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The Economic Theory of Bank Regulation and the Redesign of Switzerland's Lender of Last Resort Regime for the Twenty-First Century

THESIS

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by
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Executive Summary

In the aftermath of the 2007–2009 financial crisis, several regulatory measures have been proposed and implemented in the banking sector. However, these regulations are the subject of ongoing debate because there is no consensus in academia regarding why banks are regulated. In addition, these regulations do not definitively exclude the possibility that a systemically important bank in Switzerland (or elsewhere) will receive emergency liquidity assistance by the central bank as the lender of last resort in the future. Thus, further consideration is needed regarding the lender of last resort because the financial crisis of 2007–2009 has underscored the important role of this type of lender in restoring financial stability. Therefore, the aims of this thesis are to elucidate a comprehensive economic theory of bank regulation, on the one hand, and a well-designed lender of last resort scheme for Switzerland for the twenty-first century, on the other.

The economic theory of bank regulation draws upon the economic theory of regulation and the financial intermediation theory of banking. We extend the micro-based approach with a macro-based approach and develop an alternative regulatory view based on the endogenous nature of money and credit. Moreover, we elaborate a novel systematisation scheme to improve classification in bank regulation as an integrated part of our theory. In light of these schemes, we analyse and suggest reforms to current bank regulations because they fail to address several problems (such as the risk manipulation associated with risk-weighted capital regulation). Furthermore, we develop an alternative regulatory proposal based on the main causes of the 2007–2009 crisis.

To redesign a potential lender of last resort scheme for Switzerland for the twenty-first century, we analyse the nature of the lender of last resort and conduct a literature review of the different schools of thought. We thereby introduce two new schools of thought. Further, we analyse the history of the lender of last resort in Switzerland and empirically investigate its role in the 2007–2009 Union Bank of Switzerland (UBS) crisis. In this connection, we elaborate a novel solvency framework as an early-warning system for central banks and regulators. Based on all these considerations, we redesign Switzerland's lender of last resort regime for the twenty-first century.

This dissertation establishes for the first time a complete and comprehensive economic theory of bank regulation in the twenty-first century and a lender of last resort regime for Switzerland that is more effective, timely, sustainable and credible than the status quo.

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Antonios Koumbarakis

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Abbreviations

ABRRs	Asset-Based Reserve Requirements
ABSs	Asset-Backed Securities
AEoI	Automatic Exchange of Information
AIG	American International Group
Art.	Article
ASF	Amount of Stable Funding
BA	Federal Act on Banks and Savings
BB	Regulation of Banks and Banking
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
BoE	Bank of England
CCB	Countercyclical Capital Buffer
CCFA	Control Committees of the Federal Assembly
CDOs	Collateralised Debt Obligations
CFTC	US Commodity Futures Trading Commission
CoCos	Contingent Convertible Capital
CRA	US Community Reinvestment Act
CRD IV	Capital Requirements Directive IV
DCF	Discounted Cash Flow
DFA	Dodd-Frank Wall Street Reform and Consumer Protection Act
DRCM	Dillon Read Capital Management
DW	Discount Window
ECA	Emergency Capital Assistance
ECB	European Central Bank
ELA	Emergency Liquidity Assistance
FAZ	Frankfurter Allgemeine Zeitung
FCA	Financial Conduct Authority
FCO	Fiscal Carve-Out
FCSC	Federal Constitution of the Swiss Confederation
FDF	Federal Department of Finance
FDIC	Federal Deposit Insurance Corporation
Fed	Federal Reserve

FER	Fachkommmision Empfehlung zur Rechnungslegung
FFA	Federal Financial Administration
FIH	Financial Instability Hypothesis
FINMA	Swiss Financial Market Supervisory Authority
FinSA	Financial Service Act
FinTech	Financial Technology
FOPI	Federal Office of Private Insurance
FSB	Financial Stability Board
FTA	Federal Tax Administration
FX	Foreign Exchange
GDP	Gross Domestic Product
G-SIBs	Global Systemically Important Banks
HQLAs	High Quality Liquid Assets
IFRS	International Financial Reporting Standards
IMF	International Monetary Fund
KIID	Key Investor Information Document
LCR	Liquidity Coverage Ratio
LOLR	Lender of Last Resort
MBS	Mortgage-Backed Securities
MCNs	Mandatory Convertible Notes
ME	Multiple-Entry
MiFID	Markets in Financial Measures Directive
MLCA	Money Laundering Control Authority
MMLR	Market Maker of Last Resort
MoU	Memorandum of Understanding
NBA	National Bank Act
NBFIs	Non-Bank Financial Institutions
NBNFIs	Non-Bank Non-Financial Institutions
NSFR	Net Stable Funding Ratio
OBSEs	Off-Balance-Sheet Entities
OCC	Office of the Comptroller of the Currency
OECD	Organisation for Economic Cooperation and Development
OMOs	Open Market Operations
OTC	Over-the-Counter

Para.	Paragraph
PK	Post-Keynesian
PoNV	Point of Non-Viability
PRA	Prudential Regulatory Authority
PwC	PricewaterhouseCoopers
QE	Quantitative Easing
REPO	Repurchase Agreements
RESI	Real Estate Securities Inc.
RIH	Regulatory Instability Hypothesis
RSF	Required Amount of Stable Funding
SBA	Swiss Bankers Association
SCC	Swiss Criminal Code
SEC	Securities and Exchange Commission
SFBC	Swiss Federal Banking Commission
SFGB	Swiss Federal Gaming Board
SIBs	Systemically Important Banks
SIF	State Secretariat for International Financial Matters
SIX	Swiss Infrastructure and Exchange
SLT	Spar- und Leihkasse Thun
SNB	Swiss National Bank
SPoE	Single Point of Entry
SPV	Special Purpose Vehicle
SRF	Single Resolution Fund
UBS	Union Bank of Switzerland
UBS RESI	UBS Real Estate Securities Inc.
US GAAP	US Generally Accepted Accounting Principles
VaR	Value at Risk

Introduction

Motivation and problem statement

'It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so'.

Mark Twain (1835 -1910), American author

Although there is no evidence in the literature that Mark Twain is actually responsible for the instructive quotation above, this conventional wisdom emphasises the danger of "knowing" something that simply may not be true. In this sense, as this thesis began to take shape in 2013, we believed that the current banking regulations would eliminate the risks associated with systemically important banks (SIBs)[1] and the problems posed by SIBs in connection with emergency liquidity assistance (ELA) by the lender of last resort (LOLR), such as moral hazard and adverse selection. However, the deeper we delved, the more we began to question the efficiency and effectiveness of current bank regulatory measures (such as capital requirements, liquidity requirements and recovery and resolution standards) because of the following issues: (1) There is no consensus in academia regarding why banks are regulated. (2) The regulatory measures are not objective-oriented with regard to the problems related to the main causes of the recent financial crisis. (3) The total economic costs and benefits of the measures are disputed because, as stated by Hellwig (2010b: 2), '[t]he Basel Committee does not, however, present any systematic analysis of why the proposed measures should have the salutary effects that are expected of them'. (4) The internal ratings-based approach used by SIBs to calculate risk-weighted capital (a) is a source itself of risk manipulation—in this sense, Hellwig (2016: 24) concludes that '[c]alibrating regulatory requirements to risk-weighted assets is problematic because risk weights are highly unreliable; the statistical basis for determining risk weights is insufficient and the procedure lends itself to manipulation, including manipulation by subunits of the regulated unites. Important risks are not even consistently covered [(such as systemic risk and so forth)]'—and (b) reduces capital requirements because 'it allows banks to reduce the equity requirements by concentrating on investments [(Greek government bonds and so forth)] that the regulation treats as safe' (Admati and Hellwig 2013: 183). (5) The fact that certain

[1] 'Systemically important banks are banks, financial groups and bank-dominated financial conglomerates whose failure would do considerable harm to the Swiss economy and the Swiss financial system' (Art. 7 para. 1 of the BA 2015 [1934]; trans., see section 7.2.1).

government bonds, such as Greek government bonds, are weighted at zero risk calls into question the very nature of both capital and liquidity requirements. (6) 'A liquidity requirement is an oxymoron. If you have to continue to hold an asset to meet requirements, it is not liquid' (Goodhart 2010: 175). (7) Considering sub-prime mortgage securities (with credit ratings of AA and higher) as liquid assets (such as level 2B assets) questions liquidity regulations to a certain degree because if sub-prime mortgage securities are downgraded to junk bonds (as in the most recent financial crisis), it is difficult to imagine that these assets are liquid. (8) According to recovery and resolution standards, recovery plans are helpful. However, additional funding is required to wind down an SIB that is not guaranteed by the recent standards because '[d]iscussions about the funding of recovery and resolution procedures usually pay too little attention to the distinction between the need to fund operations as long as they are ongoing and the need to allocate or to absorb ultimate losses' (Hellwig 2014a: 19). Notably, the list of these problematic matters is not exhaustive, and additional issues that are not included herein may appear. Consequently, following Mark Twain, it is what we know for sure about bank regulation that gets us into trouble. Therefore, the above-mentioned bank regulation deficiencies require a comprehensive economic theory of bank regulation with continuing calls for further reforms.

To fill this gap in the literature, this thesis first aims to elaborate a comprehensive theory of bank regulation that is grounded in economics, a so-called 'economic theory of bank regulation'. This under-researched academic field was highlighted by the law and economics approach to banking regulation at the Second International Workshop of the Center for the Study of the New Institutional Economics at the University of Saarland, which convened on June 14, 1989, at Schloss Halberg, Saarbrücken. At this workshop, Prof. Dr. Ernst Baltensperger introduced what is likely the first contribution to the field regarding an economic theory of bank regulation. In this sense, we accept the majority of the positions articulated by Dr. Baltensperger and extend the idea to a contemporary context, thus offering the first comprehensive economic theory of bank regulation of the twenty-first century that is based upon an economic theory of regulation and a financial intermediation theory of banking. However, the 2007–2009 financial crisis has called into question exclusive reliance on the micro-based approach to the financial intermediation theory of banking. Therefore, we extend the micro-based approach with a macro-based approach and develop an alternative regulatory view derived from the endogenous nature of money and credit. Moreover, we elaborate a bank regulation systematisation scheme that produces a better classification of bank regulations and propose a revision of the main regulatory measures – or a replacement of them with alternative

proposals – based on the main causes of the most recent financial crisis. However, neither of these proposals can definitively exclude the possibility that SIBs in Switzerland (or elsewhere) will receive ELA from the LOLR in the future. As Grossmann and Rockoff (2015: 58) noted concerning the LOLR concept, 'more rethinking of the LOLR doctrine is needed' because the financial crisis of 2007–2009 has shown the important role of the LOLR in restoring financial stability.

To examine the LOLR role, the Bank for International Settlements (BIS) held a workshop entitled, 'Re-thinking the Lender of Last Resort'. At the 2014 workshop, Paul Tucker, the former deputy governor for financial stability at the Bank of England, offered several useful principles for redesigning the LOLR regime to fit the principles of modern central banking. Nonetheless, certain problems remained from a Swiss perspective: (1) the workshop did not provide any analysis of the LOLR in Switzerland; (2) the literature lacks a systematic analysis of the LOLR in Switzerland; and (3) the role of the LOLR in the 2007–2009 financial crisis remains ambiguous and unresolved. Therefore, to fill this research gap, the second objective of this dissertation will be to elaborate a substantive LOLR regime for Switzerland that should be more effective, timely, sustainable and credible than the current regime. For this purpose, we conduct a literature review of the various schools of thought and introduced two new perspectives. Moreover, we historically analyse the role of the LOLR in Switzerland and investigate this role in the UBS crisis of 2007–2009. Thereby, we elaborate a solvency framework as an early-warning system for central banks and regulators. In a nutshell, the redesigned LOLR regime (1) mitigates ELA problems, (2) enhances the financial stability of the banking sector, (3) increases market discipline, and (4) enables other central banks to rethink their role in the prevention, management and resolution of financial crises.

Research questions and outline of the thesis

To achieve the above-mentioned objectives, open research questions are introduced that will be answered in this thesis. In this sense, the following main questions can be derived and are addressed in this dissertation:

Research question 1: Why do we regulate banks?

- What is a bank, and what is bank regulation?
- What are the economic rationale and objectives of bank regulation?
- How can we classify regulatory measures in the banking industry?
- What are potential reform proposals for the recent regulatory measures?
- How could an alternative regulatory proposal be designed?

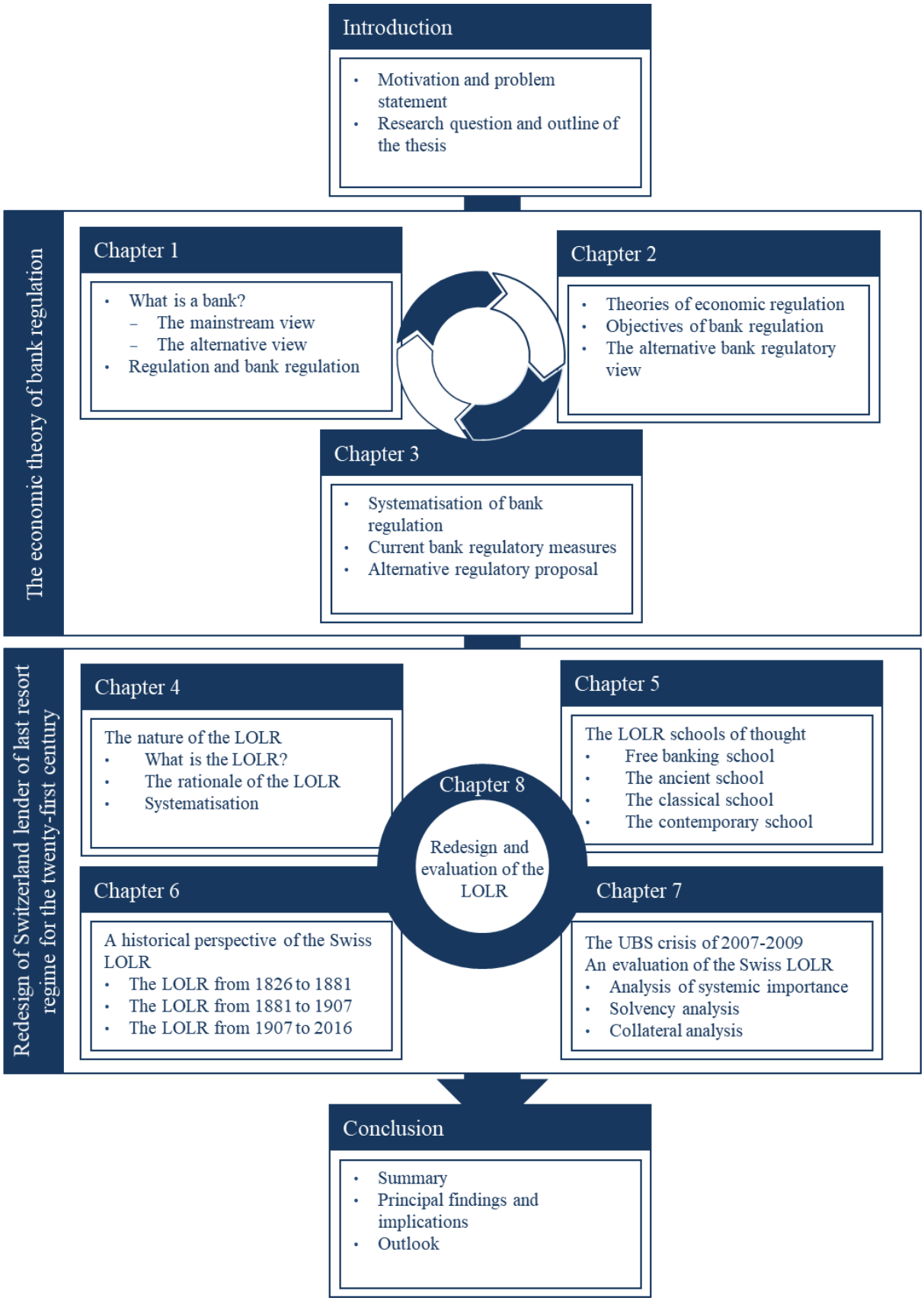
Research question 2: How can a potential Swiss LOLR regime for the twenty-first century be outlined?

- What is the LOLR, and why does it exist in Switzerland?
- What are the LOLR schools of thought?
- What conditions apply to the LOLR in Switzerland?
- Can its role be carried out via open market operations?
- Should the Swiss LOLR provide liquidity assistance to non-bank financial institutions?
- Should the Swiss LOLR provide liquidity assistance against wide or narrow classes of collateral?

To answer the first and second question sets, we divide this thesis into two parts: (1) the development of an economic theory of bank regulation and (2) a redesign of Switzerland's LOLR for the twenty-first century. The thesis is organised as follows.

The first part is divided into three chapters, which together formulate a comprehensive economic theory of bank regulation. The first chapter defines the main banking and bank regulation terms that are used throughout the manuscript. In this context, we define the term 'bank' both under the mainstream view that draws upon the dominant financial intermediation theory and under the alternative view grounded in the endogenous nature of money and credit. Chapter 2 presents the relevant theories of economic regulation and applies them in the banking context. In addition, we describe the objectives of regulation that justify regulatory measures in the banking industry. In this sense, we extend the micro-based approach with a macro-based approach that helps us classify the regulatory objectives conclusively. In addition, we present an alternative bank regulatory justification based on the alternative view articulated in chapter 1. Chapter 3 elaborates an alternative systematisation scheme to classify bank regulations more effectively. In the next step, we describe the most common regulatory measures and briefly analyse recently enacted regulatory measures, such as capital requirements, liquidity requirements and recovery and resolution standards. In this context, we propose options for

reform and ultimately design an alternative regulatory proposal based on the lessons learned during the most recent financial crisis. Although these measures mitigate the risk posed by SIBs to a certain degree, they do not completely exclude the possibility that an SIB will be allowed to fail in the future. With regard to LOLR, 'more rethinking of the LOLR doctrine is needed' given the important role of the LOLR in restoring financial stability in times of financial distress (Grossmann and Rockoff 2015: 58). Therefore, in addition to both our reform proposals and our alternative regulatory proposal, the second part of this dissertation aims to design a substantive LOLR regime for Switzerland to meet the challenges of the twenty-first century. In this context, chapter 4 elucidates the very nature of the LOLR. In other words, chapter 4 defines the term 'LOLR', explains the rationale for having an LOLR and provides a systematisation of the LOLR that is grounded in the systematisation scheme articulated in chapter 3. Chapter 5 elaborates a scheme to analyse the various schools of thought in the literature, including two new schools of thought that have extended the literature in this regard. Chapter 6 sheds light on the history of the LOLR in Switzerland. Chapter 7 empirically analyses the role of the Swiss LOLR in the UBS crisis of 2007–2009, drawing upon multiple sources, including all UBS quarterly and annual reports from 2007 through 2009, shareholder reports on UBS write-downs and so forth. Based on these sources, we assess whether UBS was systemically important, solvent and holding sufficient collateral at the time of ELA. Chapter 8 redesigns Switzerland's LOLR for the twenty-first century by drawing upon the considerations and principles elaborated in chapters 4, 5, 6 and 7. Moreover, chapter 8 provides a qualitative assessment of the LOLR. All findings and implications of this thesis are summarised in the conclusion. In addition, we present an outlook that offers fertile ground for further academic research in this area. The figure below illustrates the outline of this thesis.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Part I – The economic theory of bank regulation

1. The nature of banking and bank regulation

Achieving a clear understanding and definition of the concept of bank regulation is difficult because (1) the phrase contains two different terms, namely, 'bank' and 'regulation', and (2) both terms are considered differently; for example, the term 'bank' is defined differently in the legal and economic contexts, whereas regulation is concerned with the new political economy (public choice theory), cartel theory, and various contributions from regulations, market structure, behaviour and the results of studies in various industries. Thus, (3) the term 'regulation' is frequently found in legal and economic contexts but with various meanings, and (4) it involves a number of different regulations that vary to a considerable degree (self-regulation and government regulation). This chapter focuses on the definition of the terms 'bank' and 'bank regulation' from an economic perspective. In a first step, we define the term 'bank'. In this sense, it is necessary for regulation to focus systemically on selected industries (in our case, the banking sector) and their corresponding activities (see Selznick 1985). In a second step, we define the term 'regulation/bank regulation'.

1.1. What is a bank?

1.1.1. The mainstream view

Banks can be defined in numerous ways. In the literature, the term 'bank' can be defined using the legal or economic definition. To reduce the scope of this problem, only commercial banks in Switzerland are considered here. In Switzerland, the term 'bank' is defined by the Swiss Financial Market Supervisory Authority (FINMA). According to Art. 2 para. 1, 2 and 3 of the Bank Ordinance (BO) (2016 [2014]; trans) the term 'bank' is defined as follows:

Art. 2 Banks

[1]Banks are institutions that, in the main, are active in the finance sector, and in particular:

a. accept deposits from third parties or publicly offer such services; or
b. refinance, to a great extent, with other banks that are not influentially involved with them in order to finance an indefinite number of people or businesses in some way and with whom they do not form a financial unit.

[2] They are classified into five categories by the Swiss Financial Market Supervisory Authority according to the following criteria:

a. balance sheet total;
b. assets under management;
c. privileged deposits;
d. minimum capital.

[3] A bank is classified into the category in which it fulfils a minimum of three of these criteria.

However, the legal definition can be criticised from different angles: (1) the legal definition can change over time and across borders (see Crane et al. 1995); (2) certain bank functions are provided by non-bank financial institutions (NBFIs) that change over the years; and (3) the '[i]nstitutional form follows function – that is, innovation and competition among institutions ultimately result in greater efficiency in the performance of financial system functions' (Crane et al. 1995: 4). Therefore, the legal definition is less stable than the economic definition, and no further elaborations on the legal perspective are provided here. Conversely, the economic definition focuses on the functional perspective of what banks actually do.

In economic textbooks and in the present conventional view, the terms 'bank' and 'financial intermediary'[2] are often used interchangeably. Furthermore, the term 'bank' and bank-related activities draw upon the evolution of history. In history, the first recorded banking activity involved safeguarding deposits, as described in legal texts in the Code of Hammurabi (1000 B.C.) (see Orsingher 1967). The second recorded historical activity of banks was to exchange currencies, as described in the etymology of the Greek and Italian words for bank ("trapeza" and "banco", respectively). The third activity involved deposit management, which emerged as a result of the Italian innovation of bills of exchange in the thirteenth century and allowed merchants who travelled in Europe to avoid the security problem inherent in carrying gold or foreign coins. In this sense, bills of exchange allowed

'the recipients to draw on another merchant for the amount owed. Typically, the recipient would resell the claim to someone else, who would present it to a merchant or bank elsewhere, and so on, until at last it was presented to the issuer with whom the first merchant had initially made a deposit' (Admati and Hellwig 2013: 250).

[2] 'Financial intermediaries are entities that intermediate between providers and users of financial capital' (Greenbaum and Thakor 2007 [1995]: 43). Thereby, financial intermediaries can be categorised into different types. Greenbaum and Thakor (2007 [1995]) classify financial intermediaries in terms of whether they finance their activities with deposits. Thus, commercial banks with the characteristic of funding propositions with deposits are considered financial intermediaries.

Thus, the innovation of bills of exchange connected with foreign trade helped to develop early banks, such as the Amsterdam Bank in 1609 (see Kindleberger 2006). This contradicts accepted wisdom, that is,

> '[t]he usual textbook view is that banking developed from goldsmiths who issued receipts for gold left with them which later circulated from hand to hand, and that observation of this circulation ultimately induced goldsmiths to issue receipts without previous deposit. The story is well told but inaccurate. Goldsmiths evolved into bankers only in the middle of the seventeenth century in England. Banking developed much earlier and was connected especially with foreign trade. Even in the eighteenth century more banks in England developed from merchants than from goldsmiths' (Kindleberger 2006: 35).

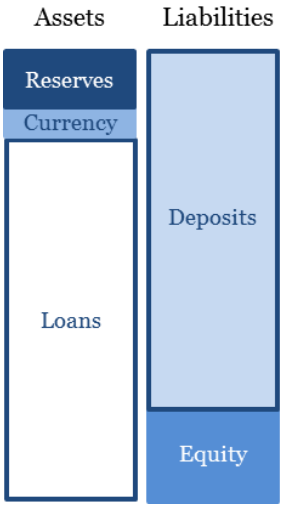
In light of these considerations, it appears that early banks were mainly defined by three functions – (1) offering payment services, (2) taking deposits and (3) transforming liquidity – because the bank 'issu[ed] liquid claims to one and the same agent that [were] backed by illiquid' receipts to merchants (Greenbaum and Thakor 2007 [1995]: 95). These early bankers (who ranged from moneychangers to deposit takers) quickly realised that it was not necessary to have a unit deposit for each outstanding receipt. Therefore, they used deposits to make loans (receipts) (see Greenbaum and Thakor 2007 [1995], Kindleberger 2006, Admati and Hellwig 2014). 'Since then, the triad of offering payment services, taking deposits, and lending has been rediscovered several times and has come to be regarded as the essence of banking' (Admati and Hellwig 2013: 250). Thereby, loans are typically created by depositors (such as household savings), and banks lend those deposits to borrowers (such as firms). Thus, banks act as financial intermediaries between different agents (depositors and lenders) at different time periods, gathering resources and reallocating them. This concept expresses the so-called '*financial intermediation theory of banking*' that has dominated the literature and the design of regulatory policy since the late 1960s (see Werner 2014). Because of its dominance in the literature, we refer to the financial intermediation theory of banking as the 'mainstream view' in this thesis.[3] To understand the main bank function of the financial intermediation theory of banking, it is useful to understand banks' balance sheets. Figure 1.1 shows a simplified balance sheet of a representative bank B.

The asset side of the balance sheet is equal to the liability side. The asset side consists of reserves (for instance, cash, non-interest-bearing deposits, treasury bills and minimum reserve requirements), currency and loans (for example, interbank loans, credit to households,

[3] The different schools of economic thought will be analysed in Appendix 3.

and credit to firms (see Dewatripont and Tirole 1994). In this case, the asset side consists of many illiquid loans and few reserves and currency.

Figure 1.1 Bank B balance sheet



Source: Authors' own elaboration.

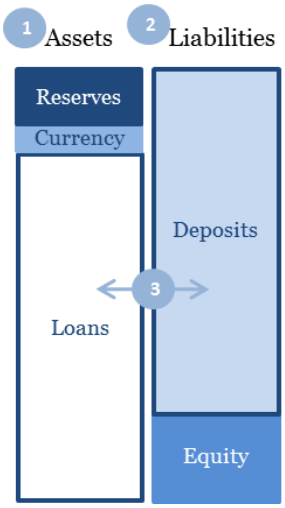
By contrast, the liability side of the balance sheet consists of deposits and equity. Thus, deposits are the bank's principal liability, including interbank deposits and funds collected from households and firms (there are demand and savings deposits and short- and long-term deposits) (see Diamond and Dybvig 1986). Equity is the other important entry on the liability side. The liability side is entirely composed of the ratio of low-equity and numerous short-term liquid debts. Moreover, the liability side is more liquid than the asset side. This characteristic is important in our further analysis of bank regulation. Based on the bank's balance sheet, the main functions include (1) asset services; (2) liability services; and (3) transformation services (see Diamond and Dybvig 1983, 1986). Figure 1.2 illustrates these main bank services with respect to the balance sheet.

Asset services are provided to borrowers and generally consist of the funding, evaluation, granting, managing and monitoring of loans. Thus, banks fund loans from the deposits that savers (bank customers) place with them. In addition to funding loans, the following information-related services can be included in asset services: securitisation,[4]

[4] The word securitisation refers to the act of an untraded group of (debt) claims in a market (such as a bank loan) being bundled and converted into traded securities by issuing claims against it and selling these claims to capital market investors (see Greenbaum and Thakor 2007 [1995], Hellwig 2009; see section 3.3 for further details).

portfolio management,[5] and investment banking activities (such as mergers and acquisitions and so forth) (see Baltensperger 1990).

Figure 1.2 Main bank functions of the balance sheet



Sources: Adapted from Dewatripont and Tirole (1994) and Mishkin (2013).

As opposed to asset services, liability services consist of accepting deposits, controlling maturity transformations between liabilities and assets, hedging against changes in interest, clearing transactions and holding currency inventories. On the liability side, Bryant (1980) and Diamond and Dybvig (1983) suggest that deposits constitute a vehicle through which banks convert illiquid assets into liquid deposits and vice versa, which is also called liquidity transformation (see also Diamond and Dybvig 1986). Bryant (1980) first addressed the question of refinancing liquid assets[6] and suggested a possible approach to understanding the existence of banks, which was developed and formalised by Diamond and Dybvig's (1983) model. Diamond and Dybvig (1983) show that a demand deposit contract leads to full information optimal risk sharing as a 'good' Nash equilibrium.[7] If agents panic and attempt to withdraw their deposits, there is a 'bad' Nash equilibrium. In the 'bad' Nash equilibrium, people run to withdraw their deposits (bank run) under the 'sequential service constraint, which specifies that a bank's payoff to any agent can depend only on the agent's place in line and not on future information about agents behind him in line', also known as the so-called 'first come, first

[5] We follow Baltensperger's (1990: 3) view on portfolio management: 'At low cost, investors can acquire a diversified portfolio of securities issued by deficit spending units [(for example, investment funds)]'.
[6] We follow the definition of Mishkin (2013: 165) that 'a liquid asset is one that can be quickly and cheaply converted into cash if the need arises' (for further considerations regarding liquidity, see section 3.2.2 for further details).
[7] A Nash equilibrium is 'a steady state attained when none of the contracting parties has an incentive to change its actions unilaterally' (Greenbaum and Thakor 2007 [1995]: 170).

served' principle (Diamond and Dybvig 1983: 408). A 'bad' Nash equilibrium can be prevented, according to Diamond and Dybvig (1983), by suspending convertibility. Calomiris and Kahn (1991) have correctly noted that, in reality, a suspension of convertibility[8] has been mandated for the banking system as a whole to avoid a system-wide run. Section 2.2.2 will elaborate on bank runs.

Transformation services are divided into (1) maturity transformation, (2) risk transformation and (3) pooling and subdividing shares. First, 'one of the key functions of the banking system is maturity transformation' (see Turner 2009: 21), understood as the transfer of resources across time and space. In this context, short-term liquid deposits are transferred to long-term illiquid loans and vice versa as the maturity of the assets and liabilities of a bank differ (see Burghof and Rudolph 1996, Turner 2009). Second, risk transformation 'is to transform the risks faced by the parties, that is, to supply risk-sharing contracts' (Baltensperger 1990: 4). In other words, risk transformation is understood as risk taking, risk diversification and risk sharing. Risk transformation distinguishes between credit risk, market risk and liquidity risk. The term 'credit risk' includes both credit risk and solvency risk. In this regard, '"credit risk" relates to the occurrence of defaults or to changes in the likelihood of such defaults related in the future' (Goodhart et al. 1998: 7). 'Consequently, a major risk that banks face is credit risk or the failure of a counterparty to perform according to a contractual arrangement' (BCBS 1997: 21). In other words, credit risk is the risk that a bank cannot fulfil the demands of the providers of debt capital or that it can only partially fulfil those demands (see BCBS 1997, Goodhart et al. 1998). In contrast to credit risk, market risks are risks of a structural type that develop from the uncertainty of future market prices with regard to interest rates, share prices, exchange rates and raw material costs (see Büschgen 1998, Kunze 2007). In other words, '[m]arket risk refers to the variability of portfolio values due to changes in market prices of the portfolio components' (Goodhart et al. 1998: 73). Liquidity risk is developed predominantly as a result of maturity transformation (see Burghof and Rudolph 1996, Büschgen 1998, Kunze 2007). If a significant number of depositors withdraw their bank deposits in a short period of time, the bank is not able to pay back all deposits. In other words, liquidity risk is related to the likelihood of loss arising when '(i) cash and/or cash equivalents are inadequate to meet the needs of depositors and borrowers; (ii) the sale of illiquid assets yields less than their fair value; or (iii) illiquid assets cannot be sold at the desired time due to a shortage of buyers' (Moosa 2015: 88). The third transformation service, the pooling and subdividing share function, occurs when numerous small credits are collected and passed on as a large credit to institutional clients

[8] Suspension of deposit withdrawals is referred to as suspension of convertibility (see Diamond and Dybvig 1983).

(for example, pension funds) and vice versa. In this case, the supply of credit is compensated with the demand for credit (see Diamond 1984, Crane et al. 1995).

In addition to the balance sheet functions, a fourth bank service includes payment services. In this sense, the banks take 'the management of the payment system, that is, to facilitate and keep track of transfers of wealth among individuals. This is the bookkeeping activity of banks realized by debiting and crediting accounts' (Baltensperger 1990: 3).

In light of these major functions, the term 'bank' can be defined as follows. According to Fischer (1983: 4), '[b]anks do two things in this economy. First, they act as financial intermediaries. […] Second, they provide transactions services, making payments as demanded by the households'. Fischer (1983) describes the dual function of banks: on the one hand, deposits create loans; on the other hand, there is the function of payment services. In relation to Baltensperger and Dermine (1987: 72),

> '[a] bank or a financial intermediary is a firm whose assets include primary financial claims issued by borrowers such as individuals, governments, firms (or other financial intermediaries) and whose liabilities are sold as secondary claims to capital surplus units in various forms such as demand deposits, savings deposits, term deposits, subordinated debt (loan capital) or equity shares'.

For Goodhart (1989: 6), '[a] bank will provide payments services, investment advice, maturity transformation, portfolio management or credit risk assessment, in addition to market making in money'. Thus, Goodhart (1989) distinguishes between bank services and market making in money. Goodhart (1989: 5) describes banks as market making in money because they '[make] bids on known terms for funds from depositors and offer loans on known terms to those needing to borrow money'. Moreover, a bank is a financial intermediary corresponding to the market making in money activity. In this regard, Dewatripont and Tirole (1994: 14) offer the following definition: '[a] bank is a financial intermediary that participates in the payment system and finances entities in financial deficit, generally the public sector, firms and some households, using the funds of entities in financial surplus, typically households'. According to Greenbaum and Thakor (2007 [1995]: 55), 'banks are widely considered the center of the financial intermediation universe because of their role in administering the community's payments, and also because commercial banks are used to transmit monetary policy impulses originating with the central bank'.

According to these considerations, the term 'bank' can be defined as follows:

A bank is understood as a financial intermediary that acts between different agents and provides four main functions: asset services, liability services, transformation services and payment services.

Source: Authors' own elaboration.

Although the mainstream view has dominated the current banking and regulatory literature, following the outbreak of the 2007–2009 financial crisis, the theory of financial intermediation in banking and the micro-based perspective in regulation have been openly questioned, which has reopened debates involving banking and regulation. Therefore, we describe an alternative view of banking.

1.1.2. The alternative view

Within the mainstream view, 'banks act simply as intermediaries, lending out the deposits that savers place with them' (McLeay et al. 2014: 15). However, according to the Bank of England (BoE), the major common misconception in banking is that banks lend out the deposits that savers place with them because (1) 'when households choose to save more money in bank accounts, those deposits come simply at the expense of deposits that would have otherwise gone to companies in payment for goods and services. Saving does not by itself increase the deposits or 'funds available'' (McLeay et al. 2014: 15) and (2) there is a misconception that 97 per cent of the circulation of money (bank deposits)[9] are loans that depositors save at banks (McLeay et al. 2014). Thus, two questions arise: how can the formation of bank deposits be explained, and thus, what are the main bank functions?

The formation of bank deposits results from a payment (Rossi 2007). 'In other words, the essential role of the banking system [and thus of banks] lies in the process, that is to say, an action, whose result is the creation, transfer or destruction of a bank deposit within the domestic economy as whole' as a result of the agent's credit demand (Rossi 2007: 34, Rochon and Rossi 2013). Consequently, the term 'bank' is closely linked to the endogenous nature of money and credit, where endogenous[10] means that the emission of money is determined by credit and money demand. Although numerous current mainstream economists (for example, Friedman, Schwartz, Wicksell; central bankers such as the former governor of the BoE, Mervyn King; and

[9] The remaining three per cent of the circulation of money is in the form of currency.
[10] In contrast, exogenous means 'that the central bank determines the quantity of loans and deposits in the economy by controlling the quantity of central bank money' (McLeay et al. 2014: 15).

regulators such as the former head of the UK Financial Services Authority, Lord Adair Turner) have advocated for some form of endogenous money, 'only post-Keynesian [(PK)[11]] authors have made, so far, endogenous money the cornerstone of their monetary theory' (Rochon and Rossi 2013: 211). However, in the PK literature, the term 'bank' is 'often misunderstood – not to say entirely neglected – even by contemporary (PK) writers' (Rossi 1998: 2).[12] In other words, PK theory lacks a definition of a bank. To fill this gap in the literature, Rossi (1998, 2007) provides a useful concept in the monetary macroeconomics of banking by combining the elements of circuit analysis and PK theory. In what follows, we adopt this concept and provide an alternative bank definition in the modern economy.

One common statement in PK theory is that banks are decisive in the business of lending because, according to the principle of double-entry accounting, whenever a bank makes a loan, it simultaneously creates a new, equal-sized deposit entry on the liability side (see Rossi 1998, 2007). Cencini (1997: 375) notes:

'[t]he reality of our modern monetary systems is thus based on the simultaneous application of the two principles, 'loans make deposits' and 'deposits make loans', where the first refers to the fact that deposits are created through the loans granted by banks to firms, while the second states that the deposits earned by workers are immediately lent to firms to financially cover their costs of production' [(for example, for wages)].

To better understanding this principle, Figure 1.3 describes the lending mechanism resulting from the payment of wages in the labour market. Suppose a set of firms, F (payer), requests loans starting from a situation in which no pre-existing bank deposits are available[13] (before loans are made) to finance its expenditures in the labour market 'in order to pay out wages to the current period workers, W' (payee) to begin the production of goods (Rossi 2007: 35).[14]

[11] The origin of PK economics may be traced to Gunnar Myrdal (1939) and to the British Radcliffe Committee report on the 'Working of the Monetary System' (1959) (see Rossi 1998, Rousseas 1998). Myrdal (1965 [1939]) was the first to clearly state that the demand and supply of money are independent. Twenty years later, the British Radcliffe Committee published a report on the 'Working of the Monetary System' to identify recent changes in the British monetary system. This report raised doubts about the assumption of mainstream theory in monetary policy and banking. The report concluded that money supply as the objective of monetary control is irrelevant and that an effective monetary policy could be enhanced by the control of general liquidity, called the Radcliffe liquidity thesis. Eleven years later, PK pioneers, such as Nicolas Kaldor (1970), Paul Davidson (1972), Sidney Weintraub (1978) and Hyman P. Minsky (1982), began to elaborate on the theory of endogenous money: 'money matters'. PK monetary theory was further elaborated and refined by authors such as Moore (1983), Rossi (1998, 2007), Lavoie (1999, 2000), Rochon and Rossi (2007, 2013).

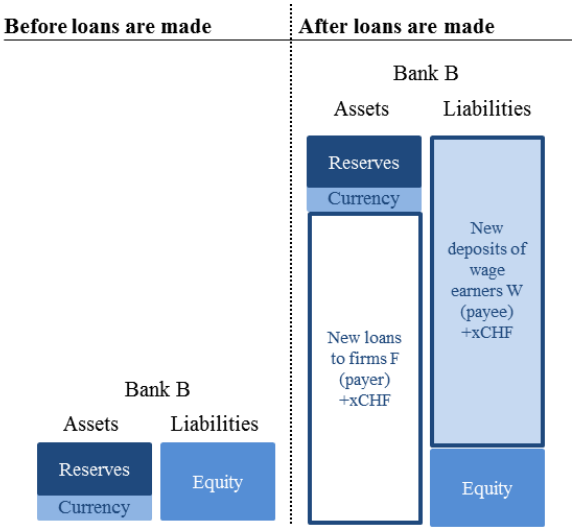
[12] Moore (1983: 541) defined 'a bank as a two-input, two-output firm. The two inputs are retail and wholesale deposits; the two outputs, loans and wholesale lending'.

[13] '[T]o avoid assuming the existence of the very object that we want to explain, that is, a bank deposit, which would amount to a petitio principii' (Rossi 2007: 35).

[14] 'Any transaction involves three parties, namely a payer, a payee and a record keeper, that is, a 'banker'' (Rochon and Rossi 2013: 221).

Bank B offers loans, on which the bank sets an interest rate according to the creditworthiness (solvency) associated with loans, also called 'screening devices' (see Rossi 2007, Rochon 2016).[15] Consequently, new loans to firms F are created on the asset side (as illustrated in the third row of Figure 1.3), and matching new deposits with wage earners W, they are simultaneously created on the liability side of the bank balance sheet. The result of this payment is shown in Figure 1.3.

Figure 1.3 Before and after loans are made



Sources: Authors' own elaboration based on Rossi (1998, 2007) and McLeay et al. (2014).

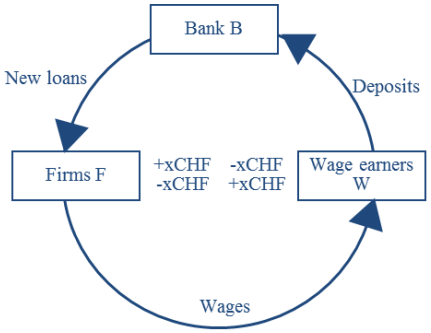
The result of the payment of wages implies that (1) 'money is created when firms agree to get into debt with regard to the banks and when wages are paid to workers' (Rochon 2016: 85); (2) 'banks provide only the number of money units asked for by non-bank agents [(such as firms, householders and so forth)] [..] – on the assumption, needless to note, that the firms' creditworthiness satisfies the benchmark set by the bankers' (Rossi 2007: 35); (3) 'the emission of money as means of payment is a credit-driven and demand-determined process, quite in line

[15] In this sense, the decision of bank B to lend is based on uncertainty, as the future by definition is unknown (see Rochon 2016). In this context, bank B faces two situations of uncertainty with respect to the set of firms F's ability to reimburse their loans in the future, namely, 'micro-uncertainty' and the minimum criteria 'macro-uncertainty' (see Rochon 2016). The former corresponds to the evaluation of the set of firms F, namely, creditworthiness. The latter corresponds to macroeconomic expectations (for example, the forecast of a growing economy or a recession) (Rochon 2016). 'If the bank believes a recession is forthcoming, characterized with a decrease in income, then this will make it more difficult for a firm to sell its products and reimburse the bank' (Rochon 2016: 86). However, irrespective of whether the bank sets minimum criteria, if a firm meets them, it will be granted a loan (Le Bourva 1992, Rochon 2016). Consequently, bank B never faces limits on the lending process with respect to macro-uncertainty. Bank B is only limited with respect to the creditworthiness of the borrower and faces limits itself in the lending process (for example, market forces constrain lending because banks must be able to lend profitably in a competitive market, and bank regulation can constrain lending) (see Tobin 1963, McLeay et al. 2014). Therefore, bank B determines the interest rate for a loan based on creditworthiness and bank regulatory requirements.

with the endogenous money literature' (Rossi 2007: 35)—in other words, money as a means of payment is issued via a credit operation[16] as a consequence of credit demand[17]—(4) 'deposit holders, workers, W, have a credit to firms, F, via the bank in which these deposits are recorded. Hence, it is W, and not the bank, that grants a credit to F eventually, even if deposit holders may not be aware of this credit operation' (Rossi 2007: 37); and (5) the production gives purchasing power to money that is a numerical form, whereas 'banks alone cannot give value to the money units' (Rossi 2007: 35),

Although Figure 1.3 is helpful in describing the result of a payment in the labour market that is a stock (in the form of bank deposits), analysis of the balance sheet is insufficient to illuminate the nature of money and the workings of payments because 'the emission of money, which is a flow [...], is an instantaneous event; that is, it has no duration in time, even though its result has indeed a stock dimension in the form of a bank deposit being either created [through production], transferred or destroyed [via consumption] in the economy as a whole' (Rossi 2007: 34). Hence, Rossi (2007: 34) proposes to conduct a circular flow analysis that helps us 'to distinguish conceptually between a flow, that is to say, money, and the actual result of this flow, [as shown in Figure 1.4], namely, a bank deposit' […] 'in which the circuit of money lasts no more than an instant, in order to reproduce the fact that a payment is an instantaneous event and so is money' (Rossi 2007: 36).

Figure 1.4 The emission of money as a flow in the labour market



Sources: Adapted from Rossi (1998, 2007).

[16] 'Although the creation of money is essentially tied to bank credit, money and credit are separate things' (Rossi 2007: 21). In this sense, Cencini (2001:3) indicated that 'money is a flow whose instantaneous circulation has a stock of income (or capital) as its object. Banks create the flow but not its object, which is closely related to production. This is to say that money and credit are not one and the same thing'.

[17] Certain observers suggest that bank deposits result from 'fountain pen money', which means 'money created by the stroke of the bank president's pen when he approves a loan and credits the proceeds to the borrower's checking account' (Tobin 1963: 1). Fountain pen money has been clearly discussed by Tobin (1963), who considers that 'banks do not create money' (Tobin 1963: 2).

Consequently, '[m]oney and payments are one and the same thing' (Schmitt 1996: 88) 'in the sense that the emission of money occurs within payments, while money balances (bank deposits) exist between payments' (Rossi 2007: 36). Therefore, the emission of the means of payment can be described with an instantaneous circular flow from and to its issuing bank B between firms F and wage earners W (see Rossi 2007). The emission of money as flow in the labour market has two implications: (1) The creation and simultaneous destruction of the relevant number of money units occur (see Rossi 2007). In this context, Cencini (2001) indicated that double-entry book-keeping leads to a perfect instantaneous balance between the creation and destruction of money units. In this connection, the following question arises: how can the destruction of money units be explained? If 'a deposit holder spends his/her purchasing power on the goods market, the corresponding bank deposit is actually destroyed for the deposit holder as well as for the economy as a whole' (Rossi 2007: 39). In other words, consumption has an effect that when wage earner W spends his/her income, bank deposits are destroyed. In this sense, 'money will flow back to firms. At this point, one can see the circuit forming: money first flows out with the payment of wages, and it then flows back with the act of consumption, which becomes a source of revenue for firms' (Rochon 2016: 87). This phenomenon is identified as a reflux mechanism that is the act of money returning to the set of firms F (see Lavoie 1999, 2000, Rochon 2016). According to Lavoie (2000: 3), '[t]he reflux principle says that when agents dispose of money balances that they do not wish to hold, these excess money balances can be extinguished by the reimbursement of previously accumulated debt'. Consequently, the flux mechanism is the creation of loans (see Rossi 2007). (2) Money is not a stock (bank deposit), as it was considered for more than 200 years, but rather a flow that occurs within payments issued via a credit operation (see Rossi 2007). In other words, 'money is a flow whose result is a stock under the form of a bank deposit' (Rossi 1998: 10). This leads us to the conclusion that 'money carries out payments, while bank deposits finance them' (Rossi 2007: 37), where the form of bank deposits is the income as a result of the effort (labour) of wage earners W (see Rossi 2007).

Consequently, if we adopt the above-mentioned considerations to define the term 'bank' under an economic point of view, a bank provides two main bank functions: asset services, particularly lending loans, and payment services. With these considerations in mind, we can formulate the following alternative definition of the term 'bank':

The crucial role of a bank is to provide two main functions: asset services, especially lending loans, and payment services as a result of the endogenous nature of money and credit.

Source: Authors' own elaboration.

1.1.3. Summary

We conclude this section by noting that the term ‘bank’ can be defined in several ways, depending on whether the definition is made in a legal or an economic context. We noted in this section that the legal definition can be criticised from several angles; thus, the legal definition can change over time and cross borders, as it is based on the functional definition of a bank. In fact, prioritising the economics literature, rather than the legal literature, appears to be useful in this regard. In the economics literature, the term ‘bank’ is defined from a functional perspective that can be traced back to the historical evolution of banking. This evolution leads us to a definition that draws on the standard references and textbook concepts, that is, that bank deposits create loans and that a bank is understood as a financial intermediary operating between two agents that provides four main functions: asset services, liability services, transformation services and payment services.

However, the outbreak of the 2007–2009 financial crisis prompted the mainstream view of banking to be questioned, thus reopening a heated debate. Therefore, we articulate an alternative view based on the assumption that banks make loans and simultaneously create matching deposits on the liability side. Furthermore, with respect to the circuit analysis, the crucial role of a bank is to provide two main functions: asset services and payment services. However, one challenging question concerns which school of thought is more appropriate. Both schools have advantages and disadvantages that have been discussed in the literature (see Tobin 1963). Overall, however, our position is that the essential function of a commercial bank lies in the provision of two main functions: asset services and payment services. These functions arise as a consequence of endogenous money and credit for the following reasons: (1) ‘[W]hen households choose to save more money in bank accounts, those deposits come simply at the expense of deposits that would have otherwise gone to companies in payment for goods and services, and saving does not increase deposits or ‘funds available’’ by itself (McLeay et al. 2014: 15). (2) There is a misconception that 97 per cent of the circulation of money (bank deposits) are loans that depositors save at banks (McLeay et al. 2014). (3) Rochon and Rossi (2013) have clearly shown that money has always been endogenous in the history of banking. In other words, ‘[m]oney goes along with the needs of production, as any payments of production costs need a means to settle debt obligations finally. Hence, in this sense, money has always been responding to the needs of markets for a means of final payment, and has

therefore always been endogenous' (Rochon and Rossi 2013: 216).[18] Consequently, over time, lending has always created deposits as a result of endogenous money and credit. (4) In modern financial systems, there are several NBFIs[19] (for example, investment institutions, i.e., investment banks such as Allen & Company), asset managers (such as BlackRock), contractual saving institutions (for example, life insurance companies such as Zürich Insurance), pension funds and government retirement funds, 'so that banks are not unique in this activity, in which they never were actually special' (Rossi 2007: 33). Moreover, (5) 'the emission of money as means of payment is a credit-driven and demand-determined process, quite in line with the endogenous money literature' (Rossi 2007: 35). (6) The principal of double-entry accounting for new loans is equal to new deposits. (7) Money is not a stock (bank deposit), as it has been considered for more than 200 years, but is considered a flow, occurring within payments issued via a credit operation (see Rossi 2007). Furthermore, in our view, banks provide a different range of other financial services that are considered supportive functions, namely, liability services, maturity transformation and risk transformation. In what follows, we explain why we consider these functions to be supportive functions.

Liability services, a useful function to clear transactions and hold currency inventories, can be considered as an effect on the demand for money and credit. Therefore, liability services are viewed as a supportive function rather than a main bank function.

Maturity transformation services are a supportive function because banks shift assets and liabilities off their balance sheets to subsidiaries and special purpose vehicles (SPVs).[20] Likewise, we can argue the same for risk transformation. However, a challenging question concerns whether we can calculate the risk of adequate funding to mitigate the likelihood of future defaults. Certain economists would say no because the future is uncertain and cannot be subject to calculation. Moreover, they would note that risk management and risk models of banks during the financial crisis of 2007–2009 failed because the banks would have otherwise adequately considered the solvency risks in their credit lending function. In this sense, assessing whether a bank is 'undercapitalised' or has too much 'value at risk' is highly technical and remains incompletely codified (see Tirole 2002, Hellwig 2010b). Furthermore,

[18] For further details, Rochon and Rossi (2013) provide a valuable analysis on the evolutionary and revolutionary view of money in banking.

[19] Non-bank financial intermediaries (investment banks and so forth) are considered in our view to be financial intermediaries with respect to Tobin's (1963) definition, namely, 'to satisfy simultaneously the portfolio preferences of two types of individuals or firms. On one side are borrowers, who wish to expand their holdings of real assets inventories, residential real estate, productive plant and equipment, etc. - beyond the limits of their own net worth. On the other side are lenders, who wish to hold part or all of their net worth in assets of stable money value with negligible risk of default'.

[20] The role of SPVs in the most recent financial crisis is analysed in section 3.4 and section 7.1.

‘it would be foolish, in forming our expectations, to attach great weight to matters which are very uncertain. It is reasonable, therefore, to be guided to a considerable degree by the facts about which we feel somewhat confident. […] The state of long-term expectation, upon which our decisions are based, does not solely depend, therefore, on the most probable forecast we can make. It also depends on the confidence with which we make this forecast on how highly we rate the likelihood of our best forecast turning out quite wrong’ (Keynes 1964 [1936]: 148).

Therefore, risk calculation itself can be a useful measure in the lending process to avoid risky lending decisions.

Another mainstream function is the pooling and subdividing share function. In our view, the pooling and subdividing share function is irrelevant, as banks lend small and large credits independent of collecting small credits to pass along to large borrowers.

Nevertheless, if the reader bases his/her decision on one concept, there can be implications for bank regulation with respect to the justification for the safety and soundness of banking services and the safety and soundness of the banking system. However, before we describe implications in this regard, we require a clear definition of the term ‘bank regulation’, and we must understand the main causes that justify government intervention in the banking industry. Thus, the next major challenge is to define regulation, particularly bank regulation, because the term (1) has several meanings, (2) can be divided into different concepts, and (3) has meanings that vary in different policy areas. The next section clarifies the difficulties discussed above and defines the term ‘bank regulation’ in both a broad and a narrow sense.

1.2. Regulation and bank regulation

1.2.1. The legal and economic concept of regulation

Understanding and defining the concept of banking regulation is no easy task, and there is no single accepted definition in the economic and legal literature (see Burghof and Rudolph 1996, Baldwin and Cave 1999, Ogus 2004).

The term 'regulation' is derived from Anglo-Saxon literature and has mainly legal – and not economic – origins (see Fest 2008). In theory, a distinction is often made between legislation and regulation. In this context, Hertog (2010: 4) states that '[a] distinction is often made between legislation and regulation. Usually in legislation regulatory powers are allocated to lower level institutions or officials. The result of the use of that power by these officials or institutions is then called regulation'. This definition describes regulation as a result of allocating power from one regulatory agency to another. In our view, regulation results not from the use of regulatory powers allocated to lower-level institutions but from a dynamic political decision-making process influenced by several regulatory agencies. Hence, on the one hand, legislation is the decision-making process of passing the public good,[21] understood as laws, rules and standards by a parliament (such as the enforcement of such legislation). On the other hand, regulation is the result (setting the rules and procedures for implementing regulation) of a legislative process controlled by officials, including the parliament, local regulatory agencies or international regulatory agencies (for instance, the Basel Committee on Banking Supervision (BCBS) and so forth). In this sense, regulation is a public good understood as a set or framework of contracts crafted as laws, rules, standards (for example, capital and liquidity standards) and supervisory actions (such as registration or licensing for banks, periodic inspections to ensure internal compliance frameworks, and identification of employee misconduct) (see Goodhart et al. 1998, Llewellyn 1999, Moosa 2015). However, in practice, the legal concept of regulation does not (1) justify government intervention; (2) investigate which form of regulation is optimal; and (3) involve any impact analysis (such as banking sector assessments). Therefore, no further headway on the legal concept of regulation is made herein.

In the economic literature on regulation, several researchers abstain from an exact definition of regulation (see Train 1997, Ekelund 1998). To delineate the subject, the few extant economic conceptions of regulation can be found in Loevinger (1966), Posner (1974), Selznick

[21] Bank regulation is a public good (non-rivalry in consumption and non-excludability).

(1985), Soltwedel et al. (1986), Baldwin and Cave (1999), Ogus (2004) and Hertog (2010). As per Loevinger (1966: 105), '[r]egulation […] usually implies control of an economic area through orders directed to named or specified enterprises by an administrative agency with limited delegated authority'. According to Posner (1974), all government intervention, such as taxes, subsidies, and legislative and administrative controls, in the market are economic regulations. In this context, Soltwedel et al. (1986) generally assumes that control of the economic decision-making of market participants is exercised either by government laws, rules, standards or supervisory actions or independently through self-regulation. Furthermore, Selznick suggests (1985: 363) that 'regulation refers to a sustained and focused control exercised by a public agency over activities that are valued by a community'.[22] Likewise, Baldwin and Cave (1999: 2) understand regulation as 'a sustained and focused control exercised by a public agency over activities'. In other words, regulation is (1) 'a specific set of commands which is a set of rules applied by a body' (Baldwin and Cave 1999; 2); (2) a deliberate state influence (for example, taxes or subsidies); or (3) all forms of social control or influence (affecting behaviour, such as the red and green light concept related to road traffic) (see Baldwin and Cave 1992). In this regard, Ogus (2004) notes that 'regulation' is used to indicate any form of behaviour control of a person or a firm. In addition, Hertog (2010: 3) indicates that regulation involves 'the employment of legal instruments for the implementation of social-economic policy objectives. A characteristic of legal instruments is that individuals or organizations can be compelled by government to comply with prescribed behavior under penalty of sanctions'. However, Hertog's (2010) definition can be criticised as follows: (1) Hertog (2010) describes an ideological anti-regulation stance (see Moosa 2015), and (2) Hertog (2010) does not say anything about why 'compelled', 'penalty' and 'sanctions' are necessary (see Moosa 2015). Therefore, no further headway on Hertog's definition is provided herein.

These legal and economic considerations can be used to formulate a broad concept of bank regulation:

Bank regulation is understood to mean any government intervention that limits banks' economic decision-making and activities.

Source: Authors' own elaboration.

[22] The term 'activity' is important for Selznick (1985: 363) because 'it is the effort to uphold public standards or purposes without undue damage to activities'. In this regard, the crux of regulation is to uphold public standards without undue damage to activities.

1.2.2. Government regulation vs. self-regulation

The understanding of bank regulation in the broader sense corresponds to the concept of government regulation as distinguished from private (or self-) regulation. Although this distinction may often be made in the literature, in reality, it is difficult because the term 'self-regulation' varies in meaning and unusual hybrids of government regulation and self-regulation are constantly developing (see Moosa 2015).

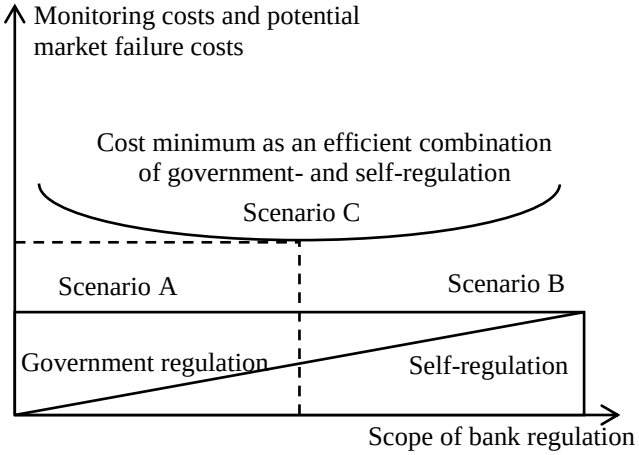
According to Baldwin and Cave (1999: 125), '[s]elf-regulation can be seen as taking place when a group of firms or individuals exert control over its own membership and their behaviour'. Therefore, the control 'may be entirely voluntary and quite informal or subject to degrees of governmental supervision and legislative structuring' (Markova 2009: 124). In addition, Taisch (2010) defines self-regulation more broadly as a fundamental outflow of private freedom or as a governmental delegation of activities, whereas FINMA attempts through systematisation to make the term 'self-regulation' amenable to further analysis. Consequently, FINMA systematised self-regulation into three different forms, namely, voluntary self-regulation,[23] self-regulation recognised as a minimum standard[24] and compulsory self-regulation[25] by private organisations (such as the Swiss Bankers Association (SBA) and so on) or in cooperation with the government (see FINMA 2007, 2015a). An example of self-regulation in Switzerland is the agreement regarding Swiss banks' code of conduct with respect to due diligence activities, which involves the identification of the beneficial owner of an account (know your customer). Only in a later step is the core content taken into the Swiss Criminal Code (SCC) (see Art. 305 SCC 2017 [1937]).

In reality, there is a smooth transition between self-regulation and government regulation. Thus, over time, the banking sector has become subject to a changing degree of regulation, which can be divided into three scenarios. Figure 1.5 shows the trade-off between scenario A ('government regulation'), scenario B ('self-regulation') and scenario C ('combination of government and self-regulation'). Scenario A assumes a fully nationalised banking industry with government regulation to protect the banking industry from crisis. Thus, protective motives play an important role in Scenario A. Scenario B assumes a low level of regulation or – in the extreme – no government intervention. Here, the banking industry

[23] Free or voluntary self-regulation is created with no government participation.
[24] Minimum standards are imposed at the request of a bank and apply to all other banks through their recognition by the regulatory authority.
[25] Compulsory self-regulation is based on legislature tasks on a specific issue (for example, deposit insurance) (see FINMA 2015a).

regulates itself and ensures adequate control and safety under the 'free banking hypothesis',[26] also called 'laissez faire'.[27] Free banking means that there is no central bank intervention (monetary policy) and bank regulation (regulatory policy) necessary because inefficient banks go bankrupt and go out of business (also in the case of overcapacity in the banking sector), thereby encouraging market discipline and efficiency. Therefore, free-banking advocates, such as Weber (1992) and Ritzmann (1996), believe that a banking sector without a regulatory authority or a central bank leads to a superior economic outcome.[28] Crises are a necessary state of nature because they turn a country from an excessive speculative system into a stable equilibrium (see Goodhart and Illing 2009).

Figure 1.5 The level of bank regulation between government regulation and self-regulation



Source: Adapted from Burghof and Rudolph (1996).

The 'free banking hypothesis' is not empirically testable because all current governments exercise some degree of central bank money and bank regulation (see Bernet 2003).[29] Therefore, no further elaboration is provided here. Scenario C shows a combination of government regulation and self-regulation. As a result, Burghof and Rudolph (1996) note that efficient regulation by bank supervision is based on the combination of monitoring and the

[26] In the literature, the best-known example is the Scottish free banking era between 1695 and 1864 and the Swiss free banking era between 1826 and 1881 (see Dowd 1992, see section 6.1).
[27] According to Kahn (1998: 17), the laissez-faire (free banking) system is based on the belief that 'an unregulated market economy will produce optimum economic results'.
[28] That 'is the optimal means for allocating and for distributing products and incomes' (Timberlake 2009 [1984]: 127, see section 5.1 for further details).
[29] In the case of SIBs, the free banking approach should be discussed as critical because if the banking sector as in 2007–2009 is not able to wind down a systemically important bank, then the costs of bankruptcy are higher than the benefits (for example UBS and Royal Bank of Scotland) (see part II).

potential cost of market failure. Government regulation can lead to higher monitoring costs compared with self-regulation. In this context, the potential cost of market failure can be reduced compared with a system without government regulation. Thus, an effective[30] and efficient[31] regulated banking system is a combination of government regulation and self-regulation with the least possible level of inputs or supervisory costs from several involved institutions. The following dissertation focuses on government regulation.

1.2.3. The boundary problem

In the literature, bank regulation can be classified according to various policy areas. The difficulties of this classification are as follows: (1) the meaning of relevant policy areas differs; (2) the classification cannot be conclusive because of the existence of various policies—in this sense, 'policy areas are related to others by common goals, common measures, and a common source of risks' (IMF 2011: 51)—and (3) it is difficult to evaluate the effectiveness of policy areas because of the lack of systematisation. Therefore, the main challenging role for any regulatory agency with multiple objectives relates exclusively to the selection and combination of several policy measures to achieve a broad set of objectives (see Tinbergen 1956). In this context, regulators and policy makers use the *Tinbergen Economic Policy: Principles and Design* (1956) to argue that a policy can only achieve a specified number of objectives with precision if it is endowed with the same or a greater number of regulatory measures. One common misunderstanding is that the principle does not state that one regulatory measure should at least be equal to the number of objectives. Hence, several policy areas with several regulatory agencies can be incorporated; the main challenge is 'how they are combined in the

[30] Baldwin and Cave (1999) suggest that effectiveness addresses the issue of whether desired outputs are achieved. In other words, '[r]egulation can always be made more effective in terms of its defined objectives' (Llewellyn 1999: 52). Therefore, the regulatory objective should be clearly formulated in advance of choosing among alternative policies (see Tinbergen 1956).

[31] In the literature, it is typical to evaluate regulation with the Pareto criterion. Pareto efficiency or simply economic efficiency exists when it is not possible to improve on the current equilibrium without making at least one economic agent worse off. In other words, bank regulation is regarded as efficient if the specified regulatory objective is achieved with as little effort as possible in terms of direct and indirect costs. Direct costs include those costs incurred for supervision and its functions. The opportunity costs of banks that arise from regulatory requirements are deemed indirect costs. In reality, it is difficult to assess bank regulation with the Pareto criterion, as the banks or the public interest will be harmed 'when the mandate fails to set down consistent or coherent objectives or where a regulator's functions intermesh with other agencies and departments' (Baldwin and Cave 1999: 81). An alternative standard is the compensation principle, which is equivalent to choosing bank regulation that yields the highest total economic surplus (such as the safety and soundness of the banking system). The basic idea is that if the 'winners' from bank regulation, for example, the banks, compensate the 'losers', in our case the central bank and the government (tax payer), so that everyone is better off, then it is a 'good' change and satisfies the Pareto criterion (see Viscusi et al. 1998).

overall policy mix' (Llewellyn 1999: 48).[32] Moreover, the main risk is an overlap with other policy areas and agencies, called a 'boundary problem', which reduces the effectiveness and efficiency of bank regulation and 'reinforc[es] existing biases towards inaction' (IMF 2011: 34). In the following, we describe four issues with respect to the boundary problem.

First, different policy areas might relate to or have undesirable side effects on one another (trade-off). For example, low policy rates of interest are consistent with low inflation rates. Low inflation rates contribute to excessive credit growth, generate asset bubbles and sow the seeds of financial instability for regulatory policy (see IMF 2013).

Second, there is a risk of overlap with respect to the objective between different agencies. For example, in Switzerland, there is a risk of overlap with respect to the objective of financial stability between the Swiss National Bank (SNB) and the FINMA.

Third, there is a coordination problem with multiple regulatory agencies.[33] For instance, Murphy (2015) noted the overlap of policy areas and regulatory agencies for JPMorgan in the US derivatives and trading businesses. In these businesses, JPMorgan must deal with five regulatory agencies and three different policy areas. The regulatory agencies are allocated to the three following policy areas: (1) monetary policy (the Federal Reserve System (Fed));[34] (2) competition policy (the Office of the Comptroller of the Currency (OCC));[35] and (3) regulatory policy (the Federal Deposit Insurance Corporation (FDIC),[36] the Securities and Exchange Commission (SEC),[37] and the US Commodity Futures Trading Commission (CFTC)[38]). Since the crisis of 2007, the banking business has been more complex because of multiple regulatory agencies (regulatory infrastructure). Therefore, we propose the adoption of an integrated

[32] For instance, bank regulatory instruments (capital, liquidity, organization and risk diversification) are mixed with monetary policy instruments.

[33] Jamie Dimon (2015: Internet), the CEO of JPMorgan Chase & Co., notes that 'in the old days, you dealt with one regulator when you had an issue, maybe two. Now, it's five or six. It makes it very difficult and very complicated'.

[34] The Fed is the US central bank and is responsible for monetary policy in the United States.

[35] 'The OCC is an independent bureau of the U.S. Department of the Treasury. Its mission is to ensure that national banks and federal savings associations 'operate in a safe and sound manner, provide fair access to financial services, treat customers fairly, and comply with applicable laws and regulations' (OCC 2015: Internet).

[36] The first deposit insurance was introduced in the United States in 1934 in response to the financial crises of the 1930s (see Fischel et al. 1987, Dewatripont and Tirole 1994, Blanchard and Johnson 2013, Mishkin 2013). The FDIC was established to prevent bank runs and to protect small depositors. The FDIC uses two methods to handle failed banks: the payoff method and the purchase-and-assumption method. The payoff method pays deposits up to USD 250,000. The purchase-and-assumption method reorganises banks by finding a willing merger partner to assume all liabilities (see Mishkin 2013). The initial coverage of the FDIC was USD 2,500. This number has increased to USD 250,000 ('In response to the crisis, all accounts are currently fully insured, regardless of the amount, but this is scheduled to end in December 2012') (Blanchard and Johnson, 2013: 95).

[37] The major objective of the Securities and Exchange Commission (SEC) is 'to protect investors; maintain fair, orderly, and efficient markets; and facilitate capital formation' (SEC 2015: Internet).

[38] 'The mission of the CFTC is 'to foster open, transparent, competitive, and financially sound markets; to avoid systemic risk; and to protect market users and their funds, consumers, and the public from fraud, manipulation, and abusive practices related to derivatives and other products' (CFTC 2015: Internet).

supervisory system for countries such as the United States. A similar discussion about the problem with multiple regulatory agencies has been held in Switzerland. In this sense, Gugler (2005) has clearly highlighted the weakness[39] of the old decentralised supervisory system, which was systematised into the following authorities: the Swiss Federal Banking Commission (SFBC),[40] the Federal Office of Private Insurance (FOPI),[41] the Money Laundering Control Authority (MLCA),[42] and the Swiss Federal Gaming Board[43] (SFGB). Although the legal bases and activities of supervision are different, as 'are the sanctions in cases where the different laws were not complied with' (Gugler 2005: 141), the Zufferey Commission and the follow-up Zimmerli Commission[44] proposed the establishment of an integrated supervisory authority (centralised regulatory system) that offers numerous advantages. For example, 'it subjects all institutions to the same set of rules (same business, same risks, and same rules), reduces the distortion of competition, increases efficiency (reduction of administrative costs and wasteful duplication), and simplifies the exchange of information. Furthermore, it should make the reform of the penalty easier' (Gugler 2005: 141). According to these considerations and the work of the Commission, in 2009, the three predecessor institutions (SFBC, FOPI and MLCA) together created the Swiss Financial Market Supervisory Authority (FINMA).

Fourth, the financial crisis of 2007 has shown that prudential regulation, market discipline such as the constructive ambivalence strategy of the central bank (see section 6.3 for further details), and inflation targeting alone cannot achieve financial stability. As a result, we propose an alternative systematisation model based on five policy areas with respect to effective aspects. In this context, the number of regulatory agencies must, from an effective perspective, be reduced to a minimum. Consequently, the focus in this dissertation is on all bank regulatory measures that are (1) overlapping between regulatory policy and other policy areas (for example, between regulatory policy and monetary policy) and (2) not sufficiently covered by

[39] For example, the SFBC is sometimes questioned regarding the control of auditing activities (see Gugler 2005). 'On the one hand, private firms conducting audits are hired by the institutions subject to supervision. They may therefore be subject to pressure. On the other hand, they compete with other audit firms and are therefore pushed to achieve minimal costs, which may imply minimal control' (Gugler 2005: 130).

[40] The SFBC was an administrative authority of the Confederation, 'which is independent of the individual directives of the Federal Council and is not a part of central government administration' (SFBC 2015: Internet).

[41] 'The FOPI monitors the business operations of private insurance companies: life insurance, accident insurance, insurance against damage and re-insurance. It grants approval for business operations, checks and approves the insurance products for life and health insurance, checks annual reports, inspects the companies and deals with complaints, if any' (FOPI 2015: Internet).

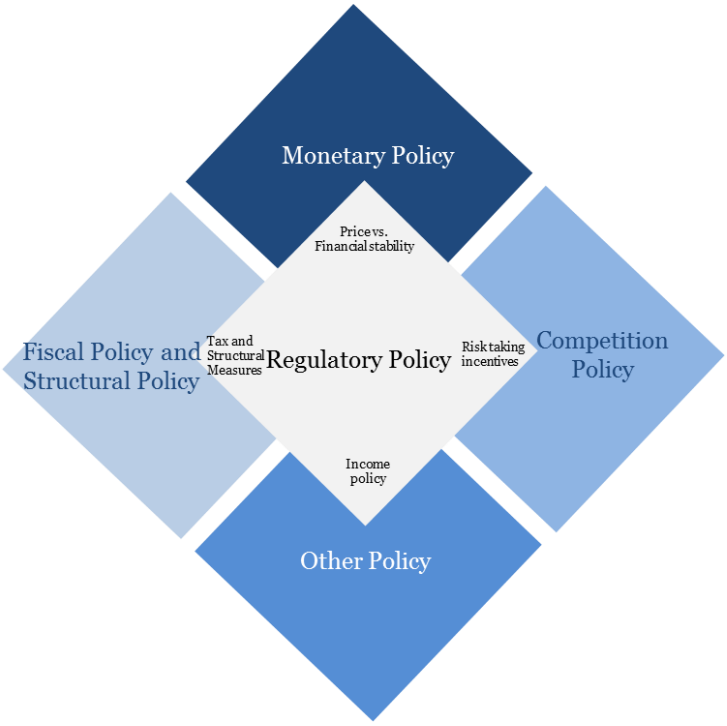
[42] The MCLA was a division of the Federal Finance Administration (FFA) (Federal Department of Finance) (see MCLA 2015).

[43] The SFGB is a supervisory authority that monitors the legal provisions on games of chance and casinos (see SFGB 2015).

[44] The Zimmerli Commission is an expert commission headed by Prof. Zimmerli from the University of Berne for the follow-up to the Zufferey expert group that recommended the adoption of an integrated supervisory system (see Gugler 2005).

policy areas other than monetary policy, fiscal and structural policies, competition policy and other policies. Figure 1.6 describes the relationship between regulatory policy and other policy areas (such as monetary policy, fiscal and structural policies, competition policy and other policies).

Figure 1.6 Relationships between regulatory policy and other policies



Sources: Authors' own elaboration based on BIS (2011), IMF (2013).

1.2.4. Bank regulation in the narrower sense

Bank regulation in the narrower sense is understood to occur when the government (and/or its agents) sets the standards (for example, supervisory authority and central bank).[45] In this case, the meaning of the term 'regulation' is equivalent to that found in Anglo-Saxon literature, which distinguishes between regulation and supervision (see Blumer 1996, Fest 2008). Supervisory authorities focus on forward-looking supervision, also known as prudential supervision regarding banks. For example, banks must always have adequate capital buffers and liquidity. Therefore, supervisory authorities monitor these requirements regularly in different supervisory categories (for instance, size and complexity) to ensure that priorities based on prudential supervision are correct (see FINMA 2015a). Consequently, in practice, a clear separation

[45] An example of bank regulation in the narrower sense is the amendment to the Swiss Banking Act (BA) with respect to banks that are too large to fail.

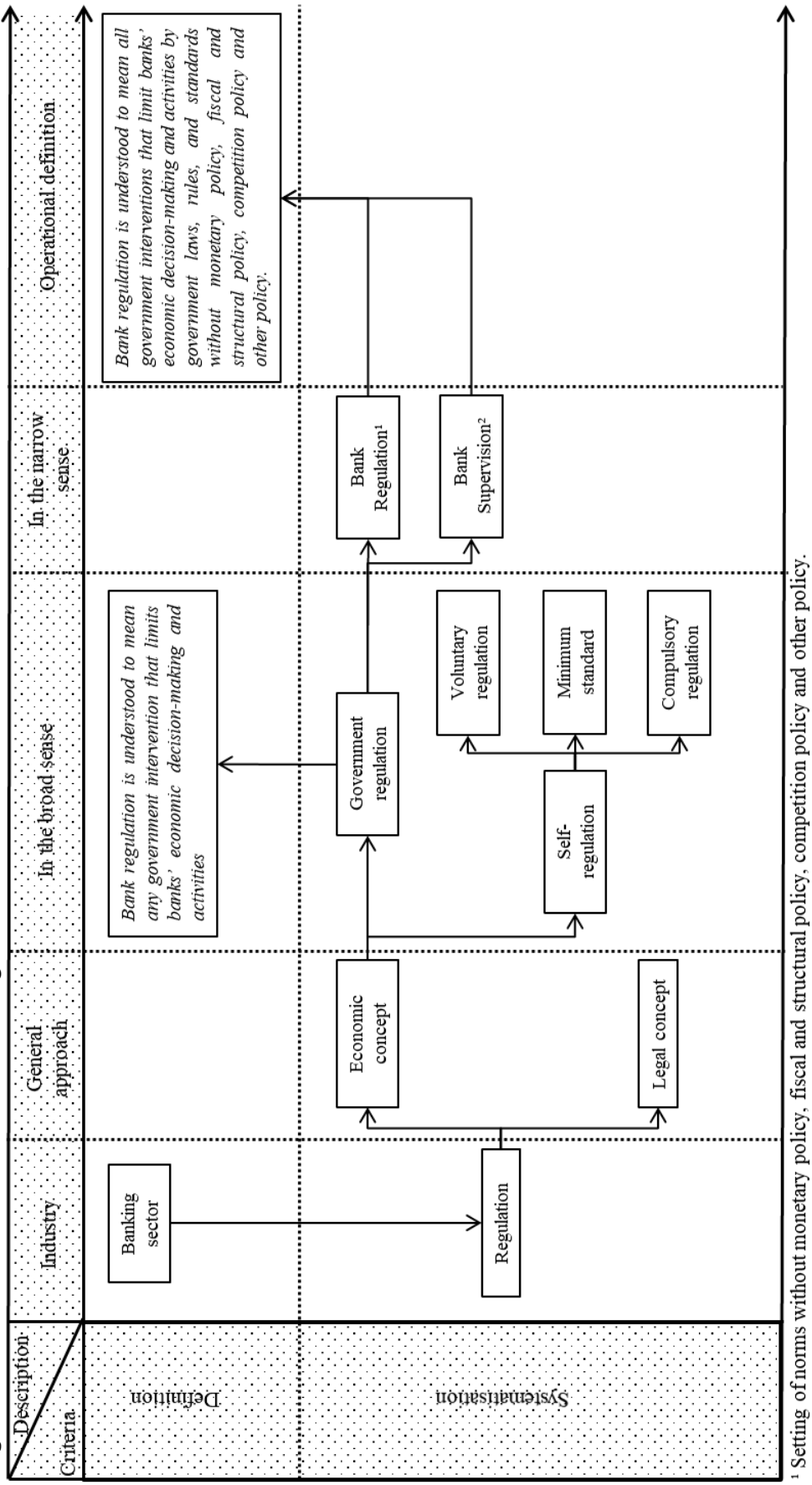
between bank regulation and supervision is difficult. As a result, bank 'regulation and [bank] supervision will be viewed in a more general sense and, in many cases, will be used interchangeably' (Spong 1994: 5). Summarising the additional concept of bank regulation yields the following operational definition (see Figure 1.7):

Bank regulation is understood to mean all government interventions that limit banks' economic decision-making and activities by government laws, rules, or standards without monetary policy, fiscal and structural policy, competition policy and other policies.

Sources: Authors' own elaboration.

Based on the working definition, one significant challenge is to justify government intervention in the banking sector. In this regard, we ask ourselves the following question: what are the rationales for bank regulation? To answer this question, the next section presents the economic rationale and objectives of bank regulation. Figure 1.7 plots the different contexts for deriving the concept of bank regulation.

Figure 1.7 Derivation of the term 'bank regulation'



[1] Setting of norms without monetary policy, fiscal and structural policy, competition policy and other policy.

[2] Monitoring, regulatory requirements and enhancing bank regulation

Sources: Authors' own elaboration based on Loevinger (1966), Stigler (1971), Weizsäcker (1982), Soltwedel et al. (1986), Spong (1994), Blumer (1996), Llewellyn (1999), Stillhart (2002) and Fest (2008).

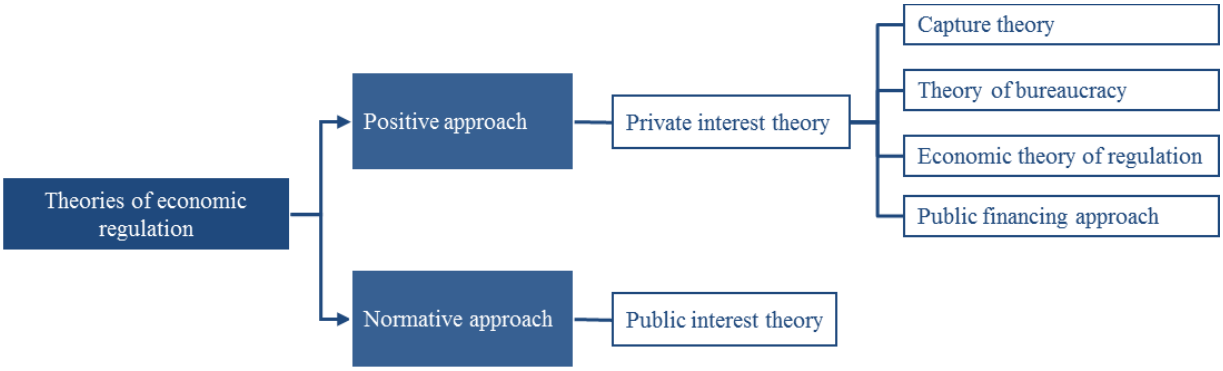
2. The economic rationale and objectives of bank regulation

In the following chapter, we describe the economic rationale and objectives of bank regulation. The former is derived from the inquiry into why bank regulation is necessary and is based on economic criteria, whereas the latter focuses on the outcome that it is trying to ensure (see Llewelyn 1999). In this chapter, based in this context, we elucidate the '*theories of economic regulation*', the '*objectives of bank regulation*' and one new regulatory view, namely, the '*alternative bank regulatory view*'.

2.1. Theories of economic regulation

At the beginning of the 1970s, the first explanations for government intervention in the markets were discussed in the United States. These explanations are shown in Figure 2.1 and were summarised for the first time by Posner (1974) in an article entitled 'Theories of Economic Regulation'. Inspired by Posner (1974) and Peltzman (1976), we classify regulation conceptually as either positive or normative (see Figure 2.1).

Figure 2.1 Theories of economic regulation



Sources: Authors' own elaboration based on Posner (1974), Peltzman (1976), Weizsäcker (1982), and Hertog (2010).

The normative approach is the oldest approach to analysing issues involving regulatory positions. The approach is called normative because the implicit assumption is that efficient regulation is desirable (see Budäus 1988, Hertog 2010). The goal of the normative approach is to justify government intervention by pointing to market failures in the banking sector. Thus, the only potential role in which the government should take action involves market failure (see Musgrave 1966, Blankart 2006). The normative approach examines economic conditions (for

example, asymmetric information or externalities)[46] to identify market failure[47] and aims to provide whichever 'type of [bank] regulation is the most efficient or optimal' (Hertog 2010: 49). The normative approach contains the public interest theory – market failure theory. The normative approach will be the focus of this thesis because the normative approach contains both first- and second-best solutions (see Rombach 1993, Stillhart 2002, Fest 2008). Moreover, there is at least one cause for bank regulation that is in the public interest and allows us to justify bank regulation with respect to different reasons (see also Goodhart et al. 1998).

The positive approach to regulation has its origins in the Chicago school. Representatives of this school include Stigler (1971), Posner (1974), Peltzman (1976), and, in the German-speaking world, Frey (1981). The positive approach, as Keynes notes, deals with 'what is' and 'is in principle independent of any particular ethical position or normative judgments' (Friedman 1996: 3). In this sense, the positive approach investigates economic explanations for – and provides impact analyses of – regulation. To that end, the positive approach explicitly considers the political decision-making process and thus involves the design of banking regulation content and its structure (see Hertog 2010). With the positive approach, according to Stigler (1971) and Peltzman (1976), regulation is understood as a public good and treated in accordance with the law of supply and demand (see Stigler 1971, Peltzman 1976). The positive approach involves private interest theory (see Figure 2.1), which in turn consists of the capture theory, the economic theory of regulation, the bureaucracy theory and the public financing approach.

The next sections are dedicated to a better understanding of economic theories.

2.1.1. Private interest theory

Private interest theory is a combination of public interest theory and neoclassical theory that 'is supplied in response to the demands of interest groups struggling among themselves to maximize the incomes of their members' (Posner 1974: 335-336). Rather than assuming the public interest, private interest theory assumes the interests of organised interest groups (such

[46] According to Kahn (1998), there are three distinguished groups of normative regulation theories: price and market entry regulation in monopolistic industries, price and market access regulation in industries with competitive structures and behaviour regulation to avoid external effects.

[47] In this context, the normative approach is not independent of the positive approach. In other words, any regulatory 'conclusion necessarily rests on a prediction about the consequences of doing one thing rather than another, a prediction that must be based - implicitly or explicitly - on positive economics' (Friedman 1996: 5).

as banks or depositors). Thus, regulatory decisions are not disinterested but reflect particular interests, and bank regulation can be understood as the result of the successive impact of pressure from interest groups, consistent with the Becker (1983) model.[48] These organised interest groups in turn are directly or indirectly involved in designing and implementing regulation in the decision-making process and trying to exploit supervisory authorities (for example, FINMA). In this regard, Kane (1985, 1986) was one of the first scholars to apply private interest theory to the banking sector, highlighting the interdependence between supervisors and the banking industry and addressing the question of whether banks should be regulated at all. In this view, interest groups as depositors or investors request banking regulation to reduce their own risk. The bottom line, according to Kane (1985, 1986), is to prevail on the market for bank regulation regarding demand, which may affect how standards are organised. Stakeholders can be banks, depositors (or depositor groups), regulators or even legislators (see Hertog 2010). Moreover, the private interest theory also features a theory of supply through the government or the regulatory agency and demand in the market (for example, depositors and banks), using banking regulation as an interchangeable good (see Stigler 1971, Posner 1974).[49] Recently, the focus has not been on the exchange but rather on a redistribution of producer and consumer surplus. For these purposes, the regulator maximises its benefits in the form of income until its marginal costs (such as monitoring costs) reach marginal revenue (see Niskanen 1975). Various interest groups compete for demand for regulation. Despite the convincing arguments of private interest theorists that banks influence the political decision-making process and related regulation, there are four main criticisms of the theory. First, Posner (1974: 347) notes that private interest theory 'has not been refined to the point where it enables us to predict specific industries in which regulation will be found. That is because the theory does not tell us what (under various conditions) is the number of members of a coalition that maximizes the likelihood of regulation'. Second, the empirical examples are criticised as being invalid. In this regard, Posner (1974: 352-353) suggests that 'only three studies have tried to test the economic theory of regulation, as distinct from the general interest group theory'. Third, 'it is not clear why an industry [(banking industry)] succeeds in subjecting an agency to its interests but cannot prevent its coming into existence'

[48] Becker (1983) focuses on the role of interest groups and assumes that they compete with one another to gain more influence.

[49] According to Llewellyn (1999), there are several reasons why consumers demand banking regulations: to secure economies of scale in bank monitoring, to address past experiences of bad bank behaviour and to lower transaction costs for consumers.

(Hertog 2010: 22). Fourth, bank regulation often serves the interest of consumers rather than that of the banking sector (see Moosa 2015).

Capture theory

In the literature, there are conflicting substantive boundaries of capture theory with respect to private interest theory. Here, Schmidt and Kirschner (1987) assume that capture theory can be interpreted as a form of private interest theory. In this regard, Hertog (2010) views capture theory as a part of private interest theory. According to Hertog (2010: 22), however, 'the capture theory is more of a hypothesis that lacks theoretical foundations. It does not explain why an industry is able to 'take over' a regulatory agency and why, for example, consumer groups fail to prevent this takeover'. Conversely, Posner (1974) notes that the theory has a certain independence. Becker (1983) maintains that capture theory does not refer to Stigler (1971) but rather is based on the approaches of public choice theory. In this dissertation, the view of Schmidt and Kirschner (1987) and Hertog (2010) is considered, that is, that capture theory is a part of private interest theory. Consequently, regulation means 'a process by which interest groups [(regulatory agencies)] seek to promote their (private) interests' (Posner 1974: 341). In other words, regulatory agencies become controlled by the banking industry. Therefore, the intent of the original regulation is captured and thwarted by banks, and regulation is modified over time until it serves the interests of the banking sector. According to Olson (1965), Stigler (1971), Niskanen (1975) and Peltzman (1976), small interest groups can be organised with lower costs than large interest groups. Thus, it is easier to organise small groups with limited interests than large groups with different objectives because of the free-rider problem (see Olson 1965, Laffont and Martimort 2002). Consequently, the interests of the producers (banks) typically prevail, which suggests a pro-producer theory. The reasons for the dominance of the producer are the declining interests of depositors, heterogeneous group attributes,[50] and free-rider problems, among others. One of the first scholars to examine the group attributes of producers was Mancur Olson (1965). To that end, Olson (1965) suggests that not all potential interests in a society can organise themselves equally well. Consequently, small homogeneous groups, such as the Swiss Bankers Association (SBA) or the American Bankers Association,

[50] Economic agents (such as consumers (depositors)) are different and have different skills and different needs – in economists' jargon, they are heterogeneous.

find it easier to organise with lower cost themselves than large heterogeneous groups[51] such as depositors. The following three examples describe the capture theory in banking.

Following the 2007 financial crisis, an expert commission was formed in Switzerland to decide which measures should be implemented to reduce the risks of SIBs. On 30 September 2010, a group of experts consisting of representatives from FINMA, the SNB, the FFA, and, among others, two large Swiss banks (Union Bank of Switzerland and Credit Suisse), appointed by the Federal Council, submitted its proposals (see Commission of Experts 2010). The proposal on 'Amending the Banking Act' (too big to fail) 'was submitted for consultation by the Federal Council on 22 December 2010 […] [and] reservations and proposals for adjustments were raised. Based on the feedback, it was decided that amendments would be made to the consultation draft in various areas and that the proposed switch from the debtor principle to the paying agent principle for withholding tax would be dealt with in a separate dispatch for technical reasons' (SIF 2013: Internet). In this regard, the 'Amending the Banking Act' was captured and thwarted by the banking lobby with respect to the paying agent principle. In practice, there are numerous other examples that show the watered-down effect. In the United States, Acharya et al. (2010) examines the modification of the Volcker rule in the Dodd-Frank Wall Street Reform and Consumer Protection Act (DFA). In this context, 'in passing the Dodd-Frank Act in 2010, Congress weakened the so-called Volcker Rule, which prohibits commercial banks from trading securities on their own account' (Admati and Hellwig 2013: 3).

The second example is related to the Swiss Financial Services Act (FinSA), which is equivalent[52] to the European Markets in Financial Measures Directive II (MiFID II).

'The FinSA governs the prerequisites for providing financial services and offering financial instruments and facilitates the enforcement of customers' claims against financial service providers. […]. [T]he rule on the reversal of the burden of proof, the procedural costs fund and the arbitration court were clearly rejected together with the instruments of collective legal protection limited to financial services' (FDF 2015a: Internet).

[51] In this respect, Goodhart et al. (1998: 7) suggests that the 'consumers [(depositors)] of financial services are not a homogeneous group'.

[52] Countries have the option of adapting their banking system to the equivalent regulations of other governments. When another regulated country has the same regulation, it is referred to in the regulation as the equivalence principle. Conversely, countries can pursue an independent 'heterogeneous' approach. Both approaches have advantages and disadvantages. In the case of the equivalence approach, countries are less independent and must assume higher monitoring costs in purchasing. By contrast, the yield potential of the equivalence approach is larger than that of the heterogeneous approach (see Gerber and Kronenberg 2014). Furthermore, countries that adopt the heterogeneous approach are less dependent on other regulated countries. According to Gerber and Kronenberg (2014), the disadvantages of the heterogeneous approach include increased expenses attached to implementation and control, which are accompanied by operational and legal risks.

In other words, the Federal Council has taken initial decisions that the procedural costs fund and the arbitration court will be removed because the preliminary draft in which customers had the possibility to enforce their claims against financial service providers faced the strong headwind of the Swiss banking lobby (see SBA 2015, FDF 2015b).

Moreover, sometimes an entire government may be captured by a regulatory agency. For instance, in autumn 2010, the European Central Bank (ECB) ensured that the Irish taxpayer would be liable for German banks' claims against Irish banks. The ECB persuaded the Irish government by threatening to stop the ELA for Irish banks, which might have caused the Irish banking sector to break down (see Hellwig 2015a). In other words, the ECB captured the Irish government by promoting their private interest or the interest of German banks. The behaviour of the central bank can be seen as a form of government failure.

Nevertheless, according to Posner (1974), capture theory is unsatisfactory for five reasons. First, in practice, capture theory is indistinguishable from public interest theory in its assumption that regulation is implemented to benefit the public interest. Second, Posner suggests (1974: 342) that the theory has no explanation for 'when a single agency regulates separate industries having conflicting interests'. Third, capture theory ignores the fact that regulation serves the interests of consumers rather than the interests of the banking sector. Fourth, banks refuse regulation because of the negative effect on profitability. Fifth, the theory does not exactly describe why a bank can capture a regulatory agency and why heterogeneous interest groups fail. However, recent capture activities from bank lobbies, according to the Basel Accord in 1996, 2007, 2010-2011 and in Switzerland, advocate for the capture theory. Therefore, further academic research is desirable with regard to the capture theory in the banking sector.

The theory of economic regulation

In 1971, George J. Stigler refined and expanded the ideas first developed in capture theory into a reformulated theory of economic regulation. This theory of economic regulation is derived from public choice theory, which is defined as 'the economic study of non-market decision making, or simply the application of economics to political science' (Mueller 2003: 1). In this context, the theory first takes the view that regulation is a public good whose allocation is governed by the laws of demand and supply (see Posner 1974). On the demand side are industry groups that have access to better information than consumers and politicians have access to; thus, this scenario begs for regulation. In other words, a central thesis of Stigler (1971: 3) is that

'regulation is acquired by the industry and is designed and operated primarily for its benefit'. On the supply side, regulation as a public good is supplied by policymakers. In this context, the second view is essentially that the political process defines the rational explanation for regulation (see Stigler 1971). Consequently, in contrast to public interest theory, government intervention does not seek to correct market inefficiencies but (following capture theory) rather accommodates the notion that regulation exists to promote the interests of politically effective groups (see Stigler 1971). The following example briefly describes the theory of economic regulation in the banking industry. Consider the case of capital regulation. Banks, particularly SIBs, must meet risk-weighted capital requirements (see section 3.2.1). Based on the theory of economic regulation, it might be argued that risk-weighted capital requirements are acquired by the banking industry for its benefit because, under the risk-weight approach, SIBs can manipulate the capital required to be held for funding propositions. According to Stigler (1971), on the demand side of the banking industry, the SIBs ask for more regulation (an internal ratings-based approach) that does not seek to correct market failures but rather to promote the interests of the politically effective group, namely, the SIBs. Although the above-mentioned example might be a possible explanation for the theory of economic regulation in the banking sector, further academic research is necessary to make such a determination.

The theory of bureaucracy

Another approach of private interest theory is Niskanen's theory of bureaucracy (1975). The theory of bureaucracy can explain the spread of regulation and over-regulation in the banking industry. However, bureaucracy theory does not explain the formation of regulated areas.

The central component in the analysis of bureaucracy theory is the government bureaucrat; in our case, this role is played by the supervisory authority of banks. In this respect,

'regulatory agencies can be viewed as supplying regulatory, monitoring and supervisory services to various stake-holders: financial firms, consumers, government etc. However, complications arise because, unlike most other goods and services, they are not supplied through a market process, but are largely imposed by the regulator even through there may be a process of consultation' (Llewellyn 1999: 6).

Thus, regulatory authorities have an informational advantage over governments with respect to regulation. Based on this informational advantage, Niskanen (1975) suggests that the regulator will maximise utility by providing monetary or non-monetary incentives. In light of these

characteristics, the main conclusion of the Niskanen model is that the public sector consists of an oversupply of regulation that is produced at little or no cost. Thus, the output of bank regulations is so large (over-regulation) that it is allocatively inefficient, notwithstanding the fact that it was produced at minimum cost. The equilibrium is called the Niskanen equilibrium (see Niskanen 1975).

The weaknesses of the Niskanen model are that its results substantially depend on assumptions: (1) budget maximisation; (2) asymmetric information; and (3) natural monopoly. The first assumption is based on the argument that regulators do not reject higher budgets. In this context, regulatory authorities have an incentive to hire more regulators and promote mature regulators. However, in practice, it is unclear whether regulatory authorities use larger budgets to hire more regulators. In relation to the second assumption, there is an asymmetric information problem between politicians and the regulator agency. In this sense, politicians cannot (or are unable) to evaluate and control regulatory services. According to the third assumption, it will be argued that the supervisory authority is a natural monopoly (see Dewatripont and Tirole 1994). However, this assumption should be differentiated because regulatory agencies (for example, FINMA and the Competition and Markets Authority) are in competition with one another (see Becker 1983, Blankart 2006).

Public financing approach

Another economic reason for bank regulation is public financing. Public financing means that a country's banking industry is devoted to funding the public sector, that is, the government. In this context, Bruni (1990) analysed the Italian banking industry as it was approaching 1992. In so doing, he found that 'the consumer market for financial services is still underdeveloped' (Bruni 1990: 255). In other words, 'a small part of the output of Italy's financial industry, a distinguishing characteristic of the country's banking sector, is that a large part of its activity is devoted to financing the public sector' (Bruni 1990: 239-240). In this context, Bruni (1990) explains that the highest percentage of the demand for bank assets in Italy involves bank claims on the government because of governmental regulation and financial protectionism. In other words, public finance results from bank regulation because regulation in the form of capital controls and financial protectionism encourages banks to fund the public sector. Consequently, the higher the degree of public funding is, the less the government is interested in deregulating the banking sector. Thus, regulation and deregulation can also be justified by means of a public financing analysis. In this regard, further academic research on the public financing argument

in a contemporary context would be desirable because the European banking sector has undergone structural changes since 1992.

2.1.2. Public interest theory – market failure theory

Public interest theory underlies numerous contributions to the literature and was developed initially by Pigou (1932 [1920]). Pigou (1932 [1920]: 229) interprets regulation as

> 'state interference, designed to modify in any way the working of free competition, is bound to injure the national dividend; for this competition left to itself will continually push resources from points of lower productivity (in terms of economic satisfaction as measured in money) to points of higher productivity, thus tending always away from less favourable, and towards more favourable, arrangements of the community´s resources'.

In the literature on public interest theory, there are four main assumptions: (1) perfect information;[53] (2) benevolent regulators who aim to pursue the public interest; (3) separate markets that are extremely unstable and inefficient; and (4) relatively costless regulation. According to these assumptions, the 'state' interferes in markets when they are unable to regulate themselves. Thus, 'state interference' is triggered when the neoclassical assumption of the Walrasian[54] general equilibrium theory breaks down and resources are not allocated to their highest valued uses, defined as 'market failure' (see Posner 1974). Hence, regulation – including bank regulation – is supplied in response to the demand of the national dividend for 'the community', known as 'public interest', to push resources from lower productivity to higher productivity. In other words, '[r]egulation's purpose is to achieve certain publicly desired results in circumstances where, for instance, the market would fail to yield these' (see Baldwin and Cave 1999: 19). The main causes of market failure are market structure (such as natural monopoly), asymmetric information and externalities. However, market structure, particularly natural monopoly, does not play a decisive role in the justification of bank regulation because the banking industry consists of a large number of banks subject to significant competition. In this regard, 'the existence of a large number of banks provides an additional reason for believing that it is extremely difficult for the banking system to form a system-wide monopoly. In short, analysis of the aggregate effects of monopoly does not provide an argument for controls [in the banking sector]' (Meltzer 1967: 483-488). Likewise, Goodhart (2010) indicated that market

[53] Conversely, Laffont and Tirole (1994) assume asymmetric information.
[54] Leon Walras (1834-1910) was a French economist and an early explorer of general equilibrium theory. Walrasian equilibrium is understood as competitive equilibrium (see Varian 2004).

structure, with a few minor exceptions (for example, access to clearing houses (see section 5.1)), is not relevant in the banking system. Therefore, no further elaboration on market structure is provided here. Conversely, asymmetric information and externalities justify regulation in the banking industry. In what follows, we describe the role of bank regulation in relation to asymmetric information and externalities.

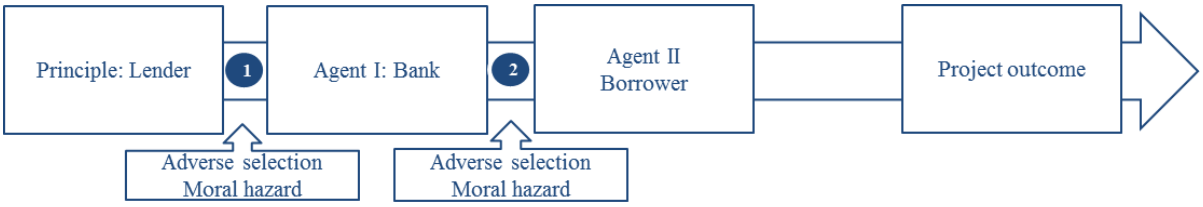
Asymmetric information

Information plays a crucial role in the economy. Contrary to the assumption often represented in models of 'perfect information',[55] real-world practice assumes 'asymmetric information' (see Budäus 1988, Tirole 1988). In 'Market for Lemons', George Akerlof (1970) became one of the first scholars to address the problem of asymmetric information, modelled as quality uncertainty in the sale of goods. For this purpose, buyers and sellers do not have the same information regarding the cost and quality of goods and services. In other words, the difficulty of bank regulation arises because each party (for example, banks, lenders and borrowers) has different knowledge and information regarding their own motives, actions, positions and services and those of other agents.

In the literature, there are three common phenomena of asymmetric information, namely, 'adverse selection', 'moral hazard' and 'ruinous competition'. The first two phenomena are frequently explained by referencing the insurance – and not the banking – industry (see Tirole 1988, Greenbaum and Thakor 2007 [1995], Burghof and Rudolph 1996, Goodhart et al. 1998, Laffont and Martimort 2002). For the purpose of describing the asymmetric information problem, we can use the principal-agent relationship.[56] In the principal-agent model, it is assumed that the principal uses an incentive-compatible contract to ensure that the representative agent acts in the principal's interests (see Maskin and Tirole 1990). Figure 2.2 depicts the bank as a member of a dual principal-agent relationship assuming utility maximisation in the credit market by the principal (lender), agent I (bank) and agent II (borrower). We called this the dual principal-agent relationship in the banking industry. Here, we assume that banks are simply financial intermediaries, that is, they are in a position to grant credit only if they have collected pre-existent deposits.[57]

[55] Kiener (1990) posits that there is perfect information when the principal and the agent at one point have the same level of knowledge regarding a decision problem. Otherwise, information is asymmetric.
[56] The literature has developed the principal-agent relationship and applied it to a variety of economic problems such as insurance contracts, labour contracts and the regulation of monopolies (see Maskin and Tirole 1990).
[57] In an endogenous money framework, deposits are created in the act of lending. To describe the asymmetric information problem, we use circuit analysis.

Figure 2.2 The bank as part of a dual principal-agent relationship with the example of the credit market



Source: Authors' own elaboration.

In the dual principal-agent relationship, a two-step asymmetric information problem is created by adding the bank between (1) the lender and the bank and (2) between the bank and the borrower. In this respect, Stiglitz and Weiss (1981) first provided evidence of adverse selection and moral hazard in the credit market by means of an increase in interest rates. Stiglitz and Weiss (1981) utilise two assumptions. First, they assume a credit market with 'good' and 'bad' borrowers. Second, they assume credit rationing.[58] In other words, demand is greater than the supply of loans, which means conversely that 'good borrowers' either do not receive loans or do not receive the desired amount of loans. Let us suppose a higher interest rate in the credit market, which will have two effects, according to Stiglitz and Weiss (1981).

First, the rationing of credit acts to exclude 'good borrowers' from the credit market. In other words, 'bad borrowers' crowd out 'good borrowers' because the bank cannot observe the borrower's credit rating. This effect is called adverse selection, 'the problem created by asymmetric information before the transaction occurs' between the bank (Agent I) and the borrower (Agent II) (Mishkin 2013: 81, see also Figure 2.2). In other words, adverse selection in banking 'occurs when the potential borrowers who are the most likely to produce undesirable (adverse) outcomes – the bad credit risks – are the ones who most actively seek out a loan and are thus most likely to be selected' (Mishkin 2013: 81). In general, adverse selection arises before signing the contract, when products or services of low quality will displace products and services of high quality due to the cost of information (see Tirole 1988). Thus, adverse selection

[58] In an endogenous money framework, banks have an incentive to accommodate all demands for funding independent of the risk preference of the borrower. The bank creates funding by accommodating the funding demands of the borrowers. Thus, as we already noted in section 1.1.2, 'there is virtually no constraint on the ability of banks to issue credit' regarding the macro-uncertainty (Rousseas 1998: 83, Rochon 2016). The question arises regarding who a bank deals with regarding micro-uncertainty. As Rochon (2016: 86) clearly noted, if the borrower already meets the basic minimum level of creditworthiness, the additional creditworthiness (micro-uncertainty) is determined by using the interest rate. In this case, if the borrower meets the minimum level but the bank expects some uncertainty regarding the repayment of a loan, the bank may impose a higher rate of interest for the borrower in question compared with other borrowers (see Rochon 2016). Consequently, higher interest rates have the effect of discouraging potential borrowers from borrowing (credit rationing), which is not desirable in a growing economy.

indicates that one side of the market cannot evaluate the quality of goods and services on the other side of the market, which is also referred to as hidden information (see Arrow 1985b, Varian 2004).

Second, 'adverse selection is not the only informational problem one can imagine' (Laffont and Martimort 2002: 145). Stiglitz and Weiss (1981: 408) posit that 'increasing interest rates or collateral requirements could increase the riskiness of the bank's loan portfolio, either by discouraging safer investors or by inducing borrowers to invest in riskier business projects' (see Figure 2.2). According to Laffont and Martimort (2002), this effect represents the moral hazard. In this case, the moral hazard 'is the problem created by asymmetric information after the transaction occurs' between the bank (Agent I) and the borrower (Agent II) (Mishkin 2013: 82). In other words, moral hazard in banking 'is the risk (hazard) that the borrower might engage in activities that are undesirable (immoral) from the lender's point of view' (Mishkin 2013: 82). In general, the moral hazard arises after the contract has been signed when an incentive for risk-taking behaviour is created as a result of risk coverage (for example, deposit insurance (see Appendix 6) and LOLR (see part II)). Thus, because of risk insurance, the insured parties do not suffer if they behave carelessly, which is referred to as hidden action (see Arrow 1985b, Tirole 1988, Laffont and Martimort 2002).

In short, Stiglitz and Weiss (1981) use the example of the credit market to show that, on the one hand, quality uncertainty leads to adverse selection[59] because banks cannot observe borrowers' creditworthiness and, on the other hand, moral hazard[60] arises due to behaviour uncertainty because banks have difficulty observing how loans are used.[61]

A third characteristic discussed in the market failure literature is ruinous competition[62] between banks. As a result of price pressure, it is believed that 'good' banks with good services are displaced by 'bad' banks with bad services. As the result of a lack of information and knowledge ('buyer ignorance'),[63] depositors can only judge the quality of banking services with substantial difficulty or not at all. Therefore, Goodhart et al. (1998: 7-8) indicate that 'the individual consumer has limited ability and opportunity to acquire the necessary skills to enter

[59] Mishkin (2013: 209) explains adverse selection by noting that 'potential bad credit risks are the ones who most actively seek out a loan'.
[60] One practical example of the moral hazard problem is the insolvency of Barings Bank. In February 1995, a bond trader incurred a large loss. In this context, the trader had two options: (1) he might reveal his loss to his manager and risk being fired or (2) he might decide to 'gamble on resurrection' by taking on more positions in the stock market to recover the initial loss. 'If the trader continues losing money and the internal controls fail, he can bring the whole bank down' (Goodhart et al. 1998: 47).
[61] Economic transactions frequently involve people with asymmetric information because 'the borrower usually knows more about its own investment opportunities than the lender' (Greenbaum and Thakor, 2007 [1995]: 24).
[62] According to Budäus (1988) and Hertog (2010), ruinous competition is a result of long-term overcapacity.
[63] Buyer ignorance is the inability of buyers to judge the quality of the purchase (see Kahn 1998).

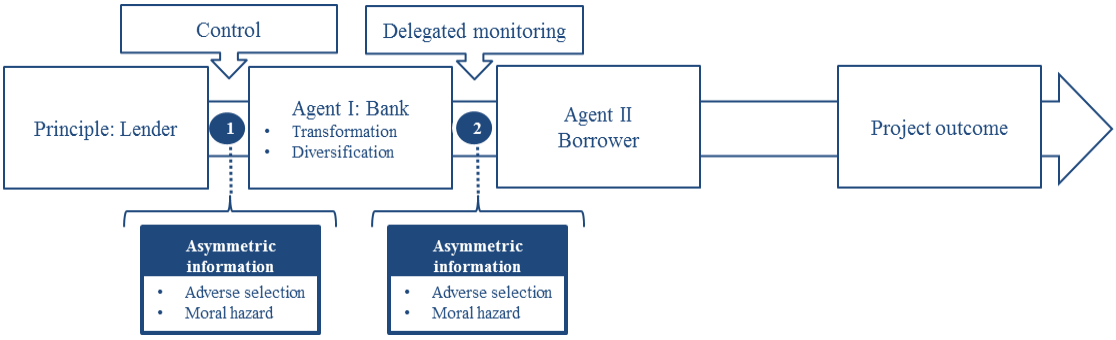
into complex financial contracts' (see also Llewellyn 1999). Expanding on this point, Spong (1994: 6) notes that an 'investigation of these factors is likely to be too complex and costly for the vast majority of depositors'. In other words, small 'depositors are said to be unaware of – and unlikely to pay the cost of acquiring information about – the risk position accepted by the bank or the character of the banker' (Meltzer 1967: 496). In light of these characteristics, the complexity of assessment and the control of financial services are prohibitively expensive for small depositors.[64] None of these authors indicate that the depositor has insufficient knowledge.[65] In this context, when creating their credit supply, 'good' banks generally work based on realistic assumptions, whereas 'bad' banks are aware that their offer to the borrower has more attractive conditions than the offers of 'good' banks. Because the lender can make the quality of the loans difficult to judge, the borrower enters into the deal with the attractive conditions of the 'bad' bank, which results in 'good banks' slowly exiting the market and, at a later stage, 'bad' banks being unable to provide additional credit. According to Baltensperger (2005), this situation leads to a sub-optimal allocation of resources in the form of loans and risks. Thus, the risk of a banking crisis increases, and the demand thus arises that 'bad' banks be excluded from the banking industry with stringent market entry restrictions. With these considerations in mind, the question arises: what does asymmetric information have to do with banking?

One key function of banks is that through delegated monitoring, a bank can eliminate the asymmetric information problem of adverse selection and moral hazard between the lender (Principal) and the bank (Agent I) and between the bank (Agent I) and the borrower (Agent II) that can occur, as shown in Figure 2.2. In this context, the question arises regarding how banks can reduce asymmetric information.

In 1984, Douglas W. Diamond developed a theory of financial intermediation and delegated monitoring. His theory was based on minimising the cost of monitoring information through the delegation of monitoring ('delegated monitoring') by a bank (see Diamond 1984). Figure 2.3 presents the Diamond model as an optimal contract that is sufficiently attractive between the borrower, the bank and the lender as part of a dual principal-agent relationship.

[64] In addition, the contribution of bank depositors is small relative to the costs of control of the bank and is not worth the deposit (see Burghof and Rudolph 1996).
[65] According to Llewellyn (1999: 31), the 'lack of information and ability of consumers to utilise information' about financial products and the bank is one important reason for consumer protection (see section 2.2.1).

Figure 2.3 The Diamond model as a dual principal-agent relationship



Source: Authors' own elaboration.

Diamond (1984) presented two main assumptions in his model: delegated monitoring and diversification. As a result of delegated monitoring, the bank incurs monitoring costs. In this case, Diamond (1984) assumed that time-consuming monitoring by banks (self-regulation) could be offered in contrast to bank regulation as cost effective 'because the alternative is either duplication of effort if each lender monitors directly, or a free-rider problem, in which case no lender monitors' (Diamond 1984: 393). The assumption of the bank's cost-effective monitoring is based on three characteristics. First, banks can use economies of scale[66] (see Diamond 1984). Second, lenders do not have to assess knowledge and information to evaluate and monitor banks (see Baltensperger and Dermine 1987, Goodhart et al. 1998, Llewellyn 1999).[67] Third, banks have better information about the activities of borrowers and lenders – as well as their own liquidity and solvency[68] – because they can monitor how diligently the borrowers conduct their activities by spending some money and avoid 'extreme' negligence (there are banks that can reduce borrowers' outside benefit) (see Diamond 1984). For this reason, the cost of delegated monitoring to lenders can be reduced with increasing numbers from the bank, which leads to lower costs compared with direct financing by the lender. However, Figure 2.3 shows an additional information problem that results from the monitoring delegated by the bank. In addition to the bank, the lender must address the problem of project outcome uncertainty. In other words, lenders and borrowers do not observe the project outcome. If nothing has been agreed upon in the loan agreements, the bank may allow opportunistic behaviour and lower

[66] Economies of scale means '[t]he reduction in transaction costs per dollar of transaction as the size (scale) of transactions increases' (Mishkin 2013: 680).
[67] 'The bank knows more about the quality of its loan book, the security of its assets and the matching of asset and liability duration than the prospective depositor. Monitoring banking solvency requires skills which many depositors do not possess' (Finsinger 1990: 59). This reasoning also explains why private audit firms (for example, PricewaterhouseCoopers) or regulators must protect the interests of depositors (see Dewatripont and Tirole 1994, Burghof and Rudolph 1996).
[68] The solvency state of nature is analysed in section 7.2.2.

project revenues for the lender. To mitigate this behaviour, lenders provide their credit contracts with an interest payment and penalties (that is, a non-pecuniary penalty) regardless of the borrower's project outcome (see Diamond 1984). Thus, the bank has an incentive to ensure that the project outcome of the lender, less monitoring costs, is equal to or greater than the corresponding interest payment and penalty costs of the borrower. In other words, banks have (1) the incentive to ensure that no sanctions are levied and (2) the incentive to monitor the movement of capital to ensure that the flow of capital is adequate to pay the lender's interest. In this context, banks attempt to use diversified capital inflows (deposits) to guarantee capital outflow (credit). Thus, Diamond (1984) suggests that with a higher number of loans, a single credit default has less of an effect on the total projected outcome. Thus, individual credit losses are identified, assessed and monitored in the risk transformation.[69] It is the goal of an efficient banking system to circulate the cost-optimal allocation of credit risk to the lender. For this purpose, credit default risks are diversified in the sum of projected outcome (see Diamond 1984).[70] Diamond (1984) showed that losses tend to be zero with an increasing number of credits through diversification.[71] Consequently, Diamond (1984) demonstrated that the benefits to the bank are found under certain assumptions in the process of risk transformation; to minimise the problem of asymmetric information, the 'agency' costs[72] are less than the costs of direct financing by the lender to the borrower.

Nonetheless, the Diamond model has limitations; for example, it does not eliminate the asymmetric information problem. This is counterfactual in the light of financial and banking crises because a banking crisis is not a rare event (see Dewatripont and Tirole 1994).[73] Therefore, bank regulation could mitigate the problem of asymmetric information.

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[69] 'The recent literature on transformation services shows that there is a close relation among improving risk sharing, fixed claim deposits and bank runs' (Diamond and Dybvig 1986: 63).

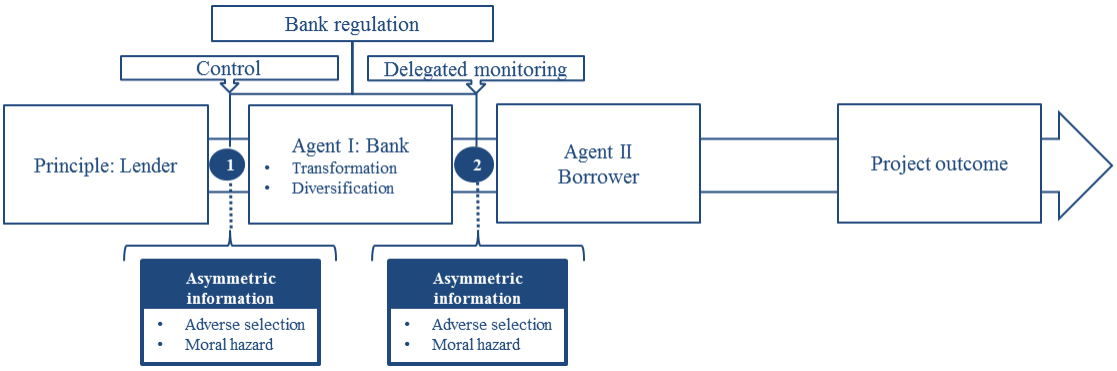
[70] In addition to diversification, there are two basic forms of risk transfer: hedging and insurance (see Bernet 2003).

[71] 'The result that the delegation costs go to zero implies that asymptotically no other delegated monitoring structure will have lower costs' (Diamond 1984: 395). The bank may reduce the probability of failure by means of risk diversification, and the default risks of loans tend towards zero (see Diamond 1984).

[72] Although banks and depositors are interested in reducing information asymmetry with monitoring, monitoring is associated with costs. The sum of the monitoring costs is called agency cost, which consists of the cost of depositors' 'bonding costs', the bank's 'monitoring costs' and the uncertain 'residual-loss' costs (see Jensen and Meckling 1976).

[73] Many researchers contradict one another regarding the frequency of financial and banking crises. Richter (1990: 28) asserts that 'it should be kept in mind, though, that a general banking crisis is an extremely rare event, what came close to it only happened once between 1931 and 1933'. Conversely, Caprio and Klingebiel (1997), Goodhart et al. (1998), Tirole (2002), Rochet (2008a) and Reihnhart and Rogoff (2009) disagree. According to Rochet (2008a), in the past thirty years, there were numerous banking and financial crises around the world, such as those in Latin America (early 1980), Russia (1998), Argentina (2001) and the United States (2007) (see Tirole 2002, Reinhart and Rogoff 2009). Further, Reinhart and Rogoff (2009) empirically analyse financial crises over eight centuries, focusing on 66 countries between 1800 and 2008. In this context, they use two approaches: defining the crisis using strict quantitative indications (such as inflation crisis, currency crashes, currency debasement and the bursting of asset price bubbles) and defining the crisis by events (for example, bank runs, external debt crisis and

Figure 2.4 Bank regulation as a consequence of potential market failure in the Diamond model



Source: Authors' own elaboration.

In this sense, bank regulation provides minimal quality standards that reduce agency costs and also serves as a substitute for the monitoring of the lender and borrower, as shown in Figure 2.4 (see also Stillhart 2002). Consequently, there is a need for bank regulation to mitigate the asymmetric information problems that arise between the lender and the bank and between the bank and the borrower.

Externalities

Another justification for bank regulation includes externalities. The concept of externalities (external effects) dates to A. Marshall (1997 [1920]) and A.C. Pigou (1932 [1920]). In defining the concept, Marshall assumed internal effects. According to Marshall (1997 [1920]), all cost and benefit factors that influence decision makers directly in their decision-making functions can be understood by the term 'internal effects'. In this case, for Marshall (1997 [1920]), externalities are the residual form of internal effects. The concept of externalities was introduced into public finance by Pigou (1932 [1920]), who posited that externalities arise whenever there are either positive or negative side effects in the consumption or production of an economic agent. In this regard, Frey (1981) suggests that consumption or production is disturbed by the economic agent, leading to a Pareto inefficient situation. As a consequence, the costs or revenues of external effects are not accounted for in the decision-making process

domestic debt crisis). According to Reinhart and Rogoff (2009), financial crises and banking crises are not rare events. Consequently, we advocated in this dissertation that financial crises and banking crises are not rare events.

and are thus not internalised (see Budäus 1988).[74] The concept of externalities from Marshall (1997 [1920]) and Pigou (1932 [1920]) can also be used in the bank regulation literature.

With externalities in consumption, all economic interdependencies are considered in which the benefits to a consumer (depositors and so on) are directly affected by the conduct of another economic agent. In simple terms, '[a]ny market action taken by one player in a market is always likely to affect the economic position of all the other players in that market' (Goodhart 2010: 168). Thus, risk-taking behaviour[75] in the form of a 'fire sale'[76] as another source of financial instability can lead to negative externalities (information contagion, linkages and counterparty exposures) on other banks in the industry. In this regard, the recent financial crisis indicates a fire sale throughout the banking industry (see Kashyap et al. 2011). Therefore, bank regulation that addresses fire-sale mechanisms can mitigate negative externalities.

Such fire-sale behaviours can spill over to other banks and functions (for example, payment systems) and play an important role with respect to adverse effects on the balance sheet (such as an impairment of the solvency positions of the bank balance sheet), which can lead to bank failure in extreme cases and the failure of other banks as the result of contagion effects[77] because the monetary and credit systems are inextricably interconnected. As the result of a bank failure, credit information is lost in the market. Therefore, borrowers must take out new loans under unattractive conditions, and as a consequence, '[m]ore expensive credit terms [are offered that] imply lower investment and [possibly] unemployment' (Baltensperger 1990: 5). Thus, a bank failure leads to potentially substantial social costs in the real economy. Because a bank failure, particularly for an SIB, can lead to enormous externalities on the entire economy, bank regulation and/or safety-net arrangements (such as deposit insurance or the LOLR) are justified to mitigate damage in the entire economy.

With regard to an externality in production, all economic interdependencies are considered in which the production level of a bank is directly affected by the action of another economic agent (see Marshall 1997 [1920], Pigou 1932 [1920], Frey 1981, Varian 2001, 2004, Blankart 2006). An externality on the banking industry can be attributed to the information-processing system (for example, lending). One such externality in production can be explained

[74] According to Budäus (1988), externalities must be observable and predictable to be internalized over time such that they can be made marketable.

[75] In this regard, Borio and Filosa (1994) argue that banking has become riskier in some countries because of deregulation and with commercial real government business.

[76] According to Shleifer and Vishny (2010: 30), 'a fire sale is essentially a forced sale of an asset at a dislocated price. A sale is forced in the sense that the seller cannot wait to raise cash, usually because he owes that cash to someone else. The price is dislocated because the highest potential bidders are typically involved in a similar activity as the seller, and are therefore themselves in a similar financial position. Rather than bidding for the asset, they might be selling similar assets themselves'.

[77] An overview of contagion effects will be provided in section 2.2.3.

using the following example. Suppose two banks, B_1 and B_2, compete in a mortgage market. B_1 sets its fixed and variable mortgage interest rates based on a costly mortgage branch analysis and publishes the fixed or variable mortgage interest rates to attract new customers. Simultaneously, bank B_2 uses the publicly accessible mortgage rates of bank B_1 and sets the mortgage interest rate at the same level as B_1 without any costly mortgage branch analysis (free-rider problem) (see Fest 2008). This example illustrates an externality on the banking sector that positively affects the action of a competitor (see Fest 2008).

In the literature, the public interest theory has been criticised from theoretical, political and empirical perspectives. First, in practice, the perfect information assumption is rarely found because regulators do not have enough information regarding the cost, demand, quality and benefits to the public interest. Second, the theory is unsatisfactory because there is no link 'or mechanism by which a perception of the public interest is translated into legislative action' (Posner 1974: 340). In addition, using the political decision-making process, it 'is extremely difficult to validate this assumption. The study of motivation is an elusive and perhaps an impossible task. Laws, particularly in the form of legislation, are rarely the work of a single mind, and there are often conflicting expressions of what was intended' (Ogus 2004: 3). Third, the market mechanism is often able to compensate for any inefficient separate markets (see Moosa 2015).[78] In theory, it can be shown that the allocation of resources by the mechanism of a free market is optimal (see Arrow 1985a). In practice, these conditions may not always apply, and market failures may result. The fourth assumption is that regulation is relatively costless; however, in practice, regulations are not inexpensive to implement, particularly in the banking sector. Fifth, the theory has been invalidated by empirical research (see Stigler 1971). Finally, capture theorists downplay the degree to which economic and political interests influence regulation (see Baldwin and Cave 1999).

[78] In separate markets, excessive competition usually occurs as an outcome of long-term overcapacity and not because they are extremely unstable (see Hertog 2010).

2.2. Objectives of bank regulation

In the literature, there are many justifiable objectives[79] for bank regulation in addition to the public and private interest. For example, according to Budäus (1988) and Rochet (2008a), regulations are the result of crisis situations that persist after the end of the crisis. This situation is explained by Budäus (1988) by the fact that an existing structure of market participants' rights of action leads to an undesirable outcome in the market process. Nevertheless, there is no consensus in academia regarding why banks are regulated because (1) the literature is fragmented and no common theoretical foundation for bank regulation exists and (2) there are several regulatory causes with different meanings and systematisations.

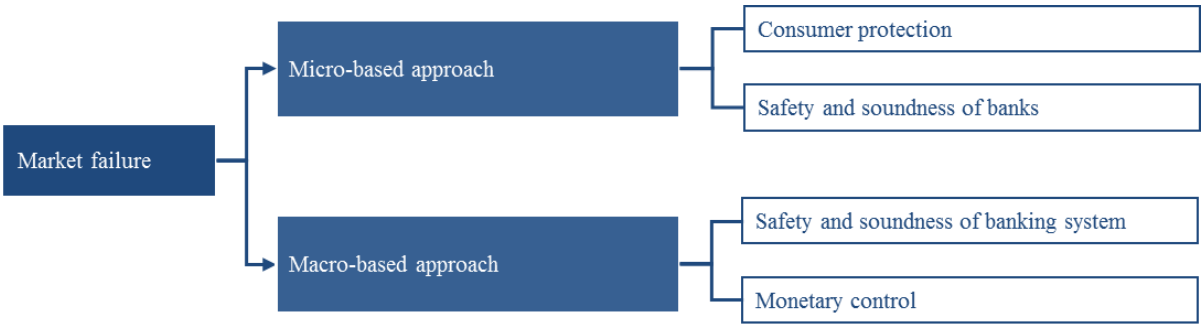
According to Seifert (1984), there are two objectives: consumer protection and the safety and soundness (stability) of the banking system. For Baltensperger (1990), there are three objectives of bank regulation, namely, bank safety and overall financial stability, monetary control and monopoly, and concentration and inadequate banking competition. By contrast, Llewellyn (1996: 9) suggests that there are three objectives, namely, 'to sustain systemic stability, to maintain the safety and soundness of financial institutions, and to protect the consumer'. According to Ogus (2004), the principal function of economic regulation is to provide a substitute for competition in relation to natural monopolies. Bernet (2005), meanwhile, indicates that these objectives are system stability, system efficiency[80] and consumer protection. According to the Financial Conduct Authority (FCA) (2015), there are two objectives, namely, consumer protection and the control of monopoly power to protect financial markets and promote competition. Further, the UK Prudential Regulation Authority (PRA) (2015), as part of the BoE, promotes the safety and soundness of banks and insurance firms and facilitates effective competition. However, competition as a regulatory objective makes little sense for Bernet (2005) because such an objective should be assigned to other policy areas. However, Bernet (2005) does not assign the competition objective to any other policy area. In contrary to the UK, the competition function in Switzerland is assigned to a separate regulatory agency called the 'Competition Commission' as part of the Federal Administration. Baltensperger (2005) first suggested that the competition objective affects other objectives (for instance, the safety and soundness of banking, among other factors). The competitive objective can be understood as valuable insights into the effects of bank regulation

[79] In other words, there are too many goals. Therefore, we need to identify the market failure (see Tirole 2002).
[80] According to Bernet (2005), system efficiency, which is the allocative efficiency included in the system that allows for resources and risk allocation, includes the transaction costs that occur.

because '[e]fficiency and competition are closely linked together. In a competitive banking system, banks must operate efficiently and utilize their resources wisely if they are to keep their customers and remain in business' (Spong 1994: 9).[81] On the one hand, system efficiency is considered, for this reason, to be the result of the safety and soundness of market structure and competition. On the other hand, it seems reasonable to assign the competition objective to bank regulatory policy because the focus of bank regulation in the United States – as opposed to Europe – has addressed the safety and soundness of markets and competition even over the long term (see Baltensperger 2005). These factors were embodied in the restrictions on branches and the separation of investment banking from commercial banking (see Baltensperger 2005). However, as we noted in section 2.1.2, market structure is not a bank regulatory cause. Therefore, competition is not considered to be a rationale for bank regulation.

Overall, the objectives of bank regulation cannot be classified conclusively; therefore, it is difficult to assess the relative benefits of bank regulation without clearly understanding the objectives. Moreover, '[t]he regulatory community [(such as the BIS)] as well as the industry must take the blame for never having specified the objectives and the presumed functioning of [..] regulation' (Hellwig 2010b: 8). We therefore propose an alternative systematisation to better categorise bank regulatory objectives, as shown in Figure 2.5.

Figure 2.5 Overview of the objectives of bank regulation



Sources: Authors' own elaboration.

In the first case, as we noted in the public-interest theory – market failure theory, banks are regulated due to anomalies or deviations in the market. In this regard, a failure is a deviation from equilibrium theory in the market, that is, economic situations in which the market is unable

[81] A competitive market depends 'on the number of banks operating in a market, the freedom of other banks to enter and compete, and the ability of banks to achieve an appropriate size for serving their customers. For instance, too few banks in a market could encourage monopolization or collusion, while banks of a suboptimal size might be unable to serve major customers and might be operating inefficiently' (Spong 1994: 9).

to coordinate supply and demand because of the system immanence[82] of the banking industry (see Musgrave 1966, Seifert 1984, Burghof and Rudolph 1996). In a nutshell, market failure is the main reason for justifying bank regulation. In this case, there is public interest in avoiding the distorting effects of market failure. For this reason, market failures should be identified in the banking industry. Tirole (2002: 114) notes 'a clearly stated objective function, which itself must be based on a clear identification of market failure' because 'once such a failure has been identified we can ask what type of regulation would help to improve the situation' (Baltensperger and Dermine 1987: 70).[83] Market failure and the corresponding regulatory causes can take different forms in practice. To that end, it is useful to systemise the causes of market failure and the corresponding bank regulations.

The financial crisis of 2007–2009 has provoked a strong controversy about the usefulness of a micro-based approach. The outbreak of the financial crisis in 2007–2009 has demonstrated that the analysis of market failure from a micro-based perspective has reached its limit. As a result, it is no longer justified to base bank regulation on such an approach. Hence, many observers, including academics and policymakers, suggest that market failure and the resulting need for bank regulation require a micro- and macro-based approach that addresses systemic risks and hence focuses on the stability of the financial system as a whole. To that effect, we extend the micro-based approach with a macro-based approach for further systematisation of regulatory reasons based on various arguments that do not include the micro-based approach (see Table 2.1).

Table 2.1 The micro- and macro-based approaches of bank regulation compared

	Micro-based approach	Macro-based approach
Proximate objective	Limit distress of individual banks	Limit financial system-wide distress
Ultimate objective	Safety and soundness of banks, consumer protection	Safety and soundness of the banking system (avoid output (GDP) costs)
Correlations and common exposures across banks	Irrelevant	Important
Calibration of prudential controls	In terms of risk of individual banks; bottom-up	In terms of system-wide distress; top-down

Source: Adapted from Borio (2003).

[82] System immanence is understood to mean that the banking sector cannot be immunised against dangers on its own (see Rombach 1993).

[83] In the economic theory of bank regulation, it remains an open question as to how a political decision arises from market failure. The theory of representative majority decision that is connected to a theory of market failure provides a possible theory to explain the gap (see Blankart 2006).

The general view of a micro-based approach attempts to explain the behaviour of the individual agents (consumers, employees and so forth) operating in a banking context under various conditions (see Kahn 1998). Thus, the micro-based approach is a study of the behaviour of individual decision-making units (see Rossi 2010). The aim of the micro-based approach is to consider the causes of market failure and the consequent need for bank regulations on individual banks (see Crockett 2000, Hanson et al. 2011). To expand upon this point, the narrow view of the micro-based approach is defined as follows:

The objective of the micro-based approach is to limit the risk of episodes of financial distress at individual banks (namely, idiosyncratic risk) by emphasising the behaviour of individual agents (particularly externalities and asymmetric information).

Sources: Authors' own elaboration based on Crockett (2000), Borio (2003), Rossi (2007), Hanson et al. (2011), and Mishkin (2013).

In this case, the ultimate objectives of the micro-based concept involve the safety and soundness of banks and consumer protection (see Goodhart et. al 1998). Furthermore, under the micro-based approach, correlations and common exposures across banks are irrelevant. In addition, the calibrations of prudential controls focus on the risks faced by individual banks (see Borio 2003, see Table 2.1).

The limits of the micro-based approach were shown in the aftermath of the financial crisis of 2007–2009. '[F]inancial crises are not simply the result of agents' forms of behaviour, but rather the outcome of a monetary–structural process, eventually inducing businesses to spend the bulk of their earnings on financial markets rather than in production activities' (Rossi 2010: 69). For that reason, 'owing to a [..] [micro-based] conception of macroeconomics and economic policy making, the suggested rules and regulations can, at best, influence agents' behaviour and expectations but cannot […] avoid the occurrence of (further) systemic crises' (Rossi 2010: 69). Further, the 'regulator pushes a troubled bank to restore its capital ratio, the regulator does not care whether the bank adjusts via the numerator or via the denominator – that is, by raising new capital or by shrinking assets' (Hanson et al. 2011: 5). In addition, the procyclicality and interconnectivity of the banking industry are not considered part of a micro-based approach. Further, Blanchard and Johnson (2013: 552) agree that 'to address bubbles, credit booms, or dangerous behaviour in the financial system, the interest rate is not the right policy measure. It is too blunt a tool, affecting the entire economy rather than resolving the

problem at hand'. Therefore, many scholars, including Meltzer (1967), Revell (1975), Crockett (2000), Borio (2003), Brunnermeier et al. (2009), Rossi (2010), Galati and Moessner (2011), Hanson et al. (2011), Blanchard and Johnson (2013), and Mishkin (2013), suggest that banking regulation requires a macro-based approach to regulation in addition to a micro-based approach (see also BIS 2011, IMF 2011, 2013). The principal question that remains the subject of debate today is how to define a macro-based approach to regulation. First, when and where has the macro-based approach been used, and can we clearly differentiate between micro- and macro-based approaches? In fact, it is difficult to say when the macro-based approach of banking regulation was first used and to delineate a macro-based approach because the terminology currently in use is unclear[84] and the examples of many countries suggest wide ranges and variations in bank regulations. In addition, it is difficult in practice but useful conceptually to clearly separate micro- from macro-based approaches (see Goodhart et al. 1998, IMF 2011, Clement 2010). Nevertheless, we attempt to address these difficulties and formulate a macro-based approach to bank regulation.

The first basic considerations of a macro-based approach are rooted in the approach of Meltzer in 1967. According to Meltzer (1967: 486), 'the cost of bank-failure […] has both micro and macro aspects'. Thus, Revell (1975: 1) concluded that 'in all countries credit institutions are regulated for two quite distinct purposes: (1) to ensure their soundness and prudential operation, (2) for reasons of monetary policy and the control of credit. In the economist's jargon, the first can be referred to as 'micro' regulation, and the second as 'macro' regulation'. In 1979, 12 years after Meltzer's definition, the macro-based approach to regulation was named and implemented for the first time at a meeting of the BCBS (see Clement 2010). However, the first appearance of the macro-based approach to regulation in a public document appears to date to 1986 in the Euro-currency Standing Committee report on recent innovations in international banking. The report defines the macro-based approach as a policy that promotes 'the safety and soundness of the broad financial system and payments mechanism' (BIS 1986: 2, see Clement 2010). To that effect, the International Monetary Fund (IMF) added the macro-based approach to its regulatory nomenclature and its so-called 'macroprudential indicators' to its 'Financial Sector Assessment Program' in the 1990s for the first time, in response to the Asian financial crisis (see Clement 2010, IMF 2011). The Euro-currency Standing Committee generally defines the macro-based approach to regulation as an approach that limits the risks and costs of a system-wide crisis rather than focusing on behavioural aspects (that is, avoiding output (GDP) costs of the bank failure exceeding the private costs) (see Borio 2003, Brunnermeier et al. 2009,

[84] Clement (2010: 59) notes that 'the term's origins and its exact meaning remain obscure'.

Galati and Moessner 2011, see also Table 2.1). The aim of the macro-based approach is to consider reasons at the system-wide level, whereas the micro-based approach is to limit the distress of individual banks. In the context of the macro-based approach to regulation, the consequences of the tight interdependence of many banks in the banking system are studied. To expand upon this point, the macro-based concept can be narrowly defined as follows:

The macro-based approach focuses on limiting the risk of episodes of system-wide distress (systemic risk) that have significant costs for the economy as a whole.

Sources: Authors' own elaboration based on Revell (1975), BIS (1986), Goodhart et al. (1998), Crockett (2000), Borio (2003), Borio and Dehmann (2009), Brunnermeier et al. (2009), Rossi (2010), BIS (2011), and IMF (2013).

In this case, the ultimate objective for macro-based policy involves the safety and soundness of the banking system for purely systemic reasons (that is, because the social costs of bank failures exceed their private costs) (see Goodhart et al. 1998). In other words, the macro-based approach should protect taxpayers from the need for rescue, also called 'bail-outs'. Furthermore, the correlation and common exposures experienced across banks are important. In addition, macro-based policies focus on the calibration of prudent system-wide controls (see Table 2.1).

Several discussion papers have been drafted for purposes of banking regulation (for example, see Llewellyn 1999 and Baltensperger 2005). Regardless of whether a normative or positive theory model or a micro- or macro-based approach is assumed, there is some consensus that banking regulation is based on objectives. In theory and practice, however, there is disagreement as to what causes and objectives exist. Based on the considerations discussed above, there are four major bank regulatory objectives: consumer protection, the safety and soundness of banks, the safety and soundness of the banking system and monetary control. Furthermore, these four objectives can be systematised with respect to the micro- and macro-based approaches. In this connection, the micro-based approach is typically justified by consumer protection and the safety and soundness of banks. Conversely, the macro-based approach justifies bank regulation on the basis of monetary control and the protection of the safety and soundness of the banking system, where the latter is understood as the major macro-economic reason for bank regulation. In the normative approach, the repercussion of market failures in efficiency is shown based on micro- and macro-based objective rationales. To that end, regulatory measures in the banking industry should lead, in principle, to positive improvements in efficiency (see Bernet 2005). The micro- and macro-based features are mutually interrelated, which may mean that individual objectives reinforce or trade-off with

one another in practice. For example, on the one hand, bank regulation increases the safety and soundness of banks and reduces the risk of system-wide shocks. On the other hand, more regulation, such as stricter capital and liquidity standards, simultaneously represents an entry barrier[85] to new entrants that can lead to less competition due to cost pressure (see Bernet 2005).

2.2.1. Consumer protection as a rationale of bank regulation

The majority of German-language literature discusses the protection of the small depositor as the main argument to justify government intervention through bank regulation. Consumer protection refers to protecting the underlying trust of consumers against misuse or malfunction. In particular, 'small depositors' and institutional clients (such as pension funds), which together provide a bank with available liquid deposits, are affected. The economic literature on consumer protection examines bank regulation in terms of market failure through asymmetric information and externalities. The starting point of consumer protection is whether an intervention addresses market failures. In this regard, Goodhart et al. (1998) suggest that consumer protection arises for two reasons: (1) because the bank where clients hold their deposits fails 'externality', that is, the 'theory of market failure', or (2) because of the adverse selection of a bank by its clients or the inability of consumers (less knowledge) to monitor the bank, that is, 'asymmetric information'. Therefore, the information economy is crucial. With regard to the information asymmetry discussed above in section 2.1.2 between the client (depositor, investor and so on) and the bank, in addition to its position as a lender and the bank itself, the lender hardly appears to be in a position to make claims against the bank's assets at an affordable price. This reasoning justifies the argument for bank regulation for purposes of consumer protection.

As a practical example to explain consumer protection, we can use FinSA, which is equivalent to MiFID II. The starting point for this regulatory measure is market failure, which results from asymmetric information between the consumer and the bank; for example, the market for financial services had low transparency in the financial crisis of 2007–2009 (see FDF 2013, Eggen and Dorner 2014). To solve the problem of market failure, the FinSA will help to ensure the following: (1) the customer will be better informed about financial products and thus protected, and (2) the competitiveness of the Swiss banking industry will be

[85] In this dissertation, we follow the definition regarding 'entry barrier' of Porter (1980) and Viscusi et al. (1998: 60) that (1) an 'entry barrier can be thought of as something that makes entry more costly or more difficult'. In other words, new banks that bring new capacity and often resources are bid through prices and bank regulation. Thus, bank regulation is a threat of entry into the banking industry that is present, 'coupled with the reaction from existing competitors [(banks)] that the entrant can expect' (Porter 1980: 7).

strengthened (see FDF 2013, Eggen and Dorner 2014).[86] In this case, banks must offer the customer a comprehensive prospectus for securities in the future. In addition, banks must create a key investor information document (KIID) and a prospectus for complex financial products that are traded in Switzerland or that originate in Switzerland. In addition to standardisation, this requirement should achieve a better comparability of investment opportunities between suppliers,[87] that is, a 'level playing field'. Clients should be offered a better calculation in the future with the help of a KIID such that they are better informed regarding the returns, risks and costs of financial services. In other words, more transparency should protect the client more effectively.

Nevertheless, the economic consideration, combined with the history of a depositor's losses, explains much of the public pressure for banking regulation to protect consumers (see Meltzer 1967).

2.2.2. Safety and soundness of banks as a rationale of bank regulation

One of the major components of existing bank regulation is justified in terms of the consideration of the safety and soundness of banks (see Baltensperger and Dermine 1987, Baltensperger 1990). In other words, if a failure in the safety and soundness of banks justifies regulatory measures, what are the major causes or threats to the safety and soundness of banks? In the literature, we identified the following three major factors affecting the safety and soundness of banks: the safety and soundness of bank services, macroeconomic externalities and bank runs. In what follows, we briefly describe the major factors that have justified bank regulation in this area.

Safety and soundness of bank services

In theory, maintaining the safety and soundness of banks is justified by the necessity of having functional and robust fundamental bank services. In other words, banks and their services are essential facets for the smooth functioning of the economy. Hence, a failure in bank services might disrupt other sectors in the economy, leading to demand for bank regulation to avoid these distortions. Although bank services are interrelated, it is helpful and convenient to

[86] In theory and practice, how the FinSA better protects customers and improves the competitiveness of the Swiss financial industry remains the subject of debate (see PwC 2014, SBA 2015).
[87] In this context, in the future, external asset managers should be treated the same as banks.

distinguish them into the following four categories: asset services, liability services, transformation services and payment services (see Fama 1980, Baltensperger 1990, Goodhart et al. 1998, Jordan 2010).

- Asset services consist of the funding, evaluation, granting and monitoring of loans and investments. Thereby, the bank acts as a delegated monitor and an efficient allocation mechanism.
- Liability services consist of accepting deposits and controlling maturity transformations between liabilities and assets.
- Transformation services can be divided into maturity transformation, risk transformation and pooling and subdividing shares.
- Payment services involve managing and facilitating the payment system in the economy.

In light of these four bank services, the threat of a failure in asset services, liability services, transformation services and payment services justifies bank regulation. This is particularly true in terms of the threat of a potential market failure in risk-sharing services (transformation services) in monitoring and information-related services related to loans and mortgages (asset services) (see Fama 1980, Baltensperger 1990). Furthermore, as Baltensperger (1990: 4) has posited, 'the recent literature on insurance and monitoring services shows that the contract that emerges – illiquid loans financed by short-term deposits [(deposits create loans)] – creates a potential market failure' that also justifies government intervention.

Nevertheless, two other independent explanations are discussed in the literature regarding the safety and soundness of banks, that is, macroeconomic externalities and bank runs. Next, we briefly elucidate these two explanations.

Macroeconomic externalities

One source of market failure is that the insolvency of numerous small and medium-sized banks or of an SIB can lead to macroeconomic externalities (see Stillhart 2002). On the one hand, as we noted in section 2.1.2, in the presence of a bank failure, credit information will be lost in the market. Therefore, borrowers must take out new loans under unattractive conditions, which means that '[m]ore expensive credit terms [are offered that] imply lower investment and [possibly] unemployment' (Baltensperger 1990: 5). On the other hand, a bank failure can potentially lead to substantial social costs for the real economy. Likewise, Calomiris (1999:

1501) indicated that 'banks suffer special risks and that their distress entails special social costs'. In this context, a bank failure – particularly the failure of an SIB – can have substantial spillover effects for the real economy because of banks' unique positioning in terms of the provision of credit and the smooth functioning of the payment system (see Calomiris 1999). However, according to Baltensperger and Siebke (1991) and Stillhart (2002), this consideration may be limited. Thus, in this context, Baltensperger and Siebke (1991: 5) suggest, first, that 'a large failure is an extraordinary event which does not warrant permanent interventions, especially in view of the regulatory costs involved. The second is that insolvent banks are taken over by other banks in most cases, precisely to avoid the costs due to losses of information'. With regard to the first point, we agree that a large failure is an extraordinary event but believe that a well-designed regulatory framework can mitigate the possibilities of such an extraordinary event and the enormous costs that can occur with such an event (such as substantial spillover effects to other sectors, disruptions in payment systems, and costly systemic bank runs (see Calomiris 1999)). In relation to the second point, insolvent banks are in most cases taken over by other banks; however, in times of financial distress, banks sometimes do not take over other institutions. For example, in the most recent financial crisis, no bank took over certain institutions such as Lehman Brothers (although Bear Stearns was sold to JPMorgan Chase). Therefore, it is desirable to have an effective regulatory system to combat macroeconomic externalities as a source of market failure. Consequently, macroeconomic externalities from bank failures are one explanation to justify permanent banking regulation. Next, we address the bank run argument.

Bank run

The second possible source of market failure that has been formalised by Diamond and Dybvig (1983) is the bank run argument. In general, '[b]ank runs are a common feature of the extreme crises that have played a prominent role in monetary history' (Diamond and Dybvig 1983: 401). In this regard, the most famous bank run occurred in the United States during the Great Depression of the 1930s. Moreover, a few other recent examples are (1) Northern Rock and Bear Stearns (interbank and investors' run) during the financial crisis of 2007–2009; (2) IndyMac Bank (mortgage loan run) in 2008 at the time of the largest failed bank resolution for the FDIC (USD 32 million); (3) the Bank of Cyprus in 2012; and (4) Greek banks (for instance, the National Bank of Greece) in 2015. Bank runs are by definition 'caused by depositors trying to get out, avoiding a loss of capital' (Diamond and Dybvig 1986: 63). In other words, a bank

run consists of the risk that lenders run to withdraw their deposits under the sequential service constraint (see Diamond and Dybvig 1983, Gorton 1985). The explanation for the bank run phenomenon extends back to Bagehot (2005 [1920]). Bagehot (2005 [1920]: 45) noted that the use of credit 'enables debtors to use a certain part of the money their creditors have lent them. If all those creditors demand all that money at once, they cannot have it, for that which their debtors have used, is for the time employed, and not to be obtained'. However, the traditional explanation for a bank run is based on (1) the illiquid structure of a bank's balance sheet (maturity mismatch) because bank loans are invested (in mortgages and so forth) for several years and cannot be withdrawn by lenders as quickly as possible in liquid assets (in particular cash) (see Admati and Hellwig 2013); (2) '[d]epositors' lack of information about bank portfolios' (Calomiris 1999: 1502); and (3) depositors' behaviour with respect to the confidence that the bank can redeem all its liabilities upon request (see Diamond and Dybvig 1983, Dale 1984, Guttentag and Herring 1987, Dewatripont and Tirole 1994). In this regard, a bank run can be systematised from both a micro-based and a macro-based perspective. A micro-based view will consider a single run on an individual bank, whereas a macro-based view will investigate a system-wide run as a source of contagion that affects the system as a whole.

Let us consider a bank run without contagion effects. A single run can lead to the premature withdrawal of liquid liabilities. It may be that the bank can no longer pay its debts because of its lack of liquidity, which means that the bank can no longer perform its functions (for example, asset services) (see Diamond and Dybvig 1983). In other words, a single run can lead to a bank's failure. However, the failure of a single bank is not the real problem because a single run – as opposed to a system-wide run – poses no threat to a country's entire economy. This process corresponds to the natural selection mechanism of the market. Based on this principle, no bank regulation is required to prevent a single bank run. However, the situation is different for a bank run on an SIB for an economy. In this regard, a single run on an SIB is a threat to a country's entire economy. Thus, the government will do everything in its power to rescue the bank to prevent a single run (see Birchler et al. 2010, IMF 2014). The situation is analogous to a system-wide run. In this context, the focal bank's depositors can affect depositors at other banks with the same portfolio in a phenomenon known as the 'homogeneity assumption'.[88] Contagion effects can thus affect the stability of the entire banking system. The goal of bank regulation is thus to prevent a run across several banks that together reach a level

[88] The homogeneity assumption indicates that bank depositors' close transactions feature comparable risks with other banks due to the homogeneous facade of banks' business policies, which can lead to contagion (see Burghof and Rudolph 1996).

that threatens the survival of the banks and the banking system. Section 2.2.3 discusses the contagion effects in the banking industry. In the literature, a bank run can result from the loss of depositor confidence in a bank; however, because we know that a run does not necessarily signal a lack of confidence, we also know that there are several other causes that can trigger a bank run. For the sake of simplicity, we divide the causes of bank runs into four categories: runs of fundamental, speculative, explained and unexplained natures (see Fischel et al. 1987, Theurl 2001, Tirole 2002).

A fundamental view of bank runs might be the problem of asymmetric information (for example, regarding the liquidity and solvency of a bank) or negative developments affecting a bank (for example, observable macroeconomic shocks[89] in banks) (see Diamond 1984, Gorton 1985, Guttentag and Herring 1987, Theurl 2001, Tirole 2002). In this regard, depositors cannot readily estimate the quality of the assets and liabilities of a bank to assess the security or insecurity of the bank (the likelihood of failure).

In contrast to fundamental reasons, speculative reasons for a bank run can connect back to depositor expectations (see Brunnermeier 2009a). Depositors who expect that other depositors will withdraw their deposits from the bank can initiate a so-called 'self-fulfilling crisis'. To expand on this point, Brunnermeier (2009a: 95) suggests that '[i]n a classic bank every investor has an incentive to preempt others and run to the bank. A first-mover advantage triggers a dynamic preemption motive' because banks operate on a 'sequential service constraint'.

A bank run might result from depositors' unexplained panic 'phobias' ('if depositors do not panic, I have no reason to panic' (Tirole 2002: 45)). The panic view can lead, on the one hand, to an inefficient allocation of resources and risks and, on the other hand, to a greater risk of banking crises and panic reactions that can initiate the so-called 'panic-based crisis'. However, the panic view has been criticised as lacking predictive power (see Tirole 2002). Therefore, models (for example, Rochet and Vives 2008) have been developed that may predict unique outcomes (panic or no panic).

Moreover, a bank run can be based on an explicable matter, or so-called 'rational behaviour'. Gorton (1985) and Jacklin and Bhattacharya (1988) were some of the first studies to examine information-based bank runs (see Stillhart 2002). A depositor may be fully informed of his/her demand deposits and have the knowledge to use information about other banks to

[89] Observable macroeconomic shocks in banks are understood as high annual losses, rumours of high risks or potential losses (Guttentag and Herring 1987). In this case, the banking industry's low capitalisation and poor risk management expose governments to large implicit liabilities (see Tirole 2002).

evaluate his/her own portfolio. Following the perfect information, the depositor can estimate the expected loss of a bank and withdraw deposits before a bank reaches a financial distress situation (for instance, temporary liquidity problems). In this sense, depositors tend to withdraw deposits faster than in conditions involving asymmetric information because of expected capital losses (Gorton 1985, Allenspach 2009). 'At this stage, allowing for some degree of opacity – or in some cases even complete opacity – may keep depositors from running the bank and may thus prevent the inefficient liquidation of this bank' (Allenspach 2009: 3).[90] In other words, enhancing transparency may increase the likelihood of bank runs before a bank finds itself in probable financial distress. In light of this characteristic, it is important to consider this point when assessing regulatory actions.

2.2.3. Safety and soundness of the banking system as a rationale of bank regulation

One of the major elements of current bank regulation is the safety and soundness of the banking system (see Baltensperger and Dermine 1987, Baltensperger 1990). Before government intervention is justified to maintain the stability of the banking industry, the concept of stability should be explained. In this context, we ask the following two questions:

- What is meant by the term 'financial stability' in the banking industry?
- What does the term 'systemic risk' mean for the banking industry?

'[S]ince financial stability as a public policy objective has risen to prominence, efforts to define it have multiplied' (Borio and Drehmann 2009: 3). Defining the notion of stability has proven to be relatively difficult because (1) there is no consensus at either the national or international levels, apart from general objectives; (2) financial stability cannot be numerically[91] approximated in terms of a generally agreed upon index; and (3) directional, rather than

[90] Inefficient liquidation lies in the nature of deposit contracts (see Diamond and Dybvig 1983).

[91] Adrian and Brunnermeier (2016) identify a possible approach to measure systemic risk, namely, the CoValue at Risk, which focuses on the contribution of a database to systemic risk. In current practice, the risk of an individual bank is measured using the value at risk (VaR) method under Basel II (see Crockett 2000, Brunnermeier 2009a, Borio and Drehmann 2009, Galati and Moessner 2011). The VaR measure is the standard instrument for the risk management of a bank and measures the expected maximum loss that will not be exceeded with a certain probability within a certain time horizon and a given confidence interval (see Jorion 1997). In other words, 'VaR measures – estimates of the probability of losses which could be incurred before positions can be closed – play a central role' (Turner 2009: 58). VaR models are designed to estimate potential losses in given portfolios by means of several fluctuations (for example, interest rates and exchange rates) via the direct application of historical data (see Goodhart et al. 1998). Therefore, the VaR is a historical data-driven simulation and represents the economy with some theoretical restrictions. The problem is that the VaR captures an individual bank's risk in isolation and may be effective for micro-based – but not macro-based – regulation (see Brunnermeier 2009a).

absolute, terms are often used, such as 'to promote', 'to support' or 'to endeavour to achieve' (see BIS 2011, Galati and Moessner 2011, SBA 2011).[92] However, '[m]ost definitions of financial stability share three useful elements. First, they focus on the financial system as a whole' (Borio and Drehmann 2009: 4). Second, they do not consider individual banks but rather measure economic activity (for example, benefits and costs in terms of economic activity such as real GDP) (see Crockett 2000, Borio and Drehmann 2009).[93] Third, 'they make an explicit reference to financial instability, the converse of stability, which is more concrete and observable' (Borio and Drehmann 2009: 4). An alternative approach to a definition of this term is based on the understanding provided by the Bank for International Settlements (BIS), which draws upon the basic idea of Milton Friedman (1962). Friedman (1962) assumed that the safety of banks relies on the claim of the 'inherent instability' of the banking system. Therefore, the instability of the banking industry plays a critical role in the security of a bank. As a result, the BIS (2011) – and Friedman (1962) – assume the mirror image of stability, namely, the absence of stability. Minsky (1982: 13) defines financial instability as 'a process in which rapid and accelerating changes in the prices of assets (both financial and capital) take place relative to the prices of current output'. An alternative definition is that the absence of stability is a consequence of systemic risk. In this context, a question arises regarding the meaning of systemic risk.

In a contemporary context, 'the term systemic risk belongs to the standard rhetoric of economic policy discussions related to the banking industry' (Summer, 2002: 6). Although systemic risk is one of the most popular terms in the bank regulation debate, there is no precise definition, only a vague understanding that there are special problems from the linkages of different banks (see Summer 2002). In short, it is unclear what systemic risk means (see Hellwig 1997). Therefore, to fill the gap in the literature, we elaborate a possible definition of systemic risk. However, before we define the term systemic risk, it is useful to understand what a system is because it is not otherwise clear what systemic risk is (see Zigrand 2014).[94] The economic literature refers to a number of systems, including price systems and payment systems. The price system depends on prices' 'numeration system', whereas the payment system depends on

[92] No numerical term is 'available to understand how much promoting, supporting or endeavouring is intended' (BIS 2011: 28).

[93] According to the IMF, the direct costs of banking crises are high and were above 10 per cent in more than a dozen cases in the past (see Crockett 2000).

[94] This dissertation follows Zigrand's (2014: 3) argumentation of 'systemic risk as a concept distinct from 'aggregate risk' or 'systematic risk' even if a commonly accepted definition of systemic is lacking'. In the past, systematic risk has been determined with two mechanisms, namely, the domino effect and asymmetric information (see Hellwig 2010a).

bilateral payments and settlement arrangements. This dissertation focuses on the banking system. A set of deposit-taking banks

'becomes a banking system in the modern era only if the banks have a fundamental reference to a central bank. For one, banks rely on the central bank for liquidity. Since banks are required to convert deposits and credits into central bank money at the simple request of depositors or creditors, there is a permanent reference to central bank money and therefore the central bank [..]. Banks also rely on a central payment and clearing system' (Zigrand 2014: 53).

In short, the banking system depends on banks and their main functions in relation to the central bank, and the decision of the system (payment system or banking system) determines the systemic risk. Thus, the systemic risk is a result of the malfunctioning of banks in relation to the central bank.[95]

The question arises regarding the type of risks that exist in the banking system. In general, the banking system can be affected exogenously, such as through an oil shock, a mortgage shock and so forth. Moreover, the banking system can be affected by banks (endogenous risk). Failure in bank functions and new technologies such as securitisation (for example, synthetic securitisation as a result of capital relief) and, in the future, financial technology (FinTech) enhance risk feedback loops and contagion, which can spiral out of control and impede the smooth functioning of the banking system. In other words, endogenous risk is the likelihood that the potential shocks of banks will spread throughout the banking system and 'has the potential to have serious negative consequences for the real economy' (FSB 2009: 2). This spreading effect is commonly called 'contagion'. Although various economists have attempted to formulate a contemporary definition of systemic risk, the basic concept goes back to Bagehot (2005 [1920]). Bagehot (2005 [1920]: 91) noted

'that our industrial organisation is liable not only to irregular external accidents [(exogenous)], but likewise to regular internal changes [(endogenous)]; that these changes make our credit system much more delicate at some times than others; and that it is the recurrence of these periodical seasons of delicacy which has given rise to the notation that panics come according to a fixed rule'.

Given these considerations, one possible definition of systemic risk in the banking industry could be the following:

[95] Hellwig (2009: 133) notes that systemic risk is 'risk that has little to do with the intrinsic solvency of the debtors and a lot to do with the functioning – or malfunctioning – of the financial system'.

Systemic risk includes the exogenous risk to the smooth functioning of the banking system as well the risk created endogenously by the banking system.

Sources: Authors' own elaboration based on Bagehot (2005 [1920]), Dewatripont and Tirole (1994), Summer (2002), IMF (2013), and Zigrand (2014).

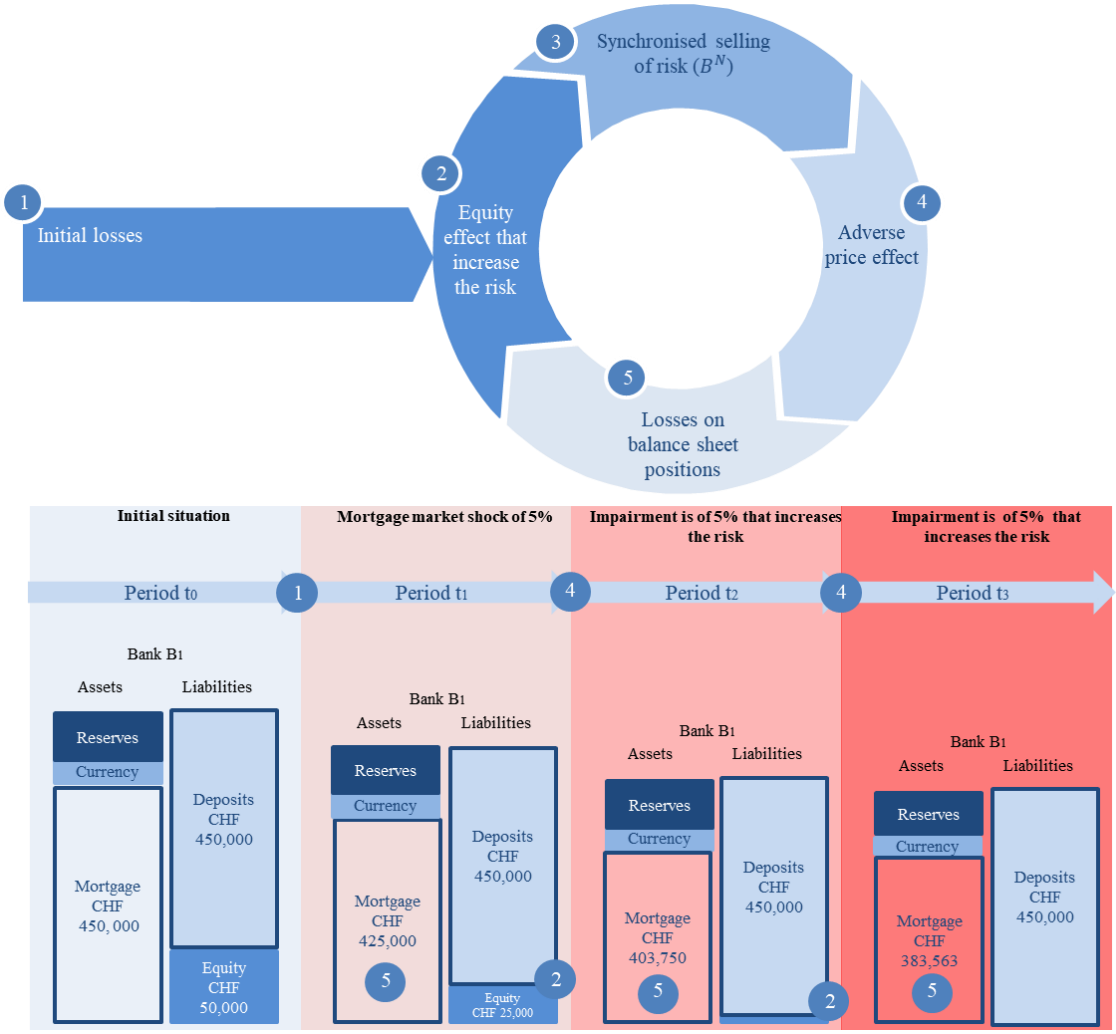
Exogenous risks are difficult or even impossible to regulate because each crisis is different and has a different trigger. However, endogenous risks, as we have seen in the previous chapters, can be regulated, even new technologies in the form of adequate general principles that are neutral and do not harm innovation. Risk feedback loops and contagion effects are essential to understand systemic risk in the banking sector and to regulate it properly. Therefore, we describe a simplified risk feedback loop and the resulting contagion effect. Risk feedback loops are characterised by five phases: starting phase 1 (initial losses); phase 2 (a capital effect that increases the risk); phase 3 (the synchronised selling of risk; in the extreme, a fire sale); phase 4 (adverse price effect); and phase 5 (losses on positions), which loops back to phase 2. Figure 2.6 presents an overview of the five phases with respect to the balance sheet structure of bank B_1. Consider a representative bank B_1 and a number of banks B^N on the mortgage market within four time periods t = 0, 1, 2, 3. Our representative bank B_1 has the characteristic of an SIB. The balance sheet structure is described as follows. The asset side consists of CHF 40,000 million reserves[96] because bank B_1 must hold reserves in the form of bank coins, bank notes and sight deposits at the central bank to fulfil the statutory minimum reserve requirements. Moreover, the bank holds CHF 10,000 million in various currencies and CHF 450,000 million loans in the form of mortgages. In other words, the asset side consists of many illiquid mortgages (CHF 450,000 million) and few liquid reserves and currency (CHF 50,000 million). Conversely, the liability side of the balance sheet consists of CHF 450,000 million deposits and CHF 50,000 million in equity. Thus, deposits are the bank's principal liability, including interbank deposits and funds collected from households and firms. Furthermore, with respect to the balance sheet structure, the liability side is more liquid than the asset side.

Let us suppose in period t_1 an initial mortgage-related security shock of five per cent (see phase 1). Bank B_1 cannot obtain new funding to replace earlier borrowing, which will have four effects. The asset shock leads to an immediate corrective action on the asset side. According to fair value accounting or mark to market (see Hellwig 2009, 2010b), bank B_1 must

[96] We assume a reserve ratio of eight per cent. In general, the reserve ratios are one per cent in Europe (ECB), 2.5 per cent in Switzerland (SNB) and 10 per cent in the United States (Fed).

write down mortgages (price) from CHF 450,000 million (book value) to CHF 425,000 million (fair value) (Δ CHF 25,000 million).

Figure 2.6 Risk feedback loop on the mortgage market for bank B



Source: Authors' own elaboration based on Brunnermeier and Pederson (2009).

Consequently, the balance sheet shrinks from CHF 500,000 million to CHF 475,000 million. To equalise the balance sheet, shrinking bank B_1 begins to deleverage on the liability side (see phase 2). Thus, the bank equity declines from CHF 50,000 million to CHF 25,000 million (Δ CHF 25,000 million). However, this effect increases the expected risk of further mortgage defaults. As a result, bank B_1 increases the interest rate on mortgages. Simultaneously, a number of banks B^N take similar corrective actions (synchronised selling of risk; in the extreme, a fire sale)[97] that can result in contagion effects on the banking system (see phase 3). Given higher

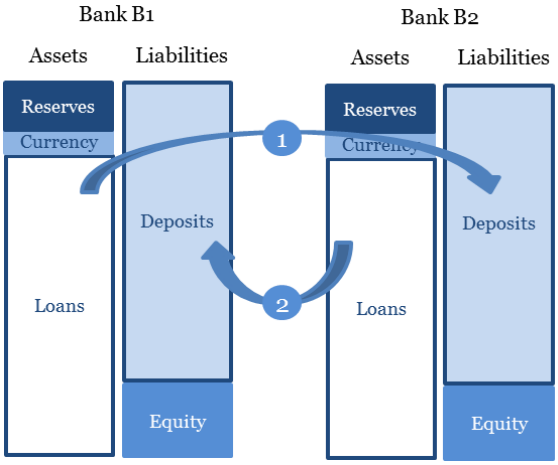
[97] Rationality should be questioned because individuals and banks can predict that they will act rationally in maximising their profits or reducing their losses. However, for the entire economy, such as in the financial crisis in 2007, individual rationality can lead to collective irrational behaviour and can harm the economy (as in the case

interest rates, householders with low income have difficulties or cannot afford to pay back their mortgage. Therefore, low-income householders must sell their houses. Consequently, housing prices drop with respect to increasing mortgage rates (adverse price effect) (see phase 4). Thus, from period t_1 to period t_2, adverse price effects create an additional impairment on mortgage positions from CHF 425,000 million (book value) to CHF 403,750 million (fair value) (Δ CHF 21,250 million) (see phase 5). Further, bank B_1 continues to deleverage. Thus, equity declines from CHF 25,000 million to CHF 3,850 million (Δ CHF 21,250 million) (see phase 2). This downward spiral continues into period t_3. In t_3, bank B_1 has no equity available to equalise the shrinking of the balance sheet. Therefore, bank B_1 equalises the mortgage losses with their liquid assets (currency); however, this leads to a liquidity problem. Assume now that lenders, investors and other banks (such as B_2 and B_3) recognise that bank B_1 is in a financial distress situation (liquidity problem). Consequently, they begin to withdraw their deposits from bank B_1, and our illiquid bank B_1 struggles with a solvency problem.[98] However, these withdrawals by other banks lead to spill-over effects on the banking sector because of the interconnectedness of the banking sector. In other words, a special feature of the banking sector is the interconnection ('too interconnected') of the contractual relations of bank participants within the clearing and settlement system, or the monetary and credit system on the interbank market (see Amara 2005, IMF 2014). In this case, banks play an important role. Figure 2.7 provides an example of our representative bank B_1 in relation to bank B_2 on the interbank market. On the interbank market, bank B_1 can offer funding in exchange for the securities of bank B_2 for a given period of time and vice versa (see point one and point two in Figure 2.7). In this case, securities must be transferred from the paying bank B_1 to the receiving bank B_2. In modern banking, this principle is defined as 'delivery versus payment' and is linked to the security transfer system and the funding transfer system (see Committee on Payment and Settlements 2003, Rossi 2007). Borio (2003) suggests that the key channel to understanding the transmission of market failure in the banking industry is the interconnectedness of banks on the interbank market (for example, in their gross positions with one another in clearing systems and in interbank deposits) because it is much stronger in the banking industry than in other industries. Thus, the failure of a single bank B_1 could spread to bank B_2, which has large credit exposures to the failing bank B_1 through corresponding deposits, and could spread to other banks in a similar manner.

of a fire-sale mechanism during a financial crisis). In other words, individual rationality does not enhance collective rationality (see Turner 2009). We call this effect 'the irrational hypothesis'. This hypothesis has not been further investigated, and further academic research would therefore be desirable.

[98] Chapter 7 describes the solvency state of nature.

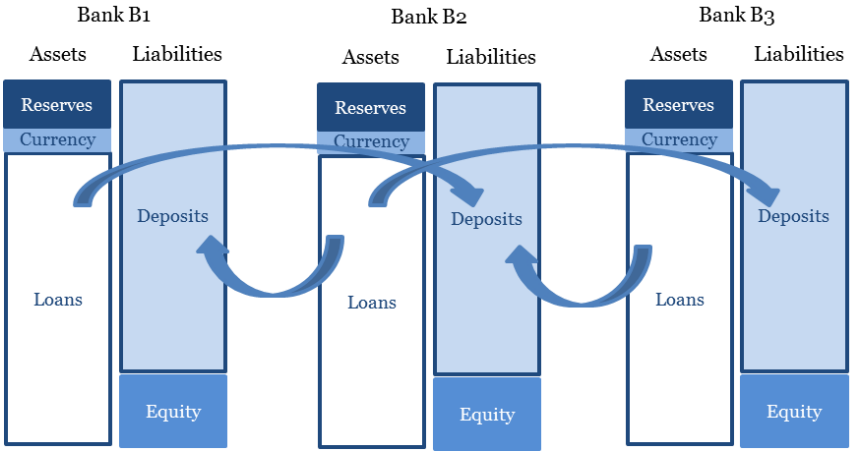
Figure 2.7 An example of interbank relationships



Source: Authors' own elaboration.

The failure of one bank on the interbank market can directly cause immediate losses in other interconnected banks and can have substantial spillover effects in other industries (see Bagehot 2005 [1920], Diamond and Dybvig 1983, Brunnermeier et al. 2009).[99]

Figure 2.8 The domino model of bank contagion



Source: Authors' own elaboration.

This contagion effect is illustrated in Figure 2.8 with the example of 'domino' models. In fact, this domino effect 'happened to the UK Bank Northern Rock, which failed in 2007, as well as

[99] The idea of contagion was likely mentioned the first time by Walter Bagehot (2005 [1920]). In this context Bagehot (2005 [1920]: 93) indicated that 'no single industry can be depressed without injury to other industries, still less can any great group of industries. Each industry when prosperous buys and consumes the produce probably of most (certainly of very many) other industries, and if industry A fail and is in difficulty, industries B, and C, and D, which used to sell to it, will not be able to sell that which they had produced in reliance on A's demand, and in future they will stand idle till industry A recovers, because in default of A there will be no one to buy the commodities which they create. Then as industry B buys of C, D, etc., the adversity of B tells on C, D, etc., and as these buy of E, F, etc.'.

the US securities houses Bear Stearns and Lehman Brothers [(NBFI)], both of which suffered crippling runs in 2008' (Brunnermeier et al. 2009: 15). Despite the convincing arguments, there are also criticisms of domino effects in banking. Based on a large number of simulations of central banks, it has been found that the domino effect has only a minimal influence and plays only a minor role in crises (see Brunnermeier et al. 2009). For this reason, Brunnermeier (2009a: 18) suggests that 'the key to understanding the events of the global liquidity and credit crunch in 2007-8 is to follow the reactions of the financial institutions themselves to price changes, and to shifts in the measured risks', as shown in the risk feedback loop.

Summarising the above-described consideration of systemic risk, banking stability might be understood as follows:

The term banking stability is understood to mean the smooth functioning of the robustness of the banking system in financial distress.

Sources: Authors' own elaboration based on Borio and Drehmann (2009), BIS (2011), Galati and Moesner (2011), and SBA (2011).

In summary, bank regulation can be explained as mitigating the exogenous and endogenous risks of the banking industry, where exogenous risk could be a macroeconomic shock and endogenous risk could be a potential failure in bank functions and new technologies.

2.2.4. Monetary control as a rationale of bank regulation

In the literature, it is assumed that the money stock and the price level without bank regulation will feature an excessive amount of variability and that the costs for the economy as a whole will be enormous because (1) financial intuitions will create money in the form of bank deposits and other liabilities (near-monies) (see Baltensperger and Dermine 1987) and (2) banks participate in the money creation process and thus inject undesirable instability into the monetary system (via unexpected reserve behaviour) (Baltensperger and Dermine 1987, Baltensperger 1990). Therefore, the banking system requires bank regulation in the form of reserve requirements[100] to mitigate the excessive amount of variability and costs for the

[100] In the literature, one common misconception is that minimum reserves are a monetary policy instrument because (1) 'minimum-reserve requirements came to be widely (but falsely) regarded as 'classical' tools of monetary policy' because a change in reserve requirements changes the demand for reserves but not the money supply and the interest rates (Niehans 1983: 546); (2) in 1996, the governor of the BoE, Eddie George, backed up his view that setting minimum reserves is not part of the objective of monetary policy, as there is no monetary policy justification for such reserves (see FAZ 1996)—likewise, Ruckriegel et al. (2000) note that such reserve requirements are more indicative of a regulatory policy than of a monetary policy—and (3) minimum reserve

economy. Although the money supply and price stability might be enhanced by reserve requirements, minimum reserve regulations are a matter of controversy both in theory and practice. Moreover, there are various discussions regarding the merits of a 'high minimum reserve' and a 'fractional reserve' banking system. Advocates for a fractional reserve banking system argue that such a system may be better in terms of the variability of the reserves, although this approach is also a source of negative externalities and increasing instability in the money supply (see Baltensperger 1990). Furthermore, such a system can prevent 'fluctuations in business activity and problems at individual banks from interrupting the flow of transactions across the economy and threatening public confidence in the banking system' (Spong 1994: 7). In a nutshell, it is not easy to choose between a fractional reserve and a high minimum reserve system because both systems have advantages and disadvantages. In this context, the advantages and disadvantages of both systems should be compared in terms of their practical implementation. Further, advocates for schemes involving minimum reserves typically make one of the following three arguments.

First, certain economists suggest that reserve requirements are necessary to control money and price levels (Greenbaum and Thakor 2007 [1995]). However, Baltensperger (1991: 15) notes that 'in any reasonable model of the economy, the money stock and the price level are determinate and finite even in the absence of legal reserve requirements'. For this reason, reserve requirements are not a necessary condition to control money and price levels and can be replaced by other measures of monetary policy, such as open market operations (OMOs).[101] By contrast and in accordance with Art. 4 of the NBA (2016 [2003]), minimum reserves (both cash and reserves) for refinancing at the central bank and at the bank note monopoly (central bank money) together form the money supply, M0, 'so that the monetary policy can utilize measures of the central bank, in particular the open market operations' (Ruckriegel et al. 2000: 316; trans.). Thus, minimum reserves cannot be replaced by other measures of monetary policy.

Second, 'as long as the bank keeps enough reserves to cover the withdrawals of the depositors who actually need their money, which is much less than the total amount of deposits, the system can function smoothly and efficiently' (Rochet 2008a: 24). Thus, high minimum

requirements are considered as administrative tasks rather than as monetary policy tasks because setting requirements is an administrative act (see Hellwig 2014a). Therefore, minimum reserve requirements will be viewed in this dissertation as a regulatory policy measure rather than as a monetary policy measure and will be subsumed under monetary control because the reserve limits restrain economic decision-making and the freedom of banks (see also Baltensperger and Dermine 1987, Greenbaum and Thakor 20007 [1995]).

[101] 'An open market operation is the purchase or sale of securities or other claims on the money market or capital market by a central bank. […]. The SNB mainly uses open market operations, which belong to the monetary policy instruments, to manage the monetary base and thereby implement its monetary policy. Open market operations of practical relevance for the SNB include repo transactions, foreign exchange market interventions, foreign exchange swaps and securities transactions' (SNB 2015c: Internet, see also section 7.1).

reserves represent a balance with demand deposits and contribute to the stability of the banking industry as a result. Nonetheless, this assumption is not true in practice for two reasons. First, Diamond and Dybvig (1986) and Rochet (2008a: 24) note that 'the system is intrinsically fragile' and that part of the long-term (illiquid) bank assets are tied to short-term (liquid) liabilities (such as maturity transformation). Second, according to Baltensperger (1991: 17), it is difficult to demonstrate the effects of high reserve requirements on the stability of the banking system because 'the focus is shifted from short-run money stock stability to the stability of aggregate demand and the price level'.

The third argument involves 'the sharing of seigniorage on bank deposits between the central bank and the commercial banks. The higher the reserve requirement, the greater the share of seigniorage that flows to [..] [the SNB] and ultimately back to the [..] Treasury. Lower reserve requirements direct these monopoly profits to the privately owned banks' (Greenbaum and Thakor 2007 [1995]: 472). Hence, reserve requirements (cash and reserves) can be thought of as a tax or a subsidy on banks depending on the claim to deposit seigniorage (see Greenbaum and Thakor 2007 [1995]).

2.3. The alternative bank regulatory view

2.3.1. The safety and soundness of bank services

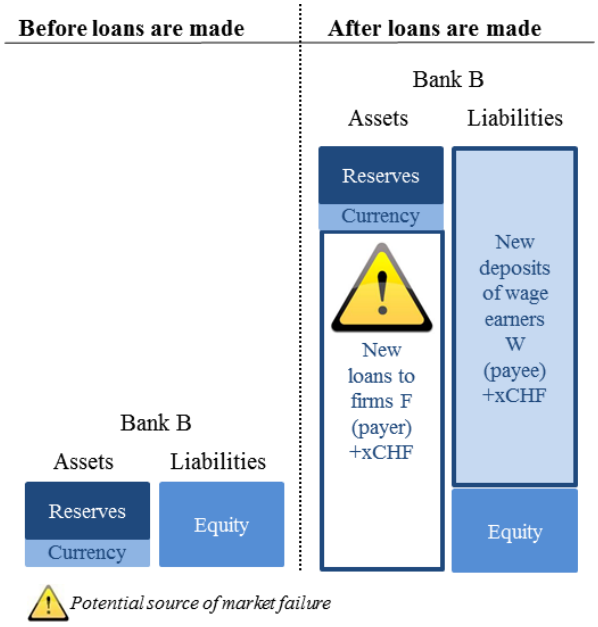
Following the outbreak of the 2007–2009 financial crisis, certain economists such as Werner (2014: 1) indicated

> 'that the most widely used macroeconomic models and finance theories did not provide an adequate description of crucial features of our economies and financial systems, and, most notably, failed to include banks. These bank-less dominant theories are likely to have influenced bank regulators and may thus have contributed to sub-optimal bank regulation'.

In other words, bank regulators design regulations based on the assumption that the financial intermediary theory of banking is correct (see section 1.1.1). However, if the underlying theory is flawed, then current bank regulations regarding the safety and soundness of bank services – including those in the Basel III Accord – would be questionable. Consequently, it is important for both scholars and policy makers to determine which theory accurately describes reality because the wrong regulatory measures might be otherwise designed and chosen (see Werner 2014, Rochon and Rossi 2016). Therefore, we formulate an alternative bank regulatory view

that is drawn from the endogenous nature of money and credit. As we noted in section 1.1.2 above, the decisive role of a bank is to provide two main functions, that is, asset services and payment services, as a result of the endogenous nature of credit and money. In light of these two bank services, a bank failure in one of them would justify regulatory measures, particularly in asset services. In this context, a failure in asset services, which covers failures in the evaluation, granting and monitoring of loans, mortgages, and investments, justifies regulatory measures in the banking sector. For a clearer understanding, the following example illuminates a failure in asset services.

Figure 2.9 A potential source of market failure resulting from the payment of wages



Sources: Adapted from Rossi (1998, 2007) and McLeay (2014).

Assume that a set of firms F demands loans to pay out their wage earners W, as noted in section 1.1.2. In the first step, bank B accommodates the loans according to the creditworthiness of firms F. In the second step, new loans on the asset side are created, and simultaneously, they are matched with the new deposits of wage earners W, which are created on the liability side of the bank balance sheet, as shown in Figure 2.9. Therefore, the bank creates its deposits in the act of lending (credit) as a result of credit demand. A failure in the lending process, such as the careless assessment of the firm's creditworthiness (solvency state of nature) or risk assessment of the firms' projects, justifies bank regulation. This approach can be used to explain one major cause of the most recent financial crisis, namely, the careless assessment in the securitisation process. The above-mentioned considerations lead to the conclusion that bank regulation regarding the safety and soundness of bank services should be focused on asset services,

particularly in the lending process that is driven by demand. In this context, a question arises as to what type of bank regulatory measure could prevent a banking crisis.

One potential alternative regulatory measure that might be adequate involves asset-based reserve requirements (ABRRs), which require banks to hold reserves against different classes of assets. ABRRs have the following advantages: (1) they are easy to implement; (2) they are compatible with current bank regulation (capital requirements); (3) they can improve the performance of monetary policy as a supplement of the short-term interest rate (see Palley 2004, 2015); and (4) they can act as automatic stabilisers when asset values rise in price and/or with new structural products. The disadvantages of ABRRs include the following: (1) for purposes of an effective ABRR, a system-wide standard would be required that is difficult to implement politically, and (2) ABRRs would encourage banks to shift their lending outside of the banking industry, thereby promoting shadow banking (see Palley 2004, 2015). In examining these advantages and disadvantages, ABRRs appear to provide more benefits than costs; however, further academic research on the benefits and costs is needed in this regard.

In addition to a potential failure in asset services, bank regulation is justified in the case of asymmetric information, bank runs and macroeconomic externalities. Although the rationale for bank regulation with respect to consumer protection remains as in the financial intermediary theory, the objective regarding the safety and soundness of the banking system can be explained in a different manner. In this regard, Hymen Minsky was one of the first economists to shed light on this issue. Therefore, next, we will briefly expand on Minsky's approach.

2.3.2. The safety and soundness of the banking system

Minsky (1982: 63) recognised that if a crisis is not a rare event, then 'it is reasonable to view financial crisis as systemic, rather than accidental'. In this context, Minsky (1977, 1982) elaborates the 'financial instability hypothesis' (FIH), which has empirical and theoretical elements. Hereafter, the focus is on the theoretical elements. In Minsky's view, the FIH is an interpretation of Keynes's 'general theory' to 'understand Keynes [in] light of the crunches and other financial disturbances of the past decade' (Minsky 1977: 6). In one sentence, the FIH states 'that changes in cash-flow relations occur over a run of good (or tranquil) years and transform an initially robust financial system into a fragile financial system' (Minsky 1982: 24). The starting point in explaining Minsky's FIH follows from the individual consideration of expectations for funding behaviour. In other words, 'the ability to debt finance new investment depends upon expectations that future investment will be high enough so that future cash flows

will be large enough for the debts that are issued today to be repaid or refinanced' (Minsky 1977: 12). Moreover, Minsky (1977) assumes that (1) demand is credit driven; (2) there is an initial stable relation between debt and income; (3) debt is a characteristic of the capitalist economy; (4) banking is a profit-seeking activity and strives for banking innovations, such as securitisation, to increase the 'cash flows (or gross profits after out-of-pocket costs and taxes)' (Minsky 1977: 10); and (5) there are three financing forms, namely, hedge finance, speculative finance and Ponzi finance (see Minsky 1977, 1982, 1992). In this regard, 'hedge finance takes place when the cash flows from operations are expected to be large enough to meet the payment commitments on debts' (Minsky 1977: 13). Thus, if a bank expects large enough cash flows from investment, it can invest more, and the leverage ratio increases (total debt (deposits) to total equity). 'Speculative finance takes place when the cash flows from operations are not expected to be large enough to meet payment commitments, even though the present value of expected cash receipts is greater than the present value of payment commitments' (Minsky 1977: 13).[102] Therefore, a 'rollover' of liabilities (deposits) occurs (transformation of liabilities to new liabilities). Ponzi finance is a situation in which 'cash payment commitments on debt are met by increasing the amount of debt outstanding' (Minsky 1977: 14). Thus, Ponzi financing is when outstanding debts are paid by issuing new debts. For example, suppose an interest rate is high and rising. In this context, higher interest rates force hedge financing into speculative financing and speculative financing into Ponzi financing, which leads to instability in the banking system (Minsky 1977, 1982, 1992). In short, an initially stable banking system turns the period of the financing regimes into an unstable system. Thus, we conclude that bank regulation should focus on mitigating risk in the three financing forms, particularly the form of speculative financing in Ponzi financing. With respect to the leverage ratio and minimum requirements for a rollover of liabilities, regulations would be desirable measures to mitigate the risk that an initially stable system turns into an unstable system.

Next, we extend the FIH with the characteristics of the risk feedback loop in section 2.2.3 in the mortgage market for bank B. Figure 2.10 describes the risk feedback loop in the mortgage market for bank B from the endogenous theory of credit and money. According to Figure 2.10, we assume a bank B with no pre-existing bank deposits in t_0 (before mortgages are made). In a second step, the bank accommodates all mortgage demands regarding the creditworthiness of the house buyer (assets side). Thus, mortgages create bank deposits

[102] Kaldor (1939: 1) defines speculation 'as the purchase (or sale) of goods with a view to re-sale (re-purchase) at a later date, where the motive behind such action is the expectation of a change in the relevant prices relative to the ruling price and not a gain accruing through their use, or any kind of transformation effected in them or their transfer between different markets'.

(liability side) owned by the seller of the house (rather than the householder) from period t_0 to period t_1. In a third step, we assume an initial loss (shock on the mortgage market). The initial shock in t_2 initiates the risk feedback loop, as we describe in section 2.2.3. In addition, the downward spiral is enhanced because of hedge financing, speculative financing and Ponzi financing. It should be noted that this enhancement in the risk feedback loop has not yet been proven and verified, which makes further analysis desirable in the literature.

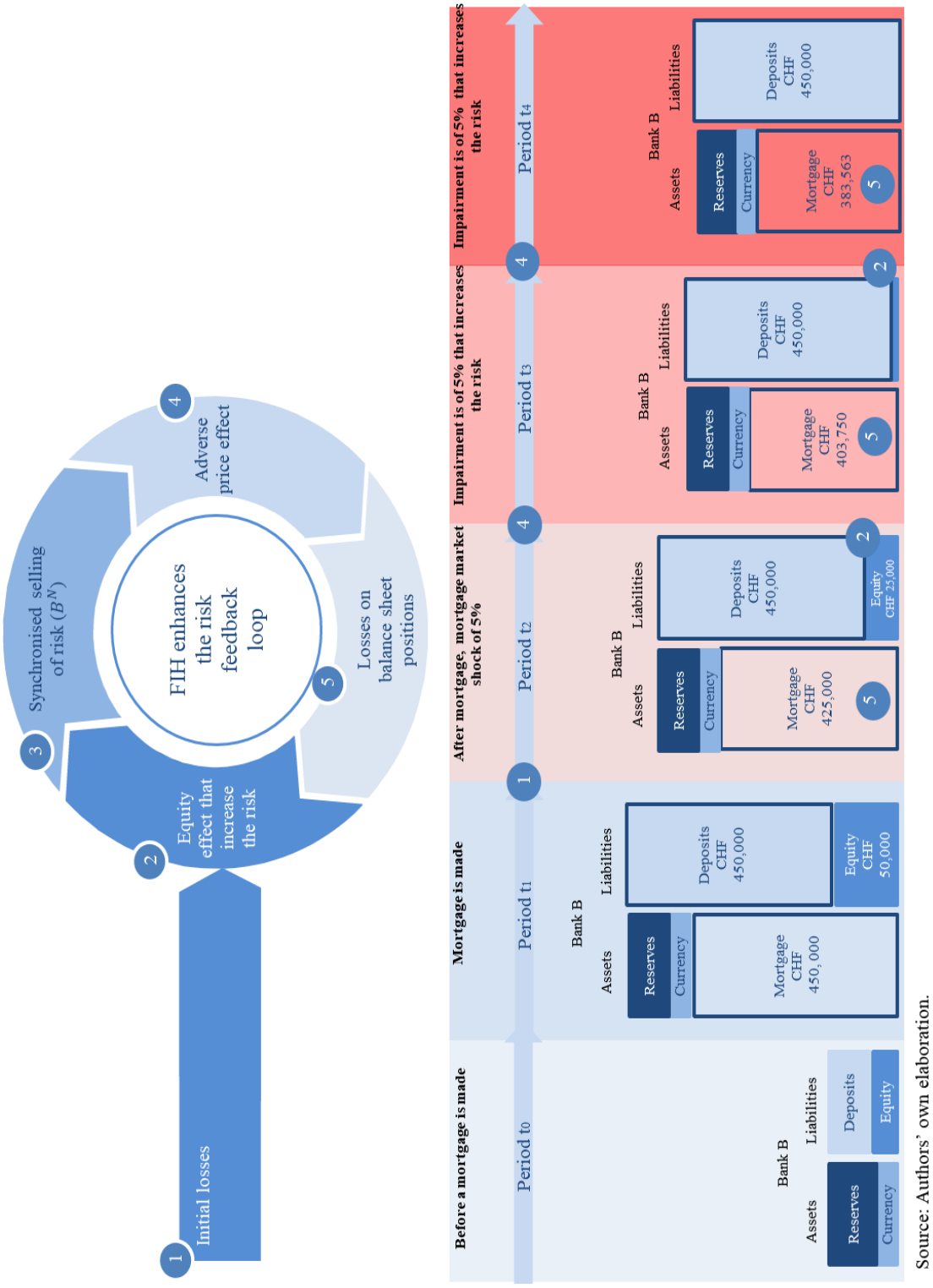


Figure 2.10 Risk feedback loop on the mortgage market for bank B under endogenous perspective

Source: Authors' own elaboration.

2.4. Summary

This chapter has shown that there are numerous reasons to justify government intervention in the banking industry. However, the problem with modern theories of bank regulation is that there is no consensus regarding why banks are regulated because (1) there is a lack of theoretical foundation; (2) there are numerous objectives; (3) the meanings of the objectives vary; and (4) the objectives cannot be classified conclusively. To fill this gap in the literature, we analyse the rationale for bank regulations under the various economic criteria employed by the so-called '*theories of economic regulation*', and we analyse what outcome is used to try to justify the so-called '*objectives of bank regulation*'. Then, we briefly elaborate an '*alternative bank regulatory view*'.

In the traditional economic regulation literature, government intervention is explained in terms of positive and normative approaches. The positive approach can be explicated via the following four theories: the capture theory, the theory of economic regulation, the theory of bureaucracy and the public financing approach, where the latter is more of an approach than a theory. The normative approach involves the public interest theory, which is also known as the 'market failure theory'. The normative approach (the market failure theory) is the focus of this dissertation because it contains both first- and second-best solutions. Furthermore, there is at least one cause for bank regulation that is in the public interest, and it allows us to justify bank regulation for a variety of reasons (see Goodhart et al. 1998). In the theory of market failure, there are three sources of failures that justify bank regulation: asymmetric information, externalities and controlling monopoly. However, with a few minor exceptions, the third reason for bank regulation is not relevant in the banking industry (see Goodhart 2010).

In addition to economic criteria, bank regulation can also be justified by the desirable outcome that should be secure. In this sense, we distinguish between four desirable objectives: consumer protection, the safety and soundness of banks, the safety and soundness of the banking system and monetary control. These objectives can be systematised into two micro-based objectives (consumer protection and the safety and soundness of banks) and two macro-based objectives (the safety and soundness of the banking system and monetary control). However, although we extend the micro-based approach with a macro-based approach because of the limited focus of the micro-based approach regarding the most recent financial crisis, various economists have questioned those financial theories, which are and have been broadly employed. In light of these considerations, we elaborate an alternative bank regulatory view based on the endogenous nature of money and credit. In this sense, two objectives of bank

regulation are expressed in a different manner as in the mainstream view, namely, the safety and soundness of bank services and the safety and soundness of the banking system. According to the former objective, regulation regarding asset services would be justified, particularly in the lending process. In this context, stronger requirements in assessing a borrower or setting higher capital requirements for house buyers can mitigate a failure in the lending process (see section 3.4). In relation to the latter objective, we note that a stable banking system changes the period of the financing regimes into an unstable system (see Minsky 1977). Therefore, bank regulation should focus on mitigating risk in the three financing forms, particularly in speculative financing that becomes Ponzi financing. In this sense, bank regulations such as the leverage ratios or minimum requirements for a rollover of liabilities would be desirable measures.

Nevertheless, the following two questions arise. How can we classify regulatory measures in the banking industry? What types of measures exist in the recent regulatory literature? In the next chapter, we introduce a systematisation and analyse the most current bank regulatory measures, including capital adequacy requirements, liquidity requirements and failed bank recovery and resolution standards.

3. Bank regulatory measures

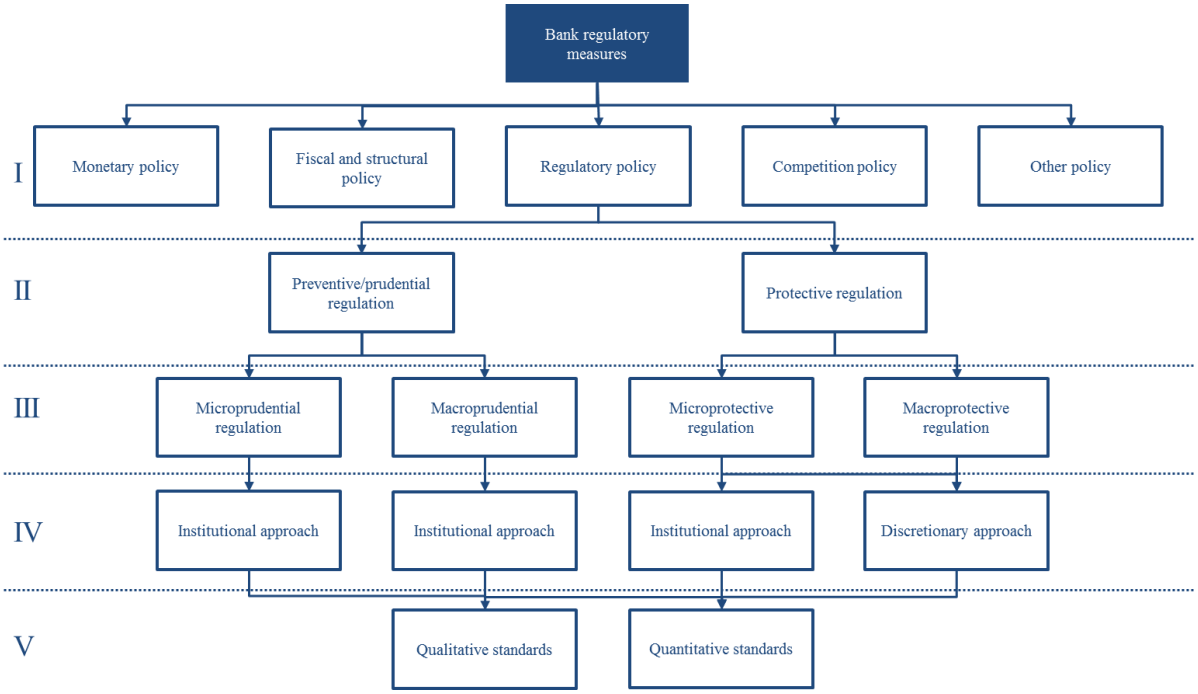
This chapter provides an overview regarding the main regulatory measures that draw upon the rationale for bank regulation in the previous chapter. However, before we can describe the various bank regulatory measures, we must first systematise them. Therefore, we proceed as follows. In the first step, we outline a possible systematisation based upon our elaborated criteria. In the second step, we briefly describe the most current bank regulatory measures and provide potential reform options. Finally, we present an alternative reform proposal.

3.1. Systematisation of bank regulatory measures

In practice, bank regulation will be systematised between preventive, which the Anglo-Saxon literature describes as prudential, and curative so-called preventive regulation, although banking regulatory measures can be classified into various categories (see Niehans 1983, Dale 1984). This classification is difficult for the following reasons: (1) the meaning of relevant terms varies; (2) numerous measures cannot be classified conclusively because of the existence of various categories; and (3) it is difficult to evaluate the effectiveness of regulatory measures because of the lack of systematisation (see Niehans 1983, Burghof and Rudolph 1996). For example, Goodhart et al. (1998) categorise financial regulation into prudential regulation, conduct regulation and wholesale versus retail regulation. Llewellyn (1999) goes a step further and distinguishes among monitoring, regulation and supervision; thus, Llewellyn (1999: 6) understands monitoring as ‘observing whether the rules are obeyed’. However, for Llewellyn (1999: 6), supervision is ‘the more general observation of the behaviour of financial firms’, whereas regulation is ‘the establishment of specific rules of behaviour’. Moosa (2015) distinguishes between safety-and-soundness (or solvency) regulation and compliance regulation. As a result of the difficulty regarding the classification of bank regulatory measures, we propose an alternative systematisation model based on various criteria to better categorise banking regulatory measures. In the course of this proposal, we systematically classify banking regulatory measures according to Figure 3.1 on the basis of five criteria allocated among five levels. Regulatory measures can be systematically organised according to ‘regulatory policy’ (see section 1.2.3); the ‘timing of intervention’ of prudential and protective regulation; the ‘micro versus macro regulation’ level of governance; the predictability of the ‘discretionary versus institutional approach’; and the evaluation of the standard ‘qualitative versus quantitative

approach'. In the following paragraphs, we describe these five criteria for a better understanding of our classification.

Figure 3.1 Overview of bank regulatory criteria



Source: Authors' own elaboration.

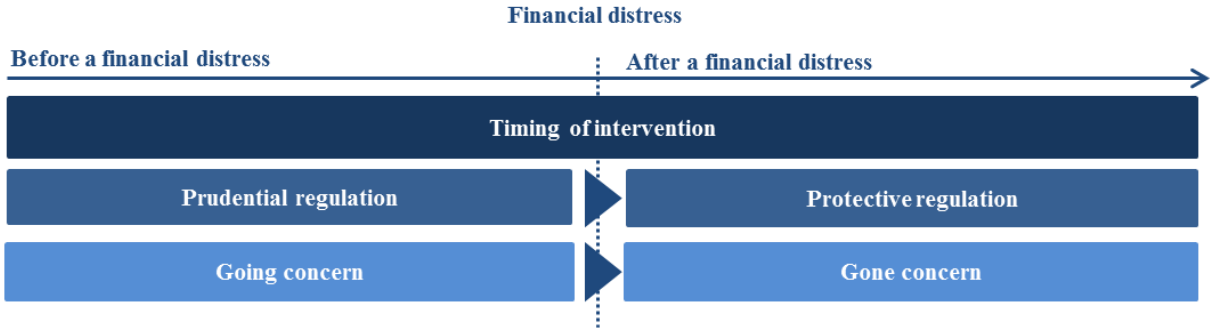
3.1.1. The timing of intervention: prudential versus protective regulation

National authorities use a variety of approaches and measures to encourage the safety and soundness of banks, consumer protection, the safety and soundness of the banking system and monetary control. According to Dale (1984), the techniques employed by these authorities fall into two main banking regulatory categories under the umbrella of prudential regulation and protective regulation. Prudential regulations are 'designed to curb risk-taking by banks and thereby reduce the likelihood of liquidity and solvency problems' (Dale 1984: 55, see also Flannery 1995). In other words, prudential measures are measures that aim to avert future crises (see Commission of Experts 2010). Conversely, protective regulations are designed to provide support to both banks and their depositors if problems arise. Thus, preventive measures secure the continuity of SIBs in the event of insolvency (see Commission of Experts 2010). Drawing on Dale (1984) and the Commission of Experts (2010), this dissertation has chosen similar

definitions in various debates[103] that target the effect of such regulatory measures. Baltensperger and Dermine (1987) emphasise that in practice, it is difficult to achieve a definitive separation between prudential and protective regulations because the two partially influence one another and because both their structure and impact can be simultaneously prudential and protective in nature. For example, protective measures such as deposit insurance not only help to build trust but also have a preventive effect (see Burghof and Rudolph 1996). Conversely, prudential measures such as the capital adequacy requirement reduce the likelihood of bank insolvency, resulting in the continued effectiveness of protective measures. Consequently, researchers can argue that in the context of prudential and protective regulation, it can 'be seen clearly that this separation is not a clear-cut one' (Baltensperger and Dermine 1987: 72). Therefore, a systematisation of regulatory measures that conceptually targets their effects appears to be inappropriate because banking supervisory systems always consist of a combination of prudential and protective measures.

An alternative criterion for the systematisation of regulatory measures in the banking industry could be the 'timing of intervention', according to Principle 22 of the Basel Core Principles, as 'banking supervisors must have at their disposal adequate supervisory measures to bring about timely corrective action when banks fail to meet prudential requirements (such as minimum capital adequacy ratios), when there are regulatory violations, or where depositors are threatened in any other way' (BCBS 1997: 7). For this purpose, Figure 3.2 depicts an alternative systematisation in line with the timing of intervention.

Figure 3.2 Timing of intervention of prudential and protective regulation



Source: Authors' own elaboration based on Burghof and Rudolph (1996).

[103] In the literature, various definitions can be found in Niehans (1983), Dale (1984), Baltensperger and Dermine (1987), Dewatripont and Tirole (1993), Greenbaum and Thakor (2007 [1995]), Burghof and Rudolph (1996), Llewellyn (1999) and Bernet (2003).

Prudential measures are thus applied during the normal ongoing course of banking business (going concern), whereas protective measures are applied in the event of imminent financial distress or after a financial distress event (gone concern) or a bank failure. A time of distress (namely, market failure) for a bank is thus determined to be a situation requiring intervention based on selected regulatory measures in the banking industry. In connection with the timing of intervention for the selection of regulatory measures, we assume the financial distress of the bank or the banking system. For that effect, the term 'gone concern' covers not only bank distress but also the time at which the crisis occurred. The time of the onset of financial distress or a banking crisis is therefore of decisive importance for the selection of appropriate banking regulatory measures (see BCBS 1997). According to the timing of the intervention, we can define prudential regulation as follows:

Prudential regulation includes all regulatory instruments that have the objective of rendering improbable the risk prior to (ex-ante) financial distress.

Sources: Authors' own elaboration based on Niehans (1983), Dale (1984), Baltensperger and Dermine (1987), Dewatripont and Tirole (1993), Flannery (1995), Greenbaum and Thakor (2007 [1995]), Burghof and Rudolph (1996), Llewellyn (1999), and Bernet (2003).

With this definition, prudential regulation corresponds to the following established regulatory banking measures: capital adequacy requirements, liquidity requirements, countercyclical capital buffers (CCBs) (see Appendix 4), accounting standards (see Appendix 7) and transparency regulation (see Appendix 5) (see Figure 3.3). In contrast, protective regulation can be defined as follows:

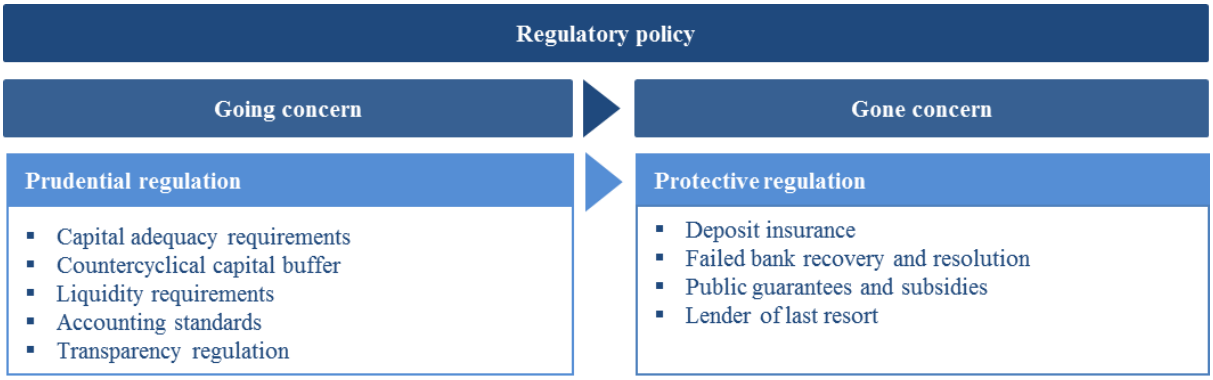
Protective regulation includes all regulatory instruments that have the objective of minimising damage to the economy either during or following (ex-post) financial distress.

Sources: Authors' own elaboration based on Niehans (1983), Dale (1984), Baltensperger and Dermine (1987), Dewatripont and Tirole (1993), Greenbaum and Thakor (2007 [1995]), Burghof and Rudolph (1996), Llewellyn (1999), and Bernet (2003).

With this definition, protective regulation contains deposit insurance (see Appendix 6), failed bank recovery and resolution, public guarantees and subsidies by the government and the LOLR. The LOLR should be distinguished from deposit insurance, as the former is for banks,

whereas the latter is for depositors. Moreover, the LOLR is part of a detailed analysis in part II. Therefore, no further headway on the LOLR is made in the first part of the thesis.

Figure 3.3 Systematising bank regulation in accordance with the timing of intervention: prudential versus protective regulation



Source: Authors' own elaboration.

In Figure 3.3, the systematisation criteria for the established banking regulatory measures (for example, capital requirements, transparency regulations, failed bank recovery and resolution, and deposit insurance) are attributed to the prudential and protective regulations according to the timing of intervention (going concerns and gone concerns). Figure 3.3 illustrates that the vast majority of the banking regulatory measures addressed in this work can be considered prudential regulation. These regulatory measures can be systematised according to further criteria, such as the intervention level, predictability and evaluation of standards.

3.1.2. The level of intervention: micro- versus macro-based regulation

Another systematisation approach subdivides prudential measures according to their 'intervention level' in micro- or macro-based regulation. We return to the micro- and macro-based approach from section 2.2 for the systematisation of prudential and protective measures discussed in this section. In connection with this approach, Burghof and Rudolph (1996) suggest that the level of intervention can be isolated to individual markets, to a bank itself (idiosyncratic) or to the bank customer level. Consequently, all regulatory measures that pursue micro-based goals are summarised under the category of micro regulation. All regulatory measures that pursue macro-based goals are summarised under the category of macro regulation.

Micro regulation aims to limit the risk of the financial distress episodes of individual banks and emphasises the behaviour of individual agents. Therefore, micro regulations primarily use prudential tools that focus on the safety and soundness of banks and consider consumer protection 'in that the consumer loses when a bank fails, even when there are no systemic consequences' (Goodhart et al. 1998: 5). Thus, capital adequacy requirements, liquidity requirements, accounting standards, transparency regulation, deposit insurance and minimum reserve requirements are considered micro regulation.

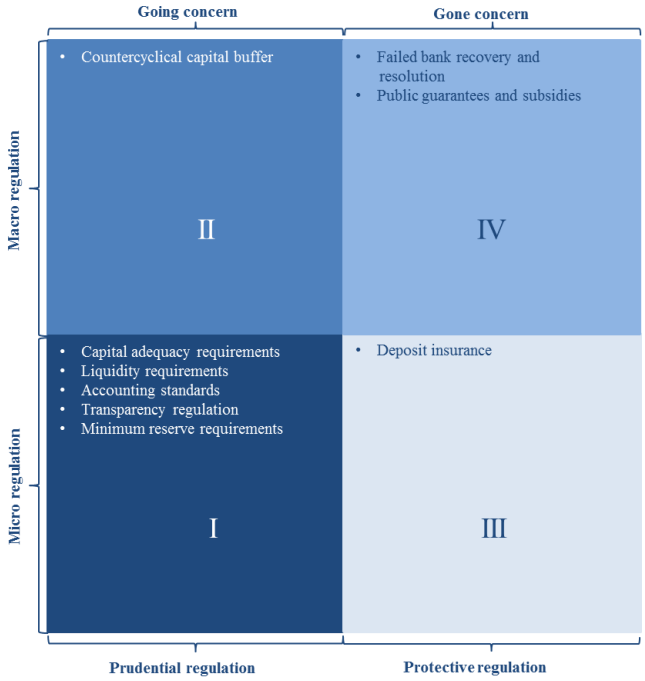
Macro regulation reduces the risk of episodes of system-wide distress, which have significant costs for the economy as a whole. We pose the following question: which macro measures aim to limit the risks and costs of systemic crisis? According to the BIS (2011: 55), 'a complete range of instruments uniquely oriented to macroprudential policy has not yet been developed'. Nevertheless, we choose one recent measure from a complete range of macro measures. Our first step is to search for an overview of possible macro measures used by the IMF (for example, CCBs, limits on loan-to-value ratios and so forth) (see Borio 2003, Brunnermeier et al. 2009, Galati and Moessner 2011, IMF 2011, SBA 2011). Our second step is to analyse the numerous measures of the IMF (2011) according to both their potential usefulness ('potentially useful') and their actual use ('actually used'). Thus, the macroprudential measures were divided into six groups:

- Group 1: Size, complexity and interconnectedness
- Group 2: Procyclicality
- Group 3: Credit growth and asset price
- Group 4: Leverage and maturity mismatch
- Group 5: Currency risk
- Group 6: Capital flow

For example, a CCB measure belongs to Group 2: Procyclicality. A CCB is currently used as a regulatory measure by approximately five to 10 countries from a total of 45 countries that use these IMF measures. Between 30 and 35 countries are expected to incorporate these measures into their macro policy in the future (see IMF 2011). Accordingly, we have selected the macro measure, CCB, based on two evaluation criteria: (1) the frequency of expected usage of the

measure for more than 20 countries[104] and (2) the 'time dimension' criteria [105] (because 'time dimension' measures, according to Brunnermeier et al. (2009), are preferred over 'cross-sectional dimension'[106] measures). With this systematisation and the classification of section 3.1.1 between prudential and preventive regulation, we can formulate four regulatory categories: microprudential regulation, macroprudential regulation, microprotective regulation and macroprotective regulation. For this purpose, Figure 3.4 classifies the prudential and protective measures introduced in section 3.1.1 as either micro or macro regulations. Capital adequacy requirements, liquidity requirements, accounting standards and transparency regulations are thus classified as microprudential regulation. Conversely, CCBs can be classified as macroprudential regulation. Deposit insurance can be classified as microprotective regulation, whereas failed bank recovery and resolution and public guarantees and subsidies can be systematised as macroprotective regulation. However, micro and macro measures cannot always be clearly distinguished in practice.

Figure 3.4 Systematising prudential regulation in accordance with the timing and level of intervention: micro versus macro regulation



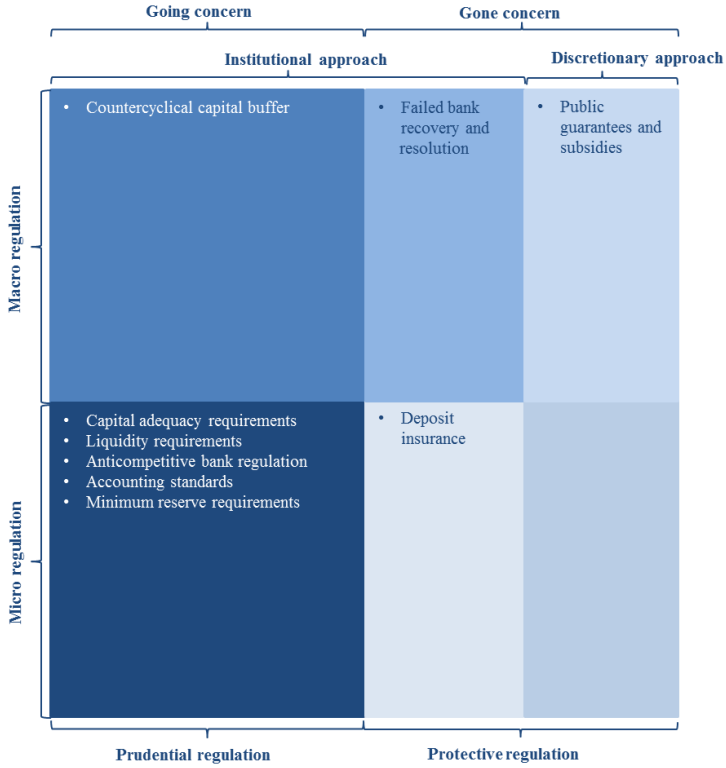
Source: Authors' own elaboration.

[104] The CCB will become available in many countries from 2016 to 2019. In fact, countries such as China, New Zealand, Switzerland and the United Kingdom may consider an accelerated phase (see IMF 2013).
[105] The time dimension 'is based on a collective tendency by economic agents [..] to increase risk exposures during the boom-phase of a financial cycle and to become overly risk-averse during the bust phase' (IMF 2011: 8, 2013). In other words, the time dimension examines the development of risk over time.
[106] The 'cross-sectional dimension' reflects the distribution of risk in the banking system (such as the solvency risk between different banks) (see Borio 2003, Clement 2010, IMF 2013).

3.1.3. Predictability: discretionary or institutional approach

The systematisation approach shown in Figure 3.5 subdivides protective measures according to their predictability, namely, into discretionary and institutional measures (see Dale 1984, Baltensperger and Dermine 1987, Baltensperger 1990, Greenbaum and Thakor 2007 [1995]). Protective measures can thus be subdivided according to the certainty with which they can be embraced. According to Baltensperger and Dermine (1987) and Burghof and Rudolph (1996), the spectrum including 'contractual', 'institutional' and 'rule-bound' interventions is sufficient and 'granted for sure' (for example, safety nets such as deposit insurance and failed bank recovery and resolution), versus discretionary interventions that are not granted 'for sure' (see Baltensperger and Dermine 1987). In this respect, '[d]iscretionary interventions are all those that are at the discretion of government: lender of last resort (possibly at a subsidized rate), public guarantees and subsidies of all sorts, or nationalization' (Baltensperger and Dermine 1987: 73). However, there are arguments in favour of the institutional approach. First, banks follow the rules if they are clearly defined. Second, a discretionary approach is a source of moral hazard (see section 2.1.2 and chapter 6).

Figure 3.5 Systematising protective regulation in accordance with predictability: discretionary or institutional approach



Source: Authors' own elaboration.

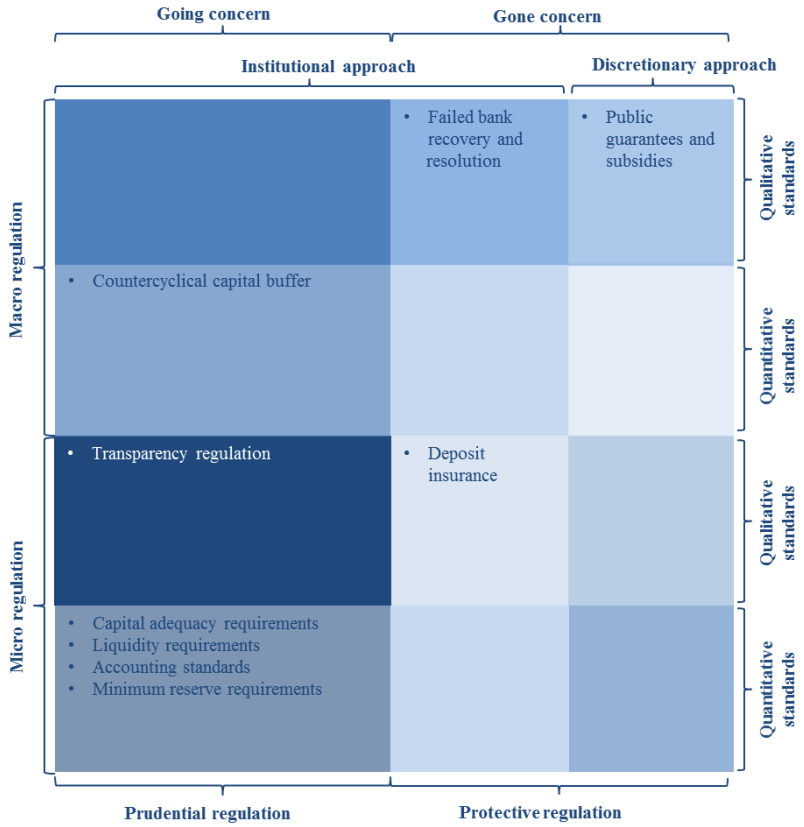
Third, Ayadi et al. (2012: 80) note that the institutional approach ‘removes the danger of undue political interference in the disciplining of banks’, and fourth, ‘it guards against a ‘collective euphoria’ syndrome whereby all agents (including supervisors) are swept along by a common euphoria’ (Ayadi et al. 2012: 81). We are sceptical regarding the fourth argument because before the financial crisis of 2007–2009, SIBs such as UBS and Credit Suisse gloated over the fact that they met the stricter capital requirements of Basel II. In other words, the time before the financial crisis of 2007–2009 was a period of collective euphoria by banks and regulatory authorities. Therefore, we conclude that rules do not guard against collective euphoria. However, further analysis regarding the connection between collective euphoria and bank regulation would be desirable.

3.1.4. Qualitative and quantitative standards

Until the mid-1990s, the supervisory authorities predominantly used traditional structural standards—also known as quantitative standards—to precisely implement the objective function of bank regulation in practice. Quantitative standards were understood as measurable and therefore verifiable targets (for example, the equity capital ratio) with the goal of limiting financial risks (for example, credit risks, market risks and liquidity risks) (see Burghof and Rudolph 1996, Amara 2005, Kunze 2007). Thus, quantitative measures are used for frequent bank regulatory changes in value (see Tinbergen 1956). Examples of quantitative standards include capital adequacy requirements, liquidity requirements and so forth. The quantitative standards shown in Figure 3.6 have the following advantages: (1) they can easily be quantified and monitored, and (2) they can be easily communicated and consequently implemented. The disadvantages are as follows: (1) they are inflexible and have a strong need for adjustment to a changeable economic environment; (2) they are insufficiently applicable to new financial products; and (3) they exhibit different margins of interpretation, thus enabling ‘regulatory arbitrage’ (see Goodhart et al. 1998, Bernet 2003). Since the mid-1990s, an increasing tendency towards qualitative standards has been observed (see Krumnow 1995, Kunze 2007). In this context, qualitative standards are understood as non-measurable standards that are used predominantly to limit operational risk. Examples of qualitative standards include transparency regulation. As opposed to quantitative standards, qualitative standards have the following advantages: (1) they are more adaptable to general conditions in the banking industry, and (2) they are better at limiting the margin of interpretation. However, qualitative standards have the following disadvantages: (1) they are more difficult to communicate, and (2) they can generate

higher costs during implementation (see Bernet 2003). In addition, according to Burghof and Rudolph (1996), qualitative standards do not achieve their full effectiveness until they have been transposed into quantitative standards, enabling a certain control of the consistency of the objectives.

Figure 3.6 Bank regulatory square



Source: Authors' own elaboration.

3.1.5. Summary

The literature examines various bank regulatory measures. The difficulty arises with respect to the classification of these measures because (1) the meaning of relevant terms varies; (2) numerous measures cannot be classified conclusively because of the existence of various categories; and (3) it is difficult to evaluate effectiveness. Therefore, we propose an alternative systematisation model based on the following criteria: 'regulatory policy', the 'timing of intervention' of prudential and protective regulation, the 'micro versus macro regulation' level of governance, the predictability of the 'discretionary versus institutional approach' and the evaluation of the standard 'qualitative versus quantitative approach'. In this sense, quantitative microprudential institutional regulations include capital adequacy requirements, liquidity

requirements, accounting standards and minimum reserve requirements. Qualitative microprudential institutional regulations include transparency regulation. An example of quantitative macroprudential institutional regulation is the CCB. Conversely, there are three preventive regulations in the banking sector: failed bank recovery and resolution, deposit insurance as an institutional regulation, and public guarantees and subsidies by the government as discretionary measures.

The next sections will introduce the established regulatory measures, namely, capital adequacy requirements, liquidity requirements and failed bank recovery and resolution standards because of their relevance in the recent regulatory debate. In this context, we briefly describe these regulatory measures and provide potential reform options. In addition, we present an alternative regulatory proposal, drawing upon the main causes of the financial crisis in 2007–2009.

3.2. Current bank regulatory measures

3.2.1. Capital adequacy requirements

From the Great Depression (1930s) to the 1970s, bank regulation focused on the safety and soundness of market structure and competition and on asset allocation rules and interest rates (see Hellwig 2010b). The subsequent period from the 1970s to the late 1980s was characterised by deregulation and bank failures, such as the insolvency of Herstatt Bank (1977) in Germany and the US savings and loan crisis (1980s). In response, the Basel Accord of 1988 attempted to stop this tendency with capital adequacy requirements. In reality, this tendency did not stop because governments permitted banks to price freely and to expand into new financial products (such as securitisation) and new geographical markets. Nevertheless, for the purpose of illuminating the basic concept of capital adequacy requirements, we consider the following four questions:

- What are the objectives of capital adequacy requirements?
- How can we define capital adequacy requirements?
- What are potential reform options for capital requirements?
- What are the effects of capital requirements in the banking sector?

In various documents on bank regulation, stricter capital requirements are justified for the following reasons: (1) banks have more to lose if they fail; (2) banks are less likely to approve risky businesses for depositors, creditors and other bank stakeholders (thus minimising moral hazard) because funding for riskier investments requires banks to hold a higher amount of capital; (3) banks tend to have safe and sound bank functions; (4) banks' resilience to future shocks will increase as a result of better capitalisation (see BCBS 2016)—in other words, 'capital serves as a buffer against unexpected losses' (Hellwig 2010b: 9)—(5) the 'capital requirement provides the supervisor with room for intervention before the bank becomes insolvent' (Hellwig 2010b: 9); and (6) these capital requirements increase the safety and soundness of the banking system and thus end up burdening creditors and taxpayers because the solvency risk, the likelihood of liquidity risk and bank runs are reduced as a result that the bank holds more capital to absorb the loss (see Baltensperger and Dermine 1987, Dewatripont and Tirole 1993, BCBS 1997, Borio et al. 2001, Hellwig 2010b, Ayadi et al. 2012, Admati and Hellwig 2013, BCBS 2016). Overall, '[i]n principle, capital regulation should contribute to maintaining the safety and soundness of banks' (Hellwig 2010b: 9), on the one hand, and the safety and soundness of the banking system, on the other, because a higher buffer also reduces the likelihood of bank failure and the expected externalities as a result (see Commission of Experts 2010, BCBS 2016). In other words, capital requirements have the objective of increasing banks' resilience to future banking crises (see Liikanen et al. 2012, BCBS 2016). Although capital requirements serve these purposes, in the literature, these purposes are 'not explained, at least not beyond the truism that insolvency corresponds to a situation where equity is negative' (Hellwig 2010b: 9).

To answer the second question, Dale (1984: 91) notes that 'banks are generally required to maintain an appropriate relationship between capital on the one hand and total assets, risk assets or liabilities on the other [hand]'. In view of these characteristics, a capital adequacy requirement (capital adequacy ratio) is defined as a quantitative regulatory measure that is typically assessed in terms of the ratio of total capital assets (tier-one capital 'core equity' plus tier-two 'supplementary capital') that prevents excessive risk-taking by reducing the probability of insolvency risk and bank crisis (prudential approach) and is a function of the risk-weighted assets that serve as a 'buffer'[107] to minimise the impact of insolvency and economic crises (protective approach) (see Baltensperger and Dermine 1987, see 3.1).

[107] In the United States, for example, subsidiaries of SIBs must fulfil high standards of equity capital and liquidity to be able to overcome a 30-day crisis (see DFA 2010). In this sense, US bank holding companies hold significantly more equity capital than the minimum required. Thereby, Berger et al. (2008) estimate the size of the preventative equity capital buffer that US bank holding companies hold above the minimum requirements. In this context, they

$$\text{Capital adequacy ratio} = \frac{\text{Tier 1 Capital+Tier 2 Capital}}{\text{Risk–Weighted Assets}} \quad (3.1)$$

In other words, although capital adequacy requirements can correspond to both prudential and protective regulation, the literature predominantly associates capital adequacy requirements with prudential measures (see Dale 1984, Baltensperger and Dermine 1987, Dewatripont and Tirole 1994, Goodhart et al. 1998). In practice, the term 'capital adequacy' raises two important issues. The first problem involves defining the term 'capital' with its components, and the second problem involves determining the 'adequacy' of capital to evaluate the different risks and potential consequences for banks (see Dale 1984, Baltensperger and Dermine 1987). To address this problem, the BCBS agreed to a standard method to ensure a bank's capital adequacy (see BCBS 1997, Borio et al. 2001, Hellwig 2010b). Using this approach, capital adequacy requirements generally take two forms. The first type addresses the leverage ratio, which is 'the amount of capital divided by the bank's total assets' (Mishkin 2013: 299). The second type addresses the risk-based capital requirements of the BCBS. Over time, many other countries have adopted the Capital Accord or a similar approach. The proposed modifications to the Capital Accord include changes in capital requirements over time because of subsequent adjustments by correcting past errors towards a perfect model (Basel N) (see Ayadi et al. 2012), and the framework conditions such as technological innovations and financial innovations change over time (see Borio et al. 2001). The current Basel Accord therefore defines a number of different quantitative capital components. According to the Basel III Accord, regulatory capital consists of the sum of tier-one capital (going-concern capital) and tier-two capital (gone-concern capital). 'The total capital (tier one plus tier two) must be at least eight per cent of risk weighted assets[108] at all times' without the conservation buffer of 2.5 per cent that was already being practiced by the majority of banks (BCBS 2011b: 12, Berger et al. 2008). In other words, the minimum capital requirements plus the conservation buffer are 10.5 per cent. Switzerland's capital requirements, also called the Swiss Finish requirements, are higher (28.60 per cent total capital (10 per cent) inclusive of the conservation buffer (18.60 per cent)) than those in the European Union and the United States (10.5 per cent) (see also Commission of Experts 2010, FINMA 2015b). In this sense, Switzerland takes a leading role compared to other countries; however, even the Swiss Finish requirements can be criticised on several grounds: (1) they lack

indicated during their sample period from 1992 to 2006 that capital ratios were higher than their actual capital ratios and that '[bank holding companies] adjusted toward those targets quite rapidly – on average, closing between 28% and 41% of the distance to their desired capital ratios in a year' (Berger et al. 2008: 25).

[108] Risk-weighted capital requirements aim to discourage banks from undertaking large amounts of credit risk and to increase the likelihood of absorbing losses that occur as a consequence of credit risk.

a precise objective; (2) 'the dynamics of implementation over time have not been given sufficient attention' (Hellwig 2010b: 8);[109] (3) they do not take into account systemic risks (such as contagion effects) (see Hellwig 2010b); (4) they do not take into account different business models (investment banks, retail banks, diversified retail banks and wholesale banks) (see Ayadi et al. 2012); and (5) the total economic costs and benefits of these measures are disputed. According to the qualitative regulatory impact assessment 'Regulierungsfolgeabschätzung' (see SIF et al. 2011), the benefits are assumed to exceed the costs in the long term. The assessment of the impact of this regulation, however, does not contain a macroempirical cost-benefit analysis.[110] Furthermore, impact assessments should be made before, not after, a regulation such as Basel III or the Dodd-Frank Act has been implemented. Hellwig (2010b: 2) states, 'The Basel Committee does not, however, present any systematic analysis of why the proposed measures should have the salutary effects that are expected of them'. Furthermore, the internal risk manipulation of weighted assets and explicit exception in regulations harm capital requirements (see Hellwig 2016). According to the last point, banks group assets into buckets and assign them different weights with regard to their internal ratings-based approach or using the external rating called the 'standardised approach', wherein the external ratings come from a recognised authority such as the FINMA or the European Securities and Markets Authority. The following example describes the problems with respect to different asset weights.

Suppose a representative European bank B opts for the standardised approach and plans to fund business loans, residential mortgages or Greek government bonds. According to these three funding propositions, the bank must meet the Basel III and Capital Requirement Directive IV (CRD IV) requirements (see EC 2013). In this context, Figure 3.7 shows how high the equity ratio must be under the standard approach of Basel III (the same as Basel I and Basel II).[111] For business loans with an external risk weight of 100 per cent, the required equity capital to the sum of business loans is at least eight per cent. For residential mortgages with an external risk weight of 50 per cent, the required equity capital to the total amount of residential mortgages is at least four per cent. For Greek government bonds with an external risk weight of zero, the

[109] In this context, Hellwig (2010b: 9) clearly notes that the conservation buffer moves well in a two-period model, but in 'a real world where financing, investment and payout decisions are taken on an ongoing basis, neither the buffer argument nor the incentive argument can be granted'.

[110] A cost-benefit analysis that measures the effects of the higher equity capital requirement on the Swiss economy was prepared by Junge and Kluger (2012). These authors conclude that an increase in equity capital with respect to GDP would be negligible and that the expected benefit in terms of avoiding GDP decline would be of the magnitude of 0.5 per cent to 0.7 per cent (see Junge and Kluger 2012).

[111] The differences between Basel I and Basel III are as follows: (1) 4.5 per cent common equity tier 1 risk-based ratio (new to Basel III); (2) 6 per cent tier 1 risk-based ratio (same as in Basel I and II); and (3) 3 per cent tier 1 leverage ratio (new to Basel III) (see also Berger and Bouwman 2016).

equity ratio is zero. Therefore, 'the ratings of EU countries are not relevant to the capital requirement for investments in EU government bonds. Equally, no equity capital has been required' (Schäfer and Meyland 2015: 270).

Figure 3.7 Standardised approach for bank B

Asset Groups	Asset Weight		Required Capital to Weighted Assets		Required Capital to Total Assets (equity ratio)
Business loans	100%	*	8%	=	8%
Residential Mortgages	50%	*	8%	=	4%
Greek government bonds	0%	*	8%	=	0%

Source: Adapted from Turner (2009).

Consequently, bank B has an incentive for funding in Greek government bonds because (1) no equity capital is required; (2) they are very liquid; (3) the expected return is high; and (4) there is support from the bank to meet the liquidity requirements (see Schäfer and Meyland 2015).[112] In light of the sovereign crisis in Europe, Greek government bonds were downgraded to junk status, and therefore, government bonds are not entirely risk-free. Thus, the question arises as to why the risk weight of Greek government bonds is zero. The answer lies in the nature of bank regulation. In Basel III[113] and CRD IV, there are special requirements for EU government bonds stating that their risk weight is zero (see EC 2013, Schäfer and Meyland 2015). This leads us to the following conclusion: bank regulation (which is a public good and a source of market failure) that has an initial focus on stability, such as Basel III/CRD IV, can transform a stable system into an instable banking system as a consequence of funding decisions. In this regard, we follow Minsky (1977) FIH and formulate our 'regulatory instability hypothesis' (RIH):

Bank regulation can transform an initially robust banking system into a fragile banking system as a consequence of funding.

Source: Authors' own elaboration.

[112] Liquidity requirements will be analysed in section 3.2.2.
[113] Basel III is based on Basel II, which 'was published with new capital requirements that created arbitrage opportunities for banks and, albeit inadvertently, facilitated off-balance-sheet activities' (PwC 2009: 11). Consequently, Basel III creates regulatory arbitrage.

Another example that promotes the RIH is based on the US Community Reinvestment Act (CRA) of 1977 that was implemented by the Regulation of Banks and Banking (BB). The US CRA has the regulatory objective to 'meet the credit needs of its entire community, including low- and moderate-income neighbourhoods' (Art. 228.11 para. b lit. 1 of the BB). This act was substantially revised by the Clinton administration in 1995 and updated again by the Bush administration in 2005 (see Fed 2016). The substantial revision in 1995 offers banks the opportunity to fund mortgages in low-income classes, also called the United States mortgage dream. The update in 2005 meant that householders with no assets and no employment could also obtain mortgages, called 'Ninja mortgages' (see Brunnermeier 2009a, PwC 2009). In other words, the US CRA aims to prevent lower-income householders from changing a stable mortgage market into a fragile mortgage market. However, empirical studies and analysis such as 'the Staff Analysis of the Relationship between the CRA and the Subprime Crisis' suggest that the CRA did not contribute in any substantive way to the financial crisis of 2007–2009 (see Canner and Bhutta 2008, Hellwig 2010a). Nevertheless, we are sceptical about claims that bank regulation has no impact on the funding behaviour of banks (such as funding of riskier businesses, restructuring portfolios, and creating new financial products that result in an inefficient allocation of banking services (regulatory arbitrage, shadow banking)) that can harm the financial stability of the banking sector.

Opponents suggest that the RIH is misleading because bank regulation has the function of mitigating market failure and enhancing stability; therefore, an initial failure cannot be worsened with new regulatory measures. Notably, bank regulations have the main function of mitigating market failure, but only if they are well designed and clearly precise (objective-targeted bank regulation); otherwise, they enhance funding incentives, such as for Greek government bonds or loans for low income holders.

Next, assume that bank B opts for the internal ratings-based approach and decreases the asset weight for business loans and residential mortgages as a consequence of this approach. Figure 3.8 shows the internal ratings-based approach for bank B. The main difference between the standard approach and the internal ratings-based approach is that bank B has the possibility of reducing or increasing the asset weights with respect to internal risk evaluation (market risk, liquidity risk, credit risk and so forth). In our case, the bank reduces the asset weight, with the following two impacts: (1) for business loans with a risk weight of 80 per cent, the new equity ratio is at least 6.4 per cent, which is a difference of 1.6 per cent from the standardised approach, and (2) for residential mortgages with a risk weight of 40 per cent, the new equity ratio is at least 3.2 per cent, which is a difference of 0.8 per cent from the standardised approach.

However, for Greek government bonds, the equity ratio remains zero per cent. In this regard, we leave it to the reader to determine the approach our representative bank B chooses.

Figure 3.8 Internal ratings-based approach for bank B

Asset Groups	Asset Weight		Required Capital to Weighted Assets		Required Capital to Total Assets (equity ratio)
Business loans	80%	*	8%	=	6.4%
Residential Mortgages	40%	*	8%	=	3.2%
Greek government bonds	0%	*	8%	=	0%

Source: Adapted from Turner (2009).

Based on these considerations, we see potential policy options to reform the capital adequacy requirements:

- Precisely systematising capital requirements with respect to the desirable objective (see section 2.2);
- Taking into account systemic risks;
- Performing an impact assessment before further incremental adjustments of capital requirements occur;
- Removing the zero-risk weighting for EU government bonds or 'introducing a non-zero risk weight floor for sovereign exposures in the standard approach' or internal ratings-based approach (ESRB 2015: 9);
- Setting a minimum standard in the internal ratings-based approach (see ESRB 2015); and
- Increasing the unweighted capital requirements[114] by 'ten percent and perhaps even closer to the twenty or thirty percent that were common before banks got used to the idea that the taxpayer couldn't afford to let them fail' (Hellwig 2010b: 11).

[114] Opponents, especially bankers and even regulators, argue that with higher capital requirements, 'banks facing capital constraints may cut back the lending, making the recession worse' (Turner 2009: 59). In the same manner, Britain's SIBs and the British Bankers' Association note that '[t]he banks have also calculated that demands by international banking regulators in Basel that they bolster their capital will require the UK's banking industry to hold an extra £600bn of capital that might otherwise have been deployed as loans to businesses or households' (Treanor 2010: Internet). Moreover, numerous studies show that an increase in capital adequacy requirements reduces credit supply (see Kishan and Opiela 2000). Conversely, Admati and Hellwig (2013:6) clearly disprove the misunderstanding of the word capital and indicate that capital requirements are not reserves: '– pile[s] of cash that banks hold that cannot be used to make loans'. In fact, capital regulation does not tell banks what to do with their funds or what they should hold; it tells banks only what portion of the funds they use must be unborrowed.

With these considerations in mind, we examine the effects of capital requirements. Although the literature includes numerous studies on the effects of capital regulation (for further details, see BCBS 2016), (1) there is less focus on empirical research regarding the estimation of benefits (see BCBS 2016); (2) the focus is on optimal capital regulation that requires a careful interpretation because there is no consistent definition of capital (as we mentioned at the beginning of this section; see BCBS 2016); (3) the social benefits are difficult to evaluate; (4) the literature focuses on the total loss-absorbing capacity that is the condition for a bail-in instrument where no quantifications of costs and benefits are possible; and (5) the impact studies suffer from methodological weaknesses (see Rochet 2014). Consequently, although the literature concludes that the net benefit of capital requirements is positive, further academic research (particularly from an empirical perspective) is needed to respond to the considerations discussed above. Therefore, we agree with Rochet (2014: 4) that 'it would be hazardous to precipitate another round of regulatory reforms, given that we know so little about the long-term impact that such reforms would have'.

3.2.2. Liquidity requirements

Liquidity requirements are mainly considered prudential regulations that require banks to hold a certain amount of liquid assets in case a financial distress event occurs. In other words, liquidity 'requirements were formulated on the basis of liquidity crisis events that were insufficiently severe' (Commission of Experts 2010: 34). In this sense, a question arises regarding why liquidity requirements are proposed in the first place. The literature suggests that a major problem in the 2007–2009 financial crisis was the lack of liquid assets and liquid funding. Therefore, based on Basel III and to increase the resilience regarding dried up liquidity, liquidity requirements have been proposed (see Liikanen et al. 2012). However, it is questionable whether the 2007–2009 financial crisis was a liquidity problem at all, and thus, liquidity requirements are questionable. In the second part of the thesis, we will illuminate this controversy (see sections 7.1 and 7.2.2 for further details). Nevertheless, for the purpose of elucidating the basic concept of liquidity requirements, the following four questions are addressed:

The statement that new regulations would require U.K. banks to ''hold an extra £600 billion of capital'' is nonsensical. The implication that loans to businesses or households are automatically reduced by that £600 billion is false'. In other words, higher capital regulation does not limit the funding of banks. Moreover, higher capital requirements increase the likelihood that 'absorb[ing'] losses without becoming insolvent' is higher than that without requirements and mitigates the fragility of banks (Admati and Hellwig 2013: 94).

- What is meant by the term ‘liquidity’?
- What are the recent liquidity requirements?
- What are potential reform options for liquidity requirements?
- What are the effects of liquidity requirements for the banking sector?

Clearly defining the term ‘liquidity’ is difficult because ‘[u]nfortunately the word liquidity has so many facets that it is often counter-productive to use it without further and closer definition’ (Goodhart 2008: 41). Moreover, there are several definitions in the literature. A more formal definition can be derived as follows (see Greenbaum and Thakor 2007 [1995]). Suppose there is a full asset price P* (perfectly marketable) and a lesser price P_i (imperfectly marketable) if the asset is sold before, where i=0,…,n determines the time of selling the assets, and n represents the time of the full asset price (see 3.2). Therefore,

$$P_n = P^* \tag{3.2}$$

Based on the time the assets are sold before the full asset price is realised (i<n), liquidity (L) can be defined as the ratio of the lesser value and the full-value price of assets (3.3). Hence,

$$L = \frac{P_i}{P^*} \tag{3.3}$$

In this regard, liquidity mainly depends on the valuation of the assets and on the timing of i, when the bank is able to sell the assets on the market for cash, which is also called the ‘marketability concept’.[115] In light of these characteristics, liquidity can be defined as follows:

‘[T]he ability to meet all claims that fall due, at any time and without restriction. Under the Banking Act, Swiss banks must ensure that they hold sufficient liquidity. Accordingly, a bank or group of banks is referred to as illiquid if it does not have sufficient liquid assets to meet all short-term claims. A bank can be solvent but nonetheless illiquid: while it may have sufficient assets to cover all debts and not be over-indebted, it may not have sufficient liquid assets to meet all short-term liabilities’ (SNB 2015a: Internet).

Likewise, UBS (2009a: 60) ‘defines liquidity as the ability to meet obligations as they come due and to provide funds for increases in assets without incurring unacceptable cost’. Based on the considerations discussed above, we define liquidity in a broad sense as follows:

[115] In this context, a good indicator to measure liquidity is the average difference between the purchase price (P*) and the sale price of an asset (P_i) (see Bundesrat (BR) 2002).

Liquidity is the ability to meet all obligations as they come due at any time without restrictions and provide funds for increases in assets without incurring unacceptable cost.

Sources: Authors' own elaboration based on UBS (2009), IMF (2013), SNB (2015a).

In a narrow sense, liquidity can be classified as (and distinguished between) market liquidity and funding liquidity. The former represents 'the ability to buy and sell an asset with a small associated price change' (IMF 2008: xi), whereas the latter involves the ability of a solvent institution to make agreed upon payments in a timely manner. With these considerations in mind, the question arises as to what the recent liquidity requirements are. As a result of the liquidity problems in the 2007–2009 financial crisis, the BCBS under the BIS introduced two liquidity requirements. Banks must fulfil a short-term liquidity risk ratio, the 'liquidity coverage ratio' (LCR), until 1 January 2019 of 100 per cent (2015, 60 per cent LCR; 2017, 70 per cent LCR; and 2018, 90 per cent LCR) and a long-term resiliency fund, the 'net stable funding ratio' (NSFR), until 1 January 2018.

The LCR is defined as the ratio of the value of the stock of high-quality liquid assets (HQLAs) and the total net cash outflows[116] over the next 30 calendar days that is determined by expectations to be above 100 per cent (see 3.4, BCBS 2013).

$$\text{LCR} = \frac{\text{Stock of HQLAs}}{\text{Total net cash outflow over the next 30 calendar days}} \geq 100\% \qquad (3.4)$$

HQLAs can be distinguished into two asset classes: (1) Level 1 asset classes, which include coins and banknotes, central bank reserves and several marketable securities representing claims on or guaranteed by sovereigns, central banks and regulators with a zero per cent risk weight asset (for example, Greek government bonds) (see BCBS 2013), and (2) Level 2 asset classes, which can be distinguished into two sub-asset classes, namely, Level 2A and Level 2B assets, permitted by the supervisor (see BCBS 2013). These sub-asset classes can be included in HQLAs and are not subject to a haircut. Level 2A asset classes are certain marketable securities representing claims on or guaranteed by sovereigns, central banks and regulators with a 20 per cent risk weight under Basel II and corporate debt securities, covered bonds with a credit rating of at least AA- and a proven record as a reliable source with a 'maximum decline of price or increase in haircut over a 30-day period during a relevant period of significant

[116] 'The term total net cash outflows is defined as the total expected cash outflows minus the total expected cash inflows in the specified stress scenario for the subsequent 30 days (Art. 69 BCBS 2013).

liquidity stress not exceeding 10%' (Art. 52 para. 52 BCBS 2013). Level 2B assets include residential mortgage-backed securities with a credit rating of AA or higher (for example, sub-prime mortgage securities (US asset-backed securities (ABSs) or US collateralised debt obligations (CDOs)) that had a credit rating of AAA before the crisis), as well as certain corporate debt securities rated between BBB- and A+ (see BCBS 2013).

The NSFR includes a bank's assets and actives over a one-year period. The NSFR is defined as the ratio of the available amount of stable funding (ASF) and the required amount of stable funding (RSF) above or equal to 100 per cent (see 3.5, BCBS 2014).

$$\text{NSFR} = \frac{\text{Available amout of stable funding}}{\text{Required amout of stable funding}} \geq 100\% \tag{3.5}$$

The amount of ASF is the sum of the weighted ASF amounts, which are divided into five ASF categories with five ASF factors for liabilities. Category (1) has an ASF factor of 100 per cent and is based on the total regulatory capital (excluding tier 2) and other liabilities with a residual maturity of one year or more (see BCBS 2014). Category (2) has an ASF factor of 95 per cent and is based on non-maturity demand deposits and term deposits of less than one year for retail and small business customers (RSCs). Category (3) has an ASF factor of 90 per cent and contains non-maturity deposits and term deposits of less than one year for RSCs. Category (2) and category (3) are difficult to distinguish with regard to term deposits. Category (4) has a 50 per cent ASF factor and is based on operational deposits and so forth. Category (5) has a zero per cent ASF factor and contains all other liabilities and equity not included in the above-mentioned categories (see BCBS 2014). The amount of ASF is the amount of RSF determined. The main difference between the ASF and RSF categories is that the RSF categories focus on the asset side; for example, zero per cent RSF includes coins and banknotes, central bank reserves and so forth.

Overall, liquidity requirements can be criticised as follows: (1) according to Goodhart (2010: 175), 'liquidity requirement is an oxymoron. If you have to continue to hold an asset to meet a requirement, it is not liquid'—in this sense,

'[t]he most salient metaphor and fable in prudential regulation is of the weary traveller who arrives at the railway station late at night, and to his delight, sees a taxi there who could take him to his distant destination. He hails the taxi, but the taxi driver replies that he cannot take him, since local bylaws require that there must always be one taxi standing ready at the station' (Goodhart 2008: 41);

(2) the weakness of treating EU government bonds as highly liquid; (3) complexity with respect to different categories and factors and the allocation of cross-border liquidity (see Ayadi et al. 2012); (4) potential manipulation regarding several asset levels and different credit risks (for example, subprime mortgage securities)—in this context, banks could assign the same assets to different asset levels because of their internal asset-liability management—(5) LCR and NSFR not properly considering liquidity and systemic risks; (6) the lack of a systemic impact analysis; and (7) liquidity having nothing to do with the main causes of the financial crisis of 2007 (such as excessive maturity transformation and securitisation through SPVs (see Gorton 2008, Brunnermeier 2009b, Hellwig 2009)). Therefore, we advocated with Goodhart (2008) to establish general principles for liquidity instead of strict requirements. According to our critique, we see potential policy options for the recent liquidity requirements:

- Taking into account systemic risks;
- Removing the zero-risk weighting of EU government bonds or introducing a non-zero risk weighting;
- Simplifying categories and factors and the allocation of cross-border liquidity;
- Setting standards to mitigate the manipulation of liquidity requirements; and
- Providing empirical impact assessments before setting further standards.

With these considerations in mind, we next identify the effects of liquidity requirements. Although, in the literature, 'there is very little theoretical or empirical research on the impact of minimum liquidity standards on bank liquidity risk or other bank risk-taking behaviour' (DeYoung and Jang 2016: 158), DeYoung and Jang (2016) offer an interesting analysis to fill this theoretical and empirical gap by testing US commercial banks regarding the management of their liquidity positions between 1992 and 2012. They conclude that 'as banks increase in size, they set lower liquidity targets – often in violation of the coming Basel III standards – but manage those targets more efficiently' (DeYoung and Jang 2016: 143). However, their study and other studies in this field (see BCBS 2010) can be criticised because recent liquidity requirements are not fully in place (see BCBS 2016). Additionally, 'the empirical, and some of the simulation, studies do not take into account the full welfare impacts of liquidity regulation' (BCBS 2016: 20). In other words, the social benefits of liquidity requirements remain entirely theoretical. Therefore, it appears difficult to simulate the effects of and to draw conclusions about liquidity regulations before they are fully implemented. Nevertheless, further academic research (particularly empirical analysis) on the effects of liquidity regulation would be

desirable if the regulation has been fully implemented, as mentioned for the LCR in 2019 and the NSFR in 2018.

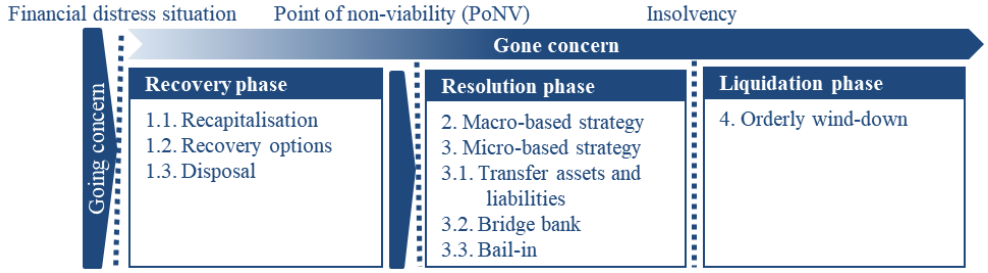
3.2.3. Failed bank recovery and resolution

In June 2007, the investment bank Bear Stearns was tied up in liquidity problems as a result of the failure of subprime mortgage hedge funds. A year later the firm was taken over by JP Morgan. In October 2008, when banks threatened to collapse worldwide due to negative developments in the financial markets, it became apparent that the banking market was not in a position to withstand the market exit of banks (for example, UBS, Royal Bank of Scotland, Citigroup and Bank of America) that are too complex to fail, too interconnected to fail or too systemic to fail. In other words, a bankruptcy would disrupt any systemically important operations (such as payment services), and resolving a bank in an orderly manner was not feasible because of the complexity of business relationships (cross-border) within such a short period. Based on systemic importance, it was immediately apparent that central banks and governments (taxpayers) should rescue the SIBs concerned and thus ensure the solvency of these banks as well as the functioning and stability of the financial market. However, the explicit guarantees of SIBs impose costs on taxpayers and encourage the potential incentive to take excessive risks in the future, also known as moral hazard (see section 2.1.2 and part II) (see also Ayadi et al. 2012). As a response, the Financial Stability Board (FSB) was developed, and the G20 adopted a recovery and resolution standard known as the Key Attributes of Effective Resolution Regimes for Financial Institutions (Key Attributes) to resolve banks in an orderly manner without taxpayer exposure and to limit moral hazard (see FSB 2011). In other words, the aim of an effective recovery and resolution regime is to ensure ‘that a bank, regardless of its size and systemic importance, can be transformed and recovered, or be wound down in a way that limits taxpayer liability for its losses’ (Liikanen et al. 2012: IV). These standards must be fully implemented by 2019. Thus, we pose the following five questions:

- What are the phases before an SIB has an orderly wind-down?
- What are the elements of recovery and resolution plans?
- Can SIBs wind-down in an orderly manner without taxpayer money with regard to the recovery and resolution standards?
- What are potential policy options for recovery and resolution standards?
- What are the effects of recovery and resolution standards for the banking sector?

In relation to the first question, Figure 3.9 illustrates the three phases of a crisis and the two defence phases before insolvency appears, namely, the recovery phase and the resolution phase. According to Figure 3.9, there are three phases after a financial distress situation of a bank, the (1) recovery phase, (2) resolution phase and (3) liquidation phase, although each phase has different characteristics. The recovery phase can be distinguished from the resolution phase with respect to the point of non-viability (PoNV). The PoNV is understood to be when a bank is 'no longer viable or likely to be no longer viable, and has no reasonable prospect of becoming so' (FSB 2011: 7). Thus, 'the preferred resolution strategy is activated on a coordinated basis with host regulators if recovery does not successfully lead to a stabilisation of the group' (FINMA 2013: 9).

Figure 3.9 Strategy to recover and resolve an SIB

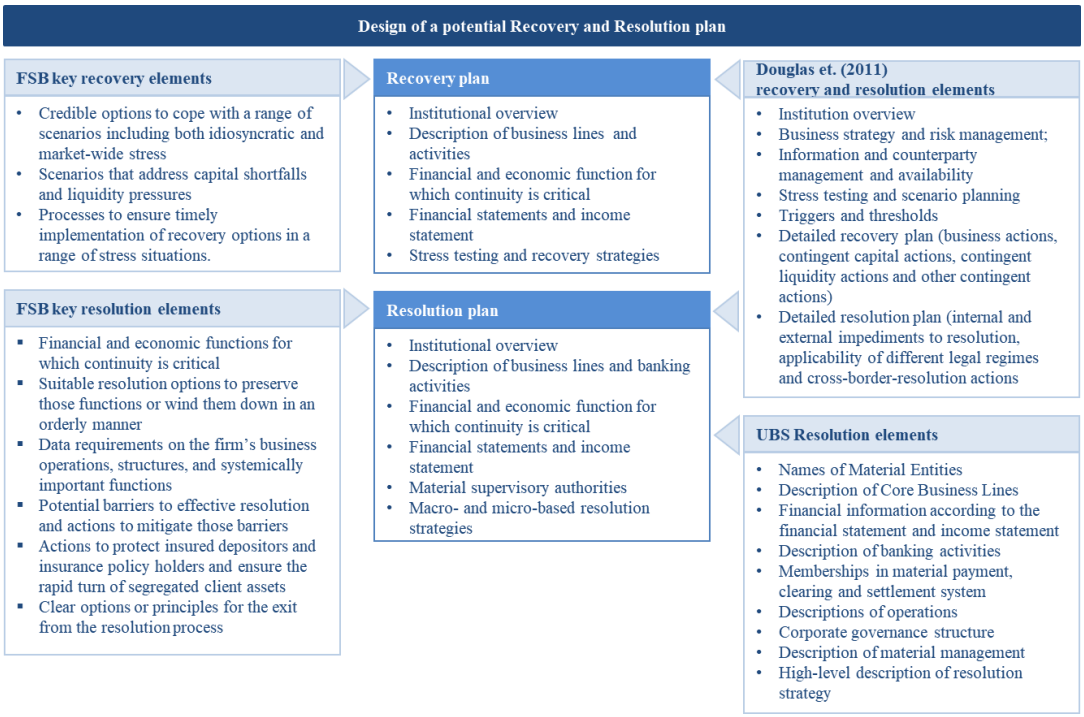


Sources: Authors' own elaboration based on FSB (2011), FINMA (2013).

The recovery phase is based on (1.1) recapitalisation, (1.2) recovery options, and (1.3) disposal. The recovery phase begins with the recapitalisation of the bank. Banks that cannot fund in the capital market (such as issuing new shares) automatically increase equity according to the conversion of contingent convertible capital (CoCos). This means that when the level of common equity tier 1 (CET1) reaches or falls below a certain per cent of risk-weighted assets (for example, in Switzerland, five per cent regarding the capital buffer (low trigger) and seven per cent with respect to the progressive component (high trigger)), new capital will automatically become available through the conversion of short-term liabilities into capital (see FINMA 2013). In other words, CoCos are debt obligations that convert to equity when a specific event occurs (such as when the common equity ratio falls below seven per cent) (see FINMA 2011). In a second step, the recovery plan (1.2) prepared beforehand (ex-ante) by the bank will be actualised. The recovery plan shows different recovery scenarios and possibilities. In particular, the recovery plan is a road map for resolving the banks. What elements determine a recovery plan?

The difficulty is that recovery and resolution plans, also called 'living wills', are not publicly available, and plans vary between different regulatory authorities. Nevertheless, we present a possible recovery and resolution plan based on the key elements of FSB (2011), Douglas et al. (2011) and the UBS resolution plan (UBS 2014b) with the objective of transparency, simplicity and modularity. Figure 3.10 illustrates the recovery and resolution plan. According to Figure 3.10, the recovery plan is based on the following: (1) an institutional overview that describes the organisational structure of a bank (see Appendix 1); (2) the description of business lines (for example, wealth management) and banking activities (such as derivative and hedging activities); (3) financial and economic functions for which continuity is critical (for example, the payment, clearing and settlement system); (4) financial statements and income statements (including market shares, value of deposits, balance sheet size and the GDP, risk profile); and (5) stress testing (macro-based market-wide (systemic) stress and micro-based bank-specific (idiosyncratic) stress scenarios) and recovery strategies (such as recapitalisation and CoCos scenarios).

Figure 3.10 Design of a potential recovery and resolution plan



Sources: Authors' own elaboration based on FSB (2011), Douglas et al. (2011), and UBS (2014b).

In a third step, banks will attempt to be sold on the financial market if a recovery is not feasible (disposal) (1.3). If the bank enters the PoNV, then the bank is part of the second defence line, namely, the resolution phase. The resolution phase can be divided into macro-based and micro-

based strategy. The macro-based strategy, also called a high-level description of resolution, 'may consist of either 'single point of entry' [(SPoE)] or 'top down' approaches and 'multiple-entry' [(ME)] resolution along national, regional or functional lines' (Hüpkes 2013: 82-83, see also Randell 2013). The SPoE approach is based on a single national resolution and the group level. Conversely, the ME is based on multiple resolution authorities with respect to national, regional or functional business lines (see also Hüpkes 2013). In Switzerland, the resolution authority (FINMA) makes the decision regarding the SPoE approach (see FINMA 2011). Conversely, the micro-based strategy is determined by the transfer of assets and liabilities, (3.1) bridge banks,[117] (3.2) and bail-in, also called 'restructuring'. In this context, observers would mention that in reality, CoCos are not different from bail-in, and thus, the recovery phase is not different from the resolution phase. This may be true regarding recapitalisation with CoCos, but the resolution phase draws upon the transfer of assets and liabilities, bridge bank strategies and so forth. Therefore, the recovery phase is different than the resolution phase, (3.3). In this regard, the bank has two possible strategies, A and B (see Tucker 2013). Figure 3.11 illustrates the two possible strategies as a consequence of hierarchy claims. Thus, a clear strategy is based on a clear objective, namely, a hierarchical structure of the claims. Figure 3.11 illustrates five hierarchical claims: (1) insured depositors that are covered by deposit insurance; (2) uninsured insurance (institutional clients such as insurance companies); (3) senior bond holders;[118] (4) junior bond holders; and (5) shareholders. In light of this hierarchy structure, the following two strategies can be described.

For Strategy A, in a first step, the equity (shareholders) will be written off entirely before uninsured senior and junior bond holders' bail-in to absorb losses. Simultaneously, selected assets, liabilities (insured depositors and uninsured insurance) and essential functions (payment services, clearing and settlement systems) are transferred to a bridge bank (see FSB 2011).

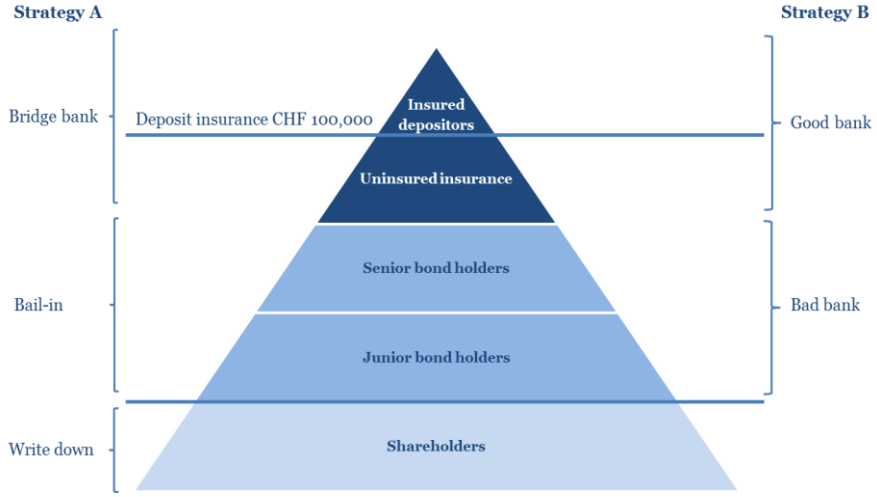
Strategy B is different regarding the restructuring clause because no restructuring is imposed for senior and junior bond holders. In this context, senior and junior bond holders and non-essential bank functions (such as investment banking) will be transferred to a bad bank. Conversely, insured depositors, uninsured insurance and essential bank functions will be transferred to a good bank that will be sold (for example, in 2012, the Cyprus banking crisis

[117] According to DeYoung et al. (2013: 615), a bridge bank is defined as a temporary national bank created by the regulatory agency, where 'assets and most liabilities of failed bank transferred to new bank. Old ownership, holding company creditors, and management are severed from bank'.

[118] The categorisation of senior and junior bond holders aims to treat bond holders equally without making one worse off in the liquidation process (see FINMA 2011).

followed strategy B; a bad bank, 'Laiki Bank', and a good bank, the 'Bank of Cyprus', were created).

Figure 3.11 Hierarchy of claims and possible strategies



Source: Authors' own elaboration.

These strategies are part of a resolution plan[119] that contains the following: (1) an institutional overview; (2) a description of business lines and banking activities; (3) financial and economic functions for which continuity is critical; (4) financial statements and income statements; (5) material supervisory authorities, indicating which regulatory authorities are involved in the resolution phase with respect to cross-border services because different countries have different resolution regimes (see also Ayadi et al. 2012, Hüpkes 2013, Randell 2013); and (6) macro- and micro-based resolution strategies. After the resolution phase, the bad bank will be insolvent and undergo an orderly write-down. In short, recovery and resolution plans indicate specific problems (see Liikanen 2012), place failed banks in a bankruptcy procedure (see Tucker 2013) and induce a simplified structure in SIBs (see Ayadi et al. 2012). Nevertheless, can SIBs wind-down in an orderly manner without taxpayer money regarding the recovery and resolution standards?

The answer is no. Additional funding is required to wind-down an SIB that is not guaranteed by the recent standards because '[d]iscussions about the funding of recovery and resolution procedures usually pay too little attention to the distinction between the need to fund operations as long as they are ongoing and the need to allocate or to absorb ultimate losses'

[119] The resolution plan is prepared by the resolution authority and includes several resolution strategies (such as open bank assistance, forbearance, purchase and assumption, partial payout, and asset liquidation) (see DeYoung et al. 2013).

(Hellwig 2014a: 19). Certain observers would argue that for this purpose, the European Banking Union[120] has created a Single Resolution Fund (SRF).[121] The SRF should represent approximately € 55 or € 70 billion when fully operational (see EC 2014), although € 55 or € 70 billion is insufficient to fund even one SIB (for example, in 2014, the liabilities of Deutsche Bank were valued at € 1,635 billion, which is a difference in the SRF of € 1,580 billion (see DB 2014)). Likewise, Hellwig (2014a: 19) notes that the target levels of the fund

'are much too small to ensure interim funding of institutions like Deutsche Bank or BNP Paribas with liabilities on the order of € 2 trillion, a large part of which is wholesale and short-term, i.e., easy to discontinue if counterparties get nervous. Promises of support from a fund with € 55 or € 70 billion are not going to stop a run if creditors with claims amounting to € 1 trillion or more are worried about a bank'.

In this example, opponents would state that CoCos are excluded; however, even if CoCos are included, the SRF fund cannot sufficiently absorb losses. Therefore, some insolvent SIBs cannot be resolved without government assistance in Europe. In Switzerland, the situation is different for the following reasons: (1) There is no SRF fund available. (2) The regulatory requirements are higher than those in the European Union. Despite these higher regulatory requirements, discussions about funding operations have devoted insufficient attention to Switzerland. Therefore, it is possible that an SIB (such as UBS or Credit Suisse) could be wound down in an orderly manner without taxpayer money or with the help of the SNB as the LOLR. (3) The SIBs are too complex based on the institutional structure (see Appendix 1). In this sense, a substantial challenge for regulatory authorities is to address solvency rules and agencies in different countries (see SFBC 2008a). (4) At the time of the transfer and separation of asset and liability classes, Tucker (2013: 17) argues that 'there is not time for a process involving negotiations between different classes of creditors and shareholders under the jurisdiction'. (5) With respect to the material supervisory agency, there is a cross-border problem. In this regard, '[t]he bail-in changes the ownership of the group but it does not affect the balance sheets of the subsidiaries' (Tucker 2013: 17, see also the subsidiary problem in Appendix 1). In other words, Gleeson (2013) notes that 'if a bank has a branch and a subsidiary in a particular jurisdiction [such as Singapore or Hong Kong] the resolution authority in that jurisdiction must be prepared to treat the creditors of the branch differently from the creditors of the subsidiary and not seek to attach assets belonging to the branch to satisfy creditors of the subsidiary'. (6) As shown in

[120] The European Banking Union, based on a single supervisory mechanism and a single resolution mechanism, have been expanded with the SRF.
[121] The SRF is funded by European SIBs with regard to the asset size of their balance sheet.

Figure 3.11, certain types of claims are 'exempt' from bail-in, namely, uninsured insurance (see Hellwig 2014a). This exemption creates a moral hazard problem and imposes excessive risk-taking. (7) Recent recovery standards are based on idiosyncratic risk; however, this is a problem because systemic risk will be not taken into consideration. According to our critique, we see potential policy options for the recovery and resolution standards:

- Setting a clear solvency framework and, in addition to cross-border resolution cooperation, setting various international memoranda of understanding among the appropriate regulatory authorities (including explicit rules for times of financial distress);
- Taking into account subsidiaries in the recovery and resolution plans;
- Taking into account uninsured insurance in a bail-in process; and
- Taking into account systemic risks, particularly in the stress tests.

With these considerations in mind, a question arises regarding the effects of recovery and resolution standards. In the literature, there is very little theoretical or empirical research on the impact of recovery and resolution standards because it is difficult to simulate the effects and draw conclusions about recovery and resolution standards before they are fully implemented. Therefore, further academic research, particularly a quantitative impact assessment on the effects of recovery and resolution standards, would be desirable if the regulation have been fully implemented in 2019.

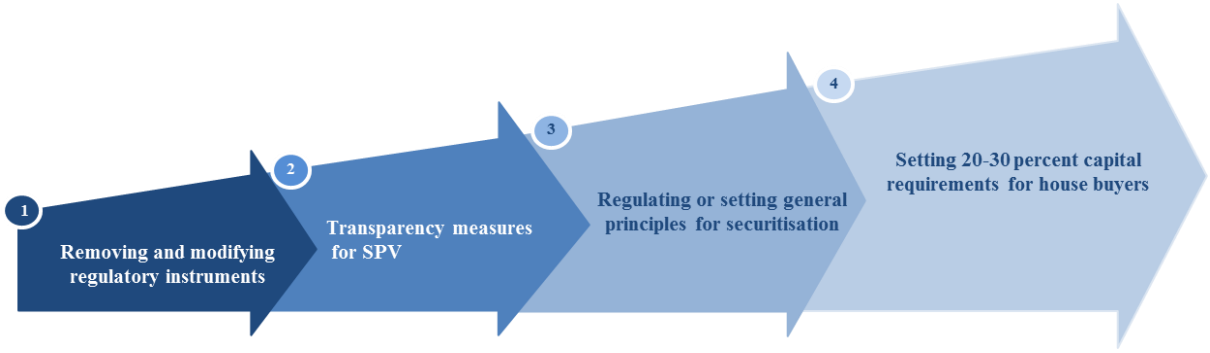
3.3. An alternative regulatory proposal

Next, we discuss an alternative bank regulatory proposal instead of capital requirements, liquidity requirements (LCR and NSFR) and so forth. As noted in chapter 2, a clearly stated bank regulation 'must be based on a clear identification of market failure' (Tirole 2002: 114). Therefore, we ask ourselves what the main causes of the financial crisis in 2007–2009 were. In this regard, the main causes[122] of market failure include the following: (1) a mismatch of maturity transformation through the lack of transparency of an SPV (see Gorton 2008, Brunnermeier 2009b, Hellwig 2009); (2) asymmetric information in the mortgage securitisation process; (3) malfunctioning in fair-value accounting (see Hellwig 2009); and (4) the low creditworthiness of householders. Considering the major causes of the financial crisis, we ask,

[122] We agree that monetary policy (reducing interest rates) also plays a decisive role (Greenspan put).

'what type of regulation would help to improve the situation?' (Baltensperger and Dermine 1987: 70). The answer is based on the four main causes of market failure. Therefore, we propose an alternative regulatory proposal, such as the Basel III requirements, because Basel III lacks a clear market failure analysis and various problems (see capital requirements, liquidity requirements, and recovery and resolution standards). Figure 3.12 illustrates the four steps of a regulatory reform programme. In what follows, we describe the alternative regulatory proposal.

Figure 3.12 Four-step regulatory proposal



Source: Authors' own elaboration.

Removing and modifying fuzzy regulatory instruments

As a first step, the banking sector should remove and modify all fuzzy regulatory measures, for instance, by modifying fair-value accounting in a financial distress situation or removing liquidity requirements. Next, we briefly expand on the modification of fair-value accounting or the removal of liquidity requirements.

Suppose a bank is in financial distress. In such a situation, a bank reassesses its positions (such as trading positions) under fair-value accounting and takes corrective actions regarding equity positions. Therefore, a bank is 'likely to involve some deleveraging […]. If the assets in question are the very assets for which markets are not functioning, the book losses turn into real losses, which they might not have done if the bank could have held on to the assets' (Hellwig 2009: 176). The real losses could spread to other banks as a result of interconnectedness in the banking sector. Therefore, fair-value accounting is a source of systemic risk (see IMF 2008, Hellwig 2009). Thus, in this regard, the IMF (2008: 65) correctly indicated that 'fair-value [accounting] is compounding market instability by applying the valuations arising from sales in these abnormal market conditions [during the financial crisis of 2007–2009] across all fair-valued portfolios, regardless of the intention of holding them'. In other words, fair-value accounting can produce scenarios that generate unnecessary losses and lead to downward

spirals in asset prices (see IMF 2008). Therefore, the IMF (2008: 66) proposes that one ability 'that should strengthen financial stability would be for financial institutions to define decision rules on the basis of fair value milestones that trigger a review of the elements, such as assumptions or special circumstances, underlying fair value'. In this context, we propose either to remove fair-value accounting in a financial distress situation in which markets are not functioning well (see Hellwig 2009) or to simplify fair-value accounting.[123] Likewise, the IMF (2008) concludes that regulators should pay greater attention to applying fair-value accounting results and must rethink the rules in that regard.

Liquidity requirements are not target orientated to the main causes of the market failure of the financial crisis because the dry up in liquidity in the most recent financial crisis was a result of a solvency problem, not the cause (see section 7.1). Opponents would argue that holding more 'liquidity' reduces the likelihood of insolvency and 'reduce[s] vulnerabilities from a system-wide increase in wholesale, short-term and foreign exchange (FX) funding' (IMF 2013: 21). This is correct, but bank regulation that comes out of the blue because policy makers and regulators want to expand their political agenda increases the cost of banking activities (harming bank functions) and the likelihood of regulatory arbitrage[124] to fund highly liquid products such as the EU government bonds of periphery counties. Therefore, in a financial distress situation, liquidity requirements do not mitigate the probability of insolvency and system-wide risk.

[123] In practice, there are three fair-value accounting instruments: Level 1 – quoted price in active markets, Level 2 – valuation techniques determined by observable market data, and Level 3 – valuation techniques not based on observable market data (see UBS 2015).

[124] Regulatory arbitrage, also called the 'Delaware effect' (The state of Delaware in the United States implements increasingly lax regulation to attract foreign companies, especially in taxation) and also known as structural arbitrage, refers to the utilisation of varying regulation levels among countries in favour of market participants (see Goodhart et al. 1998, Calomiris 1999). In other words, regulatory arbitrage occurs when banks seek to circumvent bank regulation through financial innovation (securitisation or digital transformation) or by changing the business strategy and structure. Banks offload assets from banks' balance sheets using securitisation (see Hellwig 2009, 2010a, 2010b, Ayadi et al. 2012, Admati and Hellwig 2013). Hence, banks create subsidiaries (bank activity) to shift out their credit and the liquidity risk of the balance sheet in a structured investment vehicle to avoid fulfilling higher regulatory standards.

Transparency measures for special purpose vehicles

Second, we propose the implementation of transparency measures for SPVs because 'in late July 2007 […] a vast expansion in off-balance sheet entities (OBSEs) [(such as SPVs and commercial paper conduits)] that had taken place since the mid-1990s, which was not transparent to many supervisors and regulators' (IMF 2008: 69), had played a decisive role in the most recent financial crisis (for instance, Dillon Read Capital Management in the UBS crisis in 2007–2009) (see section 7.1 for further details). These OBSEs allowed banks and other financial institutions to transfer risk that was undisclosed to regulators and investors off their balance sheets. Moreover, they improved their market liquidity via securitisation and generated fee income. In this sense, the question arises as to why OBSEs are less transparent to supervisors and regulators. The answer is based upon the accounting standards under IFRS and US GAAP. Both accounting methods allow OBSEs to limit transparency to investors and regulators (see IMF 2008). 'In general, OBSEs are structured such that no single institution holds the majority of the risks and rewards, thereby avoiding consolidation and appearance on a financial institution's balance sheet' (IMF 2008: 69). Therefore, the IMF (2008: 69) 'suggests that standard setters [must] reconsider the grounds for consolidation to improve the understanding of underlying risks by all parties because of the ability of banks to avoid consolidation'. For example, if a bank holds a majority exposure to OBSEs, the accounting rules should determine that the bank should consolidate the OBSEs in the bank's balance sheet (see IMF 2008). Such rules would lead to a better understanding of the structure and business model of SPVs for regulators and investors (which is not covered in the recovery and resolution plans) because they disclose the risk inherent in excessively shifting credit and liquidity risks (risk exposure) in banks' balance sheet.

Regulating or setting general principles for securitisation

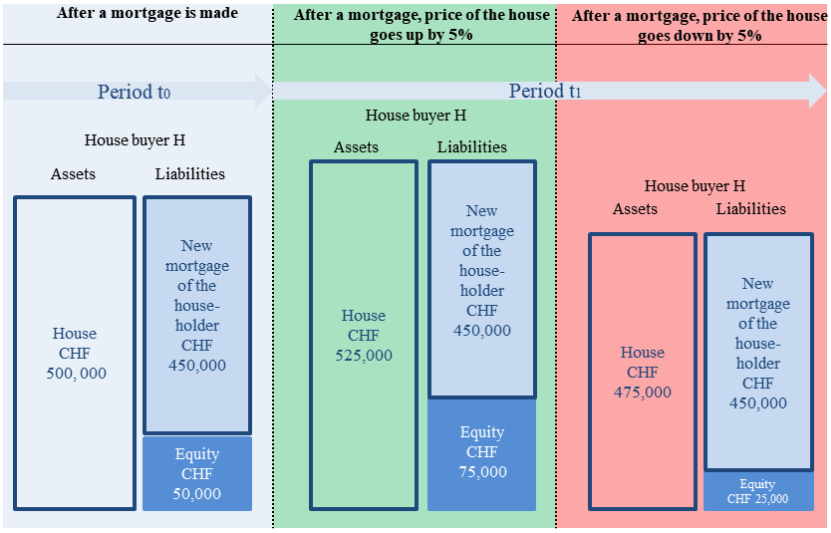
The word securitisation refers to the act of an untraded group of (debt) claims in a market (such as a bank loan) that is bundled and converted into traded securities by issuing claims against it and selling these claims to capital market investors (see Greenbaum and Thakor 2007 [1995], Hellwig 2009). Securitisation is 'sometimes referred to as the originate-and-distribute model of mortgage finance, the originating institution, traditionally a bank or a savings institution, will transfer mortgage titles to a special-purpose vehicle, a specialized institution that puts a large set of mortgages into a package and that redefines itself by issuing mortgage-backed securities'

(Hellwig 2009: 138-139). Although in the aftermath of the recent financial crisis, securitisation has been called into question, securitisation is an important part of a well-functioning financial system because '[i]n principle, [securitisation with respect to] shifting this risk away from the originating institution and its debtor makes sense because there are other market participants who are better able to bear this risk' (Hellwig 2009: 140). Moreover, creating packages that standardise asset classes can reduce asymmetric information regarding the quality of mortgages (see Hellwig 2009). Nevertheless, the reduced monitoring of the creditworthiness of sub-prime related mortgages in the securitisation process may require securitisation to be reconsidered. Therefore, in autumn 2015, the European Commission proposed a regulation for securitisation that creates a framework to identify simple, transparent and standardised securitisations. 'This framework allows investors to evaluate the risks related to securitisation and is accompanied by an amendment to the treatment of regulatory capital requirements' (EPRS 2016: 2). The common rules for all securitisations include the following: (1) due diligence requirements for investors, (2) risk retention requirements and (3) transparency requirements for originators, sponsors and SPVs. Although we agree that the proposed regulation enhances monitoring in the securitisation process, an alternative proposal could be to establish general principles to mitigate the likelihood of excessive securitisation instead of regulations for the following reasons: (1) regulations might harm those securitisations that are important to the creation of market liquidity and (2) principle-based rules (a) are neutral as securitisation changes, neither encouraging nor hindering securitisation but enabling fair competition, and (b) provide space for innovation in the securitisation process, whereas regulation controls everything in detail. However, further academic research, particularly a systematic impact analysis for both proposals, is required before we begin to regulate or establish principles in this area.

Setting capital requirements for householders

According to the fourth point, one main cause of market failure in the current financial crisis was that capital requirements for house buyers were too low. Therefore, to limit the credit risk from house buyers, we propose to impose lending restrictions, specifically an international capital requirement standard for house buyers at a minimum of 30 to 40 per cent to reduce the likelihood of credit risk (insolvency) of borrowers that is created though leverage. In this context, we follow Admati and Hellwig (2013) and describe the leverage effect on house buyer H. Suppose there are two time periods, t_0 and t_1, and a creditworthy house buyer H who wants to purchase a house for CHF 500,000 (see Figure 3.13).

Figure 3.13 Leverage effect on house buyer H



Source: Adapted from Admati and Hellwig (2013).

If H does not have enough money to pay cash for the house, he can obtain a mortgage of at least CHF 450,000 from bank B with 10 per cent of the price or CHF 50,000 as collateral. We assume that house buyer H pays only interest rates. Moreover, suppose a five per cent change where the price increases or decreases. For the first situation, we assume in period t_1 that the price of the house increases and the house buyer wants to settle the mortgage. This situation has one effect. House buyer H settles the mortgage of CHF 450,000 and receives CHF 25,000 from selling the house at a higher price of CHF 525,000. In other words, his equity increases and has a new value of CHF 75,000. This represents a return on equity of 15 per cent. However, if the price in period t_1 decreases five per cent, then the house buyer has a loss of CHF 25,000. Thus, the house buyer has a return on loss of 50 per cent. In other words, funding creates leverage and makes the equity funding of house buyer H riskier, and bank B in a financial distress situation must write down its mortgage positions (fair-value accounting) to initiate the risk-feedback loop (see Hellwig 2009, see section 2.2.3). Admati and Hellwig (2013) show that increases in equity from 10 per cent to 20 or 30 per cent, as in the case for Switzerland, reduce this leverage effect significantly. In our view, to mitigate the likelihood of future mortgage crises and to protect house buyers from leverage, internationally harmonised higher capital requirements for house buyers would be desirable. However, it is unlikely to find political favour for higher international capital requirements for house buyers.

3.4. Summary

In addition to defining the terms ‘bank’ and ‘bank regulation’, the objective of the first part of this dissertation was to summarise in theoretical form the objectives and measures of governmental intervention related to the banking industry. Toward this goal, a number of banking regulatory theories, objectives and measures were presented. The first part showed that government intervention in the banking industry can be explained by either the economic theory of regulation (public interest theory or private interest theory) or the outcome to secure banking regulation (the safety and soundness of banks and the safety and soundness of the banking system). In conjunction with the economic theory of regulation, public interest theory is the focus of this dissertation because it contains both first- and second-best solutions. Moreover, there is at least one cause for bank regulation that is in the public interest, allowing us to justify bank regulation for a variety of reasons (see Goodhart et al. 1998). In relation to the outcome, we systematise the various objectives using both a micro-based and a macro-based approach. In this regard, there are two micro-based objectives (consumer protection and the safety and soundness of banks) and two macro-based objectives (the safety and soundness of the banking system and monetary control). However, although we extend the micro-based approach with a macro-based approach as a result of the limited focus of the micro-based approach that was evident in the most recent financial crisis, various economists have widely questioned the finance theories used. In light of these considerations, we elaborate an alternative bank regulatory view based on the endogenous nature of money and credit. This view provides an alternative justification of bank regulation regarding the safety and soundness of bank services and the safety and soundness of the banking system. Regarding the former, regulation would be justified with respect to asset services, particularly in the lending process (for example, better requirements in the assessment of a borrower or setting higher capital requirements for house buyers). With regard to the latter, we note that a stable banking system changes the period of financing regimes into an unstable system (see Minsky 1977). Therefore, bank regulation should focus on mitigating risk in the three financing forms, particularly from speculative financing to Ponzi financing. In this sense, bank regulations such as leverage ratios or minimum requirements for a rollover for liabilities would be desirable measures. In a subsequent step, we elaborate the following five regulatory criteria for a better systematisation of bank regulatory measures: a ‘regulatory policy’, the ‘timing of intervention’ of prudential and protective regulation, the ‘micro versus macro regulation’ level of governance, the predictability of the ‘discretionary versus institutional approach’, and an evaluation of the standard ‘qualitative

versus quantitative approach'. In light of these five criteria, we systematise the main current bank regulatory measures (such as capital adequacy requirements, liquidity requirements and recovery and resolution standards) and analyse them critically. Further, we propose potential policy options to reform current bank regulatory measures, which are summarised in the main reform proposal shown in Figure 3.14. In this context, we propose reforming the capital requirements as follows: (1) devising a precise systematisation of capital requirements with respect to the desirable objective; (2) including a provision for taking systemic risks into account; (3) performing an impact assessment before further incremental adjustments of capital requirements occur; (4) removing the zero-risk weighting for EU government bonds or 'introducing a non-zero risk weight floor for sovereign exposures in the standard approach' or the IRB approach (ESRB 2015: 9); (5) setting a minimum standard in the IRB approach (see ESRB 2015); and (6) increasing the unweighted capital requirements to twenty and thirty per cent (Hellwig 2010b).

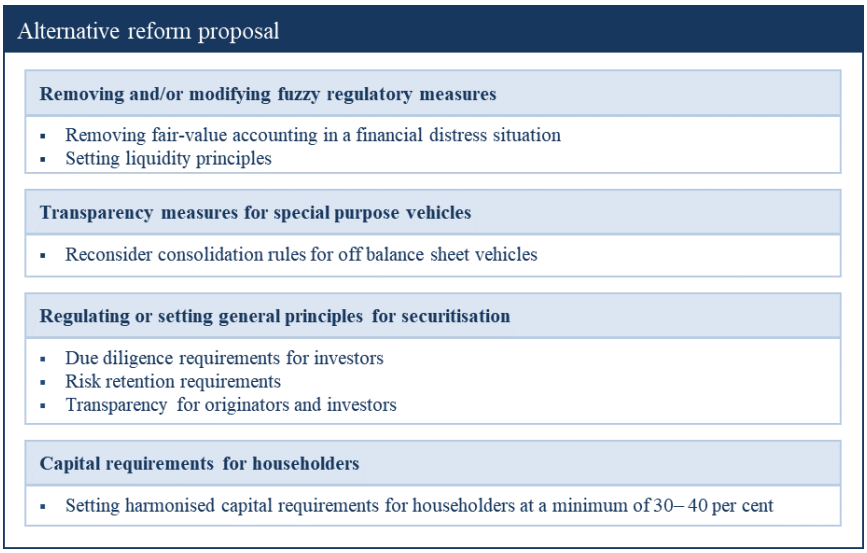
Figure 3.14 Main reform proposal

Source: Authors' own elaboration.

In relation to liquidity regulation, the following reform options are proposed: (1) taking into account systemic risks; (2) as with capital regulation, removing the zero-risk weighting of EU government bonds or introducing a non-zero risk weight; (3) simplifying categories and factors and allocating cross-border liquidity; (4) setting standards to mitigate the manipulation of

liquidity requirements; and (5) providing empirical impact assessments before establishing further standards. With regard to recovery and resolutions standards, we posit the following reform options: (1) setting a clear solvency framework and various international memoranda of understanding among the appropriate regulatory authorities (including explicit rules during financial distress); (2) taking subsidiaries into account in recovery and resolution plans; and (3) taking uninsured insurance into account for the bail-in. Moreover, an alternative regulatory proposal was formulated that is oriented towards the source of market failure of the financial crisis in 2007–2009. In this regard, we propose removing or modifying all fuzzy regulatory measures (for instance, removing fair-value accounting in financial distress situations and setting liquidity principles), implementing transparency measures for SPVs, regulating or setting general principles for securitisation and establishing harmonised 20 to 30 per cent capital requirements for house buyers, as shown in Figure 3.15.

Figure 3.15 Alternative reform proposal



Source: Authors' own elaboration.

Based on these two reform proposals, we propose a more effective regulatory system to reform the recent regulatory measures or replace them with an alternative regulatory approach that focuses on the main causes of the financial crisis of 2007–2009. However, both proposals will not definitively exclude the possibility that SIBs in Switzerland or elsewhere will be allowed to fail in the future. A 'high degree of concentration carries with it a high degree of potential systemic risk. The distress or failure of one of the top three banks in a country, for example, could destabilize that country's entire financial system' (IMF 2014: 4). For this reason, according to former Federal Reserve Chairman Ben Bernanke (2013) and FSB Chairman Mark

Carney (2013), the too-important-to-fail problem is ‘not solved and gone’. Furthermore, risks by the central banks have caused multiple bank failures and the destruction of public deposits. However, in the recent crisis, ELA was critical in stabilising the banking system. Consequently, central banks with the LOLR function are essential to enhance the stability of the economy. Therefore, we propose an effective regulatory system that is a combination of bank regulation and a well-designed LOLR. Thus, a clearly credible LOLR can be a ‘second-best’ solution to solve the too-important-to-fail problem because ‘[i]t is better to establish a credible, ‘second-best’ safety net that sets clear rules for bailouts than to claim to establish superior non-credible (and therefore ineffectual) policies’ (Calomiris 1999: 1517). In this sense, the financial crisis of 2007–2009 ‘has raised important questions about the role of the central bank [as the LOLR] in the prevention, management and resolution of financial crises’ (BIS 2009: 5). Therefore, part II of this dissertation sheds light on the role of the SNB as the LOLR in the prevention, management and resolution with ELA to individual banks in Switzerland.

Part II –Redesign of Switzerland's lender of last resort regime for the twenty-first century

'Financial crises are dramatic events. They evoke radical thinking, strong reactions and regime changes' (Goodhart and Illing 2009: 4). In this sense, the financial crisis of 2007–2009 has shown that the failure of a systemically important institution, Lehman Brothers, which was too interconnected to fail, posed a systemic risk for the entire financial system. In other words, the failure of a systemically important institution can destabilise the entire financial system and can affect the real economy of a country. Given the threat of the failure of a systemically important institution, governments and central banks can prevent it from failing. Therefore, on 16 October 2008, to avoid the destabilisation of the Swiss financial system, the SNB acted as the LOLR and provided direct ELA to strengthen the liquidity structure of the large bank UBS. Although the rescue of UBS was successful[125] and limited unnecessary risk in the banking industry, ELA is subject to various problems: (1) ELA creates an uneven playing field between SIBs[126] and small to medium-sized banks because SIBs that benefit from ELA have a competitive advantage over small to medium-sized banks and benefit from cheaper funding (see Birchler et al. 2010, Liikanen et al. 2012,). (2) ELA can lead to excessive risk-taking (moral hazard) because, as with any liquidity insurance, the LOLR creates incentives to take more of the insured risk, that is, the liquidity risk (see Tucker 2014). In other words, with ELA, 'investors do not fully price in bank risk-taking and banks are incentivised to take more risk than they would if their cost of funding reflected their activities' (Liikanen et al. 2012: 23). (3) ELA creates costs for the public sector because if central banks suffer losses, they will transfer these costs to the governments (see Hellwig 2014b, Tucker 2014,). Thus, the taxpayer bears a substantial proportion of the losses. (4) ELA creates macroeconomic costs; for example, the rescue packages of the Swiss Confederation and SNB covered only four per cent of the banks' balance sheet but cost 13 per cent of the GDP in Switzerland (government expenditures for one year) (see Birchler et al. 2010). (5) ELA represents a reputation risk for the banking sector and affects the confidence in banks and shareholders (see Baltensperger 1992, Domanski and Sushko 2014, Tucker 2014). To reduce the economic risks posed by systemically important institutions and to mitigate the problems of ELA from the SNB and the Swiss Confederation, on 4 November 2009, the Federal Council in Switzerland established a commission of experts with the involvement of

[125] The rescue of UBS had been successful because, on the one hand, the SNB realised a net benefit from the interest rates on the ELA loan. On the other hand, the Swiss Confederation made more than CHF 1 billion via interest rates in the sale of ECA to UBS.
[126] The term 'SIBs' will be defined in section 7.2.1.

representatives from Swiss financial enterprises (such as UBS and Credit Suisse), the FINMA, and the FFA. On 30 September 2010, the commission proposed four core regulatory measures to mitigate the risks posed by SIBs, namely, capital requirements, liquidity requirements, risk diversification requirements and organisational measures (recovery and resolution standards) (see part I). All these regulations are subsumed under 'too-big-to-fail' regulations, and they entered into Swiss law in March 2012 (see Commission of Experts 2010). Although these regulatory measures help mitigate the risk posed by SIBs to a certain degree and enhance the resilience of the banking industry, these stricter bank regulations will not definitively exclude the possibility that SIBs will receive ELA from the SNB in the future for the following reasons: (1) The expert group did not analyse the main causes of the crisis and did not elaborate based on target-orientated regulatory measures; thus, to a certain extent, the current regulatory measures are disputed. Instead, to identify the main causes of the most recent financial crisis, the commission analyses the benefits created by SIBs and the repercussions of failure. Although this analysis is not necessarily inessential, to create an effective regulatory system, bank regulations should consider the main causes of market failure. (2) As we note in part I, the proposed regulatory measures are related to several problems (such as the manipulation of risk-weighted assets for the calculation of the capital adequacy requirements). (3) The current bank regulations could not completely (a) exclude macroeconomic externalities, particularly large spillover effects on other sectors, (b) prevent disruptions of the smooth functioning of the payment system, or (c) mitigate the risk of costly systemic bank runs (see Calomiris 1999). (4) Several analyses by the IMF (2014) and Schäfer et al. (2016) show that the reform was able to lower bail-out expectations in Switzerland, but the expected probability for future ELA remains high. (5) The expert group did not analyse the role of the Swiss LOLR in the most recent financial crisis, which would be needed to mitigate the risks associated with providing ELA to SIBs. The deficiencies of bank regulations and the LOLR led to continuing calls for further reforms; in addition, 'more rethinking of the LOLR doctrine is needed' (Grossmann and Rockoff 2015: 58). Therefore, for a more effective regulatory system, we propose a combination of bank regulation and a well-designed Swiss LOLR. With regard to bank regulations, we propose that the recent regulatory measures[127] be reformed with respect to our main potential reform proposal from part I or be replaced with our alternative regulatory approach, which focuses on the main causes of the most recent financial crisis. Furthermore, we reconsider the LOLR and consider redesigning the current LOLR in Switzerland. However, before we can redesign a potential Swiss LOLR, we must understand the nature of the LOLR,

[127] The recent regulatory reforms should be further analysed within a theoretical framework.

examine the different LOLR schools of thought and analyse the Swiss LOLR in the most recent financial crisis. In this context, the second part of the dissertation elucidates the Swiss LOLR during the financial crisis of 2007–2009 and proposes a substantive LOLR regime for Switzerland in the twenty-first century.

4. The nature of the lender of last resort

Although the technical academic literature has provided useful insights into the LOLR (see Holmström and Tirole 1998, Freixas et al. 2007 [1999], Rochet and Vives 2008), in the central banking literature and regulatory debates, the LOLR has been relatively neglected by central bankers (see Goodhart and Illing 2009, Tucker 2014). One reason for the relative neglect of the LOLR is the controversial discussion of ELA in central banking. On the one hand, ELA is a main function of central bank policy in modern economics. On the other hand, direct ELA for SIBs introduces several problems (for instance, adverse selection and moral hazard). Despite these problems, the financial crisis of 2007–2009 and the corresponding intervention by the central banks as LOLRs has shown that an LOLR is needed to prevent financial crises and to minimise even greater damage to the economy at the national level. However, this role has raised questions about the design of the central bank in terms of prevention, management and resolution (see Domanski and Sushko 2014). To answer some of these questions, the BIS held a workshop in 2014 that challenged participants to 're-think the lender of last resort', with several contributions from academics and central bankers regarding the role of the LOLR in the most recent financial crises in the United States, the United Kingdom, the European Union, Mexico and Japan. However, the workshop did not provide any systematic and clear analysis of the LOLR in Switzerland, the so-called 'Swiss LOLR'. Furthermore, the literature provides no systematic analyses of the Swiss LOLR and its role in the financial crisis of 2007–2009. Therefore, to fill this gap in the literature, the second part of the dissertation analyses the Swiss LOLR and outlines a real, possibly substantive regime for the twenty-first century. The Swiss LOLR for the twenty-first century draws on various principles that are elaborated in the second part of this dissertation and on various considerations in the following areas: (1) the nature of the LOLR, (2) an overview of the different LOLR schools of thought, (3) a historical analysis of the LOLR in Switzerland, and (4) an economic analysis of the Swiss LOLR during the UBS crisis of 2007–2009. These principles and considerations are important because

'[a]cting as the lender of last resort involves making commitments: to lend in order to stave off or contain systemic distress. Those commitments need to be credible, which requires amongst other things that they be time consistent.

The regime won't work well if people believe a central bank will change its mind, or has no clear principles' (Tucker 2014: 11).

Based on these four subject areas, the following questions of particular interest will be answered in the second part of this dissertation:

- What is the LOLR, and why does it exist in Switzerland?
- What are the LOLR schools of thought?
- What conditions apply to the LOLR in Switzerland?
- Can its role be carried out via open market operations?
- Should the Swiss LOLR provide liquidity assistance to non-bank financial institutions?
- Should the Swiss LOLR provide liquidity assistance against wide or narrow classes of collateral?
- How can a potential Swiss LOLR regime for the twenty-first century be outlined?

To answer these questions, we proceed as follows. In the first step, we provide broad and narrow LOLR definitions, consider the rationale of the LOLR, and systematise the LOLR. In the second step, we present various LOLR schools of thought, which helps us understand the underlying LOLR concepts. In the third step, we provide a historical analysis of the LOLR in Switzerland. In the fourth step, we empirically analyse the role of the Swiss LOLR during the UBS crisis and raise the following question: Did UBS fulfil the current Swiss LOLR conditions at the time of ELA? In other words, we determine whether the bank was systemically important and solvent and held sufficient eligible collateral. As such, our main focus lies in the solvency of the nature of the bank because the operational concept of solvency is ambiguous in the literature. In the fifth step, the principles elaborated in the second part are subsumed into a reform proposal for the twenty-first century, which will be qualitatively evaluated.

4.1. What is the lender of last resort?

The first time that the term 'LOLR' was believed to be used was by Sir Francis Baring in '*Observations on the Establishment of the Bank of England and on the Paper Circulation of the Country*' in 1797. Baring (1797) mentioned several banking failures, including the failure of Air Bank in 1772 and the Bank of Newcastle in 1793. As a consequence of the analysis of bank failures and the demand for money in such distressing situations, Baring (1797) used a French legal term for a court of last appeal, *dernier ressort*, from whom banks can obtain ELA (see Grossman and Rockoff 2015). Baring (1797) indicated the BoE as a joint-stock, profit-maximising bank that should act as the *dernier ressort*, that is, the so-called *lender of last resort*, from whom all borrowers, typically banks, could obtain ELA in the form of gold and BoE notes in times of financial distress (see also Thornton 1965 [1939]). In light of these considerations, we can formulate a broad definition of the 'LOLR':

The lender of last resort is an institution from whom all borrowers, typically banks, can obtain emergency liquidity assistance in a financial distress situation.

Source: Authors' own elaboration.

Although Baring (1797) noted that the BoE was the LOLR for banks, no systematic and complete analysis about the LOLR concept existed at that time. To fill the gap in the literature, in 1802, Henry Thornton (1965 [1939]) provided a complete systematic analysis of the LOLR concept in his speeches on the Bullion Report and in his work, '*An Enquiry into the Nature and Effects of the Paper Credit of Great Britain*'. He also explained why the BoE was the LOLR, noting three of its unique characteristics (see section 5.3 for further details): (1) The BoE was the ultimate liquidity source of the banking system. (2) The BoE was responsible for managing and holding sufficient gold reserves. In other words, the BoE was the custodian of the gold reserves and had to freely provide BoE notes in times of financial distress. (3) The BoE was not like any other bank because it had a public responsibility to the entire financial system rather than just individual banks. Therefore, the BoE had to hold larger reserves than ordinary banks to avert internal and external liquidity drain in times of financial turmoil (see Thornton 1965 [1939], Humphrey and Keleher 2009 [1984]).

In 1873, Walter Bagehot (2005 [1920]) provided the strongest contribution to the LOLR concept in his book entitled '*Lombard Street: A Description of the Money Market*'. Bagehot (2005 [1920]) revived and restated many of Thornton's arguments (1965 [1939]) and noted that

the BoE, as the central bank,[128] was the LOLR and that the BoE was the ultimate liquidity source. Therefore, Bagehot (2005 [1920]) concluded that in times of financial distress, the BoE was responsible for lending to all solvent banks against good collateral at a very high interest rate. Moreover, he agreed with Thornton (1965 [1939]) that the BoE, as a monetary authority, must hold sufficient reserves, especially gold, to protect against internal and external liquidity drains. Bagehot's famous rule is to 'lend freely at a high rate' to support the stability of the financial system rather than individual banks (Bagehot 2005 [1920], Humphrey and Keleher 2009 [1984]). This review leads us to a narrow definition of the LOLR:

The lender of last resort is an institution from whom all borrowers, typically solvent but illiquid banks, can freely obtain liquidity assistance in an emergency situation at an interest rate, against good collateral.

Sources: Authors' own elaboration based on Baring (1797), Thornton (1965 [1939]) and Bagehot (2005 [1920]).

However, central banks were slow learners of the LOLR concept, and before the 1970s, the literature included few theoretical and formal analyses on this topic. The situation changed in the early 1970s, particularly after the turmoil of 1972–1973, the Herstatt Bank failure in Germany in 1974, the Swiss mortgage crisis in the 1990s, the Mexican peso crisis in 1994, the East-Asian crisis in 1997, the Russian and the long-term capital management (LTCM) crisis in 1998, the 2001–2002 stock market crash, the financial crisis of 2007–2009, and the sovereign debt crisis of 2012. With the occurrence of various crises, the analysis of financial crises became a hot research topic in modern economics, whereas the analysis of the LOLR has been relatively neglected (see Goodhart and Illing 2009). Although several studies attempt to illuminate the nature of the LOLR and definitions of the term, the LOLR's function remains ambiguous. In the contemporary literature, possible definitions of the LOLR can be found in Guttentag and Herring (1987), Freixas et al. (2007 [1999]), Bordo (2009 [1990]) and Tirole (2002). According to Tirole (2002: 110), the LOLR is 'an institution that provides liquidity to a [bank] when commercial lenders no longer want to supply funds'. Likewise, Bordo (2009 [1990]: 109) defines an LOLR as a monetary authority who 'can allay an incipient panic by timely assurance that it will provide whatever high powered money is required to satisfy the demand'. A more precise definition is provided by Guttentag and Herring (1987) and Freixas et al. (2007 [1999]). According to Guttentag and Herring (1987: 150), the term LOLR denotes 'an agency with the responsibility for preventing financial crises by lending directly and freely to a broad range of

[128] The BoE became the central bank of England with the passage of the 1844 Bank Charter Act.

borrowers during periods of financial strain'. Likewise, Freixas et al. (2007 [1999]: 28) define the term LOLR as 'the discretionary provision of liquidity to a financial institution (or the market as whole) by the central bank in reaction to an adverse shock which causes an abnormal increase in demand for liquidity which cannot be met from an alternative source'. According to these definitions, the term LOLR is closely associated with the term ELA, and they are often used interchangeably.

However, not only banks (or the private banking community) and central banks but also governments and international authorities (such as the IMF) that have a function in the international financial system can act as LOLRs and provide ELA. In the words of Baltensperger (1992: 442), the LOLR function 'can be shared with other potential suppliers of emergency help' (see also Guttentag and Herring 1987). In this context, we can distinguish between four main types of LOLRs that have distinct ELA characteristics, as shown in Figure 4.1: (1) A private banking community of commercial banks can provide ELA via a clearinghouse against loan certificates (see Timberlake 2007 [1984], see section 5.1). (2) The government can act as the LOLR and provide ELA in the form of taxpayer money. In this sense, 'thanks to its assumed ability to commit future consumer endowments via taxation' or government bonds that can be sold at a liquidity premium to meet the demand on liquidity, the government can provide ELA (Holmström and Tirole 1998: 20). However, the government is primarily responsible for solvency support – not for liquidity – because otherwise, a boundary problem will arise between the central bank and the government. Therefore, in Switzerland, the SNB provides liquidity support, whereas, in accordance with Art. 103 of the FCSC (2016 [1999]), the Swiss Confederation provides solvency support (see Baltensperger and Dermine 1987, Nyberg 2000, Heller and Kuhn 2007, Illing and König 2014, SNB 2015a).

Art. 103 Structural policy

The Confederation may support regions of the country that are under economic threat and promote specific economic sectors [for example, the banking sector] and professions, if reasonable self-help measures are insufficient to ensure their existence. In exercising its powers under this Article, it may if necessary depart from the principle of economic freedom.

(3) International authorities can act as international LOLRs and provide ELA in foreign currencies because of their decisive role in the economy when the 'private sector cannot borrow foreign currency on acceptable terms in the international money market' (Goodhart 2009[1999]: 235). Nevertheless, as a supplier of practically unlimited ELA, the central bank

stands alone because it 'has the instruments for lending available and it has resources in its balance sheet or the credibility to get resources if they are needed' (Nyberg 2000: 2, Baltensperger 1992). 'This is the role of central banks we have in mind when we talk about ELA, or Lending of Last Resort' (Baltensperger 1992: 442). We have this role of the central bank in mind in this dissertation.

Furthermore, we conceptually distinguish between the LOLR and the market maker of last resort (MMLR) (see Figure 4.1). The MMLR includes all operations provided through the market, particularly OMOs (repo transactions,[129] issuing of bills,[130] and quantitative easing (QE)[131]) to solvent but illiquid deposit institutions. In addition to OMOs, the MMLR includes the discount window (DW) (for example, liquidity-shortage financing facilities and intraday facilities) (see Appendix 2 for further details) and other operations (for instance, FX transactions,[132] FX swaps,[133] and derivatives[134]). Suppose a deposit institution is unable to find liquidity on the interbank market (inside liquidity) to settle its interbank market debt. In other words, the deposit institution is unable to fund its operations with OMOs, other operations and the DW. In this context, a question arises: why are OMOs, other operations and DW transactions (as a form of direct lending) insufficient? The answer is that the amount available via OMOs, other operations and the DW is limited. Therefore, in special cases, the central bank can act as the LOLR and provide direct ELA. The amount provided by the LOLR is unlimited, particularly in terms of domestic currency. Nevertheless, the DW is a direct lending operation, which opens a controversial discussion around ELA and its operational nature in the literature.

[129] 'In a repo transaction, the cash taker sells securities to the cash provider and simultaneously agrees to repurchase securities of the same type and quantity at a later date. The interest rate used in a repo transaction is called the repo rate' (SNB 2015a: Internet).

[130] 'Debt certificates issued by the SNB with a term of up to one year' (SNB 2015a: Internet).

[131] In the literature, the concept of QE is ambiguous. One possible definition is provided by the BoE, which defines QE as 'an unconventional form of monetary policy where a Central Bank creates new money electronically to buy financial assets, like government bonds. This process aims to directly increase private sector spending in the economy and return inflation to target' (BoE 2016: Internet). In other words, QE is a massive monetary stimulation demand for credit in the form of extraordinary monetary support, such as QE and credit easing, with 'unconventional' monetary instruments by central banks in, for example, the United States, the United Kingdom, Japan, and Switzerland and in the aftermath of the financial crisis of 2007–2009 for the entire banking system (see BoE 2016a). In our view, QE is instead a conventional OMO because transactions via buying financial assets (for example, government bonds) can be considered as OMOs.

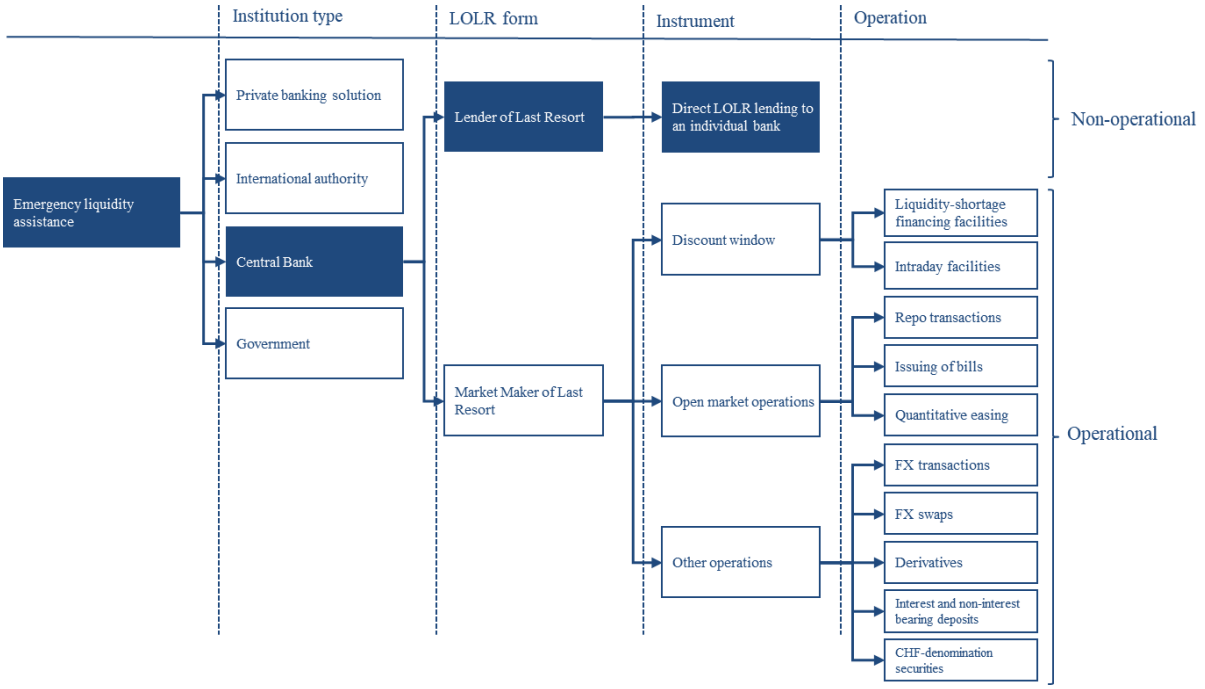
[132] 'Foreign exchange market intervention occurs when a central bank buys or sells its domestic currency (spot or forward) for one or more foreign currencies with the goal of strengthening or weakening its own currency' (SNB 2015a: Internet).

[133] 'A foreign exchange swap is a combination of a spot transaction and a forward transaction with foreign currency. In a liquidity swap, the SNB buys foreign currency from commercial banks against Swiss francs for a fixed term and sells it to them, also for a fixed term. At the end of the term, the reverse transaction is carried out at a previously agreed exchange rate' (SNB 2015a: Internet).

[134] 'Derivatives are financial instruments whose price is derived from that of an underlying asset. Underlying assets can be commodities, securities such as shares or bonds, as well as exchange rates, interest rates and indices. Derivatives can also be based on the probability of the occurrence of certain events (e.g. default). Call and put options, forwards and swaps are examples of derivatives' (SNB 2015a: Internet).

Next, we briefly expand on this controversial discussion, which is useful in understanding the LOLR concept and a narrower definition of the term.

Figure 4.1 Conceptual framework of the LOLR



Sources: Authors' own elaboration based on SNB (2015b) and SNB (2015c).

According to Goodfriend and King (2009 [1988]), we can distinguish between LOLR OMOs (MMLR) and non-LOLR OMOs (non-MMLR) (for example, the DW). The MMLR is considered to provide ELA through the market. In this sense, Goodfriend and King (2009 [1988]: 162-163) suggest that ELA in the form of 'high-powered money can be managed with open market operations in government bonds. [...]. [Moreover,] there is little evidence that public lending to particular institutions is either necessary or appropriate'. Thus, according to Goodfriend and King (2009 [1988]), an ELA credit to a direct financial institution is not needed, and the LOLR is of an operational nature, meaning that the LOLR is undertaken through general market operations (Goodhart (2009 [1999]). Although distinguishing between LOLR OMOs and non-LOLR OMOs is impossible (except in rare circumstances),[135] Goodhart (2009 [1999]: 231) criticised Goodfriend and King's view because 'it is practically impossible then to distinguish LOLR OMOs from non-LOLR OMOs'. The following examples elucidate this problem. With the outbreak of a stock market crash in 1987, the Bank of Japan (BoJ)

[135] One such occasion was the announcement of the Fed after the 1987 stock market crash (when the S&P 500 stock market index fell approximately 20 per cent) due to the difficulty of gathering information in an uncertain and chaotic environment (see Goodhart 2009 [1999], Carlson 2006).

aggressively increased the monetary base. In the aftermath of the stock market crash, the BoJ continuously increased the monetary base with non-LOLR OMOs. Likewise, in the aftermath of the financial crisis of 2007–2009, various central banks increased the monetary base with LOLR OMOs that are still ongoing (for example, QE operations). Therefore, in practice, distinguishing between LOLR OMOs and non-LOLR OMOs or between LOLR QE and non-LOLR QE was and remains impossible. Furthermore, Flannery (2007 [1996]) formally confirms that OMOs are unable to substitute for direct LOLR lending. In addition, as we have observed in the most recent financial crisis, OMOs-LOLR actions have not adequately stabilised the banking system. Thus, the distinction between direct lending by the central bank to an individual institution and OMOs, programmes as a form of QE, to the entire market is simple, practical and self-evidently justifiable (see Goodhart 2009 [1999]). The former is considered an LOLR, whereas the others concern a completely new role for the central bank, namely, as an MMLR[136] with new questionable instruments. Therefore, many observers (for example, Maux and Scialom 2012) and central bankers incorrectly consider the provision of ELA through the market or via new instruments to be an LOLR. In the words of Humphrey (2010: 333), in the most recent crisis, the central banks have 'deviated from the classical model in so many ways as to make a mockery of the notion that it is an [LOLR]'. Therefore, the MMLR is not an extension of the LOLR (see Dooley 2014). In line with Goodhart (2009 [1999]), we conclude that the LOLR is non-operational (not a DW operation, OMO or other operation (such as FX swaps) because otherwise inside liquidity and thus the provision of high-powered money via OMOs or DW transactions would be sufficient) and consider it to be an institution that provides direct lending to individual institutions (see Figure 4.1). This consideration leads us to the first principles for the LOLR in the twenty-first century:

Principle 1: The LOLR is non-operational.

With these considerations in mind, what are the main causes of an LOLR? To answer this question, the next section provides a brief overview about the rationale of the LOLR.

[136] Tucker (2014) formulated several principles to reconstruct the MMLR. For example, (1) the MMLR should intervene in exceptional situations; (2) its objective should be to stabilise a malfunction in the market; and (3) it should charge a penalty rate.

4.2. The rationale of the lender of last resort

In the literature, liquidity[137] is commonly accepted to be created within the banking sector as 'inside liquidity' and outside the banking sector as 'outside liquidity'. Outside liquidity is created by domestic outside liquidity authorities (such as domestic central banks and governments that act as LOLRs) or by foreign outside liquidity authorities (such as the IMF) (see Holmström and Tirole 1998, Tirole 2002). This dissertation focuses on domestic outside liquidity authorities. In general, illiquid and solvent banks should obtain ELA from the LOLR. Why, then, should sound banks obtain assistance? After all, with perfect or near perfect interbank markets, such banks should always find inside liquidity (see Baltensperger and Dermine 1987). However, in the presence of one of the following five conditions, markets do not work perfectly; thus, central banks assume and formal analysis confirms that inside liquidity is insufficient for the banking sector (see Holmström and Tirole 1998, Tirole 2002):

(1) A bank failure of systemic importance or a number of smaller bank failures have an impact on financial stability. In other words, a single bank or a small number of banks that are clearly systemic harm the stability of the financial and economic system (see Caprio and Klingebiel 1997, see section 2.2.3).
(2) Macroeconomic externalities faced by the banking sector are not idiosyncratic but rather system wide; thus, a bank failure can trigger a contagion effect and introduce spillover effects in other sectors (see section 2.2.2).
(3) Inside liquidity is not properly allocated within the interbank market. Thus, aggregate uncertainty exists.
(4) A coordination failure occurs, meaning that economic agents take a destabilising action based on the expectation that other agents will do so as well (strategic complementarities). Economic agents refuse to renew the credit line as a result of their strategic complementarities, and a fundamental bank run can occur (see Rochet and Vives 2008).
(5) Asymmetric information makes a solvent bank vulnerable to deposit withdrawals (panic-based bank run) and/or dries up inside liquidity in the market in times of crisis (see Goodhart 1988, Freixas et al. 2007 [1999]).

[137] Liquidity can be interpreted in numerous ways. For example, as Holmström and Tirole (1998: 2) noted, 'the liquidity of an asset is often measured by how quickly it can be sold without a price discount'.

Regarding the first condition, single or small numbers of banks that are not systemically important have no impact on the safety and soundness of the banking system. Therefore, the domestic banking and payment system can absorb the losses if small and medium-sized banks fail, and no LOLR is needed. If an SIB fails or numerous small and medium-sized banks that are systemically important fail, then the payment and settlement, the banking system and the economic system can be negatively affected, and liquidity is in demand. Therefore, inside liquidity is insufficient, and outside liquidity in the form of ELA via an LOLR is needed.

In relation to the second condition, an idiosyncratic shock can be absorbed by the domestic banking sector because good banks compensate for bad banks, and no LOLR is needed (see Holmström and Tirole 1998, Tirole 2002). However, in the presence of a systemic shock, good banks are unable to compensate for bad banks. Consequently, inside liquidity is insufficient, and outside liquidity via the LOLR is required to limit the spillover effect.

Regarding the third condition, Holmström and Tirole (1998) and Tirole (2002: 71) show that banks' pooling of funds (hoarding) leaves banks with no liquidity need 'with excess liquidity and thereby creates a waste of aggregate liquidity'. In other words, banks act as liquidity pools or insurers and redistribute excess liquidity to banks that do not need additional funding. Consequently, no LOLR is needed. In the presence of aggregated uncertainty, the 'market for short-term claims [does] not work well [because] potential lenders faced with such uncertainty may ration the borrower instead of raising the rate to cover a greater potential for losses'(Guttentag and Herring 1987: 162); thus, a liquidity shortage will occur. Therefore, in the presence of aggregated uncertainty, the private sector is unable to provide insurance because 'of [the] non-existence of, or the very limited coverage offered by, [the] deposit insurance system' (Baltensperger and Dermine 1987: 81). As such, outside liquidity and the LOLR are in demand.

According to the fourth condition, Rochet and Vives (2008) formally show that if well-informed investors have no doubts about the repayment of solvent banks' credits, they do not refuse to renew these banks' credit lines. However, if they doubt that a solvent bank will repay their credit, well-informed investors will refuse to renew the credit line[138] despite the bank's solvency. In the literature, the collective refusal to renew solvent banks' credit lines represents a 'coordination failure' (see Rochet and Vives 2008). To avoid such coordination failures, Rochet and Vives (2008) propose a combination of (1) ex-ante solvency (capital adequacy requirements) and liquidity requirements; (2) an LOLR policy; and (3) closure rules that include

[138] The assumption that investors will not renew the credit lines is based on various bank failures (such as the LTCM failure).

two types of policies: prompt corrective action of the LOLR via ELA (a) for illiquid solvent banks at a very low interest rate and (b) for illiquid insolvent banks according to an orderly resolution mechanism.

In relation to the fifth condition, depositors' asymmetric information about a bank's creditworthiness can make banks vulnerable, and the structure of bank balance sheets makes banks particularly vulnerable. As noted in the first part, banks are information specialists ('delegated monitors'), and as Calomiris (1999: 1502) indicated, 'the gain from banking derives from its economizing on information costs. But that specialisation comes at a price. Depositors' lack of information about bank portfolios can create systemic runs on solvent banks'. Therefore,

'informational asymmetries between depositor and bank, together with the prospect of contagious bank runs, led to the need for quality control and supervision. One means of achieving that would be to establish a "club" of banks: the Central Bank [(LOLR)] could be regarded as the independent arbiter and head of that "club"' (Goodhart 1988: 85).

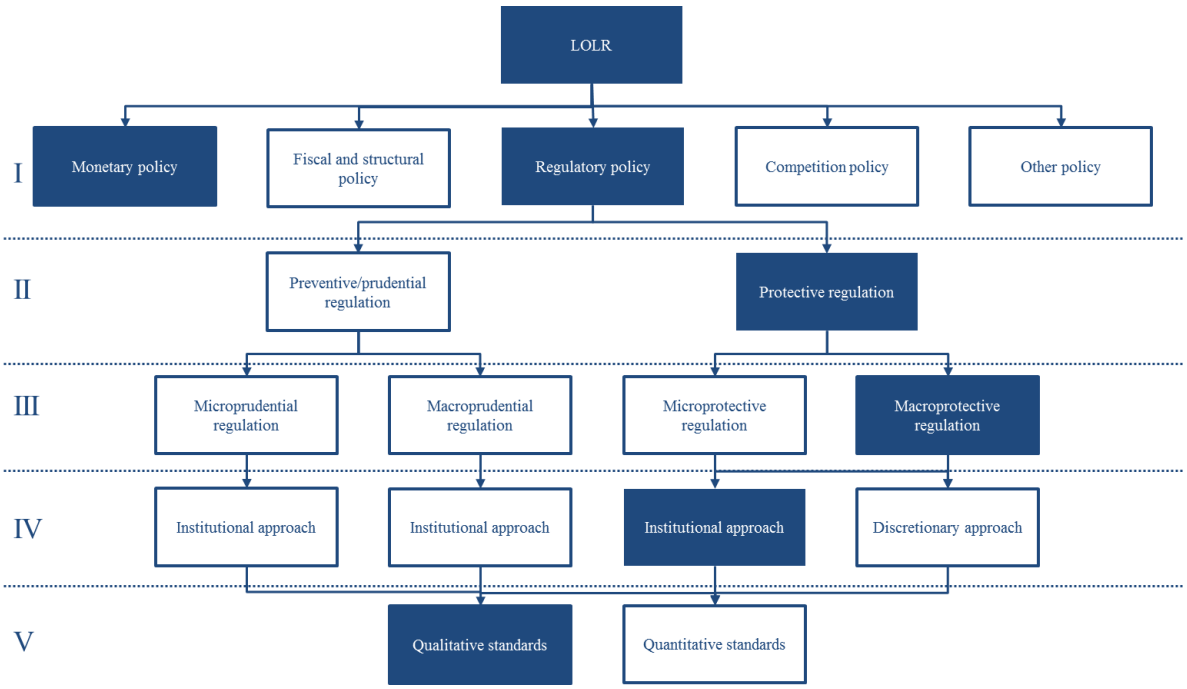
In other words, the LOLR can prevent runs or make them less likely because uniformed depositors who are confident that their bank will receive ELA in the event of a crisis will have little incentive to run (see Calomiris 1999).

Consequently, with respect to the five conditions, at least one rationale for an LOLR intervention exists in the current literature.

4.3. The systematisation of the lender of last resort

In the recent literature, no clear systematisation of the LOLR has been available. To fill this gap, we fall back on our systematisation scheme from Figure 3.1, namely, the overview of bank regulatory criteria. According to our regulatory criteria, we systematise the LOLR marked in dark blue in Figure 4.2. In this context, the LOLR is a macro-protective, institutional and qualitative safety net policy. Next, we elucidate the LOLR systematisation.

Figure 4.2 The LOLR in relation to the overview of banking regulatory measures



Source: Authors' own elaboration.

First, the LOLR is a monetary policy instrument with regulatory characteristics for the following reasons: (1) According to our bank regulation definition from part I, the LOLR is a form of government intervention. In this sense, the LOLR is a type of regulatory system of the central bank that 'stand[s] ready to provide help when banks, or the banking system as a whole, are experiencing temporary liquidity problems' (Baltensperger 1990: 10, see also Baltensperger and Dermine 1987). (2) The LOLR is an active resolution and crisis measure[139] similar to any other insurance scheme (for instance, deposit insurance or other guarantees) (see Solow 2007 [1992], Greenbaum and Thakor 2007 [1995], Tucker 2014). Thus, LOLRs 'might best be classified as instruments of crisis management' (BIS 2011: 37). (3) The LOLR influences the bank's economic decision-making and activities by subsidising bank activities for liquidity funding and encourages risk-taking (see Goodfriend and King 2009 [1988]). (4) The LOLR does not change the total volume of high-powered money (currency plus bank reserves) or the interest rate on the market as a monetary policy instrument. Opponents would argue that providing ELA to individual financial institutions would change the volume of high-powered money because the volume would be increased with an ELA credit. This increase may be temporarily true, but in the medium and long run, ELA is a credit that will settle down.

[139] This also corresponds to the considerations of the BIS (2011: 37) that LOLRs 'might best be classified as instruments of crisis management'.

Therefore, the volume of high-powered money will not be changed on the interbank market. (5) The LOLR seeks to ensure financial stability rather than price stability.

Second, is the LOLR a prudential or a protective measure? As we noted in section 3.1.1, in practice, clearly distinguishing between prudential and protective measures is difficult. However, an alternative criterion that helps us with systematisation is the 'timing of intervention'. In this regard, the central bank must make timely corrective interventions (see BCBS 1997). Likewise, Hellwig (2007: 813) noted that a 'central bank intervention must occur before a bank failure, or even the rumour of an impending failure, has put markets into a state of panic'. In this context, we conceptually distinguish between prudential and protective measures with respect to the 'timing of intervention'. Prudential measures seek to render risk improbable prior to financial distress (ex-ante). Conversely, protective measures include all regulatory instruments that seek to minimise damage to the economy either during or following (ex-post) financial distress (see section 3.1.1). According to these concepts, the LOLR is a protective instrument that protects the bank in the case of actual or impending bank failure (see Baltensperger and Dermine 1987).

Third, is the LOLR a micro-based or macro-based measure? To answer this question, we fall back on our micro-based and macro-based concept. As noted in section 3.1.2, the micro-based approach is defined as limiting the risk of episodes of financial distress at individual banks (namely, idiosyncratic risk) by emphasising the behaviour of individual agents (particularly externalities and asymmetric information). Conversely, the macro-based approach focuses on limiting the risk of episodes of system-wide distress (namely, systemic risk) that have significant costs for the economy as a whole. According to this distinction, the LOLR is a macro-based measure that is responsible for ensuring the safety and soundness of the banking sector rather than a micro-based instrument.

Fourth, is the LOLR discretionary or institutional in nature? The discretionary or institutional approach draws upon the policy decision made by the central bank, which varies between different countries and at different times. For example, before the National Bank Act (NBA) reform in 2004, the Swiss LOLR was discretionary in nature and not a grant (see section 6.3 for further details). After the NBA reform, the Swiss LOLR was 'rule bound' with respect to Art. 5 para. 2(a) and (b), and Art. 9 para. 1 (e) of the NBA (2016 [2003]) and cif. 6 of the guidelines of the SNB on monetary policy.

Fifth, in the context of our systematisation, is the LOLR a qualitative or quantitative standard? Although the LOLR is based on measurable standards such as the assessment of SIBs, solvency and collateral, the LOLR can be considered a qualitative standard rather than a

quantitative standard because it is understood as a non-measurable standard that is predominately used to minimise the damaging impact of a bank failure on the entire economy.

In short, the LOLR is a monetary-regulatory, macro-protective, institutional and qualitative safety net policy.

4.4. Summary

We now summarise the main considerations of chapter 4. In this chapter, we answered the following three questions: (1) What is the LOLR? (2) What is the rationale for the LOLR? (3) How can we systematise the LOLR?

The LOLR is an institution that can be the central bank, the government or any other organisation with sufficient resources to accommodate demands for money in a period of financial distress under certain specific conditions. In the following dissertation, our focus lies on the central bank. One specific characteristic of the LOLR is that it is non-operational in nature. However, the recent literature does not necessarily view all interventions in a period of financial distress as LOLR functions, although numerous central bankers and academics incorrectly consider all central bank interventions to be LOLR interventions. Consequently, we should differentiate between new questionable instruments (for example, QE) and direct lending to individual institutions. The former instruments are considered new central bank instruments, whereas the latter is considered an LOLR.

In a further step, we briefly describe the main rationale for the LOLR as follows: First, because an SIB failure or a number of small and medium-sized bank failures have an impact on the payment and settlement system and the financial system, an LOLR is needed. Second, if a system-wide shock leads to contagion effects, an LOLR is needed. Third, in the case of aggregated uncertainty, inside liquidity is insufficient and cannot be allocated on the interbank market; therefore, an LOLR is needed. Fourth, in a case of coordination failure, well-known investors refuse to renew the credit lines of SIBs, which requires an LOLR intervention; otherwise, the banking system will tend to break down. Fifth, in the case of asymmetric information, particularly if depositors begin to withdraw their money from solvent banks, an LOLR is needed.

Moreover, we systematise the LOLR with respect to our five criteria: policy, the timing of the intervention (thus, between prudential and protective measures), micro- and macro-level governance, the predictability of a discretionary versus institutional approach and the standards between a qualitative versus quantitative approach. In this context, the LOLR is a monetary

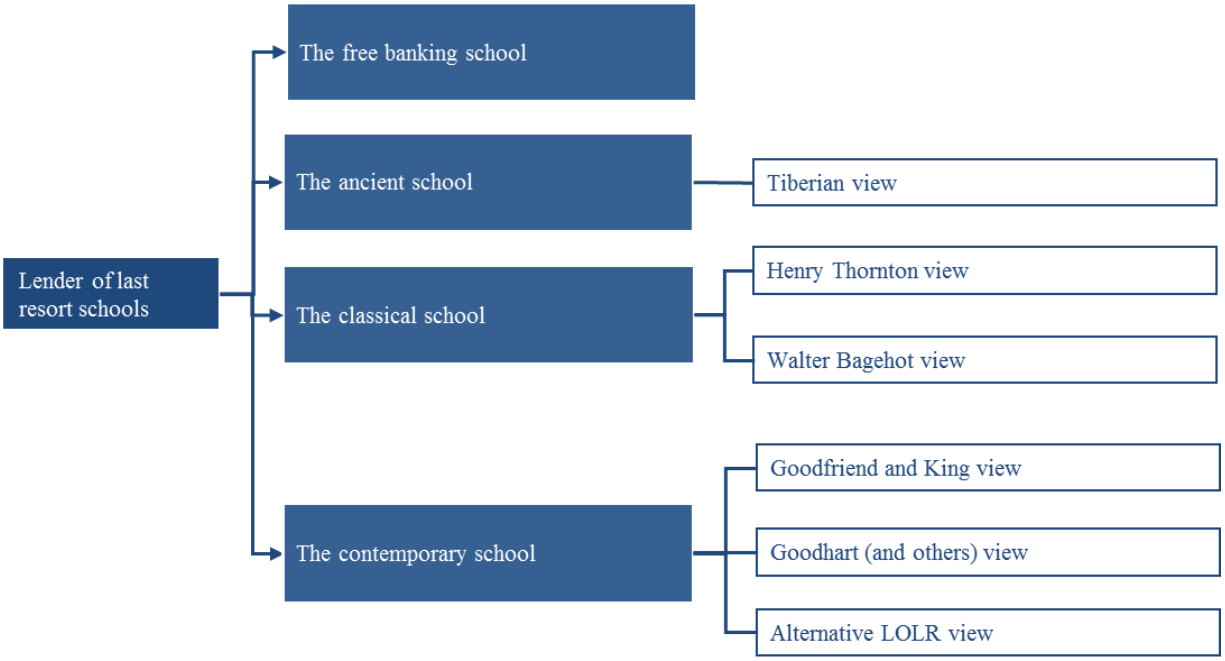
policy instrument with regulatory characteristics. The LOLR is a protective measure rather than a prudential measure because it is used during a period of financial distress, whereas prudential instruments are used before a period of financial distress. With regard to predictability, the LOLR depends on the central bank's chosen strategy, which can change across country lines and over time. In relation to quantitative and qualitative approaches, the LOLR is qualitative in nature. In a nutshell, the LOLR is a monetary-regulatory, macro-protective, institutional and qualitative safety net.

Next, we consider the different schools of thought that help us to understand the concept of the LOLR and to design the LOLR.

5. The lender of last resort schools of thought

The literature includes different schools of thought with different conditions. Therefore, as a first step, systematising the schools of thought is important before we expand into greater detail. The literature distinguishes between the following four schools of thought: (1) the free banking school, which abolishes the central bank and any form of LOLRs; (2) the 'classical Bagehot' view, or classical school of thought, which states that the LOLR should provide funding to all solvent but illiquid firms against good collateral at a very high rate of interest; (3) the Goodfriend and King view, also known as the 'Richmond Fed view', which makes a pivotal proposition regarding lending via OMOs and abolishes direct lending (for example, via the DW); and (4) the Goodhart (and others) view, also known as the 'New York Fed' view, which proposes lending to any solvent or temporarily insolvent banks, when necessary to sustain the financial system. For a better overview, we provide an alternative systematisation and introduce two new LOLR views, namely, the Tiberian view and the alternative view. Figure 5.1 shows the broad and narrow views of the LOLR schools and their representatives.

Figure 5.1 LOLR schools of thought and their representatives

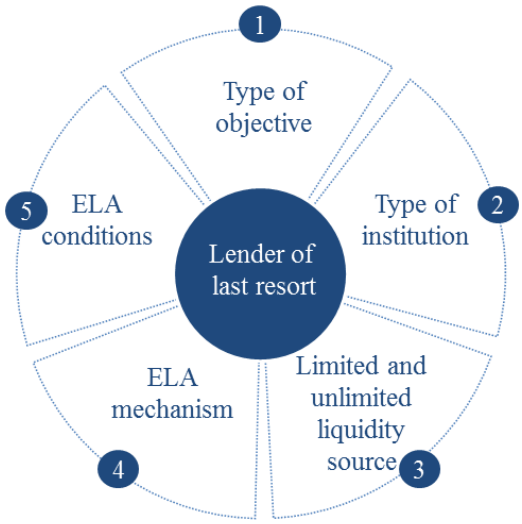


Source: Authors' own elaboration.

We broadly identified four major LOLR schools of thought, namely, *the free banking school, the ancient school of thought, the classical school of thought*, and *the contemporary school of thought*. The ancient school of thought includes the narrow '*Tiberian view*'. The classical

school of thought includes both the '*Henry Thornton view*' and the '*Walter Bagehot view*'. The contemporary school can be divided into the '*Goodfriend and King view*', the '*Goodhart (and others) view*' and the '*Alternative LOLR view*'. To analyse the different schools of thought, we can develop an LOLR analysis scheme through our analysis of the different schools of thought. All these LOLR views can be analysed according to the following five characteristics, as shown in Figure 5.2: (1) the type of objective, (2) the type of institution, (3) limited and ultimate liquidity sources, (4) the ELA mechanism, and (5) ELA conditions.

Figure 5.2 LOLR analysis scheme



Source: Authors' own elaboration.

First, in general, the LOLR's objective is to support the safety and soundness of the banking system (see section 2.2.3) and, in turn, the financial system. In this sense, the LOLR seeks to support the smooth functioning of the robustness of the banking system in a period of financial distress due to systemic risk. Systemic risk is thereby the exogenous and endogenous risk of the banking system. However, in practice, the LOLR objective type can vary between a macro-based objective and a micro-based objective (see section 2.2). Therefore, for an effective LOLR, a clearly defined objective is a mandatory condition.

Second, the LOLR is an institution, typically the central bank, but as we noted, it can also be the government, a deposit insurance regime, or an international regime.[140] Likewise,

[140] However, international regimes such as the IMF lack 'the capacity to serve as their banks and, more generally, their financial system's lender of last resort. They can[not] create high-powered base money in their own national currency, they can[not] act quickly, and they need the consent of […] another agency to act' (Schwartz 2009: 454). Nevertheless, an interesting analysis of an international liquidity provision through the IMF can be found in Tirole's '*Financial crisis, liquidity, and the international monetary system*' (2000). In this context, Tirole (2002) indicated that the IMF could act as a delegated monitor; therefore, the IMF plays the role of crisis manager and a limited role as an LOLR.

Guttentag and Herring (1987: 150) indicated that '[s]ince the nineteenth century, the lender of last resort [..] has been viewed as an agency with responsibility for preventing financial crises […]. The [..] [LOLR] responsibility is usually associated with central banks, although in the absence of a central bank other agencies can assume the responsibility'. Consequently, various institution types can fulfil the role of the LOLR.

Third, the institution is characterised as a limited or ultimate liquidity source that controls and issues money in its domestic and/or foreign currency. In this sense, Schwartz (2009: 450) emphasised that '[t]he only institution that had the resources to provide […] loans in a [liquidity] crisis is the central bank, which could create high-powered money without limit, and hence was the lender of last resort'. Conversely, Goodhart (2009 [1999]) indicated that the domestic central bank was a limited source of high-powered money, especially in the creation of foreign high-powered money (see section 5.4 for further details). We will discuss the limited and unlimited sources of liquidity in the different schools of thought before we advocate for one view.

Fourth, in general, the ELA provision can be fulfilled via direct lending (for instance, a DW) and/or via OMOs through the market. A DW is a mechanism by which banks are allowed to borrow to meet short-term liquidity needs. Thus, banks take the initiative in the transaction, and the central bank play a passive role in the transaction. A DW can be used under different circumstances:

> 'we should distinguish between routine operation of the discount window for normal monetary policy purposes, with often formalized access […], for example for short-term interest rate stabilization or to meet seasonal variations in liquidity demand, and emergency type measures for troubled banks' (Baltensperger and Dermine 1987: 79, see also Baltensperger 1992).

The DW includes intraday and overnight facilities in normal times, whereas it can extend ELA to individual banks in a period of financial distress. As an alternative to the DW, economists such as Goodfriend and King (2009 [1988]) advocate for ELA that can be provided via OMOs through the entire interbank market. As noted in section 4.1, the LOLR is non-operational in nature, particularly in direct lending to individual banks, and is considered an ELA mechanism. Nevertheless, for the sake of completeness, we consider the arguments of Goodfriend and King (2009 [1988]).

Fifth, what are the ELA conditions? This question is closely related to the type of borrower, the characteristics of the borrower and the lending conditions. With regard to the first point, in practice, different types of borrowers exist, and we can broadly distinguish between

all borrowers or specific types of borrowers. Two specific types of borrowers are systemically important borrowers and non-systemically important borrowers. Although we are not in favour of distinguishing between systemically and non-systemically important institutions due to potentially adverse selection and, in turn, discrimination, we can conceptually distinguish between three clusters: banks, NBFIs and non-bank, non-financial institutions (NBNFIs). In relation to the second point, the characteristics of the borrower can vary between illiquidity and two forms of insolvency, namely, fundamental insolvency and temporary insolvency. The borrower can be illiquid and fundamentally insolvent or illiquid and temporarily insolvent. With regard to the third point, the lending conditions range from a zero interest rate to very high interest rates and from a narrow range of good collateral to a broad range of collateral that also includes bad collateral.

Nonetheless, as a consequence of the different characteristics of the different schools of thought, the next section provides a detailed analysis of the main LOLR schools in the literature.

5.1. The free banking school

As Goodhart (1988: 13) clearly noted, 'there are several stands in the case for free banking [and one is by analogy] with the general case for free trade. If free trade and free competition are beneficial in other economic activities, what is so special about banking that justifies imposing' bank regulation? A groundswell in favour of bank regulation has developed in the academic and political milieu (see chapter 2) (see Goodhart 1988). Nevertheless, advocates of the free banking school are opposed to any government and central bank intervention and are in turn opposed to the LOLR. They suggest that government intervention, particularly bank regulation, leads to banking crises. This view corresponds with our RIH from section 3.2.1, that is, that bank regulation can transform an initially robust banking system into a fragile banking system. However, our view is not as radical as the free banking school, and as a result of the rationale of the LOLR, we believe that having a well-designed LOLR is necessary. Conversely, free banking scholars believe that in the absence of bank regulation and the LOLR, market pressures are more preventative such that banking crises will be less frequent. In other words, free market pressures will produce a panic-proof banking system because in the absence of an LOLR, banks must be careful in lending because they cannot assume that their losses will be recapitalised (Dowd 1992). In addition, although banks can fail in a free banking system, failures have been limited and have not been contagious. In this context, Dowd (1992: 14) indicated that

'[f]ree banking systems were rarely subject to major banking crises, and there is evidence that the crises that did occur were usually caused by major external factors, such as a crisis in a regulated banking system nearby or by government intervention of some sort'.

In practice, Scotland before 1844, Canada before 1935 and Switzerland before 1881 had stable banking systems without bank regulation. However, according to Dowd (1992), instability was caused by banking crises in London and New York, where banking was more regulated than it was in Scotland, Canada and Switzerland. Given these practical examples, does the free market provide a better alternative than the LOLR? Timberlake (2007 [1984]) analysed the free market solution of 'clearinghouses'[141] over a fifty-year financial crisis in the United States from 1875 to 1907 before the Fed was founded. Timberlake (2007 [1984]: 140) concluded that 'the issue of clearinghouse currency put the brakes on the development of an unstable bank credit contraction. It did not prevent the demise of inefficient banks; it only stopped the fractional reserve collapse that might otherwise have occurred'. However, the free banking solution has been criticised on several grounds: (1) By 1907, the clearinghouse issues were considered illegal as a result of 'lower denominational currency of different types [because] a law passed in the early 1860s had prohibited the private issue of token and subsidiary coin, and the national bank act had a like effect on state chartered banks' notes by taxing them 10 percent a year' (Timberlake 2007 [1984]: 132), and in turn, clearinghouse currency was illegal. (2) Historical evidence shows that such clearinghouses struggled with coordination problems. (3) In the presence of aggregate shocks, the clearinghouse or free market solution is limited (see Holmström and Tirole 1998, Tirole 2002). Therefore, scholars generally agree that an LOLR is required to prevent a banking crisis and further damage at the national level (see Goodhart and Illing 2009).

5.2. The ancient school of thought

Although the term LOLR was used the first time by Baring (1797), the concept has its origin in the early pre-classical economic era. In the Roman Empire under the Roman Emperor Tiberius

[141] The clearinghouse is an institution wherein 'every bank sends a representative to one place – the clearinghouse – where its debit items are cleared against its credit items. Then the balance is struck, and payment is due from debtor banks to creditor banks. Originally, one bank in the association was assigned the "central" administrative role for clearing the other member banks accounts' (Timberlake 2007 [1984]: 128). In this context, all banks hold commercial reserves (bank money) as a deposit with this bank against a clearinghouse certificate at a particular interest rate.

Julius Caesar Augustus (14 to 37 A.D.) (Tiberius Caesar), the 'Tiberian view'[142] developed in response to the liquidity and solvency crisis of 33 A.D. In this context, the following three questions arise:

(1) What were the main causes of the financial crisis in 33 A.D.?
(2) How did the financial crisis end?
(3) What are the main conditions of the Tiberian view?

The first question is difficult to answer because of (1) the lack of monetary data; (2) the different causes of market failure in 33 A.D. (for instance, government expenditures in foreign provinces, default on foreign debt, and domestic and international contagion); and (3) various ambiguous explanations about the main causes in the literature. For example, according to Frank (1935), the liquidity and solvency crisis of 33 A.D. had its roots in previous Roman administrations under Gaius Octavius, named Augustus Caesar, whereas Levick (1999 [1976]) suggests that the main causes rested in the Tiberius Caesar administration. We agree that both explanations are potentially justifiable, but an account of the 33 A.D. crisis would be limited by only considering one view. Therefore, in our view, the crisis had several causes. Next, we provide a brief overview of the 33 A.D. crisis.

In the early years of Augustus Caesar's regime, government expenditures had risen considerably because of the security policy on the Roman frontier in Germania. Hence, government expenditures led to a drain of Roman coinage (money drain) into Roman provinces for security policy. However, the money drain in the early years of Augustus Caesar was not a major cause of the 33 A.D. crisis because the coinage during, especially in the early years of, Augustus Caesar's regency was enormous (see Frank 1935). Therefore, on the one hand, the money drain in the early years of Augustus Caesar's rule could be balanced by coinage. However, on the other hand, the enormous coinage under Augustus Caesar had the following two repercussions: (1) prices, especially land prices, rose and were subject to speculation, and (2) it facilitated credit access, especially for landowners. Despite the enormous coinage in the early years of Augustus Caesar's rule, after 10 B.C., 'the coinage dwindled to a miserable trickle and governmental expenditures at home diminished at the very time when currency began more and more to flow abroad' (Frank 1935: 340). Moreover, the money drain had been increasing through the Roman aristocracy, which imported luxury goods from foreign provinces (for

[142] Although the ancient school of thought is considered government support (solvency support) rather than central bank support (liquidity support), we take the ancient school of thought into account for the sake of completeness.

example, Achaea, Aegyptus, and Hispania), and through funding in foreign lands because funding in secure industries had not created the expected return on equity (see Frank 1935). Arguably, the money drain had been balanced by taxation in the Roman provinces. Therefore, enough money would flow back and could be used to further fund propositions by Augustus Caesar and, thereafter, by Tiberius Caesar. However, in the later years of the Augustus regency government, expenditures diminished. Moreover, Tiberius Caesar followed a restrictive fiscal policy (money hoarding). 'At his death it was found that he had stored up 2,700,000,000 sesterces in his treasury', which was an enormous amount of money compared with the circulated sesterces (Frank 1935: 339). Levick (1999 [1976]) correctly suggested that the shortage of money was a consequence of Tiberius' restrictive fiscal policy. Nonetheless, the trigger of the financial crisis of 33 A.D. was an increase in illegal interest rates by money lenders and 'the prosecution of money lenders' (Frank 1935: 340), resulting in 'a sudden shortage of money [(market liquidity problem)] and a contraction of credit which threatened to bankrupt some of Rome's most respected citizens [and numerous landowners (solvency problem)]' (Thornton and Thornton 1990: 655). To stabilise the liquidity and solvency crisis, the Senate reintroduced an early regulation, Caesar's law of 49 B.C. This law aimed to prevent the money drain and to stabilise Italian land prices as the coinage dwindled (see Frank 1935). Therefore, money lenders had to fund two-thirds of their funds in Italian land. However, the regulatory measure steepened the decrease in Italian land prices because money was scarce.[143] Moreover, the downward spiral had been enhanced through speculative financing (see section 2.3.2), which decreased land prices and jeopardised the stability of the Roman economy. In this sense, how did the liquidity and solvency crisis of 33 A.D. end? The answer to this question lies in the government support of Tiberius Caesar, which can be considered an early LOLR concept. Tiberius Caesar, who had the monopoly on issuing money, coordinated with a commission to lend directly to landowners in distress 'a hundred million sesterces [(silver coins)] without interest for a period up to three years. This apparently ended the crisis' (Frank 1935: 337). Thus, the emperor acted as an early LOLR and provided emergency assistance (in the form of silver coins) under the following three conditions:

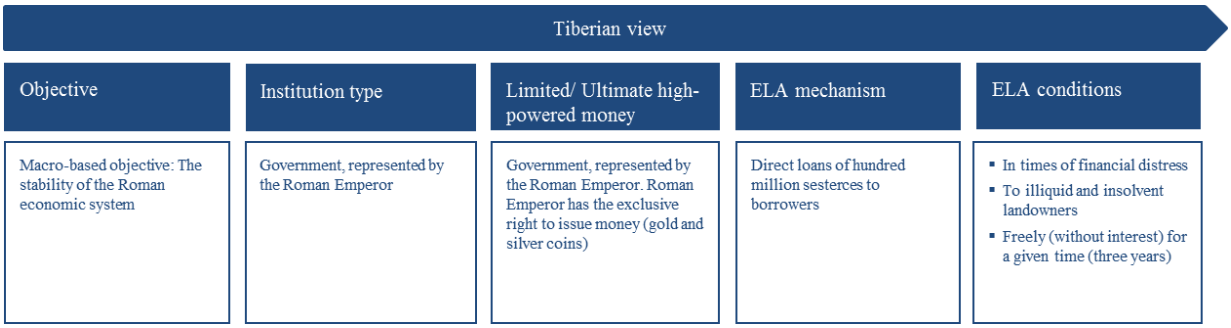
(1) In times of financial distress that jeopardised the safety and soundness of the Roman economy;
(2) To illiquid and insolvent landowners freely (without interest); and

[143] This early regulation also partially supports our RIH from section 3.2.1, namely, that regulation can enhance or lead to instability due to funding.

(3) For a given period of time (namely, three years).

Based on these considerations, can the Tiberian view be considered an LOLR? According to the five characteristics elaborated in chapter 5 and our definition, the answer is yes. Figure 5.3 summarises the Tiberian view. First, the Tiberian LOLR sought to create stability in the Roman economy. Thus, it had a macro-based objective that focused on the entire Roman economy.

Figure 5.3 The ancient school of thought – The Tiberian view



Source: Authors' own elaboration.

Second, the institution type was the government, which was represented by the Roman emperor. Third, the emperor was the ultimate source of liquidity because he had the exclusive right to issue money (gold and silver coins) and broad tax power with respect to his tax income from several Roman provinces. In this sense, one decisive characteristic of the Tiberian LOLR is that if the government acts as the LOLR, emergency assistance depends on a country's tax power. Based on this characteristic, we can formulate our tax power LOLR hypothesis:

The better a government's tax power is, the less limited the emergency assistance for the borrower is.

Authors' own elaboration.

However, observers and opponents might raise the following points. First, they might ask what the tax power of the government is. Second, they might note that in practice, the tax power LOLR hypothesis does not reflect reality because if the government acts as the LOLR, the emergency assistance to a borrower depends on various components (for example, the creditability of a borrower). In relation to the first consideration, the tax power of the government is based on various variables, such as the tax base and tax honesty, which further draw upon tax fraud and tax evasion. With regard to the second point, it is a hypothesis that has

not yet been proven and verified. However, history, especially the recent sovereign crisis in Europe, particularly in Greece, appears to support the tax power LOLR hypothesis. Thus, further academic research is desirable. Fourth, in the Tiberian view, the ELA mechanism was of a direct lending nature to landowners. In this sense, what are the conditions for emergency assistance? Tiberius provided emergency assistance under the following three conditions: (1) in a period of financial distress; (2) to illiquid and insolvent landowners; and (3) freely (with no interest rate) for a given period (three years). Consequently, according to our analysis, the earliest LOLR traces back to the Roman Empire, not to Baring (1797), Thornton (1802) and Bagehot (2005 [1920]), as mentioned in the literature.

Nonetheless, opponents would argue[144] that landowners cannot be considered banks; therefore, the above-mentioned criteria had nothing to do with the classical Bagehot view. In addition, the provision of ELA only occurs under stringent conditions, such as good collateral; therefore, the ancient LOLR is significantly different than the contemporary LOLR. According to the first point, landowners are not considered banks, but landowners freely receive emergency assistance for a given period, which corresponds with the classical LOLR doctrine of the nineteenth century attributed to Thornton (1965 [1939]) and Bagehot (2005 [1920]). In relation to the second point, with respect to the stringent conditions such as good collateral, the ancient LOLR had nothing to do with the contemporary LOLR. However, the contemporary LOLR is based on the historical evolution of the LOLR, has a macro-based objective function, and is also an institution that provides emergency assistance during a period of financial distress. Consequently, the Tiberian view is an alternative design of the LOLR.

Nevertheless, with the establishment of the first banking houses in the late Middle Ages (1300–1500), the ancient school of thought ended, falling into oblivion. The banking houses in Italy and Germany funded governments (for example, the Fugger provided loans to Holy Roman Emperor Maximilian I of the House of Habsburg against land, mines, and royal titles) and the papacy against sources of royal income. Consequently, the first banking houses acted as a source of emergency assistance. However, banks often went bankrupt, as the governments were unable to settle their credits.

[144] Moreover, some opponents argue that the emergency assistance of Tiberius Caesar had more things in common with QE than lending to individuals. Based on this argument, an article in the 'Business Insider' stated that 'Tiberius [u]sed Quantitative Easing [QE] [t]o [s]olve [t]he [f]inancial [c]risis [o]f 33 A.D.' (see Taylor 2013). In this context, Taylor (2013: Internet) noted that 'similar policies were used by Tiberius during the [f]inancial [c]risis of 33 A.D., almost 2000 years ago'. Thus, was the liquidity provision through Tiberius Caesar an early form of MMLR rather than an LOLR? The answer is no because QE is an MMLR operation through the market, whereas Tiberius Caesar is considered an LOLR who lends directly to individual borrowers. In short, Tylor (2013) wrongly considered QE to be a similar policy in the times of Tiberius Caesar.

5.3. The classical school of thought

Although the LOLR concept was first used in the early pre-classical period, the first complete and systematic elaboration was provided in the nineteenth century by Henry Thornton in his speech on the Bullion Report and in '*An Enquiry into the Nature and Effects of the Paper Credit of Great Britain (1802)*'. By 1873, Thornton's considerations had been accepted and extended by Walter Bagehot (2005 [1920]). 'Since then, LOLR [has become] standard practice among central banks' and will be considered the classical school of thought (Goodhart and Illing 2009: 1). In what follows, we describe Thornton's and Bagehot's theories of the LOLR in detail.

Henry Thornton's view

Thornton (1965 [1939]) indicated that the BoE[145] was an LOLR. He described three characteristics of the LOLR, the policy issues between monetary policy and the LOLR, and the micro-based and macro-based LOLR functions (see Thornton 1965 [1939], see also Humphrey and Keleher 2009 [1984], Humphrey 1989). Moreover, Thornton (1965 [1939]) was the first to address the 'moral hazard' problem.

First, Thornton (1965 [1939]) identified the following three LOLR characteristics: (1) the unique monopoly function with regard to the BoE's high-powered money; (2) the role of holding sufficient reserves and freely providing assistance (BoE notes) in a period of financial distress; and (3) the public duty of expanding notes during temporary financial distress. Next, we describe these characteristics in detail.

First, Thornton (1965 [1939]) indicated that the BoE had a unique role in relation to its stock of high-powered money (gold and BoE notes) because no other bank had the right to issue BoE notes. Thus, the BoE was responsible for holding gold reserves from which banks could withdraw and for supplying non-gold, namely, BoE notes, as gold equivalents. Hence, Thornton (1965 [1939]) considered the BoE to be a monopoly that could satisfy the demand for bank liquidity in times of financial distress with high-powered money (see also Humphrey and Keleher 2009 [1984]). In this context, Thornton (1965 [1939]: 305) argued the following:

[145] The BoE became the central bank after the 1844 Bank Charter Act was passed, as the BoE received the exclusive right to provide banknotes and was responsible for monetary policy in the United Kingdom.

'Bank of England have obtained the Monopoly of supplying the Metropolis with its whole Means of Circulation, and have, by their superior Credit, excluded entirely all other Paper, and have also bound themselves, as far as long Custom can bind them, to a Number of General Rules, such as that of discounting daily for the Public; and since they have also become so considerable, that their individual Conduct operates upon the Credit of the whole Nation'.

Second, because the BoE held gold, Thornton (1965 [1939]) indicated that the BoE was responsible for managing and holding sufficient central gold reserves. In addition, '[n]ot only must it hold sufficient reserves to inspire full confidence in their ready availability in times of stress, but it must also rely on its own resources (since as the last resort, it can turn to no other source) to protect the reserve from gold-depleting specie drains' (Humphrey and Keleher 2009 [1984]: 79). Thus, in a period of financial distress (in particular, a temporary liquidity problem), the BoE as the LOLR must freely provide BoE notes for the safety and soundness of the banking system. Otherwise, depositors 'seek to switch from country bank notes to gold or its equivalent' (Humphry 1989: 9). To expand on this point, Thornton (1965 [1939]) suggested that temporary withdrawals of gold could induce external[146] money drains and increase the inflationary over-issuance of BoE notes. Therefore, 'to prevent external drains caused by persistent inflationary over-issue of paper, it must hold so large a reserve as to be able to withstand those temporary and self-reversing external drains' (Humphry 1989: 9).

Third, Thornton (1965 [1939]) noted that, unlike other commercial banks, the LOLR had a public responsibility to the entire economy based on its unique role in the provision of high-powered money. In this context, in times of financial distress, the LOLR must expand its notes when banks contract loans (hoard money), which can lead to a credit freeze. Therefore, Thornton (1965 [1939]) distinguished between bank *credit* (loans) and the stock of *money* (high-powered money). Thornton (1965 [1939]) noted that bank credits and money stock tended to increase and decrease together and that bank credits were based on high-powered money. Consequently, 'the limitation on Bank Notes or the Means of Circulation that produces Mischiefs'[147] is more harmful than a contraction of bank credit (Thornton 1965 [1939]: 307). Furthermore, Thornton (1965 [1939]) distinguished between bank failure and government

[146] Thornton (1965 [1939]: 39) distinguished between internal and external drain. 'Internal drain was to grant credits liberally, and then, in learning this lesson, it forgot that in the case of an external drain exactly the opposite measures were called for'. In other words, an external drain is, for example, 'an outflow of gold which is primarily caused by an unfavourable change in the balance of trade' (Thornton 1965 [1939]: 47).

[147] Thornton (1965 [1939]: 273) defined mischiefs as 'the following: first, the great enhancement of the price of British labour and commodities, an evil with which we ought unquestionably to connect that of the diminution of the sale of our manufactures in foreign markets; secondly, the inconvenience to which we may be exposed in time of war through the want of sufficient means of making remittances in bullion to other countries; and, thirdly, the confusion which the failure of paper credit may produce at home in the event of any great disorder in the nation'.

failure or 'LOLR failure'. Thornton (1965 [1939]) observed that a bank failure had less of an impact than an LOLR failure. We agree with Thornton (1965 [1939]) that an LOLR failure is more dangerous than a bank failure, but we further differentiate between a government failure and a central bank failure. With regard to the former type, orderly winding down a bank is more appropriate than allowing a government to fail. In relation to the latter type, a central bank cannot fail and thus cannot be insolvent. Therefore, recapitalising a bank is better if the bank is not able to wind down in an ordinary manner, particularly in the case of systemically important institutions.

Second, Thornton (1965 [1939]) commented on the policy issues between monetary policy and the LOLR. According to Thornton (1965 [1939]), the LOLR is a monetary policy instrument because it relates to the temporary provision of high-powered money. In his view, monetary policy and the LOLR are consistent (no boundary problem) due to the policies being effective over different times (temporary and long-term policy). In this context, monetary policy is a long-term instrument, whereas the LOLR is a temporary instrument for a few days. According to Thornton (1965 [1939]: 259), the main tasks of the BoE are as follows:

'[t]o limit the total amount of paper issued, and to resort for this purpose, whenever the temptation to borrow is strong, to some effectual principle of restriction; in no case, however, materially to diminish the sum in circulation, but to let it vibrate only within certain limits; to afford a slow and cautious extension of it, as the general trade of the kingdom enlarges itself'.

Therefore, the main task of the central bank is to control the money stock (paper money) so that the long-term growth of the economy 'expands at a steady noninflationary pace' (long-run target growth of money stock) (Humphrey 1989: 10). In addition, Thornton (1965 [1939]: 259) noted that the BoE had

'to allow of some special, though temporary, increase in the event of any extraordinary alarm or difficulty, as the best means of preventing a great demand at home for guineas [a gold coin worth £1.05]; and to lean on the side of diminution, in the case of gold going abroad, and of the general exchanges continuing long unfavourable; this seems to be the true policy of the directors of an institution circumstanced like that of the Bank of England. To suffer either the solicitations of merchants, or the wishes of government, to determine the measure of the bank issues, is unquestionably to adopt a very false principle of conduct'.

Thus, the central bank had to prevent gold drains. In this sense, Thornton (1965 [1939]) distinguished between temporary external drains and long-term external (or foreign) drains

related to the export of gold. Temporary external drains are not as serious a problem because, as Thornton (1965 [1939]) assumed, a temporary outflow will be balanced by reserve flows later on. Therefore, temporary external drains can be covered by the LOLR characteristic, namely, holding sufficient high-powered money. Conversely, an external (or foreign) drain that is an outflow of gold due to an unfavourable change in the balance sheet should be limited with the suspension of convertibility (see Thornton 1965 [1939], Humphrey and Keleher 2009 [1984]). As a result of temporary and long-term drains, Thornton concluded that no boundary problem existed between monetary policy and LOLR policy because of the timing of intervention. In other words, monetary policy is a long-term policy, whereas the LOLR is a temporary policy.

Third, Thornton (1965 [1939]) analysed the micro-based or macro-based function of the LOLR. According to Thornton (1965 [1939]), the micro-based LOLR concerns the assistance to individual banks, whereas the macro-based LOLR is the responsibility to provide assistance to the entire banking system. In light of these characteristics, Thornton (1965 [1939]: 188) noted the following:

‘It is by no means intended to imply, that it would become the Bank of England to relieve every distress which the rashness of country banks may bring upon them: the bank, by doing this, might encourage their improvidence. There seems to be a medium at which a public bank should aim in granting aid to inferior establishments, and which it must often find very difficult to be observed. The relief should neither be so prompt and liberal as to exempt those who misconduct their business from all the natural consequences of their fault, nor so scanty and slow as deeply to involve the general interests. These interests, nevertheless, are sure to be pleaded by every distressed person whose affairs are large, however indifferent or even ruinous may be their state’.

In this passage, Thornton (1965 [1939]) clearly noted four LOLR characteristics. First, the primary objective is the safety and soundness of the markets (in particular, the banking system) – not the safety and soundness of individual banks. Second, the LOLR is confronted with the moral hazard problem (see section 2.1.2). In this sense, Thornton (1965 [1939]) was against any form of liquidity assistance because subsidising banks would increase the speculative risks of funding due to explicit guarantees (moral hazard) and because banks ‘would encourage other banks to take excessive speculative risks without fear of the consequences’ (Humphrey and Keleher 2009 [1984]: 83). To mitigate excessive speculative risks, banks should pay a high interest rate. However, the LOLR should only intervene if the ‘repercussions of such punishment threaten to become widespread [contagion]’ (Humphrey and Keleher 2009 [1984]:

83). Third, Thornton (1965 [1939]) was sceptical about the assistance for SIBs, but he was aware of the public interest. Therefore, Thornton (1965 [1939]) suggested that the LOLR should be prudential in nature and minimise secondary negative externalities on the banking system. In this context, the BoE is responsible for arresting a banking crisis that is spreading though the banking system in case of a general run or solvency problem. Thus, the LOLR must accommodate the demand for high-powered money.

- 'If any one bank fails, a *general run* upon the neighbouring ones is apt to take place, which if not checked in the beginning by a pouring into the circulation a large quantity of gold, leads to very extensive mischief' (Thornton 1965 [1939]: 180).
- 'At the time of the distress of 1793, some great and opulent country banks applied to the Bank of England for aid, in the shape of discount, which was refused on account of their not offering approved London securities: some immediate and important failures were the consequence. The Bank of England was indisposed to extend its aid to houses in the country. The event, however, shewed that the relief of the country was necessary to the solvency of the metropolis. A sense of the unfairness of the burthen cast on the bank by the large and sudden demands of the banking establishments in the country, probably contributed to produce an unwillingness to grant them relief' (Thornton 1965 [1939]: 181).

Humphrey and Keleher (2009 [1984]: 85) translated this idea into New-Keynesian terminology: the LOLR 'must be prepared to offset falls in the money multiplier [(5.1)] arising from panic-induced rises in currency and reserve ratios with compensating rises in the monetary base'. The money multiplier is defined as 'the ratio of the money supply to the monetary base [or high powered money (or sometimes M0)], it tells how much the money supply will change for a given change in high-powered money' (Goodwin et al. 2009: 269). The money multiplier is the ratio of the money supply to high-powered money (for instance, if the SNB increases its reserves by CHF 10 million, the total increase in the money supply would be CHF 20 million). The money multiplier model is described by following equation:

$$\text{Money multiplier} = \frac{\text{Money supply}}{(\text{High-powered money})} \tag{5.1}$$

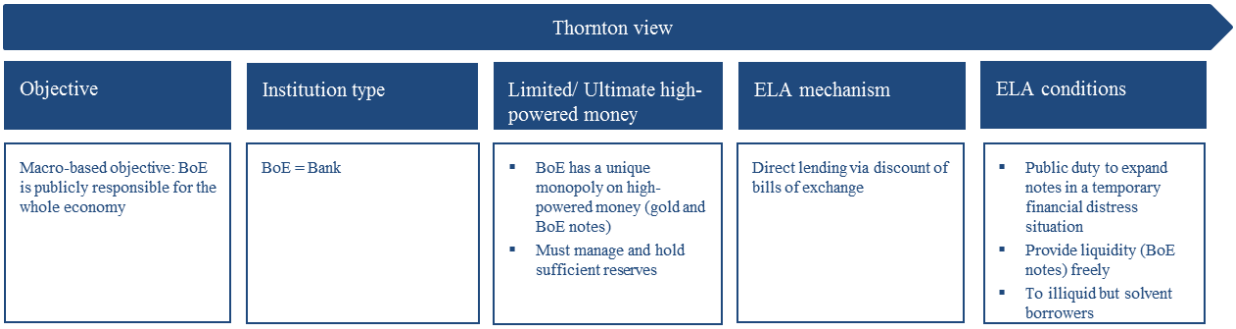
Alternatively, the LOLR can be explained from an endogenous money view[148] as follows: the LOLR accommodates the demand for high-powered money in times of financial distress due to the nature of money and credit. In other words, if banks demand emergency high-powered

[148] Section 5.4 describes the alternative LOLR view in an endogenous money framework.

money, the central bank acts as the LOLR and offers high-powered money, on which the LOLR sets an interest rate according to its creditworthiness (solvency).

Regardless of the different interpretations of money, Thornton (1965 [1939]) justified the LOLR with the concept of a general run (see section 2.2.2) and with the bank's creditworthiness (solvency, insolvency). In this context, Thornton (1965 [1939]) advocated for not solving the initial market failure and instead providing liquidity assistance to the entire banking sector. Thus, Thornton can be considered an early advocate of the MMLR. According to these considerations, we use our five characteristics to systematise and summarise Thornton's view. Figure 5.4 outlines Thornton's view.

Figure 5.4 Classical school of thought – Thornton's view



Source: Authors' own elaboration.

Thornton (1965 [1939]) considered the objective of the BoE and the LOLR to be limiting system-wide distress for the entire economy. In other words, the objective of Thornton (1965 [1939]) was macro-based in nature. Moreover, Thornton (1965 [1939]) referred to the problem of systemically important institutions and the public interest in preventing a crisis for the entire economy, particularly 'the prevention of panic-induced declines in the money stock, declines that could produce depressions in the level of economic activity' (Humphrey and Keleher 2009 [1984]: 83-84). Furthermore, Thornton (1965 [1939]) considered the BoE (which was a bank until 1844) to be an LOLR institution with a unique monopoly on high-powered money and the responsibility of managing and holding sufficient reserves. In terms of the ELA mechanism, the liquidity provision of the BoE operates through the DW via bills[149] of exchange (non-interest-bearing written orders). Although Thornton had not known about OMOs, several contemporary experts (Humphrey and Keleher 2009 [1984]: 99, see also Goodfriend and King

[149] In this context, a good bill is characterised by the borrower paying on the maturity date to settle the transaction (see Goodhart 2009 [1999]).

2009 [1988]) suggest that the LOLR had been 'accomplished either through open market operations or loans made at the penalty rate' to mitigate moral hazard in the form of speculative funding. In relation to ELA conditions, Thornton (1965 [1939]) indicated that the BoE should lend freely to illiquid and solvent borrowers in a temporary period of distress.

Walter Bagehot view

After Thornton's (1965 [1939]) work, '*An Enquiry into the Nature and Effects of the Paper Credit of Great Britain* (1802)', the economist Walter Bagehot (2005 [1920]) expanded Thornton's ideas in what became known as the 'classical' Bagehot doctrine in his essay '*Lombard Street: A Description of the Money Market* (1873)'. In 1873, he invented the LOLR in the United Kingdom in response to the financial credit crises of 1825, 1847, 1857 and particularly 1866 and the subsequent collapse of Overend, Guerney & Company (see Grossmann and Rockoff 2015). After the financial credit crisis, Bagehot (2005 [1920]) noted, as Thornton (1965 [1939]) did before him, the essential role of the BoE as the central bank in times of financial distress. In this context, the BoE was not responsible for preventing the initial failure 'but rather [for preventing and protecting] a subsequent wave of failures spreading through the system' (macro-based objective) (Humphrey and Keleher (2009 [1984]: 93). Based on this consideration, Bagehot (2005 [1920]) formulated the classical doctrine, which holds that the central bank as an LOLR should lend money to 'solvent but illiquid' banks under two main policy prescriptions (see Grossmann and Rockoff 2015):

(1) Lending only against good collateral;
(2) Lending at a 'very high' interest rate.[150]

The cardinal principle of Bagehot (2005 [1920]) involves lending to solvent but illiquid banks. Bagehot (2005 [1920]: 139) noted the following:

'That in a panic the bank, or banks, holding the ultimate reserve should refuse bad bills or bad securities will not make the panic really worse; the "unsound" people are a feeble minority, and they are afraid even to look frightened for fear their unsoundness [(insolvency)] may be detected. The great majority, the majority to be protected, are the "sound" [(solvent)] people, the people who have good security to offer'.

[150] A high interest rate should not be exclusively considered a penalty rate because (1) Bagehot did not use the word penalty in his essay about 'Lombard Street: A Description of the Money Market' and (2) the ELA rate should be higher than the market rate compared with the pre-crisis level (see Manna 2009).

Thus, Bagehot (2005 [1920]) treated sound people as solvent people. However, one critique of Bagehot's (2005 [1920]) definition is that the term 'solvency' is ambiguous and that, in turn, the distinction between solvency and liquidity is unclear. Let us expand on this point. We agree that Bagehot (2005 [1920]) did not clearly distinguish between solvency and liquidity, but he elaborated an implicit solvency and liquidity relationship that is not clearly reflected in his book. The main question arises: who are good/solvent people? Bagehot (2005 [1920]) indicated that good/solvent people are related to good securities. Therefore, solvency is determined by good securities, and vice versa. In this sense, good securities are regarded as money that 'in ordinary times can be readily obtained' (Bagehot 2005 [1920]: 139). Thus, solvency depends on the convertibility of securities into liquid assets in ordinary times. Therefore, solvency and liquidity are closely related with respect to the time dimension; thus, solvency and liquidity should not be distinguished.

Nevertheless, we elaborate Bagehot's (2005 [1920]) three conditions in detail. Similar to Thornton (1965 [1939]), Bagehot 2005 [1920] indicated the BoE's key role in the credit system. Bagehot (2005 [1920]: 32) noted that

> '[a]ll banks depend on the Bank of England, and all merchants depend on some banker. If a merchant have £10,000 at his banker's and wants to pay it to someone in Germany, he will not be able to pay it unless his banker can pay him, and the banker will not be able to pay if the Bank of England should be in difficulties and cannot produce his "reserve"'.

Therefore, the BoE is different from other banks (particularly given its large reserves in BoE notes) and, in turn, should be managed differently. Moreover, similar to Thornton (1965 [1939]), Bagehot (2005 [1920]) distinguished between internal drain,[151] also called domestic drain, and external drain. In this context, Bagehot (2005 [1920]: 41) 'supposed the best way for the bank or banks who have the custody of the bank reserve to deal with a drain arising from internal discredit [[152]], is to lend freely [[153]]'. In this case, another question arises: under what conditions? Bagehot (2005 [1920]: 43) responded that

[151] A domestic drain 'arises from a disturbance of credit within the country, and the difficulty of dealing with it is the greater, because it is often caused, or at least often enhanced, by a foreign drain [(external drain)]' (Bagehot 2005 [1920]: 40).

[152] According to Bagehot (2005 [1920]: 41), discredit is defined as 'an opinion that you have not got any money. And to dissipate that opinion, you must, if possible, show that you have money: you must employ it for the public benefit in order that the public may know that you have it'. In this context, Bagehot (2005 [1920]: 41) noted that '[a] good banker will have accumulated in ordinary times the reserve he is to make use of in extraordinary times [financial distress situation]'.

[153] In this context, Manna (2009) noted that the concept of lending freely involves a hard and a soft dimension. The former is based on the fact that the central bank should not fix the volume of ELA, whereas the latter draws upon the communication of the central bank.

'[a] panic, in a word, is a species of neuralgia, and according to the rules of science you must not starve it. The holders of the cash reserve must be ready not only to keep it for their own liabilities, but to advance it most freely for the liabilities of others. They must lend to merchants, to minor bankers, to "this man and that man," whenever the security is good. In wild periods of alarm,[154] one failure makes many, and the best way to prevent the derivative failures is to arrest the primary failure which causes them'.

In other words, as the LOLR, the BoE should lend freely to related borrowers, namely, 'merchants, minor bankers,' and to 'this and that man', in times of financial distress against good collateral (Bagehot 2005 [1920]: 43). Thus, Bagehot's (2005 [1920]) first contribution beyond Thornton's (1965 [1939]) considerations was the classification of different borrowers. A second contribution relates to the definition of good collateral. Bagehot (2005 [1920]: 139) broadly identified good collateral as 'every kind of current security, or every sort on which money is ordinarily and usually lent'. In a narrow sense, good collateral includes 'securities on which money in ordinary times can be readily obtained [liquid assets] and by which its repayment is fully secured' (for instance, eligible bills, government bonds and railway debenture stock) (Bagehot 2005 [1920]: 143). A third contribution concerns the second Bagehot (2005 [1920]: 138) doctrine, namely, that lending

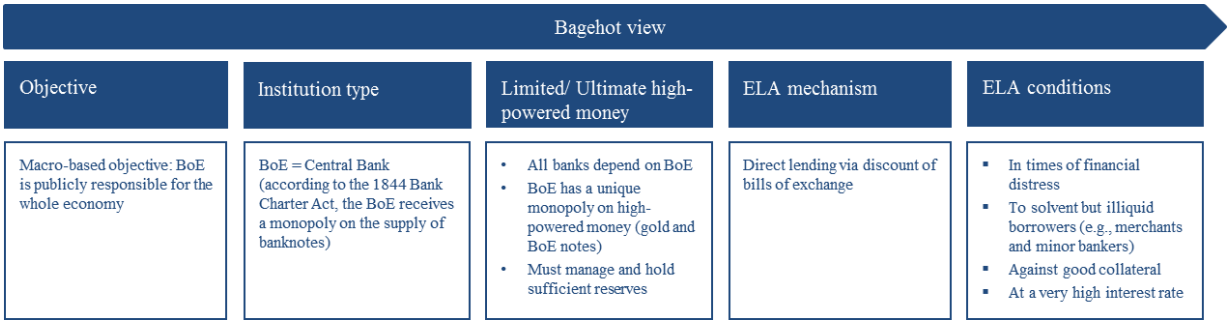
'should only be made at a very high rate of interest. This will operate as a heavy fine on unreasonable timidity, and will prevent the greatest number of applications by persons who do not require it. The rate should be paid early in the panic, so that the fine may be paid early. […]. That at this rate these advances should be made on all good banking securities [as defined above] and as largely as the public ask for them'.

Consequently, the BoE should only lend against a very high interest rate because a high interest rate 'would ration scarce liquidity to its highest-value uses just as high price rations any scarce commodity in a free market [and] it being fair that borrowers should pay [it]' (Humphrey and Keleher 2009 [1984]: 94). Furthermore, Bagehot (2005 [1920]) offered another relevant proposal for the LOLR role. The BoE should come to a clear understanding with the public because the BoE holds the ultimate banking reserves (see Bagehot (2005 [1920]). In other words, Bagehot (2005 [1920]) suggested that the BoE should have a clear commitment with respect to the public, or a 'constructive clarity strategy' (see section 6.3).

In light of these considerations, we summarise the Bagehot doctrine as shown in Figure 5.5.

[154] 'An "alarm" is an opinion that the money of certain persons will not pay their creditors when those creditors want to be paid' (Bagehot 2005 [1920]: 44).

Figure 5.5 Classical school of thought – Bagehot's view



Source: Authors' own elaboration.

As we have already noted, Bagehot (2005 [1920]) accepted and extended Thornton's view. Therefore, the objective, the ultimate source of liquidity, and the ELA mechanism remained the same as in Thornton's view. However, the primary difference between Bagehot (2005 [1920]) and Thornton (1965 [1939]) was that the BoE was a bank in Thornton's view, whereas Bagehot considered the BoE to be a central bank as a result of the 1844 Bank Charter Act. Similar to Thornton (1965 [1939]), Bagehot (2005 [1920]) elaborated the classical ELA conditions in detail. In his view, the BoE was responsible for providing emergency assistance under the following three conditions: (1) the borrower must be illiquid but solvent and the loan must be made (2) against good collateral and (3) at a very high interest rate. These three conditions are known as the classical doctrine of the LOLR.

Although the LOLR concept was developed in the early and mid-nineteenth century, the BoE and other central banks (such as the Fed and the SNB) were slow learners of the LOLR concept. For example, in the United Kingdom, '[a] series of financial panics in 1825, 1847, 1857, and 1866 occurred before [the BoE] developed the appropriate response to restore public confidence in the financial system' (Schwartz 2009: 450). Moreover, as a result of several financial crises in the nineteenth, twentieth and twenty-first centuries (such as the Herstatt Bank failure in Germany in 1974 and the 1990 mortgage crisis in Switzerland), central banks began to act as LOLRs and 'provided a stabilizing insurance mechanism against liquidity shocks' (Goodhart and Illing 2009: 1). These financial crises renewed interest in the analysis of the LOLR in the modern economic arena. Therefore, contemporary economists (such as Goodfriend and King 2009 [1988] and Goodhart 2009 [1999]) provide an analysis of the LOLR, thereby constituting the contemporary school of thought.

5.4. The contemporary school of thought

The contemporary school of thought can be divided into three different views: the Goodfriend and King view, the Goodhart (and others) view, and the alternative LOLR view. In the following sections, the three contemporary schools of thought will be described.

Goodfriend and King's view

In 1988, Goodfriend and King published *Financial Deregulation, Monetary Policy, and Central Banking*, concluding that the central bank could protect the banking system against financial crises via OMOs. In an emergency, the central bank, as the MMLR, provides ELA to the entire banking sector – not to individual banks that cannot selectively purchase assets – and cannot discriminate between different banks. Regarding the Goodfriend and King (2009 [1988]) view, we raised an initial question: can this role be carried out via OMOs?

Before Goodfriend and King (2009 [1988]) analysed the role of the LOLR, they distinguished between two central bank functions, namely, banking policy and monetary policy. Banking policy is regarded as policy that 'influence[s] outcomes in banking and financial markets by subsidizing certain economic activities, prompting the erosion of private arrangements for liquidity and encouraging risk-taking' (Goodfriend and King (2009 [1988]: 146).

Banking policy includes the DW (regular direct lending to financial institutions) and, as a supportive function, provides bank regulation and supervision, called 'oversight', for banks and the banking system.

Conversely, monetary policy is determined by a change in high-powered money. In relation to the DW, particularly the provision of ELA through the DW, Goodfriend and King (2009 [1988]) observed no rational evidence for such liquidity provisions via the DW for the following reasons: (1) '[F]inancial markets provide highly efficient means of allocating credit privately' (Goodfriend and King (2009 [1988]: 163). In other words, the interbank market provides an efficient allocation of liquidity to satisfy a temporary increase in high-powered money. (2) It is unclear that the central bank can provide ELA via the DW at a lower cost than the interbank market with respect to the asymmetric information problem of the borrower. In this context, '[e]fficient lending involves the costly accumulation of detailed information about borrowers. […]. Like many other economic activities, information production is highly costly' (for example, the pooling of diverse risk groups, costly auditing of banks, timely auditing for

short periods, and supervision costs with respect to discriminating between different types of banks) (Goodfriend and King (2009 [1988]: 147). Consequently, oversight, particularly the associated monitoring costs, must be considered to establish an appropriate price for ELA and to determine in times of financial distress the assets of the depository institution (such as commercial banks that have sight deposits at the central bank) and, in turn, its solvency or liquidity state. Goodfriend and King thus argued that if the information were provided freely, the interbank market 'would stand ready to lend any bank the present value of the expected income streams from its assets, discounted at a rate appropriate for risk' (Goodfriend and King (2009 [1988]: 153). In cases of asymmetric information, distinguishing between illiquidity and insolvency is difficult because

'[if there are] strong and weak banks, then it will only lend to any individual bank at a rate appropriate for the entire pool of borrowing banks. For any strong bank needing to borrow funds, then, the private market will charge a higher rate under incomplete information than under complete information because the rate takes into account a probability that the bank is bad, even though it may not be' (Goodfriend and King (2009 [1988]: 154).

Consequently, direct lending via the DW cannot determine banks' individual situations; therefore, whether direct lending can provide ELA at a lower cost than lending via OMOs is unclear.[155] Goodfriend and King (2009 [1988]) further noted that the market will do a better job of separating solvent institutions from insolvent ones because its participants are motivated by profits and losses and because lending through the market eliminates the problem of pricing assets. Likewise, Kaufman (2007 [1991]: 181) noted that 'open market operations eliminate the need to price LLR [[156]] assistance correctly'. (3) Goodfriend and King (2009 [1988]: 159) explained that the LOLR is a monetary policy instrument

'because it works by providing an elastic supply of high-powered money to accommodate precautionary demands to convert deposits into currency. Further, central bank lending, in the sense of advancing funds to particular institutions, is not essential to the policy since it can be executed by buying government securities outright'.

Moreover, they indicated that according to Bagehot, the LOLR should lend at a high interest rate that is 'above [..][the] market rates, making central bank borrowing generally unprofitable and minimizing' implicit government subsidies that encourage moral hazard (Goodfriend and

[155] In this sense, an OMO eliminates the need to evaluate the price of assets because in efficient markets, liquidity provision via an OMO is market to market. Conversely, liquidity via the DW must be valuated at the correct price. '[I]f priced incorrectly, [it] may reduce the effectiveness of the assistance. If the discount rate charged is too low, too much assistance is likely to be provided with resulting subsidies and encouragement to risk taking. If the discount rate is too high, insufficient assistance is likely to be provided' (Kaufman 2007 [1991]: 181).
[156] LLR corresponds to the LOLR.

King (2009 [1988]: 159). Goodfriend and King (2009 [1988]) thereby suggested that Bagehot's theory meant that the LOLR should provide ELA via OMOs[157] rather than via direct lending. Consequently, according to Goodfriend and King (2009 [1988]), ELA can be better fulfilled via OMOs than through the DW.

However, Goodfriend and King (2009 [1988]) also indicated that if ELA in the form of the DW and direct lending is 'desirable, then it must be accompanied by central bank regulation and supervision just as private line of services require[s] restrictions and continual monitoring' (Goodfriend and King (2009 [1988]: 153). In practice, in times of financial distress such as the financial crisis of 2007–2009, '[a] stable monetary regime – or, in the language of the Federal Reserve's founders, an "elastic currency" – cannot be assured by open market operations alone' (Tucker 2014: 18). Therefore, in times of financial distress, particularly in cases of aggregated uncertainty, the central banks should first act as the MMLR and as the LOLR under special circumstances because if the MMLR intervention is successful, no further LOLR intervention is needed and the market discipline will be not undermined. This consideration leads us to our second principle:

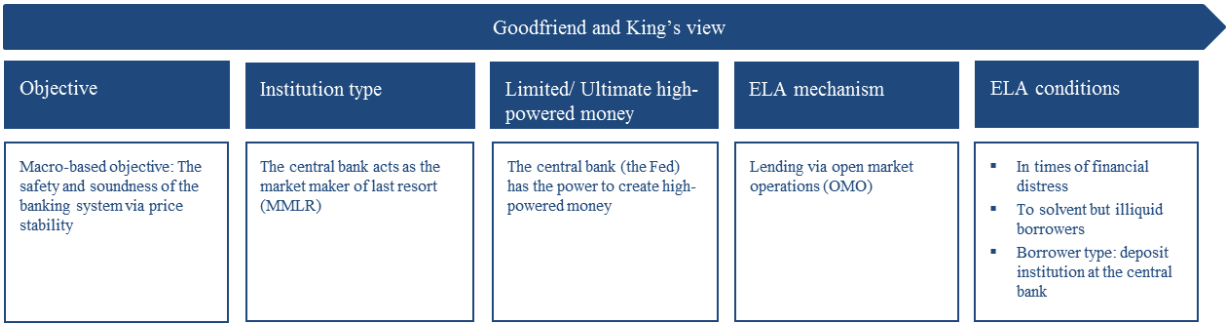
Principle 2: In times of financial distress, the central bank should primarily act as the MMLR and, if required, as the LOLR.

In light of these considerations, can the role of the LOLR be carried out via OMOs? The answer is yes, depending on the severity of the financial crisis. In some crises, an MMLR would be sufficient, whereas a combined MMLR and LOLR is needed in other financial crises. In other words, central bank interventions such as the MMLR are sufficient in certain cases; however, as previously noted, a combined MMLR and LOLR was necessary in the recent financial crisis.

Nevertheless, according to our five characteristics, Goodfriend and King's view can be summarised as shown in Figure 5.6.

[157] We do not agree with Goodfriend and King (2009 [1988]) that lending through the entire market is considered an LOLR function for the following reasons. First, it is a completely new role for the central bank (see section 4.1). Hence, the MMLR cannot be considered Bagehot's LOLR. Second, Bagehot's LOLR is non-operational and is considered a crisis and resolution instrument.

Figure 5.6 Contemporary school of thought – Goodfriend and King's view



Source: Authors' own elaboration.

The objective of Goodfriend and King's view concerns the stability of the banking system, which will be fulfilled through price stability. Therefore, no regulatory intervention by the central bank is needed. The institution type is the central bank, which is also characterised as the ultimate source of liquidity; in other words, the central bank has the power to create high-powered money. Similarly, Schwartz (2009: 450) noted that '[t]he only institution that had the resources to provide such loans in a crisis [is] the central bank, which could create high powered-money without limit,[158] and hence [is] the lender of last resort'. Although Baltensperger (1992: 442) noted that the LOLR function 'can be shared with other potential suppliers of emergency help, such as the government itself ([such as] the taxpayer), or the private banking community', the central bank 'as a supplier of (potentially unlimited) "liquidity" assistance' stands alone (Baltensperger 1992: 442). Moreover, in times of financial distress, ELA will be provided through OMOs to solvent but illiquid deposit institutions (see also Kaufman 2007 [1991]). In other words, as we noted in section 4.1, the central bank acts as the MMLR.

[158] Unlimited liquidity provision is advocated for a national central bank, whereas an international bank such as the IMF is restricted (see Goodhart 2009 [1999]).

The Goodhart (and others[159]) view

In 1999, Charles Goodhart (2009 [1999]) illuminated the myths behind the real issues surrounding the LOLR. In the following section, we describe the four Goodhart myths regarding the LOLR:

The first Goodhart (2009 [1999]) myth is that distinguishing between illiquidity and insolvency[160] is generally impossible because prior to providing ELA, the central bank requires good knowledge about the bank and the market value of its trading positions (see the balance-sheet test[161] and fair value approach). In this sense, Goodhart (2009 [1999]: 232) clearly noted that 'in a crisis situation, liquidity can disappear and values become very volatile; moreover, the true value of a complex position in derivatives markets can be far from easy to ascertain'. Likewise, Staub (1998: 196; trans.) noted that in the presence of illiquid markets, 'there is considerable leeway in the valuation of assets, and the concept of insolvency becomes vague'. In this sense, Guttentag and Herring (1987) indicated that evaluating perfect marketable bank assets (loans) is difficult because they are imperfect.[162] In other words, asymmetric information about the market value of trading positions means that liquidity and solvency are difficult to distinguish in times of financial distress. However, it does not mean that liquidity and solvency can never be distinguished (see Goodhart 2009 [1999]). Moreover, illiquidity and insolvency depend on the judgement of the central bank and the regulatory authority according to their knowledge about the bank and the market value of its trading positions (see BIS 2014). If an illiquid bank requires ELA, a suspicion of solvency must exist – otherwise, under normal economic conditions, the bank will receive liquidity against good collateral on the interbank market (inside liquidity) because the interest rate for good collateral on the market is lower than the discount rate[163] of the central bank.[164] However, when a bank cannot obtain inside liquidity, the bank is likely 'running out of good security for collateralized loans and other (bank) lenders will not lend to it on an unsecured basis in the quantities required (at acceptable rates)' (Goodhart 2009 [1999]: 231). In addition, as previously noted by Bagehot (2005 [1920]), solvency depends on securities rather than on the borrower. Bagehot (2005 [1920]) indicated

[159] For example, Solow (2009 [1992]) and Flannery (2007 [1996]) are advocates for Goodhart's view.
[160] The solvency state of nature will be analysed in section 7.2.2.
[161] Section 7.2.2 presents several tests to determine the solvency of a bank.
[162] 'A sudden increase in a bank's cash needs would not cause an illiquidity loss if the bank's assets were perfectly marketable' (Guttentag and Herring 1987: 152).
[163] However, '[t]he greater the insistence of the [..] [central bank] on charging a "penalty rate" on its own LOLR loans, the greater the endeavour of commercial banks to use their existing good collateral to borrow in the market place first' (Goodhart 2009 [1999]: 231).
[164] Goodhart (2009 [1999]) noted that the discount rate is lower than the market rate at times, but he did not elaborate on this point. In this context, chapter 7 considers the cases of lower interest rates.

that the timing of securities is necessary to distinguish between good loans (solvent people) and bad loans (suspiciously solvent people). In this context, Goodhart (2009 [1999]: 230) argues that

'Bagehot's proposal related simply to the collateral that the applicant could offer, and the effect in practice was to distinguish, in part, between those loans on which the central bank might expect with some considerable probability to make a loss (bad bills and collateral) and those on which little, or no, loss should eventuate'.

Thus, Goodhart (2009 [1999]: 233) believes '[w]hen the [..][central bank] discounted "good bills" for a financial intermediary, it did not and could not at the same time estimate the borrower's solvency'. Given these considerations, 'liquidity and solvency are the heavenly twins of banking, frequently indistinguishable [because] an illiquid bank can rapidly become insolvent and an insolvent bank illiquid' (Goodhart 2008: 40). Similarly, Baltensperger (1990), Llewellyn (1999), Tirole (2002), Schwartz (2008, 2009), and Admati and Hellwig (2013) indicated that distinguishing between a liquidity problem and a solvency problem in times of financial distress is difficult and misguided (see also Baltensperger and Dermine 1987, Kaufman 2007 [1991], Crockett 1997, Freixas et al. 2007 [1999], Hirsch 2007 [1977], Birchler 2007a, Nakaso 2014). In this context, Baltensperger (1990: 11) noted '[a]lthough, on a conceptual basis, liquidity and solvency can be distinguished neatly, it is difficult, in practice, to separate them completely. In practice, the public perception of a 'liquidity problem' usually means that some doubts exist about the bank's solvency too'. Llewellyn (1999: 18) noted that 'it is in practice a blunt instrument and cannot, at the time it is used, and with incomplete information possessed by the central bank, always discriminate between fundamentally sound but illiquid banks and those that are in truth insolvent' (see also Freixas et al. 2007 [1999]). In other words, when the central bank must make a decision regarding ELA, there may be not enough time to assess the banks' solvency or insolvency. Likewise, Tirole (2002: 111) indicated that

'[m]any observers make a distinction between "illiquidity" and "insolvency". This distinction is unwarranted. There is never illiquidity without at least some suspicion regarding insolvency. If it were known that a [bank (or for a country)] in distress were solvent, then the [bank] would immediately receive liquidity assistance from a private financier (or a consortium of private financiers)'.

Furthermore, Schwartz (2008) indicated that if a bank enters into an ELA transaction (for example, the current financial crisis) and the bank accepts liquid assets (for example, mortgage-

backed securities (MBS)) that cannot be sold on the money market in time because the value is unknown in the balance sheet, the solvency status will be unknown. Thus, because 'a large part of a bank's assets consists of nonmarketable loans to customers, the repayability of these loans at par cannot be known with certainty to the potential last resort lender' (Crockett 1997: 25). Therefore, the central bank as the LOLR does not know if the borrowing bank is solvent. Consequently, the LOLR cannot distinguish between an illiquid bank and an insolvent bank; therefore, 'it may be desirable to rescue an insolvent bank because of contagion effects on sound banks' (Schwartz 2009: 452). In addition, Admati and Hellwig (2013: 93) noted that addressing liquidity problems 'without considering solvency is misguided because solvency problems are much more dangerous than liquidity problems. Indeed, liquidity problems are quite often caused by solvency problems, because concerns about solvency induce creditors to pull out'.[165] Similarly, Nyberg (2000: 2) indicated the following:

'[t]raditionally, ELA provided by central banks has been seen as a measure to deal with pure liquidity problems in banks that essentially are solvent. In practice, situations where pure liquidity problems arise seem to be rare. In most cases where banks face liquidity problems, there is some uncertainty about the solvency of the institutions involved'.

Conversely, opponents would argue that if a bank is insolvent, then ELA will not be able to survive.

'Furthermore, the redistribution of wealth from taxpayers to depositors, creditors and/or shareholders which occurs when an LLR offers assistance to an insolvent bank lacks political legitimacy and is difficult to justify on equity grounds. Moreover, market discipline may be seriously undermined if bank managers and creditors need not be concerned that the bank will lose access to emergency liquidity assistance when its net worth approaches zero'. (Guttentag and Herring 1987: 164)

Moreover, the competence of national regulatory authorities and fiscal authorities involves intervening with respect to insolvency problems, whereas the central bank's task is to intervene if liquidity problems arise (see Baltensperger and Dermine 1987, Heller and Kuhn 2007, Illing and König 2014). Therefore, in this dissertation, the cardinal principle is also that the central bank should not provide ELA to fundamentally insolvent institutions (see Tucker 2014).[166]

[165] Conversely, if a lender is confident that a bank is solvent and even illiquid (meaning the absence of uncertainty), he or she is unlikely to withdraw his or her deposits from the bank (see Admati and Hellwig 2013).

[166] 'The challenge is how to articulate and maintain a regime that does not slip (back) into supporting fundamentally bust firms' (Tucker 2014: 19). A possible solution would be to provide a clear solvency framework that assesses the bank's solvency as part of a cost-benefit analysis (see section 7.2.2).

Although we follow the cardinal principle, in practice, it is generally impossible to distinguish between illiquidity and insolvency. Based on this consideration, we formulate the third principle for the Swiss LOLR in the twenty-first century:

Principle 3: Lending freely to illiquid–solvent and temporarily insolvent banks.

Opponents would criticise lending to temporarily insolvent banks. However, distinguishing between fundamental insolvency and temporary insolvency is useful here. Fundamental insolvency means that a bank is insolvent and unable to return to viability, even in the medium and long run. Temporary insolvency means that in times of distress, the bank can be referred to as insolvent, but it can become viable and thus solvent in the medium and long run. According to this conceptual distinction, the political legitimacy used to justify the central bank's ELA on equity grounds is easier than in the case of fundamental solvency. Furthermore, solvency support (fundamental insolvency) by the government and liquidity support (illiquidity and temporary insolvency) by the central bank can be better distinguished in this way. Moreover, ELA is closely related to the characteristics of the borrower type. In the case of a temporarily insolvent, systemically important institution, the political legitimacy of the SNB will be easier because of its systemically important role in the economy. Furthermore, market discipline will be less undermined in the case of temporary insolvency than in the case of fundamental insolvency. Despite all these intentions, how to make solvency–insolvency operational remains a difficult question. Therefore, in section 7.2.2, we elaborate a potential solvency framework to make solvency operational.

The second myth is that domestic central banks are limited in the provision of high-powered money because, as Goodhart (2009 [1999]) indicated, (1) they cannot create foreign high-powered money; (2) 'they cannot force foreign creditors to accept payment in domestic liabilities, if the contract specifies otherwise' (Goodhart 2009 [1999]: 235); and (3) if they create additional domestic high-powered money to buy foreign high-powered money, for example, via FX swaps to steer liquidity, 'this would usually be largely or entirely offset by depreciation in the international value of the domestic currency' (Goodhart 2009 [1999]: 235). Consequently, the central bank's funding is limited. Furthermore, the central bank's capital is limited because behind its liabilities are the strength and taxing powers of the government rather than the capital of the central bank (see Goodhart 2009 [1999]).

The third myth is ‘that moral hazard is everywhere and at all times a major consideration’ (Goodhart 2009 [1999]: 238). The LOLR is a form of insurance in the banking sector, and any form of insurance must grapple with the moral hazard problem. As we noted in section 2.1.2, moral hazard is a result of asymmetric information that appears after the transaction between the principal (the central bank) and the agent (the bank). Likewise, asymmetric information exists about the bank and the central bank that provides ELA. The central bank faces certain difficulties because with the provision of ELA, the banks may take excessive risks to maximise their profits because they know that they will not suffer any losses from the LOLR if they behave carelessly. Likewise, Goodhart (2009 [1999]: 238) indicated that

‘loss will generally fall on those who have had no responsibility [(central bank)] for the decisions that led to the loss. This shifting of the burden from those closer to the source of the loss-making decisions [(banks)] to those further away, taxpayers, may cause the decision-makers [(banks)] to take riskier decisions for well known reasons – that is, moral hazard’.

In the same manner, Guttentag and Herring (1987), Baltensperger (1992), Llewellyn (1999) and Tucker (2014) noted that the LOLR threatens to create adverse effects and moral hazard. Thereby, the LOLR affects the behaviour of protected or insured bank agents to accept a greater risk and thus undermines the incentives of bondholders and other unsecured, uninsured creditors to monitor them. Although moral hazard is often considered a serious problem in the literature, the primary challenge lies between the economic costs (social costs) of allowing a domicile bank, particularly an SIB, to fail and the benefits of enhancing market discipline instead of refusing the provision of ELA by the central bank. In this context, the central bank must weigh costs, where moral hazard is part of the cost of the LOLR scheme, the cost of a bank failure and the cost of systemic panic and benefits (see Baltensperger 1992, Goodhart 2009 [1999]). Similarly, Solow (2007 [1992]: 205-206) noted that ‘to protect the monetary-financial system against socially destructive disturbance, then the failure of a large bank is clearly costlier than the failure of a small bank’ (see also Hirsch 2007 [1977]). In this sense, the financial crisis of 2007–2009 has shown that the cost of allowing a systemically important institute to fail (Lehman Brothers) is higher than the benefit of enhancing market discipline. Although the costs of the moral hazard problem must clearly be compared with its benefits, whether the benefits of future LOLR interventions are higher than the costs remains an open question (for example, in 1931, the German Reichsbank provided ELA to the insolvent, systemically important Danat Bank, but the Danat Bank was unable to return to viability; the Danat Bank went bankrupt in July 1931, creating enormous costs for taxpayers and the German

economy (see Schnabel 2004)). Thus, an LOLR intervention should be determined on a case-by-case basis and based on a clear systemic cost-benefit analysis (see the seventh principle in section 7.1).

The fourth myth is that the LOLR can be abolished. This myth relates to the third myth and to the myth of Goodfriend and King that ELA can only be provided through the market as a whole via OMOs. In this regard, Goodhart (2009 [1999]: 241) noted that

'given our history, it is unthinkable that any government or central bank would now stand idly by and watch the closure of any of its major banks, the realization of large-scale losses [of SIBs] on bank deposits of its citizens and the collapse of its financial markets, if the authorities could avoid such events. And they could avoid them by judicious LOLR'.

Therefore, the main challenge is 'how best to organise the LOLR function that will continue to exist both nationally and internationally' rather than abolishing it (Goodhart 2009 [1999]: 241, see also Goodhart and Illing 2009).

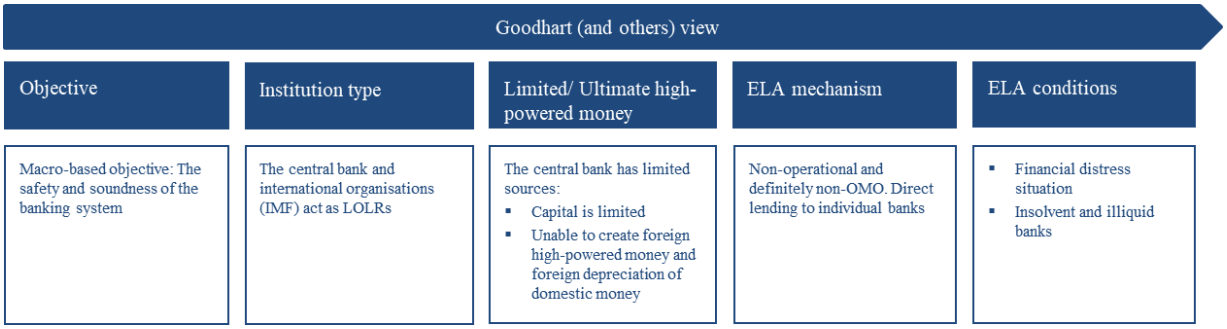
Given the above-mentioned considerations, we can summarise the LOLR with respect to our five characteristics. Figure 5.7 summarises the considerations of the Goodhart (and others) view. First, the objective of Goodhart's LOLR is focused on the safety and soundness of the banking system, not on individual banks, because of

'[t]he possibility of large shocks – for example, large jumps in asset prices, especially in crises when such a jump is downwards [(see section 2.2.3 on the risk-feedback loop)] – means that there may be multiple equilibria, to use the current jargon. Panic conditions can lead to circumstances where firms that would be viable during normal times become insolvent, though perhaps only temporarily. This syndrome may be especially serious in commercial banks' (Goodhart 2009 [1999]: 229-230).

Similarly, Solow (2007 [1992]: 210) indicated that the purpose of 'the lender of last resort is not to preserve individual banks from failure but to preserve the monetary-financial system'. Second, the central bank is the type of institution to provide domicile ELA, whereas the IMF can play the role of the LOLR on the international level. Third, Goodhart (2009 [1999]) indicated that the domestic and the international LOLR are limited sources of liquidity. A domestic LOLR has limited liquidity because it cannot create foreign currency and it has limited capital, as the strength and taxing power of the government is behind the liabilities rather than the capital of the central bank. Fourth, according to Goodhart (2009 [1999]), the ELA mechanism operates through the DW rather than OMOs because ELA is a direct bilateral loan from the central bank to the bank. Fifth, if a bank (borrower type) asks for assistance in a period

of financial distress, the liquidity and solvency problem can be neglected because central banks struggle to assess a bank's solvency (or lack thereof) during a period of distress. Furthermore, if a bank demands ELA, then the bank is of suspicious solvency because otherwise, it could have received inside liquidity on the market. Consequently, the LOLR should provide ELA to illiquid but temporarily insolvent institutions.

Figure 5.7 Contemporary school of thought – the Goodhart (and others) view



Source: Authors' own elaboration.

The alternative LOLR view

In the post-Keynesian literature, the central bank's role is explained according to two functions, namely, setting the interest rate in the short term or acting as the LOLR in times of financial turmoil. However, as Rochon and Rossi (2007: 542) clearly noted, the central bank 'not only sets the rate of interest, but it also intervenes on markets on a regular basis'. Therefore, the PK analysis is limited with respect to the central bank's functions and, in turn, with respect to the interpretation of the LOLR in modern economics. To fill this gap, Rochon and Rossi (2007) and Rossi (2007) provide a theory of endogenous money in central banking by combining the elements of circuit analysis (reflux mechanism) and PK theory (see section 1.1.2). We adopt the theory of endogenous money in central banking and show an alternative LOLR regime in the modern economy. However, before we extend beyond the LOLR, we consider the PK functions of central banking.

In the PK theory of central banking, we can distinguish between two functions, the accommodative function and the defensive function (see Eichner 1987, Rochon and Rossi 2007).

On the one hand, the accommodative function is the traditional function that is activated when an urgent need for commercial bank reserves arises.

'In this role the central bank agrees to supply reserves to the banking system on demand, usually as a result of increased economic activity. As the demand for bank credit increases and banks respond by increasing the supply to creditworthy borrowers, deposits are created against which banks must hold reserves with the central bank' (Rochon and Rossi 2007: 542).

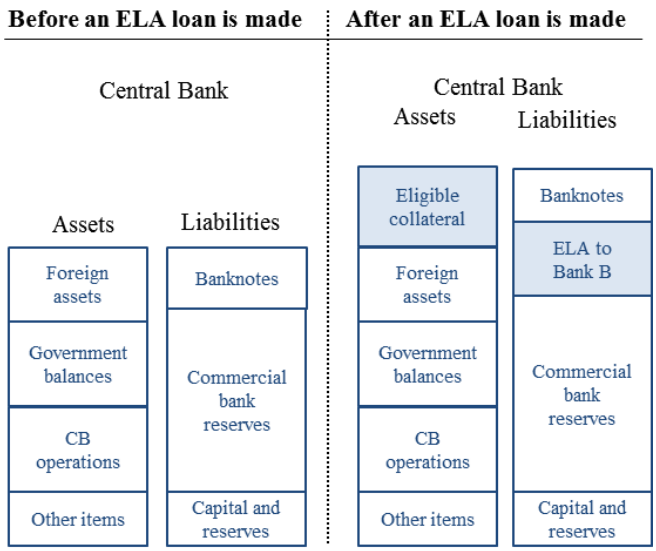
On the other hand, the defensive function is a consequence of the central bank's daily activities via OMOs on the interbank market. Although PK theory has downplayed this function because the total amount of commercial bank reserves remains unchanged, in central banking, OMOs play an essential role in daily operations, which goes beyond PK theory that primarily focuses on the accommodative function (see Rochon and Rossi 2007). According to the defensive function,

'any fall in liabilities will need to be offset by a sale of securities. Similarly, any changes in central bank assets will need to be neutralised by the sale or purchase of securities: an increase in central bank assets will need to be offset by the sale' (Rochon and Rossi 2007: 543).

In other words, OMOs adjust the overall commercial bank reserves based on the demand of the banking sector. Consequently, the central bank is omnipresent in the daily operations of the banking system, which goes beyond PK theory. Therefore, in a theory of endogenous money and central banking, both functions must be considered under PK and circuit theory. Next, we expand upon these considerations. For PK economists, the central bank acts as the LOLR and provides ELA at a high interest rate based on a bank's creditworthiness due to the demand for high-powered money, which is aligned with the classical Bagehot doctrine; the supply of money is thereby endogenous because it is demand-driven. According to double-entry accounting, whenever a central bank makes an ELA credit, it simultaneously creates a new eligible collateral of equal size on the liability side. Figure 5.8 illustrates the lending mechanism before and after an ELA credit is made by the central bank. Suppose SIB B requests an urgent ELA credit when no pre-existing ELA credit is available (before an ELA is made). The central bank offers an ELA credit and establishes an interest rate according to the creditworthiness related to the ELA credit of bank B. A new ELA credit is thus created on the liability side, and matching new eligible collateral is simultaneously created on the asset side on the central bank's balance sheet. In other words, the central bank creates its high-powered money by lending, and vice versa. Moreover, regarding the principle of double-entry accounting, the total central bank loan – in the form of an ELA credit – is equal to the total eligible collateral at any time. The ELA credit must be settled by bank B, which implies that its commercial bank reserves are not

available for funding when the bank repays the ELA credit (today and tomorrow). As previously mentioned in section 1.1.2, this phenomenon is called the reflux mechanism. Conversely, the flux mechanism is the creation of an ELA credit. Consequently, the central bank acts as an intermediary between one and the same agent, namely, bank B in different time periods, and bank B acts as the financial intermediary between one and the same agent (lender and borrower) in different time periods (today and tomorrow).

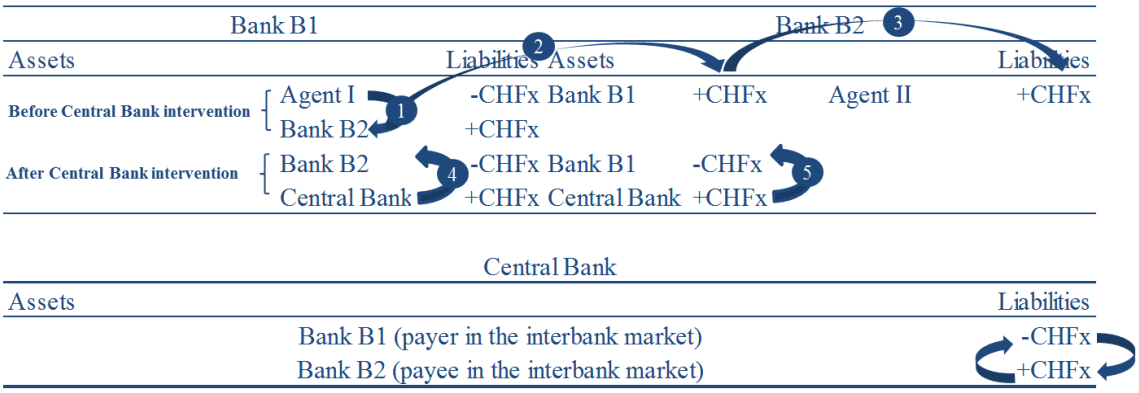
Figure 5.8 Before and after an ELA credit is made



Source: Authors' own elaboration.

The relationship between the central bank, the bank and the agent represents the 'tripartite relationship' between the payers, the payee and the banking system (Rochon and Rossi 2007). Table 5.1 describes the tripartite relationship of the central bank and two banks, B_1 and B_2, and the result of a payment between two agents of the two banks B_1 and B_2.

Table 5.1 High-powered money as a means of interbank settlements



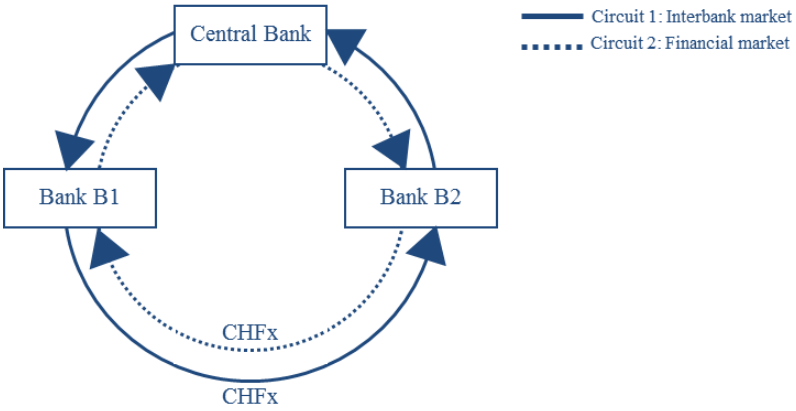
Source: Adapted from Rochon and Rossi (2007).

We assume the following: (1) a central bank deals with two SIBs, B_1 and B_2; (2) both banks are involved in a transaction between a payer, 'Agent I' of bank B_1, and a payee, 'Agent II' of bank B_2, under (3) normal circumstances and distressing circumstances. We first consider the situation in normal times. Table 5.1 describes the records of the changes in the accounting positions of the relevant agents in relation to a transaction between banks B_1 and B_2 before and after the central bank intervention (see Rochon and Rossi 2007, see also Rossi 2007). Suppose that in normal circumstances, Agent I (payer) initiates a payment worth -CHFx. On the one hand, in the books of bank B_1, +CHFx is transferred from the account of Agent I (see entry 1) to the account of bank B_2 (see entry 2). On the other hand, bank B_2 records the incoming payment from bank B_1 and credits the amount of +CHFx to Agent II's account (see entry 3). Thus, bank B_1 is indebted to bank B_2 in the amount of +CHFx as a result of the payment between Agent I and Agent II. However, Agent II has no further claims on Agent I. To settle the daily interbank positions of credit money[167] between Agent I and Agent II, bank B_1 requires high-powered money from the central bank. Based on its unlimited creation of high-powered money, the central bank offers high-powered money through OMOs (for example, repo transactions and the purchase of SNB bills) and/or standing facilities (for instance, intraday and/or overnight facilities) to bank B_1 at an interest rate. Thus, bank B_1 is now indebted to the central bank for an amount of central bank money equal to CHFx (see entry 5) (see Rochon and Rossi 2007), and bank B_2 is entitled to an equivalent deposit at the central bank (see entry 4). The high-powered money received from the central bank is used by bank B_1 to settle its payment to bank B_2. As shown in Figure 5.9 (circuit 1), this central bank money moves in a clockwise circular flow that will be repeated. Overall, high-powered money on the interbank market is created based on the demand of bank B_1 to settle its debt to bank B_2. Therefore, the central bank acts as a financial intermediary between banks B_1 and B_2 and provides credit money to bank B_1 on the grounds of the deposit of high-powered money in bank B_2's account (see Rochon and Rossi 2007). In addition, bank B_1 can find credit money (CHFx) on the financial market by entering into a bilateral transaction with bank B_2. To settle the financial payment, bank B_1 provides collateral to bank B_2 against credit money; thereby, bank B_1 forms deposits on the central bank, and bank B_2 demands high-powered money from the central bank via OMOs or standing facilities to settle the payment on the financial market, which is described in detail in Table 5.1 (see anticlockwise circuit 2 in Figure 5.10). 'Hence the central bank's financial intermediation

[167] Likewise, Thornton (1965 [1939]) conceptually distinguished between bank money or 'credit money' and central bank money or 'high-powered money', whereas high-powered money is a flow rather than a stock, as Thornton (1965 [1939]) mentioned. For a detailed discussion about money, see Rossi (2007), Rochon and Rossi (2013) and Rochon and Rossi (2016).

between bank B_1 and bank B_2 can be interpreted as a bilateral or multilateral transaction on securities' (Rochon and Rossi 2007: 551, see also Rossi 2007).

Figure 5.9 The two circuits of central bank money



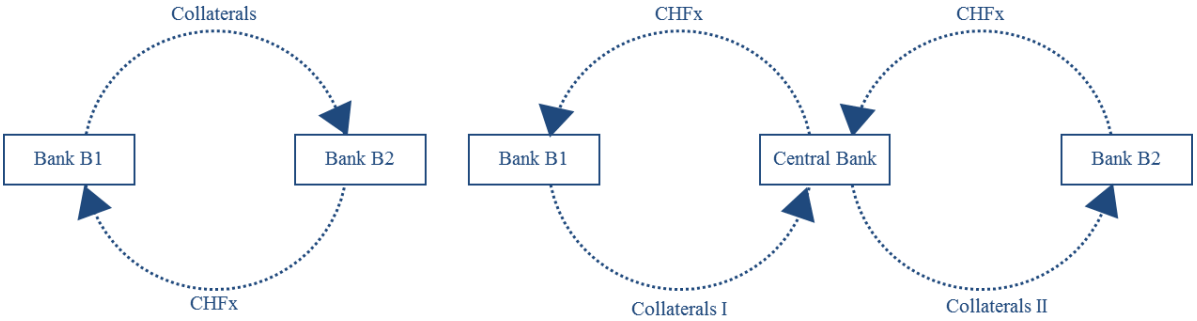
Sources: Rochon and Rossi (2007), Rossi (2007).

Table 5.2 A multilateral delivery-versus-payment transaction on collateral

Bank B1				Bank B2			
Assets		Liabilities		Assets			Liabilities
Collaterals (sold to CB)	-CHFx	Agent I	-CHFx	Collaterals (sold by CB)	+CHFx	Agent II	+CHFx

Source: Adapted from Rossi (2007).

Figure 5.10 Bilateral and multilateral financial market between banks



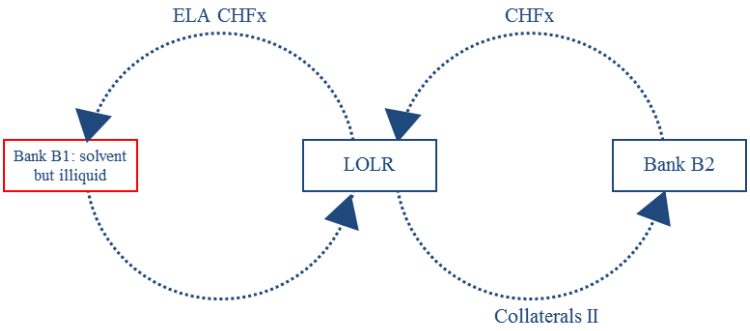
Source: Rochon and Rossi (2007).

The analysis above shows the central bank's essential defensive role via OMOs and standing facilities on the interbank market and the financial market in daily business. 'In other words, provided the defensive role is carried out effectively, thereby preventing systemic risk, the lender-of-last-resort role does not arise as often as the old literature has it' (Rochon and Rossi 2007: 551). The analysis also reveals 'a twofold endogenous phenomenon involving a money

creation, as well as a credit operation between the central bank and the banks that participate in the national payment system' (Rossi 2007: 79). In addition, the analysis suggests that the '[p]ost-Keynesian theory [of LOLR] and the theory of the monetary circuit are compatible and complement each other' (Rochon and Rossi 2007: 540). In light of these considerations, under normal circumstances, the central bank provides high-powered money via OMOs and standing facilities as a consequence of the demand for high-powered money to settle payments.

In times of financial distress, the above-mentioned mechanism can be regarded as similar but more complex. The main differences between normal times and times of distress are as follows: (1) bank B_1 is considered solvent and illiquid or temporarily insolvent in times of distress, whereas bank B_1 is considered solvent and liquid under normal circumstances; (2) the central bank acts as the LOLR as a result of the demand for ELA; and (3) the role of the LOLR can only be conducted via direct lending. Otherwise, inside liquidity, and thus the provision of high-powered money via OMOs or DW transactions, would be sufficient. Suppose that a solvent or temporarily insolvent bank B_1 is unable to find liquidity on the interbank market (inside liquidity) to settle its interbank market debt. Bank B_1 decides to use its commercial bank reserves, which usually bear no interest rate, to purchase collateral at an interest rate. In such a situation, the central bank acts as a financial intermediary between one and the same bank at different times (today and tomorrow) and provides ELA credit in high-powered money to B_1 as a result of its demand for credit money to settle a payment against eligible collateral at an interest rate (see Figure 5.11).

Figure 5.11 ELA in a multilateral interbank market between banks



Sources: Authors' own elaboration based on Rochon and Rossi (2007), Rossi (2007).

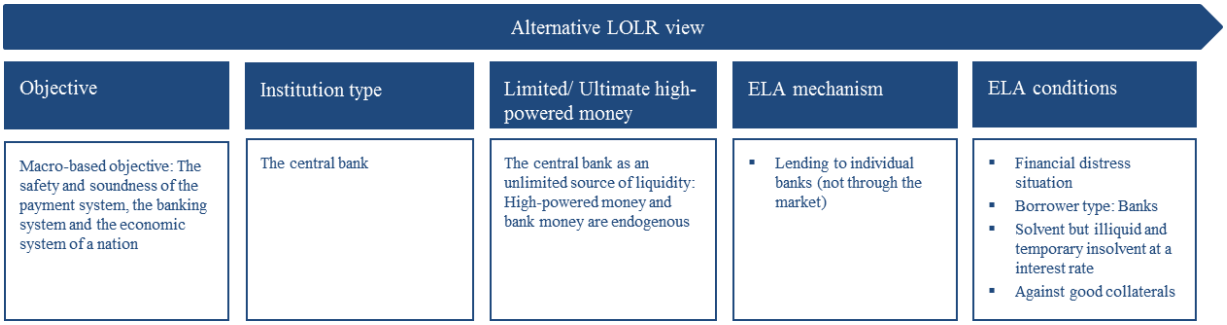
To offset the ELA payment in the amount of CHFx, the LOLR enters into a repo transaction with bank B_2 and sells collateral II in the amount of CHFx. Consequently, bank B_1 can 'clear its position towards the banking system as a whole, that the central bank intervenes by granting it a credit' (in the form of a repurchase agreement) (Rossi 1998: 78). In a nutshell, the reason

for an LOLR intervention depends on the presence of a market or bank failure that leads to a situation in which banks are unable to find inside liquidity on the interbank market to settle the final payment. This finding leads us to the same conclusion as in normal times, whereas the major finding is that the credit money and ELA provided by the LOLR are endogenous and created based on demand. In other words, the LOLR is 'a twofold endogenous phenomenon involving a money creation, as well as a credit operation between the central bank and the banks that participate in the national payment system' (Rossi 2007: 79). In this sense, we can formulate a fourth principle for the LOLR:

Principle 4: ELA from the LOLR is endogenous and created based on demand.

An additional finding is that PK theory and the theory of the monetary circuit are compatible and complement one another in relation to central banking (see Rochon and Rossi 2007). In short, the LOLR facilities ensure payment finality on the interbank market, financial stability in the banking system, and financial stability in the economic system. In other words, the LOLR has three macro-based objectives, namely, to guarantee the functioning of the payment system, to stabilise and create confidence in the banking system, and to do the same for the economic system. All these considerations are subsumed under the alternative LOLR view in Figure 5.12.

Figure 5.12 Overview of the alternative LOLR view



Source: Authors' own elaboration.

5.5. Summary

Next, we review the main considerations in chapter 5, in which we have presented the different schools of thought and provided detailed answers regarding the role of the LOLR that can be conducted via OMOs.

A controversial debate rages between two schools of thought regarding whether the LOLR can operate via OMOs. According to Goodfriend and King (2009 [1988]), the role of the LOLR can be performed via OMOs because financial markets are highly efficient in allocating credit. In addition, it is unclear whether the DW provides assistance at a lower cost than OMOs because the DW must evaluate asset prices correctly to provide an accurate discount rate; however, in times of distress, correctly evaluating asset prices and, in turn, liquidity and solvency is difficult. Hence, OMOs eliminate the need to evaluate asset prices. Because OMOs would be a better alternative for lending to individual institutions, the DW or any form of direct lending should be abolished. However, we do not agree with Goodfriend and King (2009 [1988]) on abolishing the DW and any form of direct lending for the following reasons: (1) In practice, both instruments are used, especially the LOLR, when SIBs fail. We use an analogy from medicine to explain this idea. Suppose that a patient suffers from a particular illness. A doctor has various instruments to heal the patient. In this sense, he or she is able to provide general health measures or direct targeted measures. In our context, the LOLR is the latter measure, whereas the MMLR is the former measure. To effectively heal the patient, a doctor would recommend an objective-oriented measure, that is, the LOLR. Therefore, abolishing the DW or any form of direct lending would be foolish. (2) As Humphrey (2010) clearly noted, the LOLR OMOs and other new crisis instruments are wrongly considered to be LOLRs. (3) As Goodhart 2009 [1999]) mentioned, distinguishing between the LOLR OMOs and the non-LOLR OMOs and between the LOLR QEs and the non-LOLR QEs is difficult; thus, as noted in chapters 4 and 5, the LOLR is non-operational and is considered to be direct lending. (4) Lending to individual institutions is required if inside liquidity is insufficient due to a shock that has system-wide impacts or aggregated uncertainty (see Holmström and Tirole 1998, Tirole 2002). Therefore, in normal times, OMOs are sufficient, but in irregular times, the LOLR may be needed if the MMLR cannot provide sufficient ELA. Consequently, in our view, if the MMLR does not have the desired effect on the interbank market, a combined MMLR and LOLR is needed. In other words, the challenge is to use the proper instrument in times of financial distress rather than abolishing direct lending. In this context, further academic research is desirable.

Next, in identifying the different LOLR schools of thought, we determined that the schools vary but also have similarities. For a better analysis of the LOLR schools of thought, we elaborate an LOLR analysis scheme that draws upon five characteristics: (1) the objective; (2) the institution type; (3) the limited and unlimited sources of high-powered money; (4) the emergency liquidity mechanism; and (5) emergency liquidity conditions. Based on these

characteristics, we analyse the four different schools of thought, namely, the ancient school of thought, the classical school of thought, the free banking school of thought, and the contemporary school of thought. The main representative of the ancient school of thought is Tiberius, whereas the classical school is characterised by the essential writings of Henry Thornton and Walter Bagehot. The contemporary school of thought can be divided into the Goodfriend and King view, the Goodhart (and others) view, and the alternative LOLR school of thought. According to our systematisation scheme, we find the following: (1) in all six views, the objective of the ELA is generally focused on a macro-based perspective regarding the safety and soundness of the entire economy or banking system. Thus, all schools of thought view the role of the LOLR as macro-based, namely, to limit system-wide financial distress and to avoid macroeconomic costs. (2) A broad range of institutions can act as LOLRs. In this sense, the Tiberian view regards the government as the LOLR institution; the Thornton view considers a bank (BoE) with specific characteristics to be the LOLR; and contemporary economists regard the central bank as the LOLR on the national level. (3) All schools of thought except the Goodhart view regard the LOLR as the ultimate source of high-powered money. Goodhart (2009 [1999]) counters this common assumption with the following arguments: (a) Central banks have limited capital. (b) Behind the liabilities of the central bank is the government (with taxpayers) rather than capital. Thus, the strength of the government determines the power of the central bank. (c) The central bank is unable to create foreign high-powered money, and when buying foreign high-powered money, the national currency would be depreciated. (4) According to the ELA mechanism, all schools of thought except the Goodfriend and King view consider the LOLR to be a concept through which central banks directly lend to individual banks rather than through the market. (5) ELA conditions vary with respect to borrowers – from NBNFIs to banks and NBFIs – as shown by the solvency-insolvency statuses and interest rates in Figure 5.13. For a better overview, see Figure 5.13, which summarise all LOLR schools of thought.

Nonetheless, the following four questions remain unanswered: (1) Why does the LOLR exist in Switzerland? (2) What conditions apply to the Swiss LOLR? (3) Should the LOLR provide ELA to NBFIs? (4) Should the LOLR provide ELA against wide or narrow classes of collateral? The next chapter answers the first two questions, whereas chapter 7 addresses the other two.

Figure 5.13 Overview of the LOLR schools of thought

	Tiberian view	Thornton's view	Bagehot's view	Goodfriend and King's view	The Goodhart (and other) view	The alternative view
Objective	Macro-based objective: The stability of the Roman economic system	Macro-based objective: BoE is publicly responsible for the whole economy	Macro-based objective: BoE is publicly responsible for the whole economy	Macro-based objective: The safety and soundness of the banking system via price stability	Macro-based objective: The safety and soundness of the banking system	Macro-based objective: The safety and soundness of the payment system, the banking system and the economic system of a nation
Institution type	Government, represented by the Roman Emperor	BoE = Bank	BoE = Central Bank (according to the 1844 Bank Charter Act, the BoE receives a monopoly on the supply of banknotes)	The central bank acts as the market maker of last resort (MMLR)	The central bank and international organisations (IMF) act as LOLRs	The central bank
Limited/ultimate source of high-powered money	Government, represented by the Roman Emperor. Roman Emperor has the exclusive right to issue money (gold and silver coins)	▪ BoE has a unique monopoly on high-powered money (gold and BoE notes) ▪ Must manage and hold sufficient reserves	• All banks depend on BoE • BoE has a unique monopoly on high-powered money (gold and BoE notes) • Must manage and hold sufficient reserves	The central bank (the Fed) has the power to create high-powered money	The central bank has limited sources: ▪ Capital is limited ▪ Unable to create foreign high-powered money and foreign depreciation of domestic money	The central bank as an unlimited source of liquidity: High-powered money and bank money are endogenous
ELA mechanism	Direct loans of hundred million sesterces to borrowers	Direct lending via discount of bills of exchange	Direct lending via discount of bills of exchange	Lending via open market operations (OMO)	Non-operational and definitely non-OMO. Direct lending to individual banks	▪ Lending to individual banks (not through the market)
ELA conditions	▪ In times of financial distress ▪ To illiquid and insolvent landowners ▪ Freely (without interest) for a given time (three years)	▪ Public duty to expand notes in a temporary financial distress situation ▪ Provide liquidity (BoE notes) freely ▪ To illiquid but solvent borrowers	▪ In times of financial distress ▪ To solvent but illiquid borrowers (e.g., merchants and minor bankers) ▪ Against good collateral ▪ At a very high interest rate	▪ In times of financial distress ▪ To solvent but illiquid borrowers ▪ Borrower type: deposit institution at the central bank	▪ Financial distress situation ▪ Insolvent and illiquid banks	▪ Financial distress situation ▪ Borrower type: Banks ▪ Solvent but illiquid and temporary insolvent at a interest rate ▪ Against good collaterals

Source: Authors' own elaboration.

6. A historical perspective of the Swiss lender of last resort

The role of the Swiss LOLR is indispensable in relation to the evolution of the SNB, and the evolution of the SNB is closely linked with the political evolution of Switzerland (see Weber 1992). Therefore, a historical overview of the SNB is necessary to understand the key role of the Swiss LOLR. Based on numerous historical data, Figure 6.1 provides a comprehensive overview of the evolution of the SNB and decisive key events of the LOLR. Figure 6.1 shows the economic schools of thought,[168] the LOLR schools of thought periods, and the historical evolution of the Swiss LOLR. The evolution of the Swiss LOLR is marked in blue and can be broadly divided into three time periods: the free-banking period from 1826 to 1881, the transition period from 1881 to 1907, and the central bank period from 1907 until today. Furthermore, the central bank period can be divided into two subperiods: the constructive ambiguity period from 1907 to 2004 and the constructive clarity period from 2004 until today. These decisive historical data, which have an impact on the evolution of the SNB and the Swiss LOLR, are presented in bold. In this context, the following data are essential: the Franco-Prussian War of 1807, also known as the German-French War; the Federal Banking Law of 1881; the establishment of the SNB in 1907; the 1990 Swiss mortgage crisis; and the revision of the NBA in 2004. In the following sections, we describe the evolution of the SNB and the Swiss LOLR.

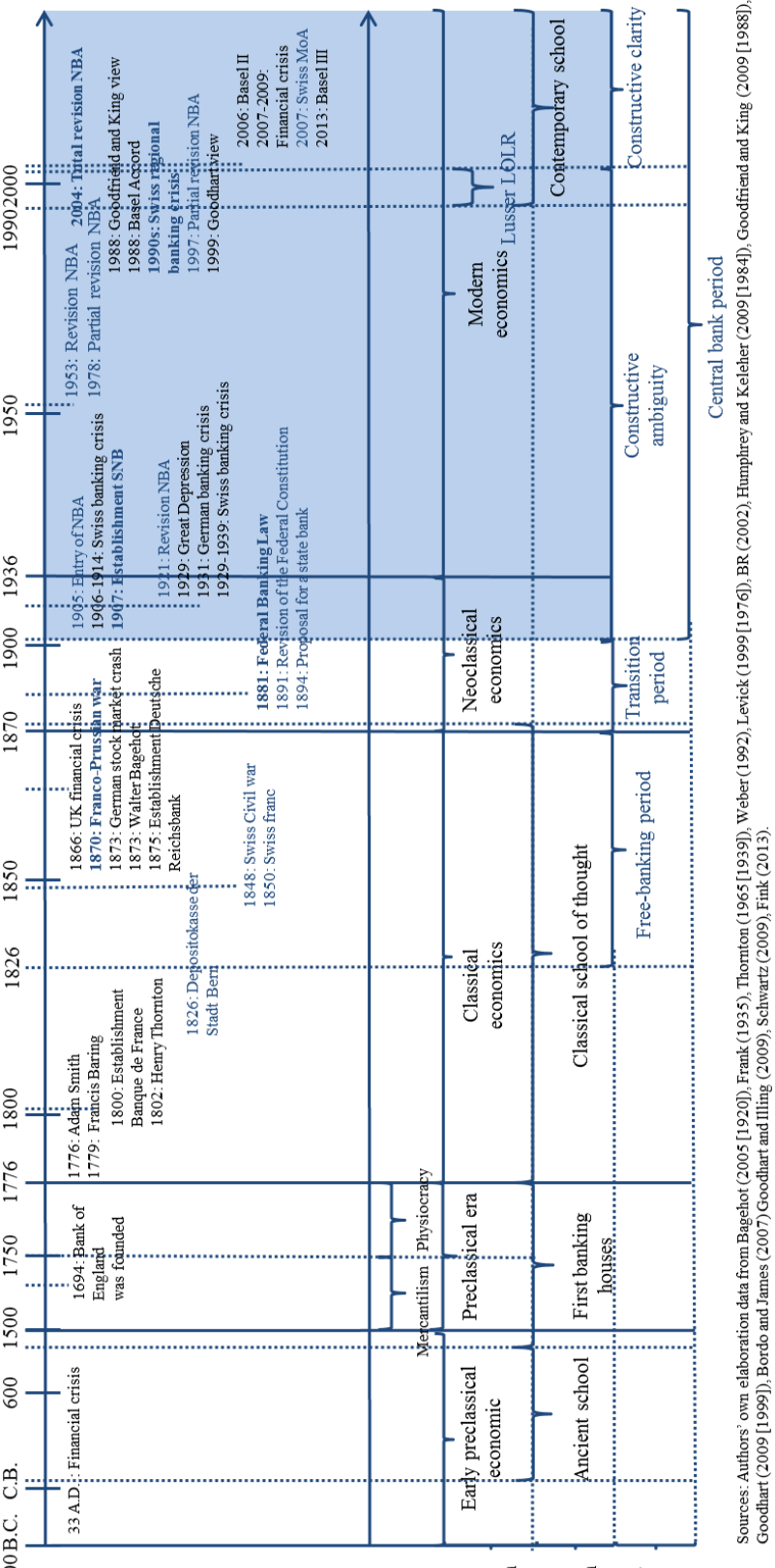
6.1. Switzerland before the Swiss National Bank from 1826 to 1881

The period between 1826 and 1881 is described as the free banking[169] period, a designation agreed upon in the literature by free-banking proponents such as Ritzmann (1996) and Weber (1992) and central bank proponents such as Bordo and James (2007). This period was closely linked to the political evolution of the federal republic, the close relationship with the French banking sector and the Franco-Prussian War. Let us briefly illuminate the period from 1826 to 1881.

[168] The different economic schools of thought will be analysed in Appendix 3.

[169] As we noted in sections 1.2.2 and 5.1, a free banking system is understood as a banking system without any government intervention, particularly without any central bank. For free-banking economists (Weber 1992, Ritzmann 1996), the Swiss free banking period is a perfect example of the absence of government intervention because no Swiss banking crisis of systemic importance appeared until the mid-nineteenth century (see Weber 1992, Bordo and James 2007, Fink 2013).

Figure 6.1 The evolution of the SNB and the Swiss LOLR



Sources: Authors' own elaboration data from Bagehot (2005 [1920]), Frank (1935), Thornton (1965 [1939]), Weber (1992), Levick (1999 [1976]), BR (2002), Humphrey and Keleher (2009 [1984]), Goodfriend and King (2009 [1988]), Goodhart (2009 [1999]), Bordo and James (2007) Goodhart and Illing (2009), Schwartz (2009), Fink (2013).

From 1826 until the mid-1840s, the Swiss banking sector was dominated by private bankers with close relationships to the aristocracy. In 1826, the first domestic Swiss bank was established, namely, the Depositokasse der Stadt Bern (see Weber 1992, Fink 2013). The Depositokasse der Stadt Bern was followed by the Kantonalbank von Bern (1834), the Bank of Zürich (1837–1906) and the Bank of St. Gallen (1837–1907). In the aftermath of a liberal revolution in 1830s and 1840s, the Swiss banking sector was deregulated, and banks could issue free banknotes in various forms and denominations.

After the mid-1840s, the liberals (Protestants) gained more control in the industrialised cantons, and a brief civil war in 1848 broke out against the Alpine cantons (Catholics); the victory of the liberal cantons converted Switzerland into a federal republic (Weber 1992). As a result of the civil war in 1848, the first Federal Constitution of the Swiss Confederation (FCSC) established that the Swiss Confederation had the exclusive right to mint coins. In 1850, the federal republic reformed the Swiss currency system, merging the multiple Swiss currency system into a single currency system (namely, the Swiss franc) and leaving the control to issue banknotes to the domestic banks in a 'decentralised banking system'. Therefore, the number of banknote issuers increased considerably until the 1880s.[170]

Another characteristic of the Swiss banking system was its close relationship with the French banking sector until the mid-nineteenth century. Thereby, the Banque de France[171] practically played a central banking role in the Swiss banking system (see Bordo and James 2007). Through this close relationship, domestic Swiss banks could convert French banknotes into Swiss gold, silver coins and banknotes, and vice versa. This French connection played an essential role in Switzerland's transition period from a decentralised system to a centralised system. Overall, the Swiss free banking system was characterised as a decentralised and deregulated system without any considerable degree of bank regulation.[172] Weber (1992) indicated that no legal tender laws existed. Under the Swiss free banking system, there was a combination of Swiss banknotes and French banknotes, and domestic banks had the exclusive right to issue banknotes without any requirements. Every domestic bank could create and design banknotes of 50, 100, 500 or 1000 Swiss Francs on their own. Thus, on the one hand, gold, silver coins, various Swiss banknotes and French banknotes guaranteed a liquid banking system. On the other hand, the presence of various banknotes meant that the banking system

[170] 'By 1850, 11 banks issued notes in Switzerland. […]. In 1865, 29 banks issued banknotes. […]. By 1880 the number of note issuing banks increased to 37' (Fink 2013: 4, see Weber 1992).
[171] The Banque de France was founded in 1800.
[172] Opponents question the accuracy of this point because private banks should meet reserve and capital requirements with respect to their articles of association. Although this is true, with regard to issuing banknotes, the system was free from regulation.

could have been experiencing banknote chaos. However, the free banking model worked well because no banking crisis of systemic importance occurred. Consequently, Weber (1992: 205) suggested that 'competition provided a stable monetary system in Switzerland in which the purchasing power of bank notes equalled that of specie and only one bank failed'.

However, in the 1860s and 1870s, the political climate change against the liberals in favour of the radicals was enhanced by the outbreak of the Franco-Prussian War in 1870, opening the way for a centralised banking system.

6.2. The origins of the Swiss National Bank from 1870 to 1907

The years between 1870 and 1907 constituted a transitional phase during which Switzerland moved from a free banking system towards a centralised central bank system. The free banking model was in doubt for the following reasons: (1) The political climate changed as a result of industrialisation. On the one hand, the Swiss economy grew rapidly and demanded more banknotes, whereas, on the other hand, social regulations were also in demand. (2) A tax of one per cent per annum on the circulation of banknotes was imposed by several cantons, which particularly affected the costs of the Bank of Zürich and its supply of banknotes. (3) A market failure due to asymmetric information occurred as a result of the Franco-Prussian War in 1870. Let us expand on this point. The Banque de France increased its monetary base of French banknotes to fund the enormous military expenditures during the war. The increase in French banknotes led to a depreciation of the French currency and a suspicion in Switzerland regarding the value of French banknotes (asymmetric information). Therefore, the Swiss banks decided to suspend the conversion of French banknotes into Swiss gold, silver and banknotes. As a result, a reflux of French banknotes occurred, leading to a drying up of banknotes that could not be balanced with domestic banknotes (temporary liquidity problem). This event called the free banking system into question. Furthermore, Weber (1992), Bordo and James (2007), and Fink (2013) indicated that the effect had been enhanced by Switzerland's membership in the Latin Monetary Union[173] with Italy, France and Belgium since 1865 (see Kindleberger 2006 [1984]). In the words of Fink (2013: 13), 'the Swiss Franc was continually pushed beyond the upper gold point. Arbitrageurs grasped the opportunity and used Swiss banknotes to buy gold in Switzerland only to cross the border to France and sell it again'. (4) The banknote chaos

[173] The rationale for the Latin Monetary Union was to reduce the fineness of the 5-franc pieces of the member state to limit their disappearance because of mint undervaluation (see Kindleberger 2006 [1984]). According to Kindleberger (2006 [1984]: 66), '[f]rom 1865 to 1867, the Latin Monetary Union worked reasonably well, and its success suggested the desirability of expanding it to arrive at a "universal money"'.

exacerbated the temporary liquidity problem because a decentralised system was assumed to be too inflexible to accommodate the demand for banknotes. Therefore, at the end of the nineteenth century, a system with many issuing banks was generally assumed to be more disadvantageous than a system with a smaller number of regulated issuing banks, thereby providing at least one reason for bank regulation in Switzerland.

Hence, in 1881, the Federal Banking Law came into force to mitigate the banknote chaos. Thereafter, the Swiss banking system could no longer be considered a free banking system. The Federal Banking Law stated that joint stock banks[174] and cantonal banks[175] had the privilege of issuing banknotes under five regulatory requirements. First, they had to have minimal reserve requirements of precious metals (such as gold and silver). The banks thus had to have at least 40 per cent of their banknote circulation in reserves. Second, the regulatory capital had to correspond to at least one-third of the banknote circulation. Third, each bank had to accept the Swiss banknotes of other banks. Fourth, banknotes had to be standardised to mitigate the banknote chaos (see Weber 1992). Fifth, the banks had to submit weekly and monthly statements to the government. Moreover, the tax of one per cent had been reduced to 0.6 per cent. However, the Federal Banking Law[176] did not have the desired success because the circulation of banknotes could not accommodate the demand for banknotes. Therefore, '[c]alls for the creation of a central bank endowed with a money-issuing privilege became increasingly vociferous' (SNB 2015b: 6). In 1891, the Federal Assembly revised Art. 39 of the FCSC, giving the Confederation the exclusive right to issue banknotes. In other words, an early decentralised system became a centralised system with the government as the early monetary authority.

However, after the revision of Art. 39 of the FCSC, the SNB was founded sixteen years later; its foundation was delayed because of a controversial discussion between radicals and liberals in the Swiss parliament regarding the design of the monetary architecture. For example, in 1894, the radicals proposed establishing a state bank, but the proposal was rejected by the

[174] Joint stock banks are stock corporations with shares owned by private investors. In this context, Bagehot (2005 [1920]) was one of the first to analyse joint stock banks. According to Bagehot (2005 [1920]: 167), joint stock banks have the following three characteristics: '- 1st. Those in which the capital is used not to work the business but to guarantee the business. Thus a banker's business – his proper business – does not begin while he is using his own money; it commences when he begins to use the capital of others. […]. 2ndly. Those companies have answered which have an exclusive privilege which they have used with judgment, or which possibly was so very profitable as to enable them to thrive with little judgment. 3rdly. Those which have undertaken a business both large and simple – employing more money than most individuals or private firms have at command'.

[175] Cantonal banks are stock corporations with shares owned by investors but primarily by the Swiss cantons. Thus, cantonal banks hold an implicit guarantee of the assets by the Swiss canton.

[176] This presents an additional argument for our RIH because the regulatory policy was not target oriented to the market failure.

Swiss people in a national referendum and provided the opportunity for a compromise (see BR 2002, SNB 2015b).

6.3. The Swiss National Bank as the LOLR from 1907 to 2016

In 1906, an acceptable compromise between radicals and liberals led to the foundation of the SNB as a joint-stock company, with two head offices in Bern and Zurich (see Art. 3 para. 3 of the NBA 2000 [1953] and Art. 3 para. 1 of the NBA 2016 [2003]). In the same year, the NBA came into force, and in June 1907, the SNB was finally founded. The SNB had an exclusive note-issuing privilege and a mandate to conduct the country's monetary policy. In accordance with Art. 99 para. 1 of the FCSC (2016 [1999]), the SNB acted independently and served in the interest of Switzerland. Thereby, the SNB had two objectives: (1) price stability and, (2) after the 2004 revision of the NBA, financial stability, an assumed prerequisite[177] for an effective[178] monetary policy (see BIS 2011, Hellwig 2015b). Although the SNB had no clear commitment to act as the LOLR from 1907 to 2004, the public perception was that if inside liquidity was insufficient and the stability of the Swiss banking system was in jeopardy, the SNB had the public duty to act as the LOLR and to provide domestic liquidity in the interest of Switzerland (see Art. 99 para. 1 of the FCSC (2016 [1999])). Thereby, the SNB would determine whether to save a crisis-stricken bank with ELA or allow it to fail. The vague strategy that the financial institutions take regarding whether they will receive ELA is described as the '*constructive ambivalence strategy*',[179] which seeks to mitigate moral hazard and enhance market discipline[180] (see Guttentag and Herring 1987, Blattner and Manz 2005, Schwartz 2009, Zürcher and Held 2009, Birchler et al. 2010). Conversely, the SNB can clearly communicate its liquidity provision to a financial institution, which is known as a '*constructive clarity strategy*', a clear explicit commitment of the central bank. According to these strategies, the SNB faces a trade-off as the LOLR. On the one hand, the LOLR can provide ELA to banks,

[177] According to the BIS (2011), financial stability is a key prerequisite and support of the effectiveness and efficiency of monetary policy (and vice versa). Similarly, Hellwig (2015b: 11) noted 'that financial stability is a prerequisite for macroeconomic stability or at least the reliability of the monetary transmission mechanism'. Although financial stability is commonly known to be a prerequisite of price stability, we should consider this relationship more critically. For example, Schwartz (1998: 41) indicated that 'monetary stability is a prerequisite of price stability, and price stability is a prerequisite of financial stability'. Therefore, a clear analysis of the direction of the main objective of central bank policy is needed to resolve the controversial discussion surrounding price and financial stability.

[178] Here, 'effective' means that the central bank intervention is problem oriented (see part I and Hellwig 2007).

[179] The constructive ambivalence strategy has its origins in the language of diplomacy and will be used between controversial negotiation partners to achieve a partial solution via ambiguous remarks (see Heller and Kuhn 2007).

[180] Market discipline fails to enhance stability in practice because markets have asymmetric information with which to evaluate the safety and soundness of banks (see Guttentag and Herring 1987).

providing sufficient liquidity during a panic or crisis.[181] On the other hand, a banking panic, particularly an SIB panic, should not be exacerbated by an intervention, which could lead to a collapse of the banking system. The bank can pursue two independent strategies. In the first strategy, the bank does not expect to be rescued, which is also consistent with the selection mechanism of the market. Therefore, the bank has no incentive to invest in risky businesses. In the second strategy, an SIB expects to be rescued by the SNB in the event of either danger or the collapse of the banking sector. Given the strategies presented, four possible payouts can be made, as listed in Table 6.1: (1) the ideal case, (2) laissez-faire, (3) panic or crisis, and (4) too important to fail.

Table 6.1 ELA and no ELA payoff matrix

		Lender of last resort	
		No ELA	ELA
Bank	Does not expect to be rescued	Laissez-faire	Ideal case
	Expects to be rescued	Panic or crisis	Too important to fail

Source: Adapted from Birchler et al. (2010).

Given the four possible payouts, what is a realistic LOLR policy? The ideal case is based on an irrational ('ethical') bank decision that is unlikely to occur. Second, a panic or crisis is the opposite situation. The 2007 financial crisis showed that given authorities' initial passivity regarding Lehman Brothers and the subsequent rescue of several SIBs, the safety of the banking system was no longer believable (see also Zürcher and Held 2009 and Kashyap et al. 2011). Consequently, a de facto government guarantee for SIBs is mentioned. The realistic objectives of measures thus lie between 'laissez-faire' and 'too important to fail' (see Table 6.1). With regard to the ambivalence and clarity strategy, there is a controversial discussion in the literature. In the follow paragraphs, we expand on this point.

[181] Similar to Schwartz (2007), we distinguish between a banking panic and a banking crisis. Schwartz (2009: 457) indicated that a 'panic occurs in the money market and is a threat to the economy's payments system. A panic can be quickly ended by a lender of last resort. […]. A financial crisis occurs when asset prices plunge, whether prices of equities, real estate, or commodities, when the exchange value of a national currency experiences substantial depreciation; when a large financial or nonfinancial firm or an industry faces bankruptcy, or a sovereign debtor defaults'.

The following arguments elucidate the discussion of both strategies. (1) According to Guttentag and Herring (1987), ambiguity discriminates against institutions such as small and medium-sized banks because depositors, based on their expectations, are encouraged to make their deposits in an SIB that has an implicit government guarantee (see Guttentag and Herring 1987). Conversely, Baltensperger (1992: 447) clearly indicated that if depositors expect that SIBs are rescued, then irrespective of the use of a constructive ambivalence strategy or an explicit strategy, 'the degree of financial market stabilisation reached should also be the same, regardless of the announcement policy perused'. Thus, the first argument cannot be the main reason for a constructive clarity strategy. (2) Ambiguity is difficult to define because the timing of an intervention is unclear, which creates uncertainty for market participants and a loss of confidence (see Freixas et al. 2007 [1999]). Therefore, ambiguity incentivises a panic-based run, thus weakening the stability of the banking system. It also creates 'bad equilibria' (see Guttentag and Herring 1987, Illing and König 2014). In other words, '[a]mbiguity led to significant – and ultimately damaging – uncertainty about the circumstances in which the bank would lend, and the terms and conditions at which it would do so' (Hauser 2014: 86). Furthermore, Hauser (2014) noted that banks' expectations vary from optimistic ELA support in the pre-crisis period to excess pessimism later in the crisis because of no clear commitment (for example, the Continental Illinois case,[182] the East Asian crisis in the 1990s[183] and the financial crisis of 2007–2009). (3) The constructive clarity strategy cannot fully eliminate the possibility of a bank run; for example, if depositors expect that other depositors will withdraw their deposits, a fundamental bank run will occur (see section 2.2.2). (4) Compared with an ambiguity strategy, clear and transparent commitment reduces aggregate uncertainty in the fragile banking system because 'at a certain point in [a period of financial distress], when the system became too fragile to withstand disruption associated with a major failure, constructive ambiguity [will be seen] as impossible. That was true not only for banks but also for bank-like institutions' (Domanski et al. 2014: 61). Therefore, the banking sector's role as a source of fragility justifies an explicit commitment rather than a vague one. (5) In addition, although the LOLR is averse to ex-ante guarantees (time inconsistency problem), Guttentag and Herring (1987: 171) believe 'this is a very weak case because the implicit guarantees offers large banks under the policy of ambiguity result in only minimal ex-ante discipline'. (6) According to Bagehot (2005 [1920]), the central bank should follow a policy that the public can clearly

[182] Guttentag and Herring (1987) describe the Continental Illinois case.
[183] Nakaso (2014) analyses the LOLR policy during the East Asian crisis in the 1990s.

understand because the central bank is the ultimate source of domestic high-powered money. In relation to the controversial discussion on strategies, which strategy does the SNB follow?

In Switzerland, a series of bank crises occurred in 1906, 1914, 1916, the 1930s,[184] and particularly the 1990s before the SNB decided to follow a constructive clarity strategy. Although the SNB eventually made this decision, it had acted as the LOLR and provided ELA during different crises. As the LOLR, the SNB provided the first ELA during the banking crises of 1906 and 1914 to the Banca Popolare Ticinese in the amount of CHF 1,5 million. However, the amount of ELA was insufficient. Therefore, the bank went bankrupt (see Wetter 1918, Bordo and James 2007). During this banking crisis, numerous small banks (in total, 83 banks) went bankrupt. The repercussions in the Swiss banking sector were a capital loss of CHF 53,5 million and credit defaults in the amount of CHF 59 million. The second provision of ELA occurred in 1916, when the SNB acted as the LOLR against rediscounted bills to rescue the Basler Hyphotekenbank (see Bordo and James 2007). The LOLR's third ELA provision occurred from 2007–2009. Notably, from 1906 until today, the SNB has provided corrective actions through the market.

Nevertheless, several financial crises in the 1970s (such as the oil crisis, 1973–1975) and 1990s (the real estate crisis, 1991–1994) occurred before the SNB began thinking about implementing a constructive clarity strategy as an LOLR. The Swiss real estate crisis in the 1990s was what set the ball rolling towards a constructive clarity approach for the twentieth century. Let us illuminate the real estate crisis of 1991 and 1992. In the literature, four main causes have been detected concerning the real estate crisis (see Birchler 2007b): (1) The cartel arrangements in the Swiss banking sector are one cause. Until the end of the 1980s, the Swiss banking sector was characterised by several cartel arrangements under the Swiss Bankers Association. Towards the end of the 1980s, the bank cartels were dissolved voluntarily or under pressure from the Competition and Markets Authority. The end of the bank cartels meant that less-profitable banks faced difficulties and went bankrupt (see Birchler 2007b). (2) The Swiss economy and the real estate market were overheated and characterised by low interest rates and high prices.[185] Birchler (2007b) indicated that the prices for single-family houses doubled

[184] With the outbreak of the financial crisis in 1929 and the bankruptcy of several banks in Germany and Austria, the liquidity situation of several Swiss banks deteriorated because they held approximately 13 per cent of the total short-term current liabilities of Germany. In this context, the balance sheets of the eight largest Swiss banks were cut in half (see Bordo and James 2007). In response to the German banking crisis in the 1930s, the former FINMA, namely, the SFBC, was founded. The Swiss banking sector thus was and is closely linked to the EU banking sector. Because of this interconnectedness, a crisis in the EU banking sector can spill over into the Swiss banking sector and harm the real economy.

[185] Similarly, as in 1991, the Swiss housing market is currently characterised as follows: (1) housing prices are high; (2) interest rates are low (zero); and (3) mortgage rates are low. Therefore, the probability of another Swiss

between 1980 and 1990. In other words, the housing boom was the cause of banks continuing to increase their exposure[186] to the Swiss commercial real estate mortgage market (see Birchler 2007b). (3) The Swiss mortgage business had been expanded considerably as higher house prices allowed householders to receive higher mortgages. Higher mortgages triggered an upward price trend in the housing market (hidden mortgage exposure for banks) (see Hellwig 1995). (4) Furthermore, in 1991, the upward price trend ended as the SNB, in agreement with the Federal Council, decided to adhere to a restrictive monetary policy.[187] In this sense, a medium-term expansion of money supply by approximately one per cent per year was instituted to stabilise the pricing system. As a result of restrictive monetary policy, interest rates for mortgages increased from five per cent to approximately eight per cent. Given these causes and our risk feedback loop on the mortgage market (see Figure 2.5), we can explain the real estate crisis of the 1990s. As we noted, the SNB initiated a mortgage-related shock of three per cent. The asset shock led to an immediate corrective action on the asset side of several domestic banks because numerous householders had difficulties or could not afford to settle their mortgages. Consequently, numerous banks increased their interest rates on mortgages to reduce the expected risk of further mortgage-related defaults. Therefore, housing prices dropped due to increased mortgage rates (adverse price effects), which led to further impairments of the mortgage positions on the banks' balance sheets. According to Birchler (2007b), the mortgage positions of SIBs, namely, UBS and Credit Suisse, were impaired by 10 per cent. However, UBS and Credit Suisse balanced their losses through gains in other business areas, particularly the investment banking division. Therefore, we are sceptical today that a less-intensive investment banking strategy had the desirable effects under a regulatory perspective. The cantonal and regional banks had to write off five per cent of their mortgage positions, which led to the bankruptcy of the medium-sized regional bank Spar- und Leihkasse Thun (SLT), which had approximately 46,000 deposit accounts, approximately CHF 1 billion in assets, and an expensive 14-year liquidation process (see Birchler 2007b, SFBC 2008a).[188] The bankruptcy of SLT directly caused immediate losses and liquidity problems for other interconnected Swiss regional banks (see Figure 2.7 on the domino model of bank contagion). Birchler (2007b) indicated that as a consequence of the SLT bankruptcy, 180 regional banks disappeared from

mortgage crisis is practically a given. However, a detailed analysis of the mortgage market, particularly of the securitisation of Swiss mortgage-related securities, is desirable.

[186] 'Exposure describes the extent to which a position is exposed to a risk. In this context, exposure may be expressed as a nominal figure (e.g. credit risk) or mark-to-market exposure (fair value) after taking into account current market fluctuations (market prices)' (FINMA 2009: 59).

[187] The following question remains unanswered: when does the SNB decide to adhere to a restrictive monetary policy that will have an impact on the real estate market?

[188] In 2005, the liquidation process had been completed (see SFBC 2008a).

the Swiss banking sector. To overcome liquidity problems and restore confidence in regional banks, a special committee of the SNB and the major domestic banks was established by the Swiss Federal Banking Commission (SFBC, the forerunner of the FINMA). The special committee proposed various solutions to end the real estate crisis (for example, the SNB should act as the LOLR and provide ELA to all solvent banks that fulfil the capital requirement of Basel I). Although the SNB could have acted as the LOLR, the liquidity problem had been managed by the Swiss banking sector (through collective action) without any form of government or central bank intervention.

Nevertheless, the real estate crisis opened up a discussion about the role of the SNB during the crisis and the ways in which the solution was organised. In the aftermath of the real estate crisis, the vice president of the SNB's board of directors, Markus Lusser, proposed an explicit commitment. The SNB would act as the LOLR and provide ELA under the following three conditions: (1) against good eligible collateral, (2) to solvent but illiquid banks and (3) on a discretionary basis (see Lusser 1993). Because of the real estate crisis in 1990, the SNB concluded that the NBA and the constructive ambivalent strategy of the LOLR was not up to date (see BR 2002), the collective crisis management of the Swiss banking sector was unreliable (see BR 2002), and the NBA of 1953 limited the role of the SNB as the LOLR in terms of the narrow range of collateral and would thus be inflexible in any forthcoming periods of financial distress (see Birchler 2007a). In other words, Art. 14 para. 4 of the NBA (2000 [1953]) limited the provision of ELA as follows:

Art. 14 Scope of Business of the National Bank

4. The granting of the interest-bearing loans on a current account basis with a maximum of ten days' period of notice to pledging bonds in Switzerland, Swiss debt-register claim, discounted drafts and gold. Shares and cooperative shares are excluded.

When providing ELA to a solvent bank, the SNB required a legal basis for doing so, namely, an emergency ordinance of the Federal Council (see Heller and Kuhn 2007, Kuhn 2007). In a period of financial distress, distinguishing between insolvent and illiquid banks is difficult. The SNB had to strike the proper balance between moral hazard and the execution of the Swiss LOLR. In this context, the SNB concluded that the moral hazard problem was relatively negligible under a constructive clarity strategy because the constructive ambiguity policy did not prevent the build-up of excessive maturity and currency mismatches (see also Domanski et al. 2014). Moreover, the SNB had to weigh the benefits of ELA (such as the safety and

soundness of the banking system) with the cost of a bank failure and the associated costs for the banking system (for example, capital losses and credit-default losses). If the costs exceeded the benefits, the ambiguous view would not always be constructive. Therefore, the SNB assumed that in the case of temporary liquidity problems, banks would obtain inside liquidity. In other words, banks would have access to the liquidity of the SNB as long as they were solvent. However, as we noted in section 4.2, they also considered the presence of aggregate uncertainty and concluded that with a 'constructive clarity strategy' as a transparency measure, the liquidity problem could be better mitigated. Therefore, compared with other central banks (for example, the BoE and the ECB),[189] the SNB was a pioneer and re-learned one of Bagehot's lessons – that clarity is more constructive in central banking. The revision of the NBA in 2004 gave the SNB a statutory objective to maintain financial stability and to change the Swiss LOLR strategy to a 'constructive clarity strategy'. In this sense, the Swiss LOLR is broadly derived from Art. 5 para. 2(a) and 2(3) and Art. 9 para. 1 (e) of the NBA 2016 [2003].

Art. 5 Tasks

a. It shall provide the Swiss franc money market with liquidity

e. It shall contribute to the stability of the financial system

In accordance with Art. 5 para. 2(e) of the NBA, the SNB is tasked with contributing to the stability of the financial system, that is, to 'financial stability'.[190] For the SNB, financial stability, particularly in the banking system, is assumed to be a prerequisite for an effective monetary policy (see BIS 2011, Hellwig 2015b).[191] Given the importance of the banking sector in Switzerland and the interconnectedness of Swiss SIBs with other countries (such as the United States and the EU) (see SNB 2007b, 2009), a potential problem such as the US subprime mortgage crisis can affect the Swiss banking sector, harming the safety and soundness of the banking system and the financial and economic stability of Switzerland. Therefore, if Swiss banks are no longer able to fund their operations on the market (inside liquidity), the SNB must act as the LOLR. Consequently, the Swiss LOLR appears with market failures, namely, if a

[189] After the financial crisis of 2007–2009, the BoE and other central banks decided to change their strategy from ambivalence to clarity.

[190] As we noted in section 2.2.3, financial stability is understood to mean the smooth functioning of a robust financial system in times of financial distress due to systemic risk.

[191] In this context, Hellwig (2014b: 19) indicated that 'financial stability under this mandate [price stability] is problematic because in some situations [for example, in times of financial distress] the two mandates can be in conflict'. Therefore, the SNB should discuss price stability and financial stability together, and 'it is desirable to bring the conflict open' (see Hellwig 2014b: 19, see also BIS 2011).

bank is unable to find inside liquidity. According to our conceptual distinction between micro-based and macro-based approaches from section 3.1, the Swiss LOLR primarily has a macro-based function because it focuses on limiting the risk of episodes of system-wide distress (namely, systemic risk), which may have significant costs for the economy as a whole, rather than on the safety and soundness of individual banks. In addition, the Swiss LOLR has a public responsibility to the entire Swiss economy to enhance financial stability. However, the Swiss LOLR also has a micro-based objective, namely, the safety and soundness of banks through its direct loans to SIBs. Although the Swiss LOLR has a macro- and micro-based objective, the main goal is the macro-based objective of financial stability, particularly the safety and soundness of the banking system. According to these considerations, our finding corresponds with the different LOLR schools of thought in the literature (see Thornton 1965 [1939], Bagehot 2005 [1920]). These considerations can be used to formulate the fifth principle as follows:

Principle 5: The Swiss LOLR's main objective is to ensure financial stability.

However, the Swiss LOLR objective overlaps with the objective of the FINMA, namely, financial stability. In other words, a boundary problem exists between the SNB and the FINMA, which can reduce the effectiveness and efficiency of the Swiss LOLR and result in biases towards their policy instruments. Therefore, before the collapse of Lehman Brothers on 23 May 2007, the SNB and the FINMA had signed a memorandum of understanding (MoU) regarding financial stability to mitigate the boundary problem and to facilitate their interaction with one another.[192] However, even the MoU presents several problems: (1) The MoU's main function is to encourage the SNB and the FINMA to discuss the topic of financial stability, but in practice, no operational functions have been defined, particularly in times of financial distress. Therefore, the MoU's effectiveness is questionable in light of the financial crisis of 2007–2009.

[192] The MoU provides '(1) a clear division between the individual tasks, (2) their common areas of interest and (3) governs their collaboration in the area of financial stability' (MoU 2010: 1). According to the first point, the SNB monitors the banking industry from a macro-based perspective, whereas the FINMA is responsible for banking supervision and enforcing bank regulation from a micro-based perspective. Moreover, the SNB acts as the LOLR in the event of a crisis according to the criteria of systemic importance, solvency and sufficient collateral (see section 7.2). Consequently, the MoU indirectly justified our fifth principle that the objective of the Swiss LOLR is the safety and soundness of the banking system. In relation to the second point, both institutions have a common interest in the following areas: (1) the assessment of the soundness of SIBs and/or the banking system; (2) bank regulation with a focus on the safety and soundness of banks and the banking system (for example, capital adequacy requirements, liquidity requirements and so forth); and (3) resolution and crisis management. In these three areas, the SNB and FINMA work closely to coordinate their activities, exchange information (for example, about the solvency of SIBs, the state of SIBs and the interconnections between banks, markets and the system (see also BIS 2011)) and share their opinions about the banking sector. According to the third point, 'where there are common areas of interest, collaboration is managed at the strategic level in the Steering Committee and at the operational level in the Standing Committee for Financial Stability' (MoU 2010: 3).

(2) An SIB (for instance, UBS or Credit Suisse) that provides bank services on national and international levels requires multiple central banks and supervisory authorities to mitigate potential systemic risk (see Hellwig 2007). (3) The 'manifold linkages of financial institutions in Switzerland with financial markets and financial institutions in other countries imply that any crisis of systemic dimensions in another country can have systemic repercussions for Switzerland' (for example, the collapse of Lehman Brothers) (Hellwig 2007: 777). Thus, intensive coordination and collaboration between the different central banks, supervisory authorities, and governments is necessary. Although cooperation and coordination have been enhanced since the financial crisis of 2007–2009, we can elaborate the sixth principle as follows:

Principle 6: The Swiss LOLR requires a clear MoU with respect to its operational functions, especially in times of financial distress that involve different central banks and regulatory authorities.

Nonetheless, in accordance with Art. 9 para. 1 (e) of the NBA (2016 [2003]), the LOLR can enter into a transaction if the participants hold sufficient collateral for a loan.

Art. 9 Transactions with financial market participants

1. In performing its monetary tasks pursuant to Article 5 paragraphs 1 and 2, the National Bank may:
   e. Enter into credit transactions with banks and other financial market participants on condition that sufficient collateral is provided for the loans.

Thus, if a domestic bank is no longer able to re-fund its operations via inside liquidity, then the SNB can act as the LOLR against sufficient collateral for solvent SIBs. Consequently, we can answer the initial question: the SNB acts as the LOLR if the following three conditions are fulfilled (see cif. 6 SNB 2015c):

(1) 'The bank or group of banks seeking credit must be of importance for the stability of the financial system.
(2) The bank seeking credit must be solvent.
(3) The liquidity assistance must be fully covered by sufficient collateral at all times. The SNB determines what collateral is sufficient.

To assess the solvency of a bank or group of banks, the SNB obtains an opinion from FINMA'.

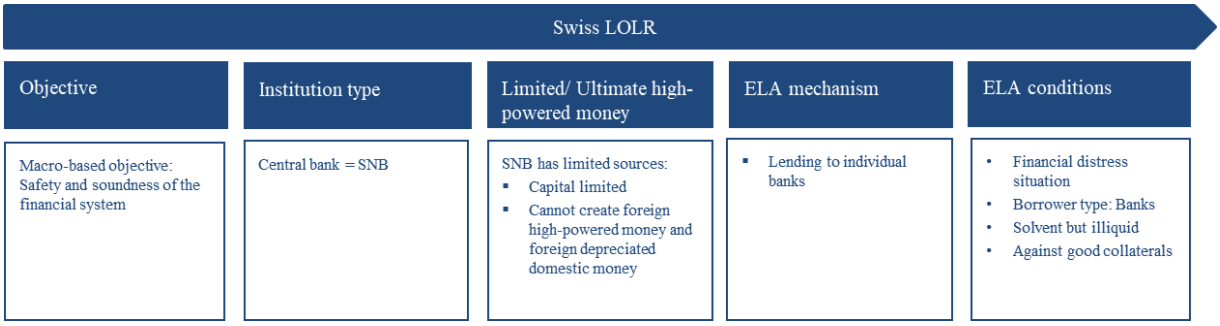
These guidelines are not binding. However, the SNB binds itself to a certain degree because of its statutory tasks (see SNB 2008a). In relation to the first condition, the SNB binds itself with respect to the type of borrower, namely, SIBs. Thus, this is a double restriction because the type of borrower must be a systemically important institution and a bank or a group of banks. With regard to the second condition, the bank must be solvent, and solvency is often difficult for regulatory authorities or the central bank to evaluate in times of financial distress. According to the third condition, the SNB accepts a wide range of collateral, thereby enhancing its flexibility.

6.4. Summary

Next, we review the history of the Swiss LOLR and answer the two questions initially raised: (1) Why does the LOLR exist in Switzerland? (2) What conditions apply to the LOLR in Switzerland? With regard to the first question, the role of the Swiss LOLR is closely linked to the foundation of the SNB. Furthermore, the SNB is closely related to the political evolution of Switzerland. Therefore, the Swiss LOLR is closely linked to the political evolution of Switzerland and the foundation of the SNB. In this regard, the Swiss LOLR can be divided into two broad periods and three narrow time periods. In a broad sense, we distinguish between the LOLR before the foundation of the SNB and the LOLR after the foundation of the SNB. In a narrower view, the period before the SNB can be divided into two time periods, the free banking period from 1826 to 1881 and the transition period from 1881 to 1907. After the foundation of the SNB, the third time dimension stretches from 1907 until today. Although the SNB was founded in 1907, the SNB had no clear commitment to act as the LOLR from 1907–2004, but it was called to act as the LOLR in the public interest if the Swiss banking system was in jeopardy. Thereby, the SNB could permit a distressed bank to receive ELA or allow it to fail. This discretionary approach is called a ‘constructive ambivalence strategy’. A series of banking crises in 1906, 1914, 1916, the 1930s, and the 1990s occurred before the SNB decided to change its strategy. In this regard, the real estate crisis of 1990 played an important role in rethinking the role of the LOLR because the Swiss LOLR concept presented various difficulties (such as the old NBA 2000 [1953]) and limited the role of the SNB in a distress situation. Therefore, the SNB decided to change the LOLR strategy from a ‘constructive ambivalence strategy’ to a ‘constrictive clarity strategy’ to enhance the effectiveness of the modern SNB if the following three conditions were fulfilled: (1) the bank must be of systemic importance in the Swiss

banking sector; (2) the bank must be solvent but illiquid; and (3) the bank must have sufficient eligible collateral, as shown in Figure 6.2.

Figure 6.2 The current view of the Swiss LOLR



Source: Authors' own elaboration.

Moreover, the Swiss LOLR has the macro-based objective to ensure financial stability. Furthermore, in light of the Goodhart view, the SNB has limited capital, cannot create foreign currency, such as USD, and provides credit to distressed individual banks rather than through the market. The former limitation will be discussed again in the next chapter. With the current Swiss LOLR in mind, another question arises: are these considerations still valid in the twenty-first century, or should they be redesigned? The recent financial crisis has raised fundamental questions about the design of the Swiss LOLR in the twenty-first century. To answer these questions, the next chapter will analyse the role of the SNB during the UBS crisis of 2007–2009.

7. The Swiss LOLR in the UBS crisis of 2007–2009

To understand the design of the Swiss LOLR in the twenty-first century, we will analyse the role of the Swiss LOLR in the UBS crisis of 2007–2009. At the time of ELA, did UBS fulfil the conditions of the Swiss LOLR? To answer this question, understanding the UBS crisis is vital. Although the recent literature has generated several useful insights into the UBS crisis, no systematic analysis has been conducted regarding the UBS case that includes all parties involved (UBS, the SFBC/FINMA, the SNB and the Swiss Confederation). Therefore, to fill the gap in the literature, we describe the UBS crisis of 2007–2009 by drawing upon the different perspectives of UBS, the SFBC/FINMA, the SNB and the Swiss Confederation.

7.1. The UBS crisis of 2007–2009

When conducting a systematic analysis of the UBS crisis and the Swiss LOLR between 2007 and 2009, it is important to provide a chronological overview of key dates. The scope of our dissertation covers the first quarter of 2007, when the prices of sub-prime MBS began to fall, to the second quarter of 2009, when the transfer of assets to the StabFund[193] was completed. For this period, we compare and combine the perspectives of the main parties involved, namely, UBS, the SNB, the SFBC/FINMA and the Swiss Confederation, whereas the later draws upon the Control Committees of the Federal Assembly (CCFA) Report entitled *'The Swiss authorities under the pressure of the financial crisis and the disclosure of UBS customer data to the USA'*. For our analysis, we use several sources that provide us with the key events of the UBS case, including (1) all UBS quarterly reports and annual reports between 2007 and 2009; (2) shareholder reports on the write-downs of UBS; (3) the SFBC investigation of the sub-prime crisis regarding the causes of the write-downs of UBS; (4) the FINMA report regarding the financial market crisis and financial market supervision; (5) the above-mentioned report of the CCFA; and (6) the SNB's Financial Stability Report of 2009 and Annual Report 2007/2008. The key dates are summarised in Table 7.1, which shows the chronology of the UBS crisis from the first quarter of 2007 to the second quarter of 2009 (when the SNB finalised the UBS asset transfer). The major three events are marked in light blue in Table 7.1.

[193] The StabFund will be analysed in section 7.2.

Table 7.1 Chronology of the UBS crisis

	1st quarter 2007	2st quarter 2007	3st quarter 2007	4st quarter 2007	1st quarter 2008	2st quarter 2008	3st quarter 2008	4st quarter 2008	1st quarter 2009	2st quarter 2009
UBS	**February:** Prices of sub-prime MBS start to fall **February:** Group results rise to CHF 11.5 billion for 2006. **March:** Meeting between representatives of the SFBC and the Chief Risk Officer of the IB in London to discuss sub-prime MBS. **End of March:** DRCM incurs losses about USD 150 million.	**May:** UBS announces reintegration of DRCM as a result of approximately USD 150 million in losses and the complexity of the asset structure. **May:** UBS publishes Q107 quarterly report with a net gain (pre-tax) of CHF 4,385 million. **June:** Moody's downgrades subprime MBS.	**August:** Write-downs and uncertainty on the interbank market lead liquidity to completely dry up. **August:** Upon the request of the SFBC, UBS has to provide an internal report about its risk exposure in the sub-prime market (net exposure of USD 53.1 billion). **August:** UBS announces a net gain (pre-tax) of CHF 6,239 million for Q207 and a profit warning for Q3 (pre-tax loss between CHF 600 million and CHF 800).	**October:** UBS announces a profit loss (pre-tax) of CHF 815 million for Q307 in relation to US sub-prime MBS. **October–November:** Moody's and S&P downgrade UBS. **December:** UBS announces write-offs of CHF 11.3 billion with regard to sub-prime MBS. **December:** Fitch downgrades UBS. **December:** *First recapitalisation* of CHF 13 billion with the issue of MCN to Singapore sovereign wealth fund and Middle Eastern investors.	**February:** UBS announces a net profit (pre-tax) loss of CHF 12,733 million and a net trading income loss of CHF 13,915 million for Q407.	**April:** The shareholder report on UBS's write-downs is presented. **April:** S&P, Moody's and Fitch downgrade UBS. **April:** *Second recapitalisation* of CHF 16,000 million through the issuance of shares. **May:** UBS sells USD 11 billion. MBS to BlackRock. **May:** UBS announces a net loss (pre-tax) of CHF 11,799 million for Q108 related structural products (CDS). Chairman of BoD Marcel Ospel replaced by Peter Kurrer.	**July:** Moody's downgrades UBS. **August:** UBS announces a net loss (pre-tax) of 4,090 CHF, a net trading income loss of CHF 3,543 million, and a Tier 1 ratio of 11.6 percent for Q208. **September:** Lehman Brothers files for Chapter 11 bankruptcy (insolvency) (15.09.2008). **September:** UBS announces that it has direct counterparty exposure to Lehman Brothers.	**October:** The Federal Council, the SNB and the SFBC decide to provide measures to strengthen UBS's balance sheet via a good–bad bank (StabFund) strategy. **October:** ECA of CHF 6 billion with the issue of MCN to the Swiss Confederation. **November:** UBS announces a net loss (pre-tax) of CHF 3,655 million for Q308. **December:** UBS transfer USD 16.4 billion in illiquid assets to StabFund and sells USD 3.4 billion shares of the Bank of China.	**February:** UBS announces a net loss (pre-tax) of CHF 13,290 million and a trading income loss of CHF 8,779 million for Q408. Moreover, Oswald Grübel becomes the new CEO. **March:** Kaspar Villiger replaces Peter Kurrer.	**April:** UBS warns of a loss of CHF 2 billion for Q109. **April:** UBS sells Brazilian financial service business (UBS Pactual) at a value of CHF 2.8 billion. **May:** UBS announces a net profit loss (pre-tax) of CHF 1,558 million and an increase in equity of at least 10 percent for Q109.
SNB		**June:** The SNB raises the target range for the three-month Libor rate.	**August:** The SNB and other CBs provide extraordinary temporary liquidity to the market (09.08 and 10.08). **August:** The SNB increases monitoring activity, particularly for the sub-prime market and SIBs in Switzerland. **September:** The first cut of the three-month Libor rate by the SNB. **September:** The SNB provides extraordinary temporary liquidity assistance to the market.	**December**: Coordinated liquidity provision by major CBs is announced. The SNB provides temporary USD liquidity to repo counterparties.	**January:** The SNB renews its temporary USD liquidity to repo counterparties. **March:** The SNB renews its temporary USD liquidity to repo counterparties.	**May:** The SNB increases the amount of USD repo auctions.	**September:** Major CBs increase dollar liquidity in international money markets. The SNB announces new overnight USD repo auction for max. of USD 10 billion.	**October:** The SNB makes cuts with respect to the target range for the three-month Libor rate (by 0.25), issues SNB bills (a new monetary instrument), and requests a legal assessment of the LOLR. **November:** The SNB makes two cuts with respect to the three-month Libor rate. **December:** The SNB acts as an intermediary, allowing UBS to obtain funding from smaller banks.	**January:** The SNB provides CHF liquidity to ECB and so forth. **February:** The SNB announces that it will issue SNB bills in USD. **March:** The SNB cuts the three-month Libor rate and announces unconventional measures.	**April:** The SNB finalises the transfer of UBS assets. The total assets transferred amount is USD 38.7 billion.
SFBC/FINMA	**January:** The KKL (Krisenleitlinien) is established. **March:** A meeting in London between representatives of the SFBC and the Chief Risk Officer of the IB regarding sub-prime MBS.	**May:** The SFBC and the SNB sign and publish the MoU. **June:** Publication of the Financial Stability Report 2007.	**August:** The SFBC increases its monitoring activity and revises its working methods. **August:** UBS has to increase its capital requirements at the insistence of the SFBC.	**December:** As a result of the UBS's write-downs, the SFBC demands a report about the causes and persons responsible.	**January:** The President of the SNB and the FBC inform the Head of the FDF that UBS is struggling with liquidity problems and that the situation requires actions by the LOLR. **End of January:** Activation of high-level crisis and resolution management. **February:** The SFBC proposes that UBS sell a certain proportion of sub-prime MBS. **March:** The SFBC prompts Marcel Ospel to step down as UBS Chairman of BoD.		**September:** UBS presents report on the causes of sub-prime mortgage crisis. **September:** On 21 September, the highest officers of the SNB, the SFBC and the FDF are informed that UBS requires ELA.		**January:** FINMA starts operating.	

Sources: Authors' own elaboration based on SNB (2007a), SNB (2007b), UBS (2007a), FINMA (2008), SFBC (2008b), UBS (2008a), UBS (2008b), CCFA (2009), SNB (2009), SNB (2016a) and all Quarterly Reports from the 1st Quarter of 2007 to the 2nd Quarter of 2009.

The main events in the chronology of the UBS financial crisis are as follows:

- In February 2007, the prices of high-risk mortgages in the United States, or 'sub-prime' mortgages, began to fall[194] in the markets (the initial MBS shock),[195] and financial institutions (UBS, Bear Stearns, Fannie Mae and Freddie Mac, and American International Group (AIG)) around the world had to write down[196] losses of several billion dollars (in euros or Swiss francs) in their trading positions in relation to the structuring, trading and investment activities surrounding mortgage- and asset-backed securities (see UBS 2008b, Brunnermeier 2009b, Hellwig 2009).[197] In Switzerland, UBS was the bank with the largest exposure to sub-prime markets. Although the Swiss Financial Banking Commission first broached the sub-prime topic at a meeting in March 2005 and again at a meeting in September 2005, 'UBS made no mention of any market risk from this area', even though the bank was extensively involved in the sub-prime market (FINMA 2009: 21). In February 2007, the prices of sub-prime mortgages started to fall, and the Swiss Financial Banking Commission raised the topic again in March 2007 at a meeting with the UBS investment bank department in London (see FINMA 2009). At this meeting, the chief risk officer of the department explained that UBS was aware of the risk exposure in the US mortgage market, that the bank held a short position on sub-prime related mortgages and that it hoped to benefit from the collapse of the sub-prime market (see FINMA 2009, CCFA 2010). Although UBS sought to profit from the collapse, the figures from the investment bank department did not reveal the actual sub-prime-related exposure of UBS because the bank

[194] In the literature, the causes of the financial crisis of 2007–2009 have been analysed by numerous economists, including Gorton (2008), Brunnermeier (2009b), and Hellwig (2009). According to these authors, the main causes included (1) a mismatch of maturity transformation through a lack of transparency from an SPV, (2) mortgage securitisation, (3) a malfunctioning of fair-value accounting that led to systemic risk, and (4) the low creditworthiness of householders. In combination with falling prices, these causes triggered the financial crisis of 2007–2009.

[195] We can use our risk-feedback loop from section 2.2.3 to explain the recent financial crisis. In this sense, an MBS shock (phase 1) sparked the crisis.

[196] In Switzerland, the SFBC prepared a report on the causes of the write-downs of UBS AG in September 2008. In the 'Shareholder Report on UBS's Write-Downs', the SFBC indicated several failures with respect to the assessment of risks, risk control systems, overly optimistic stress scenarios, unlimited trading book capacities, and insufficient monitoring, among others (see SFBC 2008b, UBS 2008a).

[197] For instance, ABS, MBS, and even more complex products, namely, CDOs. ABS are used by companies to generate liquidity, and they are created by selling a loan asset to an SPV, which in turn generates funds by issuing securities backed by these loans (securitisation) on the capital market (FINMA 2009: 56). To mitigate funding costs, ABS are divided into tranches with various risk profiles. Similarly, as with ABS, MBS are securities guaranteed by mortgage loans that create funding by issuing securities backed by mortgage loans on the capital market. Similar to ABS and MBS, CDOs are created by securitising debts and issuing debt-backed securities through an SPV (see FINMA 2009).

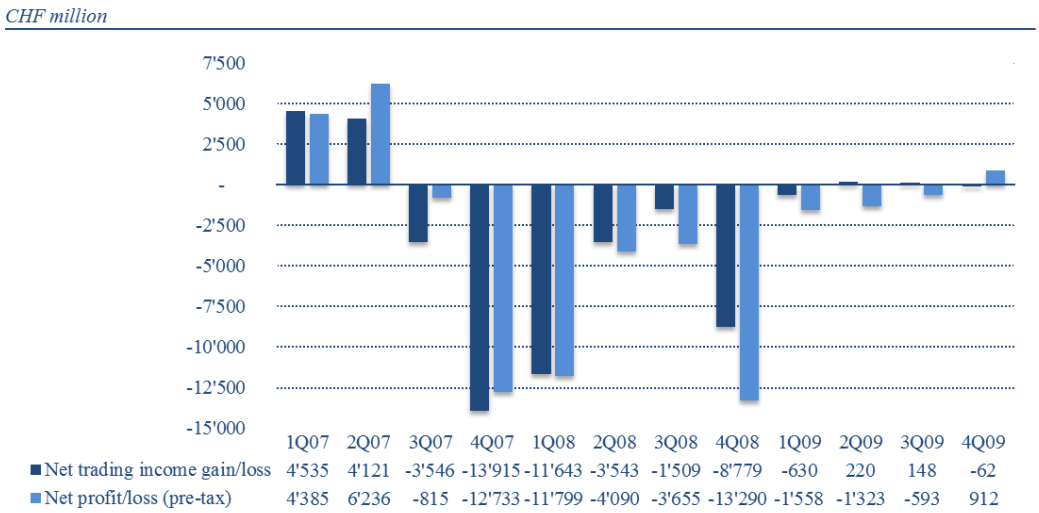
did not take into account the risk exposure of Dillon Read Capital Management (DRCM).[198] DRCM, an OBSE, was an SPV (an alternative investment management fund) that was established for high-risk, high-net worth individuals; it primarily sought to diversify capital and risk and to accommodate the demand of high net worth individuals. DRCM used a number of trading strategies with respect to high-risk, sub-prime-related securities (see UBS 2008b, SFBC 2008b).[199] Moreover, for UBS, DRCM had the advantages of transferring risk from UBS's balance sheet and allowing exposure to remain primarily undisclosed to regulators and investors; improving the liquidity of loans through securitisation; generating fee income; and achieving relief from regulatory capital requirements (see IMF 2008). The result of the meeting was that the SFBC had no reason to doubt UBS's risk exposure in the sub-prime market because the bank took into account the scenario of a collapse in the sub-prime market.

- In March 2007, prices in the high-risk mortgage market in the United States continued to fall. DRCM also announced a loss of approximately USD 150 million, and several of the positive features of DRCM became less attractive to UBS as uncertainties about asset valuation increased and caused systemic disruptions in money markets (see IMF 2008).

- Consequently, on 3 May 2007, UBS announced the integration of DRCM (with all risk-related securities in the mortgage market in the United States) because of their losses and internal difficulties (for example, operational complexity and client expectations) (see UBS 2007a, UBS 2008b). Although UBS integrated DRCM, in the first quarter of 2007, the bank realised a net profit of CHF 4,385 million that was primarily driven by the investment banking department, which had a net trading income gain of CHF 4,535 million. Figure 7.1 provides a clearer overview, showing UBS's consolidated net profit/loss (pre-tax)[200] and net trading gain/loss during the financial crisis of 2007–2009; notably, '[w]ritedowns and credit valuation adjustments are reported in the net trading income, along with realized losses from the sale of assets and gains on hedges' (UBS 2008a: 18). According to Figure 7.1, between the third quarter of 2007 and the third quarter of 2009, UBS had write-downs and credit valuation adjustments of approximately CHF 43 billion.

[198] 'This is explained by the fact that the risk management system run by UBS did not include the exposures that turned out to be the most problematical because of the a priori good Triple A rating they had been awarded by the international agencies (CCFA 2010: 3).
[199] For further details, see the 'Shareholder Report on UBS's Write-Downs', dated 18 April 2008.
[200] We use pre-tax incomes to remove potential tax benefits during the financial crisis of 2007–2009 that distort our analysis.

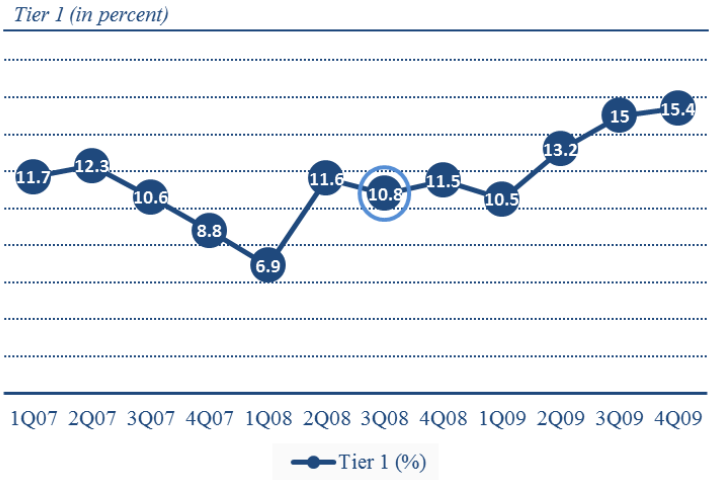
Figure 7.1 UBS consolidated net profit and trading performance during the financial crisis of 2007–2009



Source: Authors' own calculations based on (unaudited) quarterly income statements of UBS between 2007 and 2009.

In the first quarter of 2007, the Tier 1 core capital ratio was 11.7 per cent. Figure 7.2 provides an overview of the core Tier 1 capital ratio during the financial crisis of 2007–2009. The blue-framed ring shows the Tier 1 capital ratio at the time that ELA was provided by the SNB and the Swiss Confederation.[201]

Figure 7.2 UBS Tier 1 capital development during the financial crisis of 2007–2009



Source: Authors' own elaboration based on (unaudited) UBS quarterly report between 2007 and 2009.

[201] Furthermore, opponents would argue that the calculation of the leverage ratio, which would be required for a better analysis, is missing. The ratio of a bank's non-risk-weighted assets to its capital is missing because the Basel III leverage ratio is a relative new framework (since 2013) and because certain data (particularly exposure measures such as derivative exposures) were unavailable or even incomplete at the time of ELA. Therefore, we exclude the leverage ratio from our analysis.

Nevertheless, in May 2007,[202] the SFBC and the SNB held a meeting with representatives of UBS and Credit Suisse regarding 'market risks and stress testing'. In the context, a stress test was conducted for both banks. The stress test calculated a net loss between CHF 2 billion and 3 billion. In the fourth quarter of 2007 alone, the net loss (pre-tax) was approximately CHF 14 billion. According to the results of the stress test, the SNB prepared the Financial Stability Report for 2007 and published it in June of the same year.[203] The overall results of the report estimated a positive outlook. In this context, the SNB (2007b: 5) argued as follows:

> 'Our expectations regarding the stability of the Swiss banking sector are essentially positive. Despite the fact that economic growth is expected to remain strong, there are, however, initial signs that the extremely favourable overall situation may normalise. In 2006, for example, Moody's downgraded the ratings of more European companies than it upgraded. Furthermore, household insolvencies have risen in Switzerland as well as in Germany, the UK and the US. Such a normalisation, should it occur, would have only a moderate impact on banks' earnings and the level of stress for the Swiss banking sector is likely to remain below average in medium term'.

Given this statement, observers might question the usefulness of financial stability reports. For example, Geiger (2010) criticised the SNB with respect to assessing an accurate outlook in Switzerland. However, opponents might argue that the SNB also noted deteriorations in the sub-prime mortgage market in its Financial Stability Report for 2007; that is, 'the events in the US sub-prime mortgage markets could turn out to be early warning signs of a larger crisis to come in the US property market' (SNB 2007b: 5). In this sense, why did the SNB estimate an overall positive outlook? One possible answer could be based on the stress test, but the question of the effectiveness of the stress test in the banking industry then arises. In this regard, further academic research is desirable.

- On 9 August 2007, as several financial institutions were forced to make write-downs, market participants questioned these institutions' stability. In other words, asymmetric information created aggregate uncertainty and converted a stable interbank market into an unstable market, which dried up market liquidity and spread to the real economy in the form of a credit freeze. Thus, another major cause of the most recent financial crisis was

[202] In addition, on 23 May 2007, the SFBC and the SNB signed a MoU providing a clear division of the tasks, common interest areas, and collaborations in the area of financial stability (see MoU 2010).
[203] In June 2007, Moody's downgraded the sub-prime MBS, and the SNB raised the target range for the three-month Libor rate (see SNB 2009).

asymmetric information. However, the lack of market liquidity caused 9 August 2007 to be commonly viewed as the first day of the financial crisis of 2007–2009. Thus, how was the recent dry-up in market liquidity brought to an end?

- On 9 and 10 August 2007, the SNB and other central banks acted as MMLRs and began to provide extraordinary temporary liquidity to all markets via OMOs to ensure that the interbank markets would continue to function (see SNB 2009). Thus, the lack of liquidity was halted because the central banks acted as MMLRs; however, these interventions did not end the crisis. Furthermore, the SNB simultaneously increased its monitoring activities in the sub-prime market, particularly with regard to MBS. In addition, based on the MoU, the SFBC, in cooperation with the SNB, increased its supervision of the two largest banks in Switzerland (UBS and Credit Suisse). Moreover, the SFBC 'revised its working methods and reorganised its Major Banks Department' (see CFFA 2010: 4).

- On 14 August 2007, UBS published the second-quarter report of 2007, showing a net profit of CHF 6,236 million, a net trading income gain of CHF 4,121 million, and a Tier 1 capital ratio of 12.3 per cent. According to the market liquidity dry-up in the interbank market and the problems on the sub-prime mortgage market, UBS issued a profit warning and 'reported that if the current turbulent conditions prevail throughout the quarter, UBS will probably see a very weak trading result in the Investment Bank, and this makes it likely that profits in the second half of 2007 will be lower than in the second half of [2006]' (UBS 2008b: 6).

- On 24 August 2007, based on a request by the SFBC, UBS provided an internal report that revealed a net exposure of USD 53 billion in the sub-prime market, marking the first time that the SFBC had a clear overview of UBS's exposure in the sub-prime market. As a result of the internal report, the SFBC provisionally decided to increase the capital requirements for the two largest banks. Therefore, UBS and Credit Suisse were required to hold a capital buffer between 20 and 30 per cent (see FINMA 2009, CCFA 2010).[204]

- In September 2007, the SNB made the first cut in the three-month Libor rate (see SNB 2007a). Furthermore, the SNB provided additional extraordinary temporary liquidity assistance to the market.

[204] The SFBC was the only regulatory authority worldwide to take this type of corrective action.

- On 1 October 2007, UBS announced further write-downs in foreign currency (USD) of between CHF 600 million and CHF 800 million. The announcement of further write-downs was realised on 30 October 2007 as UBS published the third-quarter report of 2007. UBS announced a loss (pre-tax) of CHF 815 million, a net trading loss of CHF 3,546 million through write-downs, and credit valuation adjustments in MBS and ABS that were 'driven by markdowns in the CDO portfolio and mortgage trade business' (UBS 2007c: 13). Therefore, as a result of the risk-feedback loop from part I, the banks' Tier 1 capital ratio decreased from 12.3 per cent to 10.6 per cent. As a consequence of the write-downs, the bank had to take corrective actions to equalise its losses and to continue deleveraging on the liability side (see phase 2 of the risk-feedback loop (section 2.2.3)).

- By 10 December 2007, UBS had made additional write-downs of approximately USD 10 billion (see UBS 2008b).[205] Therefore, Moody's, Standard and Poor's, and Fitch[206] downgraded UBS. Nevertheless, in the fourth-quarter report of 2007, UBS presented an optimistic outlook with respect to its capital positions (UBS 2008a: 2-3):

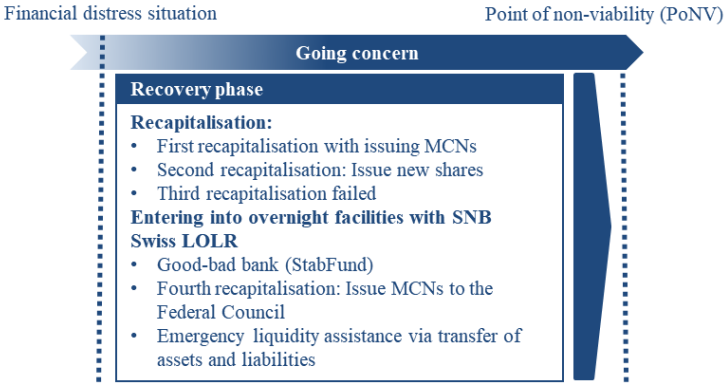
  'In addition, during fourth quarter 2007, we reduced the Investment Bank's balance sheet in trading assets, collateral trading and the loan book. This resulted in a lower level of risk-weighted assets in the Investment Bank and for UBS as a whole. Together with the rededication of treasury shares for disposal and the effect of replacing the cash dividend with the proposed stock dividend, this allowed us to end the year in a strong capital position'.

  Although UBS suggested a positive outlook, its funding liquidity and capital position worsened as a result of further write-downs and aggregate uncertainty in the interbank market. Therefore, the SNB renewed its temporary USD liquidity assistance to UBS; however, this assistance was insufficient, and the bank struggled to obtain inside liquidity. In other words, at the beginning of December 2007, UBS had a liquidity problem. Therefore, the following question arises: what were the main corrective actions that UBS took to create new funding liquidity? To depict the various strategies, we apply the recover and resolve concept from section 3.3.2 to the UBS crisis. Figure 7.3 illustrates the recovery phase. The main differences between Figure 7.3 and Figure 3.7 from section 3.3.2 are that

[205] A detailed analysis with respect to the balance sheet from the third quarter to the fourth quarter is not provided here because the fourth-quarter balance sheet is missing in the quarterly report. Therefore, we focus on the income statement.
[206] Moody's, Standard and Poor's, and Fitch are rating agencies.

the former figure lacks the resolution and liquidation phase and the recovery plans and CoCos in the recovery phase. Although the SNB and the SFBC had elaborate resolution plans for the UBS crisis, even recovery plans and CoCos were clearly insufficient in mitigating the UBS failure of 2007–2009, given the balance sheet of approximately two trillion Swiss francs.

Figure 7.3 Recovery phase of the UBS crisis



Source: Authors' own elaboration.

According to Figure 7.3, UBS took advantage of several recovery options and participated in overnight liquidity facilities with the SNB to obtain funding liquidity (see SNB 2009). Moreover, in December, UBS initiated its first successful recapitalisation of CHF 13 billion by placing mandatory convertible notes (MCNs) in a Singapore sovereign wealth fund and among various Middle Eastern investors to increase its capital base (see UBS 2008b, FINMA 2009). These recovery strategies will be discussed later in this section (for example, a second recapitalisation).

- On 19 December 2007, UBS provided a report requested by the SFBC about the causes of and persons responsible for UBS's write-downs. Furthermore, in December 2007, the major central banks (the Fed, BoE, ECB, BoJ and SNB) again announced that they were coordinating their liquidity provisions to the market as a whole. Hence, the SNB began to provide temporary USD liquidity to repo counterparties.

- On 30 January 2008, UBS pre-announced a loss of approximately CHF 4,400 million in the fourth quarter of 2007. The SNB also renewed its temporary USD liquidity provision. Moreover, the head of the Federal Department of Finance (FDF) was informed by the presidents of the SNB and the SFBC that UBS required the action of an LOLR because

UBS was struggling to create liquidity within the banking sector. As such, in late January, a high-level crisis management organisation, with top officers from the SNB and the SFBC and the head of the FDF, was activated to prepare a possible resolution strategy (see section 3.2.3). 'At that stage, the Federal Council was not informed about the seriousness of the situation by the Head of the FDF' (CCFA 2010: 4).

- On 14 February 2008, UBS announced the largest loss in the bank's history, namely, a net loss (pre-tax) of CHF 17,733 million and a net trading loss of CHF 11,643 million in the fourth quarter of 2007.[207] According to the mechanism of the risk-feedback loop, these losses led to a decrease in the Tier 1 capital ratio from 10.6 per cent to 8.8 per cent and the practical equalisation of the first recapitalisation.[208] To enhance the capital ratio, the SFBC renewed its efforts to tighten UBS's requirements for an additional capital buffer; in addition, with respect to the funding liquidity problem, the SFBC proposed selling a certain amount of sub-prime MBS.[209]

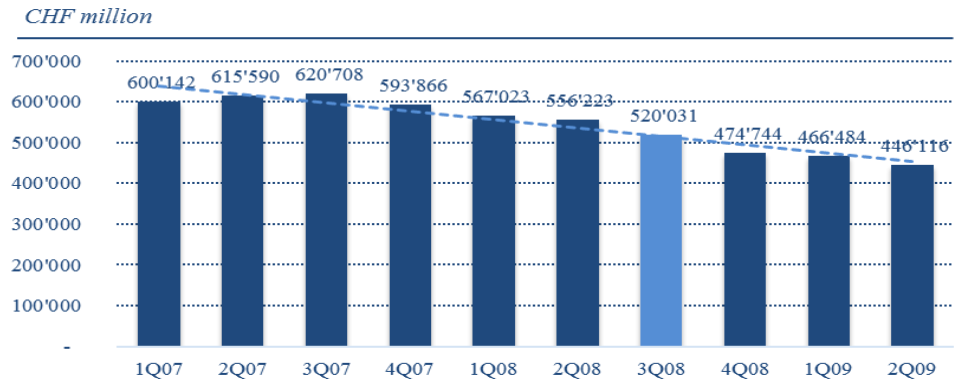
- In March 2008, drawing upon the UBS report regarding the causes of the write-downs, the SFBC proposed that Marcel Ospel step down as chairman of the UBS board of directors (see FINMA 2009, CCFA 2010).

- In April 2008, UBS published the 'Shareholder Report on UBS's Write-Downs' and fulfilled the first proposition of the SFBC. Based on this report, the SFBC investigated the causes of UBS's significant write-downs in the sub-prime mortgage market in the United States. On 30 September 2008, the SFBC published the 'UBS Sub-Prime Report' (see SFBC 2008b). As a result of the shareholder report and the ongoing financial distress experienced by UBS, Standard and Poor's, Moody's, and Fitch downgraded the bank. To address its ongoing funding liquidity and capital problems, UBS began a successful second recapitalisation and issued new shares worth CHF 16,000 million, which strengthened the bank's capital base. In addition to strengthening the funding liquidity base, in May 2008,[210]

[207] In 2007, the total net losses (pre-tax) amounted to CHF 8,805 million.
[208] However, at that time, the lower-core Tier 1 rate did not violate the Basel II requirements in Switzerland because banks that followed an internal ratings-based approach (such as UBS and Credit Suisse) had to fulfil the Basel II requirements in January 2008.
[209] In this context, did the SFBC or any other regulatory authority have the right to make proposals that could be misunderstood and exacerbate a bank's financial situation in times of financial distress? This question arises because regulatory authorities have insufficient information about the banking business (asymmetric information), and even if they do have sufficient information, banks have incentives to hide information.
[210] In addition, in May 2007 the SNB increased the amount of USD repo auctions (see SNB 2009).

UBS sold USD 11 billion MBS to BlackRock, thus fulfilling the second proposition of the SFBC. At the end of May 2008, UBS announced a net loss (pre-tax) of CHF 11,799 million and a net trading income loss with respect to US sub-prime mortgages of CHF 11,643 million for the first quarter of 2008. In addition, from the first quarter of 2007 to the third quarter of 2008, lenders withdrew CHF 80,111 million in deposits, revealing the crumbling confidence in UBS (see also SNB 2013). Figure 7.4 depicts the deposits due to customers between the first quarter of 2007 and the second quarter of 2009.[211]

Figure 7.4 Deposits due to customers



Source: Authors' own elaboration based on (unaudited) UBS quarterly reports between 2007 and 2009.

The light-blue bar shows the deposits due to customers at the time of ELA. Furthermore, UBS announced that Chairman Marcel Ospel would be replaced by Peter Kurrer; thus, the UBS fulfilled the third proposal of the SFBC (see UBS 2008c). In July 2008, Moody's downgraded UBS.

- On 12 August 2008, UBS announced a net loss (pre-tax) of CHF 4,090 million and a net trading income loss of CHF 3,543 million for the second quarter of 2008. In August 2008, the SFBC noted an enormous discrepancy (in billions) between the figures that had been presented in the meeting in March 2007 and the actual exposure to sub-prime mortgages (see CCFA 2010). Thus, the opacity of OBSEs (such as DRCM) was one main cause of the UBS crisis and the financial crisis of 2007–2009. Therefore, we propose to impose transparency principles for OBSEs (for example, rules for consolidating OBSEs (see also IMF 2008)) instead of the current regulatory measures that do not relate to the main causes of the recent financial crisis (see part I).

[211] The balance sheet for the fourth quarter of 2007 is missing from the UBS quarterly report.

- In August 2008, a successful recapitalisation increased the core capital ratio from 6.9 per cent in the first quarter of 2008 to 11.6 per cent. In other words, the capital base of UBS had been stabilised with respect to the Basel II accord. The due-to-customer deposit amount decreased from CHF 567,023 million in the first quarter of 2008 to CHF 556,223 million in the second quarter of 2008 (Δ CHF 10,800 million).

- On 15 September 2008, Lehman Brothers filed for Chapter 11 bankruptcy,[212] shocking the entire financial system and plunging the world economy into a financial crisis[213] as market conditions deteriorated. Thus, the Lehman Brothers collapse aggravated the suspicious solvency state of various financial institutions and enhanced aggregate uncertainty. Aggregate uncertainty thereby had two main effects: (1) Solvent institutions struggled to find inside liquidity. Therefore, 'institution[s] which significantly relied on short-term wholesale funding had to resort to state aid' (Liikanen et al. 2012: 7). (2) As a consequence of suspicious solvency, depositors began to withdraw their money from their accounts (a fundamental bank run). For example, from the second quarter to the third quarter of 2008, UBS depositors withdrew CHF 36,192 million.

- UBS also announced that it had direct counterparty exposure to Lehman Brothers, which restarted the risk feedback loop mechanism. As a consequence of the direct counterparty exposure to Lehman Brothers, UBS had to take large-scale write-downs in foreign currency according to fair-value accounting on illiquid sub-prime mortgages. To equalise the shrinking balance sheet, UBS began to deleverage on the liability side. Thus, the equity position in the balance sheet declined. To halt the decrease in equity, UBS announced a third recapitalisation. However, as the third recapitalisation failed, UBS was likely to be no longer viable, thus requiring ELA via the LOLR.

- On 21 September 2008, the SNB, the SFBC, and the FDF were informed that UBS would require ELA.

- As the UBS situation worsened, on 13 October 2008, the SNB instructed its internal legal department to provide a legal assessment of the legitimacy (from a central bank law

[212] In other words, Lehman Brothers was filing for bankruptcy (insolvency).
[213] As a consequence, the major central banks increased USD liquidity in the money markets. Moreover, the SNB announced a new overnight USD repo auction for a maximum of USD 10 billion to devaluate the Swiss franc and stabilise the market (see SNB 2009).

perspective) of the SNB's participation in a package of measures designed to strengthen the financial system ('UBS transaction') (see SNB 2008c). The SNB's legal department concluded that (1) the transaction was in line with the SNB's mandate; (2) the transaction fell within the scope of the SNB's business, regardless of whether the transaction qualified as granting a loan or making an equity purchase; (3) the proposed acquisition of the SPV at a price of USD 1 was unobjectionable from the legal perspective of the SNB; and (4) the responsibility for decisions regarding the implementation of the transaction fell to the SNB board, which is subject to the accountability of Parliament (see SNB 2008a).

- On 14 October 2008, UBS officially demanded ELA. In this context, the SFBC informed the SNB in writing that the stability of UBS would be threatened if no further steps were immediately undertaken. Moreover, the SFBC confirmed that UBS was *solvent* at that time, although no publicly available document clearly showed that UBS was absolutely solvent. Therefore, the next section analyses whether UBS was solvent at the time of ELA.

- Nevertheless, due to the systemic importance of UBS and the assumption that its failure could lead to the collapse of the banking system, thereby harming the Swiss economy, employment and growth, the crisis committee[214] decided (without any cost-benefit analysis) to strengthen UBS's liquidity base by reducing its balance-sheet risks through the transfer of sub-prime assets with ELA and to strengthen its capital base by providing government support. The LOLR decision to provide ELA to UBS without any cost-benefit analysis implies a seventh principle for a Swiss LOLR in the twenty-first century:

  Principle 7: The Swiss LOLR should be based on a systemic cost-benefit analysis.

  Similarly, Kaufman (2007 [1991]) and Rochet (2008b: 51) indicate that 'some form of cost-benefit analysis of LLR interventions would be useful in order to evaluate the exact costs of liquidity provision by the Central Bank, and the social cost of excessive liquidity'. However, opponents might argue the following: (1) Conducting a systemic analysis with respect to the LOLR concept would take too much time and would be impossible in practice because the central bank would be working against the clock. (2) In addition, with or without a cost-benefit analysis, the central banks would always provide ELA to distressed

[214] The crisis committee provided different solutions to resolve UBS (a scenario analysis), though not a clear cost-benefit analysis that drew upon the LOLR conditions of the SNB.

systemically important institutions; thus, '[w]e do not want to have another Lehman experience! This is the lesson learnt in 2008, and in many respects it is the right lesson' (Hellwig 2014a: 21). Therefore, a cost-benefit analysis would be useless because every systemically important institution would obtain ELA to avoid a second Lehman experience.

In relation to the first point, the crisis committee would be working against the clock. However, as we noted, based on the close cooperation between the SNB and the SFBC/FINMA through the MoU,[215] the SNB as the LOLR had enough time to prepare a systematic analysis for ELA. For example, the SFBC was first clearly informed about UBS's sub-prime exposure on 24 August 2007. If the SFBC had informed the SNB in a timely manner, both authorities would have had until 15 October 2008 – more than fourteen months' time – to conduct a proper analysis. Consequently, this working-against-the-clock argument does not appear to hold water.

In relation to the second point, of course we do not want to have another Lehman experience. However, 'too big' does not mean that the institutions in question are systemically important to an economy. In other words, relative to global SIBs (G-SIBs), SIBs should not be of systemic importance to an economy. For example, in the United States, Washington Mutual Bank was also 'too big', but the bank was not of systemic importance to the economy. Therefore, differentiating between SIBs and G-SIBs is helpful. In addition, the liquidity assistance provided to a fundamentally insolvent, systemically important institution can be dangerous for the institution that provides the assistance (the central bank and/or the government) (for example, the Reichsbank's ELA to the insolvent, systemically important Danat Bank in 1931[216] created higher costs than benefits; in addition, when the Greek government recapitalised the Greek banking sector in 2007 and 2008, the government struggled with a temporary insolvency problem). On the one hand, recapitalisation would be dangerous for the government because the potential losses would have to be covered by higher taxation or public spending cuts. On the other hand, central banks cannot enter into bankruptcy; therefore, they can absorb losses with no limitations. However, this is not true in reality because central banks can suffer losses that affect taxpayers (see Hellwig 2014b, Tucker 2014).

[215] If the cooperation between the SNB and the SFBC/FINMA in times of crisis is insufficient, then the MoU is a dubious instrument.

[216] Schnabel (2004) analyses the causal links between the banking and currency problems during the German crisis of 1931.

> 'As central banks today are mainly owned by governments, this means that profit distributions from central banks go into the governments' budgets. If the central bank makes losses on its assets and if, therefore, its profit distribution to the government is reduced, the government must either reduce some expenditures or raise taxes (or borrow more, which implies lower expenditures or higher taxes in the future)' (Hellwig 2014b: 11, see also Illing and König 2014).[217]

Consequently, if central banks suffer losses, they transfer the cost to the government, which must cover the cost through higher taxation or public spending cuts. This transfer of fiscal cost is an implicit fiscal carve-out (FCO). Therefore, the LOLR regime requires a broad FCO condition. We thus follow Tucker (2014) and Hellwig's (2014b) fiscal implications for central banking to formulate the eighth principle:

Principle 8: The Swiss LOLR should be based on a broad, explicit, and transparent fiscal carve-out condition.

- After the third recapitalisation failed, on 15 October 2008 the SNB and the Swiss Confederation acted as LOLRs, undertaking measures on the asset side and the liability side of UBS to strengthen its balance sheet via an SPV, the stabilisation fund 'StabFund'[218] under the SNB. Moreover, in October 2008, the following events occurred: (1) The SNB and major central banks coordinated their market liquidity provisions and announced a joint reduction of their interest rates to very low levels. The low interest rates contributed to a contagion effect by reassessing the net present value of investment projects and counteracted the negative effects of the liquidity shortage on asset prices (see Maux and Scialom 2012). In addition, the rates reduced banks' costs to obtain liquidity from the central banks, a potential source of bank failure (see Maux and Scialom 2012). (2) Fitch downgraded the United States. (3) The SNB introduced a new monetary policy instrument by issuing SNB bills (see FINMA 2009, SNB 2009).

- On 4 November 2008, UBS announced a net loss (pre-tax) of CHF 3,655 million, a net trading income loss of CHF 1,509 million, an outflow of deposits due to customers of CHF 36,192 million and a decreased Tier 1 rating of 10.8 per cent for the third quarter of 2008

[217] In this context, Illing and König (2014: 18) noted that the 'problem is particularly relevant when the resolution of a bank is associated with high fiscal costs which would put significant strain on the government's budget'.
[218] The StabFund was the 'bad bank', and the remainder of UBS was the 'good bank' (see IMF 2009).

(see UBS 2008e). On 26 November 2008, the SNB established the SNB StabFund and made two cuts in the three-month Libor rate (see SNB 2009).

- 'On 16 December 2008, the SNB StabFund acquired a first tranche of 2,042 securities from UBS for USD 16,4 billion. […].The purchase price was USD 0,3 billion lower than the value UBS assigned to these securities on 30 September 2008' (UBS 2009a: 6). On 19 December 2008, UBS announced the first tranche of illiquid assets for approximately USD 16,4 billion. On 30 December 2008, on the insistence of the SFBC, UBS sold its USD 3,4 billion stake in Bank of China (see UBS 2008h).

- By January 2009, the SFBC had been replaced by the FINMA, which began its operations (see FINMA 2009).

- On 10 February 2009, UBS announced a net loss (pre-tax) of CHF 13,290 million, a net trading loss of CHF 8,779 million, a decrease of deposits due to customers of CHF 45,287 million, and a Tier 1 capital ratio of 11.5 per cent for the fourth quarter of 2009 (see UBS 2009a). Furthermore, according to all quarterly reports in 2009, UBS had an (unaudited) loss (pre-tax) of approximately CHF 32,834 million. In addition, in February 2009, the SNB announced the issuance of SNB bills in USD; a three-month Libor rate cut occurred in March. Moreover, the SNB announced that it was considering further unconventional measures (such as a minimum exchange rate for CHF and a negative interest rate policy) (see SNB 2009).

- In April 2009, the SNB finalised the transfer of UBS assets for a total of USD 38,7 billion. Moreover, on 20 April 2009, UBS announced that it was selling its Brazilian financial service business for CHF 2,8 billion (UBS Pactual) (see also UBS 2009b).

- On 5 May 2009, UBS announced a net loss (pre-tax) of CHF 1,558 million, a net trading loss of CHF 630 million, a relatively stable deposits-due-to-customers position, and a Tier 1 ratio of 10.5 per cent for the first quarter of 2009 (see UBS 2009b). As a consequence of the low Tier 1 ratio, on 25 May 2009, UBS announced that it would increase the Tier 1 ratio by at least 10 per cent, which led to a higher Tier 1 ratio, namely, approximately 13.2 per cent, in the second quarter of 2009 (see UBS 2009b).

Considering the chronological overview, the following two questions arise:

- How did the Swiss LOLR provide ELA to UBS in the most recent financial crisis?
- Did UBS fulfil the Swiss LOLR's conditions at the time of ELA?

To answer these two questions, the next section briefly explains the Swiss LOLR mechanism and reveals whether UBS fulfilled the SNB's LOLR conditions at the time of ELA.

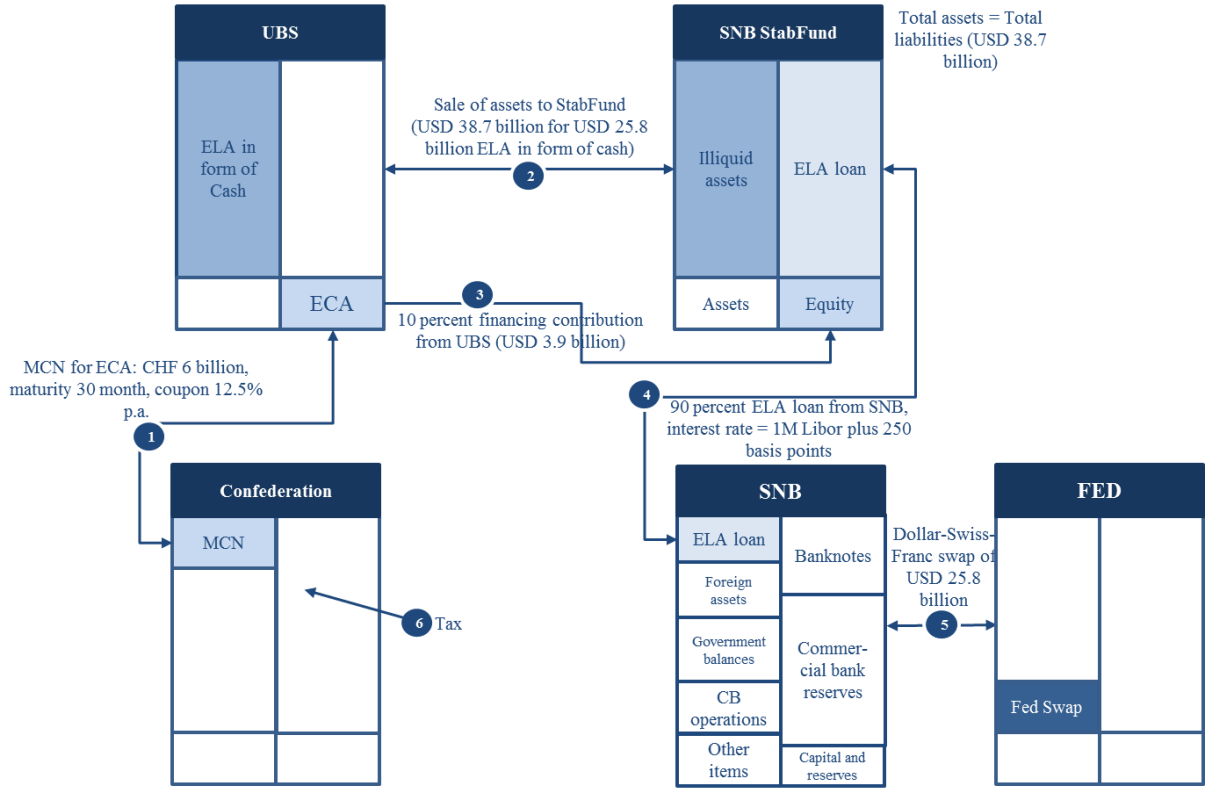
7.2. An evaluation of the Swiss LOLR policy during the crisis

The Swiss LOLR mechanism was a combination of asset sales to an asset management fund (the bad bank, also known as the StabFund) and recapitalisation via MCNs to the Swiss Confederation that provided emergency capital assistance (ECA). This form of SPV had been chosen for following reasons: (1) a separation between the SNB account and the StabFund allowed for more transparency; (2) it provided positive incentives for management and better accountability in case of losses; and (3) it strengthened the capital base of UBS by issuing CHF 6 billion of MCNs (see also UBS 2009d). Figure 7.5 shows emergency assistance via the StabFund; however, the SNB acted as the LOLR and provided indirect ELA, whereas the Confederation acted as a supportive LOLR and provided direct ECA.

Let us first observe the asset-side intervention. On the asset side, UBS's balance sheet had been strengthened by long-term credit. In this context, UBS was allowed up to USD 60 billion in illiquid assets to sell to the StabFund, whose assets totalled USD 1,875 billion (CHF 1,980 billion) at an interest rate of one-month Libor plus 250 basis points (see entry 4) (see UBS 2008e).[219]

[219] The term of the ELA loan was 8 years but could be extended to a maximum of 12 years to permit an orderly liquidation of assets (see SNB 2008a, 2008b).

Figure 7.5 Emergency assistance via StabFund



Source: Adapted from SNB (2013).

ELA from the SNB in the form of high-powered money in USD was provided indirectly to UBS via the StabFund due to its demand on funding liquidity in the form of foreign high-powered money. After the settlement of the ELA, the SNB was party to the profits and losses generated by the SPV, with USD 1 billion up front and with 50 per cent of the remaining equity value (see SNB 2008a, 2008b). However, instead of CHF 60 billion in illiquid assets, UBS sold USD 38,7 billion in illiquid assets for USD 25,8 billion in ELA to the StabFund (see point 1). This transfer of assets occurred in the fourth quarter of 2008 and the first quarter of 2009; it was priced at fair value[220] on 30 September 2008 and was verified by independent third parties (see UBS 2008g). On the asset side, one interesting finding is that the SNB provided foreign high-powered money, not though reserves on their own currency but through a dollar-Swiss franc swap line[221] between the SNB and the Fed (see entry 5), thereby challenging Goodhart's (2009

[220] In this context, what is the correct fair value of the sub-prime MBS that are not sellable on the market at that time? An external observer would say that if the assets are not sellable on the market, the value of the assets is zero. However, this is only a half-truth because behind the illiquid sub-prime MBS, the real value of a house exists. Although the value of sub-prime MBS was difficult to assess based on the securitisation process and market uncertainty, the value of a sub-prime MBS was above zero; therefore, a price could be determined by the bank and verified by an independent third party.

[221] The swap line enables the SNB to provide Swiss banks with foreign currency (such as USD and EUR) (SNB 2015a). According to the swap line, the SNB would first purchase dollars from the Fed with CHF at prevailing

[1999]) view of the limited creation of money (see section 5.4). The SNB justified its creation of money with a strategy regarding the depreciation of the Swiss franc, which had been criticised at the beginning of the financial crisis by several central banks; however, these central banks (such as the BoE) followed the SNB. Therefore, we conclude that the central banks are not limited in their provision of high-powered money. Opponents would suggest that the SNB is limited in its provision of foreign high-powered money because the volume of a dollar-Swiss franc exchange agreement is limited and depends on the counterparty's consent. They are correct on this point; however, when systemic crises occur, central banks work together and coordinate their operations to restore financial stability. Therefore, central banks can create unlimited domestic and foreign high-powered money when a systemic crisis occurs, which leads us to the ninth principle:

Principle 9: The SNB can create unlimited domestic and foreign high-powered money when a systemic crisis occurs.

On the liability side, the Swiss Confederation acted as the LOLR and provided ECA in domestic currency against MCNs in the amount of CHF 6 billion[222] at a coupon rate of 12.5 per cent payable annually (see entry 1) for an 8-year term. Furthermore, the payment period could be extended to a maximum of 12 years to permit the orderly liquidation of the assets (see SNB 2008a, 2008b, UBS 2008g). Moreover, the new capital had been used to cover 10 per cent of USD 38,7 billion, that is, USD 3,9 billion, to the StabFund (see entry 3). The remaining amount in CHF was used to strengthen the capital position of UBS. In this context, why did the Swiss Confederation decide to obtain MCNs? The Confederation made this decision because (1) from its perspective, MCNs fulfilled the high transactional security that it desired; (2) it would not become a co-owner of the bank and was able to withdraw ECA during the term of the loan (30 months);[223] and (3) MCNs compensated for the ECA that it provided (coupons of 12.5 per cent) (see Federal Council 2008). In short, through the ECA injection, the capital base of UBS had been strengthened at a cost to the Swiss taxpayer.

market exchange rates; the dollars and CHF would then be swapped back at the same exchange rate at an agreed-upon date in the future (see SNB 2015a).

[222] 'The proceeds were intended to finance UBS's equity injection in the StabFund, which was immediately valued at USD 1' (IMF 2009: 30, see also UBS 2008g).

[223] Further details are provided in the summary term sheet of the mandatory convertible notes (UBS 2008g).

On the liability side, one interesting finding is that the Swiss Confederation's provision of emergency assistance was offered at a very high interest rate. This consideration led us to conclude that lending at a very high interest rate would be a possible LOLR condition in the twenty-first century to mitigate the moral hazard problem. Moreover, lending at a risk premium could be very profitable, as noted in Switzerland. In the words of Hellwig (2015b: 5),

'acting as a lender of the last resort under Bagehot's rule and lending to solvent banks at high rates, could be very profitable. Profitability would also benefit if the support given to the financial system actually managed to forestall a deeper crisis that might have compromised the central bank's other assets'.

However, we are sceptical about lending at a very high interest rate because such a rate could be self-defeating if 'the cost of assistance would exceed the cost of liquidating illiquid assets' (Guttentag and Herring 1987: 166-167). Commercial banks would then use their existing good collateral to borrow in the marketplace (Goodhart (2007 [1999]). Therefore, instead of lending at very high interest rate, we propose lending at a high interest rate, the so-called 'risk-premium', based on the normal market rate (before the crisis) and a risk premium (for example, 250 basis points). Thus, our tenth principle for the Swiss LOLR is in line with Guttentag and Herring (1987) and Tucker (2014):

Principle 10: The Swiss LOLR should charge a risk premium.

The risk-premium proposal can be criticised from different angles. For example, lending at a very high interest rate might reduce the effectiveness of ELA in the early phase of a crisis (see Domanski et al. 2014). However, as we noted, UBS was able and agreed to pay a very high coupon rate during the financial crisis. Thus, the effectiveness of ELA in the early phase was not undermined. Another criticism is that a very high interest rate might exacerbate a bank's distress. In this context, Crockett (1997: 25) noted that when ELA institutions are in 'a fragile condition, the risk is that penalty-rate financing will make their position even more untenable and will promote further withdrawals of funds'. UBS was in a fragile condition, and lending at 12.5 per cent could have exacerbated the situation. Therefore, to avoid this problem, we propose a risk premium that falls below a very high interest rate. Further, 'implying a higher cost to a bank in the case of the occurrence of a large liquidity withdrawal, should lead the bank to be more careful and increase its propensity to avoid the occurrence of such a state' (Baltensperger 1992: 446-447). Similarly, Freixas et al. (2007 [1999]: 40) noted that a high interest rate 'send[s] a signal to the market that precipitates an untimely run, unless it is provided covertly'.

In this sense, a run on UBS deposits did occur after ELA was initiated (for example, the deposits due to customers decreased from CHF 520,031 million in the third quarter of 2008 to CHF 474,744 million in the fourth quarter of 2008). However, the idea of the interest rate signalling market participants is questionable. We are sceptical about the interest rate triggering the bank run and incentivising the bank to gamble on resurrection (see Freixas et al. 2007 [1999]). Although we agree with Freixas et al. (2007 [1999]) that gambling on resurrection is a risk with which the central bank struggled, all forms of insurance systems encounter these problems. Therefore, the main question is not how such gambling can be avoided but how it can be mitigated. Thus, to internalise the externality of gambling on resurrection, clear principles can mitigate the problem in times of financial distress. In a nutshell, although lending at a risk-premium rate can be criticised from several angles, the majority of these arguments can be countered.

With these factors in mind, we consider whether UBS fulfilled the Swiss LOLR conditions at the time of ELA. In the following section, we thus analyse whether UBS at the time of ELA (1) was of systemic importance, (2) was solvent and (3) had sufficient collateral, focusing primarily on the solvency question.

7.2.1. Analysis of systemic importance

In academia and in practice, the terms ‘too big to fail’, ‘too important to fail’ and ‘too interconnected to fail’ have been hotly debated, particularly in the aftermath of the financial crisis of 2007–2009. Based on the Global Financial Stability Report of the IMF (see IMF 2014), ‘too big to fail’, ‘too important to fail’ and ‘too interconnected to fail’ banks are referred to as SIBs in this dissertation. Although the acronym ‘SIB’ was first elaborated in the aftermath of the financial crisis, namely, submitted to the G20 finance ministers and central bank governors by the IMF, the FSB and the BIS in 2009 (see IMF et al. 2009), the concept probably originated in the writings of Bagehot. Bagehot (2005 [1920]: 180-181) indicated that ‘the ruin of one of these great banks [SIBs in the City of London] would greatly impair the credit of all’; therefore, if ‘one of the greater London joint stock banks [an early form of SIBs] failed, there would be an instant suspicion of the whole system [(that is, aggregated uncertainty)]’. More than 130 years passed and numerous financial crises occurred before the IMF, the FSB, the BIS and particularly the G20 finance ministers and central bank governors integrated the concept of the ‘systemic importance of financial institutions’ into their political agendas. Although G20

members do not have a consistent formal definition of systemic importance, in practice, they broadly consider an institution to be 'systemically important if its failure or malfunction causes widespread distress either as a direct impact or as a trigger for broader contagion' (IMF et al. 2009: 5). Similarly, the Dodd-Frank Wall Street Reform and Consumer Protection Act (DFA) in the United States defines systemic importance as follows:

SEC 803 (9) systemically important and systemic importance:

The terms "systemically important" and "systemic importance" mean a situation where the failure of or a disruption to the functioning of a financial market utility or the conduct of a payment, clearing, or settlement activity could create, or increase, the risk of significant liquidity or credit problems spreading among financial institutions or markets and thereby threaten the stability of the financial system of the United States.

In accordance with Art. 7 para. 1 of the BA (2015 [1934]; trans.), systemic importance is defined as follows:

Art. 7 Definition and purpose

Systemically important banks are banks, financial groups and bank-dominated financial conglomerates whose failure would do considerable harm to the Swiss economy and the Swiss financial system.

The difference between these two definitions concerns the adverse effects of an SIB's failure on the financial system and/or the real economy. For example, in the DFA, the term 'systemic importance' relates to the effects of an institution's failure on the financial system, whereas, in Switzerland, the term is linked to the effects of an institution's failure on the entire Swiss economy and the Swiss financial system. In other words, the Swiss definition takes into account the banking sector, NBFIs (such as hedge funds, insurance companies, and pension funds) and NBNFIs (systemically important firms such as Novartis and Nestle).

In the narrow sense, systemic importance is defined by assessment criteria, namely, size, lack of substitutability and interconnectedness. In this context, size, lack of substitutability and interconnectedness are defined as follows (IMF et al. 2009: 9):

- 'Size: The importance of a single component for the working of the financial system increases with the amount of financial services that the component provides.
- Lack of substitutability: The systemic importance of a single component increases in cases where it is difficult for other components of the system to provide the same or similar services in the event of a failure.

- Interconnectedness: Systemic risk can arise through direct and indirect interlinkages between the components of the financial system so that individual failure or malfunction has repercussions around the financial system, leading to a reduction in the aggregate amount of services'.

In other words, SIBs are 'those institutions whose distress or disorderly failure would cause significant disruption to the wider financial system and economic activity, due to their size, complexity, systemic interconnectedness or lack of good substitutes that can readily take over their activities' (Liikanen et al. 2012: 38). The IMF et al. (2009) developed various indicators to assess these criteria.

Size can be determined using three indicators (see IMF et al. 2009, FSB 2009). (1) Clearing and settlements: In this context, the amount of financial services provided to the clearing and settlement system is an indicator of systemic importance. (2) Financial intermediation: An institution that (a) has a large market share in liabilities (such as short-term and long-term deposits) and claims, (b) boasts a high asset-to-GDP ratio (see FSB 2009), (c) is a market maker, and (d) has a significant market share in loans on the market is systemically important. (3) Risk control and management: Systemic importance is determined by the role of risk management and mitigation (for example, over-the-counter (OTC) derivatives activities).

Although the lack of substitutability is difficult to assess, one simple indicator is the Hirschman-Herfindahl Index. '[T]he Hirschman-Herfindahl Index is based on the distribution of market shares across all market participants/suppliers of a service' (IMF et al. 2009: 16).

The IMF et al. (2009) noted that interconnectedness can be measured via exposure and cross-ownership/cross-institutional linkages. Indicators include the share of domestic and foreign subsidiaries' assets to total assets, the amount of intra-group exposure, the consolidation of international claims, and the exposure to countries under stress tests. In light of these indicators, the SNB has the mandate to identify systemically important firms. For this purpose, the SNB uses four indicators[224] (see Art. 8 para. 2 of the BA 2015 [1934]; trans.):

[224] Although these indicators are useful when assessing systemic importance, we propose extending the criteria with an additional criterion, namely, 'complexity', because '[a financial institution] with greater complexity [is] likely to be more difficult to resolve and therefore cause[s] significantly greater disruption to the wider financial system and economic activity' (BCBS 2011a: 4). According to the BCBS (2011a), indicators of complexity are based on business, structural and operational complexity. In this context, the following are indicators of complexity: (1) operations through numerous legal entities and jurisdictions; (2) the amount of OTC derivatives not cleared by a central counterparty (according to the BCBS (2011a: 9), '[t]he greater the number of non-centrally cleared OTC derivatives a bank enters into, the more complex a bank's activities. This is especially so in the context of resolution as highlighted in the failure of Lehman Brothers'); and (3) Level 3 assets that do not fulfil the HQLAs (including Level 1, Level 2A and Level 2B asset classes) because, as the BCBS (2011a: 9) clearly noted, these are 'assets whose fair value cannot be determined using observable measures, such as market prices or models. Level 3 assets are illiquid, and fair values can only be calculated using estimates or risk-adjusted value ranges'. Based on the complexity, we see a potential policy option to reform the valuation indicators of SIBs in Switzerland, namely, taking into account complexity.

- ‘Market shares associated with systemically important functions
- The value of insured deposits
- The relationship between the balance sheet size and the gross domestic product
- The bank’s risk profile based on its business model, balance sheet structure, quality of assets, liquidity and leverage ratio’.

With these considerations in mind, another question arises: if UBS was of systemic importance at the time of ELA, would UBS’s failure have caused considerable harm to the Swiss economy and the Swiss financial system (see Art. 7 para. 1 of the BA 2015 [1934])?

In the third quarter of 2008, the answer was a clear ‘yes’ for the following reasons: (1) The Swiss economy was characterised by its competitive banking sector with two dominant SIBs, UBS and Credit Suisse (today, five SIBs, namely, UBS, Credit Suisse, Raiffeisen Switzerland, Zürcher Kantonalbank and Post Finance AG, dominate the banking sector; in the future, Julius Bär will probably be considered an SIB because of its interconnectedness). Based on the size of the Swiss banking sector (ratio of total assets to annual GDP) at the end of 2008, its total assets amounted to CHF 4,361 billion – more than eight times the Swiss GDP – whereas UBS held approximately half of the total assets, amounting to CHF 1,999 billion (see SNB 2009). In other words, at the time of ELA, UBS’s assets amounted to CHF 1,999 billion (approximately CHF 2 trillion) – more than three and a half times the Swiss GDP (which is a sign of an institution’s systemic importance to a country’s economy). (2) The market concentration (the assets of the three largest banks as a percentage of total assets) of the banking industry is relatively high in Switzerland. The assets of the three SIBs accounted for 76 per cent of total assets in 2008, whereas the assets of UBS and Credit Suisse accounted for 73 per cent of total assets, showing the dominance of the two largest banks in the Swiss banking sector with respect to market concentration. The assets of UBS accounted for more than half of this 73 per cent, showing its relative importance with respect to market concentration. (3) In relation to the ratio of deposits due to customers to the GDP, the total UBS deposits due to customers amounted to CHF 475 billion, corresponding to 87 per cent of the GDP at the time of ELA, which is an additional indicator of a financial institution’s systemic importance with respect to systemic risk (49 per cent for Credit Suisse, 19 per cent for Raiffeisen Switzerland, 18 per cent for Zürcher Kantonalbank, and 12 per cent for Post Finance AG). (4) UBS and Credit Suisse are the representative paying agents in Switzerland. A default by one of the two banks would harm the payment system. (5) The SNB estimated that, in the case of default, (a) the cost to the economy would be between 15 and 30 per cent of the Swiss GDP, that is, between CHF 81,77

billion and CHF 163,54 billion, and (b) 70,000 companies would have found themselves in financial distress (see SNB 2008c, Birchler et al. 2010, Jordan 2011).

Based on these considerations, UBS was of systemic importance at the time of ELA, which corresponds with the views of the SNB, the SFBC/FINMA, and the Swiss Confederation.[225]

Nevertheless, the recent financial crisis shows that not only banks but also NBFIs received emergency assistance. Furthermore, the rationale for the LOLR is not limited to banks. In this regard, we ask what would happen if a systemically important NBFI (such as Zürich Insurance or SwissRe) failed (from a macro-perspective, we should also pay attention to global asset managers such as BlackRock). The answer for the banking sector also applies here; a systemically important shock (from banks or NBFIs) would harm the Swiss economy. In the words of Nakaso (2014: 106),

'we have also learned that it is not only banks that can trigger a systemic crisis. Indeed, we were forced to recognise that non-bank financial institutions, such as security firms and insurers can be the source of a market-induced systemic crisis'.

Therefore, the concept of the LOLR should be extended to the insurance and asset management sector. However, if the market is able to absorb the domestic shocks, no Swiss LOLR is needed. Furthermore, to mitigate the moral hazard problem, we propose a constructive ambivalence strategy at a risk-premium rate. In light of this consideration, the eleventh Swiss LOLR principle for the twenty-first century is proposed as follows:

Principle 11: The Swiss LOLR should be extended to systemically important NBFIs.

[225] However, the following arguments have questioned UBS's status up until this point: (1) At the time of ELA, the SNB, the SFBC/FINMA and the Swiss Confederation considered UBS systemically important, but at that time, no clear definition or indicators were used to determine whether a financial institution was systemically important. Consequently, how were the SNB, the SFBC/FINMA, and the Swiss Confederation capable of assessing the systemic importance of UBS? The answer is based on the above-mentioned considerations. (2) On 16 November 2012, the SNB 'issued decrees designating UBS as financial groups of systemic importance in accordance with articles 7 and 8 of the Banking Act' (SNB 2012). In this context, why did it take so long (three years) for UBS to receive SIB status from the SNB, even though the IMF, the FSB, and the BIS provided a report to G20 finance ministers and governors entitled 'Guidance to Assess the Systemic Importance of Financial Institutions, Markets and Instruments: Initial Considerations' in 2009? (3) We agree that UBS was a large bank in terms of size, but 'too big' does not mean that a bank is of systemic importance. For example, in the United States, the Washington Mutual Bank was also 'too big', but the bank was not of systemic importance to the economy. (4) Finally, according to the Financial Stability Report of 2009, UBS and Credit Suisse dominated the Swiss market in terms of total assets; however, both banks were relatively less significant in the domestic credit market, thereby questioning the potential for bank failure in the credit market business (see SNB 2009).

7.2.2. Solvency analysis

In the literature, researchers examine whether the most recent financial crisis was a liquidity crisis and/or a solvency crisis. As we noted in the chronological overview, in our view, the recent crisis was a solvency crisis rather than a liquidity crisis. Similarly, Schwartz (2008) indicated that the crisis of 2007–2009 was not a liquidity problem but rather an insolvency problem. Schwartz (2008) suggests that during the financial crisis, banks such as the Royal Bank of Scotland, UBS, and Bear Stearns held toxic assets (sub-prime mortgages that related to (US) ABS and (US) CDOs) that were unsellable on the market and of an unknown value. Therefore, these banks were not credible and were therefore temporarily insolvent, leading to the drying up of liquidity (see Schwartz 2008). Admati and Hellwig (2013: 40) note the following:

> 'some believe that the financial crisis of 2007–2009 was primarily caused by the liquidity problems of financial institutions that did not have access to the safety net. The liquidity problems came about when lenders to banks and other financial institutions withdrew their funding and, at the same time, the markets for mortgage-backed securities broke down. The focus on liquidity problems, however, avoids the critical question of why lenders withdraw their funding to begin with. The breakdown of funding for banks and other institutions during 2007–2009 did not come out of the blue. Rather, it reflected investors' legitimate concerns that these institutions were no longer sound and that they might actually be unable to pay their debts ever. The concern, in other words, was whether these banks might be insolvent'.

In this sense, the literature primarily focuses on the wrong market failure, namely, the liquidity problem, and on ineffective regulatory measures (such as liquidity requirements), whereas solvency analyses have been relatively neglected in the literature because of their operational difficulty (see Baltensperger and Dermine 1987, Admati and Hellwig 2013). Although '[t]he distinction between solvent and insolvent banks is a feature of the academic literature' (see Freixas et al. 2007 [1999]: 28), we attempt to elucidate this operational element to answer the question of whether UBS was solvent at the time of ELA. Our answer does not reflect the financial situation of other distressed institutions, such as Bear Stearns, Fannie Mae and Freddie Mac, AIG, Hypo Real Estate, and Dexia, during the crisis. Therefore, our analysis is limited with respect to the above-mentioned contentious discussion.[226] Nevertheless, in this context, the following four main questions arise:

[226] To determine whether the recent crisis was a solvency crisis, an overall multiple regression analysis is needed; this analysis would be based on solvency test variables that measure the solvency of all financially distressed banks that obtain ELA from the central bank and the government. Cline and Gagnon (2013) provided an analysis of the

- What does solvency–insolvency mean?
- How can solvency–insolvency be measured in the banking sector?
- Was UBS solvent at the time of ELA?
- Which agency in Switzerland is responsible for assessing an SIB's solvency?

What does solvency–insolvency mean?

In the literature, 'insolvency' can be defined both broadly and narrowly. In the broad sense, insolvency is 'the state of not having enough money to pay what you owe' (Parkinson and Noble 2008: 285). In other words, an economic agent or an institution is insolvent if their liabilities exceed their assets and their equity is below zero.

Insolvency is the state of not having enough money to pay what you owe.

Source: Parkinson and Noble (2008: 285).

In the narrow sense, insolvency can be defined with solvency tests that lead to different definitions. For instance, in bankruptcy and corporate law, three tests generally provide a narrow definition of solvency–insolvency: the capital-adequacy solvency test, the ability-to-pay solvency test, and the balance-sheet test (see Heaton 2007, IFRS 2012, Cline and Gagnon 2013). However, in addition to these solvency tests, several other tests can be used (for example, the short-term solvency test,[227] the funding liquidity test,[228] the share price test,[229] the credit default swap test, the rating test, the collateral test,[230] and the repayment test[231]). Although these tests appear in the literature, no clear framework for the LOLR explains how soundness/solvency will be assessed (see Tucker 2014). In this sense, although we agree with

solvency of Lehman Brothers, Bear Stearns, Fannie Mae and Freddie Mac, and AIG and showed that these financial institutions had been solvent at the time of ELA. However, their analysis was based on different solvency tests; therefore, a comparison of the solvency situations would be questionable. As such, we propose using a homogenous approach with multiple solvency tests for an effective comparison.

[227] The short-term solvency test, the so-called current ratio or acid-test ratio, is calculated as the ratio of current assets to current liabilities. The current ratio should be 2:1, meaning that CHF 2 of cash and assets should be converted into cash in the near future to pay CHF 1 of current liabilities.

[228] Admati and Hellwig (2013: 41) indicated that another 'possible insolvency test is whether it can raise new equity from private investors. An inability to raise equity at any prices is a clear sign that [the bank] is weak and might be insolvent'.

[229] The share price test analyses the value of shares.

[230] The collateral test analyses whether a bank has sufficient eligible collateral (for further details, see 7.2.3).

[231] The repayment test considers whether a bank is able to repay ELA in a reasonable period (see also Cline and Gagnon 2013).

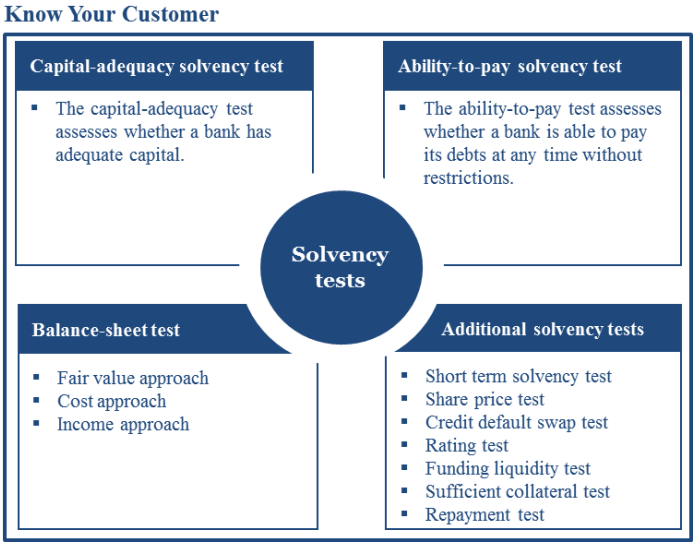
Goodhart (2009 [1999]) that estimating the borrower's solvency is difficult during a financial crisis, the twelfth principle regarding the Swiss LOLR is as follows:

Principle 12: The Swiss LOLR requires a clear solvency framework as part of a cost-benefit analysis.

How can solvency–insolvency be measured in the banking sector, and was UBS solvent at the time of ELA?

A solvency framework should help the Swiss LOLR to evaluate the solvency of a bank in distress. Acknowledging the lack of a clear solvency framework, we propose a potential framework for the banking sector (see Figure 7.6) that aims (1) to assess a bank's solvency; (2) to better know its customers; (3) to help the SNB act in a timely manner and be more effective in times of distress; and (4) to close the gap in the literature.

Figure 7.6 Overview of the bank solvency framework



Source: Authors' own elaboration.

In a broad view, we propose combining a know-your-customer framework for the Swiss LOLR with a standard solvency test approach. Moreover, the framework can be extended with other tests. Although identifying the above-mentioned tests is simple, in practice, they are difficult to

apply (see also Heaton 2007, Admati and Hellwig 2013). Therefore, we first review the three main solvency tests.[232]

The capital-adequacy test assesses whether a bank has adequate capital (for instance, a bank should meet the minimum capital requirements of the Basel accords). The SNB uses the capital-adequacy test. In this context, the SNB (2015a) finds a bank or group of banks to be solvent if it meets the capital adequacy regulations that are currently in force. However, the capital-adequacy test is not well-defined and presents several problems: (1) it does not account for systemic risk, and (2) it is based on a risk-weighted approach that allows systemically important institutions to manipulate the weighting. Therefore, a reform of the capital-adequacy requirements is necessary to improve the effectiveness of the capital-adequacy solvency test. With the capital-adequacy solvency test in mind, we ask ourselves whether UBS fulfilled the capital requirements at that time. The answer is yes because, according to Figure 7.2 from section 7.1, UBS's Tier 1 capital ratio was 10.8 per cent in the third quarter of 2008 – above the required 10 per cent of the Basel II Accord that constituted the requirements at that time. Therefore, UBS was solvent with respect to the capital-adequacy solvency test.

The ability-to-pay solvency test, or the 'cash-flow solvency test', assesses whether a bank is able to pay its obligations (the bank's current or future debts) at any time without restrictions (see Heaton 2007, IMF 2013). Conversely, if a bank is unable to pay its debts with sufficient cash or collateral,[233] then the bank is insolvent. The simple notation of the ability-to pay solvency test is linked with the definition of liquidity in section 3.2.3. Therefore, the ability-to-pay solvency test is often considered a 'liquidity test'.[234] To measure the bank's ability to pay in practice, the discounted cash-flow method (DCF) can be used (7.1).[235] The ability-to-pay solvency test measures the net present value (NPV), which is the expected net cash flow (calculated as the difference between future cash inflows and outflows) discounted to its present value, where t is the cash flow period and i the discount rate or assumed interest rate (see 7.1).

[232] A good initial analysis of the solvency tests is provided by Heaton (2007).
[233] The risk of a bank being unable to pay its debts with sufficient cash or collateral is a 'funding liquidity risk'. In contrast to the funding liquidity risk, the market liquidity risk is the risk that an asset cannot be sold in time on the market at a high discounted price.
[234] In accordance with Art. OB20 of the conceptual framework for financial reporting (IFRS 2010: A28), liquidity is described as follows: '[The] entity's cash flows during a period also helps users to assess the entity's ability to generate future net cash inflows. It indicates how the reporting entity obtains and spends cash, including information about its borrowing and repayment of debt, cash dividends or other cash distributions to investors, and other factors that may affect the entity's liquidity or solvency'.
[235] The DCF is also used for the balance-sheet test.

$$\text{NPV} = \sum_{t=0}^{N} \frac{Net\ Cash\ Flow_t}{(1+i)^t} \geq 0 \qquad (7.1)$$

If the NPV is greater than or equal to zero, the institution is considered to be solvent, whereas an NPV below zero indicates that the bank will probably be deemed insolvent. The ability-to-pay solvency test can be criticised from multiple angles. First, the test is forward-looking because it estimates future bank cash flows over a certain number of years. In this context, we could argue that the ability-to-pay test is not adequate to assess a bank's solvency because the future is uncertain and cannot be assessed. Thus, estimating future cash flows is a daunting task because it requires a reasonable justification for the estimated cash outflow and a thorough understanding of the bank and the banking industry. In other words, information about the bank's solvency (or lack thereof) is required. However, banks 'have strong incentives to hide any adverse information' from a solvency valuator (Admati and Hellwig 2013: 41 and Hellwig 2014b). Therefore, a hidden insolvency problem often exists, and the valuator must also determine whether a bank is able to raise funds on the market. To avoid these problems, we used actual income and expenses from 2008 to 2015 instead of expected income and expenses.[236] Further, for the 2015–2018 period, we project net profit (pre-tax)[237] according to the average rate from 2013 to 2014 because these two years entailed relatively small adjustments with respect to fair-value accounting in the sub-prime mortgage market.[238] Table 7.2 depicts the calculated going-concern total free cash flow of UBS between 2008 and 2018.

Table 7.2 Going-concern total free cash flow of UBS, 2008–2018 (in million CHF)

Going concern operations	31.12.2008	31.12.2009	31.12.2010	31.12.2011	31.12.2012	31.12.2013	31.12.2014	31.12.2015	31.12.2016	31.12.2017	31.12.2018	Total
Other operating income	27'019	22'925	24'523	23'445	21'963	22'602	24'185	24'909	2'244	2'244	2'244	0
Net trading income gain/loss	- 25'818	- 324	7'471	4'343	3'480	5'130	3'841	5'696	0	0	0	0
Total operating income	1'201	22'601	31'994	27'788	25'443	27'732	28'026	30'605	0	0	0	0
Total operating expenses	28'555	25'162	24'539	22'439	27'219	24'461	25'557	25'198	0	0	0	0
Net operating profit/loss (pre-tax)	- 27'354	- 2'561	7'455	5'349	- 1'776	3'271	2'469	5'407	2'244	2'244	2'244	- 15'616
+Depreciation (of property and equipment and amortisation of intangible assets)	1'454	1'248	1'035	888	795	999	900	1'025	0	0	0	8'344
-Capital expenditure (purchase of property and equipment)	- 1'217	- 854	- 541	- 1'129	- 1'118	- 1'236	- 1'915	- 1'841	0	0	0	- 9'851
Free Cash Flow	- 27'117	- 2'167	7'949	5'108	- 2'099	3'034	1'454	4'591	2'244	2'244	2'244	- 2'515
Emergency liquidity assistance	15'771	9'717	0	0	0	0	0	0	0	0	0	25'489
Confederation transaction / ECA vs MCN	6'000	0	- 1'200	0	0	0	0	0	0	0	0	- 4'800
Repayment StabFund	0	- 3'414	- 3'414	- 3'414	- 3'414	- 3'414	0	0	0	0	0	17'071
Repurchase of StabFund from SNB (incl. interest income)	0	0	0	0	0	- 3'618	0	0	0	0	0	- 3'618
Total FCF	**- 5'346**	**4'136**	**3'335**	**1'694**	**- 5'513**	**- 3'998**	**1'454**	**4'591**	**2'244**	**2'244**	**2'244**	**34'141**

Source: Authors' own calculations based on the UBS annual report between 2008 and 2009 (audited).

[236] In practice, different forecast methods can be used to determine income and expenses.
[237] We use pre-tax incomes to remove potential tax benefits during the financial crisis of 2007–2009 that may distort our analysis.
[238] Moreover, taking into account 2016–2018, a constant net operating profit (pre-tax) can be considered optimistic, but from a narrow perspective, a constant income for the future net profit (pre-tax) is rather conservative because of no further upside on profitability.

To calculate the total free cash flow per year, the net operating profit/loss (pre-tax), which is the difference between the total operating income (other operating income, net trading income gain/loss) and operating expenses, must be determined in the first step. In the second step, we calculate the free cash flow as the sum of the net operating profit/loss (pre-tax) and the depreciation (of property and equipment and the amortisation of intangible assets) minus capital expenditures. In the third step, the total free cash flow will be calculated as the sum of free cash flow, ELA, and ECA minus the repayment and repurchase of the StabFund from the SNB. To calculate the total FCF and the NPV, the following information is needed:

In December 2008, UBS transferred the first tranche of 2,042 illiquid assets (such as US sub-prime, US Al-A, US prime, commercial real estate, and student loans) and obtained ELA of USD 16,4 billion[239] (CHF 17,455 million)[240] and CHF 6 billion from the Swiss Confederation, whereas CHF 3,9 billion were used to finance the equity of the StabFund (see SNB 2008b, c, UBS 2008g, CCFA 2010).

In January 2009, UBS transferred the remaining illiquid assets and obtained a second tranche of ELA from the StabFund, namely, USD 9,4 million (CHF 9,717 million).[241] In total, UBS transferred USD 38,7 billion in illiquid assets (the net of the pricing adjustment) against USD 25,8 billion ELA from the StabFund (see UBS 2009b).

According to the agreement between the SNB and UBS, as soon as UBS repaid the ELA, the StabFund could be purchased. The repayments were thus based on the following positions: sales, repayments, interest received, and other factors valued at CHF 17,071 million (USD 17,751 million).[242] In 2010, UBS paid interest in the amount of CHF 1,200 million to the Swiss Confederation. Furthermore, the Confederation purchased MCNs from a consortium of investors. Consequently, the Confederation realised a gain through the UBS transaction.

In 2013, UBS repaid the ELA and could thus purchase the StabFund from the SNB at a price of USD 3,762 million (CHF 3,618 million) (see SNB 2013). For the sake of simplicity, we divided the repayment amount into five repayment periods from 2009 to 2013 (CHF 3,414 million per year). In this context, what is the right choice for the potential time period? Why did we choose a ten-year period? We know that the chosen time period affects the NPV. From the literature, a long time period is assumed for firms (for example, banks or hedge funds) engaging in risky businesses. Therefore, because UBS is engaging in a risky business, we use

[239] The purchase price was, according to UBS (2009), 0.3 billion lower than the value that UBS assigned to its illiquid assets on 30 September 2008.
[240] The following exchange rate was used: USD 1 = 1.0643860 CHF in 2008 (see FTA 2016).
[241] The following exchange rate was used: USD 1 = 1.0337340 CHF in 2009 (see FTA 2016).
[242] The following average exchange rate between 2008 and 2013 was used: USD 1 = 0.9616712 CHF (see FTA 2016).

a time horizon of ten years, which is the average of the minimum ELA repayment period (eight years) and the extended payment period (twelve years) for the orderly liquidation of assets.

What discount rate should be used to calculate the NPV? We know that an overly low discount rate biases the nature of bank solvency, whereas an overly high discount rate may inappropriately find that a bank is insolvent.[243] Nevertheless, we use a very high discount rate, the reference value of the SNB, and the risk premium as discount rates and compared the results to one another.

Given all these considerations, we can calculate the NPV. If we take a very high discount rate of 12.5 per cent into account, UBS had a positive NPV in the amount of CHF 2,053 million in the year of ELA. With the SNB's referenced discount rate (US Libor plus 250 basis points), the NPV was CHF 3,482 million higher than the NPV with a very high interest rate, namely, CHF 5,535 million. With the proposed risk-premium interest rate of 5.89 per cent,[244] which is below a very high interest rate and above the pre-crisis interest rate (12.5% $>i^p>$ US Libor + 2.5%), UBS had a positive NPV of CHF 3,967 million at the time of ELA. Consequently, according to the ability-to-pay solvency test, UBS was solvent at the time of ELA based on all three discount rates.

Next, we consider the balance-sheet test. This test uses different valuation methods to assess a bank's assets[245] and liabilities. According to the balance-sheet test, a bank is solvent if its assets exceed its liabilities. In the literature, three different valuation methods dominate: (1) the market approach or fair value approach; (2) the cost approach; and (3) the income approach.

The fair value approach is often referred to as the traditional balance-sheet test of insolvency. According to Art. B5 para. 61-66 of IFRS 13 (IFRS 2012: A634), the fair value approach 'uses prices and other relevant information generated by market transactions involving identical or comparable assets, liabilities, or a group of assets and liabilities, such as a business'. Thus, the fair value of a bank's assets is compared with the fair value of its liabilities. This approach has several advantages. It provides accurate valuations of assets and liabilities on an ongoing basis and limits a bank's ability to potentially manipulate its reported

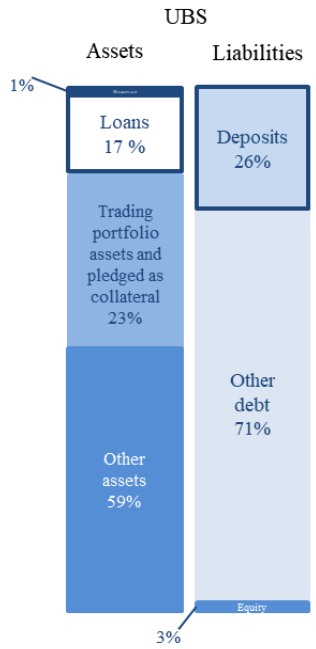
[243] Opponents might argue that the weighted average cost of capital (WACC) can be used as a representative discount rate to solve this problem. Although we agree, the WACC can also be criticized for multiple reasons. The WACC is based on the expected returns of a market that is based on uncertainty, the right choice for the risk-free rate, and the correct calculation of the beta coefficient.

[244] A risk premium of 5.89 per cent will be calculated as the sum of the pre-crisis interest rate for repo transactions and the risk premium of 2.5 per cent. On 1 August 2007, the special repo transaction interest rate (before the crisis occurred on 9 August 2007) was 3.390 per cent (for further details, see Zinssätze der Nationalbank/Taux d'intérêt de la Banque nationale/SNB interest rates (SNB 2016b)) plus 2.5 per cent, equalling 5.89 per cent.

[245] In normal times, asset quality reviews are a helpful instrument in determining solvency (see also Tucker 2014).

net income. However, the fair value approach also can be criticised from various angles. In normal times, prices can become volatile and fluctuate; thus, the revaluation of assets and liabilities becomes volatile. This volatility has an impact on the reporting of gains and losses, which can temporarily change and provide misleading information. In addition, in cases of aggregate uncertainty such as the recent financial crisis, market prices may be unavailable. Therefore, assets and liabilities may be practically impossible to valuate (see Hellwig 2014a). Hellwig (2014a: 20) indicated that, '[a]t the time of entry of the resolution authority into the bank, the bank's prospects and the value of its assets are highly uncertain. The uncertainty about the value of the assets may itself be a key factor in the difficulties'. Moreover, fair-value accounting is a source of systemic risk (see Hellwig 2009). For example, as we noted regarding the risk-feedback loop in section 2.2.3, after assets have been revalued downward, the lower value of the assets may initiate more asset sales, which may lead to a systemic crisis. Therefore, we propose removing or regulating fair-value accounting in times of market distress, particularly in cases of aggregate uncertainty. Instead of using fair-value accounting, a possible alternative would be to use either the book value approach or the 'market-to-funding' approach that assesses assets and liabilities, 'not according to the intention of the holder, but according to the funding capacity of the holder' (Brunnermeier et al. 2009: 41). To simplify, we use the book value approach to valuate assets and liabilities, as shown in Figure 7.7. On the asset side, the total assets are the sum of CHF 16,239 million in reserves (1 per cent of total assets), CHF 346,267 million in loans (17 per cent of total assets), CHF 456,748 million in the trading portfolio and pledged as collateral related to the sub-prime mortgage market (23 per cent of total assets), and CHF 1,177,465 million in other assets (for example, positive placement values, property, and equipment) (59 per cent of total assets).

Figure 7.7 UBS balance sheet for the third quarter of 2008 at the time of ELA



Source: Authors' own elaboration based on the UBS third-quarter report of 2008 (unaudited).

Table 7.3 UBS's financial statement for the third quarter of 2008 at the time of ELA

CHF million

Assets	*2Q08*	*% of total assets*	*3Q08*	*% of total assets*	*4Q08*	*% of total assets*
Reserves	**16.397**	**0,79**	**16.239**	**1**	**32.744**	**1,62**
Loans	**340.362**	**16,38**	**346.267**	**17**	**340.308**	**16,88**
Trading portfolio assets and pledged as collateral	**535.652**	**25,78**	**456.748**	**23**	**312.054**	**15,48**
Other assets	**1.185.224**	**57,05**	**1.177.465**	**59**	**1.330.443**	**66,01**
Total Assets	**2.077.635**	**100**	**1.996.719**	**100**	**2.015.549**	**100**
Liabilities						
Deposits due to customers	**556.223**	**27**	**520.031**	**26**	**474.744**	**24**
Other debt	**1.469.118**	**71**	**1.421.828**	**71**	**1.498.689**	**74**
Total liabilities	**2.025.341**	**97**	**1.941.859**	**97**	**1.973.433**	**98**
Total Equity	**52.294**	**3**	**54.860**	**3**	**42.116**	**2**
Total liabilities and equity	**2.077.635**	**100**	**1.996.719**	**100**	**2.015.549**	**100**

Source: Authors' own elaboration based on the UBS second-, third-, and fourth-quarter reports of 2008 (unaudited).

The liability side is valuated as the sum of CHF 520,031 million in deposits due to customers (26 per cent of total liabilities), CHF 1,421,828 million in other debts (71 per cent of total liabilities), and CHF 54,860 million in equity (3 per cent equity-to-asset ratio). The crucial points on the balance sheet are as follows: (1) On the asset side, UBS had very low reserves.

UBS held approximately one per cent in cash and balances with central banks and 3 per cent capital for funding liquidity. (2) In addition, 23 per cent of the assets were related to various trading positions that were primarily driven by the exposure in the sub-prime mortgage market. (3) Seventy-one per cent of the total liabilities were other debts, including repurchase agreements, negative replacement values, and financial liabilities designated by fair-value accounting. (4) Finally, the liability side showed a low equity-to-asset ratio of three per cent, which, from a regulatory perspective, was insufficient to absorb losses, although the risk-weighted core capital ratio (Tier 1) was fulfilled through risk-weight manipulation (Tier 1 is 10.8 per cent) at the time.

According to the figures on the balance sheet, we can ask ourselves whether UBS fulfilled the balance-sheet test at the time of ELA. Although UBS's financial situation in the third quarter deteriorated due to its direct exposure to Lehman Brothers, the balance-sheet test shows that UBS was solvent because the total liabilities (CHF 1,941,859 million) were less than the total assets (CHF 1,999,719 million).

In contrast to the fair-value accounting approach, '[t]he cost approach reflects the amount that would be required currently to replace the service capacity of an asset (often referred to as current replacement cost)' (Art. B8 para. 61-66 of IFRS (IFRS 2012: A634)). However, the cost approach can be criticised with respect to the limited information regarding a bank's cost positions. Therefore, no further elaboration is provided here.

The income approach 'converts future amounts (for example, cash flows and expenses) to a single current (that is discounted) amount [(DCF)]. When the income approach is used, the fair value measurement reflects current market expectations about those future amounts' (Art. B10 para. 61-66 of IFRS 13 (IFRS 2012: A635)). Because we replace fair-value accounting with book values, the income approach corresponds to the ability-to-pay solvency test; thus, no further elaboration of the income approach is provided here.

Nonetheless, the following question arises: which solvency test should be chosen in the case of inconsistent results among the capital-adequacy test, the ability-to-pay test, and the balance-sheet tests? According to Heaton (2007: 985) '[i]f the right assumptions [(discount rate, time period)] are made, then it is easy to conclude that the ability-to-pay solvency test is the optimal solvency test [because] [i]t best captures what creditors care most about – the match between their matured obligations and the [banks'] cash flow at the contracted payment date [maturity transformation]'. In other words, if the proper assumptions are made, the ability-to-pay solvency test is better than the capital-adequacy test and the balance-sheet test. However, we

are uncertain whether the ability-to pay test is the best one because it presents several problems, including the uncertainty of future cash flows and assumptions about the discount rate and the time period that can be manipulated. Therefore, we recommend using multiple solvency tests; if the tests produce less than perfectly correlated results, we suggest pronouncing a bank insolvent if any one of the three major tests indicates insolvency (see Heaton 2007). In a nutshell, if one of the tests reveals insolvency, then the investigated institution has suspicious solvency. Consequently, according to the main three solvency tests, UBS was solvent. However, additional tests would be required to provide a better valuation of UBS's solvency status. Therefore, we implement seven additional solvency tests.

First, the short-term solvency test, also called the current ratio test, measures a bank's ability to pay short-term and long-term debts. The formula to calculate a bank's current ratio is as follows:

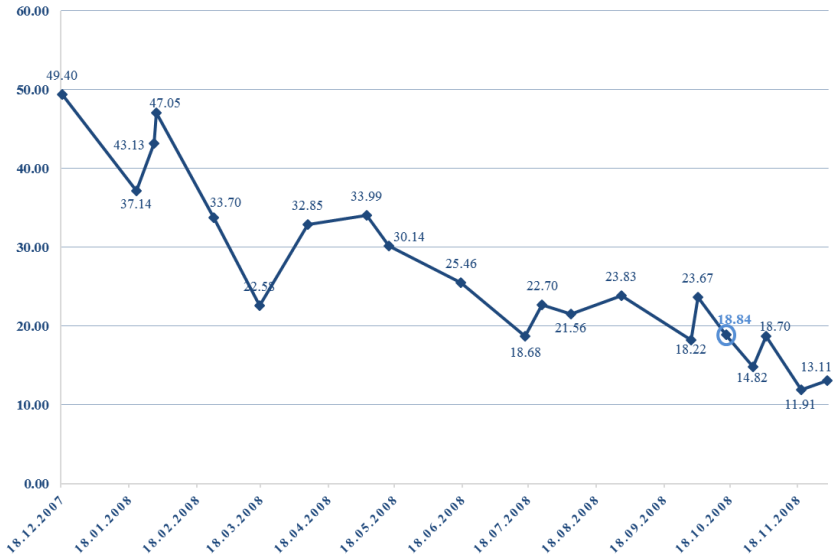
$$\text{Current ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}} \tag{7.2}$$

A current ratio of 1 means that CHF 1 of cash and assets can be converted into cash in the near future to pay CHF 1 of current liabilities. The current ratio should be greater than 1 but less than 2. If a bank's current ratio falls below 1, it signals insolvency. According to these considerations, the current ratio of UBS was 1.03 at the time of ELA; thus, UBS's solvency was not suspicious with respect to the short-term solvency test.

The second test is the share-price test. In this test, shares are indicators of a bank's expected profits. If future profits decline, the share prices decline; thus, suspicions regarding solvency may increase. In extreme cases, a bank is considered insolvent if the share price is zero. Using this rule, was the share price of UBS zero at the time of ELA? The answer is no because the share price (blue-framed ring in Figure 7.8) was CHF 18.84 (closing price) – above zero. Consequently, based on the share-price test, UBS was solvent at the time of ELA if we consider market values.[246]

[246] This solvency assessment may differ if we use another share-price instrument (for example, the price-to-book ratio or the price-to-earnings ratio).

Figure 7.8 UBS share prices at the time of ELA



Source: Authors' own elaboration based on data from SIX Swiss Exchange.

The third test involves the credit-default swap (CDS), an instrument that can be used by central banks to assess a bank's soundness and solvency. 'CDS are credit derivatives that provide insurance against the default of some reference entity' [in our case, UBS] (SNB 2009: 39). Therefore, a CDS purchaser makes periodic payments, called the CDS premia, to the seller against a bond that is subject to entity defaults. Thus, a CDS premium is an indicator of a bank's solvency. The higher the CDS premium of an SIB is in relation to the average CDS premium of the G-SIBs,[247] the higher the probability of default and thus insolvency. In relation to the UBS case, before Lehman Brothers collapsed, the CDS premium of UBS was below the average CDS premium of the G-SIBs (see SNB 2009). Therefore, UBS was considered to be sound and solvent. With the collapse of Lehman Brothers, the CDS premium of UBS increased and was 60 basis points above the G-SIBs average at the time of ELA, which marked a historical high (see SNB 2009) and indicated that UBS had suspicious solvency. On 16 October 2008, the Swiss Confederation and the SNB announced that they would act as LOLRs to provide ECA and ELA to UBS; the CDS price declined to the average CDS price of the G-SIBs. Although UBS had suspicious solvency at the time of ELA, we cannot assert that it was insolvent because we do not know the CDS premium level at which a bank is considered insolvent and the CDS premium can be high even when a bank is solvent. Consequently, the test reveals a tendency rather than a clear response regarding a bank's solvency.

[247] G-SIBs refer to the largest banks worldwide, namely, global SIBs.

The fourth test draws upon the ratings of rating agencies. Although ratings can be useful indicators to assess a bank's solvency, they can also provide misleading information. For example, sub-prime-related securities were considered AAA securities before the financial crisis of 2007–2009; after the outbreak of the crisis, these securities were downgraded to CCC securities, or junk bonds. In this context, why did rating agencies make such a mistake? The literature provides several answers (such as the influence of the banking industry or less product knowledge), which will not be further analysed here. Nevertheless, the following question arises: was UBS solvent with respect to the rating agency test at the time of ELA? The answer is yes, as UBS had a long-term rating of A+ by Fitch, Aa2 by Moody's and A+ by Standard & Poor's (see UBS 2009a). In relation to these ratings, UBS was considered a sound and thus solvent bank. In addition to these ratings, Moody's gave UBS a 'bank financial strength rating', and Fitch gave the bank an 'individual' bank rating, which are similar ratings (see Figure 7.9).

Figure 7.9 Moody's and Fitch Financial Service ratings

Moody's bank financial strength rating

	Dec 04	Dec 05	Dec 06	Dec 07	Dec 08	May 09
>B+	-	-	-	-	-	-
B+	B+	B+	B+	B+	-	-
B	-	-	-	-	-	-
B-	-	-	-	-	B-	B-
C+	-	-	-	-	-	-
C	-	-	-	-	-	-
C-	-	-	-	-	-	-
<C-	-	-	-	-	-	-

Fitch individual bank rating

	Dec 04	Dec 05	Dec 06	Dec 07	Dec 08	May 09
A	-	-	-	-	-	-
A/B	A/B	A/B	A/B	-	-	-
B	-	-	-	B	-	-
B/C	-	-	-	-	B/C	-
C	-	-	-	-	-	-
C/D	-	-	-	-	-	-
D	-	-	-	-	-	D
<D	-	-	-	-	-	-

Sources: Adapted from SNB (2009).

According to Moody's bank financial strength rating, UBS had a B- rating at the time of ELA, meaning that UBS possessed good but not strong (B rating) and acceptable (C rating) intrinsic financial strength (for instance, good financial fundamentals, within a less predictable and stable operating environment) (see Moody's 2011). Likewise, Fitch downgraded UBS's individual bank rating from an A/B rating to a B/C rating, meaning that UBS had between a strong and adequate rating because it possessed one or more troublesome aspects (see Fitch 2014). Given these ratings, UBS was considered solvent at the time of ELA.

The fifth test is the repayment test. If a financial institution is able to repay its assistance on time, then the institution is considered solvent. The repayment test is a forward-looking test, and assessing a bank's ability to repay its assistance in the future is difficult. However, we can use the test to determine whether UBS was able to repay the claims of the SNB and the Swiss Confederation. The answer is yes because UBS purchased the StabFund on November 2013,

seven years before the required deadline for resettling the StabFund. Consequently, according to the repayment test, UBS was solvent at the time of ELA.

The sixth test is the funding liquidity test, which determines whether a financial institution is able to fund itself in the market on its own (inside liquidity). As we noted in section 7.1, after a second recapitalisation, UBS was unable to fund itself in the market. Therefore, UBS was insolvent with respect to the funding liquidity test.

The seventh test is the sufficient collateral test, which assesses whether a financial institution holds sufficient collateral. According to the sufficient collateral test, UBS held sufficient collateral; thus, UBS was considered solvent. The sufficient collateral test is discussed in the next section.

The results of the above-mentioned tests are summarised in Table 7.4. Solvency tests that found UBS to be solvent are marked in green. Conversely, solvency tests that found UBS to be insolvent are marked in red. In addition, solvency tests that revealed suspicious solvency are marked in orange.

Table 7.4 Solvency assessment of UBS

UBS solvency test	Status
Main solvency tests	
Capital-adequacy solvency test	✓
Ability-to-pay solvency test	✓
Balance-sheet test	✓
Additional solvency tests	
Short-term solvency test	✓
Market share test	✓
Rating test	✓
Credit default swap test	-
Funding liquidity test	✗
Repayment test	✓
Sufficient collateral test	✓
Overall evaluation:	✓

Source: Authors' own elaboration.

Among these ten solvency tests, only one test found that UBS was insolvent, and only one test considered UBS's solvency to be suspicious at the time of ELA. Moreover, the essential three solvency tests, namely, the capital-adequacy solvency test, the ability-to-pay solvency test, and

the balance-sheet test, concluded that UBS was solvent at the time of ELA. Overall, UBS was solvent at the time of ELA, which supports the conclusion of the FINMA. Consequently, UBS fulfilled the second Swiss LOLR condition, and the SNB did not bail out an insolvent SIB.

Which agency is responsible for assessing the solvency of an SIB in Switzerland?

The FINMA is responsible for determining the solvency of a bank or a group of banks (see SNB 2015c). In the financial crisis of 2007–2009, the debate regarding the responsibilities of central banks and financial market authorities was rekindled because the SNB's emergency assistance and the UBS case naturally led to concerns about solvency assessment (see Goodhart and Schoenmaker 1995).

In the literature, three main arguments are in favour of giving the SNB the responsibility of solvency assessments: (1) solvency information can be used in daily monetary policy business, which facilitates coordination among different measures (see Goodhart and Schoenmaker 1995); (2) the SNB may be able to better distinguish between illiquidity and temporary insolvency problems (see Goodhart and Schoenmaker 1995); and (3) in times of financial distress, the coordination problem among different authorities can be mitigated.

Arguments against solvency assessment by the SNB are as follows: (1) solvency assessment is a regulatory instrument that might lead to a conflict of interest with monetary policy; (2) the combination of solvency assessment and monetary policy 'might lead to expectations on the part of the private sector that the central bank might be influenced by financial system stability considerations when determining monetary policy' (Goodhart and Schoenmaker 1995: 546); (3) the independence of the SNB could be reduced as a result of the responsibility of assessing banks' solvency; and (4) a mistake in solvency assessments can harm the SNB's reputation via 'reputational spillover' (see Goodhart and Schoenmaker 1995).

Based on these considerations, should the SNB assess the solvency of a bank? In our view, solvency assessments should be made by the Swiss LOLR, which leads us to our thirteenth principle:

Principle 13: To improve LOLR operations, the SNB should assess the solvency of SIBs.

If the status quo remains (namely, the FINMA alone is responsible for these assessments), then we offer the following potential reform proposal:

- Information about solvency should be frequently exchanged (daily or weekly) between the FINMA and the SNB;
- A clear solvency framework should contain the following tests: (1) the capital-adequacy test; (2) the ability-to-pay test; (3) the balance-sheet test; (4) the short-term solvency test; (5) the market share test; (6) the rating test; (7) the CDS test; (8) the funding liquidity test; (7) the repayment test; and (8) the sufficient collateral test.

7.2.3. Collateral analysis

For the SNB, collateral analysis is essential in the provision of ELA. In the following paragraphs, we present a simplified analysis that addresses the following main questions:

- Under what collateral conditions do banks receive ELA from the SNB?
- What types of collateral are considered sufficient in times of financial distress?
- Who decides what qualifies as sufficient collateral?
- Did UBS hold sufficient collateral at the time of ELA?

According to the first question, banks should hold sufficient collateral; otherwise, they will not be given ELA (see the guidelines of the SNB on monetary policy measures (SNB 2015c)). In accordance with cipher 4 of the guidelines, the SNB acts as the LOLR if the bank or group of banks that requires assistance can be fully covered by sufficient collateral at all times. Furthermore, banks should hold sufficient collateral for the following three reasons: (1) to mitigate the problem of adverse selection, thereby excluding insolvent banks' liquidity support; (2) to limit potential losses on risky assets; and (3) to distinguish between solvency and liquidity support. In this sense, the SNB provides liquidity support, whereas in accordance with Art. 103 of the FCSC (2016 [1999]), the Swiss Confederation provides solvency support (see Baltensperger and Dermine 1987, Nyberg 2000, Heller and Kuhn 2007, Illing and König 2014, SNB 2015a).

Art. 103 Structural policy

The Confederation may support regions of the country that are under economic threat and promote specific economic sectors [for example, the banking sector] and professions, if reasonable self-help measures are insufficient to ensure their existence. In exercising its powers under this Article, it may if necessary depart from the principle of economic freedom.

Based on Art. 103, observers might assume that the Swiss Confederation provided solvency support to UBS. However, the Federal Council would counter this argument because the Swiss Confederation received sufficient collateral, namely, MCNs, and according to Art. 184 para. 3 and Art. 185 para. 3 of the Federal Constitution, this collateral justified the liquidity support as follows:

Art. 184 Foreign relations

Where safeguarding the interests of the country so requires, the Federal Council may issue ordinances and rulings. Ordinances must be of limited duration.

Art. 185 External and internal security

It may in direct application of this Article issue ordinances and rulings in order to counter existing or imminent threats of serious disruption to public order or internal or external security. Such ordinances must be limited in duration.

The second question is difficult to answer because no answer can establish the type of collateral that will be considered sufficient,[248] and the meaning of the term 'sufficient' is unclear.

We ask ourselves what type of collateral would be considered sufficient in normal times. The answer is provided by the collateral management of the SNB, which has become an even more important central bank activity in the aftermath of the recent financial crisis. In Switzerland, the SNB's collateral management is essential because it assesses whether banks hold sufficient collateral to enter into an active (for example, an OMO or FX swap) or passive (for instance, intraday and overnight facilities) transaction (see Art. 9 para. 1 (e) of the NBA (2016 [2003])). Thereby, the SNB determines what types of collateral are sufficient. In a period of financial distress, the types of collateral vary from HQLAs to low-quality liquid assets with high credit ratings. Let us explore what types of collateral are considered sufficient in normal times and which can also be considered sufficient in times of financial distress. According to the SNB guidelines on monetary policy instruments and the instruction sheet on the eligible collateral for SNB repos, the SNB primarily accepts two types of collateral in normal times (SNB 2015d):

[248] The reason for the vague formulation of the SNB is to be more flexible with respect to the choice of collateral in times of financial distress.

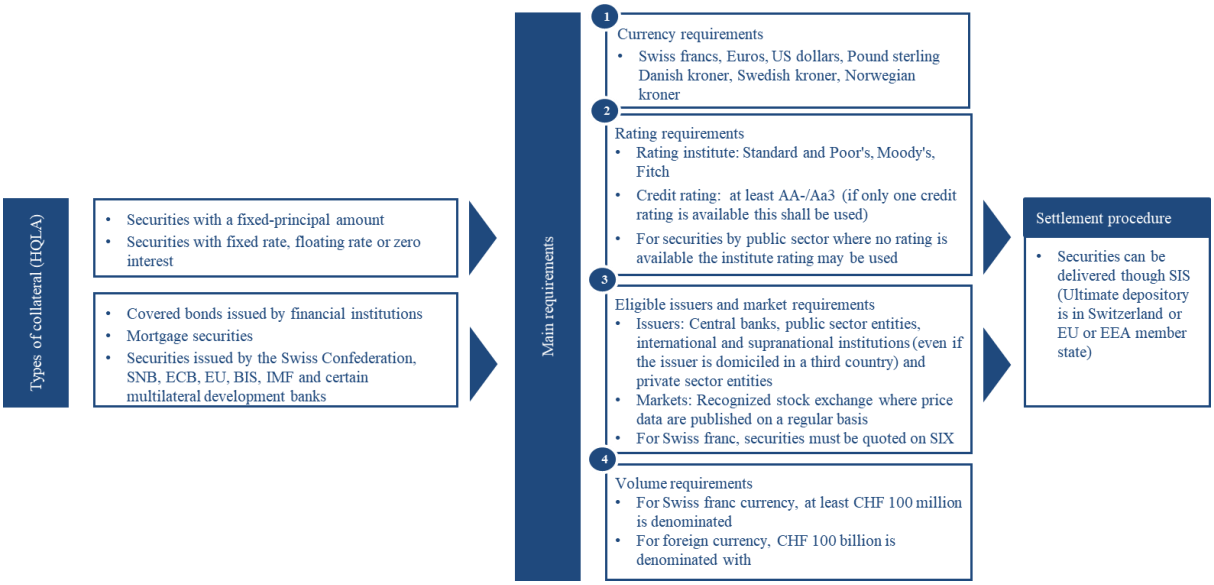
- ‘Collateral with a fixed principal amount and unconditional redemption’ (SNB 2015d: 2)
- ‘Collateral with a fixed rate, floating rate, or zero coupon interest’ (SNB 2015d: 2)

However, under certain circumstances, the following three types of collateral are also accepted (see SNB 2015d):

- Covered bonds that are issued by financial institutions if the issuer is not a domestic financial institution or its foreign subsidiary
- Collateral by the mortgage bond bank of the Swiss mortgage institutions and the mortgage bond institutions of Swiss cantonal banks
- Collateral issued by the Swiss Confederation, the SNB, the ECB, the EU, the BIS, the IMF, and certain multilateral development banks designated by the FINMA as eligible collateral

These types of collateral must meet the following requirements, as shown in Figure 7.10: currency requirements, rating requirements, eligible issuer and market requirements, and volume requirements. If the types of collateral meet all the requirements, then they are rated as eligible (sufficient) collateral and can be delivered through SIS (settlement procedure). In the following section, we briefly expand on these four requirements.

Figure 7.10 SNB criteria for the eligibility of collateral



Source: Authors’ own elaboration based on SNB (2015d).

With regard to the first requirement, collateral will be accepted in the following currencies: 'Swiss francs, euros, US dollars, pounds sterling, Danish kroner, Swedish kronor or Norwegian kroner' (see SNB 2015d: 2).

In relation to the second condition, the credit rating required from Standard & Poor's, Moody's, and Fitch must be at least AA-/Aa3. In case of collateral for the public sector, where no ratings are available, the rating of the institute may be used.

The third requirement states that the collateral must meet eligible issuer and market requirements. In this context, eligible issuers include central banks, public sector entities, and international or supranational organisations. Furthermore, eligible markets are those whose price charts are published on a regular basis, such as the Swiss stock market (the so-called SIX Swiss Exchange).

According to the fourth requirement, the volume issued must be at least CHF 100 million at the time of admission, and the requirement for foreign currency is a minimum of one billion (such as USD).

After meeting the four main requirements and gaining the approval of the FINMA, the collateral is delivered via SIS[249] to an ultimate security depository in Switzerland, the EU or the European Economic Area member states. Consequently, if a form of collateral fulfils all these criteria, it will be considered eligible and thus sufficient. Table 7.5 shows a sample of eight SNB eligible collateral out of 16,793 SNB eligible collateral that will be used for repo transactions (dated 18 April 2016), including a note issued by HSH Nordbank (3 per cent coupon rate) and a bond issued by Bayerische Landesbank (LB) (2.75 per cent coupon rate).[250]

Table 7.5 Collateral eligible for SNB repos

ISIN	Valor Number (CH)	Issuer	Issuer Domicile	Issue Date	Maturity	Coupon	Currency	Amount Outstanding	Asset Type	Basket	HQLA
CH0030985599	3098559	HSH Nordbank AG Hamburg/Kiel	DE	14.06.2007	14.06.2019	3	CHF	250'000'000	Note	L2a, L2a CHF	L2a
DE000BLB6C82	12346990	Bayerische Landesbank München	DE	25.01.2011	25.07.2016	2.75	EUR	1'000'000'000	Bond	L2a	L2a
DE000HV0EDV7	2567516	UniCredit Bank AG München	DE	24.05.2006	24.05.2016	4	EUR	1'500'000'000	Bond	L2a	L2a
EU000A1U9803	22865527	ESM	LU	20.11.2013	20.11.2023	2.125	EUR	3'990'750'000	Bond	L2a	L2a
FR0011179852	14683687	Credit Agricole Home Loan SFH	France	17.01.2012	17.01.2022	4	EUR	1'289'100'000	Medium Term Note	L2a	L2a
FR0010670737	4621974	République Française	France	25.10.2007	25.10.2018	4.25	EUR	30'947'000'000	Bond	L1	L1
GB0008931148	359097	United Kingdom	UK	30.04.1992	25.08.2017	8.75	GBP	11'025'000'000	Bond	L1	L1
XS0055498413	339011	EIB European Investment Bank	LU	14.02.1995	25.08.2017	8.75	EUR	1'000'000'000	Bond	L1	L1

Source: Adapted from a list of collateral eligible for SNB repos (dated 18 April 2016).

[249] SIS is a bank and part of the SIX Group Ltd. 'It provides for the custody and settlement of tradable financial instruments in Switzerland and as global custodian offers its participants access to over fifty foreign financial markets' (BIS 2011: 393).

[250] In the fall of 2008, several banks besides Lehman, such as HSH Nordbank and Bayerische Landesbank, had been recapitalised to avoid bankruptcy. In this context, HSH Nordbank had been recapitalised with EU 30 billion of German special financial market stabilization funds, and Bayer LB received approximately EU 15 billion from the Free State of Bavaria (follow-up costs, such as reputation costs, are not included).

Eligible collateral is characterised by the ISIN, Valor No., issuer, issuer domicile, issue date, maturity, currency, amount outstanding, asset types, basket with respect to the liquidity requirements, and HQLA rating (see section 3.2.2). With these considerations in mind, sub-prime-related securities, thus the total illiquid amount of USD 38,7 billion in toxic assets[251] transferred from UBS to the StabFund, were considered eligible and sufficient collateral for SNB repos before the financial crisis because the above-mentioned criteria were fulfilled as follows: (1) it was a mortgage security; (2) the currency was primarily in US dollars; (3) the credit rating was AAA before the crisis; and (4) it had an eligible issuer, the US Stock Exchange. However, during the financial crisis of 2007–2009, these assets did not fulfil the eligible collateral requirements and were regarded as unsafe assets. In this context, Tucker (2014: 27) indicated, 'if they are not safe enough for the central bank, then the authorities should be worried about whether the money market's liquidity is sustainable'. This understanding leads us to our fourteenth principle (see Tucker 2014):

Principle 14: The function of the Swiss LOLR makes it a de facto monitor of high-quality liquid assets and of systemically significant markets.

Consequently, the SNB 'will need to have a well-established collateral pricing policy to avoid taking undue credit and liquidity risks into their own balance sheet' (IMF 2008: xv). Moreover, the SNB violated the classical Bagehot concept by accepting collateral (sub-prime-related securities – toxic papers) against ELA, which many private banks would not do. However, the role of the SNB in accepting bad collateral – including some structured products that many private banks would not accept (23 per cent of the total assets) – calls into question whether the SNB fulfilled the third LOLR condition. In this context, there are two possible answers.

First, if bad collateral is considered sufficient collateral, ELA was fully covered by sufficient collateral at all times; thus, the third Swiss LOLR condition was fulfilled at the time of ELA. However, the basic idea behind sufficient collateral might be questioned because bad collateral (1) did not mitigate the problem of adverse selection, whereby insolvent banks were excluded from liquidity support; (2) did not limit potential losses on risky assets; and (3) did not distinguish between solvency and liquidity support.

Second, if bad collateral is not considered sufficient collateral, the SNB violated the third Swiss LOLR condition; thus, it had no right to provide ELA. As noted, the SNB

[251] US sub-prime, US Alt-A, US prime, US RLN program, commercial real estate, and without student loans (see UBS 2008g).

considered bad collateral to be sufficient collateral; however, doing so calls into question the major principles behind the idea of collateral.

Consequently, to establish a credible third condition, we propose reforming the third Swiss LOLR condition to reflect Bagehot's doctrine to lend only against good collateral. Thus, the SNB should lend against collateral on which money can be readily obtained in normal times, although the SNB determines what types of collateral are good.

7.3. Summary

To sum up, as the prices of high-risk mortgages in the United States began to decline in February 2007, several financial institutions had to write down substantial losses. The substantial write-downs in the trading positions raised doubts about the solvency of several financial institutions, and the subsequent dry-up of market liquidity reached a peak on 9 August 2007, which marked the beginning of the financial crisis of 2007–2009. In Switzerland, the most affected bank was UBS. On 15 September 2008, Lehman Brothers went bankrupt, and the financial situation of UBS worsened because it had direct counterparty exposure to Lehman Brothers. As a third recapitalisation failed on 21 September 2008, UBS informed the SNB, the SFBC/FINMA, and the FDF that it would require ELA. By 14 October 2008, the three authorities had been officially informed that UBS required ELA. On 15 October 2008, the SNB and the Swiss Confederation implemented measures on the asset side and the liability side to strengthen UBS's balance sheet. Therefore, they used an SPV, the 'StabFund'. On the asset side, UBS sold illiquid assets in the amount of USD 38,7 billion to the StabFund and received USD 25,8 billion of ELA in the form of high-powered money from the StabFund, as the ELA amount had been first transferred from the SNB to the StabFund. The SNB thereby created foreign high-powered money via a dollar-Swiss franc swap of USD 25,8 billion to depreciate the Swiss franc. On the liability side, the Swiss Confederation provided direct ELA (taxpayer money) in the amount of CHF 6 billion, whereas 10 per cent of the transferred assets (namely, CHF 3,9 billion) had to be funded by the equity of the StabFund. The remaining CHF 2,1 billion strengthened the equity base of UBS. Although UBS received ELA from the SNB, the literature remains ambiguous regarding whether UBS fulfilled the Swiss LOLR conditions. To fill the gap in the literature, we illuminate the three ELA conditions: (1) the bank or bank group must be of systemic importance to the financial system; (2) the ELA-seeking institution must be solvent; and (3) liquidity assistance must be fully covered by sufficient collateral.

According to the first condition, UBS was of systemic importance to the Swiss economy because the Swiss economy was characterised by a competitive banking sector with two dominant SIBs, namely, UBS and Credit Suisse. Based on the size of the Swiss banking sector (ratio of total assets to annual GDP), at the end of 2008, the banking sector's total assets amounted to CHF 4,361 billion – more than eight times the Swiss GDP – whereas UBS held approximately half of the total assets, amounting to CHF 1,999 billion. The market concentration of UBS in the Swiss banking industry was relatively high. The three SIBs' assets amounted to 76 per cent of the total assets in 2008; UBS and Credit Suisse accounted for 73 per cent of the total assets, showing the dominance of the two largest banks in the Swiss banking sector with respect to market concentration. Of this 73 per cent, UBS accounted for more than half, showing its relative importance with respect to market concentration. As such, a UBS default would harm the payment system and cost the economy approximately 15–30 per cent of the Swiss GDP (between CHF 81,77 billion and CHF 163,54 billion); in addition, 70,000 companies would find themselves in financial distress. Therefore, UBS was considered a systemically important institution at the time of ELA.

In relation to the second ELA condition, it was difficult to provide a solvency–insolvency definition and various solvency measures that would help us assess the bank's solvency because the literature lacks an operational approach to solvency. Therefore, to fill the gap in the literature, we elaborate a potential solvency definition and solvency framework. Solvency can be defined in both broad and narrow terms based on the solvency test used. Broadly, 'insolvency' is the state of not having enough money to pay what you owe. Narrowly, solvency can be defined with respect to the solvency test used. In the literature, there are three main solvency tests: the capital-adequacy test, the ability-to-pay test, and the balance-sheet test. The capital-adequacy test assesses whether a bank has adequate capital. Thus, if the bank fulfils the capital-adequacy requirements, it is considered solvent. The ability-to-pay test assesses whether a bank is able to pay its debts at any time without restrictions. The ability-to-pay test measures the net present value of a financial institution with a discounted cash-flow method. A net present value greater than or equal to zero indicates that the bank is solvent. In contrast to the ability-to-pay test, the balance-sheet test valuates assets and liabilities. The cardinal rule of the balance-sheet test is as follows: if a bank has fewer assets than liabilities, it is considered insolvent, and vice versa. In practice, the assets and liabilities can be valuated with respect to fair-value accounting, the cost approach and the income approach, but the income approach is primarily covered by the ability-to-pay test. If one of these three tests indicates that the bank is insolvent, then the bank must be assumed to be insolvent. Moreover, the valuator's decision

can be enhanced though additional solvency tests (for example, the short-term solvency test, the market share test, the rating test, the CDS test, the funding liquidity test, the repayment test, and the sufficient collateral test). According to the findings of the various tests, we concluded that UBS was solvent at the time of ELA, which corresponds with the valuation of the FINMA. Given the lack of a solvency framework, we recommend that the Swiss LOLR be based on a clear solvency framework in the twenty-first century.

Given the third condition, the following questions arise: (1) What type of collateral is sufficient? (2) Who determines what qualifies as sufficient collateral? (3) Did UBS hold sufficient collateral at the time of ELA? To answer the first and second questions, the SNB determines what qualifies as sufficient collateral, which varies from HQLAs to low-quality liquid assets with high credit ratings, such as mortgages. In light of the collateral analysis, UBS held sufficient collateral, including property and equipment. However, whether sub-prime-related securities can be considered sufficient collateral is questionable. According to the SNB, sub-prime-related securities were sufficient collateral, but we leave it to the reader's judgement to determine whether these types of securities should be considered sufficient. If so, the basic idea behind sufficient collateral will be challenged (for example, (a) to mitigate the problem of adverse selection, where an insolvent bank is excluded from liquidity support; (b) to limit potential losses on risky assets; and (c) to distinguish between solvency and liquidity support). To establish credibility, we propose replacing the word 'sufficient' with 'good' to avoid upending the main principles behind collateral.

As a result of our analysis of the three Swiss LOLR conditions, using the UBS crisis to illustrate our case, we concluded that UBS was systemically important to the Swiss economy, was solvent, and held questionable sufficient collateral. Therefore, from an economic point of view, our conclusion is aligned with the legal assessment of the SNB. However, our findings cannot be used to label the recent financial crisis as a solvency crisis or a liquidity crisis. To do so, a similar analysis using the same concept as this dissertation could be conducted on all banks that received ELA during the financial crisis of 2007–2009. Therefore, further academic research is needed. Using the different considerations and the elaborated principles, we can begin to design an LOLR for the twenty-first century.

8. The Swiss LOLR for the twenty-first century

Recently, the Swiss LOLR has been solely focused on the banking sector and has drawn upon three main conditions for obtaining assistance in an emergency: (1) the bank must be solvent but illiquid; (2) the bank must be systemically important to the financial system; and (3) the liquidity assistance must be fully covered by sufficient collateral at all times. However, as we noted in our analysis of the different schools of thought and our analysis of the Swiss LOLR during the UBS crisis of 2007–2009, we see the potential for a reform proposal to redesign the LOLR that will help the SNB take more effective action when a financial institution demands assistance in an emergency. In this sense, the next section subsumes our considerations and principles into a redesigned Swiss LOLR for the twenty-first century. Moreover, in section 8.2, we will qualitatively assess the redesigned LOLR because a successful LOLR must be effective, timely, sustainable, and credible.

8.1. Redesign of the Swiss LOLR for the twenty-first century

The experience of the Swiss LOLR during the recent financial crisis raised fundamental questions about the design of the LOLR framework and the execution of a more stable financial system in the twenty-first century. In this context, a challenging task is how to design an LOLR regime that financial institutions are prepared to use to contain liquidity and solvency crises and their wider social costs before it is too late (see Tucker 2014). In light of the different LOLR schools of thought and our analysis of the UBS case, we can design a Swiss LOLR for the twenty-first century. In this context, the SNB acts as the LOLR for one or more domestic banks if they are no longer able to fund their operations on the market and are no longer temporarily viable but are viable in the medium and long run. For this purpose, the form of emergency assistance varies between ELA via direct bilateral lending (standing facilities) and direct extraordinary actions (the transfer of assets and liabilities via SPVs). In the former case, ELA ‘involves making commitments: to lend in order to stave off or contain systemic distress. Those commitments need to be credible, which requires amongst other things that they be time consistent. The regime won’t work well if people believe a central bank will change its mind or has no clear principles’ (Tucker 2014: 11). In this sense, the Swiss LOLR for the twenty-first century depends on the following three conditions:

(1) The liquidity-seeking bank or group of banks must be of systemic importance to the financial system's stability.
(2) The bank must be solvent or temporarily insolvent.
(3) The liquidity assistance must be fully covered by good collateral at all times on a risk-based premium. The SNB will determine what types of collateral are good.

These three principle are the result of the historical and economical evolution of the Swiss LOLR, which has been affected by the different LOLR schools of thought, including the classical Bagehot doctrine: (1) lend only against good collateral to solvent and illiquid or temporarily insolvent banks; (2) lend at a risk premium; and (3) lend freely in times of financial distress. In addition to these three principles, we can add the following fourteen principles:

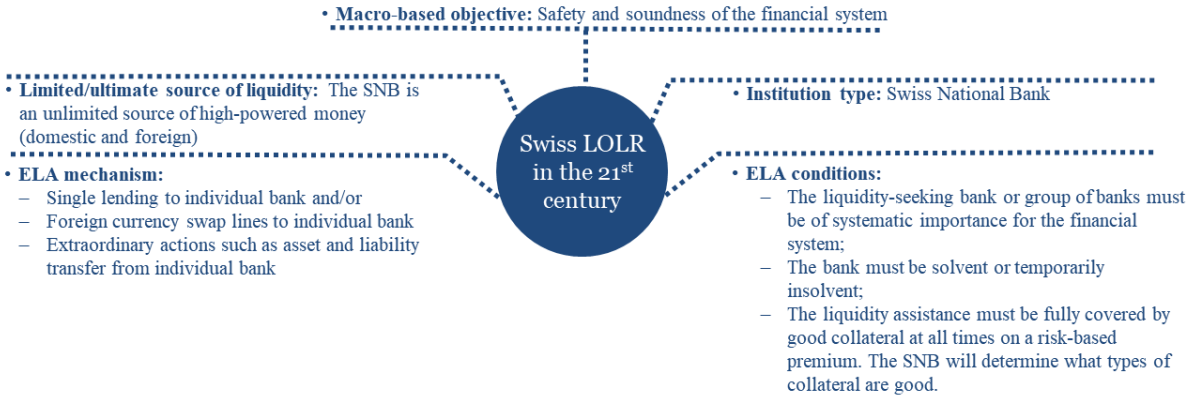
(1) The LOLR is non-operational.
(2) In times of financial distress, the central bank should primarily act as the MMLR and, if required, as the LOLR.
(3) ELA from the LOLR is endogenous and created based on demand.
(4) The Swiss LOLR's main objective is to ensure financial stability.
(5) The Swiss LOLR requires various MoUs with different central banks and regulatory authorities.
(6) The Swiss LOLR should be based on a systemic cost-benefit analysis.
(7) The Swiss LOLR should be based on a broad, explicit, and transparent fiscal carve-out condition.
(8) The SNB can create unlimited domestic and foreign high-powered money when a systemic crisis occurs.
(9) The Swiss LOLR should be extended to systemically important NBFIs under a constructive ambivalence strategy.
(10) The Swiss LOLR requires a clear solvency framework as part of a cost-benefit analysis.
(11) To improve monetary policy operations and LOLR operations, the SNB should assess the solvency of SIBs.
(12) The function of the Swiss LOLR makes it a de facto monitor of high-quality liquid assets and of systemically significant markets (see Tucker 2014).
(13) The Swiss Confederation should be excluded from liquidity support.[252]

[252] Although the SNB acts primarily as the LOLR and provides liquidity support and the Swiss Confederation generally provides solvency support, during the UBS crisis, both institutions provided liquidity support. However,

(14) Fundamentally insolvent financial institutions should be allowed to enter into debt resolution or liquidation/bankruptcy (see Tucker 2014).

With these principles in mind, we can design the Swiss LOLR for the twenty-first century using our LOLR scheme, which draws upon the following five main characteristics: (1) the type of objective; (2) the type of institution; (3) the ultimate source of liquidity; (4) the ELA mechanism; and (5) ELA requirements. Figure 8.1 illustrates the potential reform proposal with respect to these five characteristics.

Figure 8.1 The Swiss LOLR for the twenty-first century



Source: Authors' own elaboration.

The Swiss LOLR's main objective is the safety and soundness of the financial system. In this sense, the SNB is not responsible for preventing the initial failure but for keeping a subsequent wave of failures from spreading through the system. The LOLR thereby provides ELA to banks that are systemically important to the Swiss economy. In addition to banks, the SNB should also act as the LOLR for systemically important NBFIs that can have an impact on the Swiss economy.

In relation to being a limited or ultimate source of liquidity, we indicate the following: (1) according to Art. 4 of the NBA [2016 (2003)], the SNB had a unique role in terms of the stock of high-powered money (SNB notes) because no other bank has the right to issue SNB notes. Thus, the SNB has a monopoly on high-powered money and is responsible for managing asset and liability positions that determine its functions. As a consequence of its unique role in

because of the Confederation's relatively minor participation in the StabFund compared with that of the SNB and the risk of the social cost to the taxpayer, we propose that as an LOLR, the Confederation should be excluded from crisis management actions; otherwise, its liquidity support could be interpreted as solvency support and create moral hazard.

the creation and management of high-powered money, the SNB is limited with respect to its mandate (price stability). However, we noted that the SNB can create unlimited foreign high-powered money. To do so, the SNB had to enter into a swap arrangement. The foreign currency swap arrangements were an efficient mechanism for the provision of direct ELA in foreign currencies.

According to the ELA mechanism, the Swiss LOLR can provide direct ELA in three forms: (1) single bilateral lending via the DW, the SPV, or a new operational tool; (2) direct foreign currency swap lines; and (3) extraordinary actions such as asset and liability transformation to an SPV or directly to the SNB.

8.2. An evaluation of the Swiss lender of last resort

A successful Swiss LOLR for the twenty-first century must be effective, timely, sustainable and credible (see Guttentag and Herring 1987, Hellwig 2007). Given these four requirements, we provide a qualitative evaluation[253] of the status quo and compare it with the proposed Swiss LOLR for the twenty-first century. Our finding is that overall, the Swiss LOLR for the twenty-first century is a better option than the status quo. To evaluate the different LOLRs, Table 8.1 shows the four criteria and the evaluation indicators of excellent, good, satisfactory, poor and very poor.

According to the first requirement, in broad terms, central bank interventions are considered effective if the instrument is aligned with the discovered problem (see Hellwig 2007, Tucker 2014). In this sense, the central bank's intervention as the LOLR is aligned with the problem of liquidity (the status quo LOLR) and/or a temporary solvency problem (the LOLR in the twenty-first century). In a narrow sense, we distinguish among seven characteristics of effectiveness: (1) sensitivity to macroeconomic costs; (2) sensitivity to social costs; (3) a large source of liquidity; (4) moral hazard; (5) adverse selection; (6) reputational risk; and (7) boundary problems.

[253] The evaluation can be criticised with respect to the following points: (1) It is only a qualitative assessment and does not consider a quantitative assessment. Thus, a quantitative assessment should be provided here. However, in practice, quantifying a reform proposal is difficult. (2) The assessment is based on the authors' own evaluation; therefore, some may claim that it lacks objectivity.

Table 8.1 Evaluation of the Swiss LOLR for the twenty-first century

Criteria	Status quo of the Swiss LOLR	Swiss LOLR in the 21st century
Effectiveness		
1 Sensitive to macroeconomic costs	▪ Mitigate macroeconomic costs	▪ Mitigate macroeconomic costs ▪ Cost-benefit analysis
2 Sensitive to social costs	▪ Creates costs for the taxpayer because, besides the SNB, the government provides assistance	▪ Explicit and transparent FCO conditions ▪ Cost-benefit analysis ▪ Abolish government support
3 Major source of liquidity	▪ Unlimited source of high-powered money	▪ Unlimited source of high-powered money
4 Moral hazard	▪ High degree of moral hazard and gamble on resurrection	Mitigate moral hazard with ▪ A risk-based premium ▪ A cost-benefit analysis based on a clear solvency framework, HQLA monitoring and systemically relevant markets
5 Adverse selection	▪ Uneven playing field in the banking sector	▪ Uneven playing field in the banking sector ▪ Mitigate via solvency framework, cost-benefit analysis, and monitoring
6 Reputational risk	▪ Limit reputational risk for the SNB: FINMA solvency assessment	▪ Reputational risk for SNB: SNB solvency assessment
7 Boundary problem	▪ Limited by the Memorandum of Understanding (MoU) between the SNB and FINMA	▪ Limited by the MoU between the SNB and FINMA
Timeliness		
8 Timely intervention	▪ The LOLR intervened in time, as UBS was solvent but struggled to find liquidity	▪ LOLR intervention must be made in time based on early warning solvency framework
Sustainability		
9 Intervention must be within the central bank's means	▪ MoU between the SNB and FINMA	▪ MoU between the SNB and FINMA ▪ International MoU
Credibility		
10 Clear principles	▪ Unclear principles regarding eligible collateral, SIBs and so forth	▪ Clear principles with respect to FCO, solvency framework, eligible collateral, and SIBs

Excellent Good Satisfactory Poor Very poor

Source: Authors' own elaboration.

In relation to the first point, an effective Swiss LOLR is sensitive to macroeconomic costs that may result if the LOLR does not intervene in the market. In Switzerland, the cost of

the recent financial crisis amounted to CHF 30 billion or 6 per cent of the GDP (see Birchler et al. 2010). Several studies estimated that the cost would have been higher if the SNB had not acted as the LOLR. Therefore, both concepts are justifications for the LOLR in Switzerland. However, the status quo LOLR is not based on a cost-benefit analysis, which is necessary to measure the risks before an intervention. Conversely, the Swiss LOLR in the twenty-first century uses cost-benefit analyses to assess the macroeconomic costs to the economy.

With regard to the second point, an effective LOLR is less sensitive to social costs that may result from an LOLR failure (see Guttentag and Herring 1987). Compared with the Swiss LOLR for the twenty-first century, the status quo LOLR is more sensitive to social costs because if the central bank suffers losses, it transfers the costs to the government, which then increases taxes and cuts public expenditures to cover the costs. In addition, the government may also provide emergency assistance, resulting in the same repercussions for the government. In contrast to the status quo LOLR, the Swiss LOLR for the twenty-first century will abolish any form of government intervention to address liquidity problems and is based on an explicit and transparent FCO condition. With regard to the latter point, we follow Hellwig (2007: 814), who suggests that the Swiss LOLR 'requires some agreement with the government, more precisely, the minister of finance'. In addition, a cost-benefit analysis will help mitigate the SNB's decision-making process in terms of ELA provision, thereby helping the FINMA better wind down a bank.

In relation to the third point, according to Guttentag and Herring (1987), an effective LOLR should have a large source of liquidity. In this sense, both LOLR concepts refer to the LOLR as a practically unlimited source of ELA because of its creation of domestic high-powered money and its swap transactions in foreign high-powered money.

With regard to the fourth and fifth points, an effective LOLR 'is able to limit the moral hazard and adverse selection problem which access to emergency liquidity assistance may create' (Guttentag and Herring 1987: 173). However, the status quo LOLR did not mitigate the problem of excessive risk-taking. Conversely, the Swiss LOLR for the twenty-first century better addresses the problem of moral hazard. The risk-based premium above the market rate and below a very high interest rate helps mitigate the moral hazard problem, and the cost-benefit analysis becomes a form of ambivalence strategy that mitigates the moral hazard problem. For instance, suppose the cost-benefit analysis found that the bank should be allowed to enter into bankruptcy; the explicit commitment to SIBs could change to ambivalence. Consequently, the Swiss LOLR for the twenty-first century is more effective than the status quo with regard to moral hazard.

In relation to the fifth point, two adverse selection problems exist. Both concepts have created an uneven playing field. In this context, SIBs could obtain funding liquidity with a risk-free interest rate in normal times, irrespective of their solvency, whereas small and medium-sized banks would have to pay a higher interest rate than SIBs for funding liquidity. However, the uneven playing field would be mitigated with the central bank's cost-benefit analysis and the monitoring of the HQLAs,[254] a clear solvency framework and higher bank regulatory standards for SIBs.

With regard to the sixth point, under the status quo, the reputational risk for the SNB is low because the solvency assessment is made by the FINMA. However, the reputational risk for the FINMA is higher than it is in the Swiss LOLR for the twenty-first century if a failure occurs. Nevertheless, with solvency assessments, the Swiss LOLR has better information that leads to a better decision-making process, and the assessment cost can be reduced by increasing the number of SIB assessments (for example, in 2008, Switzerland had two banks of systemic importance, whereas five SIBs are of systemic importance in 2016, indicating an increasing trend).[255] In other words, according to Diamond (1984), the Swiss LOLR acts as a delegated monitor among different banks and mitigates the problem of asymmetric information (for instance, moral hazard) (see point 4).

With regard to the seventh point, an effective LOLR is sensitive to the boundary problem if overlapping policy (such as monetary policy overlapping with regulatory policy; see section 1.2.3) is a risk. As we noted in section 4.3, the LOLR is a monetary policy instrument with regulatory policy characteristics (for example, the Swiss LOLR's objective is the same as that of the Swiss regulatory authority, namely, financial stability). However, the signing of the MoU regarding financial stability by the SNB and the FINMA should not only provide a clear division between the individual tasks of both authorities but also describe the common areas of interest and collaborations in detail, thereby mitigating the boundary problem to a certain degree (see MoU 2010). However, in practice, this MoU is questionable because the operational details are not clearly elaborated.

Nevertheless, based on all these considerations, the Swiss LOLR for the twenty-first century would be more effective than the status quo.

[254] In other words, 'the central bank as lender of the last resort must be well informed about the situation. It must have a clear idea about the reality behind the numbers in the banks' books. It must also have some appreciation of the potential externalities of a bank's failure on other institutions and on markets' (Hellwig 2007: 814).

[255] This increase challenged recent regulatory policy that aimed to mitigate the too-big-to-fail problem. However, in practice, we observed that additional systemically important institutions would be found. Consequently, recent regulatory measures did not mitigate the too-big-to-fail problem; instead, they enhanced it at an enormous cost to small and medium-sized banks.

In relation to the second criterion, to be timely (see point 8), the Swiss LOLR must occur in a gone concern, which covers not only times of financial distress (bank failures) but also the time at which the crisis appeared (before bank failures). In this regard, both concepts are designed to be timely. In the words of Hellwig (2007: 813), the LOLR must 'beware of intervening prematurely, at a time when private solutions to existing problems are still available'. Therefore, the LOLR for the twenty-first century has a better early warning system than the status quo because the LOLR provides solvency analyses in normal times.

According to the third characteristic, being sustainable means that the Swiss LOLR must respect central bank measures and policy (see Guttentag and Herring 1987, Hellwig 2007). However, the LOLR's role as a monetary policy instrument with regulatory characteristics requires clear coordination between the SNB and the FINMA. Therefore, the MoU between the SNB and the FINMA closed the gap to a considerable degree. However, the MoU is insufficient because an SIB (such as UBS or Credit Suisse) that provides bank services on national and international levels requires multiple central banks and supervision authorities to mitigate a potential systemic risk (see Hellwig 2007). In addition, 'the manifold linkages of financial institutions in other countries imply that any crisis of systemic dimensions in another country can have systemic repercussions for Switzerland' (for example, the collapse of Lehman Brothers) (Hellwig 2007: 819). Therefore, the Swiss LOLR for the twenty-first century includes an international MoU between different regulatory authorities in cases of crisis prevention.[256]

In relation to the fourth property, to be credible, the Swiss LOLR must be based on clear principles. In this context, the LOLR in the twenty-first century is based on better and clearer principles than the status quo, which has unclear conditions regarding solvency and ambiguous conditions with respect to collateral. Opponents might argue that unclear conditions increase the central bank's flexibility in times of distress. Although this may be true, it also reduces the credibility of the central bank. Therefore, the Swiss LOLR for the twenty-first century will provide a combination of flexibility and credibility. On the one hand, it proposes clear and transparent principles for FCO conditions, the solvency framework and good collateral. On the other hand, the SNB remains flexible because it determines what qualifies as good collateral.

[256] However, several questions remain with regard to the international MoU. For instance, who will be the responsible counterpart, for example, in the EU? Furthermore, such cooperation is subject to friction (for further details, see Hellwig 2007).

Therefore, the Swiss LOLR for the twenty-first century will be more credible than the status quo.

Overall, the LOLR for the twenty-first century will be more effective, timely, sustainable and credible than the status quo. Therefore, the LOLR should be redesigned according to the elaborated fourteen principles.

8.3. Summary

This chapter has designed a Swiss LOLR for the twenty-first century that draws upon the objective, the institution type, the limited/ultimate source of liquidity, the ELA mechanism, and ELA conditions. According to these characteristics, (1) the LOLR has a macro-based objective that focuses on the safety and soundness of the financial system; (2) the SNB is considered the LOLR; (3) the SNB is an unlimited source of high-powered money (domestic and foreign) because of foreign currency swap agreements; (4) the ELA mechanism can generally be divided into direct single lending to individual banks, foreign currency swap lines to individual banks, and extraordinary actions such as asset and liability transfers from individual banks; and (5) a bank can obtain ELA under the following conditions: (a) the liquidity-seeking bank or group of banks must be systemically important to the stability of the financial system; (b) the bank must be solvent and illiquid or temporarily insolvent; and (c) the liquidity assistance must be fully covered by good collateral at all times on a risk-based premium. The SNB determines what qualifies as good collateral. We provide a qualitative evaluation that concludes that the Swiss LOLR for the twenty-first century will be more effective, timely, sustainable and credible than the status quo. Based on this conclusion and the initial problems (for instance, moral hazard, adverse selection, social costs, and macroeconomic costs), the SNB should redesign its role as the LOLR for the twenty-first century. The regime outlined in this dissertation could be a substantive LOLR regime under the following cardinal principle: ‘no lending to fundamentally insolvent institutions’ (Tucker 2014:37).

Conclusion

The primary objective of this dissertation has been to provide a comprehensive economic theory of bank regulation, addressing the lack of consensus in the recent literature regarding why and how banks are regulated. Therefore, to fill this gap in the literature, we elaborated an economic theory of bank regulation that described the economic rationale and objectives of bank regulation and provided a systematisation scheme for bank regulatory measures. Based on our systematisation scheme, we classified the most common bank regulatory measures. We analysed capital requirements, liquidity requirements and recovery and resolution standards in greater detail because of their fundamental relevance to the recent regulatory debate in this regard and proposed potential reform options. In addition, we designed an alternative regulatory proposal oriented towards the source of the market failure that resulted in the 2007–2009 financial crisis. Although our proposals mitigate the economic risk posed by SIBs, they will not definitively exclude the possibility that SIBs in Switzerland (or elsewhere) will be allowed to fail in the future in the event of another banking crisis. With regard to the LOLR, 'more rethinking of the LOLR doctrine is needed', given the important role of the LOLR in restoring financial stability during the recent financial crisis (Grossmann and Rockoff 2015: 58).

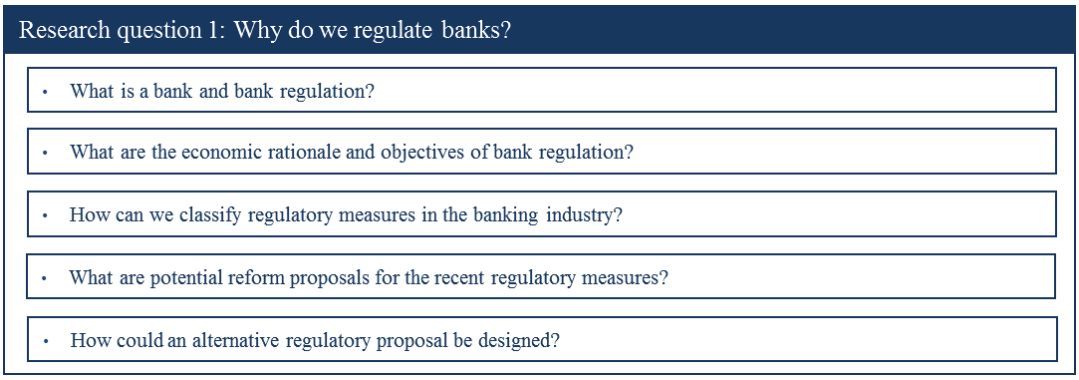
Therefore, in aiming to craft this bank regulatory system, we sought to articulate not only effective bank regulations but also a well-designed LOLR. Although the LOLR has been relatively neglected in the central banking literature and regulatory debates, the 2007–2009 financial crisis demonstrated that an effective LOLR regime is required to prevent financial crises and to minimise greater damage to the economy. Therefore, in 2014, the BIS held a workshop entitled, 'Re-thinking the lender of last resort' that focused on the most recent crises in the United States, the United Kingdom, the European Union, Mexico and Japan. However, the workshop did not provide any systematic and clear analysis of the LOLR regime in Switzerland. Additionally, the literature has not systematically analysed the role of the Swiss LOLR. Therefore, as the second objective of this thesis, we sought to fill this literature gap by analysing the Swiss LOLR and outlining a real and practical substantive LOLR regime for Switzerland in the twenty-first century. Notably, this LOLR regime should enhance stability in the banking sector and mitigate the problems that typically accompany ELA (including moral hazard, adverse selection, social costs and macroeconomic costs).

Principle findings and implications

The dissertation is divided into two parts. The first part focuses on the economic theory of bank regulation, whereas the second part concentrates on the redesign of Switzerland's LOLR regime for the twenty-first century. Next, we discuss our main findings.

The economic theory of bank regulation

The first part of the dissertation sought to answer the first set of research questions raised in the introduction.



To answer the first research question, we defined the terms 'bank' and 'bank regulation'. Although 'bank' can be defined in a variety of ways in the economics literature, in relation to the financial intermediary theory that has dominated banking and regulatory policy since the 1960s, a bank is understood as a financial intermediary that functions in the space between two different agents and provides the following four main bank functions: asset services, liability services, transformation services and payment services. However, the financial intermediation theory came under fire with the outbreak of the 2007–2009 financial crisis because the most widely used finance theories did not provide adequate descriptions of the banking system (Werner 2014). Therefore, we elaborated an alternative definition of the term 'bank' based on the theory of endogenous money in banking. In this sense, the decisive role of a bank is to provide two main functions: asset services, particularly loans, and payment services. Both views have advantages and disadvantages that have been debated in the literature. Overall, however, our position is that the decisive role of a bank lies in the provision of these two main functions of asset services and payment services as a result of endogenous money and credit for the following reasons: (1) '[W]hen households choose to save more money in bank accounts,

those deposits come simply at the expense of deposits that would have otherwise gone to companies in payment for goods and services. Saving does not by itself increase deposits or 'funds available'' (McLeay et al. 2014: 15). (2) There is a misconception that 97 per cent of the circulation of money (bank deposits) comes from loans that depositors save at banks (McLeay et al. 2014). (3) Rochon and Rossi (2013: 212) clearly show 'that money has always been endogenous' in the history of banking. (4) '[T]he emission of money as means of payment is a credit-driven and demand-determined process, quite in line with the endogenous money literature' (Rossi 2007: 35). (5) Regarding the principal of double-entry accounting, new loans are equal to new deposits. Finally, (6) money is not a stock (bank deposit), as it has been considered for more than 200 years, but rather a flow that occurs within payments issued via a credit operation (see Rossi 2007). However, if a reader were to base his/her decision on one concept, there would be implications to justify bank regulation with respect to the safety and soundness of bank services and the safety and soundness of the banking system. Nevertheless, before we describe implications in this regard, we require a clear definition of the term 'bank regulation'.

Although the term 'regulation' primarily has legal and not economic origins – and because the term used in this context frequently oscillates between 'self-regulation' and 'government regulation' – it is difficult to define the term in an economic sense. Thus, we derive the term 'regulation–bank regulation' by drawing upon various definitions in the economics literature and the degree between self-regulation and government regulation. In this sense, bank regulation is understood to mean all government interventions that limit banks' economic decision-making and activities by government laws, rules, or standards divorced from monetary policy, fiscal and structural policies, competition policy and other policies. With these considerations in mind, we described the economic rationale and objectives of bank regulation and answered our second research question.

In the literature, the economic rationale for bank regulation is based upon economic regulation theories, which can be classified based on the positive and normative approaches to regulation. The positive approach involves economic explanations and impact analyses of regulation. This approach focuses on private interest theory, which can be divided into capture theory, the economic theory of regulation, the theory of bureaucracy and the public financing approach. Next, we briefly describe these theories and apply them in the banking sector. The normative approach aims to justify regulation by focusing on market failure; this approach contains public interest theory, also known as market failure theory. In this dissertation, the

focus was on public interest theory because it contains both first- and second-best solutions. Moreover, there is at least one cause for bank regulation that is in the public interest, allowing us to justify bank regulation for different reasons (see Goodhart et al. 1998). According to market failure theory, banks are subject to regulation because they are characterised by asymmetric information and externalities. The former source of market failure is primarily a phenomenon of 'adverse selection' and 'moral hazard'. To describe the problem of asymmetric information, we used the dual principal-agent relationship by inserting the bank between the lender and the borrower. Moreover, we extended the dual principal-agent relationship using the theory of financial intermediation and delegated monitoring developed by Diamond (1984) to explain the role of the bank regarding the asymmetric information problem. In this sense, Diamond (1984) formally showed that the problem of asymmetric information can be eliminated. However, the model has limitations in practice, and bank regulation is therefore required. Another justification for regulatory interventions in the banking sector involves externalities. In this sense, the failure of an SIB or of numerous small and medium-size banks can lead to macroeconomic externalities (such as spillover effects into the real economy, disruptions in the payment system or systemic bank runs) (see Calomiris 1999). Consequently, externalities justify bank regulatory measures in the banking sector.

In the literature, bank regulation can also be explained by the objective of securing banking regulation. However, the difficulty with that framework is that there is no consensus in academia regarding the objective of bank regulation, and the financial crisis of 2007–2009 has led to heated debate regarding the usefulness of the micro-based approach. Therefore, to fill this gap in the literature, we extended the micro-based approach with a macro-based approach and classified the objectives. The micro-based approach contains all the objectives meant to limit the risk of episodes of financial distress at individual banks (namely, idiosyncratic risk) by emphasising the behaviour of individual agents. Conversely, the macro-based approach focuses on limiting episodes of system-wide distress (namely, systemic risk) that represent significant costs to the economy as a whole. In light of these criteria, the micro-based approach contains two regulatory objectives, that is, consumer protection and the safety and soundness of banks (which is based upon the safety and soundness of bank services, macroeconomic externalities and bank runs). Conversely, the macro-based approach focuses on the safety and soundness of the banking system and monetary control. Further, we described in detail the regulatory objectives used as the rationale for bank regulation. However, although we extend the micro-based approach with a macro-based approach in the most recent financial crisis, various economists have questioned these widely used finance theories. Given these

considerations, we elaborate an alternative bank regulatory view based upon the endogenous nature of money and credit. This view offers an alternative justification for bank regulation regarding the safety and soundness of bank services. In this sense, bank regulation emerged to address failures in two bank activities, asset services and the payment system, whereas in financial intermediation theory, market failures were related to asset services, liability services, transformation services and payment services. If bank regulation is justified by the alternative view, then regulatory measures should mitigate bank failure concerning asset services and payment services, particularly asset services. In this context, regulation would be justified in the lending process (for example, stronger requirements for the assessment of a borrower or higher capital requirements for house buyers). Moreover, we present an alternative justification with respect to the safety and soundness of the banking system. In this context, we note that a stable banking system changes the period of the financing regime into an unstable system (see Minsky 1977). Therefore, bank regulation should focus on mitigating the risk in the three financing forms, specifically when speculative financing turns into Ponzi financing. In this sense, bank regulations such as the leverage ratio or minimum requirements for a rollover of liabilities would be desirable to mitigate the risk of a stable banking system turning into an unstable banking system.

An economic theory of bank regulation requires a clear systematisation of regulatory measures to perform an effective and systematic impact assessment. Although various studies (such as Burghof and Rudolph 1996, Bernet 2003) have provided myriad criteria, the literature has not identified a conclusive classification scheme for bank regulations. Therefore, to fill this gap in the literature and to answer our third research question, we propose an alternative systematisation based on the following five criteria to better categorise bank regulations: ‘regulatory policy’; the ‘timing of intervention’ related to prudential and protective regulation; the ‘micro versus macro regulation’ level of governance; the predictability of the ‘discretionary versus institutional approach’; and an evaluation of the standard ‘qualitative versus quantitative approach’. Employing this systematisation scheme, we classified the most common regulatory measures, including capital requirements, liquidity requirements, failed bank recovery and resolution standards, and so forth. Moreover, we briefly analysed and proposed policy options for capital requirements, liquidity requirements and recovery and resolution standards because of their relevance to the regulatory debate. These policy options are summarised in the main reform proposal.

Main reform proposal

Capital requirements

- Precise systematisation of capital requirements with respect to the desirable objective
- Taking into account systemic risks
- Impact assessment before further incremental adjustments of capital requirements take place
- Removing the zero-risk weighting for EU government bonds or 'introducing a non-zero risk weight floor for sovereign exposures in the standard approach' or IRB approach (ESRB 2015: 9)
- Setting a minimum standard in the IRB approach (see ESRB 2015)
- Increasing the unweighted capital requirements to twenty and thirty per cent (Hellwig 2010b)

Liquidity requirements

- Taking into account systemic risks
- Removing the zero-risk weighting of EU government bonds or introducing a non-zero risk weight
- Simplification of categories and factors and allocation of cross-border liquidity
- Setting standards to mitigate the manipulation of liquidity requirements
- Provide empirical impact assessments before setting further standards

Recovery and Resolution standards

- Setting a clear solvency framework and various international Memorandum of Understandings between regulatory authorities (incl. explicit rules in time of financial distress)
- In the recovery and resolution plans taking into account of the subsidiaries
- Taking into account for the bail-in, uninsured insurance

Furthermore, we designed an alternative regulatory proposal oriented towards the source of the market failure that characterised the 2007–2009 financial crisis. In this regard, we proposed the following: (1) removing and modifying fuzzy regulatory measures; (2) implementing transparency measures for SPVs; (3) regulating or setting general principles for securitisations; and (4) setting 20 to 30 per cent harmonised capital requirements for house buyers. All policy options are summarised in the alternative reform proposal.

Alternative reform proposal

Removing and/or modifying fuzzy regulatory measures

- Removing fair the value-accounting in a financial distress situation
- Setting liquidity principles

Transparency measures for special purpose vehicles

- Reconsider consolidation rules for off balance sheet vehicles

Regulating or setting general principles for securitisation

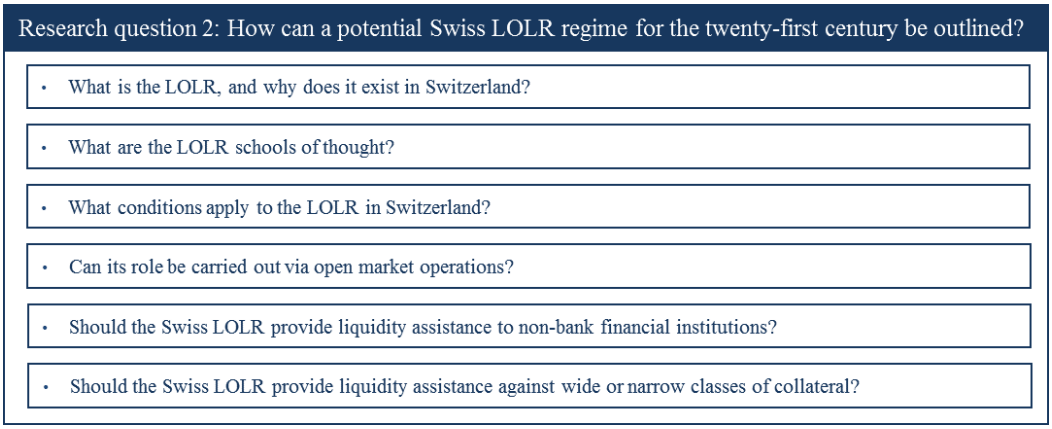
- Due diligence requirements for investors;
- Risk retention requirements and
- Transparency for originators and investors

Capital requirements for householders

- Setting harmonised capital requirements for householders at a minimum of 30– 40 per cent

Redesign of Switzerland's lender of last resort

The second part of the dissertation answered the following research questions:



To design a Swiss LOLR regime, we first had to define and understand the concept of the LOLR. Although the term 'LOLR' had been defined in numerous ways in the literature and had taken on different meanings, we defined 'LOLR' by utilising the following insights: The LOLR is an institution from whom all borrowers – particularly, solvent but illiquid banks – can obtain liquidity assistance in an emergency, freely but at an interest rate, against good collateral. Moreover, the role of the LOLR can be undertaken by various institutions, including central banks, governments and even international authorities. Furthermore, we attempt to classify the LOLR in the regulatory literature. Although the LOLR is typically considered as a protective regulatory instrument, there is no clear systematisation available. Therefore, to fill this gap in the literature, we used the systematisation scheme developed in the first part of this dissertation and classified the LOLR with respect to our regulatory criteria. In this sense, the LOLR is a monetary-regulatory, macro-protective, institutional and qualitative safety-net policy.

With these criteria in mind, we considered the different schools of thought that helped us to elucidate the concept of the LOLR and that had been further used to design the LOLR. The recent literature includes four LOLR schools of thought: (1) the free banking view that abolishes the LOLR; (2) the 'classic Bagehot view' that the LOLR should provide emergency assistance to all solvent but illiquid institutions against good collateral at a very high interest rate; (3) the Goodfriend and King view that abolishes direct lending and proposes to provide emergency assistance by means of the market; and (4) the Goodhart view (which is also espoused by and associated with other authors) that proposes lending to any solvent or temporarily insolvent bank when necessary to sustain financial stability. For an improved

overview, we systematise the four different views into four different schools of thought: the free banking school, the ancient school, the classical school and the contemporary school. In this manner, we introduced two new LOLR schools of thought, namely, the Tiberian view, in which the LOLR can be traced back to the Roman Empire under the Emperor Tiberius Julius Caesar Augustus (14 to 37 A.D.), and the alternative view, which draws upon the endogenous nature of money and posits that the LOLR is created based on demand. In this sense, the central bank acts as the LOLR and must ensure the safety and soundness of the banking system as its unlimited source of high-powered money. In this manner, the LOLR provides direct assistance to solvent and temporarily insolvent but illiquid banks against good collateral. To analyse the different LOLR schools of thoughts, we develop an LOLR analysis scheme based on the type of objective, the type of institution, limited or unlimited liquidity sources, the ELA mechanism, and ELA conditions.

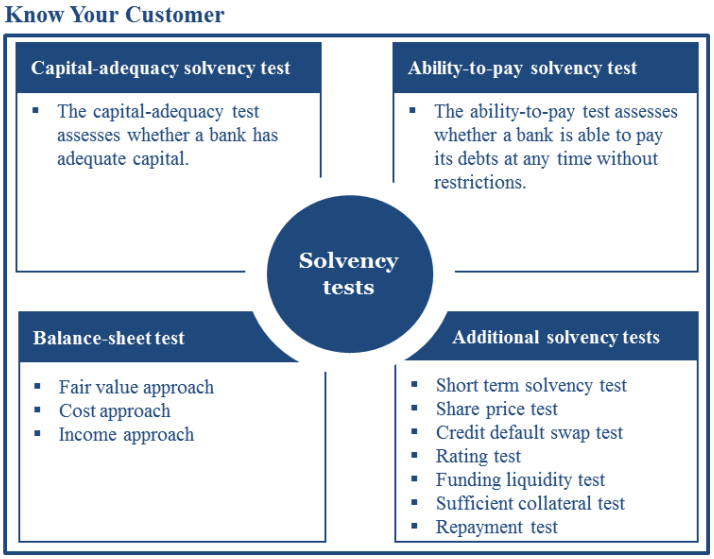
To answer our question as to why an LOLR is necessary in Switzerland, we had to understand the evolution of the SNB, which is closely linked with the political evolution of Switzerland. However, the recent literature lacks a thorough historical analysis regarding the Swiss LOLR. Therefore, we elaborated a historical analysis of the LOLR spanning from 1826 to 2016 that illuminates and reveals the nature of the Swiss LOLR. The SNB was founded in 1907, and it was assumed that in a bank failure that threatened the financial system, the SNB should act as the LOLR and provide ELA. Thus, from 1907 until 2004, the SNB followed a constructive ambivalence strategy, operating as the LOLR in cases of financial distress depending on an analysis regarding whether a crisis-stricken bank should receive ELA or not. Although the first systemic analysis of the LOLR was provided by Henry Thornton in 1802 and extended by Walter Bagehot in 1873, the SNB was a slow learner regarding the LOLR concept. Several financial crises occurred before the SNB finally rethought the role of the LOLR. In this sense, the Swiss real estate crisis in the 1990s played a decisive role that set the ball rolling towards a constructive clarity approach, an explicit commitment by the SNB to act as the LOLR in situations of financial distress under certain conditions. With the revision of the NBA in 2004, the SNB changed the Swiss LOLR strategy to a constructive clarity strategy under which the SNB acts as the LOLR in the following three conditions (see cif. 6 SNB 2015c):

(1) ‘The bank or group of banks seeking credit must be of importance for the stability of the financial system.
(2) The bank seeking credit must be solvent.

(3) The liquidity assistance must be fully covered by sufficient collateral at all times. The SNB determines what collateral is sufficient.

To assess the solvency of a bank or group of banks, the SNB obtains an opinion from FINMA' (SNB 2015c: 6)

Based on these conditions, we empirically analyse the Swiss LOLR during the UBS crisis of 2007–2009 to design a potential Swiss LOLR regime for the twenty-first century. Thereby, we ask ourselves whether UBS fulfilled the applicable conditions of the Swiss LOLR. To understand the UBS crisis, we provided a chronological overview that included for the first time in the literature all the involved parties, that is, UBS, the SFBC/FINMA, the SNB and the Swiss Confederation. In our second step, we answered the question posed above. In relation to our economic analysis, we concluded that UBS was systemically important, solvent and held sufficient collateral, although the last condition remained partially open because the SNB granted ELA against collateral of questionable value, that is, sub-prime- related mortgages. Nevertheless, the major challenge was to determine the solvency of the bank. For this purpose, we designed a framework to assess solvency. This solvency framework, which is based on various solvency tests, (1) assists in better knowing the applicant; (2) can be used as an early warning system for central banks or for OMOs in 'normal' non-crisis times to assess the solvency of banks in the financial sector; and (3) can be extended to other areas, such as assessing the solvency of asset managers and/or insurance companies.



In light of our analysis and its elaborated principles, we redesigned the conditions of the LOLR as follows: (1) the LOLR should lend only against good collateral to solvent and illiquid or temporarily insolvent banks; (2) it should lend at a risk premium; and (3) it should lend freely

in times of financial distress. In addition to these three principles, we can add the following fourteen principles:

(1) The LOLR is non-operational.
(2) In times of financial distress, the central bank should primarily act as the MMLR and, if required, as the LOLR.
(3) ELA from the LOLR is endogenous and created based on demand.
(4) The Swiss LOLR's main objective is to ensure financial stability.
(5) The Swiss LOLR requires various MoUs with different central banks and regulatory authorities.
(6) The Swiss LOLR should be based on a systemic cost-benefit analysis.
(7) The Swiss LOLR should be based on a broad, explicit, and transparent fiscal carve-out condition.
(8) The SNB can create unlimited domestic and foreign high-powered money when a systemic crisis occurs.
(9) The Swiss LOLR should be extended to systemically important NBFIs under a constructive ambivalence strategy.
(10) The Swiss LOLR requires a clear solvency framework as part of a cost-benefit analysis.
(11) To improve monetary policy operations and LOLR operations, the SNB should assess the solvency of SIBs.
(12) The function of the Swiss LOLR makes it a de facto monitor of high-quality liquid assets and of systemically significant markets (see Tucker 2014).
(13) The Swiss Confederation should be excluded from liquidity support.
(14) Fundamentally insolvent financial institutions should be allowed to enter into debt resolution or liquidation/bankruptcy (see Tucker 2014).

These principles and the redesign of the Swiss LOLR answered the remaining questions that were initially raised, in particular whether the LOLR should provide liquidity assistance via OMOs depending on the severity of the financial crises. In certain crises, an MMLR would be sufficient, whereas in other financial crises, a combined MMLR and LOLR might be required. In addition, the LOLR should provide liquidity assistance to NBFIs that are systemically important, and the Swiss LOLR should provide liquidity assistance against good collateral. We qualitatively evaluated the LOLR and concluded that the Swiss LOLR regime for the twenty-

first century will be more effective, timely, sustainable and credible than the current regime, although the evaluation was limited because it did not embark upon a quantitative assessment and the assessment was based on the authors' own evaluation. Nevertheless, the outlined regime could be a possible substantive LOLR regime for the SNB and could be helpful to other central banks in analysing and redesigning their own LOLR function.

Outlook

The research in this thesis presents numerous opportunities to extend its scope and makes further academic research desirable. Next, we present the main research topics that are most fertile for future investigation.

Based on the economic theory of bank regulation, it would be desirable to research the following: (1) the effects of bank regulation on the banking sector in greater detail because there is little theoretical or empirical research in the literature on the impact of bank regulation, particularly with respect to liquidity requirements and recovery and resolution standards; (2) the effects of an alternative regulatory proposal, which, in this context, should be based on a systematic impact assessment before (and not after) regulations such as the Basel Accord or the Dodd-Frank Act were implemented; and (3) the risk feedback loop in connection with the FIH because the enhancement of hedge financing, speculative financing and Ponzi financing in the risk feedback loop has not yet been proven and verified.

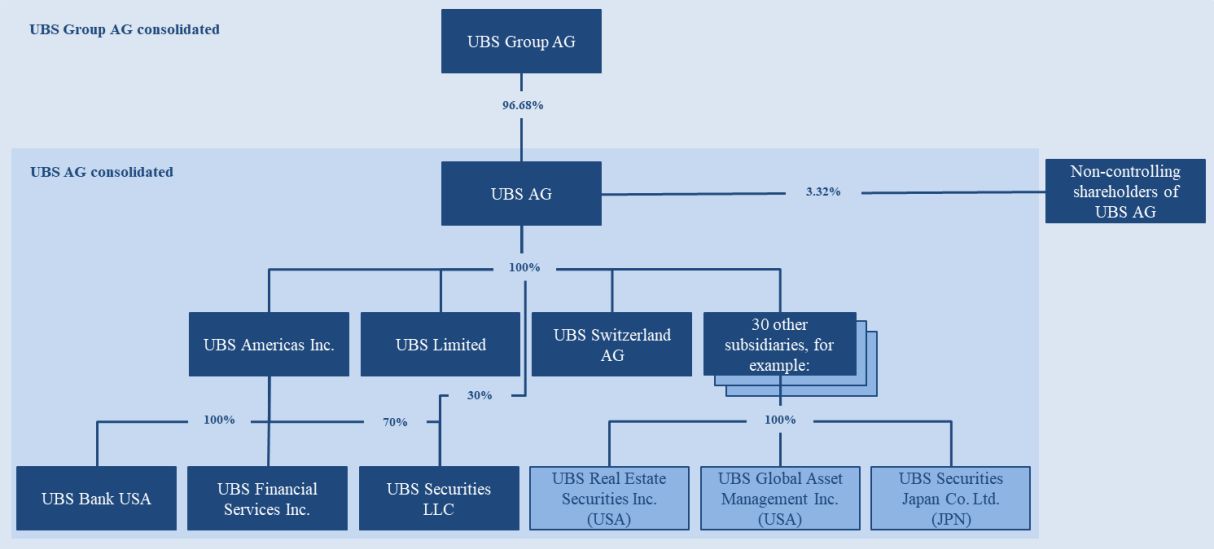
In relation to redesigning Switzerland's LOLR regime for the twenty-first century, it would be desirable to examine the following: (1) the quantitative effects of Switzerland's LOLR regime for the twenty-first century; (2) the LOLR regime in greater detail for other central banks, extending these details with the principals elaborated, including providing a comparison of different LOLRs, such as LOLRs in Switzerland, Europe, the United Kingdom and the United States; and (3) the solvency framework, in this case to build a base on the solvency test variables for an empirical analysis to investigate whether the financial crisis of 2007–2009 was more of a solvency crisis than a liquidity crisis.

Appendix

1. UBS financial group structure

Figure A.1 shows the UBS financial group structure as of December 31, 2014. According to the legal structure, the UBS Group AG is a stock corporation and the ultimate parent company of the UBS Group.

Figure A.1 Financial group structure of the UBS Group AG



Source: Adapted from UBS (2014).

During 2014, the UBS Group AG, as the holding company of the UBS Group, was established in response to evolving 'too big to fail' requirements to improve resolvability and support businesses with efficient legal, tax and funding services (such as credit, loans and investments) (see UBS 2014a). In other words, the UBS Group AG acts as a financial holding company for the UBS AG (it is 96.68 per cent owned by the UBS Group AG).[257] The UBS AG shifts out risks, issues credit and provides capital to its subsidiaries, namely, UBS Americas Inc., UBS Limited in the United Kingdom, UBS Switzerland AG and 30 other subsidiaries (owned 100 per cent by UBS AG). In the United States, the bank provides services under UBS Americas Inc., which is divided into three subsidiaries: UBS Bank USA (owned 100 per cent by UBS America Inc.), UBS Financial Services Inc. (owned 100 per cent by UBS America Inc.) and UBS Securities LLC. (owned 70 per cent by UBS America Inc. and 30 per cent by UBS Group

[257] The residual 3.32 per cent is owned by other shareholders of UBS AG.

AG) (see UBS 2014). According to the new financial group structure, the UBS AG does not classify the other 30 subsidiaries with regard to geographical structure. The UBS AG considers the other 30 subsidiaries to be not individually significant because of the contribution of the group's total assets and aggregated profit before tax thresholds and because they are not systemically important to winding down the UBS AG in a financial distress situation. In other words, under recovery and resolution standards (living will), subsidiaries play a subordinate role. Nevertheless, regulatory authorities should pay attention to subsidiaries. The following example sheds light on the role of subsidiaries before the financial crisis of 2007–2009. One of the 30 subsidiaries is UBS Real Estate Securities Inc. (UBS RESI) (see Figure A.1). From 2002 to 2007, UBS RESI was involved in the US residential mortgage market. UBS RESI acquired pools of residential sub-prime mortgage loans from originators, deposited them into securitisation trusts and subsequently converted them into ABSs or CDOs. UBS RESI was responsible for selling pools of loans acquired from originators to third-party purchasers. 'These whole loan sales during the period 2004 through 2007 totaled approximately USD 19 million in original principal balance' (UBS 2014a: 460). In this context, UBS RESI played an important role in the US sub-prime crises and in the contagion process of the entire banking system.

2. The discount window

The DW is a mechanism by which central banks allow banks to borrow short-term liquidity needs. In other words, banks take the initiative in the DW transactions. Consequently, the SNB takes a passive role in the transaction and accommodates the need for all short-liquidity with respect to the creditworthiness of the bank. Thus, DW 'lending is the extension of credit, virtually always secured by collateral, from the central bank' to financial institutions (Goodfriend and King 2009 [1988]: 149). The DW can be distinguished between 'routine operation of the discount window for normal monetary purposes, often with formalized access, for example for short-term interest rate stabilization or to meet seasonal variations in liquidity demand, and emergency type measures for trouble banks' (Baltensperger 1990: 10).

The liquidity provision through the DW in normal times operated via standing facilities, which can be divided into intraday facilities and standing facilities for the liquidity-shortage financing facility. Next, we briefly expand on the concepts of intraday and overnight facilities. In 1999, the SNB introduced intraday liquidity, in which banks obtain interest-free liquidity during the day through repo transactions that must be settled 'by the end of the same working

day at the latest' (SNB 2015c: 3).[258] The objective of an intraday facility is to facilitate the settlement of the payment and clearing system. In contrast to intraday facilities, the 'liquidity-shortage financing facility [overnight facility] [is] to bridge unexpected, short-term liquidity shortages. These mainly occur if expected payments are not received and the required funding cannot be obtained quickly enough on the interbank market' (SNB 2015c: 2). Thus, overnight facilities are used to aid temporarily illiquid banks (Goodfriend and King 2009 [1988]). In an operational manner, the liquid short-term liquidity is provided to banks against 'special-rate repo transactions and can be used until the next working day' and is thus called 'overnight facility' (SNB 2015c: 3).[259] The requirements for special-rate repo transactions are as follows: (1) granting of a limit by the SNB, (2) opening of an SNB custody cover account and (3) the provision of eligible collateral (such as asset-backed securities and so forth) that covers at least 110 per cent of the limit at all times (see SNB 2015c). Moreover, 'overnight facilities' are closely linked with reserve requirements because at the end of a reporting period, the bank must meet the minimum reserve requirements (see Greenbaum and Thakor 2007 [1995], SNB 2015c). However, an overnight facility is not only used in a shortage-liquidity situation but also in daily banking business. In this regard, Goodfriend and King (2009 [1988]: 147) indicated that '[t]he demand for line of credit services arises because [..] [banks] often need funds suddenly, as a result of unpredictable events. For example, a [..] [bank] may discover a potentially lucrative investment opportunity which must be seized quickly'. Although Goodfriend and King (2009 [1988]) indicated lucrative funding propositions via overnight loans, they neglected to note that funding decisions are also related to risks. Thus, we shed light on risk-taking investments with respect to an overnight loan. First, financial institutions such as UBS, Credit Suisse and Goldman Sachs can obtain an overnight loan under a certain interest rate against good collateral, namely, HQLAs such as Greek government bonds or asset-backed securities. Second, the overnight loan can be used to fund risky investments via securitisation to receive a higher return on investment. Third, the high return on investment settles the overnight loan with the special rate. Thus, under a regulatory perspective, an overnight facility can be viewed as a risky funding activity. Consequently, overnight facilities are a potential source of market failure. In this context, regulators would argue in favour of regulating overnight facilities. One possible reform proposal is to allow overnight facility against a narrow class of eligible collateral (such as AAA government bonds) at a penalty rate to mitigate the

[258] Moreover, intraday facilities are not included in the calculation of liquidity and minimum reserve requirements (see SNB 2015c).
[259] The special rate for liquidity shortage transactions is based on the Swiss average rate overnight (SARON) plus an interest premium (see SNB 2015c).

moral hazard risk. However, further research on the regulation of overnight facilities is needed because regulation can also harm the banking sector and can enhance regulatory arbitrage between different central banks.

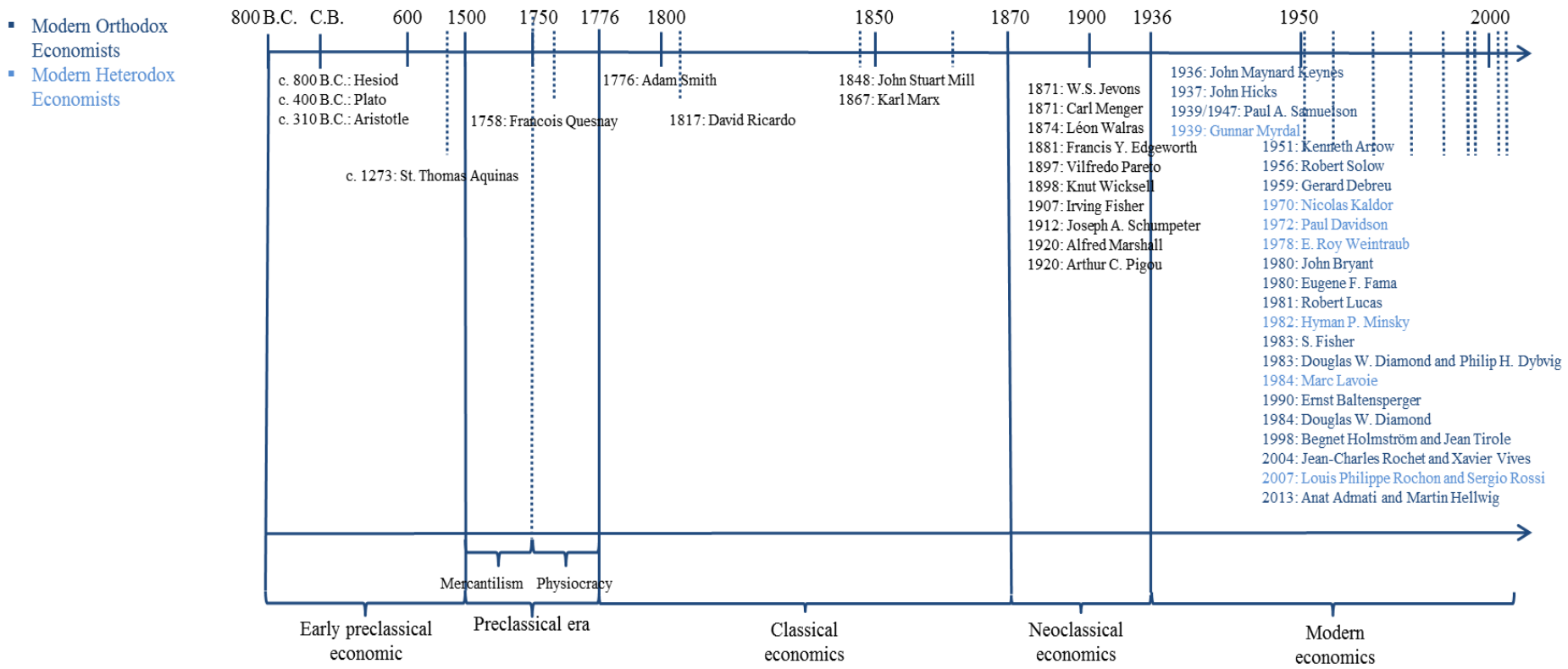
3. History of economic thought

The history of economic thought provides an overview of the different schools of economic thought in the literature. Figure A.2 illustrates the history of economic thought. Modern orthodox economists are marked in blue, whereas modern heterodox economists are marked in cyan blue. As indicated in Figure A.2, there are more orthodox economists then heterodox economists, who dominate modern economic literature. In general, the history of economic thought can be divided into five periods: an *early preclassical period* from 800 B.C. to 1500, the *preclassical era* from 1500 to 1776, the *classical economic era* from 1776 to 1870, the *neoclassical era* from 1870 to 1930s, and the *modern economic era* from the 1930s until today (see Landreth and Colander 2002). Next, we briefly expand on the evolution of economic thought.

The evolution of economic thought is influenced by the publications of important writers. In this context, the first economic analysis in Europe dates back to Hellenic thought under Hesiod, whose economic ideas are expressed in 'Works and Days,'[260] ca. 800 B.C.[261] The main representatives of the early preclassical period include Plato (The Republic, ca. 400 B.C.), Aristotle (Politics, ca. 310 B.C.) and St. Thomas Aquinas (Summa Theologica, ca. 1273). After the early preclassical period, the preclassical era was characterised by different economic, social and political changes (for example, increased trade, the growth of cities, and the building of national identities and nation-states) (see Landreth and Colander 2002). This era can be divided into two time periods, namely, 1500 to 1750 (*mercantilism*) and the short period from 1750 to 1776 (*physiocracy*). The era of mercantilism is characterised by numerous political and economic writers (such as the politician, diplomat, philosopher and humanist Niccolò Machiavelli), who wrote about politics, economics and so forth. Therefore, 'it is difficult to generalize about the resulting literature' because of the various writers active during this period (Landreth and Colander 2002: 46). Conversely, physiocrats are characterised primarily by French economists (see Francois Quesnay's 'Tableau Economique' of 1758).

[260] Hesiod analyses the nature of farmers in light of efficient production.
[261] The dates throughout this paragraph refer to specific publications.

Figure A.2 History of economic thought



Sources: Authors' own elaboration data from Jevons (1871), Pareto (1897), Walras (1992 [1897]), Marshall (1997 [1920]), Pigou (1932 [1920]), Keynes 1964 [1936], Hicks (1967 [1937]), Myrdal (1965 [1939]), Samuelson (1939), Kaldor (1970), Davidson (1972), Weintraub (1978), Bryant (1980), Fama (1980), Minsky (1982), Fisher (1983), Diamond and Dybvig (1983), Lavoie (1984), Baltensperger (1990), Holmström and Tirole (1998), Landreth and Colander (2002), Rochet and Vives (2004), Rochon and Rossi (2007), Admati and Hellwig (2013).

In 1776, the preclassical era ended with the publication of Adam Smith's 'Wealth of Nations,' which analyses the functioning of markets and price systems. The classical economic era, whose notable economists include Adam Smith (1776), David Ricardo (1817), John Stuart Mill (1848) and Karl Marx (1867), accounts for more than one hundred years of the history of economic thought. The classical economic era ended in the early 1870s as the classical market and price system came to be considered from a different angle, namely, a competitive static framework that determined relative prices, quantities of goods and so forth. In the early 1870s, three different economists, namely, W.S. Jevons (1871), Carl Menger (1871) and Léon Walras (1874), suggested that the price of a good depends upon the marginal utility of that good. In other words, marginal analysis, or the 'marginal revolution,' was the beginning of the era of neoclassical economic thought (see Bortis 2013). During this time, a second generation of economists, including Francis Y. Edgeworth (1881), Vilfredo Pareto (1897), Knut Wicksell (1898), Irving Fisher (1907), Joseph A. Schumpeter (1912) and Arthur C. Pigou (1932 [1920]), extended marginal analysis into different economic fields (for example, Pareto (1897) and Pigou (1932 [1920]) expanded marginal analysis into policy).[262] Nevertheless, Alfred Marshall (1842-1924) is noted alongside Léon Walras as one of the major pioneers of neoclassical microeconomic theory. Marshall developed an analytical framework for supply and demand analysis. Furthermore, Marshall (1997 [1920]) formulated a clear concept of price elasticity in relation to demand theory. In contrast to Marshall (1997 [1920]), Walras (1874) modelled the general equilibrium system as a formal system. Consequently, neoclassical theory is characterised by the combination of the following assumptions: (1) rational behaviour; (2) utility maximisation; (3) emphasis on equilibrium or equilibria; (4) neglect of uncertainty; (5) flexible prices and market clearing; and (6) rational expectations. However, the neoclassical era is an ongoing era, and the date on which it becomes the modern economic era cannot be specified. Therefore, it is conceptually helpful to distinguish between the neoclassical era and the modern economic era because modern economics is broader than Marshallian supply and demand analysis or Walrasian general equilibrium theory. In addition, modern economics is confronted with multiple equilibria models and dynamic models. Modern economists also use various technical tools beyond marginal analysis (for example, econometrics and game theory). In other words,

'[m]odern economics cannot usefully be called neoclassical economics because the term neoclassical denotes certain ideas, approaches, and assumptions not characteristic of contemporary economic analysis, including marginalism, the assumption of global rationality,

[262] Pareto and Pigou are also called the fathers of modern welfare economics (see Landreth and Colander 2002).

the belief in marginal-productivity theory, Walrasian general equilibrium theory, Marshallian supply-and-demand analysis, and a belief in laissez faire. All of these concepts have played central roles in economics at various times during the past 130 years, and they are what should come to mind when you hear the term "neoclassical economics' (Landreth and Colander 2002: 395). In addition,

(5) '[t]he inability of neoclassical theory to properly explain the formation of the fundamental prices prevailing in modern monetary production economy, the prices of production to wit, through the mechanism of supply and demand and to cope with the deep depression of the 1930s initiated a classical-Keynesian counterrevolution' (Bortis 2013: 5).

Therefore, we conceptually distinguish the neoclassical era from the modern era with the publication of John Maynard Keynes' The General Theory (1936). Other major representative works of modern economics include John Hicks (1967 [1937]); Paul A. Samuelson's Interaction between the Multiplier Analysis and the Principle of Acceleration (1939) and Foundations of Economic Analysis (1947); Kenneth Arrow's Social Choice and Individual Values (1951); Milton Friedman's Studies in the Quantity Theory of Money (1956); Robert Solow's A Contribution to the Theory of Growth (1956); Gerard Debreu's Theory of Value and Axiomatic Analysis of Economic Equilibrium (1959); and Robert E. Lucas Jr.'s Studies in Business-Cycle Theory (1981). Moreover, the literature of modern economics can be divided into *modern orthodox economics* and *modern heterodox economics*. The former can be divided into *new-Keynesians*, *monetarists, financial intermediary theorists* and so forth. Heterodox economists can be divided into *radicals, old American institutionalists, post-Keynesian*, *public choice* and *neo-Austrians* (see Landreth and Colander 2002). In this context, Landreth and Colander (2002: 6) indicated that the differences between orthodox and heterodox economists are often 'not diametrically opposed theories' because

'modern orthodox theorists have largely focused on the four problems of allocation, distribution, stability, and growth, heterodox economists have studied the forces that produce changes in the society and economy. Whereas orthodox writers have taken as given (something they are not interested in explaining) the specific social, political, and economic institutions and have studied economic behavior in the context of these institutions, heterodox writers have focused on the forces leading to the development of these institutions. Often what orthodox writers take as given, heterodox writers try to explain; and what heterodox writers take as given, orthodox economists try to explain (Landreth and Colander 2002: 6).

4. Countercyclical capital buffer

The global financial crisis involved leverage cycles in which the 'rise in asset prices that accompanied the credit boom resulted in higher capital buffers at financial institutions' (Mishkin 2013: 453), which led to higher asset prices and other consequences. As a response, the BCBS stated that the spectrum for bank 'regulatory capital ranges from reducing its cyclical risk sensitivity to deliberately introducing elements' of a CCB that draw upon the reserve concept of Bagehot (2005 [1920]) (Borio 2009: 37). Bagehot (2005 [1920]: 41) indicated that '[a] good banker will have accumulated in ordinary times the reserve he is to make use of in extraordinary times [(financial distress situation)]'. Likewise, the CCB has the objective to protect the banking system against potential future (prudential measure) losses (see BCBS 2010a, BCBS 2010b, BCBS 2011b, BCBS 2012). Thus, the primary advantage of the CCB is that it can be activated to increase the resiliency of the system to an entire range of shocks in the banking system. However, the countercyclical capital requirements should be stringent in times of credit booms and vice versa. During boom phases, an equity capital buffer should be built to cover losses during downturns and to guarantee credit (see Brunnermeier 2009a, BCBS 2010a, 2010b, IMF 2011). Therefore, the buffer increases or decreases over time within the range of zero to 2.5 per cent of risk-weighted assets as a consequence of the credit-to-GDP ratio. In 2010, the BCBS published guidance for national authorities to build the CCB. Nevertheless, the CCB can be criticised for the follow reasons: it is difficult to calculate credit because the data vary across jurisdictions, and the credit-to-GDP gap is drawn from an economic forecast. In this context, can supervisory authorities predict business cycles? In Switzerland, the SNB activates, adjusts and deactivates the CCB, whereas the FINMA supervises and implements the CCB in the banking sector (see SNB 2014). Thus, the CCB is primarily a central bank regulation. However, we are very sceptical that the SNB is able to predict business cycles. Similarly, Geiger (2010) indicated that if the SNB and other central banks have the wisdom to predict the future, it still remains elusive. Therefore, additional objective research is needed to design a central bank regulatory measure.

5. Transparency measures

Transparency regulation lies at the core of many bank regulatory policies because it protects consumers, ensures the integrity of the banking industry and minimises the problem of asymmetric information (see Lorez 2013). According to Lorez (2013: 14), transparency regulation is composed of three elements: 'a constant information flow of issues, disclosure of material interests in financial assets, and pre- and post-trade publicity of trades'. In consideration of these characteristics, we refer to all regulatory measures that disclose information as 'transparency regulation'. Thus, transparency regulation has the advantage that (1) it is not a heavy-intervention measure because it does not regulate the banking process (going concern), the level of output allowed, prices charged or the allocation of bank services; (2) it prohibits the supply of false or misleading information and may require mandatory disclosure, perhaps obliging suppliers to provide information to consumers on price, composition, quantity, or quality; and (3) it allows customers 'of products and services [...] to make decisions on the acceptability of the processes employed in producing those products or services' (Baldwin and Cave 1999: 49).

One example of transparency regulation is the automatic exchange of information (AEoI) for the banking sector based on the G20 working group on development (OECD 2012). The AEoI is a regular, periodic (for example, annual) transmission of tax information regarding non-resident persons sent by the jurisdiction in which income or assets are located to the jurisdiction in which the individuals may owe tax.

Nevertheless, transparency measures can be criticised on several grounds. First, reporting practices in banking vary across banks and countries (see Ayadi et al. 2012); therefore, harmonised regulation such as the AEoI extends in the right direction. Second, anticipating the user of the information disclosed (customers, pension funds and so forth) is complex because, for example, customers may fail to use the information properly, fail to understand the implications of the data given, neglect to collect the full range of relevant information, or lack the resources to research issues fully. Moreover, transparency regulation based on misleading information increases the cost for information-based regulatory authorities to evaluate information. In this context, the US program in Switzerland creates enormous costs (consulting and lawyer costs) for banks and regulatory authorities, whereas the benefit is questionable.

Nonetheless, a hypothesis can be formulated and an argument made against the reasoning of transparency regulation. Based on transparency, the following alternative hypothesis can be formulated: improving the transparency of financial services can lead to

welfare losses in the capital market, at least to a certain degree. In this regard, we assume that improving the availability of information regarding financial services influences the behaviour of market participants such that it reduces the volume of investment in the capital markets and thus generates a certain degree of welfare loss for the economy. Notably, this hypothesis has not yet been proven and verified and thus requires further analysis.

Conversely, the Anglo-Saxon literature frequently presents the argument of incentive-compatible bank contracts. It is suggested that depositors can choose between different transparent and risk-free investment opportunities, and it is the task of the bank and not of the government to reduce information asymmetry between buyers and sellers (see Bryant 1980, Diamond 1984, Dewatripont and Tirole 1994, see section 2.1.2). For this reason, incentive-compatible contracts will better protect depositors from the opportunistic behaviour of better-informed and more skilled intermediaries, which is why transparency measures are unnecessary.

6. Deposit insurance

'Deposit insurance' is not discrete in nature; instead, it is the subject of a firm contractual agreement and is 'granted for sure'. Accordingly, 'small depositors' in particular are to be protected in the event of a bank run and any resulting insolvency-related 'protective regulation', and the functionality and safety and soundness of the banking system should be secured during periods of acute or imminent insolvency and contagion effects (see Diamond and Dybvig 1983, Baltensperger and Dermine 1987, Dewatripont and Tirole 1994, Calomiris 1999). The majority of OECD countries use an approach that includes deposit insurance. Such an approach may be official (for example, the United Kingdom and the United States), may be organised by the banking industry itself with encouragement from authorities (for example, Switzerland[263] and France) or may be jointly administered by authorities and banks (for example, Japan) (see Dale 1984, Dewatripont and Tirole 1994). We pose the question regarding how to structure deposit insurance because doing so presents the government with a unique set of challenges (see also Calomiris 1999). Thus, deposit insurance can assume a variety of forms. We have expanded the four dimensions presented by Baltensperger and Dermine (1987) by adding three dimensions pursuant to Calomiris (1999) and Diamond and Dybvig (1983) (provisions by the government or by private organisations, effects on procyclicality and political economy constraints):

[263] In Switzerland, deposit insurance is self-regulated (see Art. 37h of the BA 2015 [1934]). The depositor is protected to a maximum amount of CHF 100,000 (see Art. 37a para. 1 of the BA 2015 [1934]).

(1) Fee structure (flat fee versus risk-related fee),
(2) Degree of coverage (full[264] versus partial coverage),
(3) Funding provisions (funded versus unfunded systems),
(4) Provision by the government or by private organisations,
(5) Compulsory versus voluntary participation,
(6) Effects on procyclicality or countercyclicality and
(7) Political economy as a policy constraint.

Various forms of deposit insurance can be created based on the particular selection of dimensions, yielding various advantages and disadvantages. From an economic perspective, developing a safety and soundness system that is as efficient as possible for depositors and banks and that has the ability to obtain an optimal allocation of resources is important. Thus, a safety system that protects depositors by preventing bank failures and maintaining inefficient banks should be avoided (Meltzer 1967). For example, if the coverage is 100 per cent, then a moral hazard emerges. Banks may be induced to take on riskier business because their capital is fully covered (see also Llewellyn 1999). For that reason, Calomiris (1999: 1500) suggests that deposit insurance 'must be designed to maximize welfare subject to both economic and political constraints'. However, Llewellyn (1999: 29) finds that most types of deposit insurance lead to the following four moral hazards:

- Consumers may be less careful in the selection of banks (that is, seek higher-risk banks because they receive higher interest rates);
- 'The bank takes on more risky business because depositors are protected;
- Risk is subsidised, because depositors do not demand an appropriate risk premium in their deposit interest rates; and
- The existence of deposit insurance may induce banks to hold lower capital'.

In addition to Llewellyn (1999), Greenbaum and Thakor (2007 [1995]) carefully investigate the problem of moral hazard related to deposit insurance (see also Fischel et al. 1987). Greenbaum and Thakor (2007 [1995]) conclude that a risk-related fee can reduce moral hazard (see section 7.2), whereas Greenbaum and Tahkor (2007 [1995]) advocate a combination of prudential measures and deposit insurance described as 'optimal' regulation in the Anglo-Saxon literature.

[264] For example Mexican banks have full deposit insurance and have no forced accounting standards or capital requirements (see Calomiris 1999).

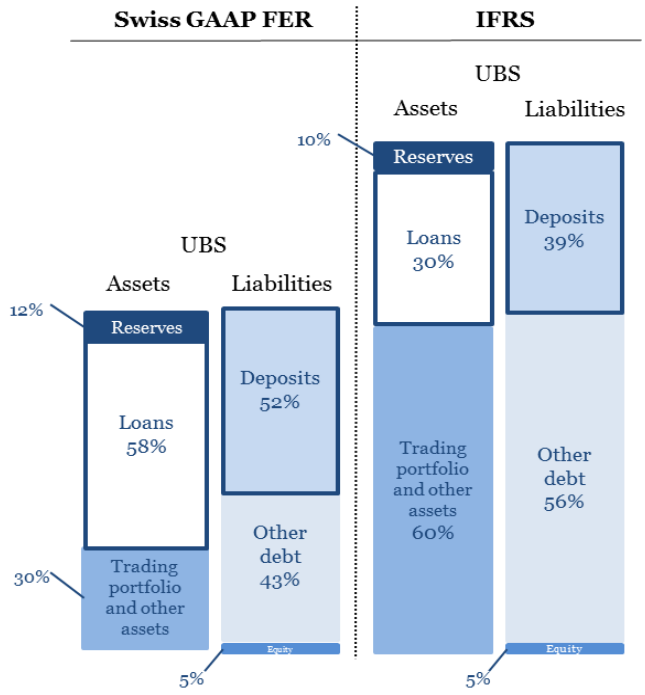
7. Accounting standards: Swiss GAAP FER versus IFRS

Accounting standards are defined as prudential standards that contain accounting and public disclosures and that are based on internal and external accounting principles and rules such that 'the information submitted by banks is of a comparable nature and its meaning is clear' (BCBS 1997: 36). Therefore, a supervisory agency provides reporting instructions for banks to clearly establish accounting standards to ensure that the information submitted by those banks is comparable (see Bernet 2003, Meyer 2006). In other words, the aim of accounting standards is to analyse and publish company information to ensure transparency in banks' information (fair presentation/true and fair value) and to improve both the elements of consumer protection and the safety and soundness of banks (see Art. 6a para. 1 of the BA 2015 [1934]; see also Meyer 2006). Thus, for every business year, banks must prepare a business report that consists of the annual financial statement, the management report and the group financial statement (see Art. 6 para. 1 letters. a-c of the BA 2015 [1934]). In principle, each Swiss bank can determine whether to voluntarily use the national accounting standards of the Swiss GAAP 'Fachkommision Empfehlung zur Rechnungslegung' (FER) (accounting recommendation) or to use an international standard (most commonly, the International Financial Reporting Standards (IFRS) or the United States' generally accepted accounting principles (US GAAP)). However, this judgement and policy discretion is limited to financial reporting once the bank chooses to be quoted on the Swiss Infrastructure and Exchange (SIX). The majority of banks quoted on the SIX must comply with either the IFRS or the US GAAP. The IFRS (fair presentation/true and fair view value) primarily focuses on banks that provide information in the foreground (consumer protection). Conversely, banks that are quoted on an American stock market and use an audit certificate in the US must comply with US GAAP (fair presentation) (see Meyer 2006). In Switzerland, for example, the consolidated UBS financial statement has been prepared with respect to the IFRS, Swiss GAAP FER and supplemental disclosures required for the US SEC (see UBS 2015).[265] Figure A.3 illustrates a simplified UBS balance sheet for the year ending on 31 December 2014 in accordance with the Swiss GAAP FER standards (left) and the IFRS (right). Table A.1 presents the detailed figures of the Swiss GAAP FER and IFRS. According to the available data of the UBS AG Annual Report 2014, the total assets under the Swiss GAAP FER are valued at CHF 777,893 million. The total assets are the sum of CHF 95,711 million in reserves (12 per cent of the total assets), CHF 451,146 million

[265] The UBS Group has prepared a reconciliation of IFRS shareholders' equity and net profit to the US GAAP.

in loans (58 per cent of the total assets) and CHF 231,036 million in other trading portfolios and other assets (30 per cent of the total assets).

Figure A.3 UBS balance sheet, 31 December, 2014, in accordance with the IFRS and Swiss GAAP FER



Source: Authors' own elaboration based on UBS (2015).

The liabilities are valued as the sum of CHF 402,488 million in deposits (52 per cent of the total liabilities), CHF 333,029 million in other debts (43 per cent of the total liabilities) and CHF 42,376 million in equity (five per cent equity-to-assets ratio). In accordance with the IFRS, the total assets are valued at CHF 1,062,478 million, which is an increase of CHF 284,585 million assets compared to the Swiss GAAP FER. Moreover, the total assets are valued as the sum of CHF 104,073 million in reserves (cash and balances with central banks; 10 per cent of the total assets), CHF 315,757 million in loans (30 per cent of the total assets), and CHF 642,648 million in trading portfolios and other assets (60 per cent of the total assets). The liability side contains CHF 410,207 million in deposits (39 per cent of the total liabilities), CHF 597,903 million in other debts (56 per cent of the total liabilities) and CHF 54,368 million in equity (five per cent equity-to-assets ratio equal under the Swiss GAAP FER).

Table A.1 UBS Financial Statement with respect to the Swiss GAAP FER and IFRS

Accounting standard	Swiss GAAP FER		IFRS	
Assets	*CHF million*	*% of the total assets*	*CHF million*	*% of the total assets*
Reserves	**95,711**	**12**	**104,073**	**10**
Loans	**451,146**	**58**	**315,757**	**30**
Trading portfolio and other assets	**231,036**	**30**	**642,648**	**60**
Total Assets	**777,893**	**100**	**1062,478**	**100**
Liabilities				
Deposits	**402,488**	**52**	**410,207**	**39**
Other debt	**333,029**	**43**	**597,903**	**56**
Total liabilities	**735,517**	**95**	**1008,110**	**95**
Total Equity	**42,376**	**5**	**54,368**	**5**
Total liabilities and equity	**777,893**	**100**	**1062,478**	**100**

Source: Authors' own elaboration based on UBS (2015).

Both accounting standards have certain similarities regarding the value of the reserve and equity positions. Reserves under the Swiss GAAP FER (12 per cent of the total assets) and under the IFRS (10 per cent of the total assets) are approximately equal. The same applies for total equity (under the Swiss GAAP FER and IFRS, five per cent equity ratio). Therefore, the main differences are in the following areas: (1) loans; (2) trading portfolios and other assets; (3) deposits; and (4) other debt. The question arises regarding how different standards explain such a high discrepancy.

The difference between the Swiss GAAP FER and the IFRS can be primarily explained using the following three arguments:[266] (1) under the IFRS, all entities controlled by the UBS Group AG (see Figure A.1 in the Appendix 1) are consolidated, whereas under the Swiss GAAP, only entities that are active are consolidated; (2) under the IFRS, financial investments are valued under fair value (which means that 'the price that would be received for the sale of an asset or paid to transfer a liability in an orderly transaction between market participants in the principal market […] as of the measurement date' (UBS 2015: 469)), whereas under the Swiss GAAP FER, the systematisation and measurement is determined by the funding; and (3) under the IFRS, the fair value applies only to certain non-trading financial assets and liabilities, whereas for the Swiss GAAP FER, the fair value applies only to structured products (see UBS 2015).

[266] In addition, there are discrepancies between the Swiss GAAP FER and IFRS in cash flow hedges, goodwill and intangible assets, pension and other post-employment benefit plans, netting of replacement values, extraordinary income and expense and other presentational differences (see UBS 2015).

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