014). Our computation of the governments direct costs, reveals that the recently concluded negotiation with foreign creditors may even leave the Icelandic government in net surplus as a consequence of the crisis, although there is still some uncertainty about the ultimate cost and our benchmark estimate is a cost corresponding to 5 percent of GDP. We summarize several lessons from the episode.

[1] Benediktsdóttir: Jackson Intitute of Global Affairs, Yale University, Eggertsson: Department of Economics, Brown University, Þórarinsson: Central Bank of Iceland. We thank Karl Aspelund, Josef Platzer, Luca Riva and Ian Tarr for excellent research assistance.

Introduction

In some respect Iceland was ground zero of the financial crisis of 2008. Its entire banking system failed within the span of a week, sparking mass protests and eventually forcing the government to resign. The Icelandic saga captured the imagination of the world. It was a topic of books, movies and television shows. Some suggested it as a key parable of the folly of bankers gone wild, while other hailed the Icelandic government´s response to the crisis as a role model for recovery from a banking crisis.

At some level, the amount of attention heaped on a tiny country of 330,000 people in the middle of the Atlantic Ocean is a mystery. Why would a country with a population equivalent to a few blocks in New York City command such attention? One indicator may shed light on this. Table 1 shows the largest bankruptcies in US history in terms of dollars. Put in that comparison, coming in at number 3, a few places below the Lehman Brothers, is the Icelandic bank failure. The banks, largely state-owned at the turn of the century, managed in only about 5 years, following privatization, to grow into international banking franchises. In 2008, at the eve of the banking crisis, the combined assets of the three Icelandic banks corresponded to about 9 times Iceland's GDP, or 155 b.dollars (115 b.euros). This was the largest banking sector relative to GDP of any country in the world. Contrast this with the second largest banking sector at that time, Switzerland's, which has a balance sheet about 6 times GDP, accumulated over a period of 3 centuries of banking experience and institution-building rather than in a span of a few years.

Table 1. Iceland and America's Largest Bankruptcies

Name	**Date of failure**	**Total Assets b.dollars**
Lehman Brothers	Sept. 2008	$639
Washington Mutual	Sept. 2008	$328
Icelandic Banks	Oct. 2008	$155
World.com	July 2002	$104
General Motors	June 2009	$91

Source: BankruptcyData.

In the annals of economic history, this stupendous growth perhaps belongs with the Dutch tulip mania of the 1600s. Yet the effects were more dramatic. Once the Icelandic banks went bust, not only did people in Iceland suffer losses, but so did hundreds of thousands of claimholders across the world. That included thousands of depositors in Britain and the Netherlands who thought their money was protected by insurance in line with EU rules. This lead to a complicated international dispute, which for a while looked like it would evolve into a serious trade conflict.

This article tells the Icelandic saga. In itself, it is a saga worth telling, due to the unprecedented growth and failure of a banking system which has been well documented in part due to exceptional access to data. After the financial crisis of 2008, the Icelandic Parliament (called the Althingi) established the Special Investigation Commission (SIC) composed of a supreme court judge, parliamentary ombudsman and an economist, Sigridur Benediktsdottir who is one of the author of this paper, to address the basic questions of "What just happened?" and "Where any

public officials responsible for mistakes or negligence?"[2] The investigation is unique in that Althingi lifted all laws on bank secrecy in the public interest. The investigation commission had unparalleled access to information about the operations of the banks, loan books, tax information, reports, and loan committees' documents and minutes from all banks. Moreover, they had subpoena power over bankers and any other relevant parties, such as politicians, business partners and regulators. The result of this effort was made public, in a 3000-page report (in Icelandic) in 2010. We will use much of the data presented in that report in the first part of the article, explaining the run-up to the crisis. Relative to that report, we have chosen to aggregate some data, which were made public, to give a more consistent macro picture that does not depend on the particulars of each bank. Furthermore, as the report was written in 2010, we now have seven years of financial statements by the banks which allows us to assess recovery rates and put the crash in a broader ex post context. In particular, it gives us better ability to assess the key question of whether or not the banks were solvent at the time of the crash – and thus a victim of self-fulfilling bank-run in the spirit of Diamond and Dybvig (1983) – or not. One of our key conclusions is that they were insolvent in 2008, although we acknowledge that such an assessment is highly speculative for reasons we outline.

Apart from telling the Icelandic saga which is interesting in its own right, there are at least three other reasons why it is worth revisiting for a broader audience.

First, the Icelandic example is often heralded as a role model on how to deal with a bank crisis—let the banks go bust (!)—but on relatively dubious premises. This popular account is not accurate. The domestic portion of the banking system was bailed out; deposits were given priority ex-post ahead of other unsecure claims. The foreign portion of the failed banks were granted a debt moratorium and resolution committees were appointed to them to preserve the value of their assets.[3] The real story, which we will seek to shed light on, is more interesting than the stylized fiction. We suspect that some aspects of the government's actions were inevitable at the time, and may therefore have predictive power for actions by other democratic governments faced with similar set of problems in the future.

Second, we think there are a several broad lessons to be learned extending beyond Iceland. Largely these are stories that have been told before, but perhaps the starkness makes Iceland a good illustration, along with the access to more detailed data that documents the rise and fall of the banks, its causes and consequences. To take but a few examples: The saga connects well with Rajan's (1994) theory of credit erosion and dangers of too rapid expansion in loan books (see e.g. Jimenez and Saurina (2006)). It is also vivid example of the moral hazard and more risk seeking triggered by explicit and implicit safety nets (see e.g. Kareken and Wallace 1978), as well as highlighting the dangers of bank runs in the absence of a viable lender of last resort (Diamond and Dybvig (1983)). The saga also highlights the importance of a robust supervisory authority and strong rules against large exposures and insider lending, connecting quite closely to the analysis in Akerlof and Romer's (1994) and Johnson, La Porta, Lopez-de-Silanes and Schleifer (2000). Similarly, the banks financing on foreign bond markets is an interesting example of what Brunnermeier (2012) calls "rating arbitrage". Finally, the story of the large

[2] Some translated chapter from the report: https://www.rna.is/eldri-nefndir/addragandi-og-orsakir-falls-islensku-bankanna-2008/skyrsla-nefndarinnar/english/

[3] The Financial Supervisory Authority Annual Report 2009.A

capital inflows leading to increased external leverage and increasing systematic risk is an example of the mechanisms highlighted in Calvo (1998), Krugman (1998), Reinhart and Rogoff (2008) and Caballero (2016). There are many other connections to mechanism identified in the literature that could be highlighted further, and we will attempt to provide some in the main text.

Third, Iceland provides an interesting case study for the cost of a financial crisis. In Iceland, it was clearly immense: GDP declined over 10% in real terms from peak to through in 2010 and disposable income declined about 20% over the same period. However, the recovery has been relatively strong. We present evidence that output lost was relatively modest in international context, given the enormous scale of the Icelandic financial sector failure relative to GDP. We also present new evidence on the fiscal cost of the crisis. The IMF estimated in 2012 that the gross fiscal cost was 44 percent of GDP, and net about 20 percent (Laeven and Valencia 2012). We update their estimate in light of recent developments and get a benchmark net –cost of about 5 percent of GDP. We also illustrate scenarios, that do not look implausible, where there is a net fiscal gain from the crisis, corresponding to about 1 percent of GDP. There are also several noteworthy features of the recovery, such as the aggressive restructuring of household and firms debt in the aftermath of the crisis, which may help explain the relatively rapid recovery, and ties closely to the literature on debt deleveraging[4] and the importance of cleaning up firm's balance sheet to avoid the problem of "Zombie firms".[5] Lastly we highlight the implementation and lifting of capital controls that were only recently lifted as well as the "stability contributions" from the old banks estates which potentially helped Iceland avoid a looming balance of payment crises.

The outline of the paper is as follows: In section 1 we make some general observation about the growth of the Icelandic financial sector. In sector 2 we document where and how the Icelandic banks funded their growth. This includes a discussion of the collection of internet deposits in Britain and Netherland amounting to 10 billion euros at its peak, corresponding at that time to about 10 percent of the banks´ balance sheet. We also discuss how the banks managed to borrow over 6 billion euro in collateralized funding from the ECB and the Central Bank of Iceland. That involved in part one Icelandic bank printing a bank bond, in exchange for a bank bond issued by another Icelandic bank, and each posting that as a collateral. Via this arrangement the banks were essentially allowed to borrow money without limit and without a meaningful collateral. In section 3 we discuss who received the funds. In particular, we take advantage of the unprecedented access of Parliaments's Special Investigation Commission (SIC) to among other loan books, derivative contracts, other lending contracts and all domestic tax returns. All the evidence suggests that the quality of the loan book eroded in the run up to the crisis, that large exposures grew, and that owners of the banks, i.e. insider, borrowed disproportionally. Large exposures and insider borrowing posed a serious systemic risk largely unbeknownst to supervisors or other policy makers at the time. The data pinpoints the exact group of individuals and firms that received the loans and the development of the exposure over time. We also document the form of these loans which were more often than not in the form of a loan with a single payment at the end of the loan period (bullet loan), with no collateral or lax restrictions on collateral. Section 4 documents that a large share of the equity of the banks was "weak" in the sense that bank shares were funded by the banks themselves directly, with the shares themselves

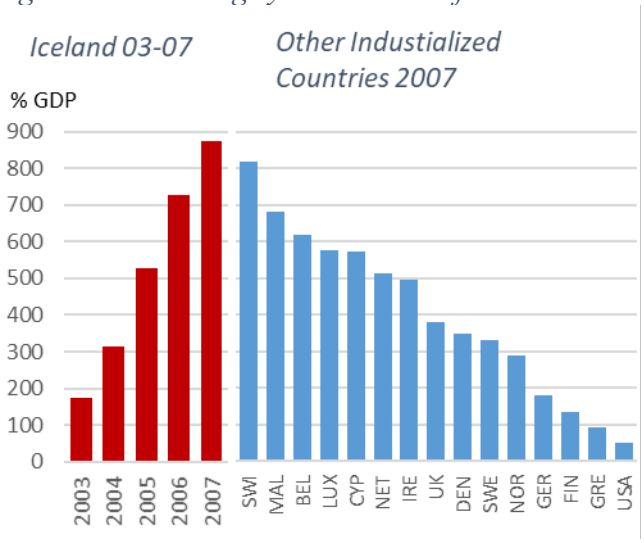
[4] See e.g. Eggertsson and Krugman (2012).
[5] See e.g. Caballero, Hoshi and Kashyap (2008).

as the only collateral for the loans. This equity evaporated during the crises, lowering recovery from the estates. In section 5 we document the nature of the government emergency laws when the banks faced a severe run on foreign currency funding, including deposits abroad. We suspect these laws have predictive power for policy actions in time of stress in countries with large international banking exposure, with important implication for cross country regulations. In section 6 we assess the recovery rate of the banks. On the basis of our estimates, we argue that it is difficult to maintain that the Icelandic banking system was solvent in 2008 and a victim of a classic self-fulfilling run. In section 7 we estimate the output cost of the banking crisis in Iceland and assess the sources of the recovery. In section 8 we estimate the fiscal costs. In section 9 we discuss Iceland's post-crisis balance of payment problem post crisis and it´s experiment with capital controls. In section 10 we draw general implication and lessons. Section 11 concludes.

1. Growth of the three large banks

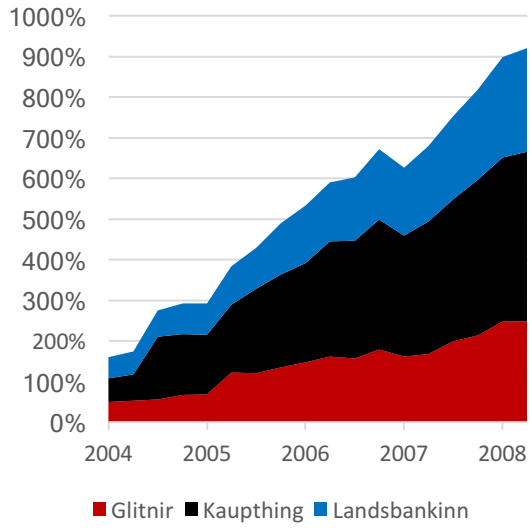
The three largest banks in Iceland, which accounted for over 95 percent of the banking system, expanded from corresponding to approximately 100 percent of GDP in 1998 to about 900 percent of GDP at the time of their failure (see Figure 1.2).[6] This growth was often cited as evidence of the unsustainability of the Icelandic banking model.[7]

Figure 1.1. Banking system size % of GDP



Source: Central Bank of Iceland, EoI 2016.

Figure 1.2. 3 Large Banks Liabilities % of GDP

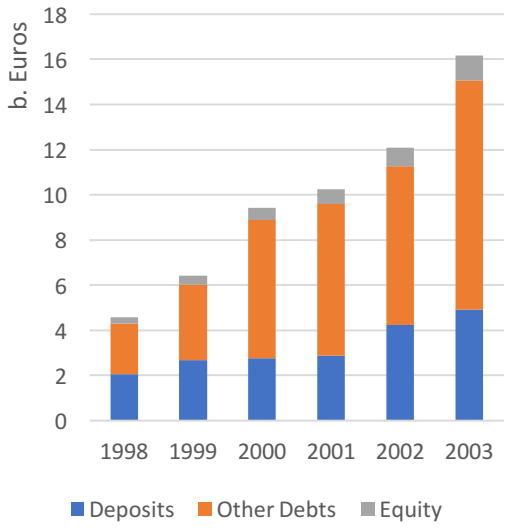


Source: SIC.

[6] The measure used is the combined balance sheet of the three largest Icelandic banks: Kaupthing, Glitnir and Landsbanki.

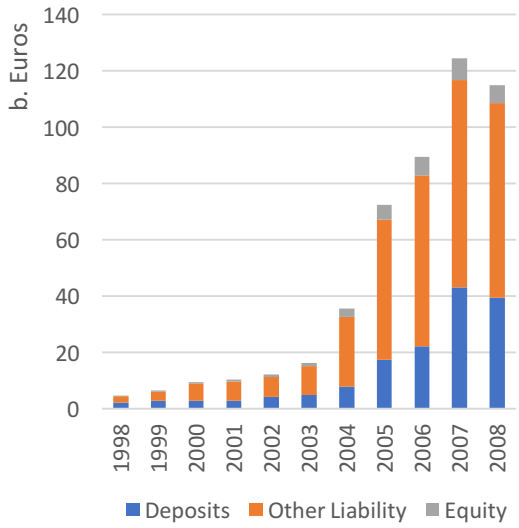
[7] The question of when a banking system is "too big" is an interesting and challenging one. Fitch Ratings (2006), for instance, focused on Iceland's net external debt and the lack of experience with floating exchange rate as a "stress test"—as opposed to Australia or New Zealand. Other concerned observers include Merrill Lynch (2006) and Danske Bank (2006).

Figure 1.3. Combined Liabilities 1998-2003



Source: SIC.

Figure 1.4. Combined Liabilities 1998-2008



Source: SIC.

To put things in perspective, Figure 1.1 shows banking system size as percentage of GDP in Iceland in the run up to the crisis and in comparison to select industrialized economies with large banking sectors in 2007. The median size banking system in this comparison is around 3 times GDP, which is around the 2004 levels in Iceland. The three large banks grew rapidly from 1998 to 2003 (Figure 1.3), but the main growth spurt happens in the five years after that (Figure 1.4), after the privatization of two of the three banks. But how did it all start, and who bought the banks?

Two groups of Icelandic investors bid for the banks in a controversial sale, whose details we will not go into here. How the purchases were financed, however, is quite relevant for the present purposes, as it seems to have set the tone for what was later to come. At the risk of oversimplifying, each group borrowed from other large banks in Iceland money to fund their bank purchase and some of the supposed foreign co-investors turned out to be fronts for unknown Icelandic investors at the time.[8]

The origin of the sales of the banks points to an important pattern: First, the new owners of the banks were very closely connected and lent each other large amounts of money right from the start. Second, this kind of equity funding seriously weakened, in a non-transparent way, the ability of the banks to suffer losses, hence increasing notably systemic risk as we further clarify in section 4. Third, the banks ownership from the beginning was murky and supervisors and policy makers seemed complacent. This was the backdrop against which the banks started to expand.

[8] More precisely, Kaupthing funded 70% of the purchasing price of Landsbanki, while Landsbanki funded 35% of the purchasing price for Bunadarbanki, which was acquired by Kaupthing less than six months later. Moreover, as it turned out, a foreign co-investor of Bunadarbanki, later turned out to be a risk-free front for Icelandic co-investors.

The standard double entry accounting will lead the way in how we answer the question: How could the Icelandic banks grow so much? First, we will analyze the liability side: who was ready to lend the banks so much money? Second, moving to the asset side, where did it all go?

Table 1.1. Combined balance sheet 30.6.2008

Assets		**Liabilities**	
Billion euros	**30.6.2008**		**30.6.2008**
Cash and equivalents	2	**Deposits**	45
Loans to banks	9	**Borrowings**	50
Loans to customers	74	**Other liability**	8
Other asset	30	**Subordinated debt**	5
		Equity	7
Total	115	**Total**	115
Sources: Q2 results of Glitnir, Kaupthing and Landsbanki 2008.			

Reviewing Table 1.1 the largest part of the Icelandic bank's assets are loans to "customers". It is interesting to dig into *who* those customers are and the nature of the loans. We will present some evidence that suggests that the lending was disproportionally to large related parties and large owners of the banks.

It turned out that the equity in the Icelandic banks was to a large extent self-funded and hence fictional. This will be major theme of Section 4. Other important funding sources for the banks were deposits and borrowing, roughly in equal proportion. Where the funding originated is of considerable interest, and we will go into detail of the available evidence in the next section.

2. Where did the money come from?

This section addresses a basic question: How, exactly, did the Icelandic banking system increase its funding seven-fold in only 5 years?

Prior to the turn of the century, the Icelandic banks largely financed themselves via domestic deposits and long-term loans from foreign financial institutions. This changed, however, once European financial market became more integrated. While Iceland is not a member of the European Union, it is a member of the European Economic Area, giving it essentially the same access to financial markets as EU member countries. This included opening bank branches and subsidiaries in EU member countries giving the banks access to collecting deposits in Europe and collateralized borrowing from the ECB. Both would turn out to be quite important funding sources after the international liquidity crises started in the middle of 2007.

The privatization of a large portion of the Icelandic banking system and the subsequent explosive growth did not occur in a vacuum. At the time, there was abundant global liquidity, or what Bernanke (2005) termed at the time "the global savings glut", and the premium on investments in peripheral economies declined to record lows as investors "searched for yield".[9] The Icelandic banks benefited greatly from this, going from being a fringe investment to a highly rated main

[9] Bracke, Thierry, and Michael Fidora. "Global liquidity glut or global savings glut? A structural VAR approach." (2008).

stream investment opportunity. Capital inflow into Iceland through the banks grew greatly, elevating the capital inflows to a prime example of what Reinhart and Reinhart (2008) term "capital flow bonanza" which they document to be highly correlated with currency and banking crisis.[10] Meanwhile, the Icelandic economy was also set up for a boom independently of the banking expansion. In 2003, a four-year investment project began on a hydroelectric dam and aluminum smelter that amounted to about 50 percent of GDP.[11]

We will focus below on the period of the most rapid growth, which was after the banks were all in private hands, i.e. after 2003. The liabilities of the banks combined increased from a little under 16 billion euros to 108 billion euros. Roughly, we can divide this period into four stages, with the Icelandic banks entering new funding markets, as the conditions in their previous markets tightened.

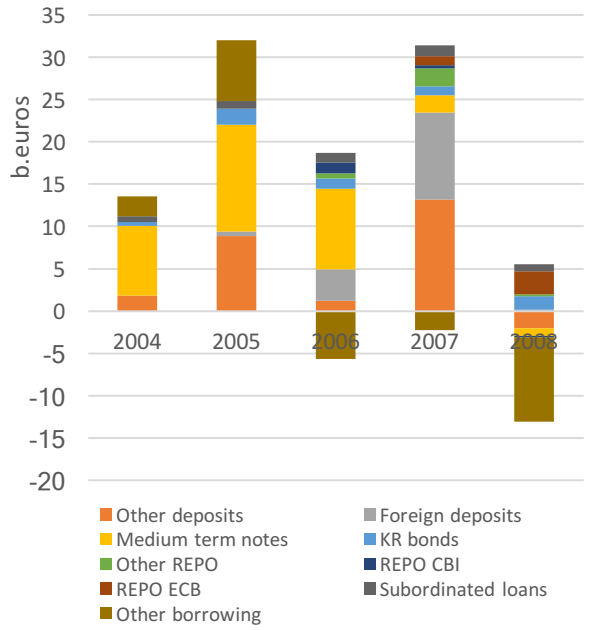
In the first stage in 2004 and 2005 the main source of funding growth came from the European bond market (EMTN market). The bond issuance is represented by the yellow in Figure 2.1. In the second stage in 2006, an important source of funding was the US bond market. In the third stage in 2006 and 2007, the banks started collecting internet deposits in Europe, represented by the grey in Figure 2.1. Finally, in 2007 and with increased vigor in 2008, the banks increased their collateralized borrowing, in particular from the European Central Bank and the Icelandic Central Bank. Each stage highlights in its own way some possible problems that the economic literature has identified with the operation of modern financial markets.

2.1 Stage 1 and 2: European and US bond markets

Many banks moved to an "originate and distribute" model in the lead-up to the financial crisis, abandoning the model of retaining loans on their balance sheet. Banks repackaged the loans and sold them to various other financial investors thereby offloading the risk via "structured" products often referred to as collateralized debt obligations (CDOs). Brunnermeier (2009) gives a careful account of this process in the lead-up of the crisis in the US, which led to weakening of credit standards and ultimately the crisis. A key problem with these products, according to this account, was that a substantial part of the risk was borne not by the originator but other financial institutions that were eager to purchase these products in the "search for yields" environment prior to the crisis. This generates a classic principal-agent problem. The banks that bundled the assets into CDOs essentially only faced the "pipeline risks" of holding the assets for some period until the risk were passed on. Their incentive to evaluate the creditworthiness of borrowers were thus not sufficiently as strong. Brunnermeier (2009) argues that this process was key driver for cheap credit, declining lending standards and the housing boom in the run up to the great financial crisis in the US.

[10] Using data from 181 emerging and advanced countries from 1960-2007.
[11] SIC chapter 4.

Figure 2.1. Changes in Banks Liability



Source: SIC and authors calculations.

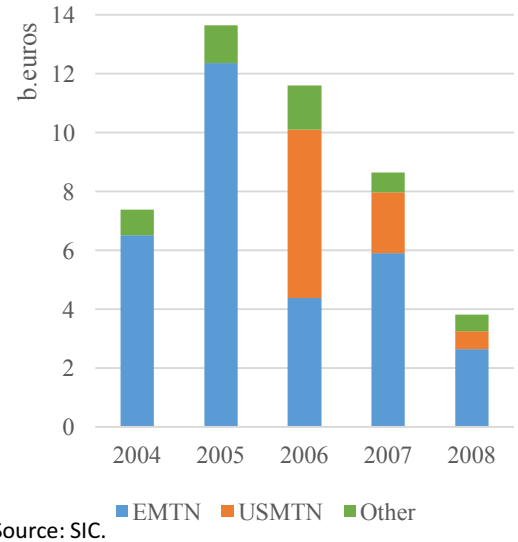
Table 2.1. Moody's Credit Rating for Long-Term Debt

Date	Glitnir	Landbanki	Kaupthing (Bunadarbanki)
1998	A3	A3	
1999	A3	A3	A3
2000	A2	A3	A3
2001	A2	A3	A3
2002	A2	A3	A3
2003	A1	A3	A2*
2004	A1	A2	A1
2005	A1	A2	A1
4/4/06	A1	A2	A1
2/23/07	Aaa	Aaa	Aaa
4/11/07	Aa3	Aaa	Aaa
2/28/08	A2	A2	A1
9/30/08	Baa2		
10/8/08	Caa1	Caa1	
10/9/08			Baa3

**** At the end of the year, after the merger with Bunadarbanki***
Source: SIC.

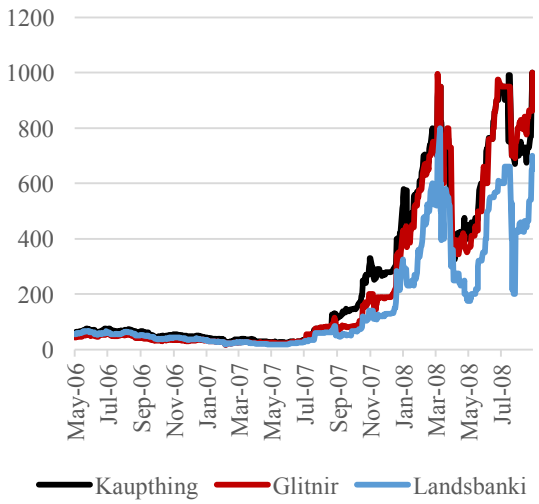
This development in financial markets helps explain the strong appetite for the Icelandic bank bonds in this period. From 2004 to 2008 the banks issued bonds, starting in the European and then moving on to the US bond market, corresponding to about 45 billion euros (see Figure 2.2), or about 40 percent of the banks' balance sheet at the time of the financial crisis and three times Iceland's 2007 GDP.

Figure 2.2. International Bond Issuance



Source: SIC.

Figure 2.3. Bank CDS 2006-2008



Source: SIC.

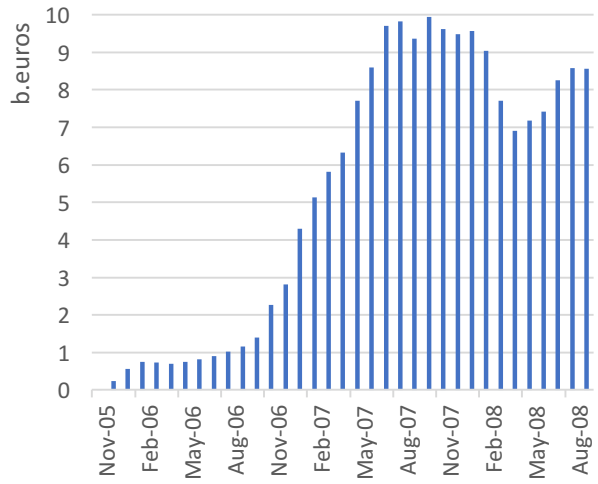
Table 2.1 shows that Moody's credit ratings for the Icelandic banks in the 10 years leading up to the financial crisis was very good. Investors had a strong appetite for Icelandic bank bonds because they were "cheap" in their rating class, i.e. they had high return relative to assets with comparable ratings.[12] This gave rise to what Brunnermeier terms "regulatory and rating arbitrage". The Icelandic bank bonds were a good way of increasing the credit rating of the CDOs with which they were bundled without compromising the returns.[13] In early 2006 the spreads on the banks bonds temporarily increased, in what was later termed a "the Geysir crisis," and access to the European bond market became limited. Later that same year, the US bond market opened up and the spreads lowered again and remained low until the liquidity crisis hit international financial markets mid-summer 2007.[14] At that stage the spreads the banks had to pay in the bond market became prohibitively high and the cost of insuring the banks bonds peaked (see Figure 2.3). Accordingly, the banks started looking for alternative sources of funding.

2.2 Stage 3: Deposit collection

EU law mandate a minimum deposit insurance of 20.000 euros, and many member countries increased this minimum during the crisis. The classic problem created by deposit insurance is moral hazard as illustrated for example in Kareken and Wallace (1978). It reduces the incentive for depositors to monitor banks and incentivizes hence banks to take on larger risk than is socially optimal. The Icelandic banking saga provides a vivid example of bad incentives created by deposit insurance. The Icelandic banks offered repeatedly the highest deposit rates according to weekly comparison of deposit rates and their advertisements and websites mentioned that the deposits fell under the EU-mandated deposit insurance.[15] For the Icelandic banks, obtaining deposits at relatively high interest expenses became preferred to the alternative, which was the increasingly tight bond market.

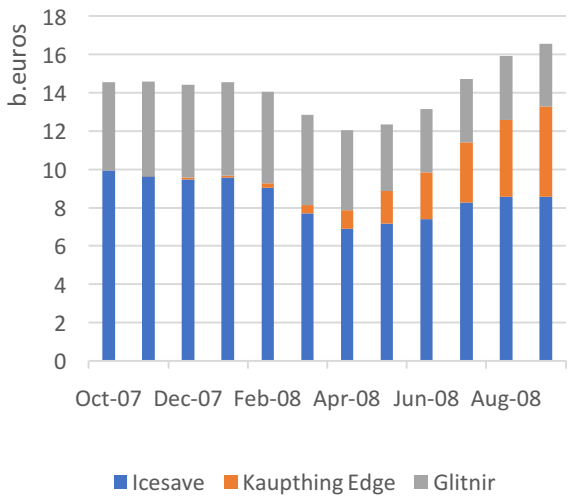
[12] SIC chapter 7.
[13] SIC chapter 7.
[14] Given how closely connected European and US markets are, it may seem a bit surprising that the US market "opened" when the market in Europe "closed" on the Icelandic banks. On possible explanation is that in the European case to a large extent large investors, who became increasingly concerned about the health of the Icelandic banks, while the Icelandic banks could access the US bond market via the "regulatory and rating arbitrage" in CDO's in the US, as we document above, where they were pooled with several other assets.
[15] SIC chapter 17, pg. 262.

Figure 2.4. Icesave Deposits



Source. SIC

Figure 2.5. Total Foreign Deposits



Source. SIC

From early 2006, following the so-called Geysir crisis, the Icelandic banks started to collecting deposits abroad. Landsbanki and Kaupthing were particularly aggressive in Britain and the Netherlands. Foreign deposits increased to over 16 billion euros by the middle of 2008 (Figure 2.5) corresponding to 15 percent of the banks' balance sheet at the time of failure. The great popularity of these accounts may appear somewhat puzzling, since at least as early as February 2006 rating firms and other market observers warned of the growth of the Icelandic banking system and its reliance in foreign funding, pointing out that the banks would most likely not be able to withstand losing access to international financial markets.[16] This was reflected in increases in credit default swaps, shown in Figure 2.3.

High interest rates attracted investors to the deposit accounts. If a bank offered one of the three best deposit rates in according to a list that was published weekly in the UK, there was a steady inflow into the accounts, while if they fell of the lists or were in fifth place there was an outflow. [17] Accordingly, these deposit accounts seem to have been very price-sensitive. There is also some evidence that the deposit guarantee of 20.000 euros played a role. This can be gauged by the large number of accounts that were just below the 20.000-euro limit.[18]

Foreign deposit collection by the three Icelandic banks peaked at about 14 billion euros in the fall of 2007. Deposit then started to flow out, in particular Icesave whole-sale deposits which are uninsured, until the spring of 2008. In the spring of 2008 Kaupthing started collecting so-called Kaupthing Edge deposits, reinvigorating foreign deposit collection by the Icelandic banks, which then peaked at 16 billion euros shortly before the failure of the banks (Figure 2.4 and 2.5).

---

[16] Fitch revises Iceland's outlook to negative on widening macro imbalances. Fitch Ratings 22. February 2006 and Thomas, Richard: Icelandic Banks: not what you are thinking. Merrill Lynch 7. mars 2006. Iceland: Geyser crisis. Research 21. mars 2006, Danske Bank.

[17] A simple regression in the report of SIC shows that the inflows into the accounts were heavily dependent on where the banks were in the lists of highest deposit rates, which was published weekly, SIC chapter 7.

[18] SIC chapter 17 pg. 37.

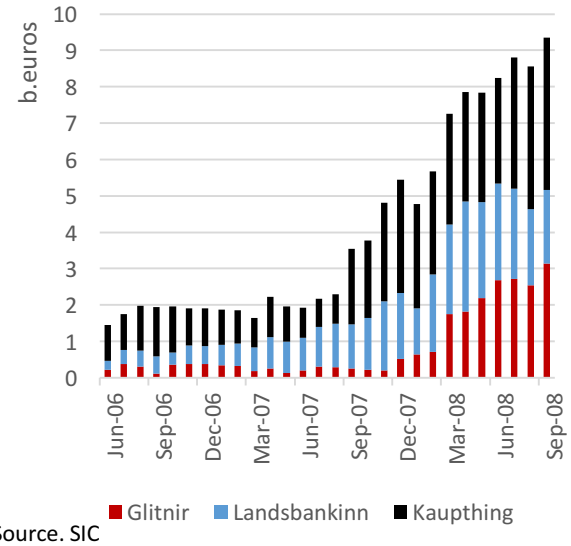
The behavior of the Icelandic banks in the European deposit market is reminiscent of the behavior of thrifts 1980, leading to the S&L crisis, as documented by Akerlof and Romer (1993). A change in regulation meant that the S&L's, that had government insured deposits, could now set deposit rates at will. Akerlof and Romer (1993) interpret this as having given the thrifts "an unlimited ability to borrow from the government" simply by making their government insured deposits more attractive via higher rates.

2.3 Stage 4: Central Bank lending

As the collection of deposits slowed in the fall of 2007 the banks turned to yet another funding source: The Central Bank of Iceland (CBI) and increasingly the European Central Bank (ECB). Both banks' main policy tool is repurchasing agreements (repo) or collateralized lending to banks. The banks post a collateral at the central bank—with a haircut—in exchange for liquidity, and then repay the loan after one week. The central banks use collateral lending to control interbank lending rates, much in the same way the Federal Reserve uses open market operations to set the Federal Funds rate in the Fed Funds market.

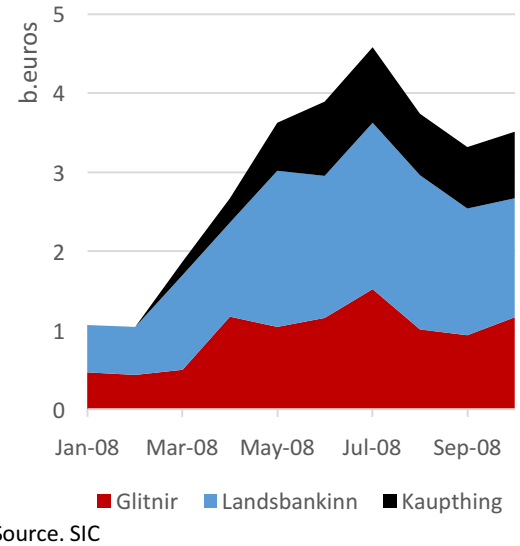
As liquidity started to tighten in mid-2007, the Icelandic banks increased their collateralized borrowing from central banks from about 2 billion euros to 9 billion. The banks borrowed directly or indirectly about 3 billion euros from CBI. Collateralized borrowing from the ECB, through their subsidiaries in Luxembourg, was about 1 billion euros at the beginning of 2008 and peaked at 4.5 billion in July 2008. The borrowing had come down to 3.5 billion euros when the banks failed. How the Icelandic banks funded themselves via collateralized borrowing from central banks carries an important lesson for central banking that we suspect may be underappreciated.

Figure 2.6. Collateralized Borrowing



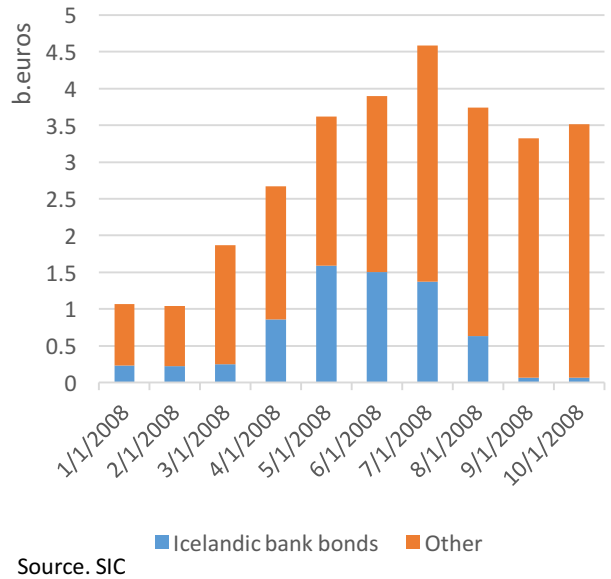
Source. SIC

Figure 2.7. Collateralized Borrowing at the ECB



Source. SIC

Figure 2.8. Collateral at the ECB



Source. SIC

Conducting monetary policy via collateralized lending and deposit is a simple way for the central bank to determine interbank rates. A key requirement in the operations is that underlying asset in the transaction is a high-quality bond to which a haircut may apply in order to minimize credit risk for the central bank.

What qualifies as a high-quality bond? As it turns out, the ECB and the CBI only required them to be above a particular rating threshold, and the pool of eligible assets included bank bonds which met certain ratings criteria. Some central banks, including those of Switzerland and Sweden explicitly forbid this. As Table 2.1 showed, the Icelandic banks had an excellent credit rating. This opened the door to a straightforward strategy for the closely interconnected Icelandic banks which became known as the "love letter" trade.

The love-letter exchange worked as follows: two Icelandic banks issued their own bonds, which they then exchanged, often without going through the financial market. Then the banks posted the respective bonds as collateral for a loan at the CBI or the ECB. As there is no limit to how much bonds they could issue and exchange to one another, the banks essentially had an unlimited access to funding from the two central banks. To some extent this was like printing money.[19, 20]

Icelandic borrowing from the ECB increased by 2.5 billion euros from the beginning of February 2008 to the end of April 2008, when it amounted to over 3.5 billion euros or more than 20 percent of the combined balance sheets of the Luxembourg subsidiaries of the Icelandic banks

[19] SIC. Chapter 4 pg. 165 and chapter 7 pg. 41.
[20] It should be noted that such a scheme is not possible in the United States because the Federal Reserve's open market operations utilize only government securities, rather than collateral posted by banks, to control the interbank lending rate. Direct lending to banks, however, take place via the Discount Window, which has strict rules about the type of collateral accepted.

(Figure 2.7).[21] About 1.5 billion euros were secured with Icelandic bank bonds, or the so-called love letters (Figure 2.8). The ECB got wind of what was going on and at the end of April 2008, ECB President Jean-Claude Trichet, called the Governor of the CBI and said the ECB viewed the bonds posted as collateral "artificial and abnormal".[22] The "love letter" collaterals were out of the ECB system by the end of August, replaced in part with CDOs of Icelandic krona loans and a currency swap agreement written by the Icelandic banks. The CBI, however, continued to take the bank bonds as collateral, essentially giving the banks free access to Icelandic króna until the bitter end. The losses by the Central Bank were sizable, close to 15 percent of GDP, as we will further discuss in Section 6.

There is anecdotal evidence that other banks engaged in similar behavior to gain access to ECB funding after the liquidity crunch began in 2007. The Icelandic banking crisis, however, provides the only direct evidence and admission of a collusion between banks and a direct swap of bonds to bring to use for collateralized borrowing to our knowledge.[23]

3. Where did the *money* go?

Getting an overview of the loan portfolio of any bank is challenging, not only because of bank secrecy laws, but also due to incomplete record keeping, the complex nature of some loan contracts, and non-transparent ownership structure of the firms that receive the money. Any assessment will thus necessarily be incomplete and only suggestive. In the case the Icelandic banks, this is particularly challenging as much of the lending was to holding companies with opaque ownership structures, sometimes registered in Iceland but sometimes held abroad by Icelandic parties. One aspect of the Icelandic banking crisis that makes it of interest, however, is that Althingi lifted bank secrecy laws and other secrecy laws to the investigatory committee, which then made some of the underlying data and conclusion public. We rely on that evidence here, while mostly aggregate the data across all three banks to streamline the narrative.

Before going into the details of the available evidence, and some of the data gaps, it is worth sketching out at a broad level the direction of lending in the run up to the crisis. The loans that can be explicitly documented appear to have been funneled, to a disproportional extent to firms and companies tightly connected to the banks' owners. At the time of the crash, approximately 20 percent of the parent banks' loan books, for which reliable information exist, can be traced to only six groups of related parties, each of which had a significant ownership connection to one of the three banks. To remind the reader, what is at stake here is a balance sheet of 115 billion euros or close to ten times Iceland's GDP.

Large exposure rules stipulate that a bank can only lend up to a maximum of 25 percent of own funds to a group of connected parties. As you will see below and the SIC documented these rules seem to have been bent if not broken in the run up to the crisis.[24] The Icelandic Financial Supervisory Authority (FSA), however, never seriously raised the subject of large exposure lending before the financial crisis. The opaqueness of firm ownership limited the FSA's

[21] Total ECB lending through the Central Bank of Luxembourg amounted to less than 2 percent of total assets of the banking system in Luxembourg at the time. See. SIC, chapter 7 pg. 48.
[22] SIC. Chapter 4 pg. 47.
[23] SIC. Chapter 7 pg. 47.
[24] SIC. Chapter 8.

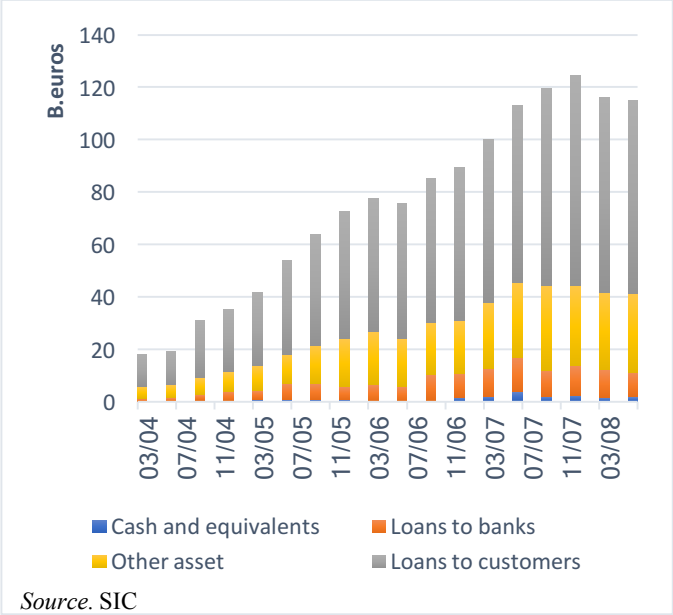
knowledge of the problem, and their narrow legal interpretation of what constituted "connected parties" also played a role. For example, FSA allowed Landsbanki to categories the two largest owners of Landsbanki as not "connected", despite them having purchased the bank together and being father and son.[25]

We will mostly focus on the expansion of the banks' balance sheet from 2003 to the financial crisis. During that period, their lending increased by 70 billion euros, or seven times Iceland's 2003 GDP. We find it useful to separate the expansion on the asset side of the banks into two stages: The first stage is the lending growth from 2003 to 2006, which funded both domestic and foreign investment by Icelandic investors and holding companies. The second stage was what we call the debt repatriation phase. From 2006 to 2008 Icelandic companies were facing margin calls from their foreign creditors and these loans were refinanced by the Icelandic bank in response. The lending expansion phase coincides roughly with the banks' successful bond issuance in European and US bonds markets (Phase 1 and 2 in Section 2), while the loan buyback period corresponded quite closely to the period when the banks started financing themselves with online deposits in Europe and with collateralized borrowing from central banks.

3.1 Nature of the expansion

Figure 3.1 shows the evolution of the asset side of the three large banks. Their combined assets increased from 18 billion euros in the first quarter of 2004 to 115 billion euros in end June 2008. The largest part of the increase is due to loans to customers, which rise from 12 billion euros at the beginning of 2004 to 74 billion at the time of their failure.[26]

Figure 3.1 Banks Total Assets



Source. SIC

[25] SIC. Chapter 8 and Appendix 2. Another stark example was that Glitnir did not connect Baugur and Gaumur to Stoðir, despite the former two being very connected and owning over 45% in Stoðir. SIC. Chapter 8 pg. 125 and 309. Documents indicate that this was done with the sole purpose of getting around rules on large exposures.

[26] The yellow portion on the asset side, denoted "other", represents mostly financial assets, securities and derivatives, but we will mostly focus on the banks' loan books, as the growth is more concentrated there.

Table 3.1: Growth of the three large banks

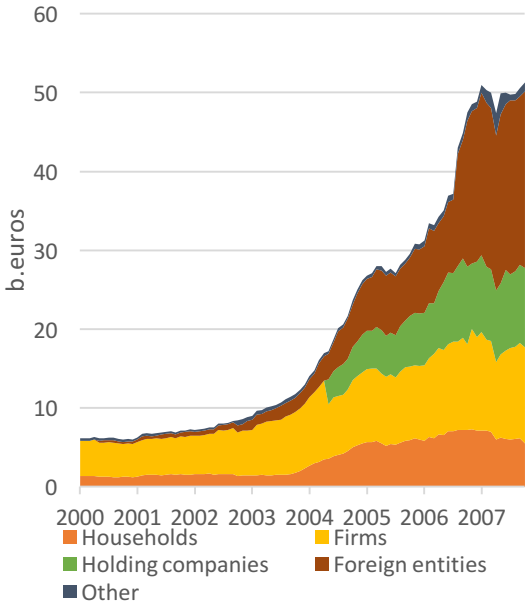
b.ISK.	2003	2004	2005	2006	2007	2008
Total assets year end. b.ISK.	1.451	2.946	5.419	8.475	11.354	14.437
Assets acquired		834	726	34	26	0
Outer growth %		57,5%	24,7%	0,6%	0,3%	0
Evaluation changes and currency		-51	-203	1.068	-231	3.302
Inner growth b.ISK.		713	1.949	1.954	3.084	-219
Inner growth %		49,2%	66,1%	36,1%	36,4%	-1,9%
Inner real growth %		43,5%	59,5%	27,2%	28,8%	-10,0%
Source: SIC.						

During this time period, the Icelandic banks acquired some foreign financial institutions, gaining foreign loan portfolios, a fact they used to soothe fears about their rapid growth. This does explain some of their growth, but only a small fraction of it. Table 3.1 decomposes the growth over this period. An acquisition of a foreign financial institution is an example of "outer growth". Other growth in the banks' lending and other assets is defined as "inner growth". As the table reveals the largest part of the growth is due to inner growth. Most of the growth on the asset side of the Icelandic banks, in other words, was "fresh" lending, i.e., lending done by the banks themselves applying their own loan standards to current or new customers. The literature documents that this kind of rapid growth of the loan portfolio is associated with increased default risks. There is both a moral hazard effect due to the behavior of over leveraged borrowers and adverse selection in connection to the expansion of customer's base (e.g. Sharpe 1990, Jiménez and Saurina 2006). We will see evidence of both in coming sections.

3.2 Erosion of the loan books

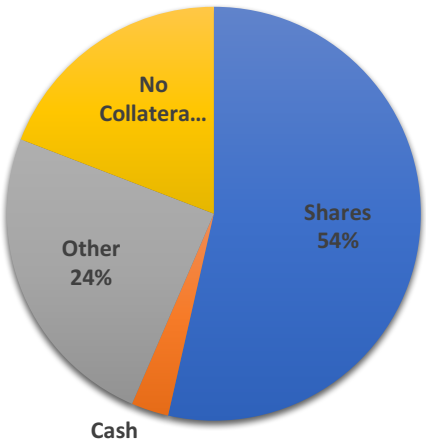
As we start to dig into the loans books the data set contracts. The investigation commission had unprecedented access to data, but it was still mostly limited to the portions of the banks that were supervised in Iceland, i.e. the parent companies. Detailed information on subsidiaries was limited to single snap shots, shared by foreign supervisors, which did not lend itself to the in-depth analysis shown in this section. Figure 3.2 shows loans from the Icelandic parent company of the three banks. This reflects about 2/3 of the loan book of the banking groups as of 2008. Some evidence will be presented from subsidiaries in Luxembourg, which were the ones that seemed most connected to the operations in Iceland.

3.2. Loans of the three large banks



Source. SIC

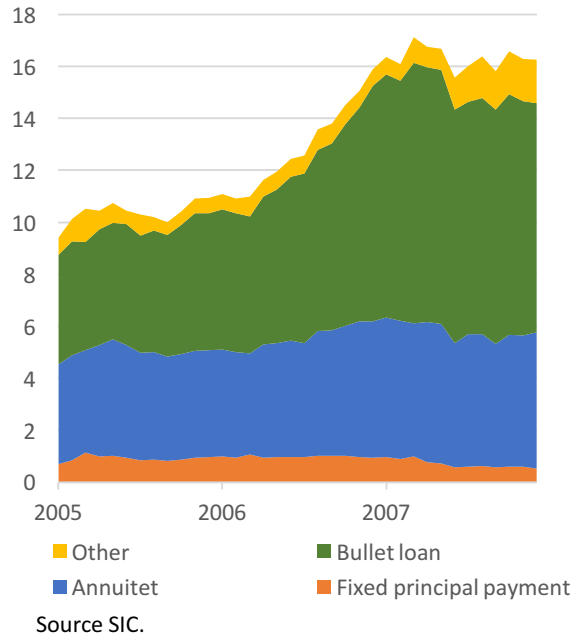
3.3. Collateral for new large exposure loans 2007-2008



Source. SIC.

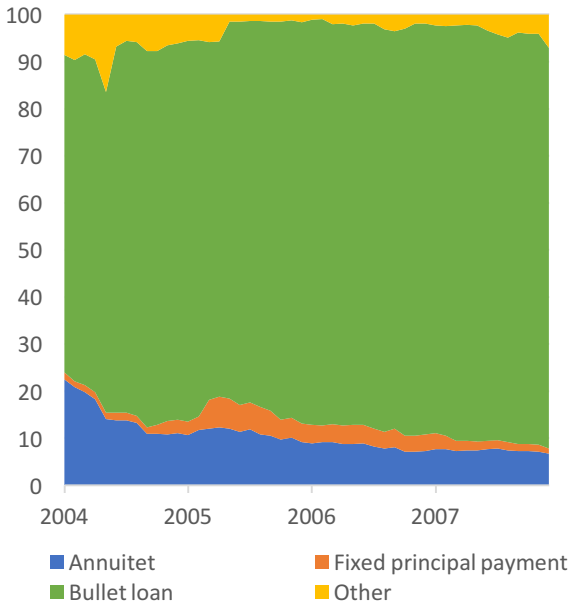
The loans in Figure 3.2 are categorized into households, firms, holding companies, foreign entities and other. The "foreign entities" are not necessarily informative about actual ownership of the borrower, as these in some cases included Icelandic investor that registered their companies abroad for variety of reason. What is particularly noteworthy is that the CBI started tracking loans specifically to limited liability holding companies in 2004. There was a sharp increase in these loans in 2006 and 2007. What did they correspond to? It became increasingly common to use holding companies to fund share purchases in listed domestic firms and in particular the banks themselves. More often than not the collateral was shares in the banks themselves, as we will later discuss. For all large exposure loans from the beginning of 2007 until the collapse, 54 percent of all loans were collateralized with shares. These loans were also increasingly bullet loans, i.e. all paid in one installment at the end of the loan period. The loan book of Landsbanki provides a vivid example of this. Figure 3.4 shows repayment methods of loans from Landsbanki, the increase of bullet loans (green) in comparison the loans with fixed payment schedules. Bullet loans double from 2006 until the crash, while other types of repayment forms increase only slightly. At the same time, virtually all loans to holding companies were bullet loans starting in mid 2004. This is in sharp contrast to loans to households, where amortizing loans were most common over the whole period and bullet loans made up less than 10 percent of the total. Bullet loans were also the most common form of repayment methods for loans categorized as to "foreign entities".

Figure 3.4 Landsbanki, Loan Repayment Forms, billion euros



Source SIC.

Figure 3.5. Landsbanki, Loans to Holding Companies



Source SIC.

Lending that requires only a single payment at the very end of the contract is arguably a riskier loan than the more usual form of loan contracts. The inability to make individual payments sends the banks a signal of the financial health of the borrower, and in the case of bullet loans this signal is lost. Supervisors should also view growth in bullet loans as a potential risk, as it is usually the form of loans that is used to evergreen loans by delinquent borrowers, so as not to have to register losses on banks loan book.[27] The information that can be gleaned from the unwinding of the banks after they failed does suggest that these loans were in fact very risky. The estimated recovery rate on loans to holding companies was reported in 2010 to be about 4% in Glitnir, while Kaupthing reported 6 percent recovery and Landsbanki 5 percent.[28]

3.3 Lending to related parties and owners (insiders)

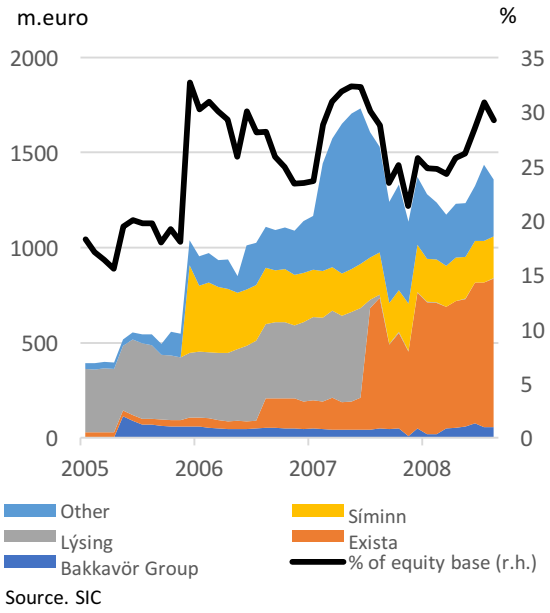
Large exposure rules are almost universal. The Basel Committee on Banking Supervision (BASEL) issued standards in 1991 for measuring and controlling large exposures. The motivation for regulations on large exposures is to prevent a sudden failure of a group of borrowers from causing the downfall of the bank. The large exposure rules in Iceland stipulated, as they did in most other countries, that each bank could not lend an amount corresponding to more than 25 percent of capital to one group of related counterparties. Large exposure rules were bent to the point of breakage in Iceland and commonly large owners of the groups that were able to borrow a lot were also large stake holders in the banks.

There are two important reason why the large exposure rules were bent without much objection from the supervisory authority. First is the absence of a clear definition of what constituted a "related party" in theory and in practice. Second, the banks themselves, rather than the Icelandic

[27] The term evergreen refers to automatically rolling over short term loan.
[28] Financial information of Glitnir, Kaupthing and Landsbanki in 2010.

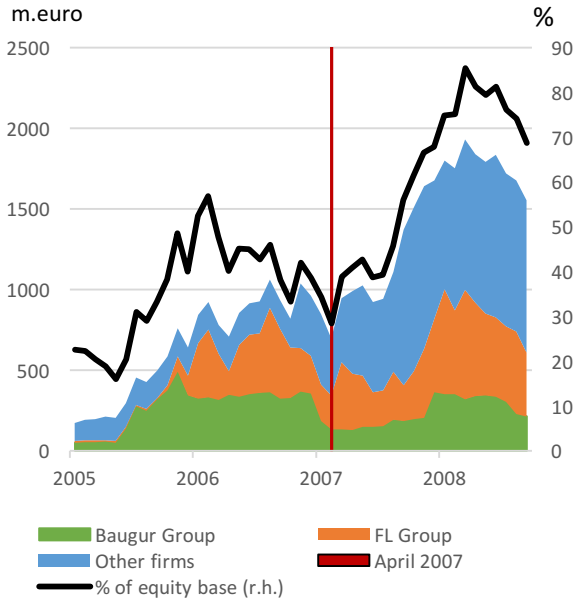
Financial Supervisory Authority (FSA), had the last word in determining which loans were deemed to be between related parties.[29]

Figure 3.6 Kaupthings Large Exposure



Source. SIC

Figure 3.7. Glitnir Large Exposure



Source: SIC.

Figures 3.6 and 3.7 shows lending by two of the major banks to a group of firms that we like the SIC define as "related,".[30] In the case of Kaupthing, the group of related parties exceeded the regulatory limit of 25 percent of the equity base from late 2005 until the failure of the bank. In the case of Glitnir, the group of related parties illustrated exceeds the regulatory maximum in 2005 and borrowing peaked at close to 90 percent of equity base in early 2008.

The banks themselves always reported large exposures within regulatory limits. An employee of the FSA notified the director general of the FSA as early as 2004 that he thought that the banks were not correctly connecting together large exposure. The employee used Baugur Group and related parties as the main example (See Figure 3.7.) The FSA did not follow up on that work and lending to the group grew exponentially in the following years.[31]

Another noteworthy fact about Figure 3.6 and 3.7 is that both of these related parties in question were also *large owners, insiders,* of the banks.[32] Figure 3.7. gives circumstantial evidence on the

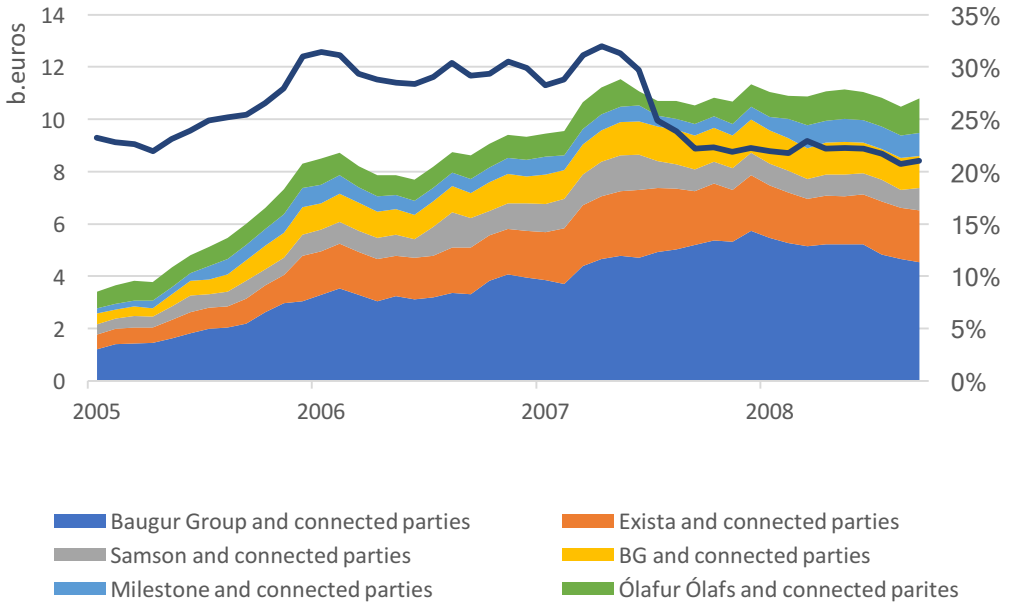
[29] In principle FSA could suggest certain parties where related, but the burden of proof was on the side of FSA to make the case. The FSA never attempted to make such a case. This has been amended post crash, as the FSA has authority to require banks to connect specific borrowers into the same exposure.
[30] There is a lot of data and investigative work underlying these two figures. Underlying the two figures is data from the banks' loan books, as well as information about cross ownership of Icelandic firms, which the SIC put together by using tax data, firm registry data and minutes from the loan committee meetings of the banks. The SIC then connected firms into groups of related parties, the methodology is outlined in Benediktsdottir, Bjarnadottir and Hansen (2015). Here, two parties are related if they own 20 percent or more directly or indirectly in each other.
[31] SIC Chapter 8 pg 124.
[32] "Insiders" includes executive officers, directors, principal shareholders and the related interests of such parties.

role ownership had in the Icelandic banks. Baugur Group bought a large stake in Glitnir in February 2007, market by the red line. Consequently, the loans to the Baugur group of related parties, who were now insiders, almost doubled from 1 billion euros to about 2 billion euros in less than a year.[33]

In general, the large owners of the banks seemed to have had disproportionate access to funds at the banks. Figure 3.8. illustrates the lending of all the three banks to six groups of related parties of borrowers who were *also* large owners of the banks, shown both in billions of euros (left axis) and as portion of the total loan book (right axis). When the banks failed, lending to these six groups corresponded to over 20 percent of the loan book of the parent banks.

Considerable literature exists documenting how lending to insiders weakens banks due to tunneling and looting (e.g. Akerlof and Romer 1993 and Johnson et al 2000). As shown it seems that lending to insiders in Iceland was on an exceptional scale. Yet it is worth keeping in mind that there are several other well documented examples of large insider lending. In the run-up to the Mexican banking crisis in the 1990s, for example, insider lending was estimated to be 20 percent of all loans (La Porta et al 2003). Insider lending was also a large factor in the Savings and Loans crisis in the US (Calavita, Tillman and Pontell 1997; Akerlof and Romer 1993).

Figure 3.8. Loans to Large Related Parties that had large ownership in the banks



Source. Authors calculations and SIC

3.4 Lending traced to individuals

Another way of characterizing lending to "related parties" is to identify it with particular underlying individuals. If a firm A secures a loan of 100 million from a bank, and a particular individual holds a 10 percent share in that company, then 10 million of the loan is assigned to

[33] SIC. Chapter 8.

his/her name. The Special Investigation Commission traced every loan from the parent banks through firms down to individuals and made the results public (Table 3.2).

The commission did not have access to the loan book of the subsidiaries of the banks abroad. One might suspect - and indeed the Icelandic banks claimed this prior to their failure - that the loans of subsidiaries abroad would diversify the risk. The commission did get a snapshot of the largest borrowers in the subsidiaries in Luxembourg for Landsbanki and Kaupthing. Once again, it is the main owners of the banks – insiders - that are borrowing heavily, even in foreign subsidiaries. We add this to the parent company loan books. Done in this way we see that the top five borrowers are also among the largest shareholders in the Icelandic banks.[34] Several of the others on the list are also closely related.[35]

Table 3.2. Ten largest debtors of the Icelandic banks parent company at the end of September 2008 and their debt in two subsidiaries, m.euros

Rank	Name	Parent company	KB and LB Luxemburg (rank in loan book)	Total
1	Robert Tchenguiz	2104.9	213 (3 in KB)	2317.9
2	Ólafur Ólafsson	1128.2	49.1 (10 in KB)	1177.3
3	Jón Ásgeir Jóhannesson	864.3	11.5 (9 in LB)	875.8
4	Björgólfur Guðmundsson	516.8	16.5 (5 in LB)	533.3
5	Björgólfur T. Björgólfsson	481.7	305 (1 in LB)	786.7
6	Ása K. Ásgeirsdóttir	430.6		430.6
7	Jóhannes Jónsson	429.7		429.7
8	Hannes Þór Smárason	410.6		410.6
9	Ingibjörg Stefanía Pálmadóttir	390.7		390.7
10	Jákup á Dul Jacobsen	349.8		349.8

Note. Debts are tabulated from the personal holdings of the individual in the banks. Ownership is assessed from holdings at the end of 2008. Data from the Luxemburg subsidiaries is from October 2nd for LB and August 31st for KB. Assumptions for calculations for subsidiaries not fully compatible.

Source. SIC.

3.5 Debt repatriation

The discussion above points to a deterioration in the loan book from over exposure to certain group of related parties and to the owners of the banks. An additional mechanism of increased credit risk is worth noting. Access to international financial market was not just opening up for the banks in the period 2003 to 2006. Icelandic holding companies also got increased access to funds at large international banks such as Barclays, Citibank, Morgan Stanley and Deutsche Bank. Often those loans were collateralized with Icelandic publicly traded shares, in particular

[34] #1 owned shares in KB and was on the board of Exista that was large large owner of KB. #2 large owner of KB. #3 large owner of Glitnir. #4 and #5 large owners of Landsbanki. #6 mother of #3. #7 father of #3 large owner of Glitnir. #9 spouse of #3. #10 no known ownership connection. And so on.

shares in the Icelandic banks. The loans usually included stipulations that the debtor needed to post further collateral if the shares fell enough in value (margin calls).[36]

This had major implications as the global liquidity crisis hit in the middle of 2007 and share prices of banks around the world started to decline. Foreign banks started to send out margin calls to Icelandic holding companies and investors, who turned to the Icelandic banks to refinance their loans.[37] Despite the liquidity tightness they were experiencing, the Icelandic banks took on the challenge, and doubled down on lending to their customers, repatriating the credit risk that had formerly been diversified out of the country. This concentrated the risk to which the banks were exposed to and increased overall systemic risk in the economy. There are a number of plausible reasons why the banks may have done this. For one, the borrowers were more often than not also large stake holders in the banks, bringing into question the principle of arms-length lending. In addition, the Icelandic banks had extended so much credit to the same holding companies, that their default would have substantial effect on the operating results. Hence these borrowers had become "too big to fail" for the Icelandic banks or there was a kind of "bank capture". Finally, the collateral that foreign banks would have seized and sold was in many cases shares in the banks themselves, so a default to the foreign creditor, would have triggered selloff of the banks stocks, further reducing their stock value, complicating future funding. Thus, the Icelandic banks were left with two bad choices: doubling down on an over-leveraged customer or risk the effect of their failure. They chose the latter, increasing the risk for the bank and the economy as a whole. This behavior is reminiscent of Rajan (1994) model of credit policy under incomplete information that explains why banks may extend loans with negative net present value. Instead of maximizing long term performance the bank manager is more concerned with information that is directly observable by the market such as share prices.

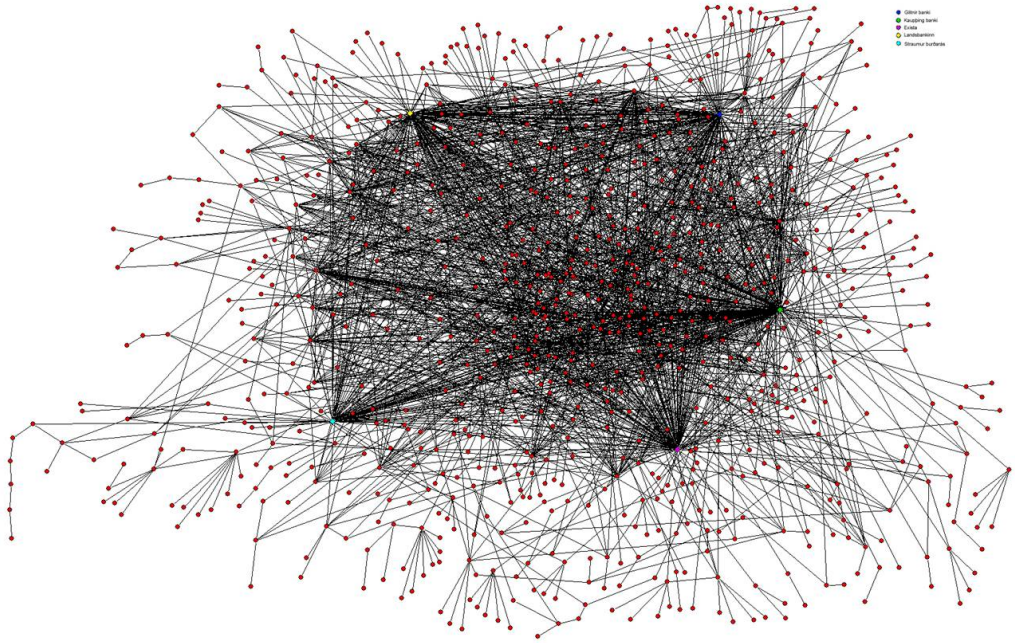
3.6 Transparency and ownership structure

It is worth stressing, that the information about lending to related parties, relies upon an extensive work of untangling several holding companies with various cross ownership that was possible only after bank secrecy laws were lifted. Little of these connections were known before the crisis. Figure 3.9 shows the complex cross-ownership of the 1,307 Icelandic firms with balance sheets in excess of 500 million ISK at the end of 2007. Most of these were holding companies that had little to no equity, and many were established explicitly to circumvent regulations about related parties. But even what became known, and we have documented above, is still only a partial picture. Bank secrecy laws were only lifted in Iceland and therefore it was often impossible to trace some of the financial relationship and firm ownership across borders. It is important to be able to trace firms' ownership to prevent too much interdependencies, too much insider lending and violations of large exposure rules. All of which is crucial for financial stability and bank supervision.

[36] SIC gives example of 3 deals with lending over 600 m. euros. It was also common that the loans from the foreign banks had a priority claim over the Icelandic loans in case of default, example loans to the pharmaceutical company Actavis.

[37] SIC Chapter 8.

Figure 3.9 Interconnectedness of Icelandic firms



Source: SIC appendix by Bjarnadóttir, Margrét V. and Guðmundur Axel Hansen

4. A Fable of Fictional Equity

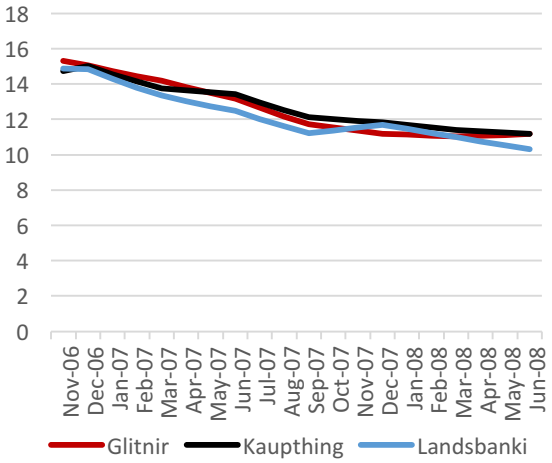
When a bank fails, those who hold equity in the bank will not get anything paid out until all other claims have been settled. Consider the stylized example of bank in Figure 4.1. This bank has 10 percent equity to asset ratio, or what is termed capital adequacy ratio, assuming 100 percent risk weights for all assets, or alternatively 10 percent leverage ratio. Now consider a scenario in which loan defaults increase to the extent that there is a 20 percent decline in the value of the loan book. It goes from $100 to $80, rendering the bank insolvent. Depositors and other creditors would recover 89 percent of their deposits, in this case, even though the value of the loan book declines 20 percent. The main loss absorbing buffer, equity, is wiped out, so in this example the bank shareholders lose all their money. Sufficiently high equity is thus key for a bank to remain resilient. Consider for example if equity had been $20 rather than $10. Then even a 20-percent drop in the value of assets would leave the depositors and other creditors fully protected and the bank would have been technically solvent.

For this reason, most countries have minimum equity requirements, i.e. the bank's equity cannot go below a certain threshold relative to total (or more generally risk weighted) assets. In Iceland, the legal requirement in the run up to the crisis was 8 percent risk weighted capital, in line with BASEL I. The Icelandic banks always met that requirement; even three months before their failure they were well above it. Figure 4.2 shows the banks' capital adequacy ratio.

Figure 4.1. Example of a Balance Sheet

Assets		Liabilities	
Loans	100	Deposits	75
		Other Liability	15
		Equity	10

Figure 4.2 Banks Reported CAD Ratio, percent



Source. SIC

Imagine now two banks, K and L with identical balance sheets as shown in Figure 4.1. As before, there is 10 percent un-risk weighted capital ratio. This provides depositors and other creditors with a cushion in case of bank failure. Now imagine that the two banks are sold at book value to two investment groups, A and B. Suppose, furthermore, that in order to finance the purchase the new bank owners borrow from each other's banks the entire purchasing amount, or $10. Suppose the only collateral for those loans are the shares in the bank being purchased. Now, on the asset side, $10 out of the $100 in the "loan book" is a loan to the owners of the other bank.

What is the problem with this arrangement? Consider if the loan book declines $20 in value for both banks rendering them insolvent. The value of their equity becomes zero and both banks will then immediately loose another $10 from the loans they have collateralized in bank equity. This means that additional $20 of the combined banks´ balance sheet gets wiped out immediately. The aggregate banking system is left with no equity and higher losses for creditors. The recovery for depositors and other creditors will be 78 percent instead of 89 percent with this kind of cross lending. Indeed, this is equivalent to the losses if both banks had no equity at all.[38] Accordingly, cross-borrowed bank equity provides no cushion to the depositors and other creditors in a case of asset value decline and system wide bank failure.

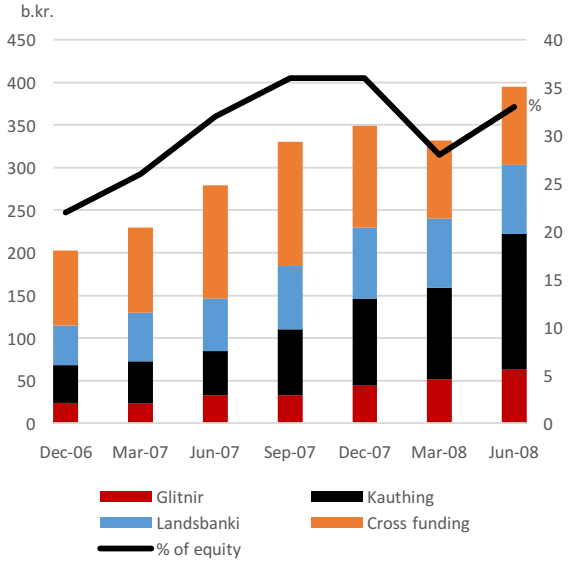
The same principle applies, but with even more force, if a bank lends money to a person to buy its own shares if the only collateral is the share itself. In that case the equity is not only weak in case of a system wide failure. It also provides no protection in the case of a failure of that individual bank. As the bank fails, the asset on the loan book corresponding to loan for share purchases immediately gets wiped out.

These simple examples are relevant in the Icelandic case. After the banks failure, and the loan books were opened up, it turned out, that from their privatization onward, their shares were heavily funded via loans from themselves and each other, as we have previously discussed. This

[38] Assets would be $90 and deposits and other liabilities $90 and equity 0, with $20 in initial losses recovery for depositors and other liability would be $70/$90=78 percent

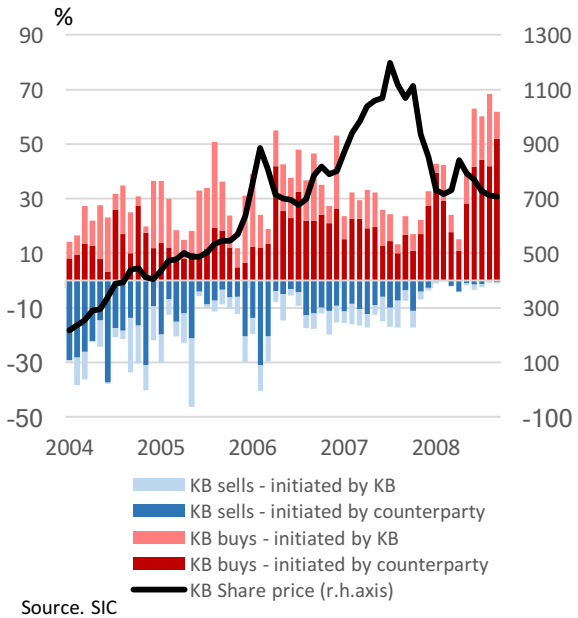
meant, that in the aggregate, the banking system had very little equity from the very beginning. In addition, the three large banks did extensive lending to purchase their own shares in the run up to the crisis. By middle of 2008 they were funding on average 25 percent of their own shares and if we include cross funding they were funding 33 percent of the shares in the three large banks.[39] This amounted to about 4 billion euros. These loans became worthless when the banks failed, giving the equivalent outcome for depositors and other creditors, as if that equity had never been there as a buffer against losses. The capital adequacy ratio for the banks was hence overestimated in the middle of 2008. Loss absorbing capital buffer was only about 8 percent rather than the 11 percent reported.[40]

Figure 4.3. Funding of Own Shares and Cross Funding of Shares



Source. SIC

Figure 4.4. Kaupthing trades with own shares on the exchanges % of trades



Source. SIC

One of the motivation for funding own shares was market manipulation. Once the liquidity crisis started in the summer of 2007 share prices of the banks became under severe pressure (Figure 4.4). The banks all reacted in the same manner, they purchased about 50 percent of all trades with their share that came through the exchanges. As can be seen in Figure 4.4 this reached up to 70 percent of all trades with the shares of Kaupthing in the last months before the failure of the bank (see Figure 4.4). The same story holds for the other two banks. In total, the banks purchased their own shares on the stock market for over 3.5 billion euros in the last 20 months before their failure, while they only sold less than half a billion on the market. The banks could not maintain those shares on their own balance sheet so they sold them directly outside the market to holding companies, often owned by related parties[41] or large customers. These sales were frequently coupled with a loan amounting to the full purchase price of the shares. The only

[39] Note. Subordinate debt accounted for about half of the banks capital so this is about a sixth of the total capital of the banks.
[40] SIC, chapter 9 pg. 22.
[41] Owners of the banks.

collateral for the loan were the shares themselves.[42] In a subsample of the largest loans, 32 firms borrowed 3.5 billion euro over the same 20-month period to fund share purchases.[43] It was clear as the crisis intensified that these loans were not handled like loans for unrelated shares. The banks waived margin calls repeatedly.[44] The investigative committee's report goes step by step over a number of these deals, which were obviously made in an attempt to manipulate the market price of the banks. Additionally, this increased systemic risk as the equity of the banks became false in the process, losing its loss absorbing capacity. Bank managers of two of the three banks have been found guilty by the Icelandic Supreme Court for market manipulation and the third case is being prosecuted now.[45]

This practice of lending for own shares was not just limited to Icelandic banks. In Ireland, for instance, a high-profile case about lending to the so-called golden circle or Maple 10. Anglo Irish lent 450 million euro to ten investors for them to reinvest in the bank's shares to bolster the share price.[46] This amplified the Irish governments loss from the banking crisis. Similarly, the Britain's Serious Fraud office charged four senior executives at Barclays for extending loans to investors to buy its own shares so as to prop up stock prices.[47] The investor, which was not accused of wrong doing in this case, was also involved in a similar market manipulation trade with Kaupthing Bank.

Doubling down on over-leveraged customers and manipulating share prices—as well as international credit default swap prices[48]—are signs that Iceland's banks were "betting on life" or "gambling for resurrection" a common theme in the finance literature. When a bank could become insolvent, bankers may shift their risk-taking to projects with low or negative expected returns if there is small probability that the returns will be high. If the gamble fails, shareholders lose; if it works, the bank may survive (see e.g. Boyd and Hakenes 2014). The banks in Iceland increased their risk-taking in many ways as we have explained, at great cost. In retrospect, this behavior became increasingly earnest—and obvious—after the liquidity crisis hit in the middle of 2007.

5. The Failure of the Icelandic banks

So far, we have not discussed much the fact that the Iceland has its own currency, the krona (ISK). The reason for this omission is not because we think it is unimportant. Rather, we think that the euro denominated view gives a more precise understanding of the balance sheets of the banks in the lead up to the crisis, as it involves the expansion of their asset and liabilities, a large portion of which was denominated in euros.

The krona, however, is critical in understanding the actual failure of the banks. The banks were increasingly operating in foreign currencies, with no credible lender of last resort in those

[42] SIC chapter 12.
[43] These loans were not only for shares sold by the banks, some of this is also loans to refund foreign loans discussed in last section.
[44] SIC chapter 12 pg. 17.
[45] Supreme court case nr. 842/2014 (4. February 2016) and nr. 498/2015 (6. October 2016).
[46] Reuters (February 2009) 'Anglo Irish lent "golden circle" 451 million euros" http://uk.reuters.com/article/uk-ireland-banks-idUKTRE51J3SB20090220
[47] https://www.sfo.gov.uk/2017/06/20/sfo-charges-in-barclays-qatar-capital-raising-case/
[48] The banks did this through Deutsche bank.

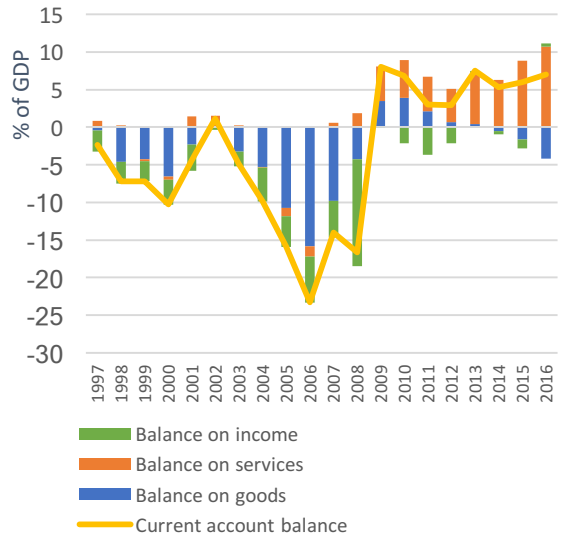
currencies. The Central Bank of Iceland foreign currency reserves were a tiny portion of the short term foreign liabilities of the Icelandic banking system. Foreign currency deposits alone were as high as eight times the central banks' reserves.[49] The banks were thus susceptible to a classic bank run as in Diamond and Dybvig (1983). Interestingly, the banks in fact failed with their coffers full of kronas, which as we have documented, they could essentially print at will via the "love letter" trade documented in Section 3. But the banks lacked foreign currency to service foreign depositors and claimholders once they came asking for their money back. Therefore, in documenting the collapse of the Icelandic banks, we begin by giving a snapshot of the aggregate financial flows in the years prior to October 2008, explaining how the external debt position played a role in the financial crisis. We will return to this issue in Section 9.

Between 2002 and 2008, investment in Iceland increased by more than 6 percent of GDP, private consumption increased and savings contracted by 13.5 percent of GDP, resulting in a current account deficit peaking at almost 25 percent of GDP in 2006 as shown in Figure 5.1. This deficit was financed by international financial markets, mostly through the domestic banking system as we have documented in Section 2. Direct borrowing in bond markets, collateralized borrowing and deposits, as mentioned earlier, funded loans in foreign currency to Icelandic households and firms which sometimes had neither assets nor income in foreign currencies. The portion of loans to household that were denominated in foreign currency rose from virtually zero in 2004 to close to 18 percent around the crash (see Figure 5.2). On the firm side, it rose from an already high 55 percent in 2004 to 60 percent at the time of the crash.

Another source of capital inflow was carry trade, which was attracted by a wide interest rate differential and possible currency appreciation. By mid-year 2007 the stock of outstanding "glacier bonds", bonds issued abroad in Icelandic krona and hedged with domestic bonds or derivatives, amounted to about a third of Iceland's GDP. Iceland looked like a classic example of a "capital flow bonanza" as in Reinhart and Reinhart (2008). The likelihood of capital flight was far from trivial.

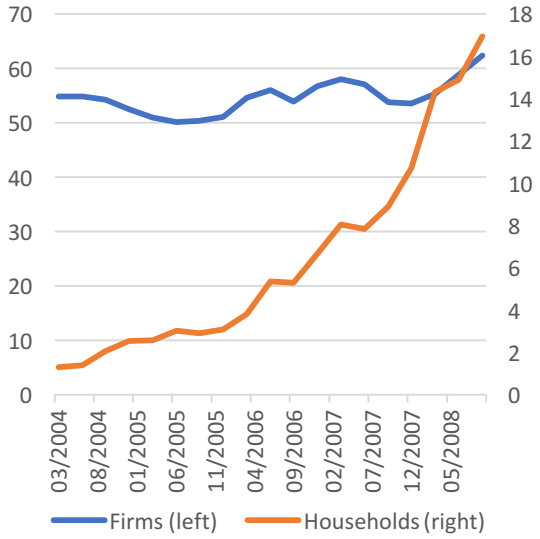
[49] SIC, chapter 7.

Figure 5.1. Current account balance



Source: Central Bank of Iceland, FS 2017/1.

Figure 5.2. Loans in foreign currency



Source: Central Bank of Iceland.

The Icelandic financial crisis look a lot like the Asian financial crises of the 1990s in this respect. There was an economic upswing, inducing an increase in interest rates to combat inflation. Interest rate differentials became quite high, capital inflow rose fast, and Icelandic banks borrowed heavily abroad to funnel funds to firms and households. The capital inflow bonanza increased the likelihood of a financial crisis which would then threatened the solvency of over leveraged local governments, firms and households.

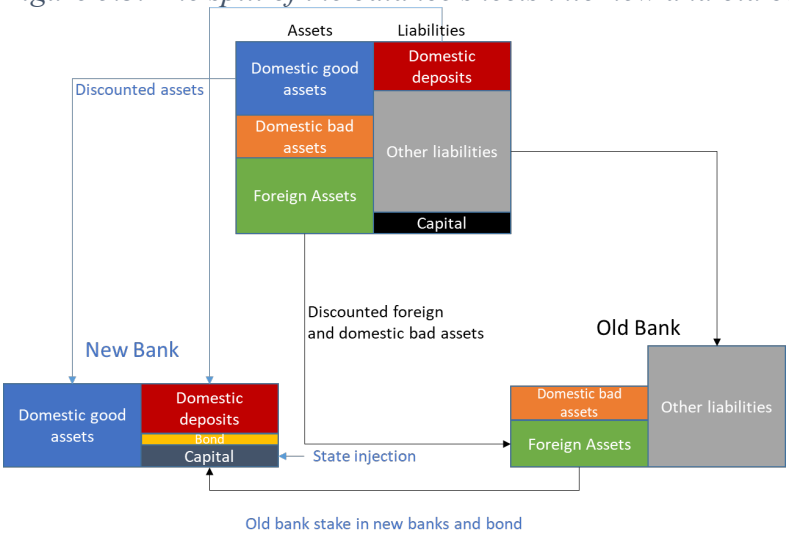
As the liquidity crisis started in 2007, it became harder for the banks and other Icelandic firms to secure foreign funding and the Icelandic krona started to give way. Around the middle of September 2008, after many months of trying to find foreign funding, it became clear that Glitnir would not be able to pay off a large loan maturing in October. The head of the board of Glitnir requested assistance from the Central Bank of Iceland on September 25. On September 29, it was publicly announced that the Government was taking over 75% of the equity in Glitnir.[50] This rattled international financial markets, already plenty rattled after the failure of Lehman Brothers. Markets did not see this move by the Icelandic government as credible, given the size of the banking system and the currency in which it operated. A full-fledged capital flight from Iceland ensued. Share and bond markets were in free fall as both domestic and foreign investors ran for the door. The banks' share prices declined, margin calls were coming in for collateralized borrowing, liquidity lines were not liquid at all and a run on foreign deposit account was growing increasingly intense. The banks were fast becoming illiquid in foreign currencies.[51]

[50] BBC news 29. September 2008. „Iceland nationalises Glitnir bank"
http://news.bbc.co.uk/1/hi/business/7641753.stm
[51] SIC chapter 4 and 20.

On October 6, 2008, the Icelandic Parliament, Althingi, passed the so-called Emergency Act.[52] The Emergency Act had two major features. First, it changed the order of the priority of claim holders by giving depositors first priority. Before the law, depositors had the same priority as other unsecure claims i.e. bond holders. Second, the Act granted the Financial Supervisory Authority (FSA) broad-based and unprecedented authorization to intervene in various ways in the operations of financial undertakings. The FSA took over all three banks in that same week.[53]

The FSA split each bank in two as illustrated in Figure 5.3. It created a domestic bank that took over all deposits in branches in Iceland, which were guaranteed in full. Most of the Icelandic assets were transferred to the new banks, at a hefty discount, as we will discuss in Section 6. The government refinanced the new banks with equity injections and subordinated loans, amounting to about 12 percent of GDP. The government then took partial ownership in the new banks according to the amount of refinancing that it had provided. The rest of the assets and liabilities were left in three holding companies, usually called "the old banks," directed by resolution committees tasked with protecting creditors interest and winding up boards were appointed to file claims. As a consequence, the operation of the banks in Iceland was never interrupted.

Figure 5.3. The spilt of the balance sheets into new and old banks



Source: FSA annual report 2009.

An immediate issue of contention in these very first days was the demand by the British and Dutch governments that the Icelandic government guarantee the EU-mandated deposit insurance for all depositors both in domestic and foreign branches, not just domestic.[54] That would be discrimination. They also argued that the government was responsible for guaranteeing at least the minimum deposit insurance amount, anything else would be a breach of obligation. The position

[52] There had been little preparation for the failure of the banks. Policymakers had prepared a few draft paragraphs for emergency legislation but little else. The first written document outlining the idea of the split is from September 30, and in it the motivation is said to be "to insure bank service for the general public and firms in Iceland and additionally limit the governments risk form the extensive foreign operations of the banks." See SIC chapter 20.

[53] Landsbanki and Glitnir on October 7th and Kaupthing on October 9th.

[54] A foreigner with a deposit in a domestic branch was bailed out and an Icelander with a deposit in a foreign branch was not.

of the Icelandic government was that this was the role of the Icelandic Depositors and Investors Guarantee Fund, which was clearly insolvent with the systematic failure of the Icelandic banking system. The Icelandic government also cited the Emergency Law stipulation that depositors were prioritized in front of other creditors, which increased the likelihood of a full recovery of the deposits. The dispute was settled in European courts[55] a few years later, where the court dismissed the case of discrimination between domestic and foreign depositors on technical grounds while the case concerning breach of obligation was dismissed on the grounds that deposit guarantees are not set up to cope with systemic banking failure of the scope that occurred in Iceland.[56]

Bank failures are typically considered a very costly affair, and the government has strong incentive to ex-post bail out depositors and sometimes also other creditors (see e.g. Chari and Kehoe 2016). The Icelandic government had a strong ex-post incentive to bail out deposits in the domestic portion of the banks, and it did. But the Icelandic government had little incentive to risk taxpayers' money to bail out depositors in foreign branches.[57] There were high political costs domestically from doing so: much of the political turmoil in Iceland following the crisis came from the strong opposition of Icelandic voters to any law that was seen as bailing out foreign depositors or creditors at tax-payers expense. Aside from the government's incentive, it is furthermore unlikely that any attempt to bail out the foreign branches would have been credible.

Following the failure of the banks the krona continued to depreciate. This posed two major problems. First devaluation fed straight through to foreign currency loans, threatening Icelandic households and firms with no income or assets in foreign currency. Secondly, the currency depreciation fed into inflation, which then fed into CPI indexed loans which made up almost all mortgages in Iceland at the time. Increased default of households and firms threatened to substantially amplify the ongoing financial crises. The Central Bank had few options to support the currency, as its efforts to strengthen foreign currency reserves had already failed earlier that spring and higher interest rates seem to do little to stop the outflow.

Capital control were adopted on November 28, 2008.[58] At that point the krona had declined about 35 percent in value against the euro in three months and over 50 percent in twelve months. The capital controls were put in place to stem the ongoing capital flight and continuous drop in the value of the currency. This provided shelter to different sectors of the economy. The newly established banking sector could retain their important deposit funding without foreign competition. The government got time to regain control over public sector finances and maintained access to domestic funds that on good terms as investors were restricted from exiting the economy. Lastly the controls created a breathing room for household and firms that had debt in foreign

[55] The EFTA Court

[56] Judgment of the EFTA Court 28 January 2013 on the case E-16/11 "Directive 94/19/EC on deposit-guarantee schemes – Obligation of result – Emanation of the State – Discrimination" http://www.eftacourt.int/fileadmin/user_upload/Files/News/2013/16_11_Judgment.pdf

[57] A foreigner with a deposit in a domestic branch was bailed out and an Icelander with a deposit in a foreign branch was not.

[58] The capital controls did allow for purchase of foreign exchange for the imports of goods and service to Iceland. Additionally, as indicated above, any scheduled repayments of foreign loans were permitted. Foreign currency income from exports was subjected to repatriations requirements. The controls put in place broad-based restrictions on investments in any type of foreign asset, such as financial instruments and real estate and prevented foreign investors who held ISK assets from recovering their investments (Central Bank of Iceland, FS 2012/1).

currency, but all their revenues in krona's. The continuing drop in the currency threatened to make them insolvent.

Figure 5.4. EUR/ISK exchange rate



Source: Central Bank of Iceland.

The capital controls were implemented in conjunction with an IMF economic program which was initiated in November as well. The program included vital financing of USD 4.4 billion, with 2.1 billion coming from the IMF and the rest from bilateral loans from the Nordic countries and Poland.[59] This allowed the Central Bank of Iceland to bolster its foreign currency reserves which was an important first step in the recovery that was sure to take a long time. We discuss the implementation and eventual lift-off of the capital controls in Section 9.

6. Were the Icelandic banks solvent?

It is sometimes said that the model of Diamond and Dybvig (1983) is the bankers' favorite model, because it gives them a reasonable claim arguing that the governments should provide emergency liquidity during crisis. The Diamond-Dybvig model formalizes the notion that even if a bank is "solvent" - that is, the value of the bank's assets exceeds the value of its liabilities - it can still fail should all depositors demand their money at the same time. This is because banks have long term assets but short-term liabilities. Their long-term assets, usually in the form of loan contracts, however, often cannot be sold for their booked value in a timely fashion, resulting in fire-sale prices. A bank run can thus be self-fulfilling, as a fully solvent bank becomes insolvent just because its depositors and other creditors ask for their money at the same time, forcing the bank to sell its assets prematurely at a discount. The fact that assets of a failing bank are typically sold at a discount makes it exceedingly hard to assess ex post whether a bank was truly insolvent or a victim of a self-fulfilling run. With this caveat in mind, it is still interesting to look at asset recovery rates of the Icelandic banks and gauge their solvency at the time of their failure.

[59] Central Bank of Iceland, EOI 2010.

6.1. Losses in the eye of the storm

Figure 6.1 gives an outline of how the assets of the bank were split up following the crisis.[60] Collateralized asset were seized immediately by financial institutions and other investors who owned secured claims on the banks ("pledged assets" in Figure 6.1). These assets include loans and securities that had been bundled into asset backed securities and used as collateral at the ECB and CBI. There is little available information on how large a fraction of the bank's assets was pledged and seized in this way.[61]

In the initial days of the crisis foreign subsidiaries of the Icelandic banks, which were under foreign supervision, were appropriated by the respective supervisory authorities in various European countries (the second branch in Figure 6.1). Some of these subsidiaries were later merged with other financial institutions, while others were liquidated. Towards the end of 2007 these subsidiaries accounted for about 40% of the banks' total assets, or more than 45 billion euros.[62] In the subsidiaries losses were fully absorbed by equity and subordinated debt, which was fully held by the parent bank in Iceland. General senior unsecured debt and deposits were however, in most cases, fully honored. Some subsidiaries issued their own debt instruments, and in those rare cases we can get some estimation of recovery of respective general claim holders, which supports this.[63] Once pledged assets and subsidiaries had been purged from the three banks' balance sheets, each had its domestic operations, assets and liabilities spun off into three separate financial institution while the rest was left in a holding company, creating the "new banks" (forth branch in Figure 6.1) and "old banks" (third branch in Figure 6.1), respectively. As explained in section 5, the "new banks" took over domestic deposit, which were fully guaranteed by the government, as well as nearly all domestic loans to firms and individuals. The old banks took over what was left of the bank's assets and liabilities with the objective of maximizing the values of the assets.

---

[60] The figure is put together using three different points in time. Since the value of the assets and currencies changed rapidly during this period there are some discrepencies.

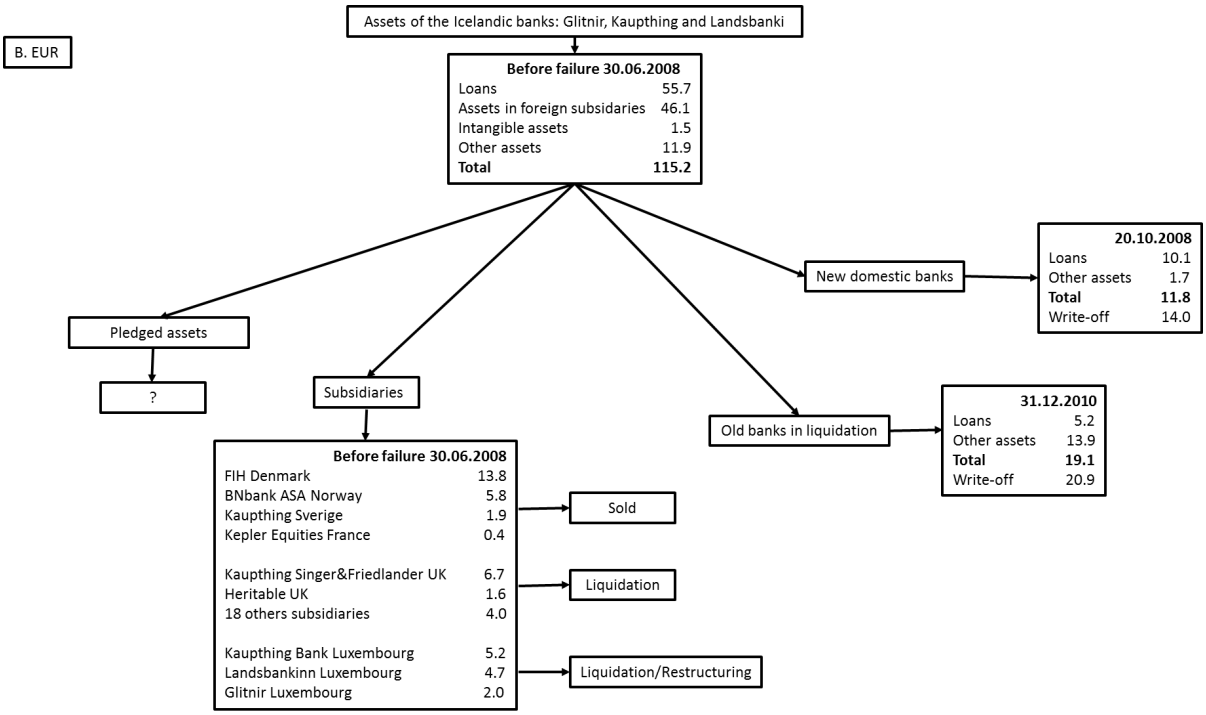
[61] One hint towards the magnitudes involved was that SIC estimated collateralized lending on September 30th amounting to about 5.2 b.euros, when we exclude loans between the Icelandic banks. In some cases the pledged assets were worth somewhat more than the underlying loan principal due to haircuts, in which case the reminder was paid back to the old banks.

SIC chapter 7 pg. 43. Pledged assets worth was falling fast in September.

[62] Central Bank of Iceland, FS 2008.

[63] Notable exception were the entities in Luxemburg. Those subsidiaries were tied more closely to the parent companies, and most of their losses in the general liquidation process wound up in the parent companies.

Figure 6.1. Assets of the Icelandic banks.



Sources: Annual reports of Glitnir, Kaupthing, Landsbanki, Islandsbanki, Arion banki and Landsbankinn, financial information of Glitnir, Kaupthing and Landsbanki and Central Bank of Iceland FS 2008.

The assets of the new banks were estimated at 11.8 billion euros at the end of 2008 as seen in Figure 6.1. These assets had a face value of 25.8 billion euros, meaning they had been transferred to the new banks at a 60% discount. Similarly, the first complete financial statement of the old banks, after their failure, available in 2010, evaluates their assets at 19.1 billion euros. The face value of those assets was 40 billion euros before the failure of the banks, indicating an estimated loan loss of 20.9 billion euros, or over 50% of the pre-crisis values of the assets. To put these initial asset, write downs in context, they amounted to 34.9 billion euros or around 5 times the reported equity of the banks prior to the failure. To the extent these estimated losses were accurate – something we will revisit shortly – the banks were clearly insolvent.

Table 6.1 reports the estimated loan losses of the old banks at the end of 2010, separated into loans to holding companies, other companies and financial institutions. We have already discussed the nature of loans to holding companies in Section 3. As the table reveals, loans to holding companies were estimated at only 6% of face value. As we have already noted, part of the loans to holding companies were extended to purchase shares in the banks themselves with the only collateral being the shares themselves, in which case the loan was fully lost.

Table 6.1. Glitnir, Kaupthing and Landsbanki loans performance 31.12.2010				
B. EUR	**Carrying value**	**Fair value**	**%**	**% of total**
Holding companies	8,6	0,5	6	9
Other companies	8,2	4,1	50	78
Financial institutions	3,3	0,6	20	12
Total	**20,1**	**5,2**	**26**	**100**
Sources: Financial information of Glitnir, Kaupthing and Landsbanki.				

6.2. Losses through the cycle at parent companies

The write-offs realized in 2008 and 2010 and reported in Figure 6.1 appear to have been a reasonable approximation for the actual losses as estimated at the end of 2015 in the old and new bank's financial statements. Table 6.2 summarizes the new and old banks' financial statements for 2015, in which the assets turned out to have appreciated slightly in value. Table 6.2 is the basis of our recovery estimate, which is 57.0 percent of accepted claims in the old banks assuming that both deposits and bonds had the same priority.[64]

Table 6.2. Estimated recovery in the parent companies as of 31.12.2015 before payments of the stability contribution and taxes	
B. EUR	
	Assets
Assets transferred to new banks against domestic deposits	8.1
Priority claims paid in the winding-up proceedings	9.4
Assets in the estates	14.6
Total	**32.1**
	Liabilities
Domestic deposits	8.1
Paid priority claims	8.7
Accepted general claims	39.5
Total	**56.4**
Estimated recovery	**57%**
Sources: Financial information of Glitnir, Kaupthing and Landsbanki, annual reports of Íslandsbanki, Arion banki and Landsbankinn and authors calculations.	

[64] This excludes special bank taxes imposed on the old banks in liquidation and the stability contribution (discussed further in Section [X]). It is worth noting that this rate only accounts for accepted claims, which were only about half of the total claims submitted to the winding up boards. Some claims were netted out against assets during the winding up proceedings, some were withdrawn while others were rejected. The amount paid to accepted priority claim holders is higher than the claim value in table 6.2., due to exchange rate movements, because claim values are based on the exchange rate 22.04.2009, per Icelandic law, while payments are based on spot exchange rate at the time they are made.

Table 6.3 gives an overview of the latest estimate of ex-post recovery rates for types of claims according to their priority. Depositors recovered 100 percent of their claims, both at home and abroad. The recovery rate of general liabilities in foreign subsidiaries were also very close to 100 percent. Recovery of equity and subordinated loans was zero. General creditors of the parent companies – most of whom had bought Icelandic bank bonds between 2005 and 2007 – also lost considerable portion of their claims. The eventual write-off for general creditors totaled 28.1 billion euros, or approximately twice Iceland's 2007 GDP.[65] The total equity in the banks prior to the crisis was 7 billion euros, i.e. a fourth of the accrued losses. While there may have been considerable losses due to fire sale prices on assets, as well as a feedback loop between the failure of the banks and adverse consequences for Icelandic firms, this nonetheless is suggestive of that the Icelandic banks were not solvent at the time of their failure. As such, the Icelandic banking crisis was not an example of self-fulfilling run, which could have been prevented with a better lender of last resort or alternative funding in foreign currency. Rather, the evidence indicates they were insolvent.

Table 6.3. Recovery Rate for Liabilities, after Stability Contribution and Taxes

B.EUR	**Before failure**	**Recovery rate**
Deposits from customers	18.8	100%
Deposits from customers in foreign subsidaries	14.5	100%
Asset backed securities	>0	29-100%
Borrowings and wholesale deposits	>52.8	29%
Borrowings and wholesale deposits in foreign subsidaries	20<x<10	Close to 100%
Other liabilities	8.0	29%
Subordinated loans	5.0	0%
Equity	6.7	0%
Total	**115.2**	

Sources: Financial information of Glitnir, Kaupthing and Landsbanki and authors calculations.

Where the recovery rates poor in international context? As the table reveals the recovery rate of senior unsecured claims was about 29 percent for general creditors of the Icelandic banks (e.g. typical bank bond holder) which appears low. While we are not able to do an extensive analysis of recovery across countries and time, a paper by Acharya, Bharath and Srinivasan, (2007) offers some hints. They compute recovery rates for senior unsecured claims between 1982 and 1999, based on bonds, loans and other debt instrument. The recovery rates are estimated as 56% for all industries and 59% for financial institutions. Put in this context, the recovery rate of senior unsecured creditors was therefore poor in the case of the Icelandic banks. One element that makes this comparison tricky, however, is that all deposits were granted super-priority in Iceland. In the case of the US, however, only insured deposits have full priority while those deposits above the insurance limit become general senior unsecured claims. The number are thus not fully comparable, as there were large uninsured deposits in the Icelandic banking system which gained super-priority at the expense of other creditors.[66]

[65] This figure includes approved claims to the Iclandic banks, after-tax payments and the stability contribution and excludes accrued interest for over six years, from the failure until the payments were/will be made.

[66] One can thus think of 29 percent as a lower bound on the recovery rate in the case of the Icleandic bank when compared to the US but 57 as an upper bound.

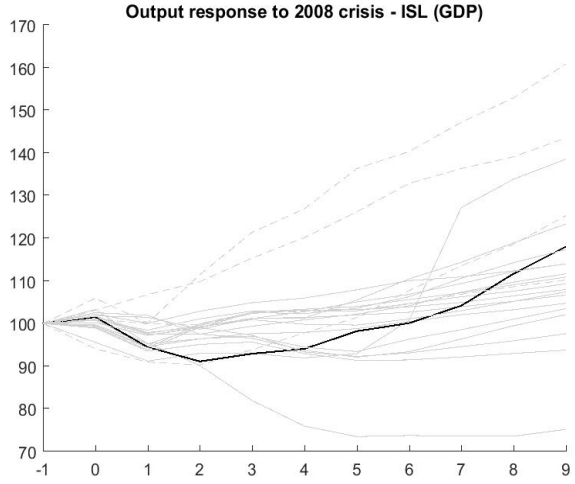
7. The output cost of the Icelandic banking crisis

A major cost associated with a banking crisis is aggregate production forgone. Given the enormous size of the Icelandic financial crisis, the output effects appear relatively modest in international context and the recovery relatively brisk, at least when taking into account the size of the failed bank relative to Iceland's GDP. Here we update and extend two well-known metrics of output losses from banking crisis, that of Laeven and Valencia (2012) who study 147 crises post 1970, and Rogoff and Reinhart (2014) that study 100 crises that span over one and a half century. The passage of time allows us to update the estimation with longer date series and longer time horizons than either study. The updated assessments suggest that Iceland's output losses, while significant, were not as large as previous thought. We discuss some theoretical possibilities that may help explain the relatively rapid recovery.

7.1. Output losses according to the output metric proposed by Laeven and Valencia (2012) with simple extensions

Figure 7.1 shows real GDP, normalized at 100 at the year of a banking crisis in 22 advanced industrial economies that are listed up in Table 7.1, using a definition of a banking crisis proposed by Laeven and Valencia (2012). Icelandic GDP is depicted with a dark solid line. Other countries that are categorizes as having experienced a banking crisis in 2008 are shown in solid lines, while the dashes line depict four other banking crises (Finland in 1991, Norway in 1991, Japan in 1997 and Korea in1997). Output fell in Iceland by about 10 percent in the first 2 years of the crisis, only Greece contracted more during the same period in this sample. If we look towards the end of the period (IMF estimate of 2017 GDP), however, Iceland has recovered to beyond pre-crisis levels, and it has the third highest level of output of the countries hit by the crisis, relative to 2007.

Figure 7.1. GDP index, index=100 at crisis date.

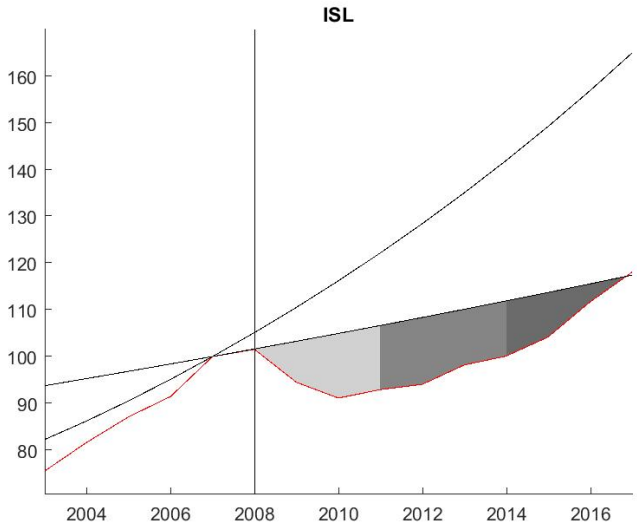


Source: IMF and authors calculations

Laeven and Valencia (2012) estimated the output loss, in the three years after the start of a crisis, as fraction of annual production at the start of the crisis. According to their metric, Iceland faced a sizable output loss of 40 percent of GDP, comparable to the cost of Japanese crisis in 1997 and

ranks as the 34 costliest crises of the 147 crises that they consider. It is considerable smaller, however, than many well-known banking crises such as Argentina in 2001and Thailand in 1997, where output loss is estimated about 70 and 100 percent of GDP respectively.

Figure 7.2. Output loss over a period of 3, 6 and 9 years



Source: Authors calculations

Figure 7.2 shows the evolution of Icelandic GDP from 2003 to IMF latest estimate of 2017 GDP. The estimated difference between "potential output" and actual output is represented by the first gray area in the figure. This is scaled to be a fraction of GDP pre-crisis, i.e. 2008. We now have access to more data so we also compute the same statistic for six and nine years after the crisis start, adding in each case the shaded region to the right in the figure. The results are shown in Table 7.1 for a select number of industrial economies, assuming their potential output is growing at the same rate. Considering a longer horizon reduces the cost of the crisis in Iceland relive to other countries on account of the strength of the recovery. While the output cost is the fourth highest according to the 3-year horizon, it goes down to 8th place for the 6 and 9 years horizon.[67]

[67] Laeven and Valencia (2012) assume that potential output grows at a different pace in different countries. We instead assume that output potential grows by the same amount across all countries (by a constant 1.62 percent per year). While this makes little difference in the relative ranking of countries at the 3 year horizon, it matters more for 6 and 9 year horizon. While our benchmark has its own problem, we think it gives a more accurate picture of the relative output losses across countries for a 6 and 9 year horizon in advanced industrialized economies. The reason is that Laeven and Valencia (2012) estimate potential by computing a trend using a HP filter for each and every county over 20 years and extrapolate it. The problem is that economic growth is often unsustainable in the run-up to a banking crisis. This is particularly obvious in the case of Iceland, where growth was amplified by large capital inflows, lending growth and an asset price bubble, giving an estimated potential growth of 5.13 percent per year using Laeven and Valencia´s suggested methodology, shown by the steep line in figure 7.2. This assumption would clearly exaggerate the estimated output loss for Iceland-- especially at a six- and nine-year horizon, even if it matters less at a 3 year horizon those authors focused on.

Table 7.1. Output Loss Over a Period of Years in % of GDP
Using the Common Potential Output Growth for All Countries

COUNTRY	Year	3 years	6 years	9 years	COUNTRY	Year	3 years	6 years	9 years
AUSTRIA	2008	0.13	0.31	0.57	**ICELAND**	2008	0.29	0.67	0.86
BELGIUM	2008	0.11	0.28	0.51	**ITALY**	2008	0.26	0.75	1.40
SWITZERLAND	2008	0.06	0.12	0.21	**JAPAN**	1997	0.14	0.41	0.75
GERMANY	2008	0.16	0.32	0.51	**KOREA**	1997	-0.09	-0.66	-1.57
DENMARK	2008	0.22	0.54	0.89	**LUXEMBOURG**	2008	0.19	0.34	0.27
SPAIN	2008	0.18	0.64	1.14	**NETHERLANDS**	2008	0.14	0.41	0.72
FINLAND	1991	0.48	1.02	1.44	**NORWAY**	1991	-0.01	-0.15	-0.37
FRANCE	2008	0.15	0.37	0.67	**PORTUGAL**	2008	0.17	0.63	1.20
UK	2007	0.12	0.35	0.54	**SLOVENIA**	2008	0.20	0.64	1.09
GREECE	2008	0.35	1.34	2.55	**SWEDEN**	2008	0.17	0.34	0.41
IRELAND	2008	0.33	0.79	0.42	**US**	2007	0.11	0.27	0.39
AVERAGE		0.18	0.44	0.66					

Source: IMF and authors calculations

As an alternative check on the output cost and the strength of the recovery we can look at the relative ranking of Icelandic GDP in this period. Iceland was the fourth richest country in the world in dollar GDP per capital terms in 2007 and drops to 21 place in 2010 according to IMF.[68] It climbs back to the fourth seat in 2017, the same year as Iceland is assumed to be back at potential in figure 7.2.[69] We will not comment in detail on the other countries in the table, yet it is worth cautioning the reader that there is a recent debate on the reliability of the GDP data for Ireland, due to its role as a hub for global tax management.[70]

7.2 Output loss metric proposed by Reinhart and Rogoff (2014)

Reinhart and Rogoff (2014) compare the output cost of 100 major banking crises that span 150 years. One advantage of their methodology is that it does not make any assumptions about underlying trend of potential GDP, which we have seen can be important. They construct a severity index for each financial crisis, the sum of the absolute value of the fall in per-capita GDP and how long (in years) it takes to get back to the pre-crisis peak.[71]

We report in Table 7.4 our re-estimation of the 11 banking crisis in Reinhart's and Rogoff's (2014) dataset, for which new data exists relative to their paper, and report the difference. Of the

[68] http://www.imf.org/external/datamapper/NGDPDPC@WEO/OEMDC/ADVEC/WEOWORLD

[69] If we instead used the country specific HP trend, the counterfactual growth shown by the line in figure 7.3 would have made Icelandic GDP the riches country in the world today by a wide margin.

[70] This debate gathered momentum in 2016 when it was reported that that the Irish economy grew by 26 percent in 2015. Following this the Central Statistics Office of Ireland has started presenting "modified gross national income" or GNI*, suggesting that GNI* was only 70 percent of GDP, and estimate mostly reached by excluding profits from US companies with big operations in Ireland such as Google and Microsoft. It is beyond our scope to go in the details of this debate, but it is worth noting that we are not aware of any similar possible sources of mismeasurement for Icelandic GDP. For details and references see FT (2018).

[71] Observe that Reinhart and Rogoff (2014) use real GDP per capital, while Laeven and Velencia use real GDP, for further discussion see Reinhart and Rogoff (2014).

cases we re-evaluate, the new estimate changes most significantly for Iceland and Ireland. Iceland severity index drops from 23.2 to 18, resulting in a 14-place drop in the overall ranking. This is below the mean of the Reinhart and Rogoff´s crisis index, but slightly above the median.[72] The main reason for the change in the assessment for Iceland's GDP in 2017 relative to the earlier assessment is that the current estimate of GDP in 2017 is 15 percent higher than in 2013, while the IMF estimates used by Reinhart and Rogoff predicted it would be only 6 percent higher.[73] To give perspective on the magnitude of this index, the costliest crisis is Chile in 1926 at 62.6, while the value of the index for the Great Depression in the US is 38.6.

Table 7.4 Estimation of Banking Crises Cost, Reinhart and Rogoff method.

		Peak to	Peak to	Peak to	Severity	New estimated	Difference
Year	**Country**	**Trough**	**trough**	**recovery**	**index**	**rank (out of 100)**	**vs. 2014 est**
2008	Greece	-26.3	6	15	41.3	9	8
2008	Ukraine	-18.2	7	14	32.2	21	13
2008	Italy	-12.4	7	15	27.4	25	4
2008	Spain	-10.6	6	11	21.6	34	5
2007	Ireland	-11.1	5	8	19.1	41	-14
2008	Iceland	-10.0	2	8	18.0	45	-14
2008	Portugal	-7.0	5	10	17.0	47	-4
2007	United Kingdom	-6.4	2	8	14.4	52	-5
2008	Netherlands	-4.3	1	9	13.3	56	-6
2008	France	-3.8	2	7	10.8	70	-13
2007	United States	-4.8	2	6	10.8	71	0
2008	Germany	-5.2	1	3	8.2	81	0
All 100	Mean	-11.5	3.2	8.3	19.8		
episodes	Median	-8.8	2	6.5	15.3		
	Standard deviation	9.2	2.5	6.2	14.3		

Source: Authors Calculations

7.3 Snapshot of the Icelandic recovery

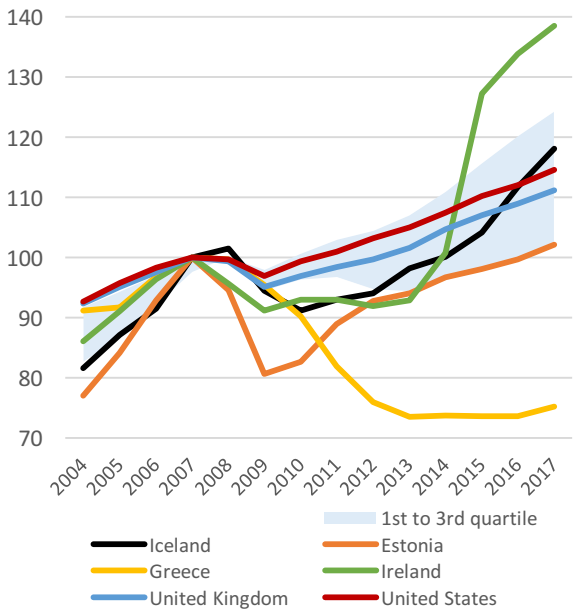
Series of influential papers by Reinhart and Rogoff have made it a stylized fact of macroeconomics that recoveries from banking crisis are slow. Given the size of the Icelandic banking system' once it failed, a reasonable conjecture is that the recovery should have been long and painful. While the output loss was substantial, we have now presented several measures which indicate that the Icelandic banking crisis is quite far from being the costliest banking crisis in economic history in terms of output loss, despite being the largest when measured by the size of the banking system relative to GDP.

[72] The aggregate statics, which we report in the table, are not very different from those reported in Reinhart and Rogoff (2014).

[73] As Reinhart and Rogoff we rely on IMF World Economic outlook estimate of future output. The new estimation shortens the duration of the crisis by two years. In addition, data revisions make 2008 the pre-crisis peak rather than 2007 which accounts for 1 year. In addition, revised data from the IMF put the peak output decline in Iceland at 10 percent, while the data Reinhart and Rogoff (2014) relied on had it at 12.2.

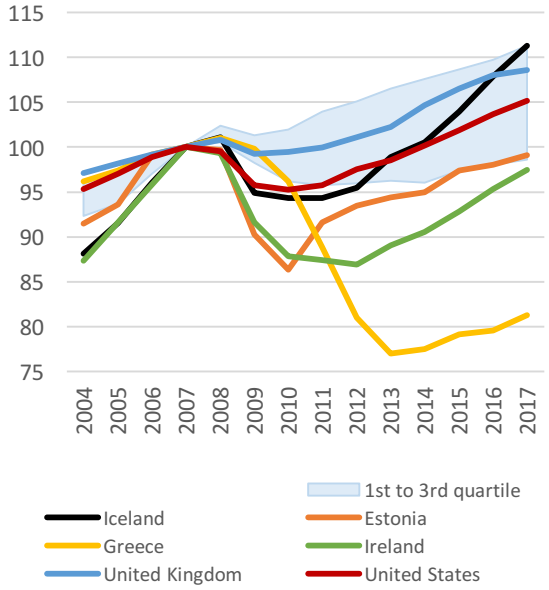
The output costs we have documented, when compared across countries and time, may even somewhat overstate the output cost in the case of Iceland since most advanced economies were also in a recession during Iceland's recovery. The S-Korea recovery after the 1997 crisis, for instance, occurred during a time of robust economic growth in the world. Figure 7.3 shows GDP in Iceland compared to 38 industrialized economies, normalized at 100 in 2007, where we have extracted a few special cases. We show with a gray area the 1st to 3rd quantile of the distribution. Laeven and Valencia (2012) dataset identifies 20 out of these 38 countries as having gone through a banking crisis in this period. As of 2017 the index for Icelandic GDP is above the US index and above the sample median. The evolution of employed workers, see Figure 7.4, shows an even stronger Icelandic recovery. Below we offer some possible explanation for the strength of the recovery, relating it to existing literature on the possible output cost of financial crisis. We leave a detailed model based analysis to future work.

Figure 7.3. GDP index at constant prices in domestic currency, index 2007=100
Compared to 38 industrialized countries



Source: IMF.

Figure 7.4. Number of employed, index 2007=100
Compared to 38 industrialized countries



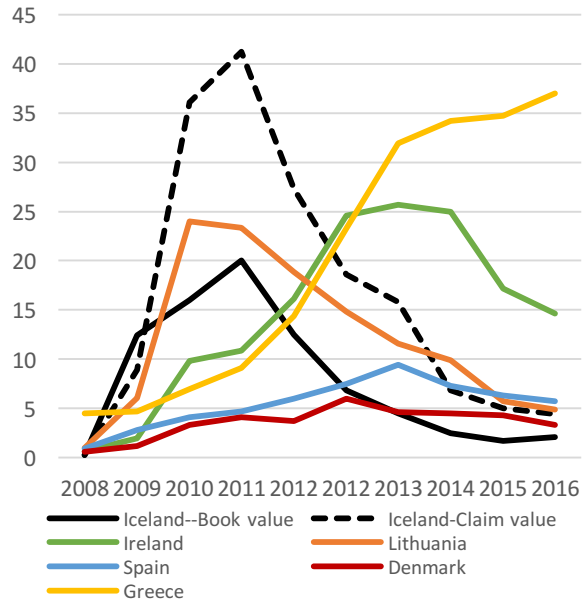
Source: IMF.

One common explanation for the slowness of the recovery of countries from banking crisis, is the presence of "zombie firms" on banks' balance sheets, which keep lending to insolvent firms to avoid necessary write off in their loan books, in which case banks may not satisfy capital adequacy regulations (Caballero et al 2008).[74] This leads to capital misallocation, as the zombie firms starve new and more promising firms from securing funding. We saw some evidence of this type of behavior in the lead-up to the financial crisis in Iceland where some borrowers

[75] To the extend other countries did not reevaluate their loan books in a similar manner, the dashed line is more comparable to what we report in other coutries. It is beyond our scope to, however, make a similar correction for the comparison countries which is likely to have differed from country to country.

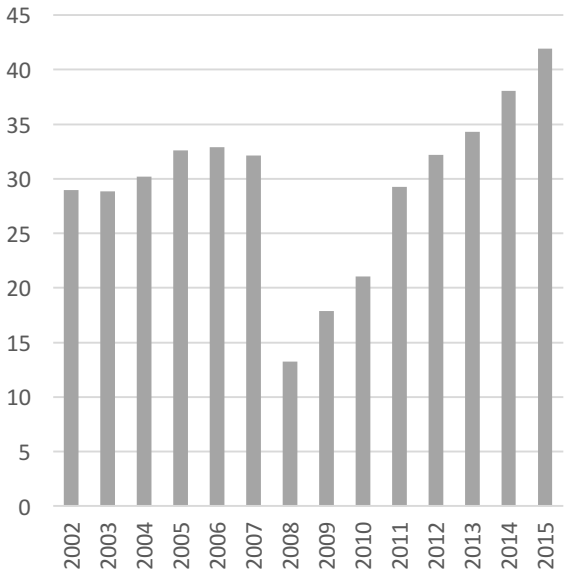
became "too big to fail" (see Section 4). However, the incentives for the banks changed after the establishment of the new banks. Icelandic firms and household loans were transferred to the new banks at a 60-percent discount of the claim value on average, and new equity was injected into the new banks. In contrast to the Japanese banks analyzed in Caballero et al (2008), the new Icelandic banks had the scope and incentives to restructure corporate and household debt, and little incentive to keep afloat zombie firms.

Figure 7.5. Default ratios, corporations and households



Source: Central Bank of Iceland FS17/1.

Figure 7.6. Firms equity ratio



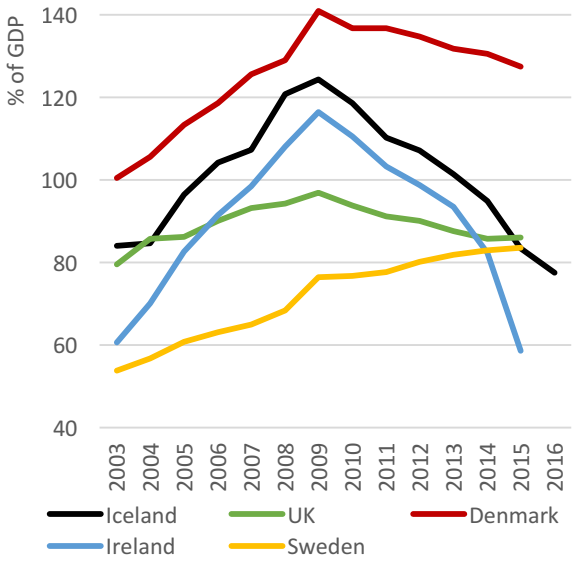
Source: Central Bank of Iceland FS17/1.

Figure 7.5 shows that the actual default ratio of corporations and household were significantly higher in 2009 and 2010 relative to many industrialized economies at that time, it however falls off fast after that which is suggestive of that the new banks were more aggressive in going through debt restructuring. Because the reported default represents default of the newly re-evaluated book value of the loan book in Iceland, the solid black line is an underestimate of loans in default, while the dashed line which shows the actual default on the pre-crisis book value of the loans is an over estimate.[75] Non-performing loans rose from being less than 1 percent to over 40 percent of the initial claim value of the loans. The new banks supported the firms they assumed viable, while other firms were wound up at a relatively high frequency in the initial years. Figure 7.6 shows that reorganization was successful in more than tripling firms equity ratios from about 12 percent in 2008 to over 40 percent in 2015. As an example, most of the

[75] To the extend other countries did not reevaluate their loan books in a similar manner, the dashed line is more comparable to what we report in other coutries. It is beyond our scope to, however, make a similar correction for the comparison countries which is likely to have differed from country to country.

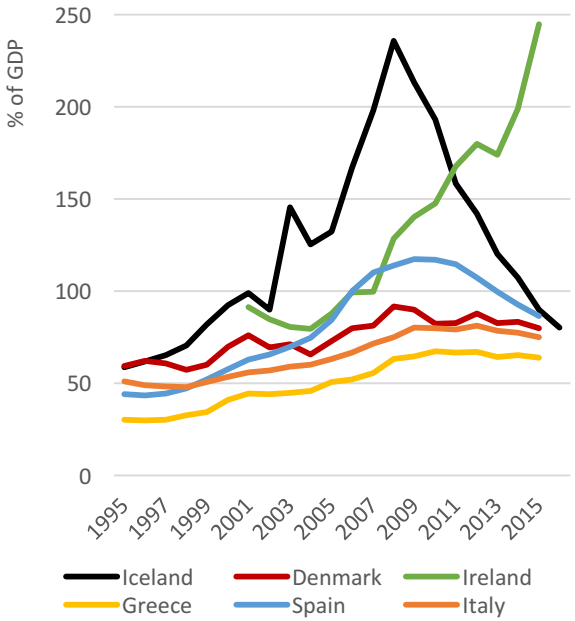
firms currently listed on the domestic stock exchange changed owners after the crisis (76 percent). [76]

Figure 7.7. Households debt



Source: Central Bank of Iceland FS17/1.

Figure 7.8. Corporate debt



Source: Central Bank of Iceland FS17/1.

A second popular explanation, closely connected to the first, is that the crisis itself is triggered by agents accumulating "too much debt" and the recovery is slow because of forced deleveraging – following what is often referred to as a "Minsky moment". (see e.g. Eggertsson and Krugman (2012), Mian and Sufi (2013) and Guerrieri and Lorenzoni (2017). As those overextended agents are forced to pay down their debt, there is a slowdown in spending and someone else must pick up the slack. The shorter the deleveraging process, the stronger will be the recovery.[77] Figures 7.7 and 7.8 show household and firm debt as a fraction of GDP, illustrating the sharp decline in debt following the crisis in comparison with select number of countries. A significant part of this sharp decline was the aggressive debt restructuring made possible by the initial asset write off when the new banks were founded. Another important factor were some specific government policies, including household debt write down and giving individuals access to pension savings to pay down principals of loans. Moreover, the Supreme Court determined that the loan contracts linked to foreign currency offered by the banks before the crisis were illegal, which reduced markedly value of outstanding debt.[78]

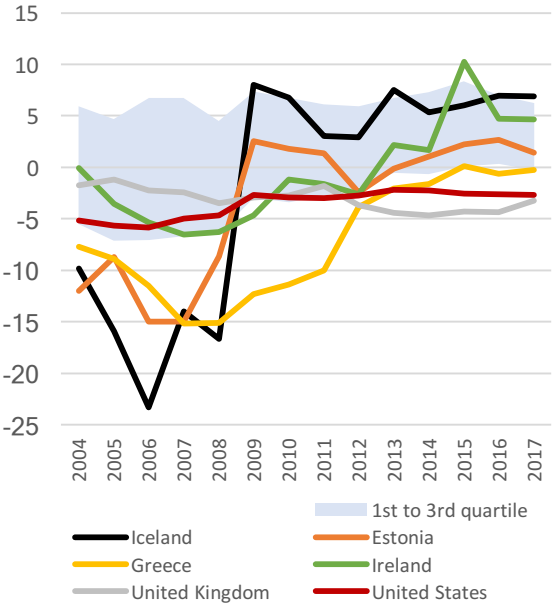
[76] Broadly speaking, it was mostly firms in the export sector that survived restructuring. All banks, insurance companies and flagship firms such as Icelandair and Eimskip, which is the largest shipping company, changed owners. Similarly the largest retail chain, Hagar, changed owners, as well as the largest newspaper, Morgunbladid, to take a few examples.

[77] Benignio, Eggertsson and Romei (2014).

[78] Central Bank of Iceland, FS 2012/1. For households about 60% of the debt deleveraging was due to illiegal foreing currency linked loans, about 20 percent was due to policy put in place soon after the cirsis and another 30 precent due to the so-called indexed loans principle reduction policy. See report on „Loan principle reduction" prime ministry 2013 https://www.stjornarradid.is/media/forsaetisraduneyti-media/media/Skyrslur/hofudstolslaekkun-

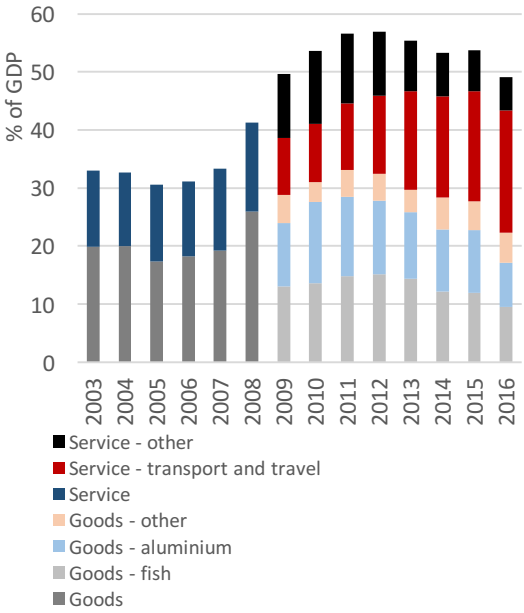
A key element Eggertsson and Krugman (2012) and Guerrieri and Lorenzoni (2017) emphasize as being important to speed up debt deleveraging, and thus speed up of a recovery from a financial crisis, is the ability of the central banks to cut interest rate. A key constraint identified in this literature is the problem of the zero lower bound on interest rate, which became a major constraint for the ECB, Bank of Japan and the Federal Reserve during the crisis. The Icelandic Central Bank, however, never faced the ZLB constraint, partially due to historically higher inflation, but perhaps more importantly because there was a large currency devaluation right around the crisis, discussed in greater detail in section 9. The Icelandic krona depreciated against the value of the euro by about 50 percent over the 12-month period before capital controls were implemented in the fall of 2008. The combination of capital controls, and large devaluation, may thus have contributed to easier monetary condition than many other countries were able to provide that were either constrained by the ZLB or part of a larger currency area and thus did not have the flexibility of devaluing their currency. It also insulated the Icelandic government from the sovereign debt crisis that shook Europe in 2012. The freedom of Iceland to devalue in the crisis, to the extent it helped the recovery, lend some credence to the provocative claim by Krugman (1991), that Iceland was an optimal currency area, an idea we do not try to formally evaluate.

Figure 7.9. Current account balance



Sources: IMF, Central Bank of Iceland FS 2017/1.

Figure 7.10. Export of good and service



Source: Statistics Iceland.

One hint towards the importance of devaluation in the recovery is the large reversal of the current account shown in Figure 7.9.[79] The current account surplus has been on average 6

husnaedislana.pdf

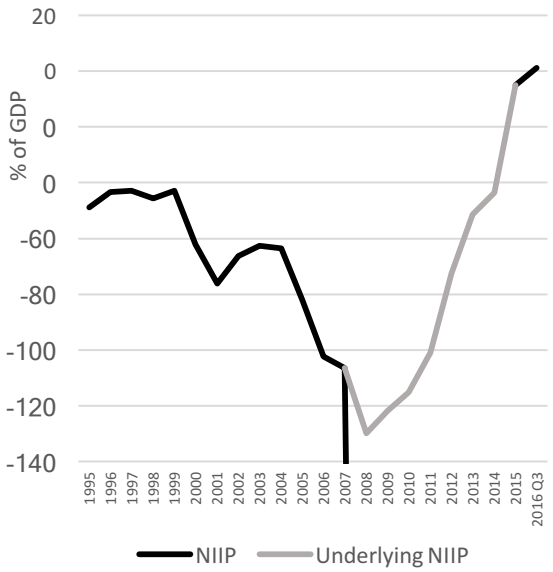
Firms debt reduction is more due to write offs, restructuring and loan payback.

[79] The current account balance for Iceland shown on Figure 7.10 is so-called underlying current account, excluding effect of the failed banks in winding-up proceedings from Q4/2008.

percent of GDP since 2008. The reversal of the trade balance was driven by a sharp turnaround in terms of trade and a decline in domestic demand for, in particular, foreign investment goods and foreign consumption goods. The financial account also improved markedly as interest expenses declined by 14 percent of GDP from 2008 to 2009 due to delinquent failed bank debt. Adding to the reversal in the trade balance has been a massive explosion in tourism. The tourism boom was partially triggered by the large initial devaluation, but a well-coordinated effort by the government and firms starting in 2010 to attract tourists could also have played a role.[80] Applying a wider definition of tourism (including airline transport), tourism now make up around 40 percent of Iceland's total exports (see Figure 7.10).

There is also evidence for external debt deleveraging. While the presence of the large Icelandic banks greatly complicated to computation of the net international investment position of Iceland, especially right before and around their failure, there is reason to believe that the CBI computation of this statistic gives a reasonable estimate of the underlying net international investment position, see the gray line in Figure 7.11. Since the failure of the banks, the net international investment position of the Icelandic economy has changed dramatically and now stands at positive 1 percent of GDP (see Figure 7.11). The rapid improvement of the external positions since 2008 is mainly due to three factors. First, external debt of failed firms has been written down by foreign creditors. Second, the current account surplus made it possible for other firms and entities to pay down foreign debt quite rapidly. Third, the stability contribution of the old bank estates alone improved the external position by about 20 percent of GDP. We will document this key element of the recovery in the next two sections.

Figure 7.11. Net international investment position, % of GDP



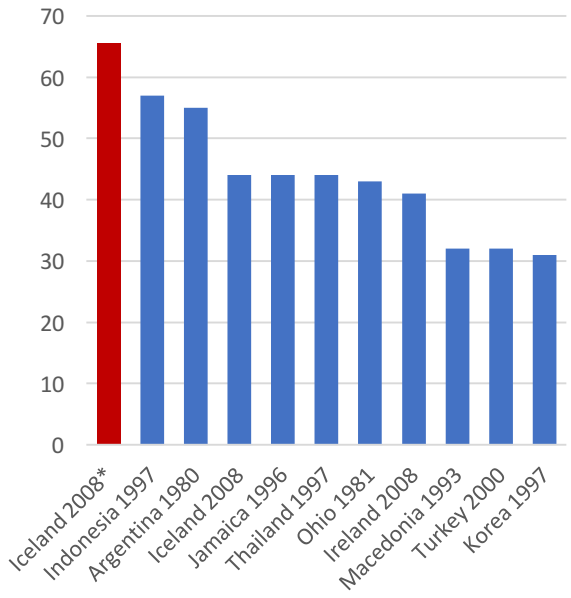
Source: Central Bank of Iceland FS17/1.

[80] For example, in 2010, a collection of firms together with the government and local authorites launched and ad campaign called "Inspired by Iceland", see Arena, Bhattachaya, and Bower (2017). Google searches for Iceland also peaked in April 2010 following the Eyjafjallajökull eruption.

8. Fiscal Cost

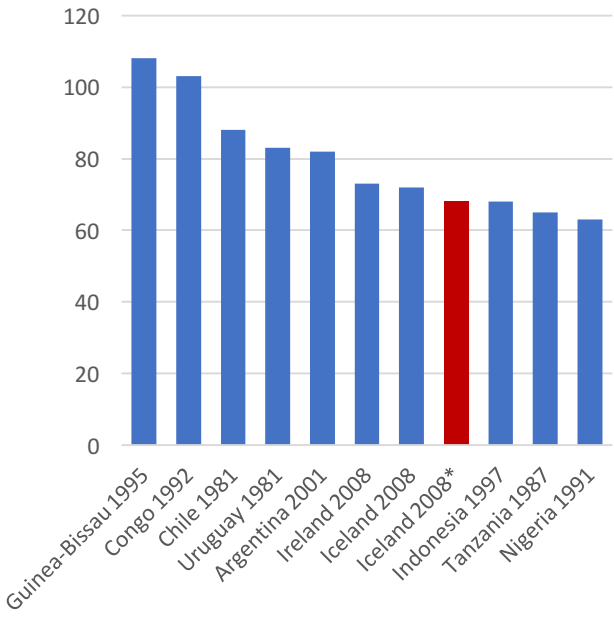
The Icelandic banking crisis is sometimes cited as one of the costliest on record from the perspective of government finances. This is based on two measures relative to GDP, gross fiscal outlays and net increase in public debt. Measured in gross fiscal cost, the Iceland's banking crisis was the third costliest out of the 147 crises in Laeven and Valencia's (2012) sample, while it was the seventh costliest measured in increase in government debt (see Figures 8.1 and 8.2, excluding red column which will be discussed later).

Figure 8.1. Fiscal cost, estimated 2012



* Updated authors calculations
Source. Laeven and Valencia and authers calculations

Figure 8.2. Increase in debt, estimated 2012



* Updated authors calculations
Source. Laeven and Valencia and authers calculations

We present some new evidence on the fiscal cost of the Icelandic crisis. According to our calculations, the fiscal cost is notably lower than estimated in 2012. There are also scenarios, which do not look too unreasonable, under which the Icelandic government's net cost is negligible or even turns into revenues. It should be emphasized, however, that this estimate is still subject to uncertainty, as it depends significantly on the market value of the government stake in the new domestic banks.

There are two main reasons why the outlook for the fiscal cost is now much better than in 2012. First, the outcome in Figure 8.1 is gross cost, which does not net out the value of the assets the government acquired concurrently. Laeven and Valencia (2012) choose this measure to "*focus on gross fiscal costs instead of net because the gross amount reflects the intensity of the intervention."* The pre-crises size of the Icelandic banking sector alone implies a very intense intervention, but as we will see, a significant portion of that intervention is likely to be recovered. The second reason is the stability contribution amounting to 18% of GDP and paid by

creditors of the failed banks to fulfill so-called stability conditions in exchange for exemption from the capital controls for the estates (see Section 9).

Table 8.1. Government debt incurred as a result of bank support and restructuring during and after the crisis.

% of GDP	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Liabilities										
CBI Holding Company	-53,5	3,1	5,8	5,1	2,0	3,8	3,8	5,0	7,4	-17,5
Saving banks			-0,1	0,0	-1,1					-1,2
FX transaction with CB of Luxembourg			1,1							1,1
State guarantees		-0,2	-1,7					0,0		-1,9
New banks	-12,0		0,1	0,2	0,1	0,7	1,1	2,1	2,4	-5,2
Taxes on the estates							1,7	1,2	0,2	3,0
HFF			-2,0		-0,7	-0,2				-3,0
Debt relief program							-2,0	-0,9	-0,8	-3,7
Lower tax revenues due to the debt relief program							-0,1	-0,2	-0,5	-0,7
Assets										
CBI Holding Company	36,3	-5,5	-6,4	-4,7	-1,9	-3,5	-5,4	-3,4	-5,2	0,3
Equity in the new banks	8,6	0,7	1,7	0,5	2,5	0,0	-0,1	-0,5	-1,6	11,8
Subordinated debt in the new banks	3,3	-0,1	-0,3	0,2	0,1	-0,4	-0,2	-1,3	-1,3	0,0
Stability contribution								7,9	1,5	9,4
Stability contribution - equity in the new banks									8,8	8,8
Gross position	-65,5	2,9	3,2	5,3	0,2	4,2	4,6	7,3	8,6	-29,1
Net position	-17,4	-1,9	-1,7	1,3	0,9	0,4	-1,1	10,0	10,7	1,1
Accumulated net position	-17,4	-19,3	-21,0	-19,7	-18,8	-18,4	-19,5	-9,5	1,1	1,1

Sources: CBI Holding Company, Islandsbanki, Arion banki, Landsbankinn, Glitnir, Kaupthing and Landsbanki annual reports, Central Bank of Iceland FSR 2015/1 and FSR 2016/1, The Icelandic National Audit Office report to the Parliament June 2012 and authors' calculations.

Table 8.1 shows the gross and the net cost of the crisis by dividing nominal cost in each year with nominal GDP of that year, the same methodology as used in the IMF assessment from 2012.[81]

The largest outlay is attributed to the Central Bank of Iceland Holding Company (CBI Holding Company), amounting to -53.5% of GDP gross cost or -17.2% of GDP net (see Table 8.1). This holding company was established to unwind assets that the Central Bank of Iceland and the Treasury took over during the crisis.[82] Most of the assets were repossessed by the Central Bank

[81] IMF Country Report No. 12/91. April 2012.

[82] The CBI Holding Company was formally established late 2009, with a balance sheet book value of 490.6 b.ISK. The claim value was 289.1 b.ISK higher, which is the amount of initial write offs. In 2009 the Central Bank and the Treasury recovered 72.1 b.ISK of assets from collateralized lending. This is added to the initial opening balance sheet of the CBI Holding Company. This method involves a slight overestimation of the gross position as a small

on account of its collateralized lending to the failed banks, the "love letter trade" we discussed in some detail in Section 2. The write off due to the "love letter" claims were estimated 17.2% of GDP in 2008 and additional 1.4% of GDP in 2009, although the eventual write offs due to collateralized lending by the Central Bank ended up closer to 14.5% of GDP. This is the largest portion of the net fiscal cost of the crises. Additional write downs of other assets were also necessary, most notably around 2.5% of GDP write down on Danish bank FIH. FIH, a subsidiary of Kaupthing, was accepted as collateral on an emergency liquidity funding loan of 0.5 billion euros extended to Kaupthing two days before the bank's failure. The Central Bank only recovered around half of the emergency loan when FIH was sold in 2010, resulting in a loss of about 2.5% of GDP. The CBI Holding Company also further wrote down some claims against savings banks, an insurance company and other smaller assets. In 2016 most of remaining CBI Holding Company assets were sold, so there is good reason to believe that the current estimate is close to right.

The second largest cost is the state refinancing of the new domestic banking system, with a gross cost of 12% of GDP in 2008. The refinancing was in the form of equity injection and subordinated loans. Since 2008 the recovery of these assets, in the form of dividends, interest payments and installments, has been 6.8% of GDP. The net cost still outstanding is 5.2% of GDP. Additionally, the government's stake in the new banks, based on the crisis equity injection, has the book value of 11.8% of GDP (see Table 8.1). The market value of the equity is however uncertain, and will be discussed in more detail shortly.

Other government expenses in connection to the crisis are much smaller. Outlays due to smaller savings banks are included in the CBI Holding Company line in the table. The recapitalization of the House Financing Fund (HFF) was necessary to offset losses on mortgages. Lastly there is net fiscal gain in 2010 due to a transaction between the Central Bank of Luxembourg and the Central Bank of Iceland. The Central Bank of Luxembourg was at this time the largest holder of the offshore krona position (see in more details in Section 9) which was wound down in this transaction.[83]

The aftermath of the crisis involved more fiscal revenues that counter the initial outlays. The single most important is the so-called stability contribution from the creditors of the failed banks, amounting to 18.2% of GDP (see Section 9). Half of the stability contribution is directly or indirectly connected to ownership stakes in two of the new banks, resulting in the state now owning over 99% in Islandsbanki (formerly Glitnir) and dividends and sales proceeds of Arion banki (formerly Kaupthing) will be split between the state and claim holders.[84] This added an estimated 8.8% of GDP in state ownership in banks, resulting in it owning what amounts to

---

portion of the assets on the CBI Holding company opening balance sheet were claims that came about in 2009, following the failure of a few smaller banks.

[83] This relates to lending from the ECB and the collateral that one Icelandic bank posted before its failure, in part to replace the "love letters" that ECB had rejected. In 2010 the Central Bank of Iceland took over this collateral and paid the ECB the nominal amount owed in full. Yet since the ECB had applied significant haircuts to the collateral, the Central Bank of Iceland was able to resell these assets to Icelandic pension funds 12 days later at a profit. The price was at a 25% discount from listed price, but yet this trade resulted in a profit corresponding to 1.1% of GDP at that time.

[84] The state already held a 99% stake in Landsbankinn (formerly Landsbani)

20.6% of GDP in bank equity at book value at the end of 2016. Other post crisis revenues include a tax on the estates of the failed banks amounting to 3% of GDP.

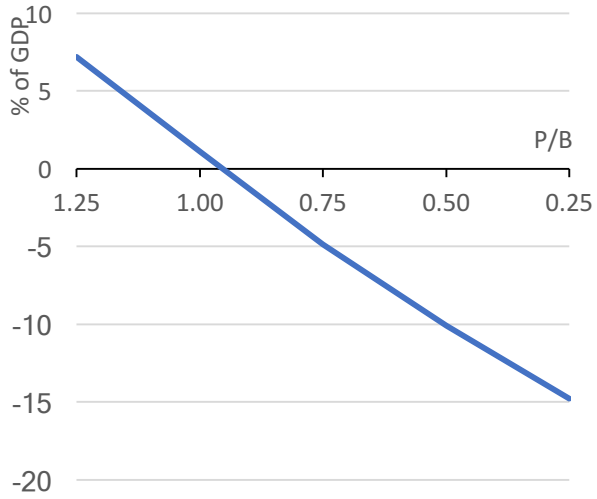
The fiscal cost of the Icelandic crisis critically depends on the assumed market value of the new banks. In Table 8.1 we value them at book value. This results in accumulated fiscal gain of 1.1% of GDP at year end 2016. This estimation is subject to uncertainty, however.[85]

The actual sale price of the new banks relative to their current book value affects the fiscal gain/losses through two channels. First, directly through the shares the government holds. This number is shown under "Equity funding for the new banks" in Table 8.1. Second, it affects the stability contribution shown in the last line of Table 8.1. If the banks are sold at a 10% discount from book value this results in an increase in fiscal cost amounting to over 2% of GDP. Figure 8.3 and Table 8.2 show the sensitivity of our estimate to different values of price-to-book as of the end of 2016. The range from p/b=1.25 to p/b= 0.25 gives fiscal gain/loss from 7.2% to -14.8% of GDP.[86]

Our conservative baseline scenario is price to book 75 percent, resulting in accumulated fiscal loss 4.9% of GDP. There are a number of reasons we choose this relatively conservative baseline. First, in February a 30% stake in Arion banki was sold in a private placement at price close to p/b=0.8.[87] Other things could also affect the price of the banks including relatively high capital requirements and heavy tax burden compared to banks in other countries. The banks also operate in one of the smallest currency area in the world, hence with limited domestic growth opportunities. Rules and regulation put in place following the crises based on the understanding that there is no lender of last resort in foreign currency, further limit international growth. We therefore assume that a conservative price of the Icelandic banks is more likely.

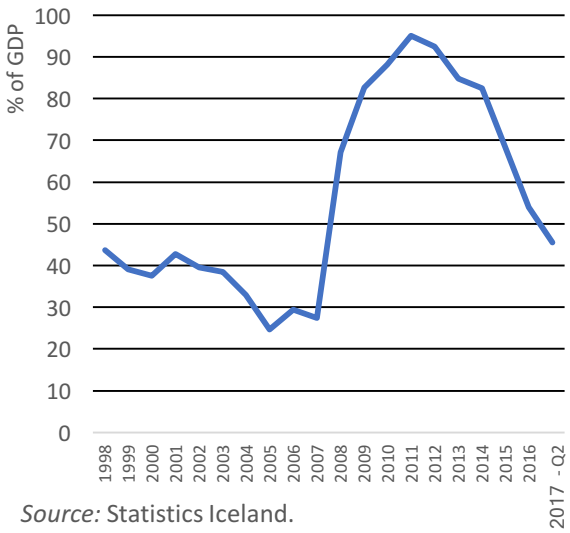
[85] The government injected about 12% of GDP into the banks, it has recuperated about 6.8% of GDP in repayments of subordinated debt and dividend payments, leaving 5.2% of GDP. The current book value of the government's stake in the banks is 11.8%.
[86] The Central Bank of Iceland, FSR 2015/1 used a little more conservative range for price to book or 0.5 to 1.
[87] Announcement from Arion banki, 19.03.2017.

Figure 8.3. Net fiscal cost of the crisis, end of 2016.



Source: Authors calculations.

Figure 8.4. Government debt.



Source: Statistics Iceland.

The fiscal costs amassed in the aftermath of the crisis are limited to the debt relief program for households. This program involved direct write downs of inflation-indexed household mortgage loans and tax relief on private pension fund withdrawals used to pay down mortgage loans. The direct government expenses to compensate financial institutions for loan write downs was 3.7% of GDP and income tax losses from 2014 to 2019 are estimated at 0.7% of GDP.[88]

In the last line in Table 8.1 we report accumulated net loss, evaluating at book value both the equity in the new banks and the assets in the CBI Holding Company. In 2010 the accumulated net loss of the banking crisis peaked at 21.0% of GDP and it was 19.7% at the end of 2011, according to our estimate. This is slightly higher than the estimated fiscal cost reported by the IMF in April 2012, which was 19.2%, and slightly lower than the 23.7% cost estimated by Leaven and Valencia (2012).[89]

In 2012 Leaven and Valencia estimated gross fiscal outlays of 44% of GDP and net increase in public debt of 72% of GDP. Our estimate in Table 8.1 is that gross fiscal outlay amounted to 65.5% of GDP, which puts the Icelandic crisis as the most expensive crisis in gross terms in the Leaven and Valencia dataset, see red column in Figure 8.1. Net increase in public debt is 67.7% of GDP from 2007 to the peak in 2011. This moves Iceland's ranking one place back in the comparison of net increase in public debt, from the seventh to eighth place (see red column Figure 8.2). Importantly, this measure of fiscal cost only looks at the increase in debt four years after the crisis. Significant costs have been recouped since then which, coupled with robust

[88] Assuming 30% income tax on average on pension.
[89] It is worth noting that at the start of the crisis, when Iceland entered a standby agreement with the IMF, the cost was estimated at -40 percent of GDP, see IMF (2012).

recovery in GDP, puts government debt as a fraction of GDP at 45.5%, down 50 percentage points from its peak and only 18.1 percentage points above the pre-crisis level.[90]

For robustness, we also use a method suggested by the Congressional Budget Office (CBO (2016)) for the estimation of the cost of the U.S. Treasury's Troubled Asset Relief Fund. It involves computing the payment and income stream connected to the crisis with appropriate discount rates. Using this method and the five-year government bond rate in Iceland as the discount rate, our estimated fiscal cost of the crisis is 0.8% of 2016 GDP, when we use the book value of the equity in the new banks (see Table 8.2). With our baseline of price 75 percent of book value, the fiscal cost of the crisis is 6.8% of 2016 GDP. Table 8.3 shows the sensitivity in these calculation with respect to p/b, and the range p/b=1.25 to p/b=0.25 gives fiscal gain/loss from 5.3 to -16.7 percent of 2016 GDP. This is almost identical to the result using the IMF methodology.

Table 8.2. Net position of fiscal cost based on price to book 1.25-0.25 on the government share in the new banks.

	p/b = 1.25	p/b = 1	p/b = 0.75	p/b = 0.5	p/b = 0.25
Net position (b. ISK)	127	-20	-165	-291	-405
Net position (% of 2016 GDP)	5,3	-0,8	-6,8	-12,0	-16,7

Sources: Islandsbanki, Arion banki and Landsbankinn annual reports, Financial Stability Report 2016/1 and authors calculations.

These estimates of the fiscal cost do not take into account a few items. One is possible gains or losses from the settlement of the stock of offshore krona. This settlement was closely linked to the build-up of foreign currency reserves at the Central Bank following the crisis, which was also costly. This estimation also does not account for potential output losses and the degree to which that affected the government's budget. There was a substantial loss in tax revenues and also increases in crisis related costs, such as unemployment benefits. As we can see in Figure 8.4, public debt is currently about 18% of GDP higher than it was prior to the crisis in 2008, and much of this can be accounted for by the drop-in government revenues in the aftermath of the crisis.

9. The role of capital controls and balance of payments

As explained in Section 5, capital controls were adopted in Iceland on November 28, 2008 and they remained in place until the winter of 2016-2017, when they were gradually lifted. The loosening of the controls followed the fulfillment of stability conditions by foreign creditors of the old bank estates. In 2008 the capital controls in conjunction with an IMF program stabilized the currency within a few months, fulfilling its main objectives. Still the krona was trading on the offshore market with at least a 20% discount, suggesting outflow pressures the controls were aimed at containing.[91]

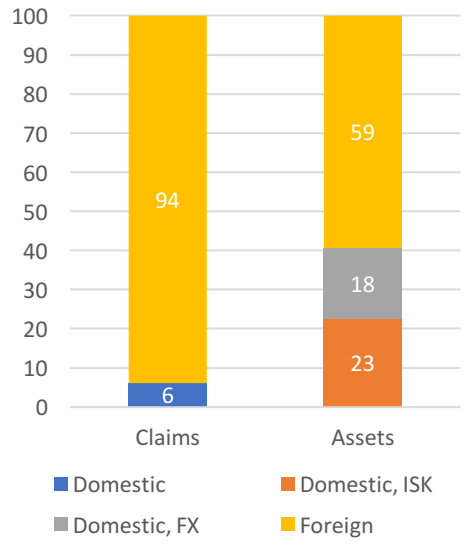
[90] An example of a large difference between gross and net fiscal costs is also the Swedish banking crises, where the gross fiscal outlay was 3.6% of GDP (Laeven and Valencia 2012) while the net fiscal loss was 2% or less (Englund 1999 and Ingves and Lind 1997)

[91] Offshore market means trade between non-residents abroad.

Why were capital controls held for so long? A key reason was that lifting them risked a capital flight, leading to balance of payment crisis, currency depreciation and potential risk to financial stability. The main source for these concerns were the old banks in liquidation. It may seem surprising that private banks that failed posed a significant risk to financial stability years after their failure. Going through the details of *why* this assessment was made gives an interesting case study of possible balance of payment crisis and the application of capital controls.

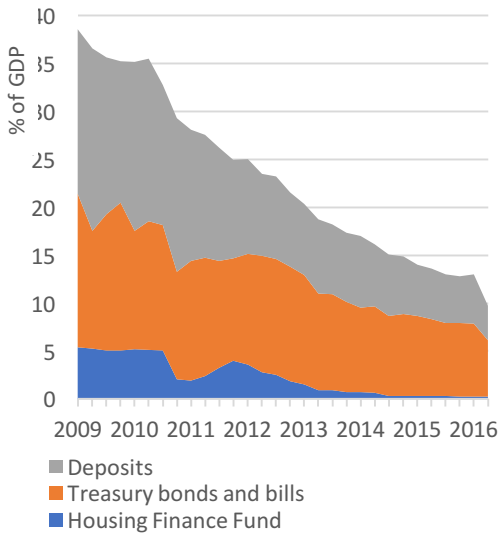
To understand the problem better, it is useful to look at the source of possible capital flight. It mainly came from three sources. First, at the end of 2015 the total remaining assets of the estates of the three large banks amounted to well over Icelandic GDP. The problem is that only 6 percent of the claims into the estate were from domestic creditors, while 41% of the assets of the estates were domestic (see Figure 9.1). This meant that a lot of domestic assets, mostly denominated in krona, would be liquidated, converted into foreign currency and distributed to foreign creditors. It was estimated in 2015 that this settlement of the failed banks' estates would have a negative impact on Iceland's strained international investment position (IIP) amounting to nearly 18% of GDP.[92] Additionally there were deep concerns about the effect on the already fragile domestic currency.

Figure 9.1. Estimated domestic/foreign breakdown of assets and claims of the old banks



Source: Central Bank of Iceland FS 2015/1.

Figure 9.2. Offshore krona assets



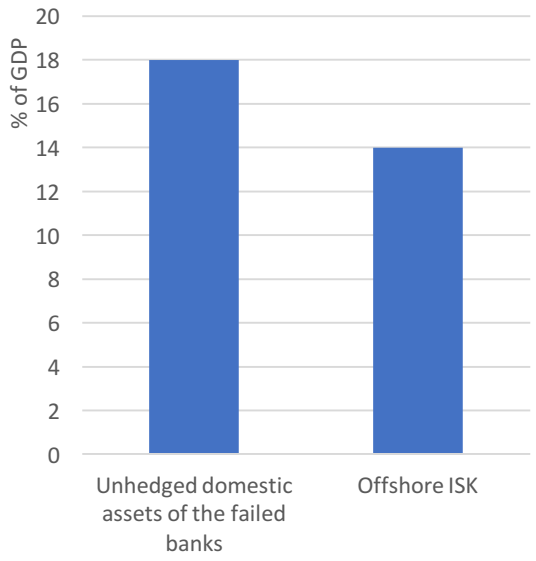
Source: Central Bank of Iceland EOI 2016.

[92] This estimate was based on the position in Q3 2015. The difference between the value of domestic assets that would have reverted to foreign creditors and foreign assets that would have reverted to domestic creditors. Central Bank of Iceland, Financial Stability report 2016/1. It is taken into account that some of the domestic assets were already collateralized or pre-funded with underlying foreign assets

The second source of outflow pressure was liquid krona assets in the hands of non-residents (see Figure 9.2). This was largely the remnant of the pre-crisis carry trades. It was in the form of krona deposits and government bonds amounting to about 35% of GDP at the beginning of 2009. The stock of liquid krona assets held by non-residents declined to about 14% of GDP between 2009 and 2015 as a result of the Central Bank's foreign currency auctions and other direct transactions. This still implied a threat to the balance of payments at the end of 2015, amounting to 14% of GDP, or double the current account surplus at the time.

The third source of capital outflow concern was domestic firms, individuals and in particular pension funds that in 2009 sought to maintain their assets in foreign currency due to lack of confidence in the domestic currency.

Figure 9.3. The balance of payments problem



Source: Central Bank of Iceland FS 2016/1.

The combined amount of potential negative balance of payment effect from the first two sources was estimated to be about 32% of GDP at the end of 2015 (see Figure 9.3). The risk of domestic investment flight from Iceland was, however, always heavily reliant on whether the solutions to the former two problems instilled confidence in the currency and on general economic conditions. Concurrently to these outflow pressures, ongoing external debt deleveraging, continued to be a strain on the economy. A key concern was that there was too little latitude for these additional capital outflows, since terms on international financial markets remained very tight after the crisis, forcing domestic firms to aggressively pay down their external debt. Policymakers also judged that the terms in international financial markets would continue to be tight as long as this balance of payment problem was looming.

In 2014 the repayment schedule of the economy was extended with an agreement between one of the new banks and the estate of the old banks. This provided latitude in the near-term external refinancing needed to lower the probability of a default, allowing improved terms on international financial markets for the government and the new banks. Now the most pressing

problem was the potential risk from unwinding the old banks' estates.[93] As the economy continued to recover, the constraints posed by the capital controls became costlier for firms and individuals, and the government was paying high interest rates on high fiscal debt.

The capital controls prevented any reimbursements from the estates of the old banks and liquid funds were piling up within the estates in both foreign currency and ISK as the unwinding proceeded. The winding-up boards continued to request exemptions from the capital controls while the Icelandic government continued to decline the requests on the grounds of risks to exchange rate and financial stability.[94]

The banks' excessive borrowing in foreign markets during the run up to the crisis had created a systemic risk externality that remained in place years after the borrowing took place and threatened to materialize. This kind of externality is for example modeled in Korinek (2013). The question now was, who should bear the cost of this externality? The Icelandic government pointed the finger at the claim holders.

In June 2015, the government presented stability conditions which would have to be fulfilled prior to any payout from the estates of the old banks. The stability conditions were presented as ensuring macroeconomic and balance of payments equilibrium in the domestic economy.[95] The claim holders had a great incentive to fulfill the stability conditions as a large portion of their foreign assets were already liquid meaning that the capital controls were the only thing standing between them and the money. An added incentive came from the government's threat that, in absence of a settlement via the stability contribution, it would impose a 31% tax on the estates to "deal with the externality" (Guðmundsson 2016).
The old bank estates fulfilled the stability conditions through composition agreements in 2015. The estates agreed to transfer assets, amounting to 18% of GDP at the time (according to our estimates) to the Icelandic government. The stability contribution was payable in the domestic assets, including a large domestic commercial bank.[96] This, as the government said, removed a major obstacle to lifting capital controls.

In the next months, the government preceded to minimize the potential risk of the liquid krona assets in the hands of non-residents we showed in Figure 9.2. In May 2016, these investors were invited to participate in a single auction or be ring fenced in deposit accounts with close to zero interest rate. Around 1/3 of the total amount was tapped off in the auction and direct transactions after the auction at 37% discount from the official exchange rate.[97] The CBI purchased another

---

[93] The CBI stated that "before the relaxation of capital controls can even be considered, the settlement of DMBs [old banks] in winding-up proceedings must be placed in a firm framework" Central Bank of Iceland Financial Stability 2013/1.
[94] Central Bank of Iceland Financial Stability 2016/1.
[95] Ministry of Finance https://eng.fjarmalaraduneyti.is/capital-controls/q-and-a/ Further it says that the "repercussions of unprepared liberalisation would be the collapse of the Icelandic króna, an almost unprecedented surge in inflation, a wave of bankruptcies, and economic instability."
[96] Central Bank of Iceland FS 2016/1.
[97] Central Bank of Iceland FS 2016/2.

third of the krona in 2017 at a 16% discount. Currently the outstanding amount of ring-fenced liquid krona assets is 3.5% of GDP.[98]

The capital controls were lifted for Icelandic firms and the public in the winter of 2016-2017.

10. Lessons

Iceland is a tiny economy with many unusual features. It is tempting to write off its banking crisis as one-off saga, a frenzy, unlikely to be repeated anytime soon anywhere else. A frenzy it was, but we think there may be some important lessons to be learned.

Following the East-Asian crisis of the 1990s, where excessive capital flows and increasing leverage also culminating in a banking crisis, there was a tendency for economists to treat it as a special case, unlikely to be borne out in more developed economies. There was even a special word used to describe those economies: "crony capitalism" (see e.g. Kang (2002)) Presumably this was meant to separate these economies from "regular" advanced capitalistic societies.[99]

As early as 2006, when faced with a mini-crisis, Icelandic banks, domestic and foreign commentators and the government, heavily publicized that Iceland was an advanced economy (fifth highest GDP per capita in the world in 2006), with among the highest life expectancy in the world, literacy rate, non-existent unemployment and very low government debt. Furthermore, international indexes were touted which showed that Iceland ranked among the first in terms of low corruption, fifth in terms of economic freedom, first in terms of freedom of the press, and so on and on. The overall perception meant to convey was that Iceland was an advanced Nordic country with strong institution and well-functioning democracy that had little in common with emerging market countries. This, presumably, was meant to draw a clear distinction to "crony capitalists." What could possibly go wrong?

The rise of the Icelandic banks into international franchises that we have documented occurred within a particular set of political ideas that became dominant in western democracies towards the end of the last century.[100] The overall attitude appeared to be that the best people to regulate bank lending were the bankers themselves. At a broad level, the Icelandic experience brings back an old hard lesson: Banks are special. If left unsupervised or under-supervised there are strong incentives for bank managers and owners to take excessive risks with other people's money. There is a rich literature in economics that attributes this to various forces, which we have cited

---

[98] Central Bank of Iceland announcement from January 13, 2017, Central Bank of Iceland announcement from June 23, 2017.

[99] Icelanders were particularly fast to reject any likeness and the OECD and other international institutions did not draw a line between Iceland and the Asian crises until after the fact, despite all the same warning signs (OECD 2007 and NY times (April 2008) „Iceland, a Tiny Dynamo, Loses Steam'. Gylfason (2008) does however compare the external liabilities in Iceland to those in Asia prior to the crisis.

[100] For example Bernanke (2015) says when outlining where his views differed relative to those of Alan Greenspan, Chairman of he Federal Reserve from 1987 – 2006 and arguably the most powerful policymaker towards at end and at the turn of the last century: "Also, he did not put much stock in the ability of bank regulation and supervision to keep banks out of trouble. He believed that, so long as the banks had enough of their own money at state, in the form of capital, market forces would deter them from unnecessarily risky lending." After the crash in a Congressional hearing, Greenspan stated: "Those of us who have looked to the self-interest of lending institutions to protect shareholders' equity, myself included, are in a state of shocked disbelief."

on various occasion. Iceland is a textbook example for many of the problems and highlights numerous policy failures.

The banks grew too fast and became too large on the back of implicit and explicit guarantees. Their funding was funneled into loans to a large extent to the same groups of related parties and to insiders, i.e. the owners of the banks. In hindsight, the evidence we presented here suggest that universal large exposure rules, that are meant to limit concentration risk and are crucial to banks viability, were broken for years before the failure of the banks. Owners of the banks had disproportionate access to the banks funds, despite rules on insider borrowing. How could this happen? While we have already pointed to one cause, namely complacency by supervisors and a general view that "the banks are in the best position to regulate themselves", it is worth highlighting another potential reason. Nobody in position of power *knew,* or in any event had the *full* picture what the banks were doing. Firm ownership in most western democracies is opaque. The only reason we know how much lending was channeled to groups of related parties and to insiders in Iceland is *because* of the crash, *because* Althingi appointed investigation commission staffed with among others economist, lawyers and accountants who over a period of almost two years tracked down who received the money, and due to the establishment of a special prosecutor of the failed banks that prosecuted the bankers.[101] This work involved untangling a complex web of holding companies, with several interlocking cross ownerships as we have documented.

We have already noted that the pattern of insider lending we document in Iceland is not unique, pointing out examples such as Ireland and Mexico, even if a detailed cross-country comparison is beyond this paper. But it is worth noting, however, that these patterns are typically discovered only *after* bank failures.

Monitoring lending to insiders, and coming up with workable definitions of them, remains a major challenge from the perspective of bank supervision, which often have to rely on the banks themselves to report these exposures. Lack of firm ownership transparency is one of the principal underlying problem.

The lack of transparency of ownership of companies is not only problematic from the perspective of insider lending but also for large exposures. In 2006 and 2007 it became clear that several of the Icelandic banks customers had become "too big to fail" for the banks. The banks had an incentive to keep their borrowers "alive", in hope of resurrection, as failure of the borrower could have dragged down the bank itself. This is a bit reminiscent of the "zombie firm" theory of Caballero et al (2008) that we discussed in section 7. The narrative, in section 3, of the repatriation of many foreign loans of the bank's main customers, as foreign banks stepped away, seems like a clear example of the importance of strongly regulating large exposures. To do that we need some clear and workable rules on large exposures, including how to define groups of firms, along with regulatory powers to enforce the rules.

[101] The special prosecutor investigated 208 cases. Of these 173 have been processed but 27 are still outstanding. Of these 173 processes 46 moved into a prosecution process. As of writing, 9 have been settled in courts, all but two in favor of the government, and all but one going through all stages of the court system, i.e. with the supreme court issuing a final judgement. Included in the cases that have been settled, where charges against the CEO's of the main three banks, who were all sentenced to serve prison time.

The heavy practice of funding own shares and each other's shares gives another important lesson. Issuing loans to buy bank shares, in particular if banks have correlated risks, will leave the banking system as a whole with less equity to absorb losses, a problem that we have noted is not isolated to the Icelandic saga. A key lesson is the need for strong enforcement of rules against banks purchasing their own shares, as well as rules against cross funding of financial institutions. Again, opaqueness in firm ownership and holding companies greatly complicates supervision of rules of this kind.

The Icelandic saga is also a good illustration of "gamble for resurrection" or "bet on life". Much of the most reckless behavior of the banks was happening at the bitter end which greatly increased the cost to their creditors and the economy as a whole. The lessons for regulators seems to be to try to develop indicators of bank stress early on so that interventions can be done earlier rather than later.

The banking crisis in Iceland highlights the difference between implicit guarantees in international banking The Icelandic government had a strong ex post incentive to bail out deposits in the *domestic* portion of the banks while it had little incentive to risk tax payers' money to bail out depositors in *foreign* branches. One should put a large discount on any assumed implicit guarantee of nation states on their own banks liabilities once those liabilities cross the border.

A second lesson concerning implicit guarantees on short term liabilities, usually deposits, is that irrespectively of the governments incentive to bail out deposits in foreign currency it may not be credible. The deposits in the Icelandic banks foreign branches were in foreign currency and stopping a run on those deposits was way beyond the capacity of the CBIs reserves. This leads us to another potential lesson.

The Icelandic crisis highlights the problem of cross currency banking. The banks operations were increasingly in foreign currency, both borrowing and lending, while the lender of last resort was the Central Bank of Iceland.[102] Once the crises hit the banks became illiquid in foreign currency fast, and with no lender of last resort in foreign currency, they were bound to fail, irrespectively if they were solvent or not. In fact, the Icelandic banks never ran out of Icelandic krona's – as we have documented. What they lacked was a lender of last resort in euros, sterling and so on. We documented that the banks did have some access to ECB via their subsidiaries in Luxembourg. However, as those borrowing increased the ECB made it clear that that it was already beyond what it considered acceptable amount for even a loan of last resort.[103] Meanwhile, many other countries solved issues of this kind by entering swap line arrangements between different central banks. Despite desperately trying to do so, the Central Bank of Iceland was unable to enter such agreements with any foreign central banks. In theory, thus, once banks are allowed to operate in

[102] The lender of last resort of subsideries is the hosting Central Bank. The subsideries of the Icelandic banks did however not recieve loan of last resort funding for their subsidieres, requestes for such loans were declined. As one bank managers says „bank of England refused to see us [Kaupthing Singer and Friedlander] as a British bank". SIC chapter 20, pg. 170.

[104] Iceland has implemented strict rules on term conversion in foreign currency, within the framework of liquidity rules. It requires a liquidity coverage ratio in foreign currency and net stable funding ratio in foreign currency as well. This is also used as means to prevent foreign deposit collecting, by requiring banks to hold fully liquid assets against foreign deposit liabilities, making such deposit collecting unsustainable.

different currencies or across borders they can become victims of self-fulfilling runs simply because they do not have access to a lender of last resort in some of the currency they operate in.[104]

The economic literature on capital flows is also very relevant to the Icelandic story. Capital inflow rose fast in the years before the crisis. Borrowing from abroad increased exponentially, led by the Icelandic banks, who funneled the funds to firms and households. The capital inflow bonanza increased the likelihood of a full blown financial crises. As the crises hit the sudden stop threatened the solvency of local governments, firms and households. The Icelandic case is a vivid example of how capital inflows can amplify economic fluctuations and it also illustrates that looming capital flight also greatly complicates policy. A key lesson is that more attention needs to be paid to capital flows, and policy tools developed to react to them.

We are not in a position to judge the extent to which any legal lessons can be drawn from the crisis. Let us just note, however, that both Icelandic courts and the EFTA courts have written judgement which gave the governments extraordinary latitude to take actions to maintain financial stability during systemic crises of these proportions.

In the eye of the storm lessons are also important. One relates to how the bank assets and liabilities were split up, but in retrospect the decision to split the bank into foreign and domestic appears to have worked well. It kept domestic banking services throughout the crisis without overextending government finances. Despite being one of the most fiscally expensive crisis historically in gross terms, the net fiscal cost will likely end up being somewhere between zero and five percent of GDP. Still there are some lessons to be learned from the split up of the banks. First of all, it was well known in 2008 that the banks were struggling. It would have been prudent to have a resolution plan in place.[105] Second it is important to consider other things besides capital when you are laying the foundation for a new bank. More consideration should have been paid to some important features of the new banks such as their term mismatch and liquidity, their asset encumbrance and their currency mismatch.[106]
The write downs that were done as the new domestic banks were formed were undoubtedly important, providing scope to clean up firms' balance sheets without affecting the new banks' capital and prevent in some instances the costly process of bankruptcies. It is worth noting that a

[104] Iceland has implemented strict rules on term conversion in foreign currency, within the framework of liquidity rules. It requires a liquidity coverage ratio in foreign currency and net stable funding ratio in foreign currency as well. This is also used as means to prevent foreign deposit collecting, by requiring banks to hold fully liquid assets against foreign deposit liabilities, making such deposit collecting unsustainable.

[105] SIC chapter 20 pg. 141.

[106] Due to term mismatch the new banks needed liquidity support for some time following their establishment. The encumbrance of two of the three new banks was so high it could have caused problems if a second wave of crisis would have hit, lowering the amount of assets available for the government to minimize depositor's loss. This increased the fiscal risk associated with the government blanked guarantee on domestic deposits. All of the liabilities in foreign currency, excluding deposits in foreign currency in branches in Iceland, were left in the old banks, while some of the domestic asset that were transferred to the new banks were in foreign currency. This meant that the old banks were short in foreign currency, an issue that was resolved with a stability contribution, while the new banks were long in foreign currency. That was partially solved by the government injecting a portion of their equity in the form of subordinated debt in foreign currency.

big portion of the write down to individuals occurred due to a court decision on illegality of currency indexed loans.

While the capital controls appear to have stabilized the currency, they did remain in place long with associated distortions. We discussed in section 9 the main reason for this were concerns of capital flight, associated collapse in the currency and possible risks to financial stability. The necessary steps to resolve those risks were understood as early as 2013.[107] The government issued the stability conditions in the middle of 2015 and the old banks estates fulfilled them a few months later. The capital controls were almost fully lifted, without any noticeable risk materializing, about a year later. Since the main ingredient for the so-called stability conditions were already understood as early as 2013, it seems quite possible that the controls could have been lifted more rapidly and thus possibly speeding up the economic recovery further.

The recovery in Iceland from the crisis also hints towards several broad lessons. Iceland suffered the largest banking crisis on record, in terms of the size of failed bank balance sheet vs GDP. The output cost of the banking crisis appears however close to average according to various measures we document in chapter 7. We think that three things may be important to explain this. First, there is a long tradition in economic thought that highlights that in case of banking crisis it is of vital importance to clean up overleveraged balance sheet of firms. As we have documented, this was done relatively aggressively in Iceland, which may account for some of the recovery. Second household debt deleveraging has been emphasized in the literature as important to speed up recovery. Here too, the Icelandic saga provides and interesting example of this. Third, the theory on optimal currency areas emphasizes the benefit of having own currency when shocks hit. It seems quite plausible that this played a constructive role in the recovery.

11. Conclusion

In this paper, we documented the rise and fall, and then the resurrection of Iceland, which was sort of a ground zero in the financial crisis, when its entire banking system failed. We have not attempted to present quantitative or formal model to estimate the importance of various forces at play during the Icelandic crisis. This is by design. Instead, we percent the Icelandic crisis as a fascinating case study that serves to highlight several models in macroeconomic, finance and banking, speaking to a rich literature developed before and after the crisis.

It is sometimes said that the crisis caught the economic profession by total surprise. It is true that most economist where caught by surprise. But as we have seen, several of the features of this particular case study, Iceland, does in fact correspond quite closely with several of the theories that can be found in the economic literature. Perhaps what was missing was not so much lack of theories about banking, finance and macroeconomics, that explain the potential risks and possibility of a crisis. Missing was that economist and others were giving the relevant theories enough thought.

[107] Central Bank of Iceland, Financial Stability 2013/1

References

Akerlof, George A and Paul Romer (1993). "Looting: The economic underworld of bankruptcy for profit." *Brookings papers on economic activity* 1993.2: 1-73.

Acharya, Viral V., Sreedhar T. Bharath, and Anand Srinivasan. "Does industry-wide distress affect defaulted firms? Evidence from creditor recoveries." *Journal of Financial Economics* 85.3 (2007): 787-821.

Arena, Bhattachaya, and Bower (2017), "Iceland's Trourist Eruption," IMF Country Report No. 17/164

Basel committee on Banking Supervision. (1991). Measuring and Controlling Large Credit Exposures.

Benediktsdóttir, Sigríður, Margrét V. Bjarnadóttir, and Guðmundur A. Hansen. "Large exposure estimation through automatic business group identification." *Annals of Operations Research* 247.2 (2016): 503-521.

Benigno, Pierpaolo, Gauti B. Eggertsson, and Federica Romei. *Dynamic debt deleveraging and optimal monetary policy*. No. w20556. National Bureau of Economic Research, 2014.

Bernanke, Ben S. *The global saving glut and the US current account deficit*. No. 77. 2005.

Bernanke, Ben S. *The courage to act: A memoir of a crisis and its aftermath*. WW Norton & Company, 2015.

Boyd, John H., and Hendrik Hakenes. "Looting and risk shifting in banking crises." *Journal of Economic Theory* 149 (2014): 43-64.

Bracke, Thierry, and Michael Fidora. "Global liquidity glut or global savings glut? A structural VAR approach." (2008).

Brunnermeier, Markus K. "Deciphering the liquidity and credit crunch 2007–2008." *The Journal of economic perspectives* 23.1 (2009): 77-100.

Buiter, Willem H.: "Central banks and financial crises." *Discussion paper no 619.* Financial Markets Group, London School of Economics and Political Science (2008)

Caballero, Julián A. "Do surges in international capital inflows influence the likelihood of banking crises?." *The Economic Journal* 126.591 (2016): 281-316.

Caballero, Ricardo J., and Arvind Krishnamurthy. "International and Domestic Collateral Constraints in a Model of Emerging Market Crises" Journal of Monetary Economics, December 2001 48(3), pp 513-548.

Caballero, Ricardo J., Takeo Hoshi, and Anil K. Kashyap. "Zombie lending and depressed restructuring in Japan." *The American Economic Review* 98.5 (2008): 1943-1977.

Calavita, Kitty, Robert Tillman, and Henry N. Pontell. "The savings and loan debacle, financial crime, and the state." *Annual review of sociology* 23.1 (1997): 19-38.

Calvo, Guillermo A. *"Capital flows and capital-market crises: the simple economics of sudden stops."* (1998).

Chari, V. V., and Patrick J. Kehoe. 2016. "Bailouts, Time Inconsistency, and Optimal Regulation: A Macroeconomic View." *American Economic Review*, 106(9): 2458-93.

Danske Bank (2006), "Iceland: Geyser Crisis", *Research,* March 21

Diamond, Douglas W., and Philip H. Dybvig. "Bank runs, deposit insurance, and liquidity." *Journal of political economy* 91.3 (1983): 401-419.

Dornbusch, Rudi. *A primer on emerging market crises*. No. w8326. National Bureau of Economic Research, 2001.

Eggertsson, Gauti B., and Paul Krugman. "Debt, deleveraging, and the liquidity trap: A Fisher-Minsky-Koo approach." *The Quarterly Journal of Economics* 127.3 (2012): 1469-1513.

Englund, Peter. "The Swedish banking crisis: roots and consequences." Oxford review of economic policy 15.3 (1999): 80-97.

Financial Supervisory Authority Annual Report 2009

Financial Times (2017), "Irelands de-globalized' data calculate a smaller economy," July 18.

Fitch Ratings (2006), "Iceland: Macro Imbalances Trigger Negative Outlook" *Special Report*, 21 February.

Guerrieri, Veronica, and Guido Lorenzoni. "Credit crises, precautionary savings, and the liquidity trap." *The Quarterly Journal of Economics* 132.3 (2017): 1427-1467.

Gylfason, Thorvaldur „Events in Iceland: Skating on thin ice?" Vox 2008

IMF (2017) "Iceland's Tourism Eruption" Selected Issues, IMF Countries Report No. 17/164

Ingves, Stefan, and Goran Lind. "Loan loss recoveries and debt resolution agencies: The Swedish experience." Banking soundness and monetary policy (1997).

Jiménez, G. og J. Saurina; „Credit Cycles, Credit Risk, and Prudential Regulation. " International Journal of Central Banking, 2:2, 2006, bls. 65–98.

Johnson, Simon, Rafael LaPorta, Florencio Lopez-de-Silanes, and Andrei Shleifer. 2000. "Tunneling." *American Economic Review Papers and Proceedings* 90 (2): 22-27.

Kareken, John H., and Neil Wallace. "Deposit insurance and bank regulation: A partial-equilibrium exposition." *Journal of Business* (1978): 413-438.

Korinek , Anton. "Regulating capital flows to emerging markets: An externality view." (2010).

Krugman, Paul (1991), "Iceland's Exchange Rate Regime: Policy Options," mimeo, can be found at https://www.gc.cuny.edu/CUNY_GC/media/LISCenter/pkrugman/krugman-iceland-1991.pdf

La Porta, Rafael, Florencio Lopez-de-Silanes, and Guillermo Zamarripa. "Related lending." *The Quarterly Journal of Economics* 118.1 (2003): 231-268.

Laeven, Luc, and Fabian Valencia. "Systemic banking crises database: An update." (2012).

Merrill Lynch (2006), "Icelandic Banks: Not What You Are Thinking" Global Securities Research and Economics Group, European Credit Research, 7 March.

Mian, Atif, Kamalesh Rao, and Amir Sufi. "Household balance sheets, consumption, and the economic slump." *The Quarterly Journal of Economics*128.4 (2013): 1687-1726.

OECD (2007) “Financial Markets in Iceland” ECO/WKP(2007)9

Rajan, Raghuram G. "Why bank credit policies fluctuate: A theory and some evidence." *The Quarterly Journal of Economics* 109.2 (1994): 399-441.

Reinhart, Carmen M., and Kenneth S. Rogoff. "Recovery from financial crises: Evidence from 100 episodes." *The American Economic Review* 104.5 (2014): 50-55.

Reinhart, Carmen M., and Vincent R. Reinhart. *Capital flow bonanzas: an encompassing view of the past and present*. No. w14321. National Bureau of Economic Research, 2008.

Sharpe, Steven A. "Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationships." The journal of finance 45.4 (1990): 1069-1087