BA Thesis

in Economics

The Too-Big-To-Fail Problem

The Case of the Post-Crisis Banking System in Iceland

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Instructor: Dr. Ásgeir Jónsson

Faculty of Economics

June 2016

HÁSKÓLI ÍSLANDS

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Final project towards a BA degree in Economics

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Printed by: Háskólaprent

Reykjavík, 2016

Preface

This thesis is a 12 ECTS-credit final project submitted in partial fulfillment for the degree of Bachelor of Arts in the Faculty of Economics at the University of Iceland, written under the instruction of associate professor Dr. Ásgeir Jónsson. I thank him for his insightful comments and feedback during the writing process. Finally, I would like to thank my family for their love and support throughout my studies.

Abstract

This thesis aims to assess the issue of too-big-to-fail (TBTF) banks in the Icelandic banking system from 2008 and to the present. It attempts to gauge the extent to which the issue is relevant to the current banking system. TBTF has become a shorthand for, among other things, banks that uninsured creditors expect the government to protect in the case of failure in light of their systemic importance and interconnectedness, as well as the high cost associated with their exit from the market. Such expectations, as well as alternatively the invalidation or vindication of those expectations, have far-reaching implications for financial stability, the broader economy and societal welfare. The implications constitute the TBTF problem. Following an overview of the theoretical framework surrounding the essential features of the TBTF issue, the TBTF problem in the post-crisis banking system in Iceland is assessed both quantitatively and qualitatively. Several sources of moral hazard are identified, including an unbinding blanket guarantee of domestic deposits still outstanding, the existence of an explicit lender of last resort within capital controls, and pre-crisis plans to nationalize and support a significant part of the banking system. An analysis of the banks' financial statements between 2008 and 2015 reveals several trends that support and contradict the TBTF problem, suggesting that the largest banks are not maximizing the value of their implicit safety net. Trends and approximations consistent with the TBTF hypothesis include increased systemic importance of the three largest banks operating in the banking sector, deposit-funding advantages for the largest banks and greater risk-taking in non-core activities. Contradictory trends include less risk-taking in the banks' loan portfolios as well as less interconnectedness in the interbank market. An attempt will also be made to harmonize the contradictory quantitative trends with exogenous factors that constrain the banks form maximizing the value of their implicit safety net. The overall result is that the TBTF problem has grown in severity in the post-crisis banking system, despite a steady downsizing of the banking system since the bursting of the banking bubble in October 2008.

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1 Introduction

> "Size, we are told, is not a crime. But size may, at least, become noxious by reason of the means through which it was attained or the uses to which it is put."
>
> **Louis D. Brandeis** (1856–1941)

Brandeis' statement, in an article entitled "The Curse of Bigness" just over a century ago, encapsulates one of the most momentous and pressing issues of modern economics and finance: the transatlantic problem of too-big-to-fail (TBTF) financial institutions, particularly banks. The benefits of balance sheet growth and a comprehensive operational scale are widely recognized in the doctrines of mainstream economic theory, such as economies of scale and the theory of the firm. However, it is a separate issue altogether whether such growth is attained through a natural market process in which economic interests are aligned, or by means of a distorted, asymmetric construct of the market. In case of the latter, scaling drives a wedge between private and social interests, conferring benefits on those who least merit the fruits of the market and imposing cost on those who least deserve it.

The ultimate embodiment of noxious magnitude is the TBTF bank. A TBTF bank is by no means a well-defined entity and the TBTF designation is to a great extent a misnomer. As a working definition, a TBTF bank may be described as a bank that uninsured creditors expect to receive (or a bank that *actually* receives) discretionary government support should it go unexpectedly into liquidation in light of the bank's failure posing significant risks to the financial system and possibly to the economic and social order (Stern and Feldman, 2009). Described as "a new kind of bank" in the bailout of Continental Illinois in the United States in 1984, the term emerged in the limelight of public discourse following the global financial crisis in 2007–2008. The crisis validated the expectations of creditors, investors, and, perhaps, bank management as governments and central banks intervened in financial markets on an unprecedented scale with facilitated mergers, capital injections and liquidity support that shielded uninsured bank debtors from losses, kept TBTF banks afloat and contained what would

have otherwise been severe, immediate adverse consequences to the financial system and the real economy. Nearly nine years on, however, these global rescue operations turn out to have been a pyrrhic victory. The fiscal positions of sovereigns are weak and central banks have engaged in money printing on a scale hitherto unknown. What is more, the problems associated with TBTF banks are largely unresolved and have arguably compounded since 2007. It is for this reason that the TBTF issue has become somewhat of a post-crisis obsession for economists and regulators, so much so that former United States Secretary of the Treasury Timothy Geithner has described it as "Moby-Dick for economists or regulators" (Sorkin, 2014).

The unorthodox policy response of Iceland, one of the first and most spectacular casualties of the global financial meltdown in 2007–2008, has been extolled as an attestation of the fallacy of banks being TBTF. In fact, "Going Iceland" has become synonymous with systemic collapse. The Icelandic boom and bust is a tragic tale of an Icarus economy whose *exodus* nonetheless makes it a canary in the coalmine in both life and death (Jónsson, 2009). Instead of nationalizing the financial sector and bailing out a subset of banks with taxpayer funds, Iceland liquidated its financial sector, downsized the banking industry and saved the financial system without saving the largest banks. It absorbed short-term pain for long-term gain. These immediate effects appeared simultaneously with their cause. However, this policy response was not premeditated in the initial stages of the crisis. In fact, the government planned to nationalize Glitnir, one of the three largest banks, and extend an emergency loan to another, Kaupthing, through the Central Bank of Iceland (CBI). Creditors also expected the Icelandic government to bail out the three largest banks, since both the government and the Icelandic banks enjoyed a triple-A, risk-free bond-rating in 2007, according to Moody's Joint Default Analysis, which incorporated external support, such as implicit government support. Three factors inhibited the government's bailout plan. Firstly, the banking system was almost 11 times GDP in 2007, far exceeding the sovereign's fiscal and economic clout, and was therefore too costly to support for the government. Secondly, most of the banking system's assets and liabilities were denominated in foreign currency with a large amount of those liabilities of short maturity, thereby rendering the CBI unable to act as an effective lender of last resort due to insufficient foreign reserves and an illiquid domestic currency (Buiter and Sibert, 2008). Lastly, there was no

outside support and even the Federal Reserve in the United States refused to extend liquidity to the CBI. In other words, the Icelandic banking system was not too-big-to-fail, but too-big-to-save (TBTS) domestically and too small to save internationally.

In spite of the Icelandic response to the banking crisis in 2008, an inevitable question springs to mind: is the TBTF issue no longer relevant to the Icelandic banking industry? The aim of this thesis is to answer that question. What may seem self-contradictory at first turns out to be a legitimate proposition; namely, that although the banking system has in many ways become structurally more robust since 2008, the TBTF problem has grown in severity.

The paper is roughly divided into two parts. The first part is an exposition of the TBTF issue, drawing on both the existing literature and the author's own contributions. It discusses the economics of the issue within a theoretical framework, using insights from macroeconomics, microeconomics, financial economics and their subsets, such as the economics of banking, behavioral economics, public choice theory, welfare economics, and portfolio theory. The first part is organized as follows. Chapter 2 circumscribes the scope of the TBTF issue by defining it and highlighting the determinants of TBTF banks. Chapter 3 lays the groundwork for the paper and discusses the TBTF problem, its features and their equilibrium consequences, namely how economizing market participants, faced with a set of incentives, act in an environment that is artificial and distorted. The TBTF features include reduced market discipline, excessive risk-taking, competition distortion, resource misallocation, and increased systemic risk. Chapter 4 discusses the political economy of the TBTF issue – the roots of the TBTF problem – within a public choice theory framework by calling attention to the time-inconsistent behavior of policymakers. Chapter 5 discusses the costs associated with the TBTF problem, which can be divided into fiscal cost and economic cost. Chapter 6 discusses alternative sources of moral hazard that expand the implicit TBTF safety net. These include a central bank acting as a lender of last resort, as well as the potential for foreign assistance.

The second part of the paper investigates the extent to which theory fits practice in the post-crisis banking system in Iceland. Such an investigation is a venture into a relatively unexplored territory that has hitherto only been named in passing and not

investigated exclusively. Due to the small size of the banking industry in Iceland, statistically significant hypothesis testing is limited. Therefore, the discussion of the TBTF problem will be a combination of quantitative as well as qualitative analysis. Chapter 7 presents an analysis of the TBTF problem in Iceland by identifying potential sources of moral hazard, post-crisis banking system developments, and TBTF effects, mostly grounded on financial statement analysis and a dynamic comparison of several of the banks' financial ratios. Chapter 8 discussed the nature of the TBTF problem in Iceland. The paper is then drawn to a close with concluding remarks in Chapter 9. The findings in the paper shed light on the development of the post-crisis banking system and trends that could indicate where the banking system is headed. To the extent they concern domestic depositors and Iceland's future financial stability, such findings can be regarded as highly topical.

2 The TBTF Doctrine

The TBTF doctrine postulates that a subset of banks are expected to receive public funds at the government's discretion in the future on the basis of their failures representing systemic risk for the financial system and potentially the economy at large (Moosa, 2010). Bank failure is defined as a bank's inability to meet its obligations to its debtors due to illiquidity or insolvency, whereas systemic risk is any risk that may affect the financial system as a whole (Freixas and Rochet, 2008). The recipients of implicit guarantees are bank creditors – uninsured depositors with no explicit entitlement to government support, insured depositors and holders of bank debt.[1] The guarantees are implicit because authorities have no explicit, *ex ante* commitment to intervene. Discretionary government support to banks is thus referred to as a "TBTF policy." Depositors tend to receive the most extensive coverage, whereas holders of other fixed-income securities and money market instruments receive less, and equity holders are rarely protected (Stern and Feldman, 2009).

Since depositors tend to receive full insurance, in excess of explicit compensation under formal deposit insurance, a TBTF policy is often viewed as a form of *de facto* total deposit insurance. However, there is a critical difference between formal and implicit *ad hoc* deposit insurance. On the one hand, government insures deposits according to statute under formal deposit insurance, which pre-determines the operation of the insurance scheme by specifying factors such as maximum compensation, the circumstances of compensation, the types of deposits eligible for compensation, arrangements for funding compensation and the administration of the scheme. Other creditors are not insured under the scheme. Alternatively, deposit insurance could be provided by the private sector where banks are required by law to purchase insurance. Under formal deposit insurance, the insured amount is capped at a minimal amount (MacDonald, 1996). By sufficiently protecting depositors from losses, the incentive to make a run on a bank and withdraw cash from deposit accounts is reduced. In effect, formal deposit insurance is therefore meant to reduce the probability of bank runs by protecting small depositors and ensure stable financial intermediation. As long as bank

[1] This definition of creditors will be used throughout the paper.

runs are prevented, deposit insurance will not even have to be paid out to depositors. As a result, the cost of maintaining deposit insurance is minimal (Diamond and Dybvig, 1983).

On the other hand, a TBTF policy amounts to unlimited, 100% deposit coverage. Whereas government-backed deposit insurance is official, statutory, capped, and relatively inexpensive, informal TBTF deposit protection is unofficial, discretionary, potentially unlimited, and highly costly to the state budget and taxpayers. Implicit government support is therefore informally a part of the financial safety net. The safety net is a state system of protection for bank customers and the banks themselves, and includes explicit guarantees of deposits and private financial fixed-income liabilities, as well as bank access to both the discount window and the interbank market (Walter and Weinberg, 2002). In fact, Moosa (2010, p. 18) refers to a TBTF policy as "the ultimate safety net" in light of its potentially unlimited compensation of depositors and other creditors. A TBTF policy as a *de facto* extension of the safety net is supported by the historical fact that explicit deposit insurance does not always govern the protection that bank creditors receive (Stern and Feldman, 2009).

Despite general agreement on the qualitative TBTF definition above, the determinants of TBTF status and their importance are debated. There is no one-size-fits-all designation of what constitutes a TBTF bank, and there is a vast literature devoted to the subject, with different areas of focus and varying conclusions. The TBTF concept has become synonymous with systemically important financial institutions (SIFIs) (Ennis and Malek, 2005). Genberg (2009) believes that size, measured by the balance sheet, is generally agreed to be the single most important characteristic of a SIFI. He also suggests two other characteristics of SIFIs: the effect of their performance on the confidence in the system as a whole, and the positive correlation between their profitability and financial market leverage (Moosa 2010). Moosa (2010) argues that, in the final analysis, the TBTF issue revolves around size and that all other determinants indeed follow on from size. The primacy of size as a determinant of a TBTF bank is, however, not undisputed. Stern and Feldman (2009), Ennis and Malek (2005), and Thomson (2009), to name a few, take a more balanced approach to the issue, arguing that size is in fact generally viewed as an inadequate and misleading way of classifying a

TBTF bank. That is, size is neither a necessary nor a sufficient condition for an institution to benefit from implicit government support and therefore does not guarantee TBTF status (Kumar and Lester, 2014). Banks with modest balance sheets could, for example, play an important role in the payment system, securities transactions or in the smooth functioning of financial markets in general (Ennis and Malek, 2005).

Thomson (2009) proposes a framework for identifying SIFIs for regulatory purposes using the "four C's criteria," which can be projected onto TBTF banks:

- Contagion ("too interconnected to fail"): contagion refers to how the failure of a bank to meet payment obligations and claims to other banks can accelerate the spread of a systemic shock if a bank or banking system is highly interconnected and interdependent. A suggested measure of contagion is interbank exposure. The interbank lending market is a market where banks extend short-term loans to one another, with terms ranging from one day (overnight loans) to a week. It allows banks to bridge temporary liquidity gaps, reduce liquidity risk and manage liquidity. A high level of transactions between banks increases the probability that the failure of one systemically important bank would impact a large number of banks. Additionally, high interbank exposure and high interbank turnover is indicative of confidence in the financial markets as well as financial stability.

- Correlation ("too many to let fail"): correlation refers to correlated risk exposures. If a number of banks, particularly large banks, hold similar loan portfolios or trading positions, then exogenous shocks could trigger systemic fire sales of assets at substantial discounts from prevailing market quotes in order to raise liquidity, which could lead to widespread balance-sheet insolvencies. This is arguably more serious for large banks, which tend to have larger loan portfolios.

- Concentration ("too dominant to fail"): concentration refers to bank size relative to particular financial markets. A bank is therefore systemically important and likely to be TBTF if new entrants or incumbent entities in a particular market are unable to assume the activities of the bank in distressed circumstances. A bank is then said to have low substitutability. Examples include market share in financial intermediation (deposit-taking and the extension of credit), liquidity insurance, securities transactions and the payment system.

- Conditions/Context ("too much attention to fail"): context relates to how a bank can be systemically important only in certain states of nature or macro-financial conditions, especially distressed conditions.

In what follows, the common TBTF terminology will be adopted in the interest of consistency, since it has acquired sufficiently wide acceptance in the economic literature and public policy debates to be considered a practical shorthand to address the subject matter (Goldstein and Véron, 2011).

3 The TBTF Problem

The "TBTF problem" is a term employed in this paper with respect to the effects that market expectations of future support have on financial markets and the real economy in the present. It is based on the assumption that market prices – namely rates on bank funds – contain information and reflect expectations of market participants. It is also grounded in the structure-conduct-performance model of industrial economics, which describes how changed market structures affect market behaviors as well as performance (Heffernan, 2005). The TBTF problem was succinctly described by former Federal Reserve Chairman Ben Bernanke in 2009:

> [T]he belief of market participants that a particular firm is considered too big to fail has many undesirable effects. For instance, it reduces market discipline and encourages excessive risk-taking by the firm. It also provides an artificial incentive for firms to grow in order to be perceived as too big to fail. And it creates an unlevel playing field with smaller firms, which may not be regarded as having implicit government support (Bernanke, 2009).

The "undesirable effects" are what constitute the TBTF problem; namely, a reduction in market discipline, excessive risk-taking, competition distortion, artificial growth incentives and, although not mentioned in the quotation above, an increase in systemic risk and resource misallocation.

3.1 Moral hazard and excessive risk-taking

> "The Sun will not exceed its limits, because the avenging Furies, ministers of Justice, would find out."
>
> **Heraclitus** (c. 535–c. 475 BCE)

The relationship between a bank and its creditors is a principal–agent relationship. The principal–agent relationship is an arrangement in which a person or an institution, the agent, performs a task on behalf of another person, the principal (Mankiw and Taylor, 2011). In banking, a creditor (the principal) entrusts a bank (the agent) with funds. Before deploying their funds to a bank, creditors perform due diligence and assess the bank's risk. Based on the assessment, the creditor signals a required rate of return to the bank in excess of other, less risky alternatives. Risky banks, such as banks posing a

high chance of failure and a loss to creditors, face higher prices from creditors. In order to attract funds, banks pay the demanded risk premium. This, in turn, influences the decisions of banks, since the required rate of return on borrowing as well as the quantity of funds handed over to a bank limits its operational capacity, since banks seek to maximize the term spread between borrowing rates and lending rates in their loan portfolios. Creditors then prudently monitor the activities of the bank entrusted with their funds with price and quantity signaling in order to ensure access to liquidity or an acceptable return on their investments, and to minimize the problem of asymmetric information, that is, differences in information held by the principal and the agent. This monitoring role constrains banking activities and imposes discipline on a bank's risk-taking (Stern and Feldman, 2009). Even with official deposit insurance, depositors still have an incentive to monitor their bank's risk-taking since their insured losses are capped according to statute.

Should creditors expect or be certain of their funds being fully or significantly insured by the government against losses, they have a reduced incentive to monitor the bank. Implicit support overturns and perverts the incentive structures of creditors and the bank that they expect the government to support in distressed times, thereby undermining market discipline and creating a hidden principal–agent problem characterized by a conflict of interest and moral hazard. If creditors expect to be shielded from losses in the event of their bank's distress or failure, notwithstanding that there is no explicit promise of government support, they undercharge their bank relative to its real credit risk *in tandem* with their expectations of protection by demanding lower yields as compensation for the perceived (lower) risk. They also reduce or terminate altogether their vigilance in monitoring. The more confident creditors are about receiving a certain level of protection, the more muted are their price and quantity signals. In the extreme case, when creditors expect to receive 100% protection, their required rate of return converges towards the risk-free rate on government bonds.

Creditors' signaling of lower risk premiums (or the discontinuation of signaling altogether), in turn, distorts the incentive structure of a bank considered TBTF by creating moral hazard and removing the previous constraints on its activities. Moral

hazard describes the tendency to take on excessive risk due to imperfect monitoring and insurance that induces a change in behavior. Being reasonably certain that its activities are imperfectly monitored and that its liabilities are significantly or fully guaranteed, the bank has an incentive to take excessive risk for higher returns. This is because it paradoxically faces a lower funding cost and can exclusively benefit from the upside (potential higher returns) of a wider range of loans or investments without bearing the downside (potential costs) of those decisions (Stern and Feldman, 2009). A bank's liability management becomes more imprudent since its liabilities are partially or, in the extreme case, fully separated from its assets. Its source of funding will not be found in its vaults, but rather, at the tip of a fountain pen. However, since implicit support is not absolute but rather a contingent public liability that hinges on the discretion of elected officials and other policymakers, it potentially creates a conflict of interest and a principal–agent problem, should the expectations of banks and creditors turn out to have been in vain, because creditors would incur unexpected losses and the bank would most likely liquidate. It should also be noted that expectations are not rigid and could change suddenly, with or without warning, and reverse due to unexpected factors such as political instability or a natural disaster. Expectations of implicit support are therefore arguably procyclical in nature.

3.1.1 Maturity mismatching

One manifestation of a TBTF bank taking on excessive risk is aggressive maturity transformation. Maturity transformation is a type of asset transformation in which short-term deposits and fixed-obligation debt are converted into long-term loans, resulting in a mismatch of maturities between liquid, short-term liabilities and illiquid, long-term assets (Matthews and Thompson, 2008). Maturity mismatching with debts of zero maturity such as demand deposits, used to grant credit to capital-intensive projects, constitutes the most extreme form of maturity transformation. Maturity mismatching is a highly profitable activity, whereby a bank takes advantage of an upward-sloping yield curve, which plots the cost of borrowing for similar debt contracts of different maturities and reflects higher yields for longer maturities, by selling short-term rates on borrowed funds to creditors (mostly depositors) while buying long-term rates on invested capital and profiting from the interest rate spread between short-

term and long-term rates (Bagus and Howden, 2011). It is the cornerstone of the inherently unstable modern banking model, fractional reserve banking[2], in which a bank holds only a fraction of its deposit liabilities on reserve, either according to statute or discretion, as currency or deposits at the central bank to meet redemption demand, while the excess amount is lent out or invested. A fractional reserve bank's cash on hand is therefore short of demand claims to cash outstanding at any given time (Mishkin 2012).

Figure 1 illustrates the effects of maturity mismatching, both before and after the introduction of implicit support. Let us assume that a bank finances its maturity transformation with uninsured demand deposits. The bank pays a term premium of $r_D - r_f$ for its funds, where r_D is interest charged on demand deposits and r_f is the risk-free rate (e.g. government bill rate), whereas the bank charges r_L on loans such that the maturity of a loan (t_L) exceeds that of demand deposits (t_D), $t_L > t_D$. The marginal cost (*MC*) curve is assumed to be constant, whereas the marginal revenue (*MR*) curve slopes downward on the assumption that the bank rations credit to those projects that yield the highest returns. In equilibrium (*MC* = *MR*), the bank's maturity mismatching yields a spread of $r_s = r_L - r_D$ and a surplus of *s*.

Now let us assume that market participants perceive the bank as being TBTF, such that the bank's demand deposits are implicitly insured by the government. The implicit guarantee creates a moral hazard where the bank can decide how much risk to take, without potentially bearing the cost should things go sour. The implicit guarantee provides the bank with a profit opportunity in the form of a wider term spread by extending further out on the yield curve and shifting its loan portfolio towards shorter funds and higher-yielding, illiquid, long assets. Marginal revenue shifts from *MR* to *MR*′, since a reduced incentive to hold cash in reserve against the bank's long-maturity assets frees up more loanable funds to deploy to riskier projects. This entails higher risk and a wider term premium. The effects of higher risk could have two separate effects. Either the marginal cost curve shifts upward from *MC* to *MC*′ (illustrated in Figure 1), since the

[2] The fractional reserve system is perhaps best described by George Bailey (James Stewart), President of Building & Loan, during a run on his bank in the 1946 classic *It's a Wonderful Life*: "You're thinking of this place all wrong, as if I had the money back in the safe."

new high-yield borrowers are more likely to default, resulting in higher deposit rates to attract funds, or it shifts downward towards the risk-free rate, since depositors underprice real credit risk. Assuming the former effect, the interest on loans is now $r_L' > r_L$ and the interest on deposits $r_D' > r_D$, widening the credit spread from r_s to r_s' as well as the expected surplus from s to s', thus creating a wider maturity spread between t_L' and t_D' as opposed to t_L and t_D. (If deposit rates converge towards the risk-free rate, however, the spread becomes even greater.) However, by exerting leverage on society to provide bailouts should the riskier borrowers default would transform the expected surplus into a welfare cost or deadweight loss to society – that is, a reduction in societal well-being.

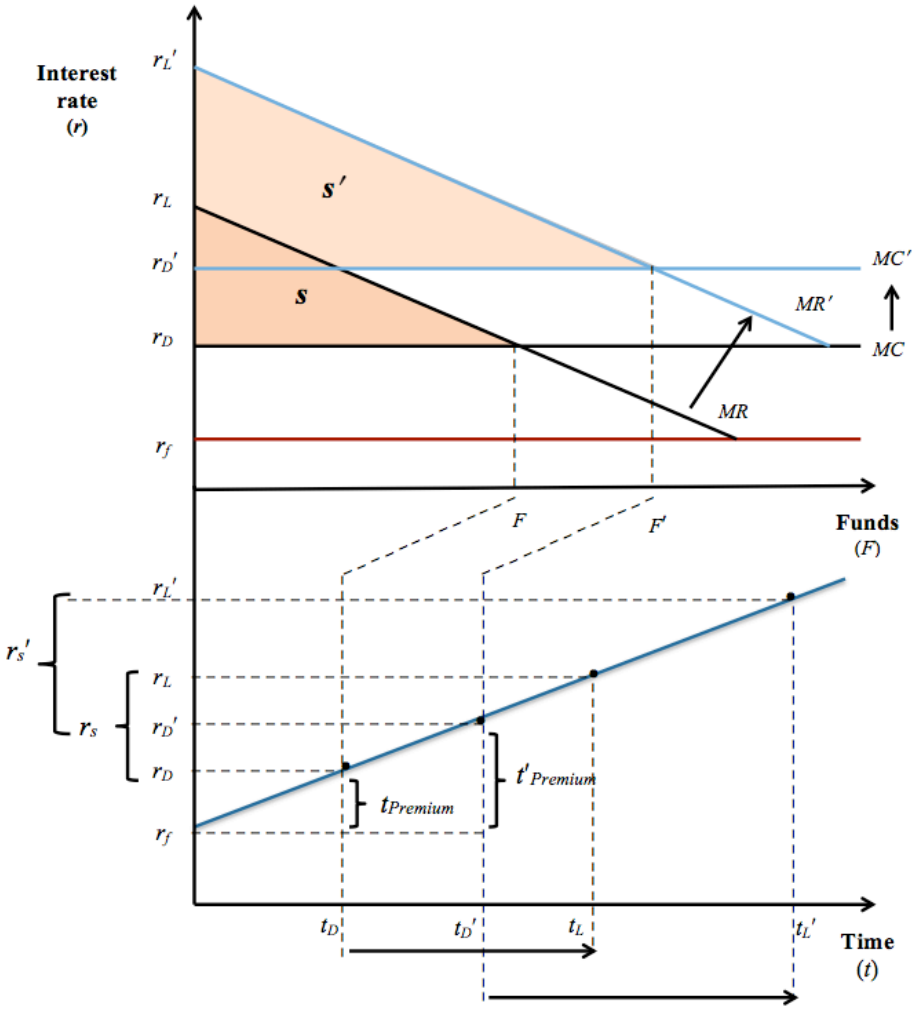

Figure 1. Maturity mismatching with implicit TBTF support.

Source: Own elaboration.

The success of maturity mismatching is sustained by continuous reinvestment of the short-term debt used to finance the long-term assets. This reinvestment uncertainty, which hinges on confidence in the bank as well as exogenous factors, exposes the bank to a "sudden stop syndrome" and liquidity risk. In the absence of fund coverage, creditors monitor this liquidity risk and impose discipline on a bank's mismatching of maturities by maintaining the reinvestment uncertainty with a threat of withdrawal, should the bank engage in moral hazard. However, if depositors expect a "free lunch" by depositing their funds in a TBTF bank, and the bank expects those funds to be guaranteed in light of its TBTF status, this uncertainty largely evaporates. Additionally, a central bank, acting as a lender of last resort in light of its monopoly on the issuance of fiat currency, may discourage creditor monitoring and encourage more casual liquidity management by offering a liquidity backstop. This, in turn, creates an incentive for the bank to engage in extreme maturity mismatching for a given credit demand, as illustrated above. A TBTF bank that engages in extreme maturity mismatching, therefore, engages in a form of risk-free arbitrage. Such a tendency should manifest itself in a number of financial ratios and statistics, such as a higher loan-to-deposit ratio, wider term spreads and net interest margins, bigger funding gaps between liabilities and assets of certain maturity, and potentially an increase in nonperforming loans due to the deliberate extension of credit to weak, high-yield borrowers or due to a diminished incentive to screen borrowers.

3.1.2 Asset- and investment management

Another example of a universal TBTF bank taking on excessive risk (that is, risk in excess of what a bank would otherwise not pursue in the absence of expected TBTF coverage) is a riskier investment portfolio due to riskier asset- and investment management and a riskier trading book (although asset management is ring-fenced from the main portfolio). Asset management describes institutional money management, whereas investment management is private wealth management. Higher risk means higher returns for a bank's clients, as well as higher commission, fees and returns for the bank.

As a simple approximation, let us assume that the portfolio managers of a TBTF bank collectively behave like a single investor within the mean–variance framework of the modern portfolio theory. According to portfolio theory, an investor attaches utility to

different investment opportunities. This utility is a function of an asset's expected rate of return, $E(r)$, and its variance, σ^2, which, given a normal distribution, measures risk. (Alternatively, the square root of the variance gives the standard deviation or volatility, σ, which is a more accurate expression of risk within the framework.) This utility is also a function of the investor's degree of risk aversion, A. An investor with a risk aversion of $A > 0$ is said to be risk averse, demanding risk premiums for known risks. A risk aversion of $A = 0$ indicates risk neutrality, where the investor decides on an investment solely on the basis of its expected return. A risk aversion of $A < 0$ indicates risk seeking, where utility increases with increased risk. The risk aversion of a bank's asset- and/or investment management is determined by its clients' appetite for risk, which also imposes discipline on the bank via the monitoring mechanism. A decrease in risk aversion, therefore, indicates a greater risk tolerance. The investor's utility function is expressed by equation (3.1):

$$U\left(E(r),\sigma^2\right) = E(r) - 0.5A\sigma^2 \tag{3.1}$$

The utility function expressed in equation (3.1) can be graphically illustrated with an upward-sloping indifference curve, which shows the different combinations of risk, measured by the standard deviation, and return, measured by the expected return, according to the risk-reward tradeoff for a constant utility score. The slope of the indifference curve is the investor's risk tolerance, A. An increase in A makes the slope of the indifference curve steeper, whereas a decrease in A makes it flatter (Bodie, Kane and Marcus, 2014).

For a given risk aversion and given an active management strategy in which capital is allocated between a risk-free asset (r_f) and an optimal risky portfolio (P), an investor maximizes utility where the indifference curve is tangent to the capital allocation line (CAL), which depicts the investor's investment opportunity set; that is, the risk–return combinations available to investors in the financial market. Let us assume that a bank is risk averse ($A > 0$) and manages a hybrid portfolio, which is its optimal complete portfolio. The portfolio is illustrated in point X in Figure 2, where the bank's indifference curve U is tangent to the CAL, offering an expected return, $E(r_0)$, for a certain level of risk, σ_0.

Now let us assume that a bank's clients, be they creditors or investors who turn their funds over to a bank, perceive it to be TBTF, such that they expect their funds to be guaranteed in times of crisis. As before, the monitoring mechanism decays. This increases the risk tolerance of a bank's clients, thereby lowering the bank's risk aversion. Alternatively, if the bank manages a portfolio for its own account, the management's risk tolerance becomes greater (perhaps due to shareholder pressure). Implicit government support lowers the bank's degree of risk aversion to A^*, where $0 < A^* < A$, reflecting a greater tolerance for risk without complete indifference towards risk. The bank's capital allocation between r_f and P changes such that more capital is allocated to volatile asset classes, such as private equity, cyclical securities, and high-beta stocks, making the portfolio more weighted towards assets that gain most from volatility in point Y, where the new indifference curve U^* is tangent to the CAL, offering a higher expected return, $E(r_1) > E(r_0)$, for higher risk, $\sigma_1 > \sigma_0$. This effect is seen in Figure 2.

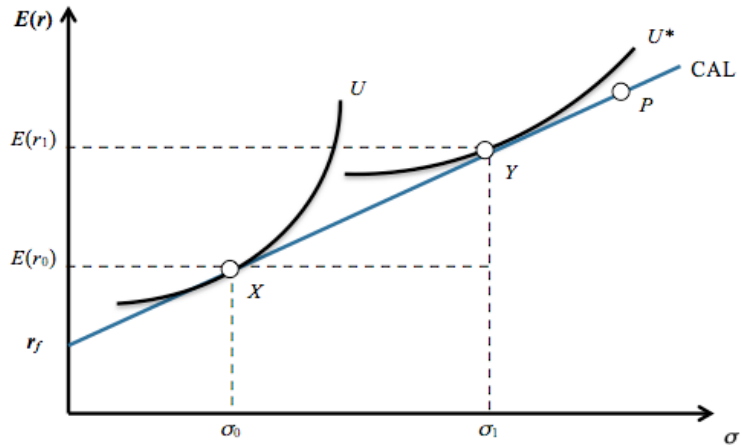

Figure 2. Capital allocation with implicit TBTF support.

Source: Own elaboration.

However, since the perception of safety is not absolute and the expected downside associated with greater risk is offloaded onto a mutually exclusive third party (taxpayers) with a social tolerance for risk that is disproportionate to a bank's risk tolerance, the change in risk aversion is artificial and inappropriate. Equation (3.2) describes a risk aversion distortion ratio between a bank's natural risk aversion, A, and the artificial TBTF risk aversion A^*, where α is a measure of risk-reward distortion:

$$A^* = (1-\alpha)A \Rightarrow \frac{A^*}{A} = (1-\alpha) \tag{3.2}$$

where $\alpha = \frac{e}{(1+e)}$, $0 \leq \alpha < 1$, $e \in \left[0, \lim_{e\to\infty}(\alpha = 1)\right]$, and *e* is a confidence score on the basis of expected protection in the range of 0 (no expectations) and, theoretically, infinity (or full protection) such that α approaches 1 but never actually equals 1 since it is assumed that risk aversion is greater than zero. As expectations of implicit support increase, the risk–reward distortion increases, thereby increasing the discrepancy between a bank's risk aversion with and without implicit support, reflected in a lower *A**/*A* ratio. This distortion is illustrated in Figure 3 by the angle α between the bank's indifference curve without implicit support (*U*) and with implicit support (*U**), since an investor's degree of risk aversion is the indifference curve slope.

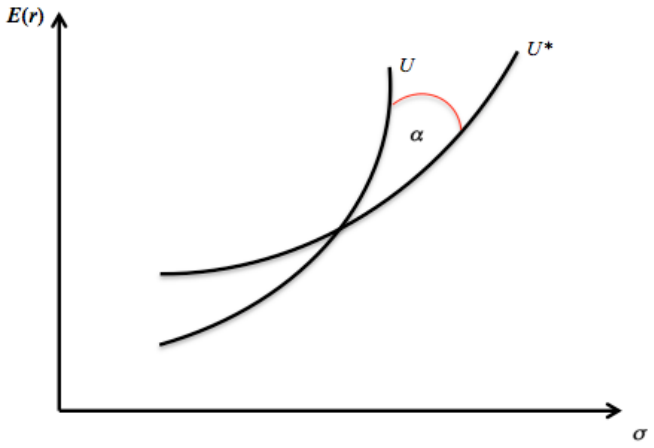

Figure 3. Distorted risk aversion due to implicit support.

Source: Own elaboration.

This section illustrates how a universal bank may increase its risk tolerance on its investment banking side, on behalf of its clients or in its own portfolio, in light of an implicit TBTF funding guarantee on its retail- and commercial banking side, such as unlimited deposit coverage.

3.1.3 Asymmetric loss function

> "If a builder build a house for a man and complete it, (that man) shall give him two shekels of silver per SAR of house as his wage. If a builder build a house for a man and do not make its construction firm, and the house which he has built collapses and cause the death of the owner of the house, that builder shall be put to death."
>
> **Code of Hammurabi** (18th century BC)

The illustrations above (figures 1 and 2) highlight another feature of a TBTF policy; namely, the divorce of risk from reward and the privatization of profit and the socialization of losses. If a bank is officially deemed TBTF, it is, in effect, exempt from the profit-and-loss feedback mechanism of the market. Its profits and losses, risks and rewards are bifurcated. This absolves the bank from having to act efficiently against the threat of losses and taking responsibility for its actions. Moosa (2010, p. 13) has called this an "asymmetric loss function." When the market forms expectations based on risk that is priced at a discount from real risk, real risk becomes hidden in the sense that it is not accounted for by the banks, but is offloaded onto a third party (taxpayers) that is not part of the principal–agent contract between a bank and its creditors. TBTF banks skew their distributions of risk and reward towards frequent, decent returns and large, unlikely losses, thereby creating a negatively skewed distribution with hidden tail risk for a third party. This is the definition of a negative externality or external cost, which is a cost imposed on a third party that is not part of the transaction that produced it due to an incentive to overproduce (Mankiw and Taylor, 2011). The negative risk externality materializes in a direct fiscal cost during a banking crisis, should policymakers deem a bank to be TBTF. The third party thus becomes the *de facto* insurer of TBTF banks' potential losses. It is unaware that it shoulders hidden exposure that is disproportionate to the degree of social risk tolerance, meaning that there exists an asymmetry of information and an agency problem in an informal principal–agent relationship between the public and the banking sector. The area *s*′ in Figure 1 is the welfare loss to society as a result of a socialization of risk, whereas the area between σ_0 and σ_1 and the line *XY* in Figure 2 amounts to a negative risk externality that a TBTF bank's increased risk-taking imposes on society. Costs associated with the TBTF problem and a TBTF policy are discussed further in Chapter 5.

A caveat is in order. It is important to bear in mind that that the assumption here is one of market participants responding to incentives and not one of inherent moral predispositions. The TBTF problem is not the result of poor management or unethical conduct, but rather the effect of a firm-specific policy preference on incentive structures and rational behavior.

3.2 Competition distortion, artificial growth incentives and the TBTF subsidy

Besides weakening market discipline and promoting excessive risk-taking on the part of banks, implicit TBTF support also has implications for competition in financial markets. As mentioned before, expectations of government protection for the largest, most interconnected banks encourages creditors and investors to discount risk when they provide those banks with funding. A lower yield demand provides those banks with lower funding costs relative to the market and makes their financing costs insensitive to risk, thus propelling the bank towards riskier activities. In effect, TBTF banks enjoy a competitive funding advantage over their smaller competitors in the capital market. This funding advantage amounts to a subsidy. A subsidy is government financial assistance in the form of a cash payment and/or a price discount (Nechyba, 2011). However, a TBTF policy is merely a contingent subsidy and not an actual subsidy in that it is conditional on future government discretion. This implicit subsidy nonetheless affects present market conditions by artificially lowering TBTF banks' costs of raising capital and increasing its profits.

The effect of a TBTF subsidy on a bank's cost of funds and profits is shown in Figure 4. In a competitive market without TBTF subsidies, the demand (*D*) for a certain quantity of loans is inversely related to the interest rate (*r*) and slopes downward. Banks supply deposits (S_D) and well as loans (S_L), both of which are positively related to the interest rate. The rate on loans (r_L) exceeds that of deposits (r_D), $r_L > r_D$, resulting in a term spread and a profit (π). In a competitive equilibrium (*e*), the supply of loans equals the demand for funds, with a lending rate of r_L and a corresponding deposit rate, r_{D_1}, resulting in a profit, π. A TBTF subsidy, however, shifts a bank's supply of deposits to the right from S_{D_1} to S_{D_2}, decreasing the deposit rate to r_{D_2} and increasing profit to $\pi + \pi^*$, thereby lowering funding costs and increasing profit for an unchanged lending rate.

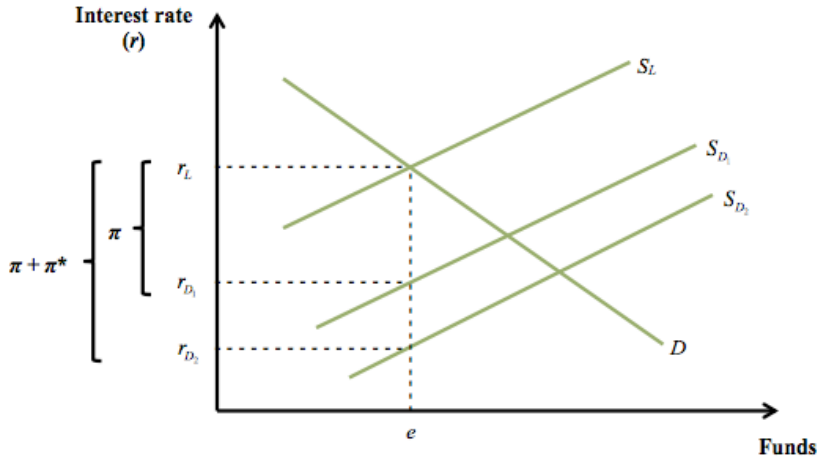

Figure 4. TBTF funding cost and profit.

Source: Own elaboration, based on Heffernan (2005, p. 2).

By viewing the issue within the option-framework of financial economics, the implicit subsidy works like a premium-free protective put option for bank management on a TBTF bank's assets (or liabilities) with no specified exercise date, written by the government. Since put options benefit from volatility, bank management is motivated to take greater risks due to the availability of cheaper funds. During a bull market, when the value of the bank's asset portfolio is increasing, the option is out of the money with a low intrinsic value but a high time value. During a bear market, on the other hand, the present value of the option increases. This option, however, has an asymmetric payoff since it places a stop-loss order on society to cover the downside, making the upside a "free lunch" for the bank.

Figure 5 shows how the implicit subsidy distorts competition. It plots a negatively sloped line of marginal opportunities for a TBTF and non-TBTF bank with respect to a bank's scale of activity (such as balance sheet size), reflecting the fact that larger banks enjoy lower funding costs. In order to retain profitability, smaller competitors who face higher financing costs have an incentive to pursue riskier activities and move under the TBTF umbrella (Panzera and Rossi, 2011).

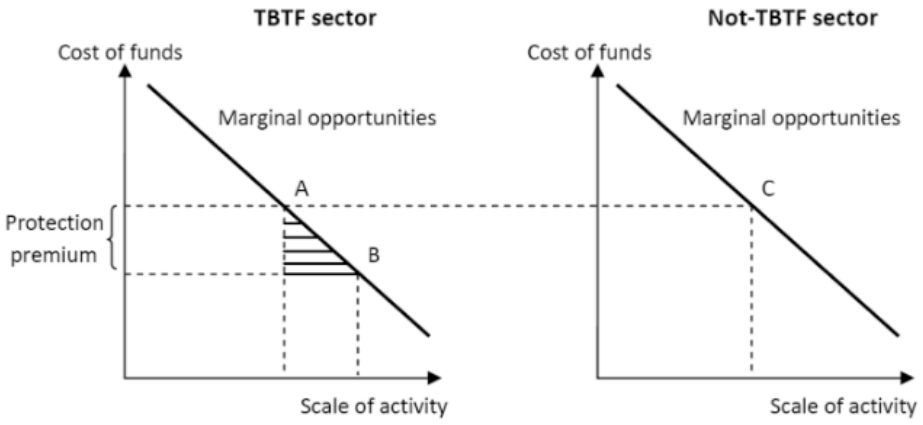

Figure 5. TBTF subsidy.

Source: Panzera and Rossi (2011, p. 316).

In this way, the protection premium or TBTF subsidy distorts competition via perverse risk and growth incentives, as well as herding behavior, and compounds systemic risk in the banking sector. Alternatively, due to the existence of implicit government insurance, banks may simply have an incentive to inflate their balance sheets (e.g. by increasing risk or obtaining mergers and acquisitions) in order to gain access to the safety net (Moosa 2010). This fosters a banking environment that is characterized by increased size, complexity and risk. A wider scale of activity raises the scale of failure, thereby aggravating the possible contagion effects of a TBTF bank's failure in the financial market and the real economy (Kumar and Lester, 2014).

Additionally, a TBTF policy that materializes may give rise to *ex post* moral hazard, thereby opening a Pandora's box. Having received confirmation of their TBTF status, such banks will increase risk further on the grounds that their operations will always be sustained by public transfers. This further erodes market discipline, creating a self-reinforcing vicious cycle with a gradually expanding safety net. In other words, a TBTF bailout has a cobra effect[3] and is subject to the law of unintended consequences, in that

[3] The banking safety net is much like the so-called cobra effect, whereby the attempted solution to a problem ends up aggravating the problem. The term stems from an anecdote set at the time of British Raj in India. Concerned about the number of venomous cobra snakes in Delhi, the British government offered a reward for every dead cobra. Initially, this program was effective, as large numbers of snakes were killed for the bounty. However, enterprising people began to breed cobras for the income. When the government realized this, the bounty program was abandoned, causing the cobra breeders to set the now-worthless cobras free. As a result, in

a bailout unwittingly exacerbates the problem it was meant to solve and increases systemic risk.

3.3 Systemic risk

Dowd (2009) has used the example of "the good bank" and "the bad bank" to illustrate how mandatory deposit insurance creates moral hazard and makes the banking sector more risk-biased by comparing equilibria before and after the introduction of deposit insurance. In order to illustrate the distorting effects of a TBTF subsidy on competition in the banking sector, an argument based on that of Dowd can be made with minor alterations. If we assume an implicit TBTF subsidy instead of Dowd's deposit insurance and extend the argument to not only depositors but also creditors and investors, his argument still holds. Assume the existence of two banks: The Good Bank, whose investment risk is in line with the risk aversion of its creditors and investors, signaled by their monitoring, and The Bad Bank, whose risk tolerance exceeds that of its creditors. Let us also assume two equilibrium scenarios, each divided into two periods (0 and 1). The first scenario is a competitive, unregulated banking sector. The second scenario is a banking sector operating under the assumption of an implicit policy preference for a subset of the market. In the first scenario, the two banks are in fact identical competitors in equilibrium at period 0. At period 1, one of the two banks increases its risk tolerance. It becomes The Bad Bank. Since creditors and investors at The Bad Bank believe they are unduly compensated for the bank's risk, they transfer their funds to The Good Bank, which is able to accommodate their risk premia. Given that depositors seek liquidity insurance and investors seek investment returns, the transfer of funds from The Bad Bank to The Good Bank does not cause a systemic bank panic or bank run and creates a new equilibrium where The Bad Bank has lost competitiveness. The competitive equilibrium at period 0 is therefore Pareto optimal and the first welfare theorem, which states that resource allocation is Pareto efficient so long as there are no price distortions, externalities, asymmetric information or market power, holds (Nechyba, 2011).

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the long term, the wild cobra population increased, and the cobra problem was made even worse by the attempted solution.

At period 0 in the second scenario, the banking sector is in equilibrium as in period 0 in the first scenario. At period 1, however, a subset of the banking sector operates under the assumption of an implicit TBTF subsidy. Let us assume that only one of the two banks expects government protection. It increases its risk tolerance and becomes The Bad Bank. Unlike the previous scenario, however, creditors at The Bad Bank lose their monitoring incentive and do not transfer their accounts to the prudent Good Bank, which the market does not expect to receive government protection. Whereas The Bad Bank lost competitiveness due to increased risk in the absence of a TBTF subsidy, it is now at a competitive advantage in the capital market, rendering The Good Bank uncompetitive. In order to retain competitiveness, The Good Bank must increase risk in order to provide its clients with the same expected higher rates of return "guaranteed" by The Bad Bank. In this new equilibrium, the first welfare theorem is violated, systemic risk in the banking sector increases since the inefficient Bad Bank remains in the market, and The Good Bank has an incentive to behave like The Bad Bank and become TBTF.

3.4 Concentration and oligopoly

In light of the argument that perceived guarantees distort competition, it may also be argued that financial market or banking sector concentration exacerbates the TBTF problem, and that the TBTF problem is more pronounced in oligopolistic banking sectors. Oligopoly is defined as a concentrated market structure in which a small number of large firms compete in the presence of high barriers to entry and produce identical or similar products in isolation from outside competition (Nechyba, 2011). In general, banking markets tend to be highly concentrated. However, according to the "concentration fragility view," banks in concentrated markets, such as an oligopolistic market structure, are more likely to receive TBTF subsidies than banks in competitive environments since a declining number of banks and increasing market power for the remaining banks renders each of the remaining banks more systemically important with respect to their market share in financial intermediation. This increases incentives for excessive risk taking, leading to moral hazard and increased systemic fragility (Moosa, 2010).

3.5 Resource misallocation

The competition distortion in the banking sector leads to another macroeconomic feature of the TBTF problem: resource misallocation. If a particular subset of the financial sector enjoys a safety net, capital may flow to those entities from sectors that lack a guarantee of funds. A positive wealth effect thus accrues to TBTF banks, with corresponding negative effects accruing to non-TBTF banks. Resources may flow from more valuable uses in unsubsidized sectors to projects with limited potential to increase economic output, thereby reducing efficiency and potentially hindering the economy's ability to produce income and wealth. This flight to perceived safety (or higher returns that high-risk banks are able to offer) due to rational expectations of government support may make the economy heavily exposed to banking, much like a 'resource curse'. An overallocation of funds to TBTF banks may give rise to a banking sector bubble, since lower funding costs and increased risk potentially widen their balance sheets. Additionally, implicit guarantees may lead to an overextension of credit and an excessive flow of cheap funds to various asset classes, thereby driving up prices and potentially causing asset bubbles. An implicit TBTF subsidy therefore degrades the financial system's ability to facilitate the efficient intermediation of financial capital to the real economy by distorting the allocation process (Stern and Feldman, 2009). Furthermore, it has been argued that implicit bank debt guarantees increase income inequality, since bank shareholders and bank management, who tend to be located at the upper end of the income distribution, stand to gain the most from increased volatility as well as a TBTF policy (Denk, Schich and Cournède, 2015).

From a market-based perspective, a business that reaches the state of bankruptcy is most likely pursuing inefficient, high-cost activities that consume capital instead of contributing to the generation of wealth and productivity. In a profit-and-loss system, such activities are terminated. As mentioned previously in Chapter 3.1.3, a TBTF policy amounts to the exemption of a bank from this continuous market test, thereby preventing an inefficient bank's market exit and what Schumpeter (1942) called "creative destruction." Creative destruction describes a process by which business failure and economic downturns are essential in the transfer of resources and real savings to their most productive uses. Inefficient business models and economic structures are destroyed and are revolutionized "from within" by the creative

innovations of entrepreneurial action, rooted in the profit-seeking motive, and the utilization of the inputs that have been freed up from failed enterprise. The ejection of unproductive firms from the market and the shifting of resources between sectors of the economy necessarily entails immediate high short-term costs in the form of unemployment and output loss below the productive capacity of the economy, but with the benefit of payoff in the long term. Ignoring market signals and subsidizing declining economic structures in order to avert the costs associated with this process – such as through a TBTF subsidy – amounts therefore to the rewarding of poor performance and inefficiency for a short-term relief but at a higher cost in the long term due to resource misallocation.

4 The Political Economy of TBTF

4.1 Time inconsistency

A question largely unanswered hitherto is why the TBTF problem exists in the first place. While the roots of the TBTF problem lie in uninsured creditors' expectations of government support in the case of bank failure, the underlying source of the problem is a lack of credibility on the part of policymakers due to time inconsistency.

Time inconsistency is the inconsistency between actions and words over time. As it relates to policymakers, time inconsistency is the discretionary discounting or disregard of long-run concerns in favor of the perceived short-term benefits of intervention in a banking crisis, despite pledges or commitments to the contrary (Stern and Feldman, 2009). As Dowd (2009, p. 141) notes, time inconsistency essentially amounts to policymakers "throwing their policy manuals overboard." Since past commitments contradict present action, they lose credibility. In anticipation of policymakers encountering the same set of short-term benefits, costs, incentives, and trade-offs each time the prospect of a potential failure of a systemically important bank forces them to consider intervening, creditors make their economic calculations and act accordingly (Stern and Feldman, 2009). Creditors' expectations of government support are therefore practically forward-looking, but not independent of history altogether, since time inconsistency is a historical phenomenon involving government's propensity to support failing banks despite verbal commitments or predetermined rules to the contrary. Verbal commitments and predetermined rules are therefore "noise" rather than information to be conveyed to the market and acted upon.

4.2 Intervention incentives

In the context of behavioral economics, policymakers are time-inconsistent because they have present-biased preferences for propelling support for uninsured creditors of systemically important banks and thus contradicting prior commitments to nonintervention. Such preferences for short-term benefits are explained by the incentive structure that they face. Stern and Feldman (2009) consider three sets of such incentives that may be mutually inclusive: the preservation of macroeconomic stability, credit allocation and the maximization of personal welfare.

4.2.1 Macroeconomic stability

Firstly, elected officials and policymakers may pursue TBTF coverage due to concerns over spillover effects following the failure of a systemically important bank that may put the stability of the real economy at risk (due to factors such as the four C's). This would entail high cost and output loss below the productive capacity of the economy and into the area of macroeconomic contraction. Given government's propensity to act in times of crisis, these concerns may be rooted in a sense of duty or responsibility to perform a task for the public good, the economic consequences of which may turn out to be either beneficial or detrimental in the long-run. Should government decide to intervene, by facilitating mergers in a concerted effort with a central bank or injecting public equity into TBTF banks, the perceived benefits of TBTF protection for uninsured creditors and the guaranteeing of a significant portion of a failing bank's liabilities are estimated to outweigh the cost. TBTF status is thus confirmed (Stern and Feldman, 2009). Government may also intervene due to fears of social unrest. However, it should be noted that governments are no exception to bounded rationality. Bounded rationality is the assumption that in decision-making, individuals are cognitively and informationally limited. In addition, they face time constraints within which they have to plan and act. Government cannot act as a benevolent, utilitarian social planner, that is, an entity in possession of all information that allocates resources with the aim of maximizing a social goal (Nechyba, 2011). As such, government rescue operations may be suboptimal, although the opportunity cost of their response is unobservable.

4.2.2 Credit allocation

Secondly, if the state plays a role in credit allocation, either directly via government-owned banks or indirectly by encouraging the rationing of credit by private lenders to particular enterprises that it deems underserved by private markets, it may have an incentive to prevent bank failure. Since it is dubious that government is able to perform the role of the benevolent social planner and collect, process and anticipate information better than the spontaneous order of the private market, the ultimate beneficiaries of such bailouts may be politically connected entities or cronies, although the state-favored industries may end up performing well (Stern and Feldman, 2009).

4.2.3 Personal considerations

Lastly, policymakers may be motivated to maximize personal welfare or political rent by pursuing a TBTF policy. Instead of conducting a social or macroeconomic cost-benefit analysis and choosing the best alternative from a social standpoint, they perform a subjective analysis of private cost and benefit of such a policy and choose the best private alternative (Stern and Feldman, 2009). In other words, policymakers, who do not directly bear the pecuniary costs associated with their decisions, may act on their own behalf rather than on behalf of society, at society's expense. By drawing on insights from public choice theory, which applies the logic of microeconomics to politics and public policy, one may acknowledge that politicians, policymakers and bureaucrats are self-interested utility maximizers, motivated by factors including public reputation, salary, and power. By preventing the failure of a systemically important bank by insuring the losses of uninsured creditors, policymakers may therefore be acting out of a conflict of interest, lobbying pressure, concerns for personal political or party reputation, or sheer corruption. Whatever their personal motivations for a TBTF policy may be, it is clear that bank failures, besides having economic consequences, also entail political consequences that may give rise to moral hazard on the part of policymakers.

4.3 The invisible hand of government

Due to time inconsistency, the official TBTF status of a bank is determined when policymakers weigh the benefits and cost of either allowing the bank to fail or preventing it from failing. In other words, banking crises constitute the only viable revelation mechanism of both official TBTF banks and policymakers' preferences. Neither the probability of a contingent liability guarantee nor its settlement day can be accurately determined. This creates a guessing game, whereby creditors and banks forecast and estimate the subjective probability of state support. These forecasts are influenced by a number of factors, such as the subjective probability of bank failure, losses in the event of failure, historical information (time inconsistency), public information (such as the state of public finances), and the business cycle. Given their forecasts and incentive structures, creditors and bank management alter their behaviors accordingly. This environment leads to the mispricing of risk, due to reduced market discipline, and a misallocation of resources to inefficient uses. It therefore

seems plausible that the TBTF problem is a rational market response to expectations set by government's inconsistency over time, whereby the invisible hand of government unwittingly crowds out the invisible hand of the market, leading to market distortions.

5 The Cost of TBTF

Implicit guarantees for TBTF banks impose net costs on society in roughly three ways. First is the direct, observable *ex post* fiscal and accounting cost associated with actual TBTF support in the form of a TBTF policy. Second is the unquantifiable welfare cost generated by market expectations of TBTF support, that is, interim moral hazard, independent of whether a TBTF policy materializes or not. Lastly, a third potential cost associated with the TBTF problem is the economic cost of miscalculation and an overestimation of implicit support.

5.1 Fiscal cost

The government pursues a TBTF policy if it deems that the benefits of such a policy outweigh the cost, and if government considers it to be fiscally viable. To fund a bailout, the government incurs fiscal and accounting cost associated with the redistribution or transferring of public funds from taxpayers to creditors (Kellermann, 2011). Since such coverage is discretionary, it is highly unlikely that financial resources for such compensation are earmarked in fiscal budget reports. Additionally, there is no automatic funding mechanism for obtaining such resources. This makes funding difficulties likely. Support would have to be funded by a deficit and a future transfer of funds, that is, higher taxation in the future, along with higher public debt. Since the scope of such coverage is potentially non-discriminating, amounting to a blanket guarantee for all categories of bank creditors, TBTF subsidies may result in outrageously high fiscal cost to taxpayers. This has macroeconomic implications, since higher taxes to compensate the TBTF debt distort the behavior of the taxpayer by possibly affecting work incentives and the supply of labor and imposing losses on society (Stern and Feldman, 2009). It should also be noted that while it is impossible to unambiguously establish the *ex post* opportunity cost of a rescue operation, the cost of government miscalculation of the necessity of capitalizing failing banks may manifest itself in an unsustainable trajectory for its public finances, thus putting a nation's fiscal autonomy at risk (Goldstein and Véron, 2011).

5.2 Welfare cost

The short-term flow of funds from taxpayers to creditors does not accurately capture the economic cost associated with market expectations of a fiscal commitment to a TBTF policy. Whereas a transfer of public funds serves to benefit creditors at the expense of taxpayers, economic cost benefits no one and dwarfs the financial losses of the state purse. Economic cost is the cost of lost output associated with the resource misallocation discussed in Chapter 3.3, which could manifest itself in wasted investments, capital erosion and other inefficiencies such as a lack of innovation. They amount to a reduction in societal well-being in the form of a deadweight loss or welfare cost (Stern and Feldman, 2009). This misallocation arises due to expectations of funding insurance on the part of banks and their creditors; bank management expects liability coverage and takes on too much risk, while creditors expect asset coverage and reduce discipline. It is for this reason that Stern and Feldman (2009, p. 23) state that "[e]xpectations of TBTF coverage are costly."

5.3 Cost of miscalculation and TBTS

> "Below a certain size, everything fuses, joins or accumulates. But beyond a certain size, everything collapses or explodes."
>
> **Leopold Kohr** (1909–1994)

A third potential cost associated with the TBTF problem is the economic cost of miscalculation and overestimation of implicit support, should insurance expectations turn out to have been in vain. Simply put, market expectations of government support can be right or wrong. So far, the cost of the interim market guessing game of whether the government will support failing banks, as well as the validation of market expectations in the form of a TBTF policy, have been discussed. However, TBTF cost may be most severe when forecasts of support turn out to have been wrong.

As was described in Chapter 3.2, implicit government guarantees increase systemic risk in the banking system, thereby increasing its scale of failure and aggravating subsequent contagion effects in financial markets and the real economy should expected TBTF support not materialize. The scope of such error in economic calculation is arguably worse if implicit support is procyclical. During good times, when public

finances are sound and the sovereign enjoys a high credit-rating, the market may drive expectations of implicit support to the extreme and cause a banking bubble. The bubble may be sustained with a bailout, thus delaying and possibly aggravating an unpleasant market correction, or it may burst with immediate adverse effects to the real economy. In such a situation, government has a choice as to whether it should intervene or not. The most extreme form of miscalculation, however, is when government has no such choice. When implicit government support and government's ability to support is overestimated in such a way that market expectations drive the size of the TBTF subset of the banking sector past the point at which implicit support is maximized, the government's ability to intervene is undermined. This is because such a subset has an intangible tipping point at which it becomes too costly to support relative to the government's ability to support, or TBTS. Figure 6 displays such a banking bubble. The sustainable equilibrium of a bank is the viability of its magnitude from a macroeconomic standpoint, where its liquidation does not necessitate severe adverse effects to the economy. In such an equilibrium, a bank's supply of services is in line with natural demand. Beyond that, there is a discrepancy between the sustainable equilibrium and the optimum size of the bank from a business standpoint. This discrepancy arises due to expectations of implicit government insurance, which alter a bank's privately optimal scale of activity. The implicit TBTF subsidy is maximized where the increasing blue line intercepts the TBTS ceiling. If expectations are driven past the point at which the subsidy is maximized, the bank, or even the banking system, becomes TBTS. This unsustainability ultimately leads to a forced market exit or forced return to a minimal sector size – something of a Malthusian check – furthermore undermining the economy's ability to sustain the previously sustainable equilibrium (signified by the dark red rampant) due to a possible output contraction.

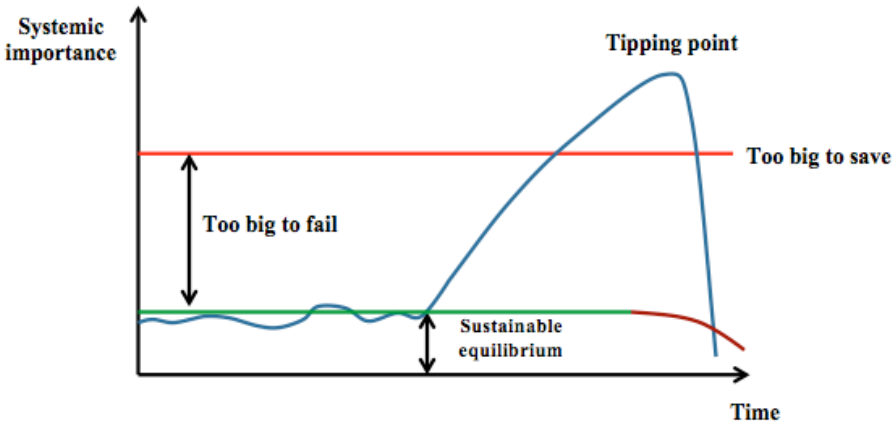

Figure 6. Tipping point.

Source: Own elaboration.

The possibility of a bank becoming TBTS has important implications for the link between an implicit TBTF policy and the state of a nation's public finances. A TBTF policy is dependent on government's ability to finance such a policy. Deteriorating public finances, a downgrade in the sovereign's credit-rating or large budget deficits raise doubts as to the ability of government to support TBTF banks, rendering the net benefits of size as ambiguous, if size is taken as a proxy for TBTF status. What may at first seem paradoxical, then, is perfectly logical; namely, that given deteriorating public finances, some systemically important banks who have grown beyond the size that maximizes their implicit subsidy can reverse course and downsize or split up in order to make the subsidy credible and fiscally appropriate (Demirgüç-Kunt and Huizinga, 2010).

5.4 Cost of scaling

Figure 7 summarizes the fiscal costs associated with bank failures according to the marginal private benefit (*MPB*) and marginal social cost (*MSC*) of increasing the scale of activity of a subset of banks.

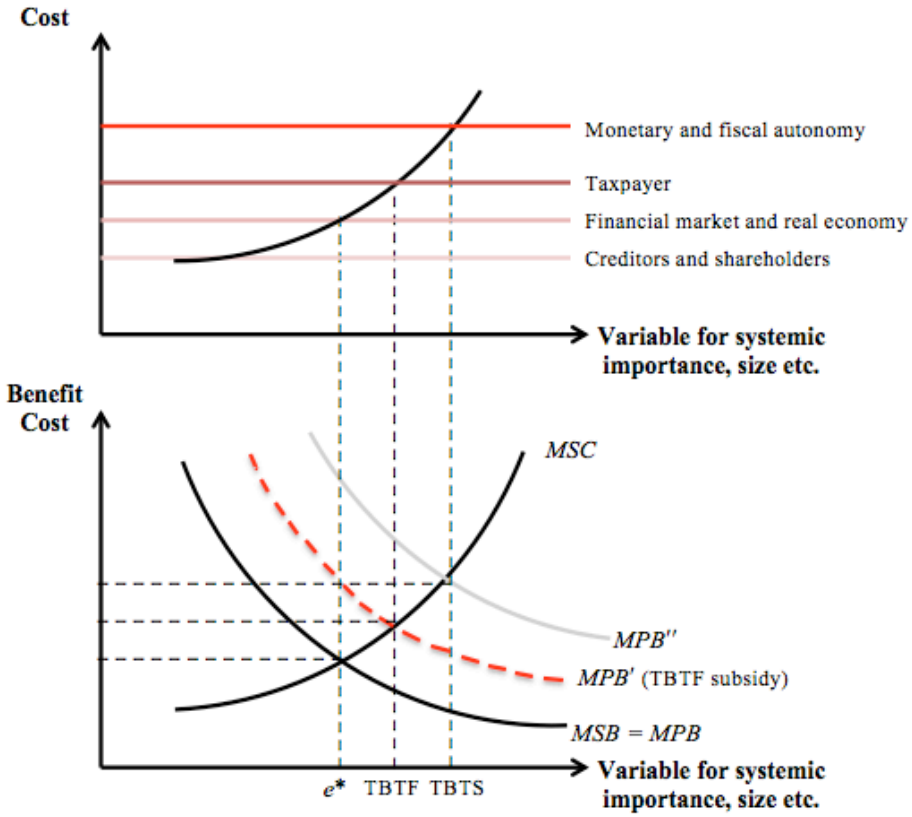

Figure 7. Macroeconomic cost of scaling.

Source: Own elaboration, based on Kellermann (2011, p. 341).

In a sustainable equilibrium *e**, where it is assumed that the marginal private benefit of the subset's scale of activity equals the marginal social benefit (*MSB*), the cost of bank liquidation is borne by bank creditors and shareholders. Financial markets and the real economy also experience economic cost due to investment termination and output loss in the short-run. The lowering of funding cost for a subset of banks with implicit insurance on their balance sheets creates economies of scale for those banks (Mishkin 2005). However, the new, subsidized optimal operational dimension of banks (TBTF), where additional economies of scale become effective, is only suboptimal from a macroeconomic perspective. Increasing the subset's scale of activity, which increases their marginal private benefit, increases the corresponding cost of their failure, giving rise to a negative risk externality by increasing the marginal social cost to taxpayers. Such diseconomies of scale, from a macroeconomic standpoint, reach a crux when a banking system becomes TBTS, since the cost of its failure may threaten a nation's fiscal and monetary autonomy (Kellermann 2011).

6 Alternative Sources of Moral Hazard

The discussion thus far of the TBTF problem and the safety net has concerned only the taxing power of government when systemically important banks are confronted with insolvency. There are, however, two other sources that contribute to the safety net that possibly give rise to moral hazard that is relevant to the TBTF problem: the Central Bank, acting as a lender of last resort, and foreign assistance.

6.1 Lender of last resort

The lender of last resort function is one of the most crucial functions for a central bank. A lender of last resort is a monetary authority that can allay a systemic liquidity shock or an incipient banking panic in a timely fashion by supplying illiquid banks with high powered money against high interest on good collateral (Bordo, 2014). However, effectively distinguishing between illiquidity and insolvency is difficult, especially during a banking crisis. This is because 'fire sales' in response to illiquidity can lead to insolvency. Selling assets to fund liability redemptions puts a downward pressure on asset prices and selling illiquid, long-term assets at substantial discounts from their market value can lead to substantial losses on a bank's books. Falling asset prices, in turn, force banks to write down capital, opening up the prospect of insolvency. Rescue operations during a banking crisis therefore necessitate a division of responsibilities between the government, in light of its taxing power to combat insolvency, and the central bank, in light of its monopoly on the issuance of fiat currency to combat illiquidity.

6.2 The TBTF doctrine and monetary policy

Adopting the TBTF doctrine changes the role of the central bank as a lender of last resort. Whether the bank is illiquid or insolvent becomes largely irrelevant, since the responsibility of the central bank lies with the stability of the financial system as a whole, not with a single bank (Capie, 2002). This, however, is problematic. Whether a central bank acts as an explicit or implicit lender of last resort, access to the discount window forms a safety net for TBTF banks, which gives rise to moral hazard (Dowd, 2009). Central banks essentially act as 'roller-overs of last resort' in renewing the short-term debt of TBTF banks, preventing liquidation of potentially insolvent TBTF banks and

subsidizing inefficient liquidity management. Having this safety net as a backstop may limit the losses incurred by maturity mismatching, thereby encouraging excessive risk taking. Stabilization via the injection of liquidity may furthermore encourage *ex post* moral hazard among TBTF banks. Therefore the Central Bank is in the exact same position as the government when faced with the decision of whether to intervene or not; both entities weigh the benefits of preventing a bank panic in the present, against the cost of increased risk-taking and a greater likelihood of future panics induced by moral hazard (Goodfriend and King, 1988). However, the central bank may be a more potent source of moral hazard for TBTF banks than the government, since the central bank, unlike the government, has no budget constraint given its monopoly of the money supply. Instead, it can increase its assets unilaterally to fund deposit insurance claims by issuing liabilities in the form of non-redeemable currency, thereby retiring bank debt obligations denominated in domestic currency.

The adoption of the TBTF doctrine by central banks also has negative implications for consumers. The central bank can inflate the real supply of money in circulation and thus offer liquidity by a number of means. However, monetary inflation can result in both economic and fiscal cost to consumers and taxpayers due to higher inflation and a loss in purchasing power, a loss on repurchase agreements (since central banks are usually publicly-owned entities) and future taxation due to the buying of government bonds. In any case, any loss on the central bank's balance sheet will be borne by the taxpayer (Goodhart, 1999).

6.3 Foreign assistance

Another potential source of moral hazard that may reduce banks' incentive to stay solvent is loans from foreign governments, foreign central banks or the International Monetary Fund (IMF). The IMF can act as an implicit or even explicit international lender of last resort, extending subsidized taxpayer-funded credits to governments and, ultimately, banks, if local government cannot honor implicit or explicit TBTF guarantees in the event of a banking crisis (Vaubel, 1983).

7 The TBTF Problem in Iceland

> "In the economic sphere an act, a habit, an institution, a law produces not only one effect, but a series of effects. Of these effects, the first alone is immediate; it appears simultaneously with its cause; it is seen. The other effects emerge only subsequently; they are not seen … There is only one difference between a bad economist and a good one: the bad economist confines himself to the visible effect; the good economist takes into account both the effect that can be seen and those effects that must be foreseen. Yet this difference is tremendous; for it almost always happens that when the immediate consequence is favorable, the later consequences are disastrous…"
>
> **Frédéric Bastiat** (1801–1850)

This chapter investigates the TBTF issue in relation to the current banking system in Iceland. It begins with a brief review of the roots of the current banking system. The discussion then moves on to identify possible sources of moral hazard in the banking system from the outset as a result of the restructuring of the banking system and capital controls. Following this, post-crisis banking system developments with respect to concentration, funding, and interconnectedness will be discussed. An attempt will also be made to identify TBTF effects in the banking system with respect to the banks' cost of deposits and risk-taking, despite the small size of the banking system. In some instances, the analysis will compare the current banking system to the pre-crisis system. Systemic risk inherent in the banking system will be discussed, as well as the effects of capital controls on portfolio risk and risk correlation. Finally, the extent to which the TBTF problem exists in the current banking system will be addressed, taking into consideration data trends, the nature of the banks' funding model, current economic conditions, and the implications of the government's rescue operation in 2008.

7.1 The Emergency Act, bank restructuring and capital controls

The current banking system in Iceland dates back to October 2008. Contrary to popular belief, the Icelandic banks were allowed to default but did not *completely* fail during the financial crisis in 2008 since the financial system itself was always up and running. Saying that the Icelandic banks were allowed to fail trivializes the significant role of the Icelandic government in saving the Icelandic banking system.

On October 6, the Icelandic legislature instituted the Emergency Act[4] as a response to the collapse of the Icelandic banking system, granting the Icelandic Financial Supervisory Authority (FSA) the ability to take unprecedented intervention measures in the financial market. These measures included intervening in the assets, rights and obligations of financial institutions, and granting deposit claims priority in insolvency proceedings of such institutions at the expense of senior unsecured debt. Prioritizing deposit claims at the expense of unsecured debt was a landmark in European banking history and bordered on apostasy, since European bondholders had not absorbed losses due to bank failure in decades (Jónsson and Sigurgeirsson, 2015). The Minister of Finance was furthermore authorized to disburse funds in order to establish new financial undertakings. The principal objective of the Act was to enable the government to promptly intervene in the financial market and assure the functioning of the payment system, the continuation of domestic banking and deposit security in case the largest, failing banks became insolvent (Ministry of Finance and Economic Affairs, 2012).

During the month of October, the three largest banks in Iceland – Landsbanki, Glitnir, and Kaupthing – were put into receivership and their domestic and foreign operations severed. According to a modified good bank–bad bank model employed during the Swedish banking rescue in 1992 and the Federal Deposit Insurance Corporation's intervention at Washington Mutual in the United States in September 2008, the FSA performed a surgery on the banks along geographical lines by transferring domestic deposits and assets into new entities: New Landsbanki, New Glitnir, and New Kaupthing. The Icelandic State Treasury recapitalized the banks with equity injections, liquidity support and subordinated loans, financed by a sovereign debt package from the IMF and the Nordic countries. The recapitalization bid swelled the budget deficit and more than doubled the public debt. Ultimately, after reaching agreements on the settlement of assets and liabilities with the old banks' resolution committees, which acted on behalf of the old banks' creditors, following the division of the old banks, the Treasury's equity stake in the new banks amounted to about a third of the new banking system. These banks were later renamed: Landsbankinn, Íslandsbanki and Arion Bank. They

[4] Act No. 125/2008 on the Authority for Treasury Disbursements due to Unusual Financial Market Circumstances etc.

immediately facilitated the functioning of the payment system and perpetuated domestic banking operations. The old banks' foreign assets and international operations remained inside the old banks for winding up. During the first three weeks of October, the banking system was downsized by roughly 85%. In order to prevent the transpiring systemic bank runs, the government issued a blanket guarantee of all domestic deposits separately according to a statement issued the same day it adopted the Emergency Act. The statement has not been officially retracted and thus remains valid (Ministry of Finance and Economic Affairs, 2012).

In November 2008, capital controls were imposed to stabilize the value of the national currency, the Icelandic króna (ISK), and halt capital outflows. Capital controls are measures taken by a nation's government, central bank or other regulatory bodies to regulate capital flows – trade in real and financial assets – in the country's capital account of its balance of payments (Neely, 1999). They are still in place.

7.2 Sources of moral hazard

Although there is much to extol in the Icelandic policy response to the banking crisis in 2008, such as maintaining access to liquidity and savings, downsizing the banking sector, preventing currency depreciation and not burdening taxpayers with private losses, the discussion of its effects cannot be restricted to its seen, favorable effects, lest it be characterized by a survivorship bias where its inadvertent, unfavorable long-term features are overlooked. In fact, the current banking system is a prisoner to the law of unintended consequences. The concerted rescue operations of the Icelandic government, the CBI, and the FSA produced a series of effects that have given rise to sources of moral hazard. From the outset, it may therefore be useful to identify these sources before analyzing the TBTF problem in the current banking system. These effects include the still-outstanding nominal blanket guarantee of deposits that was issued to prevent further bank runs, as well as initial plans to nationalize a significant part of the banking system, and a more credible lender of last resort function for the CBI within capital controls.

7.2.1 Blanket guarantee of deposits

The government's statement of guaranteeing all domestic deposits has not been officially retracted. As such, it is still valid, although unbinding, meaning that all domestic retail deposits are in theory insured by an unlimited amount. As will be seen, this may have significant implications for the banks' deposit-funding model. Taking the government's statement at face value, both small and large depositors may lose their monitoring incentive. Under formal deposit insurance, the enforcement mechanism of small depositors may disappear, but large depositors with cash holdings in excess of the legal maximum insurable amount would still have an incentive to monitor their banks. Under unlimited TBTF deposit insurance, however, both monitoring mechanisms may disintegrate. This increases funds at the banks' disposal, potentially giving rise to market distortions and moral hazard in the form of excessive risk taking with real savings, such as more aggressive maturity mismatching and/or riskier investments funded by deposit accounts.

It should be noted that there exists a statutory deposit insurance fund in Iceland, the privately run Depositors' and Investors' Guarantee Fund (DIGF), in accordance with the rules of the European Economic Area. It is funded by annual dues from all domestic banks. The minimum deposit guarantee is pegged just above EUR 20,880 but is payable in ISK. During the banking collapse in 2008, the fund only held 0.41% of total bank deposits, which was insufficient to halt bank runs (Sigurjónsson, 2015). As of 2015, the fund held less than 1.5% of total bank deposits, which is still insufficient to halt bank runs.

Unlimited TBTF deposit insurance has significant implications for public finances. As of year-end 2015, the public debt stood at 2,161,521 million ISK or 98% of GDP, and has been decreasing (Statistics Iceland, 2016a). Total deposits from residents at year-end 2015 amounted to 1,700,331 million ISK (Central Bank of Iceland, 2016a). Assuming that a 100% deposit guarantee would be financed by debt and future taxation, the public debt would increase to about 175% of GDP, at par with that of Greece. It is clear that full (or even partial) deposit coverage (which, as will be seen, would guarantee over half of the three largest banks' current funding model) would put public finances on an unsustainable trajectory, thereby jeopardizing the sovereign's own solvency.

Additionally, as of January 30, 2016, the Icelandic government agreed to receive the shares of Glitnir's international creditors in Íslandsbanki as part of a "stability contribution" (as opposed to an exit tax) to become exempt from the capital controls and exit the country with their funds. As a result of this deal, the Icelandic state became the sole owner of Íslandsbanki, increasing its ownership of the banking system to 70%. Although a temporary situation, this in effect socializes the three largest banks' risk-taking and means that the banking system will not be allowed to fail under any circumstance.

7.2.2 Lender of last resort within capital controls

According to Article 7 in the Act on the Central Bank of Iceland, the CBI can act as a lender of last resort when deemed necessary by the CBI.[5] Prior to the banking crisis in 2008, the CBI was unable to act as an effective lender of last resort. This was due to the fact that the banking system's assets and liabilities (especially liabilities of short-maturity) were mostly denominated in foreign currency. Despite having liquid balance sheets, the Icelandic banks' liquidity was contingent on the convertibility of their assets into foreign currency. However, the CBI's foreign exchange reserves relative to the banking system's foreign liabilities stood below 10% in 2008, making it an unreliable lender of last resort with currency to neutralize liquidity risk as well as an ineffective market maker due to the illiquidity of the Icelandic króna (Buiter and Sibert, 2008). In other words, in a small currency area with a currency that is not a reserve currency, a central bank cannot act as an effective lender of last resort during a banking crisis by printing the domestic currency without the liquidity possibly flowing out of the country via the capital account due to a flight to safety, thereby devaluing the national currency and causing a currency crisis alongside the banking crisis – a twin crisis (Kaminsky and Reinhart, 1999).

The capital controls, imposed in November 2008, prevented capital flight and stabilized the value of the ISK. It also reinforced the CBI's ability to pursue an independent monetary policy, as well as act as a lender of last resort without potentially causing a balance of payments crisis. Furthermore, the CBI is able to act as a lender of

[5] Act No. 36/2011.

last resort in the light of the fact that the current banking system's liabilities are mostly denominated in domestic currency. It is able to print M3 (M2 + liquid assets) – basically deposits – thereby unilaterally expanding the liability-side of the banks' balance sheets much like in the European banking model. With a backstop to liquidity management, the existence of a credible lender of last resort within capital controls may skew incentive structures towards riskier undertakings, especially in light of the increased systemic importance of the banks and the short-term nature of their deposit-funding model. This may give rise to moral hazard on the part of the banks, since the CBI can act as a 'roller-over' of debts of zero maturity via collateralized loans, thereby insuring deposits and subsidizing intense maturity mismatching for a given credit demand. Excessive use of this function, however, could lead to asset bubbles and inflation, since liquidity can only flow into domestic markets and asset classes within capital controls, resulting in potential welfare costs to society. It could also destroy the domestic currency should the liquidity flow out of the capital account when the capital controls are lifted.

7.2.3 Pre-crisis plans

Actions speak louder than words, and the Icelandic government's actions and intentions in the initial stages of the banking crisis in 2008 may convey information to the market to be acted upon by depositors and bank management. As mentioned in Chapter 1, the Icelandic rescue operation was not premeditated. To the contrary, the government initially sought to nationalize Glitnir, and Kaupthing was granted an emergency loan from the CBI (whereas Landsbanki's request was denied). As it turned out, however, the three largest banks were TBTS (Jónsson, 2009). Nonetheless, these intentions may hint at a propensity to support the largest banks in times of distress, which may be relevant to the current banking system as long as it does not become too costly to support relative to Iceland's fiscal and monetary capacity to support. If such TBTF support is perceived to be credible by the market, it may lead to moral hazard.

7.3 Systemic importance: Post-crisis banking system developments

The Icelandic banking system has undergone major changes since the autumn of 2008. At their peak in September 2008, the three largest banks dwarfed the country with a combined balance sheet of nearly 10 times GDP. The current banking system, on the other hand, is just under 2 times GDP. Figure 8 shows the average total assets of the banking system as a percentage of annual GDP from September 2003 to December 2015. Since 2009, the size of the new banking system has been stable at roughly two times GDP on average, but displays a downward trend relative to (increasing) GDP growth. The three largest banks of the old banking system, along with Straumur Investment Bank, have been replaced by three smaller banks, as well as a fourth bank, Kvika Bank (formerly MP Bank, which merged with Straumur Investment Bank). The old banks were highly leveraged, international universal banks, whereas the new banks are universal banks operating almost exclusively in the domestic market, funded mostly by domestic deposits. As of year-end 2015, Landsbankinn's assets totaled 1,118,658 million ISK, Íslandsbanki 1,045,769 million, Arion Bank 1,011,043 million and Kvika Bank roughly 61,614 million.[6] The three largest banks are therefore of similar size, whereas the smallest competitor in the sector is about 5.5-times smaller than the largest bank.

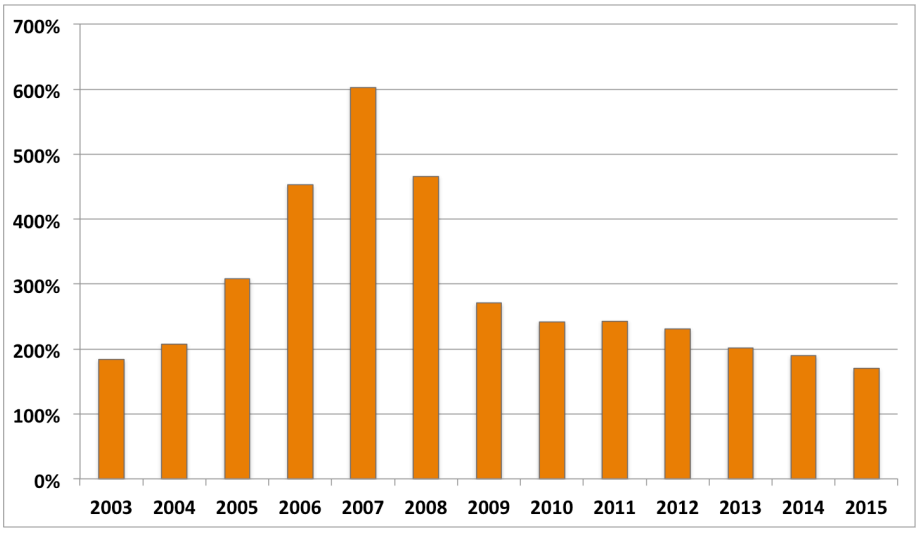

Figure 8. Total average assets of the banking system relative to GDP, 2003–2015.

Sources: Central Bank of Iceland (2016a), Statistics Iceland (2016b), own calculations.

[6] Arion Bank (2015), Íslandsbanki (2015), Kvika Bank (2015) and Landsbankinn (2015).

The current banking system is more in line with the size of the Icelandic economy, compared to the previous system. Nevertheless, it may be argued that although the banking system was downsized by 85% in 2008, the current banking system is TBTF and even more so than prior to the collapse of the banking system in 2008. In fact, as the banking system decreases in size relative to GDP, the government's ability to finance a TBTF policy potentially increases. In other words, TBTF status becomes more credible and fiscally appropriate as the banking system, which turned out to be TBTS in 2008, is downsized. Furthermore, an analysis of the banks' financial statements between 2008 and 2015 and several financial ratios supports the view that the current banking system is likely to be considered TBTF.

7.3.1 Concentration

During the post-crisis restructuring, concentration in the banking sector and the financial market has increased considerably and is at its highest point in decades while competition has decreased. This is supported by a number of trends, namely the declining number of depository institutions, increasingly disparate distribution of bank assets, and greater concentration of the three largest banks in market share with respect to domestic deposits and loans. As will be discussed towards the end of this section, these trends have acute implications for the TBTF problem.

7.3.1.1 Asset concentration

Since around 2006, asset concentration in the Icelandic banking sector has increased significantly. The total average domestic assets of the banking system (including savings banks), adjusted for inflation, have expanded by a factor of about 0.75 between 2000 and 2015. At the same time, the number of deposit-and-loan institutions has fallen from 29 to 8. Prior to 2006, the number of such institutions was relatively stable despite the growing size of the banking system. These two trends are shown in Figure 9. This suggests that a fewer number of deposit-and-loans institutions hold a greater share of bank assets in the domestic market.

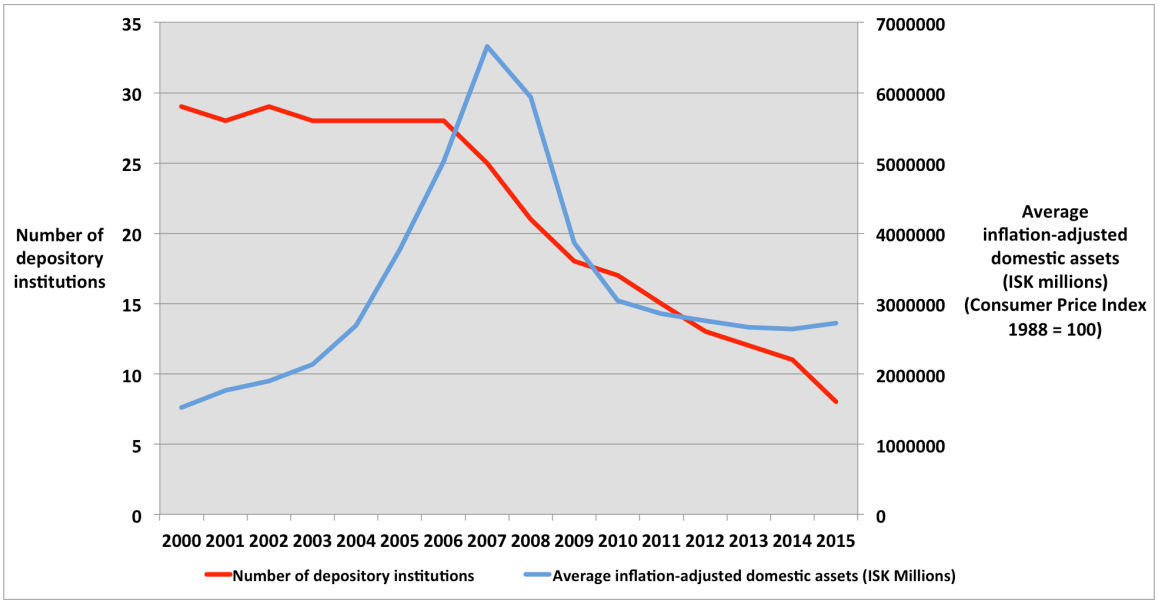

Figure 9. Concentration trend in the banking sector, 2000–2015.[7]

Furthermore, the share of total banking system assets held by the three largest banks is currently greater than that of the three largest banks in 2007. This is shown in Figure 10.

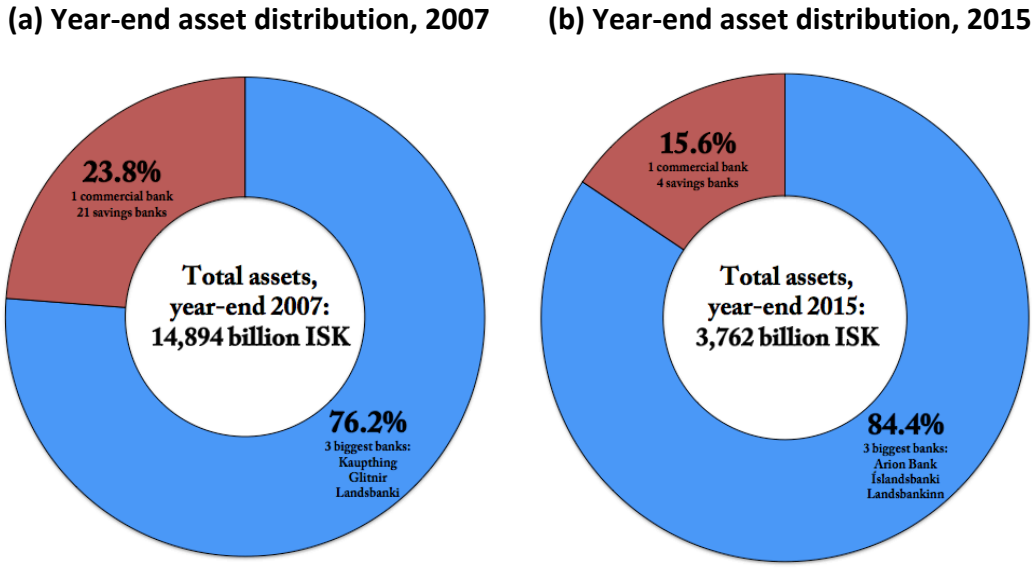

Figure 10. Year-end asset distributions of three largest banks, 2007 and 2015.[8]

[7] Sources: Central Bank of Iceland (2016a), Financial Supervisory Authority (2000–2009, 2015), Statistics Iceland (2016c), own calculations.

In 2007, the three largest banks held 76.2% of the banking system's total assets, while the other 22 depository institutions held 23.8%. This is shown in chart (a). Eight years later, by contrast, the three largest banks hold 84.4% of the banking system's total assets (3,762 billion ISK compared to almost 15 billion in 2007), while the other 5 depository institutions hold 15.6%. This is shown in chart (b). This is a further indication of greater post-crisis asset concentration in the banking sector, particularly among the three largest banks.

7.3.1.2 Market share

From 2008 onwards, the market share of each of the three largest banks with respect to domestic deposits, calculated as the ratio of customer deposits to total deposits from residents in the banking sector, has increased from roughly 20–25% to about 30–35%. At the same time, the share of other deposit-and-loan institutions has fallen from about 33% to 3% and the share of Kvika Bank has hovered around 2% since 2009. This is illustrated in Figure 11. The combined deposit share of the three largest banks has trended upwards since 2008. Between 1999 and 2008, deviations from about 70% in the combined domestic deposit share of the three largest banks were minimal. Compared to foreign banks, the average market share of the four largest banks in OECD countries was about 60% in 2010 (Ministry of Finance and Economic Affairs, 2012). Currently, however, the combined domestic deposits of the

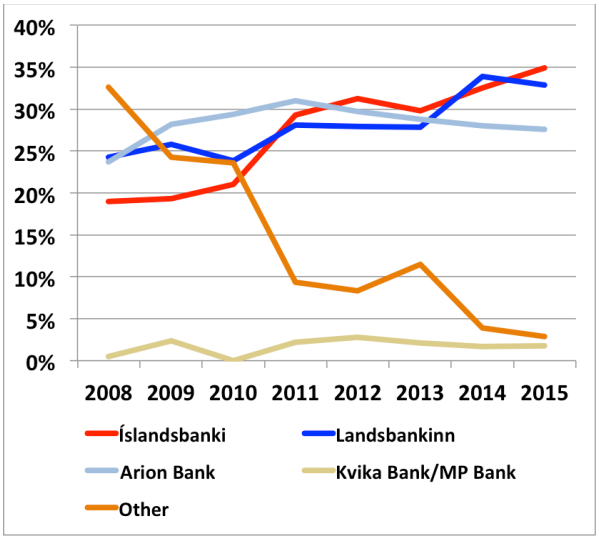

Figure 11. Market share of domestic deposits, 2008–2015.[9]

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[8] (a) Sources: Central Bank of Iceland (2016a), Glitnir (2007), Kaupthing (2007), Landsbanki (2007), own calculations.

(b) Sources: Central Bank of Iceland (2016a), Arion Bank (2016), Íslandsbanki (2016), Landsbankinn (2016), own calculations.

[9] Sources: Arion Bank (2008–2015), Central Bank of Iceland (2016b), Íslandsbanki (2008–2015), Kvika Bank (2015), Landsbankinn (2008–2015), MP Bank (2008–2014), own calculations.

three largest banks amount to 95.3% of total domestic deposits. This means that, should one of the three largest banks fail, roughly a third of the population, as well as firms, would not be able to access their deposits for transactions or necessities.

Similarly, the market share of the three largest banks with respect to customer loans, calculated as the ratio of customer loans to total credit to residents in the banking system, has increased. This is illustrated in Figure 12. The combined loan share of the three largest banks amounts to about 93% of total credit to residents in the banking sector as of 2015, compared to roughly 64% in 2008. The share of deposit-and-loan institutions, on the other hand, has fallen from about 36% to 6% and the share of Kvika Bank has been around 1%. The market share of the three largest banks in both deposits and credit has therefore increased since 2008, with each of them currently holding about a third of the market share in both deposits and customer loans.

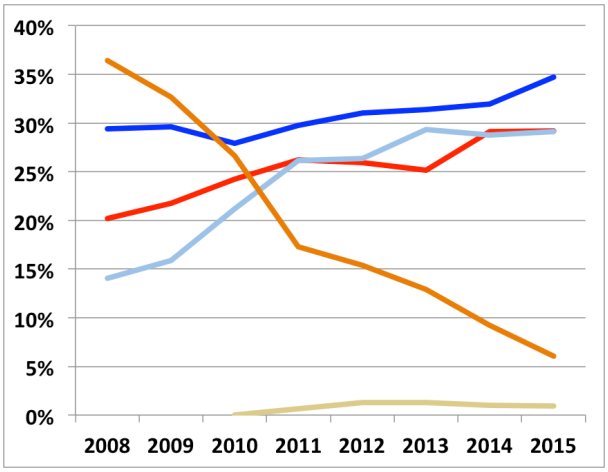

Figure 12. Market share of customer loans, 2008–2015.[10]

[10] Sources: Arion Bank (2008–2015), Central Bank of Iceland (2016c), Íslandsbanki (2008–2015), Kvika Bank (2015), Landsbankinn (2008–2015), MP Bank (2008–2014), own calculations.

7.3.1.3 Herfindahl–Hirschman Index

The consolidation trend in the banking sector with respect to domestic deposits is summed up in Figure 13, which shows the development of the estimated Herfindahl–Hirschman Index (HHI) in the banking sector. The HHI is a statistical measure of concentration, accounting for the number of firms in a market by incorporating the relative size (market share) of all firms in a market.[11] A market is considered concentrated if HHI > 1800 (Rhoades, 1993). According to the estimate[12], market concentration in the banking system has doubled from 1500 to around 3000 between 2008 and 2015. At no point prior to the collapse of the banking system in 2008 did the index rise above 2000 (Icelandic Competition Authority, 2011).

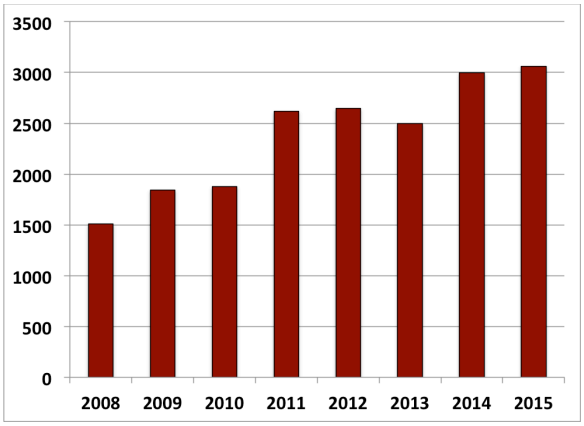

Figure 13. Estimated Herfindahl–Hirschman Index in the banking sector, 2008–2015.

Source: See footnote 9.

Several factors account for the increased financial market and banking sector concentration in recent years. Most of the savings banks that operated in the financial market between 2000 and 2006 have merged with the three largest banks due to cost efficiency. Moreover, the savings banks' dual bottom line business model of maximizing profit via maturity transformation with mostly demand deposits and investing profit in local or regional projects has been rendered inefficient due to technological advancements. They also face higher post-crisis operational costs due to regulatory costs (such as higher Basel III equity requirements), higher deposit rates in order to retain minimal competitiveness in the deposit market, and small size. An expanding regulatory framework and increased tax expenses also affect the competitiveness of

[11] The HHI is calculated by squaring the market shares (*MS*) of all *n* firms in a market and then summing the squares: $HHI = \sum_{i=1}^{n} (MS_i)^2$.

[12] The estimate takes into account the actual market shares of the four universal banks in the banking sector, but assumes an equal market share for all savings banks.

other financial undertakings. The high currency risk of the ISK furthermore deters foreign competition. The collapse of the equity market in 2008 also drove out competitors in the financial market, and post-crisis credit demand remains limited. Lastly, capital controls limit investment opportunities (Icelandic Competition Authority, 2011).

The post-crisis trend of greater concentration in the banking sector has rendered the current three largest banks more systemically important than those of the pre-crisis system. Despite being roughly four times smaller than the old banks according to assets, the new banks hold a greater market share of bank assets, deposits, and loans to customers. Furthermore, average domestic bank assets have doubled since 2008 while the number of deposit-and-loan institutions has rapidly declined. Implicit in this trend is the fact that the three largest banks have become increasingly important in the payment and clearing system. It is therefore clear that the three largest banks are increasingly asserting their systemic importance. By definition, this makes them TBTF in the sense that they are too systemically important to let fail.

7.3.2 Deposit-funding model

The banking system that collapsed in 2008 had a funding model that was fundamentally different from that of the current banking system and one that contributed greatly to its collapse. The old banks were highly leveraged and heavily dependent on international capital markets, long-term wholesale funding, and collateralized lending with the CBI. Only about 20% of their funding came from deposits. With assets amounting to 11 times GDP in 2007 and about 76% of the banking system's assets, and with a significant part of their liabilities denominated in foreign currency that far exceeded the country's foreign reserves, the three largest banks eclipsed the ability of the government and the CBI to bail them out, which rendered them TBTS (Jónsson, 2009).

In contrast, the current banking system is largely defined by the domestic savings pool and is mostly barred from foreign wholesale funding markets. As a result, the three largest banks have minimal gearing. Figure 14 shows the change in the average deposit-

to-liabilities ratio[13] of the three largest banks between 2008 and 2015, and serves as an approximation of the weight of deposits in their financing. It also shows the term structure of deposits, relative to liabilities.

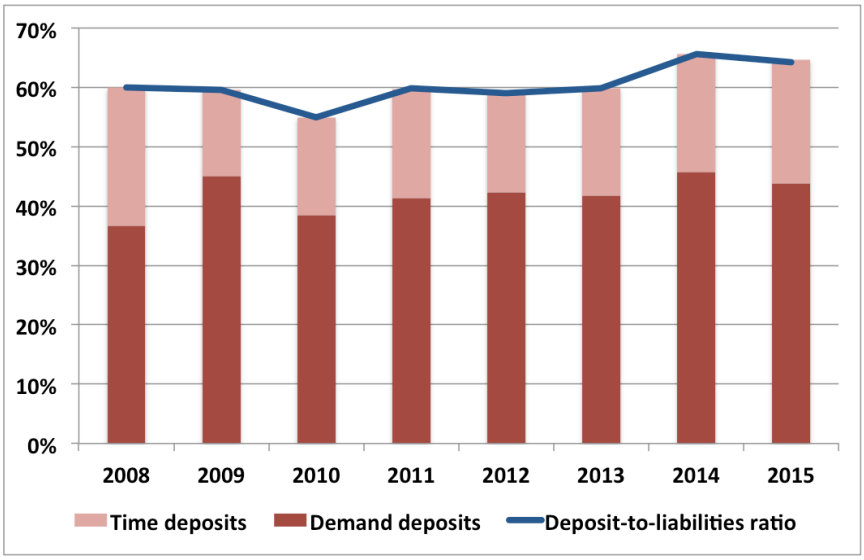

Figure 14. Average deposit-to-liabilities ratio and term structure of deposits for the three largest banks, 2008–2015.[14]

According to the chart, customer deposits – mostly demand deposits – have accounted for roughly 60% of the banks' liabilities on average since 2008, and have slightly increased in importance, with the remainder the banks' funding largely coming from equity and covered bonds issued in the domestic debt market. Between 2008 and 2015, the deposit-to-liabilities ratios for Íslandsbanki and Landsbankinn have increased from roughly 57% to 70% and about 48% to 64%, respectively, whereas Arion Bank's ratio has declined from just under 75% to 58%. These figures suggest that deposits are the single most important source of funding for the three largest banks' activities, even with expanding balance sheets.

Four factors explain why the Icelandic banks are mostly financed with deposits: size, credit ratings, capital controls, and deposit preference in insolvency proceedings due to

[13] $Deposit\text{–}to\text{–}liabilities\ ratio = \frac{Total\ customer\ deposits}{Total\ liabilities}$

[14] Sources: Arion Bank (2008–2015), Íslandsbanki (2008–2015), Landsbankinn (2008–2015), own calculations.

the Emergency Act. There is an inverse relationship between bank size and wholesale debt financing; as a bank becomes smaller, wholesale funding becomes more difficult, which makes it more dependent on deposits. Additionally, the three banks all currently hold a long-term credit rating of BBB- from Standard & Poor's, which means that they face high risk premiums in foreign wholesale markets (Kristjánsdóttir, 2014). Capital controls directly limit access to foreign wholesale markets, which, in turn, limits the extent to which the banks can diversify their sources of funding. They also limit investment opportunities for individuals, pension funds and 'captive' foreign investors (mostly hedge funds and banks that form the foreign currency overhang held by non-residents) who seek returns on their funds, which they park in some part in the banks in the form of deposits until capital controls are lifted. Lastly, the prioritization of deposits over unsecured senior debt in insolvency proceedings according to the Emergency Act has made wholesale funding more difficult for the banks. Prior to the collapse, depositors and unsecured bondholders were *pari passu* in the sense that the remaining value of the asset pool in the case of bankruptcy would be split among depositors and unsecured bondholders on a pro rata basis. The Emergency Act, however, broke with this European tradition and granted depositors greater protection at the expense of bondholders. This also explains why covered bonds, which are bonds covered by a pool of supposedly high-quality assets, mostly make up the remainder of the banks' funds besides deposits and equity, since the holders of covered bonds should be able to rely on their collateral in the case of default instead of potentially 'bailing in' depositors.

The banks' deposit-funding model has several implications for the TBTF problem. The most obvious implication is that the funding model makes the liability-side of the banks' balance sheets shorter. In other words, the current banks' funding model is inherently short-term, whereas the previous banking system was more dependent on long-term wholesale funding. Deposit funding is also inexpensive, which is one factor among many that contributes to increased net interest margins. In fact, the post-crisis net interest margin has hovered around 3% due to deposit funding as well as factors such as higher equity requirements and the bank tax. In contrast, the margin decreased from about 3.2% in 2001 to 1.8% in 2007 mostly due to the fact that the banks extended further out onto the yield curve with foreign wholesale funding and gearing (Kristjánsdóttir, 2014). Overall, just over half of the three largest banks' activities are funded by deposits,

thereof about 35% by demand deposits. This means that roughly a third of the banking system's assets are financed by debts of zero maturity that are redeemable in currency at face value on demand, which makes a third of the banking system's operational capacity 'runable' at any point in time. Since the banks are heavily dependent on short-term financing, the viability of their funding model is conditional on the constant reinvestment of those funds. The hazard of such a funding model is that it makes the banking system vulnerable to "sudden stops" and liquidity shocks. As a rule, as the volume of deposits and money market borrowing relative to total liabilities at a bank grows larger, the larger the potential loss in confidence of the public due to bank runs and the larger the contagion effect on other institutions' liquidity and solvency, should the bank fail. As a result, the potential monetary impact of the central bank's liquidity supply or 'roll-over support' to failing banks becomes greater. This makes the largest banks more likely to receive external support – especially since deposits include household savings and corporate funds – and, therefore, more likely to be perceived as TBTF. Should a TBTF subsidy to depositors not materialize, real savings would be significantly wiped out if a loan portfolio that incurs heavy losses is in fact mostly financed by deposits. Deposit accounts, despite being generally viewed as nearly risk-free, can therefore become repositories for tail risk due to expectations of insurance for a bank's deposit-funding model.

A second implication of the banks' funding model as well as the Emergency Act is that by giving deposits a higher claim on assets at the expense of holders of bank debt, expectations of TBTF coverage for bank debtors other than depositors are most likely non-existent. This is supported by the elevated use of secured borrowings in the banks' funding – that is, covered bonds – as opposed to potentially loss-absorbing unsecured debt, which indicates market mistrust in the banks' balance sheets.

A third implication of the deposit-funding model is that in light of the blanket guarantee of domestic deposits still outstanding, roughly two-thirds of the banking system's funding is, in theory, nominally guaranteed, which may give rise to moral hazard. The riskiness of the deposit-funding model, however, is ultimately dependent on a bank's loan portfolio as well as its asset portfolio as distinct from interest-bearing assets. A universal bank with a deposit funding model finances loans on the commercial

banking side and investments on the investment banking side mostly with deposits. On the one hand, a deposit-funding model is risky if a bank engages in aggressive maturity mismatching, since it expands short-term exposure. On the other hand, a deposit-funding model is risky if real savings are increasingly being used to finance risky investments. These are discussed in sections 7.4.2–7.4.3.

7.3.3 Interconnectedness

As discussed in Chapter 2, short-term interbank financing is a measure of interconnectedness. According to Stern and Feldman (2009), increased short-term financing in the interbank market by large banks, such as through overnight loans, commercial paper, certificates of deposit and repurchase agreements, aggravates the TBTF problem, since large banks become more interconnected and exposed to contagion effects, thereby enhancing systematic risk. Figure 15 illustrates the daily turnover in the interbank market with ISK between 2000 and 2016.

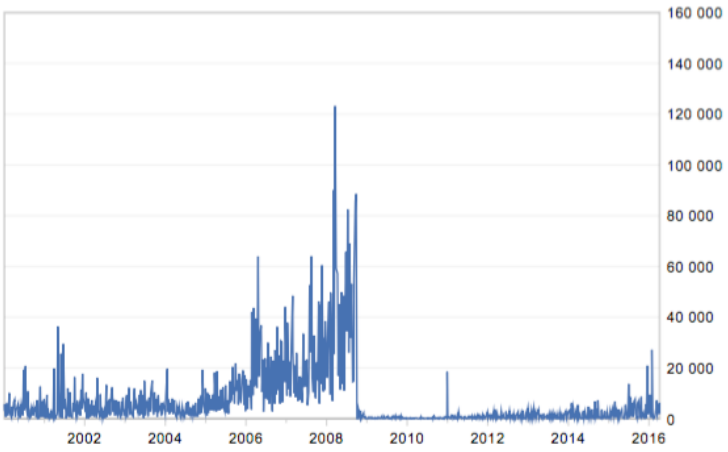

Figure 15. Daily interbank turnover with ISK, January 2000 – April 2016 (millions ISK).

Source: Central Bank of Iceland (2016d).

The post-crisis turnover has been low, indicating limited confidence in the financial market and that the banks have sufficient liquidity. Furthermore, the average year-end interbank exposures of the three largest banks, calculated as the amount of repurchase agreements from the CBI and money-market deposits from credit institutions against total liabilities, which roughly quantifies the risk of contagion, have declined from about 21% in 2008 to 3.7% in 2015. This is shown in Figure 16.

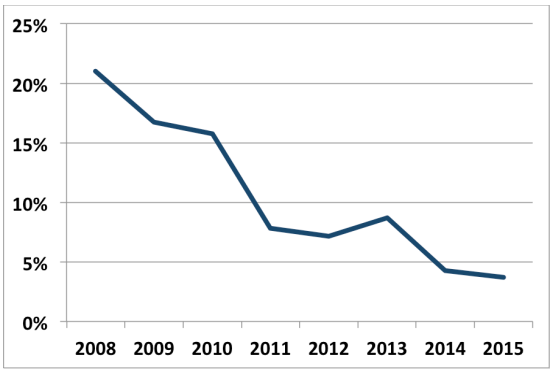

Figure 16. Average year-end interbank exposures of the three largest banks, 2008–2015.

Source: See footnote 14.

Decreasing interbank turnover and interbank exposures point to less interconnectedness among the three largest banks in recent years. Less interconnectedness therefore limits the extent to which a systemic shock would accelerate throughout the banking system, although contagion effects are arguably more potent in small banking sectors.

7.4 TBTF effects

A large number of studies have attempted to test the TBTF hypothesis with different areas of focus, reflecting the far-reaching implications of the issue.[15] A significant part of those studies has attempted to capture creditor expectations (including depositors) of government support for the largest banks should they get into financial difficulties. These studies focus on credit spreads on bank bonds and treasury bills, spreads on bank credit default swaps, bank stock returns, and deposit costs.[16] Others focus directly on

[15] Information on the body of research surrounding the TBTF problem presented here – which is far from being exhaustive – is taken from Afonso, Santos, and Traina (2014). The majority of the studies noted concern TBTF effects in the United States.

[16] Studies on bank bond spreads include Flannery and Sorescu (1996), Balasubramnian and Cyree (2011), Acharya, Anginer, and Warburton (2013), Strongin et al. (2013), Anginer and Warburton (2014) and Santos (2014). CDS spread studies include Demirguc-Kunt and Huizinga (2010) and Li, Qu, and Zhang (2011). Bank stock return studies include Correa et al. (2012).

the behavior of banks due to expectations of external support, such as additional risk-taking, using balance sheet analysis, investigating syndicated loans and using risk-measures such as bank z-scores.[17] Still others investigate purchase premiums that banks pay in mergers and acquisitions in order to enter a defined TBTF category.[18] Finally, another part of the literature attempts to measure the likelihood of a bank receiving government support as well as the influence of such perceived support on bank behavior, by relying on support ratings by credit rating agencies, namely Moody's, Standard & Poor's (S&P) and Fitch Ratings.[19]

The extent to which TBTF effects can be measured in the case of Iceland is very limited. The banking industry in Iceland is made up of four private, universal banks, three of which hold a combined 95.3% of the market share in deposits, or about 31.8% each on average. In other words, there are three large banks and one small bank operating in the market. Such a small 'population' of banks undermines the effectiveness of robustly assessing empirical evidence with statistical analysis. Most of the aforementioned methods used to explicate TBTF effects are inapplicable to the Icelandic banking sector, extremely difficult or even pointless to assess, such as merger premiums and stock returns. Nevertheless, TBTF effects in the Icelandic banking system can be investigated with respect to deposit cost spreads (in light of the importance of deposits in the three largest banks' funding model), maturity mismatching in the banks' loan portfolios, and data related to non-core activities using financial statement analysis.

Studies concerning deposit costs include Baker and McArthur (2009), Jacewitz and Pogach (2013), and Kumar and Lester (2014).

[17] Studies on bank risk-taking include Gropp, Hakenes, and Schnabel (2011), Gadanecz, Tsatsaronis, and Altunbas (2012), Marques et al. (2013) and Afonso, Santos, and Traina (2014).

[18] Merger and acquisition studies include Penas and Unal (2004), Brewer and Jagtiani (2007) and Molyneux, Schaeck, and Zhou (2010).

[19] Studies on the likelihood of government support as well as the effects on banks of rating agencies classifying banks according to such likelihood include Haldane (2010), Molyneux, Schaeck, and Zhou (2010), Gropp, Hakenes, and Schnabel (2011), Lindh and Schich (2012), Hau, Langfield and Marqués-Ibañez (2013) and Afonso, Santos, and Traina (2014).

7.4.1 Cost of deposits

Market perceptions of a subset of banks enjoying a competitive funding edge due to an implicit TBTF subsidy should manifest themselves *inter alia* in deposit funding cost differences between large banks and their smaller competitors. According to such a proposition, large banks considered TBTF tend to offer deposit accounts with rates at a discount from non-TBTF banks, since the expected default risk of lending funds to government-sponsored TBTF banks is considered less risky than lending to banks that are not expected to receive government support. Therefore, depositors discount risk when providing TBTF banks with funding, resulting in a spread between deposit rates of non-TBTF banks and TBTF banks. Table 1 shows demand deposit rates as well as time deposit rates for the four Icelandic banks, as well as rate averages for the three largest banks. The data shows that the three largest banks do in fact have a deposit funding advantage over the smaller bank, Kvika Bank. The spread between the demand deposit rates of Kvika Bank and the average of the three largest banks as of January 1, 2016, is 143 basis points (bps).[20] The spread between time deposit rates is 27 bps. Furthermore, the state-owned bank Landsbankinn has the lowest demand deposit rate, with a spread of 43, 35 and 25 bps compared to Kvika Bank, Arion Bank and Íslandsbanki, respectively.

Table 1. Bank deposit rates and rate spreads, January 1, 2016.[21]

Bank	Demand deposit	Time deposit (36 mo.)*	Time deposit (60 mo.)*
Arion banki	1.35%	1.70%	1.90%
Íslandsbanki	1.25%	1.65%	1.85%
Landsbankinn	1.00%	1.70%	1.90%
Kvika	2.63%**	1.95%	2.15%
Average for three largest banks	1.20%	1.68%	1.88%
Spread	**1.43%**	**0.27%**	**0.27%**

* Price-indexed.

** More accurately 2.625%, or the average deposit rate for individuals (2.60%) and companies (2.65%).

[20] 1 basis point = 0.01%.

[21] Interest rates as of January 1, 2016. Retrieved from the banks' websites. Own calculations.

These results support the proposition that the three largest banks enjoy a funding advantage on their deposits (and, in effect, on the majority of their funding) relative to the smaller competitor on the market. Landsbankinn has the lowest demand deposit rate, which is in line with the fact that deposits at national banks are perceived to be safer and therefore enjoy a more credible implicit guarantee than deposits at privately owned banks. However, it should be noted that it is difficult to isolate the effects of a perceived TBTF policy on deposit rates, as funding cost differences between large and small banks likely incorporate factors that are unrelated to TBTF perceptions.

7.4.2 Loan portfolio

As mentioned in Section 3.1.1, excessive risk taking by a bank due to implicit state funding guarantees may reveal itself in aggressive maturity mismatching, that is, increasingly borrowing short and lending long. Figure 17 shows the loan-to-deposit ratios[22] of the three largest banks between 2008 and 2015. Since 2008, the ratio has decreased for Íslandsbanki and Landsbankinn but increased significantly for Arion Bank. This suggests that deposits, which are inherently short-term, are increasingly being used to financed long-term loans for at least two of the three largest banks.

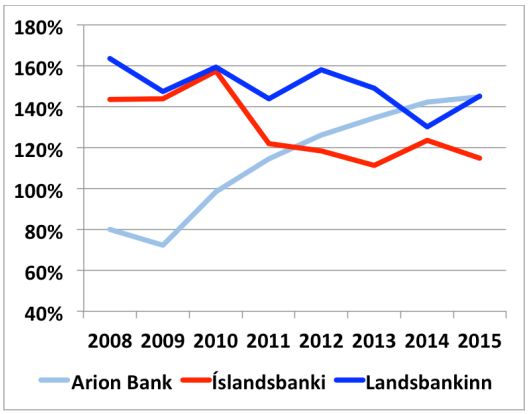

Figure 17. Loan-to-deposit ratios of the three largest banks, 2008–2015.

Source: See footnote 14.

The extent of a bank's maturity mismatching for various maturities can be more accurately measured with the funding gap or the face value of liabilities less assets of a certain maturity. If the funding gap is positive, then liabilities exceed assets of a certain maturity, resulting in a net liability position for that maturity. If it is negative, the

[22] $Loan\text{–}to\text{–}deposit\ ratio = \frac{Total\ customer\ loans\ to\ residents}{Total\ deposits\ from\ residents}$

opposite holds true. Figure 18 displays the aggregate year-end funding gap of the three largest banks.

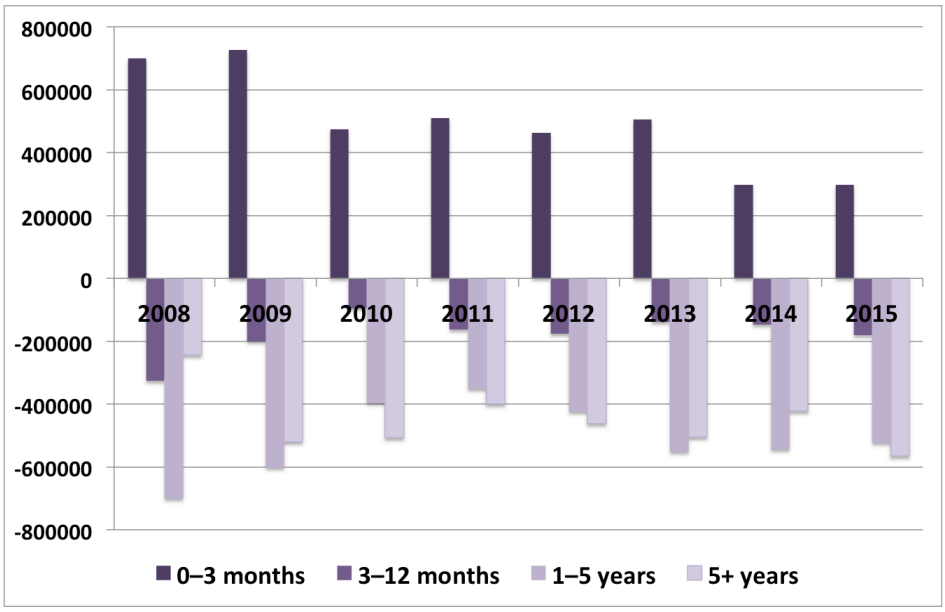

Figure 18. Aggregate year-end funding gap for the three largest banks for various maturities, 2008–2015 (ISK millions).

Source: See footnote 14.

According to the chart, aggregate maturity mismatching for the three largest banks has been most pronounced for the most liquid source of financing (debt of 0–3 month maturity, mostly demand deposits) since 2008. According to their financial statements, Arion Bank and Landsbankinn have more outstanding 0–3 month debt than they do liquid assets, whereas Íslandsbanki does not. Instead, Íslandsbanki has liabilities in excess of assets for a maturity of five years or more. However, the aggregate 0–3 month funding gap has decreased since 2008 and the funding gap for maturities of over 3 months has been negative since 2008. This means that the current banking system does not engage in aggressive maturity mismatching. Short-term maturity mismatching is declining and the three largest banks have assets to cover liabilities with maturities of over 3 months.

Figure 19 shows the 0–3 month funding gap as a percentage of GDP and shows that the time the Icelandic economy would have needed to cover the funding gap resulting from a potential reinvestment cessation has decreased from almost 6 months in 2008 to about 2 months in 2015. The shrinking funding gap for the three largest banks is indicative of a larger margin of safety to cover short-term debts , stronger liquidity positions and more vigilant fractional reserve banking.

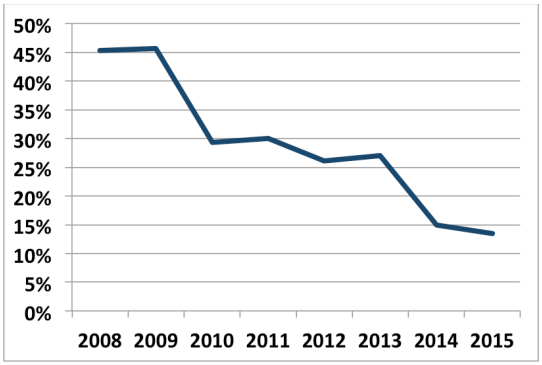

Figure 19. Aggregate 0–3 month funding gap for the three largest banks relative to GDP, 2008–2015.[23]

Besides more intense maturity mismatching, an increasingly risky loan profile due to implicit TBTF support could be demonstrated in a bank's ratio of nonperforming loans[25] due to the adverse selection of weak, high-yield borrowers. In the case of the Icelandic banking system, the average nonperforming loans ratio for the banking system has declined rapidly, from about 28% to 2.6% in five years, indicating no excessive risk-taking in the banks' loan portfolios. This is displayed in Figure 20. A catalyst for this trend has been the improving economic environment of the past years and increased borrower credit quality. The ratio of nonperforming loans also serves as an indicator of the efficiency of resource allocation, since a high level of nonperforming

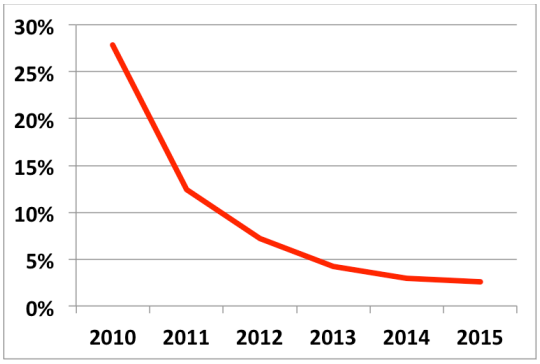

Figure 20. Average nonperforming loans ratio for the three largest banks, 2010–2015.[24]

[23] Sources: Arion Bank (2008–2015), Íslandsbanki (2008–2015), Landsbankinn (2008–2015), Statistics Iceland (2016b), own calculations.

[24] Sources: Arion Bank (2010–2015), Íslandsbanki (2010–2015), Landsbankinn (2010–2015), own calculations.

[25] $$Nonperforming\ loans\ ratio = \frac{Individually\ impaired\ loans\ to\ customers}{Total\ customer\ loans}$$

loans indicates widespread liquidations of unproductive investment projects and capital erosion. An erosion of capital furthermore depletes a bank's reserves, exposing it to insolvency and potential failure. According to this, capital is increasingly being put to productive uses in the Icelandic economy. As such, resource misallocation due to TBTF perceptions may be minimal.

Although the loan-to-deposit ratios of the three largest banks suggest that implicitly guaranteed deposits are increasingly being used to finance customer loans for two of the three banks, the data presented in this section suggests that the three largest banks, on the whole, are not taking on excessive risk in their loan portfolios, contrary to what might be expected in light of the short-term nature of the banks' deposit-funding model as well as the CBI's liquidity backstop. This is reflected in a decreasing 0–3 month funding gap and a net asset position for other maturities, as well as a decrease in nonperforming loans for the whole banking system.

The extent to which the three largest banks are able to maximize the value of their implicit TBTF subsidy by taking on more risk in their loan portfolio is constrained by a number of limiting factors. Credit demand in the post-crisis economy remains low, which is reflected in a stable level of household loans since 2008 as well as declining loans to businesses, which have remained sluggish since 2014 (Central Bank of Iceland, 2016e). While private- and household debt as a percentage of GDP has decreased, debt levels are still high (Financial Supervisory Authority, 2015). Instead of financing new investments, domestic market participants have used resources to pay down debt. Additionally, according to a recent Deloitte survey among financial managers in Iceland, bank credit is becoming increasingly unpopular due to high interest rates on bank loans as well as the risks associated with maturity mismatching, making corporate bond issuance the preferred method of financing (Deloitte, 2015). The banks must also be liquid when capital controls are lifted due to outflows of short-term funds from non-residents. According to recent announcements from the Ministry of Finance and Economic Affairs as well as the CBI, this may happen sooner rather than later, as an auction of offshore ISK is planned for the first half of 2016.

7.4.3 Risk-related financial ratios

Measuring the incremental effects of increased risk taking due to expected government support and moral hazard in isolation is an impossible task. Moral hazard is, by nature, unobservable and involves hidden action (Holmström, 1979). However, it can be useful to observe trends in banking activities and approximations as to how risky the banking environment is, in order to illuminate the TBTF problem and its possible effects. The following ratios will be analyzed: Tier 1 risk-based capital ratio, ratio of risk-weighted assets to GDP, return on assets and non-interest income ratio.

7.4.3.1 Tier-1 capital ratio

The traditional rationale behind capital requirements is that capital acts as a protection buffer against unexpected losses, since capital needed for such protection is closely related to the risk profile that leads to those losses. As such, higher capital ratios have been suggested as a measure to reduce the TBTF problem. High-risk banks therefore tend (according to regulatory requirements) to hold higher capital than less risky banks (Afonso, Santos and Traina, 2014). (Alternatively, a risky financial environment induces banks to hold higher capital.) From this perspective, the Tier 1 risk-based capital ratio can capture a bank's inherent riskiness. Tier 1 capital is core capital or basic equity, comprised primarily of common stock and disclosed reserves. The Tier 1 risk-based capital ratio is the ratio of a bank's Tier 1 capital to its total risk-weighted assets (RWA), which are a bank's assets weighted by credit risk. As such, the ratio takes into account the riskiness of a bank's asset portfolio. Under the Basel III accord, the minimum Tier 1 capital ratio is 6% (Basel Committee on Banking Supervision, 2011).

Figure 21 shows the upward-trending average Tier 1 capital ratio for the three largest banks in Iceland between 2009 and 2015. Between 2009 and 2015, the Icelandic banks' average ratio increased from about 15% to 27.3%. Prior to 2007, the Icelandic banks' capital ratios were between 7–8% (The World Bank, 2015). In contrast, the average ratio of a sample of 56 European Union banks increased from about 10% to just over 13% (Financial Supervisory Authority, 2015). Relative to the EU sample, the equity positions of the largest Icelandic banks are strong. Nevertheless, the increasing ratio hints at the inherent riskiness of the Icelandic banking system.

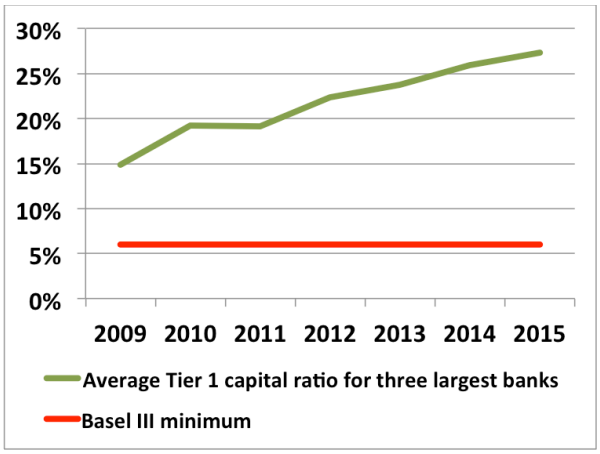

Figure 21. Average Tier 1 capital ratio for the three largest banks, 2009–2015.[26]

7.4.3.2 Risk-weighted assets to GDP

One of the Independent Commission on Banking's (2011) recommendations for capital change in the so-called Vickers Report was that banks should have equity-to-RWA ratios of at least 10% if they have RWA-to-GDP ratios of 3% or more. This serves as an approximation of a TBTF threshold, since the failure of such banks would impose costs on the economy in excess of the annual benchmark cost of a bank crisis (3% of GDP). The RWA-to-GDP ratios of the Icelandic banks, as of year-end 2015, are presented in Table 2. The three largest banks in Iceland surpass the threshold by a factor of nearly 12, whereas the smallest bank (Kvika Bank) does not pass the TBTF threshold.

[26] Sources: Arion Bank (2009–2015), Íslandsbanki (2009–2015), Landsbankinn (2009–2015), own calculations.

Table 2. RWA-to-GDP ratios of the banking system, year-end 2015.[27]

Bank	RWA-to-GDP
Arion Bank	36.6%
Íslandsbanki	31.7%
Landsbankinn	39.2%
Kvika Bank	1.3%

While higher equity requirements are to some extent meant to reduce the TBTF problem, they nonetheless reflect inherent risk in the banking system. Systemic risk and fragility in the banking system is acknowledged by a high (increasing) average Tier 1 capital ratio of the three largest banks, as well as high RWA-to-GDP ratios relative to other European banks. What these statistics suggest is that the Icelandic banking system is inherently risky.

7.4.3.3 Return on assets

Return on assets (ROA)[28] is a financial ratio that indicates the degree to which a company's assets produce net income and therefore captures a company's capital utilization, managerial productivity, and asset profitability. Banks with high ROA typically have riskier asset portfolios and good risk management. As such, ROA can be viewed as a proxy for the risk preference of a bank (Afonso, Santos and Traina, 2014). Figure 22 shows the average ROA of the three largest banks between 2009 and 2015. If ROA is seen as a proxy for risk preference, then the graph shows that the banks' asset portfolios have become riskier since 2011, increasing ROA from 1% to almost 4%.

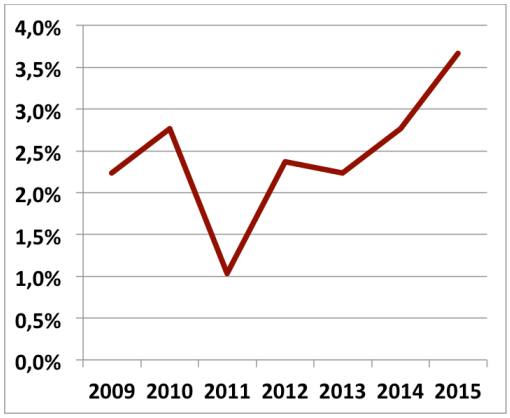

Figure 22. Average return on assets for the three largest banks, 2009–2015.

Source: See Footnote 24.

[27] Sources: Arion Bank (2015), Íslandsbanki (2015), Kvika Bank (2015), Landsbankinn (2015), Statistics Iceland (2016b), own calculations.

[28] $ROA = \frac{Net\ income}{Average\ total\ assets}$

7.4.3.4 Non-interest income

Another manifestation of bank risk-taking is the non-interest income ratio[29], which measures gains on assets as distinct from the interest income on a bank's loan portfolio from non-core activities such as investment banking, asset management, advisory and brokerage activities, and proprietary trading. Non-interest income is associated with volatile bank returns and it has been argued that banks with high non-interest income contribute more to systemic risk than traditional financial intermediaries (Brunnermeier, Dong and Palia, 2012). Figure 23 shows the average non-interest income ratio of the Icelandic banking system between 2001 and 2015. The ratio has increased steadily between 2012 and 2015, from 35% to almost 55%. This is indicative of greater risk-taking and profitability from non-core activities as of 2012. Nonetheless, the post-crisis risk-taking in that regard does not match the pre-crisis risk-taking, with the non-interest income ratio reaching 80% in 2006.

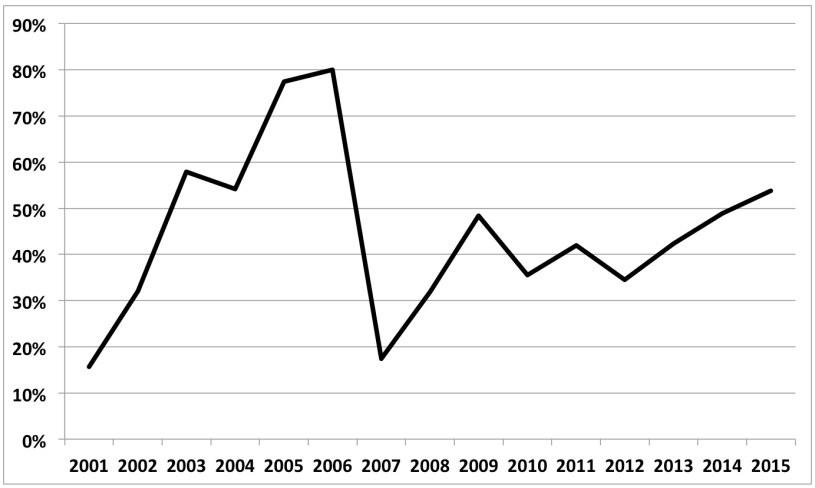

Figure 23. Average non-interest income ratio for the three largest banks, 2001–2015.[30]

Interestingly, whereas a less risky loan portfolio contradicts the TBTF hypothesis, it is supported by slightly more risk taking with respect to non-core activities. If ROA is taken as a proxy for a bank's risk preference, then the three largest banks' risk preference has

[29] $Non\text{–}interest\ income\ ratio = 1 - \frac{Net\ interest\ income}{Total\ operating\ income}$

[30] Sources: Arion Bank (2009–2015), Federal Reserve Bank of St. Louis (2015), Íslandsbanki (2009–2015), Kvika (2015), Landsbankinn (2009–2015), MP Bank (2009–2014), own calculations.

increased since 2011. Additionally, the average non-interest income ratio for the three largest banks has increased since 2012, reaching about 54% of total income, indicating greater risk-taking and profitability from non-core activities in recent years.

7.4.4 Capital controls, correlation and total risk

There are two additional risk factors present in the banks' portfolio management that are not accounted for in the preceding analysis, but are nonetheless worth mentioning since they aggravate the TBTF problem. Both stem from capital controls. Firstly, capital controls limit investment opportunities and security selection to domestic markets. Capital controls therefore shift the banks' minimum-variance frontier, which is a graph of the lowest portfolio risk that is attainable for a given portfolio expected return, to the right, reflecting a smaller opportunity set for their risk portfolios. The effect is shown in Figure 24. Combined with the small size of the domestic economy, this makes the banking system's risk profiles nearly identical and their exposures more correlated, which affects the shape of the frontier. For example, a drop in the price of an asset that all three banks are exposed to could result in significant portfolio losses, possibly leading to fire sales and insolvency.

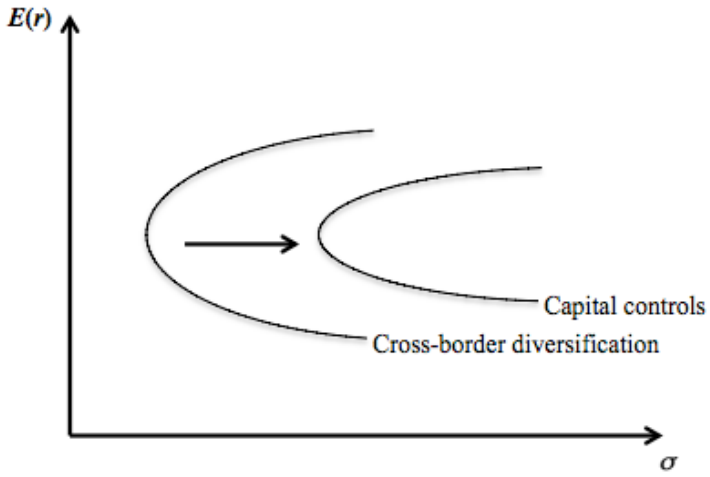

Figure 24. Minimum-variance frontier with capital controls.

Source: Own elaboration.

Secondly, capital controls increase total portfolio risk. According to modern portfolio theory, the total risk associated with managing an asset portfolio can be divided into unsystematic risk and systematic risk. Unsystematic risk is firm-specific and uncorrelated to the market. It is diversifiable as long as financial assets with less than a perfectly positive correlation to the portfolio are added to the portfolio according to the diversification effect. Systematic risk is inherent to the entire market and affects the overall market, although it affects particular industries and firms differently according to their sensitivity to the business cycle and macroeconomic factors. It is non-diversifiable, although it can be reduced via cross-border diversification but not eliminated since international asset returns are correlated. According to the law of large numbers, unsystematic risk is reduced and converges towards systematic risk as the variety of financial assets (*n*) in the portfolio increases (Bodie, Kane and Marcus, 2014). However, by limiting the investment opportunity set and containing risk to the domestic economy, capital controls cap the variety of financial assets, thereby limiting the extent to which unsystematic and systematic risk can be diversified. In other words, capital controls increase total risk. The effect of capital controls on total risk is shown in Figure 25. By limiting the investment menu, the probability distributions of bank portfolio returns may also exhibit kurtosis risk by making returns more prone to tail risk, that is, a higher probability of large losses relative to a normal distribution.

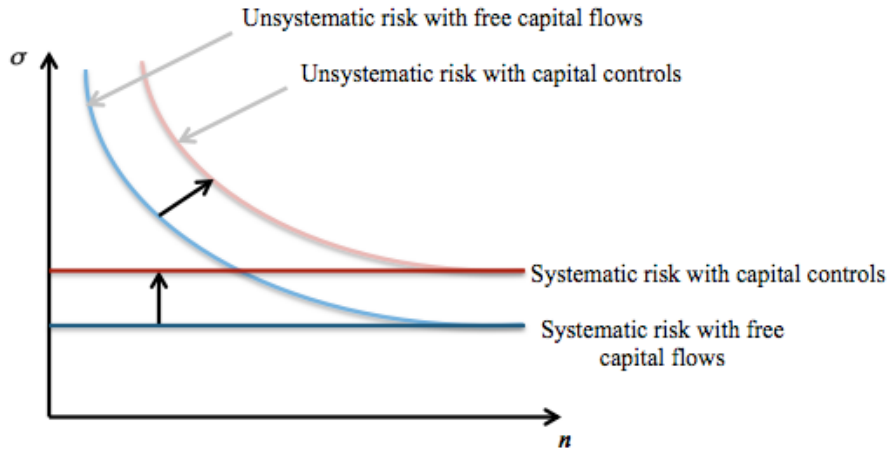

Figure 25. Total risk with capital controls.

Source: Own elaboration.

Besides contributing to the increased systemic importance of each of the three largest banks, capital controls also increase systemic risk, which means that the banks operate in an environment where diversifiable risk is contained within the system. Since the banks' risk profiles are most likely more correlated, there is an increased probability of large, correlated portfolio losses within capital controls. Capital controls could therefore make the three largest banks more likely to be considered TBTF.

8 Discussion: The Nature of the TBTF Problem in Iceland

"To see what is in front of one's nose needs a constant struggle."

George Orwell (1903–1950)

In light of the preceding analysis, it may be argued that the TBTF problem is in fact relevant to the current banking system, and even more so than to the previous system. However, to what extent is it relevant? What is the nature of the TBTF problem in Iceland? The nature of the TBTF problem in Iceland is primarily characterized by four factors.

1. **The three largest banks are currently more systemically important than other Icelandic banks in recent history. This is supported by a steady downsizing of the banking sector relative to GDP, greater post-crisis concentration in the banking sector with respect to bank assets, deposits and loans, as well as their funding model, which is mostly defined by the implicitly guaranteed domestic savings pool. Additionally, capital controls increase both diversifiable and non-diversifiable risk by limiting the banks' investment opportunities to the domestic market. Along with the small size of the domestic market, capital controls make the banks' risk profiles more correlated. However, interconnectedness in the post-crisis banking system has declined due to less activity in the interbank market. According to the theoretical discussion in the first half of the paper, these factors make the three largest banks more likely to be considered TBTF.**

2. **The TBTF problem in Iceland is defined by the argument that a possible TBTF policy would only apply to depositors and not other categories of bank debtors. The Emergency Act changed the nature of the TBTF problem. Prior to the financial crisis of 2008, depositors and senior unsecured debt holders were *pari passu*. The pre-crisis TBTF perception of European banks, including the Icelandic banks, was therefore characterized by the fact that, in order to keep systemically important banks afloat, both depositors and unsecured bondholders had to be reimbursed with government support if TBTF banks**

could not honor claims on their asset pools. By granting depositors a higher claim on assets at the expense of holders of bank debt, it may be argued that the likelihood of government support for bank debtors other than depositors has mostly disappeared, which is reflected in the banks' minimal wholesale funding and elevated use of covered bonds. The TBTF problem in the current banking system is therefore primarily defined by potentially unlimited deposit insurance, which amounts to the guaranteeing of about half of the largest banks' funding model.

3. **Three possible sources of moral hazard define the TBTF problem in Iceland. An explicit, unbinding statement of full deposit coverage is still outstanding, which may give rise to moral hazard by disintegrating the monitoring mechanism of depositors and encouraging the banks to take on more risk. Alternatively, it may also be argued that the government's statement amounts to nothing more than "noise," and that the banks inevitably possess implicit government guarantees on the majority of their funds in light of their systemic importance. The existence of a lender of last resort may also expand the safety net enjoyed by the banks. In light of the banks' deposit-funding model, the banks may face a moral hazard to take on more risk in their liquidity management due to an implicit liquidity backstop. The third source of possible moral hazard is the government's pre-crisis plan to nationalize a significant part of the banking system and offer liquidity support, since it hints at a propensity to support the largest banks in times of distress. As long as the three largest banks do not outgrow the nation's fiscal and monetary capacity to support, this source of moral hazard may be relevant.**

4. **The "undesirable effects" of the TBTF problem discussed in Chapter 3 in relation to the Icelandic banking system are limited. Although the largest banks enjoy a competitive edge relative to the smallest competitor in the form of lower deposit costs, the banks' loan portfolio risk has decreased, which seemingly contradicts the TBTF hypothesis, whereas higher returns from non-core activities may point to an increased tolerance for risk outside of the loan portfolio. The banks may not be maximizing the value of their implicit**

government guarantee due to exogenous factors such as limited credit risk and limited investment opportunities.

Besides posing a potential problem for public finances, the statement of full deposit coverage for residents still outstanding, which is a contingent public liability, may also give rise to a principal–agent problem between depositors and their bank. The statement gives the government a certain flexibility in responding to a potential banking crisis, but its ambiguity may nonetheless spur a guessing game that affects incentive structures and market outcomes. Should full deposit coverage fail to materialize, significant portfolio losses could be borne by depositors should the banking system be allowed to collapse if the banks are unable to honor claims on their asset pools. In light of the three largest banks' increased systemic importance, this seems unlikely. However, it is still a possibility, making depositors potentially exposed to hidden tail risk. The government's statement of full coverage may therefore turn out to be costly in three ways. Expectations of coverage and market distortions, such as the mispricing of risk, have associated efficiency costs. Expected coverage may then turn out to be accurate, leading to great fiscal and accounting costs financed by government debt through future transfers, making the taxpayer the *de facto* insurer of the banks' private risk-taking. It may also be overestimated and fail to materialize, resulting in the widespread erosion of nearly the entire Icelandic savings pool if the banks engage in intense maturity mismatching, a systemic banking collapse, and the collapse of the payment and clearing system, with grievous costs to the real economy.

9 Conclusion

As a contribution to the discussion of the state of the post-crisis banking system in Iceland, the objective of this thesis was to investigate the extent to which the TBTF problem is relevant to the current banking system. According to an analysis of the banks' financial statements and the structure of the banking system, as well as the identification of possible sources of moral hazard, evidence is found that supports the view that the TBTF problem, the features of which were discussed in the first half of the paper, is in fact relevant to the Icelandic banking system, and even more relevant to the current banking system than to the pre-crisis system. The three largest banks are more systemically important in the current banking sector relative to the three largest banks of the previous system, notwithstanding the fact that they are about four times smaller in size according to assets. Financial intermediation and risky investment banking activities are mostly financed by the domestic pool of household and corporate savings. In light of both the nominal yet unbinding guarantee of domestic deposits and the three largest banks' increased systemic importance, the largest banks may enjoy a TBTF subsidy on nearly two-thirds of their liabilities. Depending on the banks' risk-taking, which is currently limited due to exogenous constraints, this could be problematic for depositors and the overall economy. Increasing short-term exposure, such as by widening the funding gap, could lead to capital erosion if the market loses confidence in the banks, while a TBTF deposit insurance policy would cripple the economy. Whereas a fiscal and monetary TBTF policy was impossible with respect to the three largest banks of the old banking system, it is a legitimate, although costly, possibility for the current system in light of its smaller size, its deposit-funding model, and the existence of capital controls. As public finances improve and the banking system diminishes in size relative to the economy, such a policy becomes increasingly more credible.

Although the focus of the paper has been on the positive economics of the TBTF issue in Iceland as opposed to its normative aspect, it is clear that regulators must work towards minimizing the adverse contagion effects associated with the failure of systemically important banks, limiting the effect of banks on systemic risk, and preventing taxpayer-funded bailouts of TBTF banks. In the meantime, the TBTF problem remains relevant, until the banking system becomes TBTS yet again.

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