Regulation of Multinational Banks in the European Union

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Katri Mikkonen

Referent:	Prof. Dr. Gerhard Illing
Korreferent:	Prof. Dr. Monika Schnitzer
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Chapter 1

Introduction

In the past years, financial markets in the European Union (EU) have been under a profound change. Most importantly, the enlargement of May 2004 brought ten new member countries into the EU. In particular, eight of them are former socialist countries that differ radically from the old member countries in terms of financial market characteristics. The pace of change will go on, as the new members are soon due to enter the European Monetary Union (EMU), and as the negotiations for further enlargement of the EU are in an advanced stage.

This study considers the regulation of multinational banks in the EU. The focus on multinational banks implies that the enlargement will play a central role in the work at hand: Whereas the old 15 member countries (EU-15) do not generally show large shares of foreign ownership in their banking sectors, most banks in the Central and Eastern European new member (CEE) countries are foreign owned[1]. The enlargement has thus significantly changed the structure of the EU banking market and increased its degree of heterogeneity. In particular, the enlargement has accentuated the role of regulation of multinational banks for the overall financial market stability.

The term multinational bank is used in this work to describe a bank that has operational units in more than one country. This excludes in particular lending in the international capital markets, and lighter forms of foreign establishments such as representative offices. Furthermore, it is assumed that a multinational bank has a parent bank in one of the countries, which will be called the home country. Following

[1]The CEE countries comprise the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia. The EU-15 countries comprise Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom (UK).

the EU legislative terminology, countries where the multinational bank operates, but that are not home countries, are called host countries.

The ownership structure of the multinational bank will play a central role in the present work. In short, a multinational bank wishing to settle down in a country can choose between a branch and a subsidiary form. A branch is an elementary part of the parent bank, meaning that the assets of the two units are consolidated into one entity. In contrast, a subsidiary is an independent asset of the parent bank. Most importantly, a subsidiary can go bankrupt separately of the parent, i.e. without the assets of the parent bank being touched. The ownership structure has implications on bank risk taking, and consequently, on the organisation of bank regulation.

Throughout the study, we refer to the general definitions of Goodhart & al. (1998) for regulation. Accordingly, banking regulation is used as an overall term, which comprises rules, supervision, and crisis action. Rules consist of the legislative framework that is determined ex ante, such as deposit insurance, minimum capital requirements, or the rules for emergency lending provided by the lender of last resort (LOLR). Supervision refers to the information acquisition process of the regulators, including on-the-site inspections and information disclosure of the banks, among others. Finally, crisis action is used for the regulatory interventions during times of financial distress, such as bank closure or restructuring, capital injections, and emergency lending.

The study is a theoretical inquiry on the regulation of multinational banks. The objective of the present chapter is to first briefly describe the EU banking markets and regulatory framework and review the policy discussion around the EU regulatory arrangements. After, theoretical literature in banking, regulation, and multinational banks is outlined, followed by an outlook into the subsequent chapters.

The theoretical analysis comprises Chapters 2, 3, and 4. Whereas Chapter 2 studies the incentive effect of regulatory arrangements on the choice of bank ownership structure, Chapter 3 abstracts from liability structure considerations and determines the optimal division of emergency lending responsibilities in the presence of both national and supranational regulators. Chapter 4 then turns into the distribution of foreign direct investment in the market and considers the stability effects of minimum capital requirements via incentives for international takeovers. Finally, Chapter 5 concludes.

1.1 Banks and Regulation in the EU

1.1.1 Regulatory Framework

The purpose of the EU is to promote four freedoms: free movements of people, goods, services and capital, the leading idea thereby being enhanced efficiency through increased competition. The EU banking regulation is therefore designed to implement the idea of free movement of services: The second banking cooperation Directive[2] sets the cornerstones of bank regulation in EU being the principles of mutual recognition and home country control. The first principle states that a bank, having acquired a licence in any of the member countries, has the right to operate branches in all the others. The latter one assigns the responsibility of the consolidated supervision of the foreign branches of a bank to the regulator of the home country. The role of the regulator in the host country is limited to providing relevant information and supervising the liquidity of the branch. Further, the Directive on the reorganisation and winding-up of credit institutions[3], extends the home country control principle to the bankruptcy procedure.

The single market equally aims at harmonisation of rules under which the banks operate. With some few exceptions, every credit institution within the EU is required to join a deposit insurance scheme. As to international banks, the branches are to be covered by the home country deposit insurance, unless the branch wants to join the host country deposit insurance. The minimum coverage is up to EUR 20 000 for each depositor. As to minimum capital requirements, a universal start capital of EUR 5 millions is defined in the Directive on capital adequacy of investment firms and credit institutions. The solvency ratio requirements in the EU are compatible with the Basel requirements, the minimum risk-adjusted solvency ratio being eight per cent. The Basel II approach will be integrated in the EU legislation as well.[4]

Although the banking rules in the EU seem to be harmonised in paper, there is some leeway in their implementation. For example, the deposit insurance coverage regulation only sets the minimum guarantee level. Table 1.1 demonstrates that the actual deposit guarantees for the EU countries vary to a significant degree. Furthermore, note that despite being members of the EU, some CEE countries are still under transition as

[2] If not otherwise stated, the EU legislation is to be found in the consolidated Directive 2000/12/EC on the taking up and pursuit of credit institutions.

[3] Directive 2001/24/EC.

[4] For the Basel Accords, see BIS (1988) and BIS (2005).

to harmonisation of the minimum deposit insurance coverage. In particular, the CEE countries are members only since May 2004. Before this date, they of course did not have the obligation to fulfil the EU standards. For example, Slovenia restricted accession of foreign branches until 1999, and Hungary required that the branches had capital adequacy similar to subsidiaries until 2004[5]. This transition period was also of practical importance: for example, no means of fulfilling minimum capital requirements or deposit insurance were at place directly after transition[6].

Table 1.1: Deposit guarantees in the EU, 2004

Country (EU-15)	Guarantee level	Country (CEE)	Guarantee level
Austria	20,000	Czech Rep	25,000
Belgium	20,000	Estonia	6,391[a)]
Denmark	40,329	Latvia	8,597[a)]
Finland	25,000	Lithuania	14,481[a)]
France	60,980	Hungary	26,651
Germany	20,000	Poland	22,500
Greece	20,000	Slovenia	25,025
Ireland	20,000	Slovakia	20,000
Italy	103,291		
Luxemburg	20,000		
Netherlands	20,000		
Portugal	25,000		
Spain	20,000		
Sweden	27,714		
UK	44,961		

[a)] Shall be raised to EUR 20,000 by 2008.
Source: EC (2006).

In a system that includes multiple regulators, the success of banking supervision and crisis action is dependent on information acquisition abilities and on the incentives to pass the information forward or to use it. The streamlined regulation is meant to increase competition within the single market and reduce costs of banking to consumers and businesses[7]. However, the home country control principle has some implications that differ from a "true" single market. In particular, supervision of multinational banks and crisis action in the EU is not only a national task, but the European Central Bank (ECB) is appointed to guarantee the "smooth functioning of the payment

[5] See BoS (1999) for Slovenia, and Majnoni & al. (2003) and Gelegonya (2003) for Hungary.

[6] For example, in Estonia, independence led to the Russian banks exiting from the market. Therefore, the regulator had to rely on an easy licensing policy in order to preserve at least some banking system in the country in the early years of transition. See Soerg (1999).

[7] See Begg & Altunbas (2002) and Danthine & al. (1999).

system"[8]. The fragmented view on regulation can, at first sight, be compatible with the idea of a European-wide financial market only if the cooperation between the national regulators functions smoothly.

The EU has responded to the need for cooperation by founding various committees. An overview of the activities of the committees can be found in e.g. ECB (2002). First, bilateral coordination is organised through the Memoranda of Understanding, which are in place as a framework for day-to-day matters in supervision of financial organisations. Second, the Banking Supervision Committee (BSC) of the European System of Central Banks, meeting five times a year, is the formal EMU organisation for multilateral change of information. Despite its connection to the ECB, the BSC has a EU-wide mandate in the field of systemic stability and the smooth functioning of payments and securities settlement systems. The BSC acts as an interaction organ between the central banks and the supervisors and as a crisis management coordinator in case of aggregate shocks. Third, the Groupe de Contact consists of banking supervisors of the EU countries and handles individual problems at the time they emerge among the members of the European Economic Area. It equally promotes information exchanges on general developments in banking regulation.

In addition, from 2004 on, two new committees have been founded that strengthen the involvement of the European Commission[9]: The European Banking Committee that consists of high level representatives from the member countries and from the European Commission, and the Committee of European Banking Supervisors, consisting of experts from the national supervisors, central banks, and from the ECB, also in connection to the European Commission.

1.1.2 Banks in the EU

In this section, we briefly illustrate the structure of the banking markets in the EU[10]. As it will turn out that the CEE countries are the most interesting markets for the European banking regulation, special attention is paid to them.

Table 1.2 presents figures as to the structure of the financial markets in years 2001 and 2004. In general, the EU financial markets are rather bank than stock market

[8] See Article 105(2) of the Treaty on the EU.

[9] The legislation as to these committees is to be found in the Commission Decisions 2004/5/EC and 2004/10/EC.

[10] A more general analysis can be found in e.g. Allen & al. (2005).

oriented[11]. According to the IMF (2005), bank assets comprised 67 and stock market capitalisation 139 per cent of the gross domestic product (GDP) in the United States (US) in year 2004. Furthermore, comparison within the EU shows that the CEE countries are similar to the old member countries in this regard: the stock market capitalisation always lies below the value of the bank assets. The relation varies from very bank concentrated Latvia and Slovakia to more stock market oriented Lithuania and Estonia, for whom the value of stock market capitalisation amounts to over the half of the value of bank assets. Although the difference between the EU-15 and the CEE countries has diminished lately, one can see that especially still in year 2001 the differences between stock market capitalisations of the two regions were large.

Table 1.2: Bank assets and stock market capitalisation in the EU

Country	Bank assets / GDP 2001	2004	Stock market capitalisation / GDP 2001	2004	Total 2001	2004
Eurozone	253	265	70	57	323	322
EU25	275[a)]	293	82	67	329	360
Czech Rep	115	100	16	37	131	137
Estonia	65	94	25	49	91	143
Latvia	79	101	9	10	88	111
Lithuania	32	47	22	34	54	81
Hungary	68	80	20	26	88	106
Poland	63	68	14	25	77	93
Slovenia	81	94	18	27	98	121
Slovakia	n.a.	88	17	11	n.a.	99

[a)] Without Slovakia. Sources: Eurostat, except ECB (2005a) for bank assets.

However, a closer look reveals that the CEE markets differ from those of the EU-15 in many aspects. First of all, Table 1.2 demonstrates the differences in the sizes of the combined bank and stock markets. In addition, the absolute size difference is still larger: although the CEE countries comprise eight of the 25 EU member countries, their combined contribution to the GDP of the EU was around four per cent in year 2004[12].

A second difference can be detected in Table 1.3, which presents data as to the scope and form of foreign ownership in the banking sector. Whereas the old member countries, apart from Finland, are moderately foreign owned, the assets of the foreign

[11] For a thorough comparison of financial systems, see Allen & Gale (2000a).

[12] See Eurostat. Among the CEE countries, Poland is clearly the largest one with 1,9% of the GDP of the EU; this leaves the mere 2,1% for the seven remaining countries.

banks account for between 60 and 100 per cent of all bank assets for the CEE countries, except for Slovenia and Latvia. The early years of transition were typically followed by a banking crisis, as badly capitalised and managed new banks, largely born under the lax licensing policy of the early years of transition, were not able to survive in the market. As the economy started to grow, foreign banks entered the markets.[13]

Table 1.3: Foreign banks and bank capital in some European countries, 2004

Country	Assets (Foreign banks/Total)[a)]	Nr of banks	Nr of foreign branches	Nr of foreign subsidiaries	Capital adequacy[b)]
Austria	21,7	796	18	20	14,7
Belgium	19,3	104	45	26	12,3
Denmark	19,5	202	17	10	13[a)]
Finland	61,7	363	20	5	19,1
France	11,2	897	82	166	10,4[a)]
Germany	5,5	2148	83	42	13,2
Greece	12,14	62	23	4	11,9
Ireland	30,3	80	32	32	12,6
Italy	9,5	787	104	8	11,5
Netherlands	9,9	461	29	29	11,5
Portugal	23,5	197	27	13	10,3
Spain	9,8	346	61	51	11,6
Sweden	5,9	212	20	23	10
UK	19,2	413	175	95	12,3
Czech Rep	96,2	68	9	22	12,6
Estonia	98,5	9	3	3	13,4
Latvia	48,1	23	1	8	11,7
Lithuania	92,3	74	2	5	12,3
Hungary	62,5	213	0	23	11,2
Poland	67,3	653	3	41	15,6
Slovenia	19,3	24	2	5	11
Slovakia	92,9	21	3	15	19

Sources: ECB (2005a), except for [a)]: ECB (2005b) and [b)]: IMF (2005).

An obvious implication that arises from the combination of large foreign ownership and the smallness of the markets is that the foreign bank units in the CEE must be small in comparison to the parent banks. For example, the total of the Baltic assets of Hansapank, the market leader in Estonia, and strongly present in Latvia and

[13] See Caprio & Klingebiel (1996) and Lindgren & al. (1996) for description of the early banking crises. As to entrance of foreigners in Poland, the Czech Republic, Hungary, Slovakia and Slovenia, see Schardax & Reininger (2001). Barisitz (2002) and Adahl (2002) provide a profound overview on the history of banking in the Baltic countries.

Lithuania as well, comprised about seven per cent of the total assets of its Swedish parent, Swedbank[14]. The number two in Estonia, Ühispank, made 1,25 per cent out of the assets of SEB, its equally Swedish parent bank. The figures for the Latvian and Lithuanian subsidiaries of SEB, of which the latter is again a market leader, were 0,95 and 1,72 per cent, respectively.[15] Finally, the market leader in Poland, Bank Pekao S.A, comprised around five per cent of the assets of its Italian parent, UniCredito, in 2003[16].

Table 1.3 also classifies the foreign banks according to their ownership structure. An international bank can choose between a branch and a subsidiary form, the former meaning that the assets of the foreign and the domestic units are pooled, whereas the subsidiary is an independent asset that can be liquidated without touching the assets of the parent bank. Generally, the branch form is thought to be more interesting for banks, due to more efficient use of equity capital and other gains in operating as a single unit.[17] The single licence principle, meant to enhance the integration and efficiency of the banking market, grants permission to set up branches in any EU country, whereas subsidiaries need to be licensed in every country of operation. In addition, according to the home country control, the latter fall to the responsibility of the host country regulator. In light of the data presented in Table 3, there seem to be advantages in the subsidiary form, especially in the CEE countries, that counteract the higher efficiency of a branch structure.

Finally, Table 1.3 presents the capital adequacy ratios of the banks in the EU. The eight per cent minimum capital requirement hardly seems to be binding, and even less so in the CEE countries[18]. In particular, there seems to be lot of variation, with some very high levels of capital in some CEE countries. Note that, both in terms of capital adequacy and foreign ownership, Finland seems to be an outlier among the old member countries. On the CEE side, Slovenia has both the lowest foreign ownership and capital adequacy ratio.

[14] See Swedbank (2004) and Hansapank (2004).

[15] See SEB (2004) and Ühispank (2004).

[16] See UniCredito (2003).

[17] As an example, Nordea (2003) has given these efficiency gains as an explanation for its recent switch from subsidiary to branch structure.

[18] The unweighted average of the CEE countries is higher than that of the EU-15.

1.1.3 Policy Discussion

The discussion around the integration of European banking markets and banking regulation has evolved around the above-mentioned aspects. Two questions will be considered here in detail: First, whether there are arguments for transferring the regulatory power to the European level; and second, how explicit should the rules concerning the division of responsibilities be.

Most of the discussion has concentrated on the regulatory externalities inherent in multinational banking. The most prominent of these externalities are the systemic costs of a bank closure or failure that, in case of multinational banks, are not necessarily limited to the jurisdiction of the regulator in charge. This gives rise to information acquisition problems and conflicts of interests. As to the first of these problems, Wihlborg (1999) points out that, whereas local regulators may have better access to information as to actions in their countries, they may have less of an accurate idea of the situation abroad than a common regulator would. In this regard, as Mayes & Vesala (1998) put it, there may still be differences according to the ownership structure: as information on branch structure banks is provided in a consolidated way in the home country, assessing the systemic risk within their countries is even more difficult for the host country regulators. A second problem is the potential interest conflicts between the home and the host country regulators. Eichengreen & Ghironi (2002) point out that national regulators internalise the cost of failure to a lesser amount than a common regulator would. As to crisis action, the role of CEE countries as hosts may aggravate the incentive conflict, as the host country banks may be too small to save for others than local regulators[19].

Regulatory competition in Europe and the fear of a race to the bottom has equally evoked contributions to the political discussion. In principle, the regulatory rules framework is set by the Basel accords and thus treats all countries equally. In reality, however, Bini Smaghi (2000) points out that e.g. asset risk valuation and minimum deposit insurance give a lot of discretion for national regulators. In addition, apart from the common minimum level, the coverage of the deposit insurance is a national matter. Huizinga (2002) and Bini Smaghi (2000) point out that there may be distortions in competition, as domestic and foreign banks that compete in the same market may be subject to different deposit insurance schemes, and as more stringent rules on deposit

[19] Also Mayes & Vesala (1998) discuss the special problems of the small host country in the home country control framework.

insurance make it more costly and risky to enter a market as a foreign bank. However, as Vives (2001) remarks, this may not be a great concern as a foreign branch may join a more favourable host country scheme.

The externalities argument and fear for regulatory race to the bottom have prompted many authors to support the idea of supranational regulator for Europe. Whereas Aglietta (1999) and Vives (2001) argue for the ECB as the LOLR, Padoa-Schioppa (1999) calls for a Euro area regulator or at least very close cooperation, as the propagation of problems will be area-wide. Also Danthine & al. (1999) suggest an independent Europe-wide, independent regulatory agency. Besides of advantages in form of externalities such as diminished capture and excessive interventionism, they assume that a common regulator would increase the speed of reaction. From the regulatory competition point of view, DiNoia & DiGiorgio (1999) would like the international regulator to coordinate and to harmonise the legislation.

On the other hand, externalities can be used to advocate for the national regulator. In particular, Vives (2001) argues that crisis management and deposit insurance considerations should be reunited at the European level, which is difficult without a European fiscal authority. A second reason for not creating a common regulator for the EMU, maintained by Schoenmaker (2000) among others, is the fact that most of the multinational banking still takes place outside the ECB jurisdiction. The common regulator would thus not be better able to detect the bulk of the international activities of the banks, nor to resolve the incentive problems. Finally, although many authors expect the systemic costs to increase within the common market[20], there are arguments that predict the opposite. First, although some cross-border development is seen in the EMU, we saw in the previous Section that the banks still operate mainly nationally, except in the CEE countries. Second, Milne & Wood (2003) argue that as banks have become more international, the assets have become more diversified at the same time, which decreases systemic risk. Finally, the small absolute amount of internationalisation is equally an important argument against a costly restructuration and has inspired some writers to promote the national regulatory system[21].

Besides giving the responsibility to one or another regulatory level, a comparative advantage view prevails, advocated by Mayes & Vesala (1998), Bini Smaghi (2000), and Schüler (2003), among others. According to this view, the ECB has a comparative advantage on assessing the systemic risk, whereas the national regulator is better at

[20] See Aglietta (1999), Bruni & de Boissieu (2000), Vives (2001), and Schüler (2003).
[21] See Huizinga (2002), Begg & Altunbas (2002), and Eichengreen & Ghironi (2002).

credit risk evaluation. Therefore, the former should be appointed to the ECB and the latter to the national central bank (NCB). In a similar vein, Wihlborg (1999) advocates for a veto right for ECB on LOLR and active coordination of supervision. This approach however presupposes that the NCBs and the ECB can effectively cooperate with each other.

Turning to the question how explicit the division of responsibilities should be, not only policy discussion but also the EU legislation was seen to highlight the importance of cooperation among the regulators. However, coordination may be impossible to achieve due to free-riding, as pointed out by Uhlig (2002), or national incentives, as argued by Aglietta (1999), and Vives (2001). Therefore, the non-specification of responsibilities may lead to interest-based regulation instead of the coordination solution.

A second problem, related to division of responsibilities, is that in EMU in particular, the ambiguity has a special form of leaving the identity of the LOLR open in the Treaty on the EU. The idea is to compensate for the apparent time inconsistency and too big to fail problems inherent to banking regulation with ambiguous identity of the LOLR. Padoa-Schioppa (1999) maintains that the current ambiguity is accurate and that critics underestimate the Eurosystem's capacity to act and overestimate systemic risk. On the critics' side, Prati & Schinasi (2000) point out that ambiguity as to responsibilities causes delays, coordination problems, and raises the costs of resolutions and can damage EMU's credibility. For example, if banks do not believe that the ECB will decide on the liquidity assistance, they may expect it from the NCB in a situation where it will not be given and take larger risks. This again increases the risk of time inconsistency of the LOLR policy. Further, Prati & Schinasi (2000) maintain that constructive ambiguity as to which LOLR facilities are available may be necessary to curb moral hazard, but there should be no ambiguity among the policymakers as to the mechanisms that can be used to manage crisis situations. Also, Bruni & de Boissieu (2000) are of the opinion that more transparency is badly needed and does not undermine constructive ambiguity in policy making. In particular, ambiguity as to the mandates may lead to quarrels and interest conflicts between national and central authorities and regulatory moral hazard of NCBs, if they rely on the ECB willingness to avoid systemic disruptions. The sceptical view as to the ambiguity on the identity of the LOLR is equally shared by Aglietta (1999), and Lastra (2000), who point out the discretionary nature the LOLR policy has been given in the Treaty on the EU.

1.1.4 Summary

In sum, the proper functioning of the EU banking regulation requires smooth and timely cooperation. Judging from the current policy discussion, a doubt seems to prevail whether this is a realistic requirement, given that the incentives of the national actors cannot always coincide with each other nor with those of a European regulator. Second, integration in the banking markets seems to have largely happened outside the common market, the CEE countries having served as hosts of the foreign investment for a long time before they entered the EU. In addition, as most of this investment is still made in form of founding subsidiaries, it seems that integration has preceded legislation and not vice versa. This further highlights the mismatch of banking and its regulation within the area. Finally, the clear role of the CEE countries as hosts implies that their special characteristics may matter a lot as to the success of banking regulation in the EU.

1.2 Overview of the Literature

In this section, theoretical literature on multinational banking and its regulation is discussed. Before proceeding with the international framework, a short review on the theory of banking and regulation of banks is presented.

1.2.1 Banking Theory

In the Arreu-Debrew world, the Modigliani-Miller (1958) Theorem states that the form of financing is irrelevant for the cost of capital and for the projects the firm will choose. Consequently, there is no reason for banks to exist. The modern banking theory, as presented in e.g. Freixas & Rochet (1997), departs from this framework by assuming informational asymmetries to exist in the market. We concentrate here on informational problems that lead to the emerging of banks as liquidity creators, either in the liability side as an insurer of the agents' uncertain liquidity needs, or in the asset side as credit suppliers.

The first strand of literature studies the role of a bank as a liquidity insurer for agents, whose intertemporal consumption needs are uncertain. In Diamond & Dybvig (1983), the banks act as maturity transformers: due to unforeseen liquidity needs, agents are not able to privately invest in efficient but illiquid projects, which creates

a role for a bank that retains the fraction of expected liquidity needs as reserves. However, this maturity transformation, together with the sequential service rule[22] for deposit payments, exposes banks to depositor runs, which, if they occur, force the bank to inefficiently liquidate their investments before maturity.

Diamond & Dybvig (1983) abstract from bank risk, and so bank runs are always of speculative nature and therefore detrimental. If bank risk taking is introduced, a coexistence of fundamental and speculative bank runs emerges, which may create a positive role for bank runs as imposers of market discipline. In Calomiris & Kahn (1991), demand deposits are helpful in disciplining bank managers that would otherwise act in their own interests. Alonso (1996) abstracts from panic bank runs by assuming that depositors do not observe the actions of each other and allows the banks to be able to write contracts that do not allow for bank runs. In the equilibrium, banks sometimes choose to write contracts with a positive probability of bank run, since it enables them to use private information to direct behaviour. Finally, in a framework with risky assets and when the sequential service rule is relaxed, Allen & Gale (1998) show that bank runs have an advantage of risk sharing between early and late consumers.

The overall beneficial effect of a bank run in presence of moral hazard is, however, not a foregone conclusion. Chari & Jagannathan (1988) show how the coexistence of informed and uninformed depositors, together with risky bank returns and random liquidity needs, can produce socially costly bank runs even without the sequential service constraint. In Chen (1999), bank panics can trigger a costly contagion effect if depositors interpret a bank run in one bank as a signal on probability of bank failure in another bank. Jacklin & Bhattacharya (1988) introduce risk aversion and equity and show that a demand deposits economy is superior to holding equity for low dispersion of returns, and vice versa.

Finally, some alternative explanations as to banks as liquidity insurers have been advanced. Gorton & Pennacchi (1990) assume that assets are information sensitive, and that agents face unforeseen liquidity needs. This leads to coexistence of informed and uninformed traders. Banks then arise as self-protection of uninformed traders: banks create liquidity by splitting cash flows into risky and riskless assets (deposits), and the latter are demanded by the uninformed traders. A bank thus separates an otherwise pooled market of uninformed and informed traders. Holmström & Tirole (1998) find a role for financial intermediation as a liquidity coordinator, such that the

[22] Sequential service is here used as a synonym for the familiar first-come-first-served rule, according to which the depositors are paid in the order they demand payments, as long as there are funds that can be paid out.

costly liquidity reserves are minimised. In Diamond (1997), banks arise endogenously as market makers, when there is limited participation in the markets.

The second strand of literature concentrates on the asset side of the banks. If the returns on investments are not easily observable, the creditor has difficulty in finding out whether the borrower really pays back the agreed amount. Diamond (1984) models banks as delegated monitorers and shows that the net monitoring costs are minimised because of a diversification effect within the bank. Delegation then solves either the costly duplication, or the free-rider problem of no-one monitoring. Further, Besanko & Kanatas (1993) and Holmström & Tirole (1997) show that, as monitoring is costly, a bank that can eliminate the moral hazard of the borrower can itself face one. In a setting where banks have a comparative advantage in monitoring, Besanko & Kanatas (1993) show how equity and credit both exist in a situation where the bank's monitoring effort directly affects the probability of success of the project. In Holmström & Tirole (1997), the bank moral hazard creates a reason for bank capital in a setting with correlated returns within a bank.

Delegated monitoring increases the bank's information about its borrowers vis-à-vis to the others and may lead to relationship borrowing. Evidence of the importance of bank relationships is provided by Petersen & Rajan (1994). Bolton & Freixas (2000) create a role for banks as relationship lenders: as banks know their clients and do not practise inefficient liquidation, relatively risky firms are willing to pay the intermediary cost of bank financing. Finally, Diamond & Rajan (2001) combine the relationship borrowing view with bank runs. In their model, the possibility of a bank run helps banks to commit to efficient pledging as a relationship lender. In their approach, the banks act as liquidity creators both by providing liquidity insurance for the depositors and by being efficient loan collectors, due to the demand deposit contracts.

1.2.2 Banking Regulation

Banking is a highly regulated area of business. On the one hand, the role of liquidity provider together with the role as maturity shifter in an environment of imperfect information is a fragile combination. On the other, bank failures seem to imply significant costs to the society. As a consequence, most economies have designed a safety net, typically consisting of a deposit insurance combined with a method to curb the bank moral hazard, and of an emergency lending facility, the LOLR. Nevertheless, the high costs of bank failure may equally lead to enforcement problems in form of regulatory

forbearance. The next section will consider the literature on the design of the safety net. In the section after, the incentive problems of the regulator as to the optimal implementation of the safety net are considered.

Safety Net Design

Although a bank run turned out to be efficient in some cases, the possibility of an inefficient bank run and the related information and inequality problems as well as the effect of reduced liquidity creation have resulted in the search for means to avoid it. Under deposit insurance, the regulatory body guarantees the payment of deposits at least to some relatively high a limit.[23] As modelled in Gorton & Pennacchi (1990), the introduction of a tax-funded deposit insurance ultimately turns deposits into a riskless object. If the bank investment is considered to be riskless, there is no additional effect, and social optimum can be achieved, as is the case in Diamond & Dybvig (1983). However, if bank invests in risky projects, deposit insurance has an incentive effect, as the efficient bank runs become eliminated as well. As information on bank risk taking is often not observable or nonverifiable, an agency problem emerges. Similarly, in the delegated monitoring framework, moral hazard occurs due to costly monitoring cost that the banks incur and the information that they accrue through monitoring, as in Besanko & Kanatas (1993). Finally, Dewatripont & Tirole (1994) show that even if banks are considered as ordinary firms that are highly leveraged, market failure arises from the collective action problem of the agents, which gives rise to an agency problem even in absence of deposit insurance. In sum, banks, and in particular insured ones, seem to be prone to agency problems and therefore need further regulation.

Among the attempts to ex ante improve the social optimality of bank activities in presence of deposit insurance, minimum capital requirements have attracted a lot of attention and will be discussed here more profoundly[24]. Higher bank capital increases the amount of uninsured funds at stake and therefore increases the incentives of the bank for prudential behaviour. At the same time, however, they may have some unintended side effects on the bank's optimisation problem. Koehn & Santomero (1980) demonstrate how minimum capital requirements can increase bank risk taking, and

[23] An alternative for deposit insurance has been suspension of convertibility, which equally removes the incentives of unnecessary withdrawals in Diamond & Dybvig (1983), and decreases the costs of non-fundamental bank runs in Chari & Jagannathan (1988). However, suspension of convertibility leads to an inequality problem, as risk sharing is uneven, and consequently has become increasingly unpopular.

[24] For problems with fairly priced deposit insurance, see e.g. Chan & al. (1992).

always increase the dispersion of risk in the banking sector in total. In Bolt & Tieman (2004), the increased incentives for risk taking arise in a dynamic framework. If the regulator wants to limit the insolvency risk, he can do it by introducing risk-adjusted capital requirements, as in Kim & Santomero (1988). Also Giammarino & al (1993) find out, in a setting with adverse selection and moral hazard in banking, that an optimal contract is to some extent risk dependent and equals the probability of failure across banks. Somewhat differently, Hellmann & al. (2000) show that if banks take risk in the form of deposit rate competition, a combination of simple minimum capital requirements and deposit rate controls leads to Pareto-efficiency.

In the above-mentioned literature, capital adequacy ratios are assumed to be continuously binding for the banks. In contrast, Milne (2002) contests the need for risk related weighting and shows that, with a penalty associated with ex post breaching the minimum capital requirement, banks have an incentive to hold capital above the minimum, which leads to simple capital adequacy requirement possibly being sufficient to improve the banks' asset quality.

Besides deposit insurance, another way to curb the effect of sudden liquidity needs is to introduce emergency lending[25]. This function of the LOLR is often placed at the central bank for the practical reason of funds availability. Holmström & Tirole (1996, 1998) and Aghion & al. (2000) give a rationale for tax-financed aggregate liquidity provision in case of aggregate liquidity shocks. However, emergency lending is in practice often targeted to the financial institutions in trouble. In addition, the Bagehot (1873) principles on LOLR activity state that emergency lending should be given to illiquid but only solvent banks. Yet, as Goodhart (1999) points out, a separation between illiquid and insolvent banks is hardly possible in practice, since emergency lending is mostly used in a crisis situation that demands fast actions. As in the case of deposit insurance, emergency lending to individual banks in case of nonobservable difference between liquidity and solvency shocks, or alternatively, the possibility of a bail-out of an insolvent institution due to aggregate liquidity reasons, equally reduces bank incentives to invest sufficiently in safety[26]. Moreover, as there may be additional efficiency and regulatory incentive considerations involved, Goodfriend & King (1988) and Kaufman (1991), among others, have argued that emergency lending should happen through open market operations only.

A few contributions have arisen lately in order to justify the bailing out of individ-

[25] See Goodhart & Illing (2002) for a comprehensive reader on LOLR literature.

[26] See e.g. Freixas & al. (2000b) for discussion.

ual banks even if the difference between illiquid and insolvent banks is hard to detect. In Flannery (1996), the need for emergency lending to individual institutions arises in times of crisis, as banks become less willing to give credit in the interbank market. Somewhat differently, Freixas & al. (2000a) construct a model with interbank payment flows due to spatial consumption uncertainty. In case of liquidation of an insolvent bank, the central bank intervention in individual banks dependent on the insolvent banks is socially justified. Cordella & Yeyati (2003) show that a commitment to an individual bailout may have a value effect that increases the bank incentives to improve loan quality. In Freixas & al. (2004), emergency lending for individual banks is justified in crisis periods and in markets where market discipline is high. In these cases, screening of potential borrowers is the main source of moral hazard, and emergency lending decreases increases for gambling. Finally, Gorton & Huang (2004) point to the opportunity costs of private agents having large amounts of liquidity at hand. Because private liquidity is costly, bank bail-outs may be socially optimal.

Constructive ambiguity has been proposed as a mechanism for decreasing banks' risk taking in presence of LOLR policy. This term refers to randomising the rescue of banks unconditionally and so reducing the expectations of a bail-out[27]. In a setting with nonseparable liquidity and solvency risk, Freixas (2000) considers the optimal LOLR policy. This comprises announcing a limit for the uninsured debt of banks, above which the bank will never be rescued, and exercising constructive ambiguity for the rest of the banks. In contrast, neither Cordella & Yeyati (2003) nor Freixas & al. (2004) find any justification for constructive ambiguity; instead, commitment to a rule always dominates in terms of welfare.

Finally, Giammarino & al. (1993) offer an interesting insight into regulatory forbearance by explaining the phenomenon as part of the optimal regulatory policy. In their model, the regulator weights off the effects of adverse selection, moral hazard, and costly regulatory intervention. The optimal policy then implies a higher level of bank risk in the society than could be possible to achieve. In the following section, we see how forbearance mostly originates from the incentives of the regulator in theoretic models, and is therefore not socially optimal.

[27] See e.g. Goodfriend & Lacker (1999) and Freixas (2000). Note that this kind of randomisation may include liquidation of solvent but illiquid banks for incentive reasons. Situations where the ability of the LOLR to commit to such a policy as well as alternative definitions of constructive ambiguity is questioned are considered in the following Section.

Regulatory Incentives

In the previous section, optimal safety net design was investigated, given that the regulator was able to produce the socially optimal regulatory outcome. However, societies seem to suffer large losses in case of bank failures. In addition, governments often inject money into troubled financial institutions, and there is evidence that not every governmental restructuration effort has been effective after a bank crisis.[28] Finally, banking regulation is often delegated to some institution, whose interests may differ from those of the social planner.

In this section, contributions related to regulatory incentive problems are considered. The risk level of the bank portfolio or the true level of assets is typically nonobservable or at least nonverifiable information, and so they cannot be contracted upon. Even the definition of bank capital is not entirely free from regulatory discretion. The incomplete contracts paradigm shows that, even in absence of informational asymmetries, regulatory problems may arise due to nonverifiability. In the following, two situations are distinguished. First, the regulator is often a separate body from the social planner and may therefore have biased incentives. Second, there may be some closure costs for the society, such that the regulator's incentives may be altered ex post and optimal regulatory policy may be time inconsistent. As this is anticipated by the rational agents, an enforcement problem arises as to the optimal bailout policy.

The possibility of the regulators acting according to their own interest has raised the question of socially optimal division of tasks between the regulatory agencies[29]. In an incomplete contracts setting, Repullo (2000) compares the performance of the central bank and the deposit insurance corporation as a LOLR with the social optimum, given their task-related, biased incentives. He shows that the central bank is closer to the social optimum when liquidity shocks are small, whereas the deposit insurance corporation is more optimal when these shocks are large enough. This is because, due to the objective functions of the two agents, the central bank is too soft for small shocks and too strict for large ones, whereas the deposit insurance corporation is always too strict. In contrast, Boot & Thakor (1993) model a situation where there is uncertainty about the regulator's detection ability. The regulator, worried about his reputation,

[28] See Caprio & Klingebiel (1996). Kane (1990) describes the Savings & Loans crisis in the United States, and the costs related to the length of the insolvency period before closure. Vihriälä (1997) provides information as to the costs of bank support during the Finnish bank crisis.

[29] We concentrate here on the agency problem and do not consider here the question whether financial supervisory information is helpful in conducting monetary policy. For this issue, see e.g. Di Noia & Di Giorgio (1999), Goodhart & Schoenmaker (1995), and Peek & al. (1999).

closes the bank less eagerly than would be socially optimal, because a closure decision will make the public revise downwards its beliefs on the monitoring ability of the regulator. As this results from the regulator manipulating the closure decision in order to influence its reputation as a monitorer, separation of monitoring and closure tasks would eliminate the distortion.

The second strand of literature considers the renegotiation problem of bank closure by a welfare-maximising regulator, when bank closure is costly. Examples of such costs include the opportunity cost of foregone financial intermediation, as in Mailath & Mester (1994) and in Gorton & Winton (1998, 2000), or a systemic cost in form of chain reaction in the payment system, as in Freixas & al. (2000a) and in Allen & Gale (2000b). Once a bank has not complied with the rules, the regulator's incentives may differ from the ex ante ones, if the net costs of the bailout remain below the closure costs.

The existence of closure costs and the inability of the regulator to commit to act against its ex post interests lead to time inconsistency of the regulatory closure policy in the sense of Kydland & Prescott (1977): Ex ante, it is optimal for the welfare-maximising regulator to announce the socially optimal closure rule. Ex post, however, the regulator will face closure costs, which it weights against the costs of letting the bank operate under the current bank risk. As the bank rationally anticipates this, it chooses a higher than socially optimal risk level.

A well-known formalisation of the time inconsistency problem of the optimal closure policy is Mailath & Mester (1994), where expected costs of failure of an imprudent bank are compared to the immediate costs of closure and to the opportunity cost of a shrinking financial sector. Elsewhere, Gorton & Winton (1995, 1998) show how the time inconsistency problem in the presence of the opportunity cost of lost financial intermediation leads to no regulatory restriction being binding for a bank if there are no other closure costs involved[30]. Also Dewatripont & Tirole (1994) distinguish between the shareholder and depositor incentives and show that achieving social optimum necessitates the regulator to represent the depositors instead of the total welfare. In their paper, the incentives of the social planner thus have to be distorted towards one interest group in order to counteract the time inconsistency problem.

In terms of LOLR policy, the time inconsistent regulatory policy manifests itself as the tendency of unconditional bail-outs of banks that are too big to fail. In other

[30] The value of the bank in trouble is typically undetermined as there is still a chance that the risky investment will pay out; the closure costs, on the contrary, may be determined.

words, there is a threshold, above which a bank is so important for the system that it is optimal for the lender of last resort to ex post always exercise bailout. This is of course reflected in the bank's strategy. In an interbank market model, Rochet & Tirole (1996) show how optimal incentives for banks imply a rule where the lender of a bank in distress has to be closed before it becomes insolvent. This policy is, however, time inconsistent, and so there is too little monitoring in the interbank market. Too big to fail then emerges as a policy where the borrower bank will be rescued instead of the solvent but illiquid lender banks. In Freixas & al. (2000a) payment system model, liquidity provision to the counterparties is not feasible under certain conditions, which results in predestined bail-outs of money-centre banks.

In the previous section, a notion of constructive ambiguity was presented. As the concept has originated from practitioners, theorists have tried to find a suitable definition for it[31]. Consequently, some solution concepts proposed for correcting the too big to fail problem have fallen under constructive ambiguity in the literature. One definition, as proposed in BIS (1997) and in Enoch & al. (1997), is regulatory discretion as to the conditions of emergency lending, in order to increase the uncertainty of a bank bail-out. Nevertheless, as Freixas & al. (2000b) point out, discretion of this type again gives rise to a time inconsistency problem, where intervention ex post may be the incentive compatible action, even though ex ante it would be better to deny the existence of the safety net. Yet another approach has been to define constructive ambiguity as a result of the social trade-off in terms of balancing between systemic implications of a bank failure and moral hazard, as in Bini Smaghi (2000) and Goodhart & Huang (1999, 2005). Goodhart & Huang (2005) postulate that the central bank trades off a stochastic loss of shrinking deposits due to bank failures against the bank moral hazard. The optimal bail-out policy, depending on the insolvency and contagion probabilities, and in addition, on bank size in a non-monotonic way, is called constructive ambiguity because of its time variance and because of the elimination of the too big to fail problem. However, the problem of predetermined bailouts remains. The fundamental difference as to the definition of constructive ambiguity in the previous section is that here, the LOLR will never liquidate a bank against its own interests. Hence, if these interests are known to the banks, there will be no ambiguity as to the bail-out policy.

[31] See Freixas & al. (2000b) for a discussion.

1.2.3 Regulation of Multinational Banks

Multinational banking has several consequences on regulation. First, as long as national regulators continue to exist, there is a mismatch as to geographical regulatory jurisdictions and the areas of operation of the banks. This gives rise to externalities, but may also alter the ease of information acquisition. Second, the coexistence of multiple regulators may lead to regulatory competition and common agency. The multiplicity of regulators enlarges the strategy space of the social planner and options may become available that bring the regulatory equilibrium closer to the social optimum. In the following, each of these aspects will be studied more in detail.

The optimal regulation of multinational banks presupposes taking into account their different liability structure, on the one hand, and the diversification effect of holding assets in several markets, on the other. As to the liability structure, an international bank can normally choose between a branch or a subsidiary structure. Whereas the former is an elementary part of the parent bank with pooled assets, the latter is a separate asset that can be liquidated without involvement of parent assets. Under limited liability, the subsidiary thus bears similarities with a call option. Kahn & Winton (2004) consider the welfare effects of a symmetric subsidiary structure, where each subsidiary is liable up to its own assets only. They find out that allowing firms to choose subsidiary structure reduces incentives to risk shifting in the safer subsidiary and can improve welfare, as limited risk shifting within the riskier subsidiary is often less costly than risk shifting within a pooled structure. A related result is obtained by Harr & Ronde (2006) in the banking context, where branch structure banks turn out to be less prudent than subsidiary structure banks. In a multinational setting, Loranth & Morrison (2003) compare the liability structures and diversification effects of the two ownership forms and find out that minimum capital requirements lead to underinvestment of multinational banks due to a combination of risk diversification and capital increase effect on the value of deposit insurance. As a consequence, the optimal minimum capital requirements are the lowest for the branch bank and the highest for a domestic bank. In contrast, the optimal minimum capital requirements in Harr & Ronde (2006) are time variant for the branch structure banks. If the bank's risk level is private information, the banks can be induced to self-selection in structure by imposing a lower minimum capital requirement for the branch structure bank.

In the above mentioned papers, regulators were assumed to be able to commit to the optimal regulatory policy. This assumption may be unrealistic in the multinational

context in particular, as there are many national regulators involved, with possible systemic effects of their actions outside their jurisdiction. In addition, the time inconsistency problem presented in the domestic case equally applies in the international context. In Repullo (2001), the deposit insurance externality causes the regulator to be more lenient towards a multinational branch bank than towards a domestic one. The regulatory effect will be likely to increase the incentives for takeovers, especially if the target bank is small in its market, if the difference in risk in the two countries is large, and if the deposit insurance payment is diminished by the inclusion in the home country deposit insurance system. In a similar vein, Calzolari & Loranth (2005) consider regulatory incentives in a multinational banks setting when there is imperfect information as to the bank's investment project and regional externalities according to the home country control principle. Due to differences in regional externalities and assets available for diminishing deposit insurance payments, incentives for regulatory intervention by the home country regulator and for regulatory monitoring are generally higher for branch structure banks than for subsidiary structure banks.

Although regulation of one entity is always appointed to a single regulator according to the home country control principle, more than one regulators participate in the regulatory process of a multinational bank in form of supervisory information exchange and regulatory rules setting. This can lead to competitive behaviour that reduces regulatory standards, as in Holthausen & Ronde (2004), Dell'Ariccia & Marquez (2003), Acharya (2003), and Dalen & Olsen (2003). Holthausen & Ronde (2004) show that if national regulators pursue their own interests, regulatory cooperation in form of information exchange prevails only to the extent that the interests of the regulators are aligned. This creates incentives for multinational banks to strategically allocate investments across countries in order to avoid closure. Dell'Ariccia & Marquez (2003) consider banking systems with differing tastes for regulation and show that regulatory race to the bottom emerges. Moreover, if regulators are welfare-maximising in their jurisdictions, an additional effect appears in form of promoting the shareholders in the country via competitive advantage in form of laxer regulation. As in Holthausen & Ronde (2004), cooperation necessitates sufficiently aligned interests. Acharya (2003) shows that the harmonisation of capital adequacy regulation leads to the implementation of the worst closure policy among the countries, unless bank closure is centralised. Finally, Dalen & Olsen (2003) show that despite regulatory race to the bottom in capital adequacy requirements, the probability of bank failure remains insensitive, as national regulators compensate by increasing incentives to improve asset quality.

Finally, as to LOLR activity within Europe, the Treaty on the EU does not assign

an unambiguous responsibility to one regulator but preserves a veto right for the ECB. The common agency paradigm, developed by Bernheim & Whinston (1986), considers the coexistence of principals. In a setting where the agent's action is nonobservable, non-cooperation of principals becomes detrimental precisely in cases where welfare losses due to information asymmetries arise under perfect cooperation. In particular, separate agendas have no welfare advantage of any kind as to cooperation. In contrast, if there is risk of collusion between the agent and the principal, common agency can improve welfare, as in Laffont & Martimort (1999). For the European financial market context, we are particularly interested in common agency models with overlapping tasks. Martimort (1999) shows that if there is asymmetric information between the regulators, separation of regulatory power can be optimal, as it improves commitment by making renegotiation harder. Finally, Tirole (1994) demonstrates that, under observable but nonverifiable information, the time inconsistency problem of the government can be solved by separation of regulators that have biased objectives and by allocating the regulatory power in a state-contingent way, based on some contractible variable.

1.2.4 Summary

Three aspects arise from the theoretical considerations presented above. First, for equality and efficiency considerations, it seems to make sense to incorporate a safety net into the regulatory framework. However, the strategic effect on bank behaviour must not be ignored, implying that some control mechanism for bank risk has to be introduced. Second, an agency problem between the regulator and the social planner may emerge, or the optimal policy may be time inconsistent. Third, as regulation of international banks is linked with the separation of regulatory jurisdictions and regulatory impacts, significant externalities may arise. This further highlights the importance of the consideration of regulatory incentives.

1.3 Implications and Outlook

Based on the current organisation of banking regulation and on the market structure, three main questions emerge in the context of European banking regulation:

1. Who should regulate? Is the current practise of home country control principle optimal, or should we move towards integrated regulation in Europe? Given the existing and well-documented externalities inherent in the combination of in multinational banking and national regulation, centralising regulation within the EU seems to possess natural allure.

2. How explicit should the division of responsibilities be? In particular, is the ambiguity as to the LOLR responsibilities in case of a pan-European bank failure of constructive nature? If banking regulation is to remain at a national level, how explicit rules should be designed as to information exchange and coordinated action?

3. Does market structure matter? In particular, what implications and origins may the strong division of the EU-15 as mainly home countries and the CEE countries as hosts have?

The modelling approach taken in the subsequent chapters seeks to elaborate on these questions. Chapter 2 compares the home country control principle with a common regulator setting and studies the regulatory effect on bank risk taking and on the structure of ownership of multinational banks. It turns out that the characteristics of the host market can have important implications on the optimality of the regulatory system. It is shown that if regulators are welfare maximising, the host country regulator is less lenient for the foreign subsidiaries than the common regulator, and additionally, promotes the efficient branch structure better. As a conclusion, if some banks are represented via subsidiaries, and if the foreign units are small, home country control principle performs better in terms of welfare than a common regulator.

Chapter 3 asks whether the time inconsistency problem of the optimal emergency lending policy can be compensated for by appointing an additional, supranational LOLR. Two scenarios are considered: First, the supranational regulator has the right to veto the liquidation decision of the national regulator. The second scenario is more theoretical and asks, given that a mechanism exists where the two regulators are able to alter the expectations of the banks on bail-out conditions, whether such a mechanism can improve welfare. It turns out that both kind of ambiguities are seldom welfare improving and, in particular, compensate badly for the elimination of the time

inconsistency problem. The optimal policy in most cases is shown to be to appoint the responsibilities to the stricter regulator according to a size and ownership contingent rule.

Finally, Chapter 4 studies the conditions and the effects of international takeovers when bank capital is costly due to restrictions in the supply side and when banks care for their continuation, or charter, values. It turns out that internationalisation increases bank capital in the market in total. Moreover, with large enough a difference in the price of capital, a multinational bank imports stability into the host country. Finally, minimum capital requirements, if they are binding, direct foreign investment towards less developed markets. The increased incentives for takeovers in case of minimum capital requirements in the home country, and the greater concentration of internationalisation in case of host country regulation, do not necessarily conflict with the stability objective of regulation. On the contrary, the stability effect of internationalisation is strengthened in the least developed financial markets, which may be the place where such an effect is the most desired.

All the three models are dynamic games with strategic interaction between the regulators and the banks. The bank finances either part or all of its investments with insured debt and thus faces a limited liability. In addition, in Chapters 2 and 3, the bank acts as a delegated monitorer. Under nonverifiable monitoring effort, it follows that the bank incentives are suboptimal such that the firm moral hazard will be passed on in form of a socially insufficient level of monitoring. These factors give rise to the need of regulation in the models.

The society responds to the need of regulation by appointing an agency that has the power to close the bank, or as in Chapter 3, additionally to provide emergency financing. Chapters 2 and 3 concentrate on the regulatory time inconsistency problem and look at the effect of regional externalities on regulatory incentives. Chapter 4 abstracts from the regulatory forbearance and asks instead how multinational banking and the amount of bank capital are linked with each other, and how minimum capital requirements affect the banks' incentives to internationalise.

The main result states that the optimality of a common European regulator requires a more homogenous market than the European market is at the moment. The multiplicity of regulators enlarges the regulatory strategy space of the social planner in a beneficial way, as it is possible to reduce the problem of regulatory forbearance with an optimal division of responsibilities and clear mandates. All forms of informal cooperation, in contrast, are likely to worsen the regulatory outcome from the national

one. Finally, the extreme concentration of foreign direct investment in Europe may be a symptom of the prevailing heterogeneity in terms of financial market development, and regulation may have enforced the effect further. However, this phenomenon is stability improving. In sum, the heterogeneity of the European markets and the multiplicity of national regulators may not be anything to worry about, as long as more attention is paid to the avoidance of unclear mandates, and as long as the single market in terms of the level of financial market development has not truly emerged.

Chapter 2

Incomplete Contracts, Multinational Bank Closure, and the Choice of Ownership Structure

2.1 Introduction

This paper studies the impact of the regulatory arrangement on the regulatory incentives, on the risk level of the bank assets, and on the form of ownership of an international bank, when the bank in question can control the risk level through monitoring and choose between branch and subsidiary form.

Bankruptcy legislation defines a branch as part of the parent bank, its assets being pooled with those of the parent, whereas a subsidiary is an independent asset of the parent bank. As a consequence, in case of financial distress, a branch has to be bailed out by the parent; a subsidiary, however, can fail independently. Banking regulation in the EU reflects this through the principle of home country control, which attributes the consolidated regulation of the entire multinational branch structure bank to the country where the bank has been licensed in the first place, i.e. to the home country. Subsidiaries, on the contrary, belong to the responsibility of the country where they operate, the host country.

The model wants to capture some characteristics of banking that are typical for the new enlarged EU. In almost all of the CEE countries, foreign ownership accounts for more than half of the banking sector, subsidiaries being the dominant structure in most countries. In addition, credit risk is often substantial. Moreover, as the banking

sectors in the CEE countries are small in comparison to those of the EU-15, branches and subsidiaries in those countries often account for a very small part of the assets of the parent bank.

Existing policy literature on the organisation of banking regulation in Europe often advocates for unified regulation in the EMU level, either within the ECB or as an independent authority[1]. In particular, Danthine & al. (1999) argue that a common regulator diminishes excessive interventionism of the national regulators that fail to internalise the effects outside of their jurisdictions. However, if the common regulator maximises social welfare, a time inconsistency problem may emerge, as closing the bank becomes ex post less attractive than what it was ex ante. In this case, the home country control principle may introduce a positive externality in the form of the neglect of expected returns and systemic costs that occur outside the jurisdiction of the regulator in charge.

The aim of the model is to concentrate on the liability structure of multinational banks and not on internationalisation or diversification motives per se. As a consequence, we do not consider domestic banks. We model a situation where, under the limited liability due to deposit insurance, an unregulated bank would monitor its investments less than what would be socially optimal. At the same time, the welfare-maximising regulators are not able to commit to the socially optimal closure rule: Although it is ex ante optimal for the regulator to close a bank whose monitoring level lies below the social optimum, ex post, social welfare is higher for a range of lower monitoring values if the bank remains open than if it is closed. As a consequence, the regulatory announcement of the ex ante socially optimal closure policy is not credible. The bank will take this into account and, knowing that the regulator will allow the bank to continue, will choose a monitoring level as close as possible to its unconstrained optimum.

We consider both a scenario where the multinational bank is regulated by a common regulator and where the home country control principle is applied. In the latter situation, there are two counteracting externalities at work. First, the home country regulator does not take into account the systemic costs caused by closure or failure of an international branch in the host country. Second, the host country regulator does not internalise the amount of profits going to the foreign owners of the subsidiary. As to the bank, the monitoring decision is guided by a trade-off between the expected return

[1]For discussion, see e.g. Aglietta (1999), Danthine & al. (1999), DiNoia & DiGiorgio (1999), Padoa-Schioppa (1999), Eichengreen & Ghironi (2002), Huizinga (2002), and Schüler (2003).

and the costs of monitoring. In choosing between branch and subsidiary structure, the bank weighs the more efficient monitoring technology in the former case against the higher value of the deposit insurance in the latter one.

In a setting where the ownership structure is fixed, it turns out that neither the common nor the home country regulator restricts the branch structure bank in its monitoring choice, if the size of the foreign entity is small. Nevertheless, the smallness of the branch together with the liability structure implies that the bank internalises all its effects, and therefore, chooses the socially optimal monitoring level. This would not happen in the case of an unconstrained subsidiary bank; in addition, the common regulator now lets the bank operate within a range of monitoring levels below the social optimum. However, the home country control principle is helpful in overcoming the time inconsistency problem to some extent: as the host country regulator does not take all the returns of the international bank into account at the time of decision making, its closure threat is more restrictive for the bank than that of the common regulator.

Endogenising the choice of ownership structure further emphasises the advantages of the home country control principle. In particular, if the size of the foreign entity is small, the home country control principle is more successful in inducing inefficient subsidiary structure banks to choose the branch form than the common regulator. As the branch structure here is the more efficient and, additionally, turns out to be the more stable form of banking for the case of small host markets, stability and efficiency are complements in our framework.

Like in Diamond (1984) and in Besanko & Kanatas (1993), the bank is modelled here as a delegated monitorer of a firm investing in risky projects. If this monitorer faces a limited liability due to deposit insurance, monitoring incentives are decreased, as pointed out by Besanko & Kanatas (1993) and Holmström & Tirole (1997), among others. Delegating the monitoring of banks further to a regulator and threatening them with closure can then help in achieving the first best. But in presence of nonverifiable information and costs related to bank closure, it gives rise to the time inconsistency problem as to the socially optimal closure policy. In this strand of literature, Mailath & Mester (1994) conclude that the closure constraint is rarely binding for the bank: a bank in operation has a value per se for the regulator, who cannot commit itself to the closure in case the bank does not choose the socially optimal risk level. Gorton & Winton (1998) reproduce this result in a transition economy case with capital adequacy ratios. However, they do not consider foreign ownership in their work. Indeed, the present paper argues that foreign ownership changes regulatory trade-offs in a significant way.

In the theoretical literature on multinational banking regulation, recent contributions from Holthausen & Ronde (2004) and from Dell'Ariccia & Marquez (2003) study regulatory competition and find out that heterogeneity of the regulated markets decreases welfare in cooperative settings. The former result builds on a signalling game between regulators, where the international banks profit from the interest conflict in form of lower closure probability. The latter analyse incentives for regulatory cooperation and show that heterogeneity increases the costs of flexibility loss. The present paper is closer to Loranth & Morrison (2003), who distinguish between branch and subsidiary structures in a capital regulation and deposit insurance setting. Whereas they investigate the relation between capital requirements and under-investment of a multinational bank, we concentrate on the effect of the two regulatory arrangements on the time inconsistency problem of the regulator and on welfare in an international setting. Calzolari & Loranth (2005) study regulatory incentives to intervene and monitor the bank and their impact on the ownership structure choice with asymmetric information on the risk level of the bank's investment. The central trade-off is between more available assets for financing the deposit insurance in the branch case and the more limited responsibility to provide deposit insurance in the subsidiary case. However, they do not take a stand in terms of welfare, nor has the regulator any effect on the risk level of the investment. Finally, Dalen & Olsen (2003) investigate the effect of regulatory arrangements and of ownership structure on stability and on efficiency in a symmetric common agency setting. If regulators extract rents in form of insurance premium, the probability of bank failure is insensitive to the decentralised nature of bank regulation due to counteracting effects on capital requirements and investment quality. In case of time inconsistency, as the regulator is no more capable of enforcing compensation rules, this insensitiveness no longer applies. The fundamental difference as to my approach is that, in Dalen & Olsen (2003), a common regulator with branch structure banks create the highest aggregate efficiency. On the contrary, due to the time inconsistency problem, the home country control regime is the most efficient form of regulation in the present paper: it not only induces the socially preferred branch form for a larger parameter set, but also works more efficiently in regulating the subsidiaries than the common regulator.

The chapter is organised as follows: The first section presents the basic model, and the utility functions of the bank and of the regulators are explained. The choice of monitoring level with exogenous ownership structure is solved in Section 2.3, and in Section 2.4, the ownership structure choice is endogenised. Section 2.5 summarises the main implications for banking regulation in the EU, and finally, Section 2.6 concludes.

2.2 The Basic Model

In this section, the basic assumptions concerning the model structure are first explained. Before continuing with the solving of the model, the utility functions of the bank and of the regulators are equally studied in detail.

2.2.1 Economy Structure

The economy consists of two countries with a monopolistic multinational bank that has a parent bank in the home country and either a branch or a subsidiary in the host country. We assume that the foreign entity is smaller than the parent bank and scale the operations in the host country with λ , $0 < \lambda < 1$.The parent bank maximises the expected profit of the entire bank. The bank receives $1 + \lambda$ as deposits, and invests them into projects in respective countries. In order to keep things simple and not to introduce the possibility of failure at home, we assume that the bank receives a riskless income Y at home, with $1 < Y < 2$. In the host country, however, the bank invests its deposits λ in a risky project, the probability of success of which depends on the effort devoted to monitoring by the bank. More precisely, the return in the host country will be

$$R = \begin{cases} H & with \quad probability \quad p \\ 0 & with \quad probability \quad (1-p), \end{cases} \tag{2.1}$$

where the bank directly chooses the probability p and $1 < H < 2$.[2] Increasing the probability of success through monitoring is costly and has a cost function $C(p) = \frac{p^2}{2\beta}$, where $\beta > 0$.

The deposit insurance premium paid by the bank is assumed to be a flat rate and is normalised to zero, as well as the interest rate paid on the deposits.

The difference between the branch and subsidiary structures arises here from two

[2]This form of simplification is chosen because we are interested in the choice of ownership form and not in the risk diversification motive of internationalisation in general, like Loranth & Morrison (2003). In comparison to the branch structure, the advantage of the subsidiary structure is its option nature, as the parent bank is not liable for losses of the subsidiary. In Section 2.A in the Appendix it will be shown that allowing for risk diversification weakens this insurance somewhat but does not have qualitative effects on the results concerning the host country. In the real life, subsidiary form is popular in particular in the CEE countries, which, taking the high credit risk there into account, may indeed reflect the importance of the option motive.

factors. First, the assets of the branch bank are pooled, whereas the subsidiary has a separate treatment in bankruptcy. As a consequence, the value of deposit insurance is higher for the subsidiary structure bank than for the branch structure bank. Second, I assume that the branch bank is more efficient in monitoring its assets[3]. This manifests itself in the model through smaller monitoring costs for the branch structure bank: $\beta_B > \beta_S$, where the index "B" indicates the cost function parameter of the branch form and "S" that of the subsidiary form.

The bank is regulated either by a common regulator or by two regulators that divide the responsibilities according to the home country principle. A regulator maximises the expected welfare of its own jurisdiction through deciding whether to close the bank or to let it continue, based on the probability of success of the risky project in the host country. In doing so, it compares the following two outcomes:

- If the bank is let to continue, with probability p the regulator does not have to intervene. With probability $(1-p)$, however, the risky investment yields zero return. In this case, the regulator has to pay the deposit insurance and the systemic cost S.

- If the regulator decides to close the bank, the bank can be liquidated at a value $L < 1$. The deposits beyond the liquidation value will again be paid by the regulator, as well as the systemic cost γS which is assumed to be smaller than in the case of later bankruptcy. In addition, $0 < \gamma < 1 - L$.[4]

In the equilibrium with rational expectations, the regulator knows the chosen monitoring level; however, it is not verifiable to a third party. As a consequence, the regulator cannot commit itself to any closure policy through a contract but acts according to its own interests.

Finally, we assume that it is first-best efficient to have financial markets in operation. Without this assumption, there would be no game.

[3]One rationale for this goes along the ownership structure literature following Grossman & Hart (1986) and Hart & Moore (1990). Unlike branch, a subsidiary can be either wholly or partially owned by the parent. This looser ownership form may lead to less control on residual rights and less incentives to use the assets efficiently. In a similar vein, literature on spill-overs in foreign direct investment points out that a less complete foreign ownership may lead to larger technological spill-overs and thus decreased incentives for the foreign firm to transfer technology into the foreign unit (see Blomström & Kokko 1998 for a survey). Finally, some anecdotal evidence supports our view. For example, Nordea (2003), a Swedish bank operating in the Baltic countries, justifies its recent restructuring from a subsidiary to a branch structure bank with efficiency gains.

Note that subsidiary ownership is assumed to be 100 percent foreign in the present model. As letting the share vary does not change the results qualitatively, it is left out for simplicity.

[4]The connection between the liquidity value and the share of systemic cost in case of closure guarantees that an increase in the systemic cost S always increases regulatory incentives to close the bank.

2.2.2 The Utility Functions of the Bank and of the Regulators

Before going into solving the model, we briefly consider the utility functions of the bank and of the regulators.

In case of an international bank with a branch structure and with full deposit insurance, the parent bank maximises the following expected profit:

$$E\left(\Pi_B^*\right) = p\left(W + \lambda H\right) - \lambda C_B\left(p\right) + \left(1 - p\right)\left\{\max W, 0\right\}, \tag{2.2}$$

where $W \equiv Y - 1 - \lambda$[5]. The parameter W is introduced in order to better be able to distinguish between two cases, depending on whether the bank is able to pay back the deposits both in the home and in the host country with the riskless returns from the home country investment or not. If the branch bank can finance its deposits even in the case of failure in the host country (i.e. $W \geq 0$), the bank will never go bankrupt. If, however, the home country return is too small to cover the deposits in the two countries ($W < 0$), there is a positive probability that the whole branch structure bank will fail. In the latter case, the bank is entitled to deposit insurance and its liability is limited so that the maximum loss it can suffer is its investment in monitoring in the host country.

In case of an international bank with a subsidiary structure and full deposit insurance, the expected profit for the bank becomes

$$E\left(\Pi_S^*\right) = Y - 1 + \lambda\left[p\left(H - 1\right) - C_S\left(p\right)\right]. \tag{2.3}$$

Note that the bank can now always retain the safe earnings in the home country and hence never risks a total bankruptcy nor has a duty to pay the deposits in the host country from its earnings in the home country. The liability of the subsidiary structure bank is thus more limited than that of the branch structure bank.

Turning to the regulator, he maximises welfare within his jurisdiction. In the common regulator case, this means maximising the joint welfare of the two economies. In the home country control case, the home country regulator is responsible for the entire

[5] We assume here that the effort cost must not be covered through the income, i.e. the bank can make a loss as big as the effort cost. This helps us in showing in the Appendix that the bank's desired choice of monitoring is lower than the social optimum equally in the branch case when W<0. Note that by definition, -1 < W < 1. Note in addition that the limit on liability also depends on efficiency. In general, the liability of the branch structure bank is always larger than that of the subsidiary structure bank.

branch structure bank, whereas the host country regulator controls the subsidiary in its country.

Table 2.1 shows the payoffs of the welfare-maximising common regulator. The regulator determines the lowest monitoring level for which it leaves the bank open, given the trade-off between the probability and the costs of failure, on the one hand, and closure costs, on the other. The former costs vary not only depending on whether the whole bank or just the subsidiary will be closed, but also with the probability of failure that differs according to the organisational structure. Note in particular that in the branch case with $W \geq 0$ the risk of failure is zero, whereas closure is costly.

Table 2.1: Payoffs of the welfare-maximising common regulator

	Branch $W \geq 0$	Branch $W < 0$	Subsidiary
CR, open	$W+\lambda(pH-C(p))$	$W+\lambda(pH-C(p))-(1-p)(1+\lambda)S$	$W+\lambda(pH-C(p))-(1-p)\lambda S$
CR, close	$(1+\lambda)(L-1-\gamma S)-\lambda C(p)$	$(1+\lambda)(L-1-\gamma S)-\lambda C(p)$	$\lambda(L-1-\gamma S)+Y-1-\lambda C(p)$

If the home country principle applies, the entire branch bank is regulated by the home country regulator, whereas the subsidiary falls to the responsibility of the host country regulator. In addition to the bankruptcy code, the threshold monitoring level is now influenced by the identity of the regulator, since he is interested in the returns and the systemic cost only within his jurisdiction and in the deposit insurance payment he is responsible for. This leads to the emergence of two externalities: First, in the branch case, the regulator, although responsible for the entire bank, is not interested in the systemic cost in the host country. Second, the subsidiary regulator does not care for the profits of the bank, since they accrue to host country shareholders. In so doing, the welfare-maximising host country regulator acts in fact like the cost minimising regulator in Mailath & Mester (1994). The payoffs in case of the home country control principle are listed in Table 2.2.

We now turn to solving the model. As the primary interest lies in the CEE countries, we focus here on the situation where $W \geq 0$[6]. The case with $W < 0$ is studied in Section 2.B in the Appendix. In the following, we first consider a scenario where the ownership structure of the bank is exogenously given. The focus will be on the social trade-off of

[6]In the CEE countries in particular, economies are small as compared to those of the home countries of the international banks in the area. The assets of foreign branches and subsidiaries, despite of them often being local market leaders, hardly never exceed five per cent of the assets of their parent banks.

Table 2.2: Payoffs of the welfare-maximising regulator, Home Country Control

	Branch $W \geq 0$ (Home country regulator)	Branch $W < 0$ (Home country regulator)	Subsidiary (Host country regulator)
HCC, open	$W+\lambda(pH-C(p))$	$W+\lambda(pH-C(p))-(1-p)S$	$-\lambda(1-p)(1+S)$
HCC, close	$(1+\lambda)(L-1)-\gamma S-\lambda C(p)$	$(1+\lambda)(L-1)-\gamma S-\lambda C(p)$	$\lambda(L-1-\gamma S)$

time inconsistency with the common regulator against regulatory externalities in the case of home country control principle. The effect of regulatory arrangements on the choice of ownership structure will then be studied in Section 2.4.

2.3 Monitoring with Exogenous Ownership Structure

In this section, we consider a situation with fixed ownership structure and study the effect of regulation on bank behaviour. This is a multi-stage game with perfect information that will be solved through backward induction. The timing of the game is as follows: The bank first decides the monitoring level p at cost $C(p)$. The regulator then makes its closure decision. Finally, profits and losses materialise.

Before solving the game, we briefly consider the first best solution as well as the maximisation problem of an unrestricted bank and show that the absence of the regulatory threat results in too little monitoring from the social welfare point of view. We then proceed with the multi-stage game by bringing the regulator into the model and by assuming that it is impossible for him to commit to a closure policy other than what is ex post optimal for his jurisdiction. We find out that, due to the time inconsistency problem, the common regulator indeed does not produce the first-best closure policy if a bank failure gives rise to a systemic cost and if there is deposit insurance in place. The introduction of national regulators and imposition of the home country control principle shows that delegating the control over the subsidiary to the host country regulator can improve social welfare.

2.3.1 First Best Solution

The first best solution results from maximising the expected utility for the two regions, which consists of the expected income of the bank less the expected social costs of failure. In case of a branch structure bank with $W \geq 0$, the maximisation problem will be

$$\underset{p}{Max} \quad W + \lambda \left[pH - C_B \left(p \right) \right]. \tag{2.4}$$

Note that if the branch is small enough, the returns generated in the home market are sufficient to cover the payments to the depositors even in the case when the risky host country investment does not pay off. As a consequence, the bank cannot fail and thus there are no systemic costs occurring at any probability. The resulting equilibrium first best monitoring level will be

$$p^{FB}_{W \geq 0} = \beta_B H. \tag{2.5}$$

In case of subsidiary structure, it is possible to close the subsidiary without closing the parent bank. However, the closure decision is associated with a systemic cost in the host country. The social welfare maximisation problem will be of the form

$$\underset{p}{Max} \quad W + \lambda \left[pH - (1-p) S - C_S \left(p \right) \right]. \tag{2.6}$$

The welfare-maximising monitoring level is in this case

$$p^{FB}_S = \beta_S \left(H + S \right). \tag{2.7}$$

Compared to the branch case, there are two effects in action. First, the lower efficiency is reflected by lower beta in the subsidiary case. Second, the positive risk of bankruptcy of the subsidiary increases the first best monitoring level. The interaction of these two terms determines which first best monitoring level is higher.

We restrict ourselves to cases where an interior solution exists, i.e. we assume that the chosen monitoring level is always smaller than one at least in the cases of branch structure with $W > 0$ and in the subsidiary case[7]. Intuitively, monitoring technology

[7]Formally, this translates into assuming that $\beta_S < \frac{1}{H+S}$ and $\beta_B < \frac{1}{H}$.

is not so good that it would be first best efficient to monitor fully, in particular when the threat of failure and systemic cost is absent in the branch case.

2.3.2 Desired Strategies of the Bank

Before going into the game with the bank and the regulator, we briefly consider the desired asset choices of the subsidiary and branch structure banks.

In the absence of closure threat, the branch bank with $W \geq 0$ would choose a monitoring level of

$$p^*_{B|W\geq 0} = \beta_B H. \tag{2.8}$$

Note that in our framework, the branch structure bank will choose the socially optimal monitoring level as long as $W \geq 0$. As there is no danger of default, the bank internalises all the effects that it has on the economy, and its profit function coincides with the social welfare function.

In case of a subsidiary structure bank, optimising without regulatory threat leads to

$$p^*_S = \beta_S (H - 1). \tag{2.9}$$

The chosen monitoring effort is now lower than in the branch case for two reasons: First, due to technology, monitoring is more expensive than with the branch structure. Second, due to separated assets, the liability of the subsidiary structure bank is more limited than that of the branch structure bank. In case of bankruptcy, the bank not only fails to internalise the systemic cost it causes to the society, but also gets a transfer in form of deposit insurance. Consequently, the chosen monitoring level is below the social optimum. Lemma 1 reports the standard moral hazard outcome.

Lemma 1 *In the branch case with $W \geq 0$, social welfare will not be affected through the introduction of the bank. In the subsidiary case, the chosen level of monitoring is lower than would be socially optimal and lower than in the branch case with $W \geq 0$.*

Proof. See Section 2.C in the Appendix. ■

The social optimum could thus be achieved through a regulator that closes the

bank if the chosen monitoring level is below the first best level[8]. In the following, we introduce a regulator into the game. We will see that, in the absence of complete contracts, the regulator will not be able to commit itself to the social optimum.

2.3.3 Regulators' Decisions

We now proceed with solving the game by backward induction. In the last stage of the game, the regulator maximises the welfare of its jurisdiction by deciding whether to close the bank, given the chosen monitoring level. This results in a threshold monitoring level below which the bank will be closed. The threshold will depend on the direct costs and on the expected opportunity costs of closure, on the one hand, and on the expected costs of failure, on the other. Efficiency, on the contrary, does not have any influence on this decision, as monitoring costs are sunk for the regulator.

In what follows, the maximisation problem of a common regulator who maximises the welfare of the two countries is first presented. After, the home country control regime is considered.

Common Regulator: In the branch case with $W \geq 0$, the common regulator will leave the bank open as long as the continuation value of the bank is positive, i.e.,

$$W + \lambda pH - (1 + \lambda)(L - 1 - \gamma S) \geq 0. \tag{2.10}$$

We immediately see that this value is always positive and that the branch will always be left open. Intuitively, the risk of failure of a branch structure bank is zero when $W \geq 0$, and therefore, the failure costs never materialise. Closure costs, on the contrary, are positive.

For the subsidiary, the same procedure will end up with a threshold monitoring level. In other words, the subsidiary is left open as long as

$$p \geq p_S^{CR} \equiv \frac{L + (1 - \gamma) S}{H + S}. \tag{2.11}$$

Now there is a positive probability of failure with a cost λS. Note that because the regulator has no access to assets at home for paying the deposit insurance, the closure decision is independent of the size of the subsidiary. Comparison with the first best

[8]Note that we do not need to worry here about the participation constraint of the bank, as it is fulfilled as long as the social welfare of bank activity is positive.

solution shows that the threshold with the common regulator is lower than the first best probability. This reflects the inability of the regulator to commit to the optimal closure rule: given the direct closure costs and the opportunity costs of foregone investment, it is still better ex post to let the bank continue for some lower values of monitoring than the social optimum. As the bank anticipates this, it chooses a monitoring level as close as possible to its unconstrained optimum, given the ex post closure rule of the regulator. We can state the following:

Lemma 2 *The welfare-maximising common regulator never closes the branch bank if* $W \geq 0$. *On the contrary, the common regulator closes the subsidiary if* $p < p_S^{CR}$. *The threshold monitoring level for continuing is lower than the social optimum; hence, the time inconsistency problem exists.*

Proof. See Section 2.C in the Appendix. ■

By assumption, the regulatory threshold is increasing in the systemic cost S. On the contrary, the higher the share γ of systemic cost in case of closure and the higher the return H in the host country, the less inclined is the common regulator to close. Note in particular that a lower liquidity value L reduces the regulatory threshold. This is related to the standard result of gambling for resurrection, saying that the worse the initial condition of the bank, the more it pays off for the bank to bet for an insecure, good outcome[9]. Here, a lower liquidation value increases the incentives of the regulator to bet on the good outcome, as the relation of the sure closure costs to expected costs deteriorates.

Home Country Control: In the branch case, the regulator in charge is that of the home country, whereas in the subsidiary case, the host country regulator is responsible for the closure of the subsidiary. We denote the home country regulator with upper index $R1$ and the host country regulator with $R2$.

In the case of a branch structure bank with $W \geq 0$, the bank will not fail if it is let to operate, whereas closing the bank will still cause a systemic cost and a deposit insurance payment. The home country regulator ignores the systemic cost in the host country, but takes the liquidation values and the deposit insurance into account in both countries. As a consequence, the regulator lets the bank continue if

$$W + \lambda pH - (1 + \lambda)(L - 1) + \gamma S > 0. \tag{2.12}$$

[9]See e.g. Chari & Jagannathan (1988).

As in the common regulator case, the continuation value always remains above zero. In other words, despite the externality of the closure cost in the host country, the home country regulator always leaves the bank open.

In the case of a subsidiary structure bank, regulation of the subsidiary falls to the responsibility of the host country regulator. The host regulator lets the subsidiary continue if

$$p \geq p_S^{R2} \equiv \frac{L + (1-\gamma)\, S}{1+S}. \tag{2.13}$$

Note that this threshold is higher than the one in the common regulator case. This is because the host country regulator does not take the bank returns, accruing to the home country shareholders, into account. The society thus benefits from the host country regulator not taking into account the totality of positive factors associated with the continuing decision, as this externality counteracts the time inconsistency problem associated with the welfare-maximising regulator. Note that even if foreign ownership is not complete, this result remains valid as long as some share of the returns goes abroad.

In the Appendix it is shown that the host country regulator is never too tough, i.e. never closes when it is not socially optimal. This guarantees that the stricter policy of the host country regulator always improves welfare. More generally, it also means that the time inconsistency problem of regulatory policy exists even with a cost-minimising regulator. This is because the direct losses of closure in terms of systemic cost and deposit insurance payments are enough to divert regulatory incentives away from the socially optimal closure policy, despite the absence of opportunity cost considerations in terms of bank returns.

Proposition 1 *In the subsidiary case, the host country regulator is stricter than the common regulator. Since* $p_S^{R2} < p_S^{FB}$*, the host country regulator improves social welfare if the regulatory constraint is binding.*

Proof. see Section 2.C in the Appendix. ■

Besides the missing effect of bank returns, the comparative statics remain as in the common regulator case: a larger γ induces less strict regulatory behaviour, whereas increases in liquidity value and systemic cost result in a tighter closure rule.

2.3.4 Bank's Restricted Choice

We now move on to study the bank's choice of monitoring level. In the first stage of the game, the bank maximises its expected profits, given the closure threat of the regulator. As the branch structure bank always stays open if $W \geq 0$ and as the first best is achieved, the focus will be on the subsidiary structure bank. The question whether regulatory requirement is restrictive for the bank turns into asking whether the monitoring technology of the bank is efficient enough to allow enough monitoring from the regulatory point of view. Less efficient subsidiary structure banks thus face a closure threat and modify their choice accordingly.

The subsidiary structure bank maximises its expected profits given the regulatory closure threshold:

$$\underset{p}{Max} \quad Y - 1 + \lambda \left[p \left(H - 1 \right) - C_S \left(p \right) \right] \quad s.t. \quad p \geq p_S^{CR} \quad or \quad p \geq p_S^{R2}. \tag{2.14}$$

We get the following result:

Proposition 2 *a) If the following conditions are fulfilled, the regulator in question is binding and improves welfare:*

$p_S^{CR} > p_S^* \quad \leftrightarrow \quad \beta_S < \bar{\beta}_S^{CR} \equiv \frac{L+(1-\gamma)S}{(H-1)(H+S)}$

$p_S^{R2} > p_S^* \quad \leftrightarrow \quad \beta_S < \bar{\beta}_S^{R2} \equiv \frac{L+(1-\gamma)S}{(H-1)(1+S)}$.

b) The host country regulator is binding for a larger set of parameter values than the common regulator.

Proof. See Section 2.C in the Appendix. ■

Too inefficient a subsidiary would thus monitor less than the regulator allows and will as a consequence be pushed to choose between closure and the threshold monitoring value of the regulator. As the common regulator is influenced by the bank returns, the inefficient banks face less stringent restrictions than in case of home country control.

2.4 Endogenous Choice of Ownership Structure

We now relax the assumption of an exogenous ownership structure. From the welfare or common regulator point of view, we will see that the efficiency argument in favour of branch structure remains. From the bank's point of view, however, the choice between a branch and a subsidiary is characterised by trade-off between efficiency and insurance: whereas the branch structure enables a cheaper monitoring technology, the right to an isolated bankruptcy in the case of subsidiary decreases the liability of the parent bank. We are interested in finding out the regulatory effect in terms of promoting the more efficient branch structure.

The timing of the game is now the following: the bank first chooses whether to found a branch or a subsidiary, and then makes its monitoring decision. Next, the regulator decides whether to close the bank or to let it open. Finally, profits and losses materialise. The only difference to the game in the previous Section is the first stage, and so, the results for the regulatory as well as the bank monitoring decisions are still valid, and we can directly proceed in solving the first stage of the game. First, however, the first best and the unconstrained ownership choice of the bank are presented.

2.4.1 First Best and Desired Structures of Ownership

We first compare the first best solutions with branch and subsidiary structure. If $W \geq 0$, it is easy to see that the society would prefer the branch option. The result is intuitively quite simple: the branch structure contains efficiency gains, and if $W \geq 0$, there is no risk of failure and no need for closure, and as a consequence, no closure costs. Flexibility then bears no advantages for the society.[10]

If $W \geq 0$, the bank's return at home is large enough to cover the losses in the host country in the branch case. The unconstrained bank has a trade-off between the efficient monitoring structure, on the one hand, and the right for the deposit insurance in the host country without touching the assets of the parent bank, on the other. Comparing the expected returns, we see that the deposit insurance effect weights out the efficiency gains and the bank prefers the subsidiary structure. In sum, we can state the following:

[10] In Section B in the Appendix it is shown that, for W<0, this is not the case: As soon as W<0, it may be socially optimal to separate the risky investment from the safe parent bank as a subsidiary. See Kahn & Winton (2004) for a related result.

Lemma 3 *If $W \geq 0$, the first best is always to have a branch structure. However, the unconstrained international bank always prefers the subsidiary structure.*

Proof. See Section 2.C in the Appendix. ■

2.4.2 The Bank's Constrained Choice

We now proceed into the solving the first stage of the multi-stage game with endogenous ownership structure. If $W \geq 0$, we saw that the regulator never closed a branch; in the subsidiary case, however, the regulator was sometimes binding. Moreover, Lemma 3 said that a subsidiary structure bank efficient enough not to be restricted will always find branch structure inferior to the status quo. It therefore suffices to compare the unrestricted maximum in the branch case with the restricted choices in the subsidiary case. The conditions for the bank choosing the branch structure pin down to

$$\begin{aligned} E\left(\Pi^{*}_{B|W\geq 0}\right) &> E\left(\Pi^{CR}_{S}\right) \quad if \\ \beta_S &< \beta_S^{CR(B>S)} \\ &\equiv \frac{\left(L+(1-\gamma)S\right)^2}{(H+S)\left[(H+S)\left(2-\beta_B H^2\right)+2\left(H-1\right)\left(L+(1-\gamma)S\right)\right]} \end{aligned} \tag{2.15}$$

$$\begin{aligned} E\left(\Pi^{*}_{B|W\geq 0}\right) &> E\left(\Pi^{R2}_{S}\right) \quad if \\ \beta_S &< \beta_S^{R2(B>S)} \\ &\equiv \frac{\left(L+(1-\gamma)S\right)^2}{(1+S)\left[(1+S)\left(2-\beta_B H^2\right)+2\left(H-1\right)\left(L+(1-\gamma)S\right)\right]}. \end{aligned} \tag{2.16}$$

With its closure decision, the regulator affects the bank's trade-off between efficiency gains in the branch case and higher value of deposit insurance in the subsidiary case. As a result, the relatively most inefficient subsidiary banks are induced to choose the branch structure. We can state the following:

Proposition 3 *a) If $\beta_S < \bar{\beta}_S^{CR(B>S)}$, the common regulator is binding and induces the bank to choose the branch structure.*

b) If $\beta_S < \bar{\beta}_S^{R2(B>S)}$, the host country regulator is binding and induces the bank to

choose the branch structure. In this case, the home country regulator becomes responsible and the bank will choose the social optimum.

c) The home country control system is more successful in inducing the branch structure: $\bar{\beta}_S^{R2(B>S)} > \bar{\beta}_S^{CR(B>S)}$ *. In doing this, the home country control system is welfare-improving.*

Proof. See Section 2.C in the Appendix. ■

The threshold subsidiary efficiency level for switching to branch is lower than the one where the regulatory monitoring level becomes binding. In other words, the regulator forces moderately inefficient banks to choose a higher monitoring level than they would desire. For the most inefficient subsidiary structure banks, however, the regulatory requirement induces a switch to branch structure. The regulator thus has a second channel of operation: besides influencing the stability of the bank through imposition of a higher monitoring level, it enhances its efficiency through the effect on the ownership structure. This further increases stability, as the branch structure banks cannot fail. Note that in our framework, stability and efficiency become complements.

Finally, we see that a higher liquidation value and a lower share of systemic cost occurring at early closure shift the threshold efficiency upwards: as both regulators react by tightening their closure policy on subsidiaries, the branch structure gains in attractiveness. An increase in β_B, i.e. an improvement in the branch relative to subsidiary monitoring technology, increases the opportunity costs of not switching to branch and therefore increases the threshold efficiency. The effects of systemic cost and of H for the common regulator are ambiguous. In case of the host country regulator, however, the effect of increasing H loosens incentives to choose branch structure. As the host country regulatory threshold is independent of bank returns, the gain in approaching the desired monitoring level with the subsidiary structure bank outweighs the higher return in the branch equilibrium.

2.5 Policy Implications

The purpose of the paper was to focus on the welfare effect of the regulatory structure in the enlarged EU, while keeping in mind that foreign investment in the banking sector typically goes from the old member countries to the CEE countries, and that these host markets are very small. In addition, both subsidiary and branch structures prevail in the market. Taking these market characteristics into account, we can summarise the main results of the model so far:

Corollary 1 *As long as* $W \geq 0$*:*

a) The branch structure bank achieves the social optimum; an unregulated bank, however, prefers the subsidiary structure.

b) The subsidiary will be closed with higher levels of monitoring when the host country regulator is in charge than when there is a common regulator.

c) No regulator is binding in the branch case. In the subsidiary case, the host country regulator is stricter and, compared to the common regulator, improves welfare if $\beta_S < \bar{\beta}_S^{R2}$.

d) Inefficient enough a subsidiary will have an incentive to choose a branch structure instead. The host country regulator, being more successful in promoting the branch structure, induces the switch if $\beta_S < \bar{\beta}_S^{R2(B>S)}$.

Hence, if the host market is small in comparison to the parent banks, home country control may have some advantages after all. The neglect of the welfare-maximising host country regulator as to profits accruing to the foreign bank counteracts the regulatory time inconsistency problem arising from closure costs, and therefore increases welfare in comparison to the common regulator, who internalises all externalities. As regulation does not matter in the branch case when branches are small, the overall effect remains favourable for the home country control.

In Section 2.B in the Appendix, the case with $W < 0$ shows that once foreign branch units become larger, the picture becomes less clear. First, the common regulator is shown to be more restrictive for the banks with large branches than the home country regulator. This means that the welfare effect of the regulatory arrangements depends on the respective weights of the branch and subsidiary structure banks in the economy. Second, the social desirability of the branch structure is no more evident, since this

may bear higher social costs in the end. The optima depend strongly on parameter values and characterising the equilibrium outcome becomes complicated. Nevertheless, it may be said that the more there are branches in the economy and the larger they are, the better the common regulator becomes in terms of improving social welfare.

2.6 Conclusion

Despite vivid political discussion, only few attempts currently exist to formalise the problematic of banking regulation in the enlarged EU. The striking fact is that, at present, foreign direct investment in banking in the EU is very much concentrated in the CEE countries, where the financial markets are small. In addition, unlike in many other geographical areas, the subsidiary form is popular. This paper attempted to shed light on the issue, concentrating on the effect of the difficulty of regulators to commit to a rule that is ex post not optimal on the efficiency-insurance trade-off of the bank when choosing the ownership form.

The model compared the common regulator arrangement to the home country control principle, when the regulatory policy is subject to time inconsistency problem. Like in Mailath & Mester (1994), the lack of regulatory commitment led to a second best solution even if the regulator was welfare-maximising. It turned out that, if the host markets were small, imposing the home country control principle instead of the common regulator improved the second best not only through increased monitoring effort from the part of the international bank, but also through greater success in inducing the more efficient and stable branch structure.

The observation that home country control principle improves welfare stands in conflict with the Danthine & al. (1999) proposition of centralising banking regulation in Europe. Their argument bases on the common regulator standing at an arm's length from the banks and therefore being less influenced by their expected returns. The present paper demonstrates that, if there are international banks and if some of them have subsidiary structures, the present regulatory arrangement may work better in that sense. In a way, home country control principle more efficiently alienates the regulator from the bank profits in case of the subsidiary structure than centralised regulation does, and this externality counteracts the regulatory time inconsistency problem. This result is, however, sensitive to the assumption of the welfare maximising regulator. If regulators were cost minimisers instead, no difference would arise between the regulatory arrangements.

By introducing the choice of ownership structure into the game, the paper made the point that stability and efficiency are not necessarily substitutes, as they are in e.g. Gorton & Winton (1998). This result is crucially dependent on the assumption that the branch structure is more efficient than the subsidiary structure. Apart from the obvious efficiency gains in the flexible use of capital, the paper relied on the argument that firms that are less completely controlled by foreigners have higher spill-overs and therefore fewer incentives to invest in technology. As Müller & Schnitzer (2003) demonstrate, this argument cannot be taken for granted, as the opposite may be true if the host country is politically unstable or if spill-overs spur investment in local infrastructure. These effects may, however, be limited in the CEE countries that are EU members and have recently shown remarkable convergence in other economic aspects.

The model is a contribution to the discussion on whether banking regulation in Europe should be unified, while keeping in mind that most foreign direct investment in the banking sector is currently taking place in the CEE countries and that their special characteristics might therefore count for the organisation of regulation of multinational banks. Section 2.B in the Appendix shows that the superiority of the home country control principle begins to erode once the branch of a bank becomes large enough to cause bankruptcy of the parent bank. In the literature of regulatory cooperation, Dell'Ariccia & Marquez (2003) and Holthausen & Ronde (2004) both find that centralised regulation is disadvantageous in the case of heterogeneous countries; in the first paper, this result arose from the cost of flexibility loss, whereas in the second, banks profited from internationalisation because of interest conflicts of the regulators with non-aligned objectives. In this light, our work offers yet another argument against uniform regulation of heterogeneous markets, with heterogeneity arising from the size difference between the home and host country. The home country regulatory incentives bear externalities, the impact of which increases in branch size. As a consequence, the situation may change, as host country units grow, and as branch structure banks become more common. Integrated regulation may well be a better solution for branch structure bank dominated and symmetric financial markets. Reconsideration should therefore take place after the single market has truly proved to exist.

Appendix 2

2.A Risky Investments in Both Countries

In this section, the model is generalised to allow for risk both in the home and in the host country. Risky investment in the home country reduces the option motive for the subsidiary structure, as risk taken in the home unit increases the risk of failure of the whole bank. On the other hand, risk diversification steps in as an advantage of international banking in general. In the following, the general results are briefly explained.

The bank will choose the monitoring level p_i for the return structure

$$R_i = \begin{cases} H_i \quad with \quad probability \quad p_i \\ 0 \quad with \quad probability \quad (1-p_i) \end{cases},$$

and for costs $C_{io}(p_i)$where $i \in \{1,2\}$ denotes the home country with index 1 and the host country with index 2, and $o \in \{B,S\}$ denotes the ownership structure "branch" with index B and "subsidiary" with index S, respectively. Like before, we assume that the home unit is large enough so that the returns in the good case will cover the deposits in both countries: $H_1 - 1 - \lambda \geq 0$. In addition, note that a bad outcome in the home country will lead to the failure of the whole bank irrespective of the ownership structure[11]. Finally, we maintain the assumption of the host country monitoring technology being expensive enough for the first best monitoring level there to be below one.

After some manipulations, the expected return for the branch bank becomes

[11] This is because, as long as $\lambda < 1$ and $H_2 < 2$, $\lambda(H_2 - 1) < 1$ and the returns from the host country will not suffice for the deposit payments at home.

$$E(\Pi_B) = p_1(H_1 - 1 - \lambda) + p_1 p_2 \lambda H_2 - C_{1B}(p_1) - \lambda C_{2B}(p_2).$$

Maximising as to $p_1$and p_2 produces the first order conditions

$$\begin{aligned} p_1 &= \beta_{1B}(H_1 - 1 - \lambda) + \beta_{1B}\lambda H_2 p_2 \\ p_2 &= \beta_{2B} H_2 p_1. \end{aligned}$$

Solving explicitly will result to the equilibrium monitoring levels

$$\begin{aligned} p_{1B}^* &= \frac{\beta_{1B}(H_1 - 1 - \lambda)}{1 - \beta_{1B}\beta_{2B}H_2^2\lambda} \\ p_{2B}^* &= \frac{\beta_{1B}\beta_{2B}H_2(H_1 - 1 - \lambda)}{1 - \beta_{1B}\beta_{2B}H_2^2\lambda}, \end{aligned}$$

which, under the assumptions made, also fulfil the second order conditions for a maximum. Like in the base model, a difference to the first best would spot the need for regulation. The first best utility can be written as

$$E\left(U_B^{FB}\right) = E(\Pi_B) + (1 - p_1)[p_2\lambda H_2 - (1 + \lambda)(1 + S)] < E(\Pi_B).$$

The first order conditions yield

$$\begin{aligned} p_{1B}^{FB} &= \beta_{1B}(H_1 + (1 + \lambda)S) \\ p_{2B}^{FB} &= \beta_{2B} H_2. \end{aligned}$$

Note that if $p_{1B}^* = 1$, the bank optimum p_{2B}^* no more coincides with the first best optimum: as the risk of failure in the home country increases that in the host country unit, too, incentives to monitor in the host country are weakened. A need for regulation thus emerges here even in the branch case. As to the parent bank, a sufficient condition for $p_{1B}^* < p_{1B}^{FB}$ always is to have $\beta_{1B} < \frac{1}{\lambda H_2}$.

Under the assumptions made, the chosen monitoring level at home is higher than that in the host country.

For the subsidiary, we get the following expected return:

$$E(\Pi_S) = p_1(H_1 - 1) + p_1 p_2 \lambda (H_2 - 1) - C_{1S}(p_1) - \lambda C_{2S}(p_2).$$

The resulting first order conditions are

$$\begin{aligned} p_1 &= \beta_{1S}(H_1 - 1) + \beta_{1S}\lambda(H_2 - 1)p_2 \\ p_2 &= \beta_{2S}(H_2 - 1)p_1, \end{aligned}$$

which yield the explicit solutions

$$\begin{aligned} p_{1S}^* &= \frac{\beta_{1S}(H_1 - 1)}{1 - \beta_{1S}\beta_{2S}\lambda(H_2 - 1)^2} \\ p_{2S}^* &= \frac{\beta_{1S}\beta_{2S}(H_1 - 1)(H_2 - 1)}{1 - \beta_{1S}\beta_{2S}\lambda(H_2 - 1)^2}. \end{aligned}$$

The chosen monitoring level at home is again higher than that in the host country if $\beta_{2S} < \frac{1}{H_2 - 1}$, which is already fulfilled by assumption and by $\beta_S < \beta_B$[12].

We can write the first best subsidiary expected utility as

$$E\left(U_S^{FB}\right) = E(\Pi_S) + (1 - p_1)[\lambda p_2(H_2 - 1 - S) - (1 + S)] - \lambda(1 - p_2)(1 + S) < E(\Pi_S).$$

The first order conditions yield

$$\begin{aligned} p_1 &= \beta_{1S}(H_1 + (1 + \lambda p_2)S) \\ p_2 &= \beta_{2S}(H_2 + p_1 S), \end{aligned}$$

which result in the following explicit solutions:

[12]Note that the second order condition for maximum, $\beta_{1S}\beta_{2S} < \frac{1}{H_2 - 1}$ is equally fulfilled.

$$\begin{aligned} p_{1S}^{FB} &= \frac{H_1 + S}{1 - \beta_{1S}\lambda S^2} \\ p_{2S}^{FB} &= \beta_{2S}H_2 + \frac{\beta_{2S}S\left(H_1 + S\right)}{1 - \beta_{1S}\lambda S^2}. \end{aligned}$$

Note that the first best optima are now interdependent: the probability of the separate bankruptcy of the subsidiary not only depends on its own monitoring level, but also positively on the monitoring level of the parent bank. The cost of this separate bankruptcy is $-p_1\left(1 - p_2\right)\lambda S$. Compared to the branch bank case, this results in the first best being lower in the home country and higher in the host country in the subsidiary case. As to need of regulation, we immediately see that $p_{2S}^* < p_{2S}^{FB}$ always. On the contrary, $p_{1S}^* < p_{1S}^{FB}$ only if $\beta_{2S} < \frac{H_1+S-\beta_{1S}\left(1-\beta_{1S}\lambda S^2\right)(H_1-1)}{\beta_{1S}\lambda(H_1+S)(H_2-1)^2}$.

The results will be summarised in the following proposition.

Lemma 4 (A) *Assume the monitoring technology in the host country is expensive enough such that* $p_B^{FB} < 1$. *Define* $\overline{\beta}_{1B} \equiv \frac{1}{H_1-1-\lambda+\beta_2(H_2-1)^2}$ *and* $\overline{\beta}_{1S} \equiv \frac{1}{H_1-1+\beta_2\lambda(H_2-1)^2}$, *where* $\overline{\beta}_{1B} > \overline{\beta}_{1S}$. *Assume in addition that* $\beta_{iS} < \beta_{iB}$. *Then,*

a) for both branch and subsidiary banks, $p_1^* > p_2^*$;

b) if $\beta_{1B} \geq \overline{\beta}_{1B}$, $p_{1B}^* = 1$ *and the results of the base model applies for both the branch and the subsidiary bank;*

c) if $\beta_{1S} \geq \overline{\beta}_{1S}$, $p_{1S}^* = 1$ *and the results of the base model applies for the subsidiary bank;*

d) in other cases, $p_{1B}^* = \frac{\beta_{1B}(H_1-1-\lambda)}{1-\beta_{1B}\beta_{2B}H_2^2\lambda}$ *and* $p_{1S}^* = \frac{\beta_{1S}(H_1-1)}{1-\beta_{1S}\beta_{2S}\lambda(H_2-1)^2}$. *As at least* $p_{2B}^* < p_{2B}^{FB}$ *and* $p_{2S}^* < p_{2S}^{FB}$, *there is need for regulation.*

Introducing risk in the home country complicates the analysis of the regulatory game significantly. As to the branch bank, the question of interest remains basically the same as before, namely, whether the common regulator closes the entire bank for higher or for lower levels of monitoring than the home country regulator would. As before, a threshold in monitoring level emerges, below which the bank will be closed. However, the thresholds of the two units are now intertwined such that there is a linear and negative relation between the monitoring level at home and the threshold monitoring level in the host country. The main conclusion is that the common regulator is stricter in closing an international branch bank than the home country regulator,

unless the systemic cost becomes very large. In that case, the home country regulator who, despite of not taking the systemic costs in the host country into account, puts more weight on the systemic cost in its closure decision will become stricter.

For the closure of a subsidiary structure bank, the regulatory game becomes complicated, as the regulator now can close either the entire bank or the subsidiary. In particular in the home country control case, the previous decision falls to the responsibility of the home country regulator, whereas the latter decision belongs to the competence of the host country regulator. We concentrate here on the host country perspective, asking at what threshold monitoring level the subsidiary will be closed, either as a consequence of a separate or of a total closure. The effect of introducing risk in the home country is that the probability of closure not only depends on the investment in the host country, but also on the additional closure risk coming from the home unit.

If we assume that $H_2 \geq H_1$, the results for the subsidiary structure bank can be summarised as follows:

- The common regulator chooses to close the whole bank instead of just closing a subsidiary if p_1 lies below a critical level.
- In case of the home country control, the home country regulator is more eager to close the whole bank than the host country regulator the subsidiary for some intermediate levels of p_1.
- For most of the values of p_1, the home country control principle produces stricter regulation than the common regulator; however, there are at most three intermediate intervals of p_1 where common regulator is stricter than the regulator appointed by the home country control principle.

Thus, although introducing risk into the home country investment complicates the picture in a significant way, the main lines of our argumentation remain.

2.B Monitoring and Choice of Ownership Structure when W<0

In this section, solutions for the branch structure bank with $W < 0$ are derived and they are compared with the subsidiary solutions in the paper. If $W < 0$, the branch is large enough to endanger the existence of the whole bank. This means that the liability of the bank is limited and it is entitled to deposit insurance in case of bad outcome. The trade-off of the regulator also changes, as the bank may now fail with a positive probability.

First Best Solution

If $W < 0$, the branch is large enough to cause the failure of the entire bank. As a consequence, the society faces a positive probability that there are deposits payable that will not be covered by the bank profit; in addition, a systemic cost occurs in case of failure. The first best maximisation problem becomes the form

$$\underset{p}{Max} \quad W + \lambda \left(pH - C_B \left(p \right) \right) - \left(1 - p \right) \left(1 + \lambda \right) S.$$

Compared with the equation 2.4 in the paper, there are two effects in action that decrease social welfare. First, $W < 0$ by definition, and second, the risk of failure introduces an expected systemic cost. Maximising with respect to p produces

$$p_{W<0}^{FB} = \beta_B \left(H + \frac{1+\lambda}{\lambda} S \right).$$

Note that, because of the systemic risk, $p_{B|W\geq 0}^{FB} < p_{B|W<0}^{FB}$. In addition, it is clear that $p_S^{FB} < p_{B|W<0}^{FB}$. This is due to the greater efficiency of the branch structure as well as the greater flexibility of the subsidiary structure in the way that the parent bank can continue its activities and the systemic cost in the home country will thus be saved, which lowers the social cost of bankruptcy.

Desired Strategy of the Bank

The unconstrained maximising in the branch case with $W < 0$ has the solution

$$p_{B|W<0}^{*} = \beta_B \left(H + \frac{W}{\lambda} \right),$$

where the second term in brackets, $\frac{W}{\lambda}$, is negative by definition. As the right to deposit insurance limits the bank's liability and as the systemic cost of failure is not internalised by the bank, however, the chosen monitoring level is lower than what would be socially optimal: $p^*_{B|W<0} < p^{FB}_{B|W<0}$. We can state the following standard moral hazard result:

Lemma 5 (A) *Social welfare declines through the introduction of the bank in the branch case if $W < 0$.*

Proof. See Section 2.C. ■

In addition, as the branch bank with $W \geq 0$ always chose the social optimum, we can state that $p^*_{B|W<0} < p^*_{B|W\geq 0}$. Thus, without a regulatory closure threat, the bank with limited liability ($W < 0$) will choose a lower level of monitoring than the bank with unlimited liability ($W \geq 0$). In other words, monitoring level is size dependent. Note that in the first best solution, the larger branch implied larger risky investment and larger risk for the society, and therefore, the first best monitoring level was increasing in size. In presence of deposit insurance, the risk of failure is shifted to the regulator, and the gap between the first best and the desired monitoring level increases as the bank becomes larger.

Finally, if $W < 0$, the branch bank, unlike the subsidiary bank, stands in danger to loose the profits in the home country due to the pooled asset structure. This vulnerability translates into an unregulated branch bank choosing a higher monitoring level: $p^*_{B|W<0} > p^*_S$.

Regulators' Decisions

In deciding whether to close the branch structure bank or to let it continue, the regulator trades off the indirect costs of closure in form of forgone investment in both countries and the immediate systemic cost in both countries against the risk of failure of the entire bank. As long as $W \geq 0$, the latter part of the trade-off was absent and the regulator always let the bank open. This will change with $W < 0$.

Common Regulator: For the branch bank with $W < 0$, the condition for continuing will be

$$p \geq p^{CR}_{B|W<0} \equiv \frac{(1+\lambda)\,(L + (1-\gamma)\,S) - Y}{\lambda H + (1+\lambda)\,S}.$$

In Section C it will be shown that this is lower than the first best solution. This

means that the common regulator is not successful in inducing the first best monitoring level, as it also accepts lower levels. Note that a necessary and sufficient condition for the common regulator to be willing to close the bank at some monitoring levels is $L > \frac{Y}{1+\lambda} - (1-\gamma) S$. We can state:

Lemma 6 (A) *The threshold probability for continuing is lower than the social optimum for the branch bank with $W < 0$. The time inconsistency problem exists.*

Proof. See Section 2.C. ■

Home Country Control: In the case of the branch structure bank with $W < 0$, the continuation threshold becomes

$$p \geq p^{R1}_{B|W<0} \equiv \frac{(1+\lambda) L + (1-\gamma) S - Y}{\lambda H + S}.$$

Compared with the common regulator case, the home country regulator ignores the systemic effects λS in the host country. Therefore, the common regulator is always stricter than the home country regulator, that is, $p^{CR}_{B|W<0} > p^{R1}_{B|W<0}$. A necessary and sufficient condition for the home country regulator to be willing to close the bank at some monitoring levels is $L > \frac{Y-(1-\gamma)S}{1+\lambda}$.

Proposition 4 (A) *In the branch case with $W<0$, the common regulator is stricter than the home country regulator.*

Proof. See Section 2.C. ■

Note that although the common regulator is here stricter, the host country regulator is still stricter in regulating the subsidiary structure banks. In other words, if regulation were binding, the subsidiary structure banks would have a higher monitoring level than the large branch structure banks.

Bank's Restricted Choice

The branch structure bank maximises its expected profits given the closure threat:

$$\underset{p}{Max} \quad p\left[Y - 1 + \lambda\left(H - 1\right)\right] - \lambda C_B\left(p\right) \quad s.t. \quad p \geq p^{CR}_{B|W<0} \quad or \quad p \geq p^{R1}_{B|W<0}.$$

Proposition 5 (A) *a) If the following conditions are fulfilled, the regulator in question is binding and improves welfare:*

$$p^{CR}_{B|W<0} > p^{*}_{B|W<0} \quad \leftrightarrow \quad \beta_B > \underline{\beta}^{CR}_{B} \equiv \tfrac{\lambda[(1+\lambda)(L+(1-\gamma)S)-Y]}{[\lambda H+(1+\lambda)S][\lambda H+W]}$$
$$p^{R1}_{B|W<0} > p^{*}_{B|W<0} \quad \leftrightarrow \quad \beta_B > \underline{\beta}^{R1}_{B} \equiv \tfrac{\lambda[(1+\lambda)(L+(1-\gamma)S)-Y]}{(\lambda H+S)[\lambda H+W]} \ .$$

b)The common regulator is binding for a larger set of parameter values than the home country regulator.

Proof. See Section 2.C. ■

Endogenous Choice of Ownership Structure

If $W < 0$, the choice of ownership structure becomes somewhat complicated. Already in the first best, the optimal choice depends on parameters. This is because, unlike small branch banks that never fail, large branch banks introduce a risk of failure. This results in the first best trade-off between the better efficiency of the branch bank, on the one hand, and the risk of systemic cost in both countries instead of just one in the subsidiary case, on the other. The bank, from its part, weights the greater efficiency of the branch structure against the higher value of the deposit insurance in the subsidiary case.

In the following, a sketch of the solution is presented. Going into more details is tedious and does not bring insights that are relevant for our point.

First Best: If $W < 0$, the society faces a trade-off between flexibility and efficiency in production technology. In particular,

$$\begin{aligned} U^{FB}_{B|W<0} - U^{FB}_{S} &> 0 \quad if \\ &\quad \lambda\left[\left(p^{FB}_{B|W<0} - p^{FB}_{S}\right)H - \left(C_B\left(p^{FB}_{B|W<0}\right) - C_S\left(p^{FB}_{S}\right)\right)\right] \\ &> \left(1 - p^{FB}_{B|W<0}\right)S + \left(p^{FB}_{B|W<0} - p^{FB}_{S}\right)\lambda S. \end{aligned}$$

The efficiency gains of the branch structure, depicted on the left side, have to cover the expected loss in the form of higher systemic cost. This translates into a threshold efficiency level:

$$U^{FB}_{B|W<0} - U^{FB}_{S} > 0 \quad if \quad \beta_S < \overline{\beta}^{FB(B>S)}_{S} \equiv \frac{\left(\lambda H + (1+\lambda)S\right)^2}{\lambda\left(H+S\right)^2}\beta_B - \frac{2S}{\left(H+S\right)^2}.$$

Note that it is no more obvious that the first best solution is to implement the more efficient branch solution. As $W < 0$, a failure will imply the loss of the whole branch structure bank, whereas the subsidiary structure secures the parent bank through isolation of assets. The society as a whole saves in systemic costs. Therefore, in order to compensate this probable loss, the branch structure bank needs to be efficient enough to be the first best solution.

This result is similar to the Kahn & Winton (2004) result, adjusted for banking groups by Harr & Ronde (2006). According to them, as soon as the risk in banking increases sufficiently, it is socially optimal to let the bank choose a subsidiary structure for the riskiest investments, as it limits risk shifting and therefore improves welfare.

The Bank's Desired Choice: If $W < 0$, the bank has a trade-off between the efficiency and the value of deposit insurance. In particular:

$$\begin{aligned} E\left(\Pi^*_{B|W<0}\right) &> E\left(\Pi^*_S\right) \quad if \\ & \lambda\left[\left(p^*_{B|W<0} - p^*_S\right)H - \left(C_B\left(p^*_{B|W<0}\right) - C_S\left(p^*_S\right)\right)\right] \\ &> \left(1 - p^*_{B|W<0}\right)(Y-1) + \left(p^*_{B|W<0} - p^*_S\right)\lambda. \end{aligned}$$

The efficiency gains of the branch structure have to cover the expected loss in terms of the value of the deposit insurance for the bank. We get

$$E\left(\Pi^*_{B|W<0}\right) > E\left(\Pi^*_S\right) \quad if \quad \beta_S < \overline{\beta}^{*(B>S)}_S \equiv \frac{(\lambda H + W)^2 + 3\lambda(Y-1)}{\lambda^2(H-1)^2}\beta_B - \frac{2(Y-1)}{\lambda(H-1)^2}.$$

In sum, both the bank and the society prefer the branch structure when the efficiency gains are large enough, and the subsidiary structure, when they are not. Depending on whether $\overline{\beta}^{*(B>S)}_S > \overline{\beta}^{FB(B>S)}_S$ or the other way around, we get a middle area where the bank action differs from the socially optimal ownership structure. In particular:

- If $\overline{\beta}^{*(B>S)}_S < \overline{\beta}^{FB(B>S)}_S$, there exists an area $\beta_S \in \left(\overline{\beta}^{*(B>S)}_S, \overline{\beta}^{FB(B>S)}_S\right)$ where the first best solution is the branch structure bank, but the unregulated bank will choose the subsidiary structure. Here, we need regulation to push the bank towards the branch structure, i.e. the home country control works better.

- If $\overline{\beta}_S^{*(B>S)} > \overline{\beta}_S^{FB(B>S)}$, there exists an area $\beta_S \in \left(\overline{\beta}_S^{FB(B>S)}, \overline{\beta}_S^{*(B>S)}\right)$ such that the first best solution is the subsidiary structure bank, but the unregulated bank will choose the branch structure. Regulation is needed to enhance the choice of subsidiary structure, i.e. the common regulator works better.

At this point, the analysis gets beyond the point we wanted to make and we stop here. The general message of this section is that the common regulator scheme gets more interesting when the size of the foreign unit of an international bank becomes large.

2.C Proofs

Proof of Lemma 1

We first want to state that $p_S^* < p_{B|W\geq 0}^*$. Assume the opposite: $p_S^* > p_{B|W\geq 0}^* \quad \leftrightarrow$ $\beta_S(H-1) > \beta_B H$. As $\beta_B > \beta_S$ and $H > H-1$, it is obvious that this is not true. Thus, $p_S^* < p_{B|W\geq 0}^*$.

As the social welfare function is concave in p, deviating from the socially optimal monitoring level will lead to a decrease in welfare.

In the case of branch structure with $W \geq 0$, $p_{B|W\geq 0}^{FB} = p_{B|W\geq 0} = \beta_B H$. In the subsidiary case, if $p_S^* \geq p_S^{FB} \quad \leftrightarrow \quad \beta_S(H-1) \geq \beta_S(H+S)$, which is a contradiction. Thus, $p_S^{FB} > p_S^*$.

Proof of Lemma 5(A)

In the case of branch structure with $W < 0$, if the desired monitoring level would be equal to or higher than the social optimum, $p_{B|W<0}^* \geq p_{B|W<0}^{FB} \quad \longleftrightarrow$

$\beta_B\left(H-1+\frac{Y-1}{\lambda}\right) \geq \beta_B\left(H+\frac{1+\lambda}{\lambda}S\right) \quad \leftrightarrow \quad S \leq \frac{W}{1+\lambda}$. Since by definition $W < 0$, this is a contradiction and $p_{B|W<0}^{FB} > p_{B|W<0}^*$.

Proof of Lemma 2

In the branch case with $W \geq 0$, the condition for continuing becomes $p \geq p_{B|W\geq 0}^{CR} \equiv \frac{(1+\lambda)(L-\gamma S)-Y}{\lambda H}$. As, by definition, $W \geq 0$ and $L < 1$, it follows that $(1+\lambda)L - Y < -W < 0$. Therefore, $p_{B|W\geq 0}^{CR} < 0$ and the regulator never closes the bank when $W \geq 0$.

In the subsidiary case, we get $p_S^{CR} \geq p_S^{FB} \quad \leftrightarrow \quad \frac{L+(1-\gamma)S}{H+S} \geq \beta_S(H+S) \quad \leftrightarrow$ $\beta_S \leq \frac{L+(1-\gamma)S}{(H+S)^2}$. Assuming that that it is always first-best efficient to leave the bank

open, i.e. $U^{FB}\left(p^{FB}\right) > U^{CLOSE}(0)$, leads to the following restrictions on the cost parameter:

$$\beta_S > \underline{\beta}_S \equiv \frac{2\left[L + (1-\gamma)S\right]}{(H+S)^2}.$$

This restriction is contradictory to the condition derived above. As a consequence, $p_S^{CR} < p_S^{FB}$, and the time inconsistency problem exists.

Proof of Lemma 6(A)

Assuming again that the social maximum of the closure strategy is smaller than the maximum of the continuing strategy leads to the following restriction on the cost parameter:

$$\beta_B > \underline{\beta}_B \equiv \frac{2\left[(1+\lambda)\left(L + (1-\gamma)S\right) - Y\right]}{(\lambda H + (1+\lambda)S)^2}.$$

In the branch case with W < 0, if $p_{B|W<0}^{CR} \geq p_{B|W<0}^{FB} \quad \leftrightarrow \quad \frac{(1+\lambda)(L+(1-\gamma)S)-Y}{\lambda H+(1+\lambda)S} \geq \beta_B\left(H + \frac{1+\lambda}{\lambda}S\right) \quad \leftrightarrow \quad \beta_B \leq \frac{\lambda[(1+\lambda)(L+(1-\gamma)S)-Y]}{(\lambda H+(1+\lambda)S)^2}$.This is contradictory to $\beta_B > \underline{\beta}_B$. Thus, $p_{B|W<0}^{CR} < p_{B|W<0}^{FB}$ and the time inconsistency problem exists.

Proof of Proposition 1

In the subsidiary case, if the common regulator is stricter than the host country regulator, $p_S^{CR} > p_S^{R2} \quad \leftrightarrow \quad \frac{L+(1-\gamma)S}{H+S} > \frac{L+(1-\gamma)S}{1+S} \quad \leftrightarrow \quad -H+1 > 0$. This is a contradiction, and as a consequence, $p_S^{CR} < p_S^{R2}$.

Turning to the question whether the host country regulator might be too strict, we need to check whether the threshold is higher than the social optimum. The threshold is below the social optimum if $\beta_S > \frac{L+(1-\gamma)S}{(H+S)(1+S)}$. This value is always below $\underline{\beta}_S$; as a consequence, the cost function in the model is such that the requirement is fulfilled and the host country regulator is never too strict.

Proof of Proposition 4(A)

In the branch case with $W < 0$, if the home country regulator is stricter than the common regulator, $p_{B|W<0}^{R1} > p_{B|W<0}^{CR} \quad \leftrightarrow \quad \frac{(1+\lambda)L+(1-\gamma)S-Y}{\lambda H+S} > \frac{(1+\lambda)[L+(1-\gamma)S]-Y}{\lambda H+(1+\lambda)S} \quad \leftrightarrow$ $(1+\lambda)L - Y - (1-\gamma)\lambda H > 0$. By assumption, $\gamma < 1 - L$. Plugging the maximum value in results in $L - Y + (1-H)\lambda L > 0$, which is a contradiction. Thus, $p_{B|W<0}^{R1} < p_{B|W<0}^{CR}$.

Proof of Proposition 2

a) Whether the constraint is binding boils down to whether $p_S^{CR} > p_S^*$. The condition will be: $\frac{L+(1-\gamma)S}{H+S} > \beta_S(H-1) \quad \leftrightarrow \quad \beta_S < \frac{L+(1-\gamma)S}{(H+S)(H-1)}$. Similarly, $p_S^{R2} > p_S^* \quad \leftrightarrow \quad \frac{L+(1-\gamma)S}{1+S} > \beta_S(H-1) \quad \leftrightarrow \quad \beta_S < \frac{L+(1-\gamma)S}{(1+S)(H-1)}$.

b) We want to show that $\overline{\beta}_S^{R2} > \overline{\beta}_S^{CR}$. Assume the contrary: $\overline{\beta}_S^{CR} > \overline{\beta}_S^{R2} \quad \leftrightarrow \quad \frac{L+(1-\gamma)S}{(H-1)(H+S)} > \frac{L+(1-\gamma)S}{(H-1)(1+S)} \quad \leftrightarrow \quad 1 > H.$ which is by assumption not true. It follows that $\overline{\beta}_S^{R2} > \overline{\beta}_S^{CR}$.

Proof of Proposition 5(A)

a) As in the previous proof, we want to find the condition for $p_{B|W<0}^{CR} > p_{B|W<0}^*$:

$p_{B|W<0}^{CR} > p_{B|W<0}^* \quad \leftrightarrow \frac{(1+\lambda)[L+(1-\gamma)S]-Y}{\lambda H+(1+\lambda)S} > \beta_B\left(H-1+\frac{Y-1}{\lambda}\right) \quad \leftrightarrow$

$\beta_B < \frac{\lambda[(1+\lambda)[L+(1-\gamma)S]-Y]}{[\lambda H+(1+\lambda)S][\lambda(H-1)+Y-1]}$.

Similarly,

$p_{B|W<0}^{R1} > p_{B|W<0}^* \quad \leftrightarrow \frac{(1+\lambda)L+(1-\gamma)S-Y}{\lambda H+S} > \beta_B\left(H-1+\frac{Y-1}{\lambda}\right) \quad \leftrightarrow$

$\beta_B < \frac{\lambda[(1+\lambda)L+(1-\gamma)S-Y]}{[\lambda H+S][\lambda(H-1)+Y-1]}$.

b) The statement boils down to claiming that $\overline{\beta}_B^{CR} > \overline{\beta}_B^{R1}$. Assuming the contrary leads to $\overline{\beta}_B^{CR} < \overline{\beta}_B^{R1} \quad \leftrightarrow \quad \frac{(1+\lambda)L+(1-\gamma)S-Y}{(\lambda H+S)} > \frac{L+(1-\gamma)S}{(\lambda H+(1+\lambda)S)}$. This has already been proved to be a contradiction in the proof of Proposition A1. Hence, $\overline{\beta}_B^{CR} > \overline{\beta}_B^{R1}$.

Proof of Lemma 3

The statement $U_{B|W\geq 0}^{FB} > U_S^{FB}$ follows directly from the concavity of the social welfare function and from Lemma 1. Whenever $W \geq 0$, the expected payoffs for the banks are $E\left(\Pi_{B|W\geq 0}^*\right) = W + \frac{\beta_B \lambda}{2} H^2$and $E\left(\Pi_S^*\right) = Y - 1 + \frac{\beta_S \lambda}{2}(H-1)^2$. It follows that $E\left(\Pi_{B|W\geq 0}^*\right) - E\left(\Pi_S^*\right) > 0$ if $\beta_B > \frac{2}{H^2} + \left(1-\frac{1}{H}\right)^2 \beta_S$. Under the assumption $\beta_B < \frac{1}{H}$ this is never true. Thus, if $W \geq 0$, the bank will always prefer the subsidiary structure.

Proof of Proposition 3

We want to show that $\overline{\beta}_S^{R2(B>S)} > \overline{\beta}_S^{CR(B>S)}$. The opposite would mean

$\overline{\beta}_S^{CR(B>S)} > \overline{\beta}_S^{R2(B>S)} \quad \leftrightarrow \quad \frac{1}{H+S} - \frac{1}{1+S} > 0 \quad \leftrightarrow \quad H < 1$, which is a contradiction. Therefore, $\overline{\beta}_S^{R2(B>S)} > \overline{\beta}_S^{CR(B>S)}$. Again, a comparison between $E\left(\Pi_{B|W\geq 0}^*\right)$and $E\left(\Pi_S^{CR}\right)$is sufficient.

As to welfare, we know that $U_S^{FB} > U_S^{R2}$ due to concavity and $U_S^{R2} > U_S^{CR}$due to

concavity and from Proposition 1. Finally, through Lemma 3 we know that $U^{FB}_{B|W\geq 0} > U^{FB}_{S}$.

Chapter 3

Multiple Regulators, Bank Bail-Outs, and Constructive Ambiguity

3.1 Introduction

The handling of bank crises in the EU is in principle a national task, the ECB having reserved itself the right to intervene if it suspects that the smooth functioning of the payment system is in danger[1]. This formulation avoids explicit criteria for the division of the LOLR responsibilities and creates uncertainty as to the roles of the national regulators (NCBs) and of the ECB.

The present arrangement has been justified through constructive ambiguity[2]. This term is normally used in the context of optimal LOLR policy and refers to the voluntary uncertainty as to the conditions of emergency lending to individual banks, which aims at curbing bank moral hazard inherent to a predictable LOLR policy[3]. Nevertheless, many authors so far have raised doubts whether the notion of constructive ambiguity is transferable as to the identity of the European LOLR[4].

This chapter asks whether the inability of the LOLR to commit to a socially optimal policy can be compensated for by appointing two regulators with differing objectives

[1] See Article 105(2) in the Treaty on the EU.

[2] For discussion, see e.g. Padoa-Schioppa (1999) and Prati & Schinasi (2000).

[3] As the LOLR cares for systemic consequences occurring due to a closure or a failure of a bank, it faces difficulties in committing not to rescue banks that are too big to fail.

[4] See Aglietta (1999), Bruni & de Boissieu (2000), and Lastra (2000), among others.

instead and, in particular, by not defining their roles clearly[5]. In presence of the time inconsistency problem of the LOLR policy and of regulatory externalities arising from the regulators' regional interests, we consider the welfare effect of ambiguity as to the identity of the LOLR and determine the optimal rule for the division of responsibilities. Ambiguity is then considered to be constructive if it increases social welfare. The focus is on the underlying structure of the regulatory game between the NCB and the ECB. In particular, the present arrangement will be approximated in two ways: first, as a Stackelberg regulatory game with an incomplete contract on identity; and second, as an optimal rule on the division of the roles, given the existence of the two regulators and their utility functions.

In most cases, the ECB intervention turns out to be welfare improving, if the responsibility division is defined as a size and ownership structure contingent rule. In contrast, ambiguity is found to be constructive for a very limited group of relatively inefficient banks, under the assumption that regulators are cost-minimising instead of welfare-maximising. For all other cases, a clear division of responsibilities, contingent on size and ownership structure, dominates ambiguity.

In the model, the bank maximises its profits by choosing how much to invest in monitoring its borrowers, taking the regulatory response into account. In particular, due to externalities in form of deposit insurance as well as systemic costs of failure, the bank's unconstrained choice of monitoring level lies below the social optimum. This creates the need for bank regulation. Furthermore, the bank is subject to an unforeseen, random liquidity shock in the sense of Diamond & Dybvig (1983) and Holmström & Tirole (1996). If such a shock occurs, the bank can either terminate the illiquid investment project, or ask the regulator for an emergency credit.

A regulator decides whether to give emergency lending to the bank, trading the immediate costs of not doing so against the cost of lending and the expected costs of bank failure. The magnitude of these costs depends on the jurisdiction of the regulator and on the bank's ownership structure: Whereas the ECB internalises the systemic cost of the whole area, the NCB internalises it only within its country. Further, the NCB is responsible for, and thus internalises, the deposit insurance of the entire branch structure bank; if, however, the bank has a subsidiary structure, the NCB has to pay for the deposit insurance in the home country only.

The chapter asks whether the problem of time inconsistency, caused by the inability of the regulator to commit to the socially optimal policy, can be addressed by an ap-

[5]Throughout the chapter, we use LOLR and regulator as synonyms.

propriate division of tasks between the ECB and the NCB, and in particular, whether non-specification of responsibilities can be welfare-improving. In the first setting without commitment, the question is whether the incompleteness of the contract on identity of the LOLR is justified by the nonverifiability of the determinants of the policy choice[6]. Yet, this is in general not the case: as long as the actions of choosing the identity and the bank risk taking are substitutes in terms of welfare, leaving the contract open for the identity choice will produce the worst outcome in terms of payoffs, as the threshold of the most lenient regulator becomes the effective regulatory restriction. This can be welfare-improving only for inefficient subsidiary structure banks for which the NCB is too strict.

In the second setting, the LOLRs are assumed to be able to commit to a division of responsibilities. It turns out that, under certain conditions, the optimal rule can indeed be to exercise ambiguity in the sense of not specifying the identity of the LOLR. However, the optimal rule of whether to exercise ambiguity or not is contingent on the efficiency of the banks, which is hardly verifiable information. As a consequence, the implementation problem, inherent to the optimal policy with a single regulator, still remains. In addition, the necessary conditions also lead to questions on implementability. In particular, it is not enough to leave the identity of the LOLR unspecified if this does not change the expectations of the bank as to the effective regulatory threshold from those of the two regulators in the direction of the first best. For example, allowing the regulators to negotiate whenever a bank belonging to the constructive ambiguity class needs liquidity assistance does not produce this result, since the bank still expects to be rescued at the lower regulatory threshold. Simply randomising would not change the expectations either, since the ex post threshold would be either one of the two thresholds.

Finally, a crucial element needed for constructive ambiguity in both settings is the existence of inefficient closures. If the regulators are welfare-maximising instead of cost-minimising, the regional regulatory externalities are not alone sufficient for generating too strict regulation from the part of the NCB, which would justify ECB intervention when it is the laxer regulation, i.e. in the case of large subsidiary structure banks. Therefore, the size and ownership structure contingent rule of appointing the regulation of branch banks and of small subsidiary banks to the ECB, and of the large subsidiary banks to the NCBs, may indeed be optimal after all.

[6] This could happen if the incompleteness of the contract on identity allows for better punishment of the first player from the part of the second player, as e.g. in Bernheim & Whinston (1998).

If constructive ambiguity as to identity is to improve the banks' prudential behaviour, the first best regulatory policy is not attainable by the single regulator. Here, closure costs and the nonverifiability of the bank risk level together lead to the difficulty of the regulator to commit to the optimal policy, as in the Mailath & Mester (1994) paper on time inconsistency of the optimal closure policy. In the LOLR literature, time inconsistency of optimal policy manifests itself in particular as a tendency of the LOLR to unconditionally bail out banks that are too big or too important to fail, as in Goodhart & Huang (1999, 2005), and Freixas (2000), among others[7].

The issue of multiple regulators has been studied in the common agency literature, originated by Bernheim & Whinston (1986). In particular, they ask whether non-cooperation can be of benefit in a setting where the agent's action is nonobservable. It turns out that common agency never improves upon the coordinated solution; however, common agency is detrimental in cases where the informational asymmetries lead to the first best not being obtainable in the coordination case. Further work in settings of multiple regulators with overlapping tasks by e.g. Martimort (1999) and Laffont & Martimort (1999) show that separation of regulators can be optimal if information is asymmetric between the regulators. Whereas separation of regulators makes the renegotiation proofness restriction stricter in Martimort (1999), in Laffont & Martimort (1999), separation acts against collusion. We ask instead whether there is an alternative mechanism that would enable the regulators to commit to verifiable aspects and whether we can find a justification to ambiguity in this way. The closest approach to ours is Tirole (1994), who shows how biasedness of regulators and state-contingent allocation of power may improve welfare under nonverifiable information. As in our work, Tirole's (1994) result bases on the ability of agencies with biased objectives to commit to policies that under some circumstances are closer to the social optimum than the time consistent policy of the social planner. Similarly, we derive an optimal division rule, contingent on the size and on the ownership structure of the bank. In a related setting, Repullo (2000) models LOLR behaviour without commitment and asks whether the task should be allocated to a central bank or to a deposit insurance corporation. The optimal division of responsibilities is a rule, contingent on the size of the liquidity shock.

An elementary part of the present work is to ask whether the optimal rule can be one that leaves the responsibility division open. This is related to the constructive ambiguity concept of the optimal LOLR policy, aimed at improving the prudential behaviour

[7]See also Rochet & Tirole (1996) and Freixas & al. (2000a). Goodhart & Illing (2002) provide a comprehensive reader on LOLR literature.

of the banks. As the term constructive ambiguity has originated from practitioners, a multiplicity of theoretical definitions prevails. One interpretation is to define constructive ambiguity as a mixed strategy, as in e.g. Goodfriend & Lacker (1999). The evidence on constructive ambiguity of the LOLR policy in this sense is mixed: Whereas Freixas (2000) finds randomisation of bail-outs optimal for some banks, Cordella & Yeyati (2003) and Freixas & al. (2004) find that a publicly announced, conditional rule always dominates over ambiguity. Alternatively, constructive ambiguity has been defined as a contingent rule with regard to policy that is subject to regulatory discretion[8]. Goodhart & Huang (2005) then find evidence for constructive ambiguity of the optimal LOLR policy as a time and shock contingent rule that balances the moral hazard effect against costs of failures at the macro level. The present work acknowledges the multiplicity of definitions by considering both types of constructive ambiguity.

The chapter is organised as follows: First, the structure of the economy and the timing of the game are explained in Section 3.2. Then, Section 3.3 goes on with the characterisation of the discretionary and the commitment games, after which the main results are presented. After, Section 3.4 considers the robustness of the results and Section 3.5 addresses the problems with the implementation of the optimal solution. Finally, concluding remarks are made.

3.2 Economy Structure

In the economy, international banks maximise their profits by choosing the monitoring level of their investment, p, which directly determines the risk level of their assets, $(1-p)$.[9] This decision has a convex cost $C(p)$, with $C'(p) > 0$ and $C''(p) > 0$. The choice of p is perfectly observable but nonverifiable, so no contracts can be written on it. The bank invests in a project that has a return $H > 1$ with probability p and zero otherwise, and finances its operations with deposits 1 that are fully insured by the NCB. In addition, a bank failure will cause a systemic cost $s \in (0,1)$ in the

[8] See BIS (1997), Enoch & al. (1997), Freixas & al. (2000b), Mishkin (1999), and Lastra (2000), among others.

[9] One possibility is to interpret $(1-p)$ as the perceived probability of the entire bank going bankrupt, i.e. the aggregate risk. In the end, this is the only risk that interests the regulator calculating the expected costs of failure or closure of the bank and the cost of emergency loan. The scope of internationalisation n would then just approximate the international magnitude of these costs. Another interpretation, as our LOLR is interested in total bank failure, would be to state that $(1-p)$ represents the probability that the parent bank goes bankrupt. In EU in particular, where most of foreign ownership in the banking sector takes place in the CEE countries and hardly ever exceeds five per cent of the total assets of the parent bank, this may be the relevant regulatory concern.

country where it operates; if the bank operates in n countries, the systemic cost will be ns[10]. The limited liability and the externality in form of the systemic cost lead to the standard moral hazard result, where a bank, if not regulated, chooses a higher than the socially optimal risk level. In addition, the bank is subject to an unforeseen liquidity shock $v \in (0, n)$. It is assumed that if the bank does not get emergency financing, it will have to terminate the illiquid investment project, which will lead to bank failure.[11]

In order to mitigate the moral hazard arising from the limited liability, there is a regulator in each country, and in addition a common regulator for the whole area (ECB). Each regulator is assumed to care about the systemic cost of closure or failure within its own jurisdiction only. In addition, the national regulator (NCB) cares about the deposit insurance payable according to the home country control principle, which states that the deposit insurance of an entire branch structure bank belongs to the responsibility of the home country regulator, whereas for the subsidiary structure bank, the home country regulator only has to pay for the home unit.

The task of the regulator is to choose whether to extend the emergency credit v or not to the bank asking for it: the regulatory action $a_{REG} \in \{L, C\}$, where $L = lend\ v$ and $C = do\ not\ lend\ v$. This decision is based on the trade-off between the direct closure costs and the expected costs of a later failure of the bailed-out bank, which include the loss of v. As will become clear later on, this trade-off depends on the monitoring level p, and, for the ECB and for the NCB regulating a branch structure bank, additionally on the international size of the bank, n.

In order to derive some welfare results, let us define the expected welfare of the social planner as follows:

$$\begin{aligned} U^{SOC} &\equiv n\left(p\left(H-1\right)-C\left(p\right)\right)-\left(1-p\right)\left(n+sn+v\right) \\ &= E\left(\Pi\right)-\left(1-p\right)\left(n+sn+v\right), \end{aligned} \tag{3.1}$$

where $E\left(\Pi\right)$ denotes the expected return of a bank. The expected welfare of the social planner thus consists of the expected bank return and of the expected external-

[10] The systemic cost is an externality to the banking system, for example, in form of some contagion or inefficiency effect. For examples, see Mailath & Mester (1994) or Gorton & Winton (1995).

[11] One could also imagine an endogenous choice in n with a convex cost $K\left(n\right)$. This would give rise to an internationalisation motive in order to avoid regulation in monitoring levels and strengthen a rule appointing the regulation of large subsidiaries to the NCB instead of the size-influenced ECB. The results would not, however, be changed significantly; the present approach is chosen due to its simplicity.

ities of a bank failure. The first order condition determines the first best monitoring level p_{FB} for a bank:

$$p_{FB} = \begin{cases} \left[(C)_p\right]^{-1}\left[H + s + \frac{v}{n}\right] & if \quad \left[(C)_p\right]^{-1}\left[H + s + \frac{v}{n}\right] < 1 \\ 1 & otherwise. \end{cases} \tag{3.2}$$

The first best monitoring level is thus lower, the more costly the monitoring technology, and the lower the return on the project, the systemic cost, and the liquidity shock per bank unit. The first best closure rule would be to close all banks for which $p < p_{FB.}$

In the following, we concentrate on the banks for which the unconstrained maximisation of the expected return produces a monitoring level $p* < 1$, that is, that exhibit the moral hazard phenomenon[12]. The banks that do not fulfil this assumption do not need to be regulated, since the first best is already achieved. In addition, we only consider banks that are hit by the liquidity shock. The timing of the game is as follows:

1. Bank chooses $p \in [0, 1]$.
2. Bank asks for v.
3. Regulary game will be played; $a_{REG} \in \{L, C\}$.
4. If $a_{REG} = L$, returns on the investment will be realised.

3.3 Regulatory Game

In what follows, we start by approximating discretionary LOLR behaviour with a Stackelberg game, where first the NCB decides whether to extend the emergency loan or not. After, the ECB has a veto right to overrule the NCB's decision in case the NCB did not lend. We then compare the welfare implications of the game to the case first with NCB only and then with an optimal rule on responsibilities in presence of the two incentive-driven regulators. In all games, the equilibrium concept will be the subgame perfect equilibrium that will be solved by backward induction[13]. Yet, before continuing with solving the game, the regulatory payoffs and thresholds are presented.

[12] The technical requirement for the cost function is then $[C_p]^{-1}(p^*) < \frac{1}{H-1}$.

[13] For the game theoretic solution concepts, see Chapters 3 and 8 in Fudenberg & Tirole (2000).

3.3.1 Regulatory Thresholds

The lending decision of the regulators is characterised by a trade-off between the direct cost of immediate closure and the expected costs of lending, of the deposit insurance, and of the systemic consequences, in case the bank project will not succeed. These costs differ for each regulator and from the total social costs due to the externalities bound to the differing legal responsibilities. The more the regulator internalises the externalities of the bank activity, the more reluctant it is to close a bank, and the more prevalent is the time inconsistency problem. Regulatory externalities thus counteract the time inconsistency problem of the social planner.

As a supranational regulator, the ECB internalises the systemic cost everywhere. However, it does not take into account the consequences of its actions to the deposit insurance costs that belong to the responsibilities of the NCBs. The expected payoffs for the ECB are as follows:

$$\begin{aligned} a_{ECB} &= L: \qquad U_{ECB} = -(1-p)(v+ns) \\ a_{ECB} &= C: \qquad U_{ECB} = -ns. \end{aligned} \tag{3.3}$$

It results that the ECB rescues the bank iff

$$p \geq p_{ECB} \equiv \frac{v}{v+ns}. \tag{3.4}$$

This ECB threshold increases in v and decreases in n and in s. In particular, banks with a large scope of internationalisation face a lower ECB threshold than less international ones.

We now turn to the NCB decision. Besides not internalising the systemic cost $(n-1)s$ abroad, the NCB bears the cost of deposit insurance in case of failure or closure of the bank. As the latter cost varies according to the form of ownership of the bank, we need to differentiate between branch and subsidiary structure banks. A branch structure bank belongs to the deposit insurance scheme of the home country, whereas a subsidiary structure bank is insured in the countries of operation, thus merely leaving the parent unit for the home country NCB.

In case of a branch structure bank, the decision of the NCB that is responsible for

the deposit insurance of the entire bank will result from the comparison of the following alternative payoffs:

$$\begin{aligned} a_{NCB(B)} &= L: \qquad U_{NCB(B)} = -(1-p)(v+n+s) \\ a_{NCB(B)} &= C: \qquad U_{NCB(B)} = -(n+s). \end{aligned} \tag{3.5}$$

Consequently, the NCB will give the emergency loan to a branch structure bank iff

$$p \geq p_{NCB(B)} \equiv \frac{v}{v+n+s}. \tag{3.6}$$

This threshold is again increasing in v and decreasing in n und in s. Comparison with the ECB threshold in Equation (3.4) immediately shows that, as the cost of deposit insurance always exceeds the systemic cost by assumption, the NCB is always a more lenient branch bank regulator than the ECB.

If we assume a subsidiary structure instead, the NCB only has to pay for the deposit insurance in its own country. In deciding whether to grant the emergency loan, the NCB makes the following consideration:

$$\begin{aligned} a_{NCB(S)} &= L: \qquad U_{NCB(S)} = -(1-p)(v+s+1) \\ a_{NCB(S)} &= C: \qquad U_{NCB(S)} = -(s+1). \end{aligned} \tag{3.7}$$

As a consequence, the NCB will give the emergency loan to a subsidiary structure bank iff

$$p \geq p_{NCB(S)} \equiv \frac{v}{v+s+1}. \tag{3.8}$$

Like before, this threshold is increasing in v and decreasing in s. In contrast, due to the limited deposit insurance responsibility, the NCB threshold is independent of the international size of a subsidiary bank. Consequently, the NCB threshold for the subsidiary bank is higher, ceteris paribus, than that for the branch bank as soon as the bank becomes international.

Before going on, let us briefly consider the relation of the regulatory thresholds to

the first best monitoring level, which determines the condition for too strict regulation.

Lemma 7 *The regulator is too strict, i.e. inefficient closure can happen only if the bank is inefficient enough. For the ECB, this means* $p_{FB} < \frac{v}{v+ns}$*, and for the NCB,* $p_{FB} < \frac{v}{v+n+s}$ *in the branch bank case and* $p_{FB} < \frac{v}{v+s+1}$ *in the subsidiary case.*

Hence, the most inefficient banks for which it is still socially optimal to let them operate face a possibility of inefficient closure due to the externalities not taken into account by the regulator. Note that these externalities indeed do not have this effect for all banks: the time inconsistency of the closure policy counteracts externalities and, as a result, efficient enough banks face rather too lax a closure policy. For example, banks for which $p_{FB} = 1$ will never face inefficient closure. In the general setting, it is not possible to exclude the existence of banks that face too strict regulation; however, we will later discuss some restrictions that will eliminate this parameter space.

3.3.2 Discretionary Game

We now proceed with solving the discretionary case, where the ECB has a veto right to overrule the NCB's closure decision. This multi-stage game is a dynamic contracting problem where the bank first chooses the level of monitoring. If a liquidity shock occurs, it then asks for emergency lending from the NCB, who decides whether to lend to the bank or not. In case of no lending, the ECB considers whether it is worthwhile to rescue the bank, and in case of a positive response, acts as a LOLR.

Through backward induction, the ECB threshold in the last stage is as in Equation (3.4). In the previous stage, the NCB makes its move, given the expected reaction of the ECB. Consider first the regulation of a branch structure bank. Instead of using the decision rule in Equation (3.6), the NCB takes into account the possibility that the ECB will lend in the later phase. The expected payoffs in case of closure now depend from the ECB action and become

$$\begin{aligned} a_{NCB(B)} &= C: \quad U_{NCB(B)} = -(n+s) \quad if \quad p < p_{ECB} \\ a_{NCB(B)} &= C: \quad U_{NCB(B)} = -(1-p)(n+s) \quad if \quad p \geq p_{ECB}. \end{aligned} \tag{3.9}$$

Using again backward induction, we see that the NCB is able to force the ECB to finance the emergency loan whenever $p \geq p_{ECB}$. The NCB is thus free-riding on the

cost of ECB. However, a parameter space $p_{NCB(B)} \leq p < p_{ECB}$ remains where only the NCB is willing to save the bank. The subgame perfect equilibrium for a branch structure bank is given in the following Lemma.

Lemma 8 *In the case of a branch structure bank, the ECB will give the emergency loan if $p \geq p_{ECB}$, whereas the NCB will give the loan if $p_{NCB(B)} \leq p < p_{ECB}$.*

Both the NCB and the ECB thresholds depend negatively on the international size of the bank. However, because of the deposit insurance cost exceeding the systemic cost by assumption, the NCB threshold is always situated below the ECB threshold for a branch structure bank. As the combined regulatory restriction is continuous in p, the NCB threshold is the only binding restriction for a branch structure bank.

Similarly, the expected NCB payoffs for not lending in case of a subsidiary structure bank are

$$\begin{aligned} a_{NCB(S)} &= C: \quad U_{NCB(S)} = -(s+1) \quad if \quad p < p_{ECB} \\ a_{NCB(S)} &= C: \quad U_{NCB(S)} = -(1-p)(s+1) \quad if \quad p \geq p_{ECB}. \end{aligned} \tag{3.10}$$

Now, an implicit rule, contingent on the international size of the bank, emerges: The NCB acts for subsidiary structure banks that are smaller than the threshold size $\frac{s+1}{s}$ and have a monitoring level low enough such that the ECB will not save the bank, the ECB intervening for the larger or more stable banks. The interest of the NCB in saving less stable small banks than the ECB is a consequence of the ECB ignoring the deposit insurance cost. However, as the bank enlarges its activities abroad, the systemic cost effect is multiplied. As a consequence, the ECB threshold monitoring level decreases, reaching the NCB threshold at $n = \frac{s+1}{s}$. After this level, the ECB becomes the sole emergency lender.

Lemma 9 *In the case of a subsidiary structure bank, i) the NCB will give the loan if $n < \frac{s+1}{s}$ and $p_{NCB(S)} \leq p < p_{ECB}$; ii) the ECB will give the loan if $p \geq p_{ECB}$.*

Note that although the NCB threshold is not dependent on n, the regulatory decision is continuous in p, and so, if choosing n were costless, the bank could opt for any p it would wish through increasing n enough in order to transfer the responsibility

to the ECB, whose decision is again sensitive to the bank size. In that case, the only relevant restriction would be the ECB threshold.

Comparing the regulatory restrictions in the discretionary case leads us to the conclusion that, ceteris paribus, the subsidiary structure bank encounters stricter regulation than the branch structure bank, no matter who the regulator for the subsidiary bank is. For the national regulators, this is due to the branch bank regulator having to pay the deposit insurance for the whole bank, whereas the subsidiary bank regulator only pays for the home unit.[14] In contrast, the ECB intervention lowers the regulatory threshold for large subsidiaries, but now, the deposit insurance effect of the NCB regulating the branch bank dominates the systemic cost effect of the ECB, responsible for the subsidiary bank.

Finally, we formulate the bank maximisation problem in the first stage of the game:

$$\begin{aligned} & Max \quad E(\Pi) \quad s.t. \\ p &\geq \min\{p_{ECB}, p_{NCB}\} \\ E(\Pi(p_{REG})) &\geq E(\Pi(0)) \end{aligned} \tag{3.11}$$

The welfare consequences of the introduction of the ECB and of the discretionary regulatory game are summarised in the following proposition.

Proposition 6 *Assigning the LOLR responsibility according to the incentives of the regulators*

a) has no welfare effect for branch banks, and for small subsidiary banks with $n \leq \frac{s+1}{s}$*;*

b) decreases welfare for subsidiary structure banks with $n > \frac{s+1}{s}$*, for which* $p_{FB} > (C')^{-1}\left[\frac{C(p_{NCB})-C(p_{ECB})}{p_{NCB}-p_{ECB}}\right]$*, or for which* $p_{FB} < (C')^{-1}\left[\frac{C(p_{ECB})+1+s+\frac{v}{n}}{p_{ECB}}\right]$ *and* $\frac{C(p_{ECB})}{p_{ECB}} < H-1 < \frac{C(p_{NCB})}{p_{NCB}}$*; and*

c) increases welfare for all other subsidiary structure banks with $n > \frac{s+1}{s}$*.*

Proof. See the Appendix. ■

The first point of the Proposition is a straightforward consequence of Lemmas 8

[14] Repullo (2001) has a similar deposit insurance effect, but he only compares international branch bank regulation to that of a domestic bank.

and 9. In the branch bank case where the ECB turned out to be the stricter regulator, there is no change in the regulatory restriction, and hence, the veto right of the ECB does not have any welfare effects. The same applies for subsidiary structure banks with $n \leq \frac{s+1}{s}$.

In the subsidiary case with $n > \frac{s+1}{s}$, the NCB, not taking the effects of its actions abroad into account, may turn out to be too strict for some banks from the social welfare point of view. Here, the ECB intervention can indeed improve welfare if the bank has a low first best level of monitoring, i.e. is inefficient enough. A necessary condition for this is that $p_{FB} < p_{NCB}$. In the aggregate, however, this effect has to be balanced against the welfare-decreasing effect of more efficient banks that face more lenient regulation, as well as against that of inefficient banks that are encouraged to enter the market at the lower threshold but contribute negatively to welfare.

It is worth noting that the eventual welfare improvement of the discretionary game as to a single regulator does not originate from banks taking less risk in form of higher monitoring level; on the contrary, it results from the possibility to prevent too strict a national regulator from closing viable subsidiary structure banks. This will be the case only if the problem of too eager regulation exists in the first place, i.e. the externality of not considering the bank return has to dominate the time inconsistency problem. Then, the bank action and the choice of the identity of the regulator are strategic complements in welfare, so the bank action in the first stage of the game induces a socially more optimal regulatory response.

3.3.3 Commitment Game and the Optimal Rule

The design of the ECB veto right discretionary game drew on the formulation of the Treaty on the EU. In the following, we present an alternative approach to ambiguity that may be compatible with the prescription in the Treaty. In particular, the regulator is supposed to be able to commit to a rule on the identity of the LOLR, including the commitment to not specifying the identity. In other words, we ask whether and under which conditions it may be optimal not to explicitly appoint the LOLR responsibility to any of the regulators. The following lemma states the first necessary condition for constructive ambiguity.

Lemma 10 *For ambiguity of LOLR identity to be welfare improving, it must be that* $E[p_{REG}] \in (\min\{p_{ECB}, p_{NCB}\}; \max\{p_{ECB}, p_{NCB}\})$.

Proof. See the Appendix. ■

The necessary condition in Lemma 10 appears to be quite restrictive. For example, merely randomising which threshold is binding will not produce a role for constructive ambiguity. The reason is that as the banks just adjust their expectations as to the probability of a threshold being binding, they always choose either one of the thresholds. In this case, however, it would always be welfare-improving to announce the threshold that is closer to the first best.[15] Similarly, allowing the regulators to enter into negotiations on terms of rescue only lead the bank to expect rescue at the lowest regulatory threshold level.

Nevertheless, let us assume from now on that a mechanism that fulfils the necessary condition exists. As an approximation of ambiguity, let us assume that the bank attributes a weight z on the ECB and $(1-z)$ on the NCB, so that the bank forms its expectations such that the expected regulatory threshold becomes $E(p_{REG}) = zp_{ECB} + (1-z)p_{NCB}$. The optimal policy is then the solution of the following maximisation problem:

$$\begin{aligned} & & Max \quad U^{SOC}(p,z) \qquad s.t. \\ p &\in \arg\max E(\Pi) \\ p &\geq p_{REG} \in [p_{ECB}, p_{NCB}] \\ E[\Pi(E(p_{REG}))] &\geq E(\Pi(0)) \\ U^{SOC}[E(p_{REG})] &\geq 0. \end{aligned} \tag{3.12}$$

Note that the individual rationality constraint on the line 4 of Equation (3.12) is always fulfilled in $p \in (0, p_{REG})$ if the rationality constraint for the society is fulfilled.[16] The solution is summarised in the following proposition.

[15] For illustration, the randomising game of incomplete information is presented in Section 3.A in the Appendix.

[16] This is because, as long as $p \leq 1$, $U^{SOC} = E(\Pi) - externalities \leq E(\Pi)$.

Proposition 7 *a) As long as* $p_{ECB}, p_{NCB} \leq p_{FB}$*, the optimal rule of the commitment game is a corner solution with* $p_{REG} = \max\{p_{ECB}, p_{NCB}\}$*;*

b) If $p_{NCB} < p_{FB} < \min\{p_{ECB}, C^{-1}[p_{ECB}H - s]\}$*, or*

$p_{ECB} < p_{FB} < \min\left\{p_{NCB(S)}, C^{-1}\left[p_{NCB(S)}H - \frac{(s+1)\left(s+\frac{v}{n}\right)}{v+s+1}\right]\right\}$*, the optimal rule is to choose* $z^* = \frac{p_{FB}-p_{NCB}}{p_{ECB}-p_{NCB}}$*, in which case* $E(p_{REG}) = p_{FB}$*;*

c) In all the other cases, the optimal rule is to choose $p_{REG} = \min\{p_{ECB}, p_{NCB}\}$*.*

Proof. See the Appendix. ■

Hence, the coexistence of the ECB and the NCB can indeed improve upon the NCB also in cases where the NCB was too lenient due to the time inconsistency problem in the first place. For those branch structure banks for which the NCB would be too lenient but the ECB is too strict, ambiguity is constructive. In addition, ambiguity allows improving upon the discretionary solution for those subsidiary structure banks, for which the NCB is too strict and the ECB too lenient.

Ambiguity in identity is constructive only in the case that either one, but only one, of the regulators is too strict and practises inefficient closures of banks that would have a positive social value at the first best. This happens for banks that are relatively inefficient. Therefore, if a mechanism exists to alter the expectations of the bank away from the regulatory thresholds, one too tight a regulator makes the first best solution achievable. In the case of both regulators being too strict, the bank will be kept open only if the rationality constraint of the social planner is fulfilled at the lower regulatory threshold. The optimal rule for those banks thus coincides with the discretionary solution.

Note that the commitment game always improves upon the discretionary game. This is not surprising because, if the discretionary solution would be optimal, the social planner could choose it in the commitment game; however, the possibility to commit enlarges the strategy space of the social planner.

Commitment to ambiguity in identity thus allows in theory to compensate somewhat for the time inconsistency problem. However, the welfare improvement applies only for a limited class of banks for whom one of the regulators is too strict, as in Lemma 7. Next, we demonstrate how sensitive the result of constructive ambiguity is with the help of some robustness checks.

3.4 Robustness

The existence of constructive ambiguity was shown in a fairly general time inconsistency framework. In order to see how robust the results are, we restrict the setting through first introducing a specific cost function for monitoring, and then assuming that the regulators actually maximise welfare within their jurisdictions according to the home country control principle. We then drop the assumption of the deposit insurance costs exceeding the systemic costs and see how this affects the results.

3.4.1 Quadratic Costs and Welfare-Maximising Regulators

Whereas the specification of the cost function restricts the level as to which the banks can improve their efficiency, assuming welfare-maximising regulators changes the regulatory trade-off by decreasing the externalities that counteract the time inconsistency problem. The following corollary sums up the results.

Corollary 2 *Assume a quadratic cost function* $C(p) = \frac{p^2}{2\beta}$*, or alternatively, welfare-maximising regulators within their jurisdictions. Then it is true that*

a) The discretionary game reduces welfare as to the single regulator case;

b) The optimal rule for all banks is $p_{REG} = \max\{p_{ECB}, p_{NCB}\}$.

Proof. See the Appendix. ■

The intuition for the quadratic cost function result is that, the cost function having relatively little curvature, it is relatively expensive for the banks to monitor. Consequently, no improvement of the efficiency parameter β is sufficient to bring those banks into producing social surplus. In particular, if the NCB threshold lies above the first best monitoring level, the banks have no incentives to be in action either, since their individual rationality constraint is not fulfilled. However, this is not necessarily the case for the ECB threshold; therefore, the ECB intervention that decreases the regulatory threshold for the large subsidiary banks induces some of them into action. Nevertheless, as the social rationality constraint however remains negative, the effect on welfare is in this case decreasing.

As to the welfare-maximising regulators, we see that regional externalities alone are not sufficient for constructive ambiguity in identity to emerge. As in Mailath & Mester

(1994), a welfare-maximising regulator internalises all benefits from bank actions. The reason why the regulators do not become too strict is that the expected bank return now increases the value of continuation. Combined with the effect of closure costs that works to make closure even less attractive, the time inconsistency problem dominates the regulatory externalities effect.

3.4.2 Deposit Insurance versus Systemic Costs

So far, we have assumed that the deposit insurance payments exceed the systemic costs. However, as only part of the bank liabilities may be insured, and as the deposit insurer may be able to collect some liquidation value in order to diminish the deposit insurance payments at the time of bank closure, it may be reasonable to consider the opposite case. Consequently, we now drop the assumption of $s < 1$. Thus, in what follows, the deposit insurance payment, not the liabilities in total, is normalised to one. However, we still assume that both costs increase proportionally to the level of international activities. We now consider the effect on the results presented in the paper.

If the systemic cost effect is larger than the deposit insurance cost, the ECB in particular becomes more sensitive to the time inconsistency problem. It follows that the subgame perfect equilibrium in the discretionary game divides the regulation of the branch bank as follows: if $n < \frac{s}{s-1}$, the NCB will give the loan iff $p_{NCB(B)} \leq p < p_{ECB}$, and the ECB will give the loan iff $p \geq p_{ECB}$. As to the NCB threshold for a subsidiary structure bank, the relation between the ECB and NCB thresholds remains the same as before.

In sum, changing the relation of the deposit insurance to the systemic cost qualitatively affects only the regulation of large branch structure banks, which becomes more lenient. As a consequence, the ECB veto right may have welfare effects not only in case of large subsidiary banks, as in Proposition 6, but through the regulation of large branch banks, the direction of this effect depending on the efficiency of those banks. In the similar vein, an additional condition for constructive ambiguity should be included in Proposition 7, concerning the large banks whose first best monitoring level is situated between the too strict NCB and the too lenient ECB.

3.5 Implementation

We saw that the second best rule includes constructive ambiguity for a category of banks that are relatively inefficient, but efficient enough to be kept in action, and not the most inefficient ones in the market. The question arises how this constructive ambiguity could be implementable. Already, Lemma 10 points to problems in mechanism design, as it is difficult to find a mechanism that changes the banks' expectations from the ECB and NCB thresholds.

Second, the optimal policy was contingent on the efficiency of the banks. However, it is questionable whether the efficiency of the banks is verifiable information, on which the regulators can commit. Surely, efficiency is a more permanent feature than the risk level of the bank assets. But as we search for a tool to mend the problem of non-verifiability in monitoring via policy based on verifiable aspects, caution is needed.

Third, Section 3.4 demonstrated that constructive ambiguity only exists under fairly strict conditions. In particular, distortionary regulatory incentives that lead to inefficient bank closures are needed, and bank monitoring has to be expensive enough.

Suppose that the social planner is able to observe the overall efficiency of its banking sector The following Corollary then proposes a third best rule.

Corollary 3 *a)If there are a lot of inefficient banks in the economy, the fourth best rule is to give the ECB a veto right;*

b) If most of the banks are efficient enough, implement the rule

$p_{REG} = \max\{p_{ECB}, p_{NCB}\}$.

Following from Lemmas 8 and 9, the third best solution is a rule contingent on the size and the ownership structure of the bank. In general, it may be assumed that most of the banks are efficient, and that the improvement on the banks' risk behaviour dominates the effect of decreased social welfare due to stricter regulation of less efficient banks. Therefore, appointing regulation to the regulator with the maximum threshold will be socially optimal in most cases. In practice, this implies exactly the opposite of the discretionary solution: Depending on whether the deposit insurance costs are assumed to be higher or lower than the systemic costs arising from a bank failure, either all or just small branch banks, and small subsidiaries, should be regulated by the ECB, whereas the regulation of large subsidiaries should be appointed to the NCB.

3.6 Conclusion

The objective of the chapter was to consider the notion of constructive ambiguity in identity and to ask whether it could compensate for the time inconsistency problem of regulating observable but nonverifiable bank risk taking. In so doing, the paper comments on the political discussion evolving around the Treaty on the EU that gives some leeway as to who is to act as the LOLR in Europe.

It turned out that the ECB intervention can indeed improve social welfare, if it is introduced as a size and ownership contingent rule. Ambiguity, on the contrary, was welfare-improving for a very limited class of relatively inefficient banks, and detrimental in case of all the other banks.

When evaluating the regulatory mechanism, the social planner faces a trade-off between the effects of the time inconsistency problem, on the one hand, and the possibility of an inefficient bank closure due to cost-minimising regulators, on the other. Since leaving the bank open almost always contains a positive probability that the bank will not go bankrupt, the time inconsistency problem is inherent to regulatory policy as long as there are closure costs present, for which the regulator cares. As in Tirole (1994), the magnitude of the effect can be decreased by appropriate regulatory design, i.e. by appointing responsibilities to regulators that are only partially concerned about the closure costs.

The chapter showed that, if banks indeed prefer a monitoring level that is inferior to the social optimum, and if the first best regulation is not achieved in terms of closure policy due to closure costs, commitment to a rule is superior to a policy where the contract on identity is left open in case of most banks. As the bank, by choosing a lower monitoring level, induces the laxer regulator to take action, there is no justification for incomplete contracts in those cases where the two actions are strategic substitutes in welfare. In general, it was shown that a necessary condition for ambiguity to be beneficial, i.e. to improve the risk behaviour of the bank in terms of welfare, was that it has to create an expected threshold that differs from those of the two regulators. Furthermore, this threshold has to represent a pareto improvement when compared to the ECB and NCB thresholds. This is the case only for banks for which one, but only one, regulator is too strict due to regulatory externalities that counteract the time inconsistency problem. It was further shown that if the regulators are welfare-maximising, or if the cost function has a quadratic form, these banks do not exist, and ambiguity in identity does not have any constructive role in terms of improving welfare.

Finally, the weight put on systemic costs against the deposit insurance concerns of the regulators only slightly affected the results. The optimal rule, applicable for the most cases, appoints the regulation of branch banks and of small subsidiary structure banks to the ECB, whereas the large subsidiary structure banks should be regulated by the NCBs.

This chapter looked at ambiguity in identity in the most intuitive way, given the current legislation and the political discussion around it. Alternative approaches, left for future work, would include introducing information asymmetries between the regulators, or risk of collusion. A relevant and interesting modification would be to consider constructive ambiguity in regulatory identity as a self-selection mechanism in presence of hidden information on bank risk taking.

Appendix 3

3.A Randomising LOLR Identity in a Dynamic Game with Incomplete Information

I will approximate the mixed strategy concept of policy ambiguity as to the identity question with a dynamic game of incomplete information, where the identity of the LOLR is chosen by nature. Note that this is not constructive ambiguity in the sense of mixed strategy, as would be in the case of a national regulator randomising on lending policy. Rather, the bank does not know which game is played, the one with the national regulator or the one with ECB. There is incomplete information as to which node the bank is situated after the random choice of regulator. The bank then attributes probabilities to these nodes and calculates the expected return.

A mixed strategy assumes perfect information on payoffs of the other player; on the contrary, in the European LOLR identity game, the type of the regulator is not known, and the payoff of the regulator changes according to its type. Note that a mixed strategy may very well be implemented in case of a single regulator deciding whether to give emergency lending or not: here, the expected payoff of the regulator of course remains the same throughout the game.

The maximisation problem is as follows:

$$\begin{aligned} & & & MaxU^{SOC}(p,z) \quad s.t. \\ & p & \in & \arg\max E(\Pi) \\ & p & \geq & p_{REG} \in \{p_{ECB}, p_{NCB}\} \\ & E[\Pi(p_{REG})] & \geq & E[\Pi(0)] \\ & U^{SOC}(p_{REG}) & \geq & 0. \end{aligned}$$

Given that the social rationality constraint is fulfilled, the bank chooses the regulatory threshold that is closer to the first best monitoring level as long as the probability of that regulator exceeds a particular level. Therefore, the optimal solution is either $z^* = 0$ or $z^* = 1$. The perfect Bayesian equilibrium of this problem is to choose the regulator that maximises social welfare; there is no role for ambiguity.

3.B Proofs

Proof of Proposition 6

The bank maximises its profit given the regulatory reaction in stage three:

$$\begin{array}{rcl} & \underset{p}{MaxE}\left(\Pi\right) \quad s.t. & \\ p & \geq & \min\left\{p_{ECB}, p_{NCB}\right\}. \end{array}$$

This is a concave maximisation problem with a linear constraint, so the solution will be

$$p = \begin{cases} p^* \equiv \left(C'\right)^{-1}\left(H-1\right) & if \quad \left(C'\right)^{-1}\left(H-1\right) \geq \min\left\{p_{ECB}, p_{NCB}\right\} \\ \min\left\{p_{ECB}, p_{NCB}\right\} & otherwise. \end{cases}$$

In order to derive the welfare effect, we need to distinguish between the cases where the regulator with the smaller threshold is the NCB and where it is the ECB. If the minimum threshold is that of the NCB, there is no welfare effect at all since, from backward induction, the only effective threshold is the NCB and the emergence of the ECB does not change anything in regulation in that case. So, from the part of branch banks and small subsidiary banks, there is no change in welfare. For large subsidiary structure banks, however, we have a welfare effect, since the more lenient regulator is the ECB. In terms of an individual bank, since the maximisation problem of the society is single peaked and since for the society it is desirable to get as close to p_{FB} as possible, the only way for the ECB intervention to be welfare improving is to get a bank closer to p_{FB}. This happens if $U^{SOC}\left(p_{ECB}\right) > U^{SOC}\left(p_{NCB}\right)$. In addition, as for some banks it may be that $E\left[\Pi\left(p_{NCB}\right)\right] < E\left[\Pi\left(0\right)\right]$ but $E\left[\Pi\left(p_{ECB}\right)\right] \geq E\left[\Pi\left(0\right)\right]$, only those

banks for which $U^{SOC}(p_{ECB}) > 0$ improve welfare, as the ones with $U^{SOC}(p_{ECB}) \leq 0$ decrease it.

The former inequality will be fulfilled if

$$p_{FB} < \overline{p}_{FB} \equiv (C')^{-1}\left[\frac{C(p_{NCB}) - C(p_{ECB})}{p_{NCB} - p_{ECB}}\right].$$

Note that an improvement in welfare implies that $p_{NCB} > p_{FB}$.

If $p_{NCB} > p_{FB}$, ECB may improve welfare by letting surplus generating banks to operate that under NCB would have been eliminated from the market. Nevertheless, it is also possible that welfare decreasing banks that previously were discouraged to operate by the NCB now enter. The welfare decreasing banks are those for which the individual rationality constraint is fulfilled at p_{ECB} but not at p_{NCB}, and for which additionally the social rationality condition is not fulfilled at p_{ECB}. This turns into

$$p_{FB} < (C')^{-1}\left[\frac{C(p_{ECB}) + 1 + s + \frac{v}{n}}{p_{ECB}}\right] \quad \cap \quad \frac{C(p_{ECB})}{p_{ECB}} < H - 1 < \frac{C(p_{NCB})}{p_{NCB}}.$$

Thus, the welfare effect of discretion is positive for subsidiary banks with $n > \frac{s+1}{s}$, for which $p_{FB} < \overline{p}_{FB} \equiv (C')^{-1}\left[\frac{C(p_{NCB})-C(p_{ECB})}{p_{NCB}-p_{ECB}}\right]$ and which belong to the complement of the above mentioned set; for all other subsidiary banks with $n > \frac{s+1}{s}$, the welfare effect is negative.

Proof of Lemma 10

Assume the social welfare maximising problem with $p_{REG} \in \{p_{ECB}, p_{NCB}\}$. This is equivalent to the game of incomplete information in Section 3.A in the Appendix, where it was shown that the social welfare will be maximised through appointing regulation to the regulator whose threshold is closer to the social optimum.

Assume the social welfare maximising problem with $p_{REG} \in [0, \min\{p_{ECB}, p_{NCB}\})$ or $p_{REG} \in (\max\{p_{ECB}, p_{NCB}\}, 1]$. In the first case, it is incentive compatible for both regulators to close the bank at p_{REG}, and in the second case, to leave the bank open. Therefore, these values are not attainable for the social planner.

Therefore, if it is possible to get a solution where the incentives of the regulators are combined such that $p_{REG} \in (p_{ECB}, p_{NCB})$, there may be a chance for constructive ambiguity.

Proof of Proposition 7

The optimal rule on regulatory identity is the solution to the following maximisation problem:

$$\begin{aligned} & & Max \quad U^{SOC}(p,z) \qquad s.t. \\ p & \in & \arg\max E(\Pi) \\ p & \geq & p_{REG} \in [p_{ECB}, p_{NCB}] \\ E[\Pi(E(p_{REG}))] & \geq & E(\Pi(0)) \\ U^{SOC}[E(p_{REG})] & \geq & 0. \end{aligned}$$

We can eliminate the individual rationality constraint on line 4 through the fact that it is fulfilled as long as the society rationality constraint on line 5 is fulfilled. The society rational constraint is fulfilled at p_{FB} as long as $p_{FB} \geq \frac{C\left[(C')^{-1}\left(H+s+\frac{v}{n}\right)\right]+s+\frac{v}{n}}{H+s+\frac{v}{n}}$. As the maximisation problem of the society is concave, it follows that as long as this condition is fulfilled, the social and individual rationality constraints are fulfilled for all $p_{REG} \leq p^{FB}$.

a) As U^{SOC} is increasing in p as long as $p_{REG} < p_{FB}$, for those banks, there is no interior solution in z that improves upon the corner solutions $z^* = 1$ if $p_{ECB} > p_{NCB}$ and $z^* = 0$ if $p_{ECB} < p_{NCB}$.

b) If one of the regulatory thresholds exceeds p_{FB}, it becomes possible to achieve the first best. Choosing z^* as given above produces $E(p_{REG}) = p_{FB}$, which means that the individual and society rationality constraints are again fulfilled as long as $p_{FB} \geq \frac{C\left[(C')^{-1}\left(H+s+\frac{v}{n}\right)\right]+s+\frac{v}{n}}{H+s+\frac{v}{n}}$. Combining this with the requirement that $p_{REG} > p_{FB}$ for one threshold we get the ambiguity condition: Ambiguity increases welfare iff

$p_{NCB} < p_{FB} < \min\{p_{ECB}, C^{-1}[p_{ECB}H - S]\}$, or iff

$$p_{ECB} < p_{FB} < \min\left\{p_{NCB(S)}, C^{-1}\left[p_{NCB(S)}H - \frac{(s+1)\left(s+\frac{v}{n}\right)}{v+s+1}\right]\right\}.$$

c) In all the other cases, either the society rationality constraint cannot be fulfilled, or, as $p_{FB} < p_{REG}$, it is optimal to choose the regulator with the lower threshold.

Proof of Corollary 2

Quadratic cost function: If $C(p) \equiv \frac{p^2}{2\beta}$, the condition $U^{SOC}(p_{FB}) \geq 0$ can be expressed as $\beta \geq \frac{2[v+n+ns]}{n\left(H+s+\frac{v}{n}\right)}$. For $p_{ECB} > p_{FB}$ to be true, it must be $\beta < \frac{v}{(v+ns)\left(H+s+\frac{v}{n}\right)}$, and $p_{NCB(S)} > p_{FB}$ implies $\beta < \frac{v}{(v+s+1)\left(H+s+\frac{v}{n}\right)}$, which both do not fulfil the social rationality constraint. As the restriction for the NCB threshold in case of branch structure bank is even tighter, the same applies to it. It follows that all socially desirable banks have $p_{REG} < p_{FB}$. For these cases, the optimal rule was $p_{REG} = \max\{p_{ECB}, p_{NCB}\}$.

As to the individual rationality constraint, the requirement $E(\Pi(p_{ECB})) \geq 0$ can be expressed as $\beta \geq \frac{v}{2(H-1)(v+ns)}$. Now, this is compatible with the requirement of $p_{NCB(S)} > p_{FB}$ iff $n > \frac{v(2-H)+Hs+sv+s^2+H+s+\sqrt{[v(2-H)+Hs+sv+s^2+H+s]^2+8sv(H-1)(2+s)}}{4s(H-1)}$. Remember however that for these banks, $U^{SOC}(p_{FB}) < 0$. In the aggregate, they thus reduce welfare in the discretionary game.

Welfare-maximising regulators: Assume the regulators maximise welfare within their jurisdictions, i.e. take the expected bank returns into account. The utilities for the ECB are as follows:

$$\begin{aligned} a_{ECB} &= L: \qquad U_{ECB} = n[p(H-1) - C(p)] - (1-p)(v+ns+n) = U^{SOC} \\ a_{ECB} &= C: \qquad U_{ECB} = -nC(p) - n - ns. \end{aligned}$$

As $U_{ECB(OPEN)} = U^{SOC}$, and as $U_{ECB(OPEN)}(p=0) < U_{ECB(CLOSE)}$, for every bank for which $U^{SOC}(p_{FB}) \geq 0$, it must be that $p_{ECB} < p_{FB}$. The same applies for $p_{NCB(S)}$ and for $p_{NCB(B)}$. The consequences are as in the case of the quadratic cost function.

Chapter 4

Strategic Bank Takeovers and the Cost of Capital

4.1 Introduction

It is nowadays common procedure in theoretical banking literature to assume that bank capital is costly. As a consequence, banks, if not subject to minimum capital requirements, often prefer to finance their activities with deposits only[1]. In real life, however, one observes that many banks hold more capital than demanded by the regulator.

At the same time, foreign direct investment in the banking sector is unevenly distributed around the world[2]. The phenomenon is clearly present in the EU: Whereas foreigners own almost entire banking sectors in some CEE countries, foreign ownership of banks is still relatively rare in the old EU member countries. A broader look at the financial markets of the two EU areas reveals further differences. In particular, although the whole of Europe is rather bank concentrated when compared to the US[3], the significance of stock markets in the CEE countries is even smaller than those of the EU-15.

The objective of the model is to consider the effect of restricted capital supply and of banking regulation on the international structure of banking markets and on stability. For this purpose, a model on financial structure decision of a domestic and of an

[1] Examples include Bolton & Freixas (2000) and Hellmann & al. (2000).

[2] For evidence on the dispersion of the foreign direct investment in banking, see e.g. Berger & al. (2000) and Clarke & a. (2003).

[3] See e.g. Allen & Gale (2000a).

multinational bank is proposed. The banks face a trade-off between the costly capital and the probability of being allowed to continue and preserve the charter value. In particular, it is assumed that the direct link between the price of capital and the solvency probability is disconnected, i.e. that the market specific factors dominate the bank specific ones. This is justified with supply side considerations such as heterogeneous liquidity needs of the agents who decide whether to hold shares or deposits, and with some asymmetric information prevailing, as in the Gorton & Pennacchi (1990) lemons cost model. Moreover, these liquidity needs may differ across societies, according to their wealth or to some factors related to the financial market structure.

The second focal point of the modelling approach at hand is the effect of international takeovers. In particular, incentives of a bank to acquire a foreign bank and the link to the bank capital choice and to stability are studied. Furthermore, we are interested in the effect of minimum capital requirements on those incentives.

It turns out that takeover incentives imply a dispersion of foreign direct investment such that a division of the market to home and host countries occurs. What is more, introducing minimum capital requirements amplifies this effect, directing foreign direct investment towards the less developed markets. Finally, as this leads to an increase in bank capital in markets where it has a relatively larger negative effect on the probability of bank failure, this amplification is stability increasing.

In the model, bank capital is costly, and deposits are subject to a comprehensive deposit insurance. As a consequence, a higher level of capital increases the costs of financing by decreasing the value of the deposit insurance, and, absent other effects, the bank would consequently prefer deposits to capital. However, the opposite side of the capital trade-off results from the probability of being able to preserve the charter value, which increases in capital, as the regulator will close the bank as soon as the random return does not cover the deposits payable.

Internationalisation of the bank via subsidiary structure works as an option for the bank: since the subsidiary is considered as an asset of the parent bank, it is allowed to go bankrupt independently, the parent being liable only to the extent of capital invested in the subsidiary. As a consequence, the probability of preserving the charter value in the home country is isolated from the probability of success in the host country. The probability of preserving the charter value in the host country is now, however, dependent on the risk in the home country, as the failure of the home unit implies failure of the host unit as well.

It turns out that the bank faces a trade-off between capital and deposits such that

it may choose an interior point. Moreover, internationalisation changes the liability structure of the bank, on the one hand, thereby creating incentives to shift bank capital from the host to the home unit. On the other, as it turns out that the takeover decreases the price of capital for the host country unit, the increase in allocative efficiency induces the bank to raise the overall amount of capital. Whether this trade-off leads to more or less capital in the host unit after the takeover depends on the difference in the price of capital between the two markets. Introducing minimum capital requirements in the home country is then shown to increase takeovers, as multinational banks prefer to hold more capital than domestic ones. Introduction of minimum capital requirements in the host country directs foreign direct investment in banking towards the least developed markets, as multinational banks prefer to hold more capital in relation to the price of acquisition, the less developed the market.

Due to its concentration on the supply side of bank capital, the model belongs to the strand of literature that considers a bank as liquidity provider for depositors. The seminal Diamond & Dybvig (1983) contribution combines consumers' unexpected liquidity needs with an exogenous cost of early liquidation of an investment project and creates a role for the bank as a liquidity insurer. Within this framework, the price advantage of deposits as to capital has been modelled by Gorton & Pennacchi (1990), who introduce imperfect information on assets and show that bank deposits arise endogenously as a solution for uninformed traders to protect themselves against the informed traders in the market. Relatedly, the cost of bank capital has been modelled as an information cost in Bolton & Freixas (1998, 2000).

The bank's capital decision has been studied by Gorton & Winton (1995, 2000), among others, who use the idea of liquidity in Gorton & Pennacchi (1990) to derive the cost of bank capital from the role of demand deposits as the ideal medium of exchange. The bank, wishing to preserve its charter value, decides on equity in a general equilibrium framework with information sensitive bank capital and liquidity constrained agents. Concentrating on the bank's asset side, Diamond & Rajan (2000) derive the price of bank capital from its negative effect on liquidity creation in terms of the bank's ability to collect loans effectively. Under asymmetric information, capital then protects against inefficient bank runs. Most of the work on bank capital however assumes a constant cost on it. Bolt & Tieman (2004) derive an interior solution in a dynamic framework related to Hellmann & al. (2000), where more capital raises the expected life span of the bank. Equally in a dynamic setting, Milne & Whalley (2001) find that minimum capital requirements at the end of the project result in banks holding capital buffers over the minimum. A different approach is taken by Froot &

Stein (1998), who interestingly show how the bank's capital decision can be linked with the amount of nontradeable risk and affects the bank's degree of risk aversion. Finally, Dietrich & Vollmer (2004) have studied the capital decision of the bank in the Diamond & Rajan (2000) framework and show that with risky renegotiations and a risk averse bank with decreasing absolute risk aversion, the bank may choose capital in excess of regulatory requirements as a negotiation tool against the borrower.

The incentive effect of minimum capital requirements on bank behaviour has been studied mainly in terms of bank risk taking. Koehn & Santomero (1980) find out that minimum capital requirements can increase bank risk taking, and increase the dispersion of risk in the banking sector in total. Kim & Santomero (1988) then derive theoretically correct risk weights for bank assets and correct for the unintended negative effect on stability. Equally, Giammarino & al. (1993) study the optimal regulation of bank capital and show that high asset quality should induce lower minimum capital requirements. Milne (2002) contests this view and shows that with a penalty associated with ex post breaching the minimum capital requirement, banks have an incentive to hold capital above the minimum, which leads to simple capital adequacy requirement possibly being sufficient to improving the banks' asset quality. With a slight change in point of view, Hellmann & al. (2000) show that if deposit rates can be set freely, minimum capital requirements increase incentives of banks to offer high deposit rates, which can endanger stability. They show that a combination of minimum capital requirements and deposit rate controls leads to Pareto-efficiency. Finally, in a multinational setting, Loranth & Morrison (2003) find out that minimum capital requirements lead to underinvestment of multinational banks due to a combination of risk diversification and capital increase effect on the value of deposit insurance, and therefore, they should be adjusted for the risk diversification effect inherent to multinational banking.

In contrast to the bank capital regulation literature mentioned above, our work concentrates on the effect of minimum capital requirements on the takeover incentives and further on stability. Unlike in Koehn & Santomero (1980) or in Hellmann & al. (2000), it turns out that the result, i.e. the increased incentives for takeovers in case of minimum capital requirements in the home country and the greater concentration of foreign ownership in case of host country regulation, does not necessarily conflict with the stability objective of regulation. On the contrary, the stability effect is strengthened in the least developed financial markets, where such an effect is most welcome.

Finally, the empirical literature on the incentives for foreign direct investment in the banking sector has traditionally divided the causes into push factors that depend on the

home country, and into pull factors depending on the host market[4]. The present work stresses the importance of the financing conditions in both countries. At a theoretical level, Repullo (2001) considers the determinants of international takeovers and finds out that the smaller the target bank and the riskier its investments relative to the parent bank, the more likely the takeover is to happen. Moreover, a takeover is almost always welfare improving. However, he does not consider subsidiary structure, and as there is no capital in the model, liquidity shortages in the host country or capital requirements cannot play any role.

The structure of the chapter is as follows: The general model and the bank trade-off is first presented in Section 4.2. After that we proceed with linear capital costs in Section 4.3 and show that, with the linear cost of capital, bank capital in the economy is increased after the takeover, and derive explicit solutions. Section 4.4 then considers the effect of minimum capital requirements. Finally, we conclude.

4.2 Model Structure

In the following, a banking model with an at least weakly increasing and weakly convex cost of capital function and with a charter value is proposed. The purpose is, first, to show the effect of these elements on the bank's maximisation problem and, second, to demonstrate the departure from the assumption that the bank's financial structure is always determined by the regulatory minimum capital requirement. In this section, the role of the agents in the economy is further explained, after which we proceed with the trade-off of a domestic bank. Finally, the takeover condition used in the model is presented.

[4]Clarke & al. (2003) provide a survey on the topic. Berger & al. (2003) and Clarke & al. (2003) find evidence on the importance of the legal and financial market conditions in the host market as a driving force behind foreign bank entry, and Claessens & al. (2001) on the higher profit opportunities as a reason for entry especially in the less developed economies. In terms of pull factors, Berger & al. (2000) stress the role of the regulatory and financial market framework in the home country. For banks investing in the CEE countries in particular, de Haas & van Lelyveld (2003) find evidence of them not being capital-constrained, which points towards favourable financial conditions in the home country.

4.2.1 Shareholders and Depositors

A key argument is that the bank has to not only acquire deposits but also equity from the financial markets. This has consequences in terms of the cost of bank capital, but also in terms of actions that the bank can undertake. In the case where the realised return does not cover all claims payable, the depositors have the senior claim, followed by the shareholders. The last claimant is thus the bank itself, wanting to preserve its charter value by continuation of activities. This continuation is only possible if the depositors, represented through the regulator, and the shareholders agree.

The crucial assumption made here is that the bank has to compensate not only for the risk of bankruptcy but also for the liquidity risk of the shareholders. This risk increases in bank capital. In the following, it will be assumed that the liquidity risk always dominates the solvency risk considerations of the shareholders in the sense that the cost of capital is at least weakly increasing and convex in the level of capital for any society. In other words, $\rho'(K) \geq 0$ and $\rho''(K) \geq 0$. In addition, it is assumed that $\rho(0) = 0$.[5]

The deposits are fully insured in the model and can be withdrawn at any time. They are thus the ideal asset for the agents having a high probability of unforeseeable liquidity needs. As the international subsidiary structure bank belongs to the jurisdiction of the home country regulator for its domestic unit and to that of the host country regulator for its subsidiary, the regulator has a right to the returns within the country in order to diminish the deposit insurance payments, but does not have access to the returns in the other country.

4.2.2 Bank Trade-off

When raising capital, the bank has a trade-off between the probability of preserving the charter value C, on the one hand, and the cost of capital due to the liquidity and solvency risks of the shareholders, on the other. The charter value can be thought of reflecting the value of information inherent to relationship banking and cannot be alienated from a specific bank[6]. We assume that the banker is able to extract this value

[5] One can think of a Gorton & Winton (1995, 2000) type of economy, where bank capital bears a lemon's share due to asymmetric information as to the bank return, and heterogeneous liquidity needs make it more profitable for one part of the population to hold deposits instead of shares, given the price in the market.

[6] See e.g. Petersen & Rajan (1994) for evidence on the value of bank relationships. An alternative treatment for the charter value would be to consider it as the present value of the expected future

as a payment. The investment yields a random return $\widetilde{R}$, which is not influenced by the financial structure choice.[7] The timing of the domestic banking game is as follows[8]:

1. The bank acquires capital K and deposits $D \equiv 1 - K$ and invests in a project.
2. Returns materialise.
3. The regulator closes the bank if the random bank return does not cover the deposits payable.
4. Depositors and eventually shareholders are compensated.

The bank's payoff structure is determined as

$$\Pi = \begin{cases} \widetilde{R} + C - \rho(K) K - 1 & if \quad \widetilde{R} \geq 1 - K \\ 0 & if \quad \widetilde{R} < 1 - K \end{cases} . \tag{4.1}$$

The return on investment $\widetilde{R}$ is assumed to be a random variable, distributed uniformly in $[0, 2]$. The cut-off value reflects the regulatory bank closure in the case that the return will not cover the deposits payable. Under the distributive assumptions, the probability of bank survival, $\Pr ob\left(\widetilde{R} \geq 1 - K\right)$, becomes $\frac{1+K}{2}$. The conditional expectation of the return, $E\left(\widetilde{R} \mid \widetilde{R} \geq 1 - K\right)$ then becomes $\frac{3-K}{2}$. The conditional expectation decreases in the amount of capital: given that the amount of capital is low, the bank needs a relatively high return in order to be able to cover the deposits payable and not to be closed, and vice versa. The bank maximises its expected return:

$$\underset{K}{Max} \quad E(\Pi) = \left(\frac{1+K}{2}\right)\left(\frac{3-K}{2} + C - \rho(K) K - 1\right). \tag{4.2}$$

Note that the probability of success is a positive function of K, whereas an increase in K decreases the value of the bank in terms of lower conditional expected returns and the cost of capital. Maximising over K produces the following trade-off:

returns. This approach would lead to an interior solution in bank capital for the domestic bank. The introduction of the multinational bank would, however, make the model intractable, not the least because of the complications in the shareholders' decision process as to the closure of the subsidiary.

[7] Note that we depart from e.g. Koehn & Santomero (1980) and Kim & Santomero (1988) and Loranth & Morrison (2003), who all consider the effect of capital on risk taking incentives. Our goal is to study the effect on incentives to internationalise.

[8] Again, the multinational banking framework requires us to remain in a single period framework for analytical tractability. For repeated games in banking with charter value, see e.g. Hellmann & al. (2000) or Bolt & Tieman (2004).

$$\rho'(K) = \frac{C - K - (1 + 2K)\,\rho(K)}{K + K^2}. \tag{4.3}$$

That is, in the optimum, the bank equals the marginal cost of capital with the net marginal utility of holding it. The latter is increased in the charter value of the bank: as increasing K increases the probability of success, the value of this effect depends on the charter value. The marginal utility is diminished by the change in conditional expectations on the return and by the increased probability that the shareholder compensation $\rho(K)$ will become due, as the probability of the good outcome increases. The solution of the maximisation problem is characterised in the following Lemma:

Lemma 11 *With $\rho''(K) \geq 0$, the bank's maximisation problem is concave for $K \geq 0$ and has an interior maximum $K \in (0, 1)$ for some parameter values.*

Proof. See the Appendix. ■

This lemma says that, even though capital is costly, it may be that the bank chooses to hold some of it. In particular, the potential regulatory requirements on the amount of capital are no more necessarily binding.

Two features are necessary for achieving the interior maximum. First, the bank would choose the minimum level of capital, unless there was an advantage from continuing that is not negatively influenced by higher capital level.[9] In this model, the charter value plays the role of this additional benefit. Second, and maybe surprisingly, the mere existence of charter value is not enough to move the result from the corner solutions, but the need to compensate the shareholders for liquidity risk is crucial.[10] Intuitively, increasing capital just above zero has a sure and relatively high cost, but the increase in the probability of success is minimal. On the other hand, decreasing capital just below one has a small utility in terms of saving the cost of it that will be dominated by the decrease in the probability of success. In sum, both the charter value and market specific costs for capital are needed for an interior solution.

[9] Recall that the conditional expected return was decreasing in capital.

[10] More formally: If the only concern would be the solvency risk, the price the shareholders would demand would be $\frac{1-K}{1+K}$ with a decreasing derivative $\frac{\partial \rho}{\partial K} = \frac{-2}{(1+K)^2}$, and the model would result into corner solutions $K \in \{0, 1\}$ with a minimum in $K = 1 - C$.

4.2.3 Takeover Condition

We next proceed with considering the incentives for international acquisitions. If the takeover is to be profitable for the raider bank, the expected return of the international bank must exceed the sum of the opportunity cost of operating as a domestic bank and the compensation due to the host country shareholders. As we have perfect information in the model, this is equivalent to saying that the takeover takes place if the value of the multinational bank is larger than the summed-up value of the two domestic banks[11]. More precisely, the home bank will take the host bank over iff

$$E(\Pi_C) \geq E(\Pi) + E(\Pi^*).^{12} \tag{4.4}$$

Later on, it will turn out that we can reformulate the takeover condition as a decision rule contingent on the price of capital in the host markets.

In the following, the basic model is used to analyse the influence of the cost of capital on internationalisation of the banking sector and on stability. For the sake of analytical tractability, we assume the cost of capital -function to be linear from now on.

[11] Perfect information has the consequence that the minimum bid price of the share, i.e. the price that the raider at least has to pay to the host country shareholders, is equivalent to the expected return per share with the current capital level

[12] The results of the paper are not dependent on how the surplus is divided between the buyers and the sellers. To see this, note first that the equilibrium capital levels are determined independent of the takeover condition. Second, all the other effects are marginal effects that are valid for a bid price $P_B \in [E(\Pi^*), E(\Pi_C) - E(\Pi)]$.

4.3 A Model of Multinational Banking with Linear Costs

In this section, the bank's basic maximisation problem is augmented with multinational banking. The multinational bank is assumed to have a subsidiary structure and to maximise the expected return by choosing the level of capital in both countries[13]. We look at a multi-stage game with domestic and foreign shareholders, depositors, two domestic banks that eventually form an multinational bank, and two regulators that, besides providing full deposit insurance, decide whether the bank belonging to their jurisdiction is allowed to continue its activities or not. The timing of the game is now the following:

1. The bank acquires capital and deposits and invests in a project.
2. The bank decides whether to buy a subsidiary or not; if yes, capital is acquired at home and the foreign shareholders are compensated.
3. Returns materialise.
4. The regulator closes the bank if the random bank return does not cover the deposits payable within its jurisdiction.
5. Depositors and eventually shareholders are compensated.

Here, the price of capital is assumed to be a constant ρ; as a consequence, $\rho'(K)$, $\rho''(K) = 0$, and the cost of increasing the amount of capital becomes linear. The expected profit maximisation problem of the domestic bank is

$$\underset{K}{Max} \quad E(\Pi) = \left(\frac{1+K}{2}\right)\left(\frac{1-K}{2} + C - \rho K\right), \tag{4.5}$$

and the maximum is found in

$$K = \begin{cases} \frac{C-\rho}{1+2\rho} & if \quad C < 1+3\rho \\ 1 & otherwise \end{cases}. \tag{4.6}$$

[13]The difference between the subsidiary and the branch structure is that, in the former case, the subsidiary is a separate asset of the parent bank, whereas in the latter case, the assets of the parent and the branch are pooled. The regulation according to the home country control principle reflects this difference by appointing the responsibility of the branch structure bank entirely to the home country regulator, whereas the responsibilities are divided in case of the subsidiary structure bank.

The optimal capital level increases in the charter value C, as more capital increases the probability of preserving the charter value. On the other hand, increasing capital also increases the costs, which is why the optimal capital level decreases in price ρ. The constant 1 in the denominator reflects the effect of capital on the expected return, conditional on the bank being left open.

A multinational bank invests the capital received from the home country shareholders to a subsidiary abroad. Since the parent bank is fully isolated from the bankruptcy procedure of the subsidiary, the subsidiary is similar to an option for the parent bank. In case of bankruptcy of the parent bank, of course, the subsidiary has to be liquidated.

The multinational bank maximises over two capital levels, in the home and in the host country. The expected return maximisation problem becomes

$$\begin{aligned} \underset{K,K^*}{Max} \quad E\left(\Pi_C\right) \;=\; & \left(\frac{1+K}{2}\right)\left(\frac{1-K}{2}+C-\rho K\right) \\ & +\left(\frac{1+K^*}{2}\right)\left(\frac{1-K^*}{2}+\frac{1+K}{2}C^*-\rho K^*\right), \end{aligned} \tag{4.7}$$

where the variables with asterisk refer to the host country. Note that, compared to the domestic bank's maximisation problem in the host country, the expected value of the charter value of the subsidiary has now decreased: Whether the bank is able to preserve the charter value in the host country not only depends on the success of the subsidiary, but also of the success of the parent bank. Yet, a bad outcome in the subsidiary does not have an effect on the parent bank balance sheet, so the probability of success of the parent remains directly unaltered by the international linkage.[14] Note in addition that, as the international takeover means buying shares from the host country shareholders and selling them to the home country ones, the cost of capital for the subsidiary depends on the conditions at the home capital market. Optimisation results in the following first order conditions:

[14]Note that the failure of the home unit cannot be avoided by a profit transfer from the host country unit. This is because the shareholders are separated from the bank and have a priority as a claimant over the bank who wants to preserve its charter values. Consequently, the return in the host unit above the deposits payable will be claimed by the shareholders.

$$\begin{aligned} K_C &= \frac{C-\rho}{1+2\rho} + \frac{(1+K_C^*)\,C^*}{2\,(1+2\rho)} \\ K_C^* &= -\frac{\rho}{1+2\rho} + \frac{(1+K_C)\,C^*}{2\,(1+2\rho)} = K_C - \frac{2C}{2\,(1+2\rho)+C^*}. \end{aligned} \tag{4.8}$$

Note first that, by the implicit function theorem, $\frac{\partial K_C}{\partial K_C^*}, \frac{\partial K_C^*}{\partial K_C} = \frac{C^*}{2(1+2\rho)} > 0$. The capital levels in the home and host countries are thus complements, as an increase in capital in either of the two units increases the total expected value of the bank, which again increases the capital in the other unit, and vice versa. There is thus an indirect link from the capital level in the host unit to that of the home unit, which equally influences the probability of success of the home unit. We additionally make here the standard assumption of $\frac{C^*}{2(1+2\rho)} < 1$[15].

Second, it is clear that the multinational bank invests more capital at home than a domestic bank would. This is because of the option nature of the subsidiary: more capital invested at home increases the probability of preserving the charter value in the subsidiary. The reverse is, however, not true: increasing capital in the subsidiary influences the probability of preserving the charter value in the subsidiary, but not that of preserving the charter value of the parent bank. Indeed, the insurance effect of increasing capital in the host unit is decreased by the possibility that a failure of the mother bank will cause the bankruptcy of the subsidiary as well, independent of the performance of the latter.

Finally, we can already state that, were there no difference in cost of capital between the home and host markets, a multinational bank would invest more capital altogether than the separate domestic banks. This is because the marginal utility of an increase in K_C is higher than the marginal loss of decreasing K_C^*, as the former helps in preserving both C and C^*, but the latter has no effect on the probability of saving C.

Solving explicitly for the capital levels produces:

$$\begin{aligned} K_C &= \frac{C^{*2} + 2\,(1+\rho)\,C^* + 4\,(1+2\rho)\,(C-\rho)}{4\,(1+2\rho)^2 - C^{*2}} \\ K_C^* &= \frac{2\left[(1+\rho+C)\,C^* - 2\rho\,(1+2\rho)\right]}{4\,(1+2\rho)^2 - C^{*2}}. \end{aligned} \tag{4.9}$$

[15] This serves to exclude the possibility that the indirect influence on domestic capital via the foreign unit will exceed the direct effect (and vice versa), but also happens to be the SOC for a maximum.

We now turn to the question under which conditions the takeover is to happen. The takeover condition for the linear cost of capital model is characterised in the following Lemma.

Lemma 12 *i) The international takeover takes place iff*

$\rho^* > A - \sqrt{(A - C^*)(A + C^* + 1)}$, *where*

$A \equiv 1 + \frac{(C-\rho)(1-4\rho(1+\rho))C^*}{2(1+2\rho)} + \frac{[(C-\rho)(1-4\rho(1+\rho))+2(1+2\rho)]C^*}{2(1+2\rho)} K_C^* + (1+2\rho) K_C^{*2}$ *and* $A - C^* \geq 0$.

ii) A necessary condition for a takeover is that $\rho^* > \rho$.

iii) The takeover becomes more profitable, ceteris paribus, the lower the ρ *and the higher the* C *is.*

Proof. See the Appendix. ■

Thus, the takeover condition implies that only banks that can buy capital cheaper than the target banks will become raiders. Intuitively, Lemma 12 simply says that if countries can be classified as to the degree of efficiency of their financial markets, the countries with the most efficient financial markets will have the most raiders, whereas the countries with the least efficient financial markets will become host countries. In addition, there is an intermediate interval in financial market efficiency, where the countries show little international activity[16].

After having determined the equilibrium capital levels and the conditions for takeover, we can derive some results as to bank capital in the market. Let us define $\overline{\rho}^* \equiv \rho + \frac{(1-K_C)C^*}{(1+(1+K_C)C^*)} \left[\rho + \frac{1}{2}\right]$. The results are summarised in the following proposition.

Proposition 8 *i) A multinational bank with a subsidiary structure invests more capital in the home country than a domestic bank would:* $K_C > K$.

ii) The total sum of capital of the multinational bank is higher than the sum of the capital of the two domestic banks: $K_C + K_C^* > K + K^*$.

iii) The capital level in the foreign unit is higher after the acquisition iff $\rho^* > \overline{\rho}^*$. *The higher the* ρ *and the lower the* C, *the higher is* $\overline{\rho}^*$.

[16] Since the measure is relative, the intermediate financial markets may show some internationalisation, as the banks originating from the most efficient countries may invest in them if there are no banks to be acquired in the less developed financial markets, and as the banks from the intermediate markets may invest in the least developed countries.

Proof. See the Appendix. ■

The takeover condition excludes all takeovers that are not profitable. The first two points refer to the banks that remain in the set of international banks after this elimination. The third point defines the price difference above which, despite the liability structure of the multinational bank driving capital into the parent unit, the host country unit holds more capital after than before the takeover. It is thus possible that the trade-off between cheaper capital and the increased risk on capital is dominated by the first effect. This may also explain why, despite of apparently little obvious reason, capital is widely held above the regulatory limit in the CEE countries in particular. The higher the difference between the two capital markets and the higher the charter value of the home unit of the bank, the larger is the parameter space for which the international takeover increases capital in the host country.

Finally, we are interested in the stability consequences of takeovers. In the following, stability is defined as the probability of not being liquidated by the regulator. Due to the liability structure, stability in the host unit is influenced by the probability of success of the home unit. In addition, due to the complementary link between the two capital levels, capital held in the host unit equally affects the stability of the parent bank.

Define $\rho^{*S} \equiv \frac{1+2C^*}{2\left(K_C+K_C^*+K_CK_C^*\right)} - \frac{1}{2}$. Then, the following Proposition sums up the effect of an international takeover on stability.

Proposition 9 *An international takeover increases the stability of the parent unit. For the host unit, the probability of success is higher than before acquisition iff* $\rho^* > \rho^{*S}$*; in this case, the multinational bank imports stability to the host country.*

Proof. See the Appendix. ■

The increased stability in the parent unit is a direct consequence of its influence in preservation of charter values that is higher for the multinational bank than for domestic banks. Whether the stability of the host country unit is increased or decreased, depends on the bank trade-off between the lower share price ρ and the increased fragility in the case that $K_C < 1$. If the improvement in the allocative efficiency in the form of lower cost of capital dominates the effect of the introduction of the more fragile bank structure, the international takeover increases capital in the host unit enough such that the multinational bank imports stability to the host country.

4.4 Effect of Minimum Capital Requirements

So far, the only task allocated to the regulator was to close the bank, if the random return did not suffice to cover the deposits payable. Assume now that, in order to reduce the probability of this outcome, the regulator introduces a minimum capital requirement that has to hold when the project starts; otherwise, the bank will be closed[17][18]. In this section, consequences for the amount of capital held, for takeover incentives, and for stability are considered. The results concerning the first two aspects are summarised in the following Proposition.

Proposition 10 *i) Minimum capital requirements increase capital of domestic banks in their respective countries, and of the multinational bank in both countries;*

ii) An introduction or an increase of a minimum capital requirement in the home country always increases the incentives for takeovers;

iii) An introduction or an increase of a minimum capital requirement in the host country always increases the incentives for takeovers for banks with $K^* < K_C^*$ *. In addition, for banks for which* $K^* > K_C^*$*, an introduction or an increase of a minimum capital requirement increases takeover incentives if* $\overline{K}^* > \overline{K}^{*crit}$*, and decreases them otherwise. The higher the* ρ^**, the larger is the parameter space for which an introduction or an increase of a minimum capital requirement increases takeover activity.*

Proof. See the Appendix. ■

In the Proposition, $\overline{K}^{*crit} \equiv \frac{(1-K_C)C^*}{4(\rho^*-\rho)} - \frac{1}{2}$. The first result restates the equation (4.8) for an international bank with binding capital requirements. Bearing in mind that the capital levels of the parent and of the subsidiary were complements, the optimal response of a multinational bank to a binding capital requirement in one unit is to

[17] In a repeated game, this means that if the bank return is sufficiently low as not to cover the deposits and the minimum capital, the bank has to acquire more capital from the market before being allowed to launch a new project. An alternative would be to demand that the capital adequacy requirement has to be fulfilled continuously. This modelling approach would lead to the banks holding a capital buffer as in e.g. Milne & Whalley (2001). However, in our setting, this regulatory approach is dominated by the chosen one in terms of welfare due to the impact of inefficient closures. Intuitively, even if the bank chose $K = 1$, it would be closed if $\widetilde{R} < \overline{K}$.

[18] Note that we do not have to worry about the bank's participation constraint here: As the expected social welfare consists of the expected bank returns and of the negative externalities in terms of expected deposit insurance payments, the expected bank return is always positive as long as it is socially optimal to let the bank operate.

increase capital in the other one as well. Nevertheless, since the resulting amount of capital is not the optimal solution to the bank's maximisation problem any more, the expected return of the multinational bank will decrease.

Points ii) and iii) consider the effects of the introduction of minimum capital requirements for the two countries separately. First, note that within the model, minimum capital requirements affect the incentives of the banks to internationalise. In particular, capital adequacy ratios in the home country always increase the takeover activity, since this may help the bank escape a restriction by reorganisation to a multinational bank, as the higher value of continuing induces the bank voluntarily to hold more capital within the multinational structure.

Second, the effect of the introduction of minimum capital requirements in the host country on the takeover activity depends on the price difference between the home and the host countries. For those host countries that have a relatively low price of capital, minimum capital requirements reduce the incentives of foreign bank entrance, since the price difference is not large enough to compensate for the loss in terms of higher capital requirements. Yet, for the host countries for which the price of domestic capital is high, incentives for foreign bank takeovers are increased, as the compensation payable for the host country shareholder becomes smaller. For those markets, the capital increase in the host bank may just simply result from the unrestricted maximisation of the multinational bank, whereas the domestic shareholders may have been unable to get the funds necessary to fulfil the minimum capital requirement.

If we assume a common capital adequacy ratio introduced in both countries instead, it is either binding for both countries, or for the host country only (since $\rho \leq \rho^*$). The total effect then is driven by the effect of capital requirements introduced in the host country.

The result can be interpreted as the capital adequacy ratios first increasing takeover activity, and second, directing foreign direct investment towards the least developed financial markets. The latter effect leads to polarisation of internationalisation of the banking sector.

Finally, we are interested in how minimum capital requirements affect the stability of the banks. The stability consequences are summarised in the following Corollary.

Corollary 4 *i) An increase in capital requirements in the home country a) increases the probability of success of the domestic banks in the home country; and b) of the existing multinational banks both in the home and in the host country; and c) through*

the increased takeover incentives as in Proposition 2.

ii) An increase in capital requirements in the host country a) increases the probability of success of the domestic banks and of the multinational banks both in the home and in the host country, and b) increases the overall probability of success of banks via directing takeovers to countries with higher ρ^**.*

Proof. See the Appendix. ■

Now, an increase in capital requirement works through three channels. First, there is a direct effect of increasing the bank capital in the country of the capital requirement. Again, an increase of capital requirement has a linear effect on the stability of a domestic bank as well as on the home unit of a multinational bank, whereas the effect on a subsidiary is diminished through the parent unit's probability of failure. Second, for multinational banks, there is a complementarity effect, due to which the amount of capital in the other country will be increased as well, which equally increases the stability of the unit.

Third, a capital requirement in either country can either decrease or increase incentives to internationalise, as we saw from Proposition 10. In particular, for an introduction or increase in the home country, the effect on internationalisation is positive, whereas the effect of an introduction or an increase in the host country is positive only for the relatively least developed countries. Together with the notion that an international takeover increases stability in the least developed markets, a minimum capital requirement in the host country further increases bank stability by directing takeover activity towards those markets.

4.5 Conclusion

The aim of the model was to analyse the bank's financing decision in a setting where the shareholders care about their liquidity needs, and to link this to the context of multinational banking, where shareholders do not necessarily reside in the country of operation. Within this framework, the consequences for the stability of the financial markets and the effects of minimum capital requirements were then considered.

Endogenisation of takeover activity in the model resulted in the division of the market into home and host countries. What is more, introducing minimum capital requirements increased takeover activity and directed it towards less developed markets. This latter amplification effect was shown to be stability increasing. Thus, unlike in Koehn & Santomero (1980) or in Hellman & al. (2000), the indirect effect of minimum capital requirements on bank incentives is not necessarily at odds with the stability objective of the regulator.

In more detail, it turned out that, with a weakly increasing and convex cost of capital, the bank faces a trade-off between the probability of saving its charter value and the cost of capital, such that an interior solution in bank capital emerged. Moreover, a multinational bank acquired more capital in the home country than a domestic bank did, shifting some from the host country unit to the home country unit. In addition, if a takeover was to happen, the difference in the cost of capital must be such that the overall amount of capital of the multinational bank was higher than that of the two domestic units before the takeover.

Stability of the parent unit was shown to increase as a consequence of the takeover, whereas the effect on the stability of the subsidiary was ambiguous. Indeed, despite the shift of capital from the host country unit to the home country unit, the increase in allocative efficiency in form of lower price of capital could be so high that even the stability of the host unit was increased. Finally, minimum capital requirements in the home country increased incentives for takeovers, whereas, if introduced in the host country, they directed foreign direct investment in banking towards the least developed financial markets. This was shown to increase overall stability.

The model has two empirical implications. First, according to the model, multinational banks that have a subsidiary structure should hold more capital than their domestic equivalents. Second, the markets should exhibit a large concentration in foreign direct investment, the most efficient markets being the home countries and the

least efficient ones the host countries. The latter phenomenon has been documented by e.g. Berger & al. (2000), who attribute it to the more advantageous regulatory conditions in the home market. Our work suggest a closely related explanation in form of a mixture of more advantageous home country financial markets and the amplifying effect of internationally common minimum capital requirements.

As is the case with many related contributions, the work at hand models the supply of bank capital only rudimentarily. In this regard, further research will be needed. In addition, the internationalisation of the bank was assumed to happen in the form of a subsidiary structure. Introducing branch structure into the model would bring more insights in terms of results and empirical implications, but would also require some further simplifications, in order to keep the model tractable.

In this chapter, we concentrated on the supply side of the bank capital market. Alternatively, one could consider the asset side of the banks, as in Diamond & Rajan (2000, 2001). In their models, demand deposits create liquidity for the depositors, and the first come, first served -system gives an incentive to meet unverifiable needs in the asset side of the banks. Our main focus was, however, to consider multinational banking, which clearly necessitates some supply side considerations. The impressive presence of foreign banks in the CEE countries, coupled with the small market value and low liquidity of the local stock markets, served as a powerful inspiration for us along the way. Also, this is why we think that further work on a theory of bank capital concentrating on the restrictions on the supply side is useful.

Appendix 4

4.A Proofs

Proof of Lemma 11

Function $E(\Pi)$ is continuous with a continuous derivative. The first derivative of the bank's maximising problem is $\frac{\partial E(\Pi)}{\partial K} = -\frac{\rho(K)(2K+1)}{2} - \frac{\rho'(K)\left(K^2+K\right)}{2} - \frac{K}{2} + \frac{C}{2}$. The second order derivative $\frac{\partial^2 E(\Pi)}{\partial^2 K} = -\rho'(K)(2K+1) - \frac{\rho''(K)\left(K^2+K\right)}{2} - \rho(K) - \frac{1}{2} < 0$ for all $K \geq 0$, given that $\rho'(K), \rho''(K) \geq 0$. The maximising problem is thus concave for $K \geq 0$, and achieves its maximum in $K \in (0,1)$ iff $\frac{\partial E(\Pi)}{\partial K} \mid_{K=1} < 0$. This is true if $\rho'(1) > -\frac{3\rho(1)}{2} + \frac{C-1}{2}$.

Proof of Lemma 12

i) The explicit takeover condition TC takes the form

$$\begin{aligned} TC \equiv \frac{1}{2} - \frac{C^*}{4} + \frac{C-\rho}{2}(K_C - K) - \left(\frac{1+2\rho}{4}\right)\left(K_C^2 - K^2\right) + \frac{C^*}{4}K_C \\ + \frac{C^*-2\rho}{4}K_C^* - \left(\frac{1+2\rho}{4}\right)K_C^{*2} + \frac{K_C K_C^* C^*}{4} \\ - \frac{(C^*-\rho^*)}{2}K^* + \frac{(1+2\rho^*)}{4}K^{*2} > 0. \end{aligned}$$

Arranging this for ρ^* (and remembering that $\frac{\partial K}{\partial \rho^*}, \frac{\partial K_C}{\partial \rho^*}, \frac{\partial K_C^*}{\partial \rho^*} = 0$) we get a quadratic condition:

$-\rho^* + 2A\rho^* + [A - (1+C^*)C^*] > 0$, where

$A \equiv 1 + \frac{\left(1+K_C^*\right)(C-\rho)(1-4\rho(1+\rho))C^*}{2(1+2\rho)} + (C^* - 2\rho + (1+2\rho)K_C^*)K_C^*$. The solution for this condition is then $A - \sqrt{(A-C^*)(A+C^*+1)} < \rho^* < A + \sqrt{(A-C^*)(A+C^*+1)}$.

If we now have $A < C^*$, the takeover condition is always negative. If we have $A \geq C^*$, it follows that $A + \sqrt{(A - C^*)(A + C^* + 1)} > A > C^*$, which can be true only for banks for which $K^* = 0$. If we exclude these banks, the remaining condition for a takeover becomes $\rho^* > A - \sqrt{(A - C^*)(A + C^* + 1)}$.

ii) The takeover condition can be turned into

$E(\Pi_{K_C}) + E\left(\Pi^*_{K^*_C}\right) - \frac{(1-K_C)\left(1+K^*_C\right)C^*}{4} > E(\Pi) + E(\Pi^*)$. As $E(\Pi)$ and $E(\Pi^*)$ reach their optima at K and K^*, respectively, the left hand side is always inferior to the right hand side with equal prices. Thus, a necessary condition for the condition to hold is that $\rho < \rho^*$.

iii) Comparative statics on the takeover condition with regard to C:

$\frac{\partial TC}{\partial C} = \frac{1}{2}(K_C - K) + \left(\frac{C-\rho-(1+2\rho)K_C}{2} + \frac{\left(1+K^*_C\right)C^*}{4}\right)\frac{\partial K_C}{\partial C}$

$-\left(\frac{C-\rho-(1+2\rho)K}{2}\right)\frac{\partial K}{\partial C} + \left(\frac{(1+K_C)C^*-2\rho-2K^*_C(1+2\rho)}{4}\right)\frac{\partial K^*_C}{\partial C}$.

As $\frac{C-\rho-(1+2\rho)K_C}{2} + \frac{\left(1+K^*_C\right)C^*}{4} = \frac{\partial E(\Pi_C)}{\partial K_C}$, $\frac{C-\rho-(1+2\rho)K}{2} = \frac{\partial E(\Pi)}{\partial K}$ and $\frac{(1+K_C)C^*-2\rho-2K^*_C(1+2\rho)}{4} = \frac{\partial E(\Pi_C)}{\partial K^*_C}$ and as $\frac{\partial E(\Pi_C)}{\partial K_C} = \frac{\partial E(\Pi)}{\partial K} = \frac{\partial E(\Pi_C)}{\partial K^*_C} = 0$ in the optimum, it follows that $\frac{\partial TC}{\partial C} = \frac{1}{2}(K_C - K) > 0$.

Comparative statics on the takeover condition with regard to ρ:

$\frac{\partial TC}{\partial \rho} = -\frac{1}{2}(K_C - K + K_C^2 - K^2) - \frac{1}{2}K^*_C$

$+\left(\frac{C-\rho+(1+2\rho)K_C}{2} + \frac{\left(1+K^*_C\right)C^*}{4}\right)\frac{\partial K_C}{\partial \rho} - \left(\frac{C-\rho+(1+2\rho)K}{2}\right)\frac{\partial K}{\partial \rho} + \frac{C^*-2\rho+K_CC^*}{4}\frac{\partial K^*_C}{\partial \rho}$. As we know that $K_C > K$, the first term of the equation is negative, as well as the second one. In order to determine the signs of the remaining terms, we first calculate the derivatives:

$\frac{\partial K}{\partial \rho} = -\frac{1+2C}{(1+2\rho)^2} < 0$

$\frac{\partial K_C}{\partial \rho} = \frac{\left[4(1+2\rho)^2-C^{*2}\right][2C^*+4(2C-1-4\rho)]-16(1+2\rho)\left[C^{*2}+2C^*(1+\rho)+4(1+2\rho)(C-\rho)\right]}{\left[4(1+2\rho)^2-C^{*2}\right]^2} > 0$ iff

$-4(1+2\rho)^2[12(C-\rho)-4[C-\rho-(1+2\rho)]] - 8C^*(1+2\rho)(3+2\rho)$

$-(2C^*+4(C-\rho)+12(1+2\rho))C^{*2} > 0$. As this is not true, $\frac{\partial K_C}{\partial \rho} < 0$.

$\frac{\partial K^*_C}{\partial \rho} = \frac{\left[4(1+2\rho)^2-C^{*2}\right][3C^*-4]-16(1+2\rho)[(2+3\rho+C)C^*-4\rho(1+2\rho)]}{\left[4(1+2\rho)^2-C^{*2}\right]^2} > 0$ iff

$4(1+2\rho)[C^*-4C-6\rho-5]-16(1+2\rho)^2-3C^{*3} > 0$. As this is not true, $\frac{\partial K^*_C}{\partial \rho} < 0$.

In addition, we know that $\frac{\partial K_C}{\partial \rho} - \frac{\partial K}{\partial \rho}$

$= \frac{-8(1+2\rho)^3(3+2\rho)C^*-(1+2\rho)^2(2C^*+4(C-\rho)+12(1+2\rho))C^{*2}-\left[8(1+2\rho)^2-C^{*2}\right]C^{*2}}{(1+2\rho)^2\left[4(1+2\rho)^2-C^{*2}\right]^2} < 0$ (since by assumption, $C^* < 2\,(1+2\rho)$). This means that $\left|\frac{\partial K_C}{\partial \rho} - \frac{\partial K}{\partial \rho}\right| > 0$.

As $\left(\frac{C-\rho+(1+2\rho)K_C}{2} + \frac{\left(1+K_C^*\right)C^*}{4}\right) - \left(\frac{C-\rho+(1+2\rho)K}{2}\right) = \frac{2(1+2\rho)(K_C-K)+\left(1+K_C^*\right)C^*}{4} > 0$, it follows that $\left(\frac{C-\rho+(1+2\rho)K_C}{2} + \frac{\left(1+K_C^*\right)C^*}{4}\right)\frac{\partial K_C}{\partial \rho} - \left(\frac{C-\rho+(1+2\rho)K}{2}\right)\frac{\partial K}{\partial \rho} < 0$ too.

Finally, as to the last term in the equation, $\frac{C^*-2\rho+K_CC^*}{4} > 0$ iff

$K_C > \frac{2\rho-C^*}{C^*}$. Assuming the opposite and plugging the value of K_C into equation (4.8), we see that if $K_C < \frac{2\rho-C^*}{C^*}$, $K_C^* < -\frac{2\rho+C^*+2\rho-C^*}{2(1+2\rho)} = 0$. Thus, if the bank is willing to invest any capital into the foreign unit, it must be that $\frac{C^*-2\rho+K_CC^*}{4} > 0$, and it follows that $\frac{C^*-2\rho+K_CC^*}{4}\frac{\partial K_C^*}{\partial \rho} < 0$. As a consequence, $\frac{\partial TC}{\partial \rho} < 0$.

Proof of Proposition 8

i) The amount of capital held at home is larger in the case of a multinational bank than in that of a domestic bank since $K_C = \frac{C-\rho}{1+2\rho} + \frac{\left(1+K_C^*\right)C^*}{2(1+2\rho)} > \frac{C-\rho}{1+2\rho} = K$.

ii) We saw already from Lemma 12 that a necessary condition for a takeover was $\rho < \rho^*$.

The sum of capital held in the multinational bank is larger than the sum of the two domestic banks iff

$K_C+K_C^* > K+K^* \quad \longleftrightarrow \quad \frac{C-\rho}{1+2\rho}+\frac{\left(1+K_C^*\right)C^*}{2(1+2\rho)}-\frac{\rho}{1+2\rho}+\frac{(1+K_C)C^*}{2(1+2\rho)} > \frac{C-\rho}{1+2\rho}+\frac{C^*-\rho^*}{1+2\rho^*} \quad \longleftrightarrow$

$\rho^* > \rho - \frac{\left(K_C^*+K_C\right)C^*}{\left[2C^*+1+\left(K_C^*+K_C\right)C^*\right]}\,(1+\rho)$.

As the necessary condition for a takeover is stricter than the condition for the international bank holding more capital than the two domestic banks together, it follows that for every international bank, $K_C + K_C^* > K + K^*$ holds.

iii) For $K_C^* > K^*$, it must be that $-\frac{\rho}{1+2\rho} + \frac{(1+K_C)C^*}{2(1+2\rho)} > \frac{C^*-\rho^*}{1+2\rho^*} \quad \longleftrightarrow$

$\rho^* > \overline{\rho}^* \equiv \rho + \frac{(1-K_C)C^*}{1+(1+K_C)C^*}\left[\rho + \frac{1}{2}\right]$.

Comparative statics as to C:

$\frac{\partial \overline{\rho}^*}{\partial C} = \frac{\partial \overline{\rho}^*}{\partial K_C}\frac{\partial K_C}{\partial C}$. As $\frac{\partial \overline{\rho}^*}{\partial K_C} = \left(\rho + \frac{1}{2}\right)\left[\frac{-C^*(1+4C^*)}{(1+(1+K_C)C^*)^2}\right]\frac{\partial K_C}{\partial C}$ and as

$\frac{\partial K_C}{\partial C} = \frac{4(1+2\rho)}{4(1+2\rho)^2-C^{*2}} > 0$, $\frac{\partial \overline{\rho}^*}{\partial C} < 0$.

Comparative statics as to ρ:

$\frac{\partial \overline{\rho}^*}{\partial \rho} = 1 + \left[\frac{(1-K_C)C^*}{1+(1+K_C)C^*}\right] + \left(\rho + \frac{1}{2}\right)\left[\frac{\partial\left[\frac{(1-K_C)C^*}{1+(1+K_C)C^*}\right]}{\partial K_C}\right]\frac{\partial K_C}{\partial \rho}$

$= 1 + \left[\frac{(1-K_C)C^*}{1+(1+K_C)C^*}\right] + \left(\rho + \frac{1}{2}\right)\left[\frac{-C^*(1+4C^*)}{(1+(1+K_C)C^*)^2}\right]\frac{\partial K_C}{\partial \rho}$. The two first terms of the equation are positive. Since the coefficient of the third term is negative and since we know from the proof of Lemma 12 that $\frac{\partial K_C}{\partial \rho} < 0$, it follows that $\frac{\partial \overline{\rho}^*}{\partial \rho} > 0$.

Proof of Proposition 9

The probability of success of the home unit is in the case of subsidiary structure dependent only on the performance in the parent unit, which is determined by $\frac{1+K}{2}$. As $\frac{\partial\left(\frac{1+K}{2}\right)}{\partial K} > 0$, an increase in capital in the home unit increases the probability of success and therefore stability.

Subsidiary: The probability of success in the host country unit is higher for a subsidiary than for a domestic bank iff

$\left(\frac{1+K_C}{2}\right)\left(\frac{1+K_C^*}{2}\right) > \left(\frac{1+K^*}{2}\right) \quad \longleftrightarrow \quad \rho^* > \rho^{*S} \equiv \frac{1+2C^*}{2\left(K_C+K_C^*+K_CK_C^*\right)} - \frac{1}{2}$.

Proof of Proposition 10

i) See equation (4.8).

ii) From Proposition 8 it follows that $K_C > K$ always. As a consequence, a capital adequacy ratio in the home country is either binding only for a domestic bank or for both the domestic and the multinational bank. For every $\overline{K} > K$, the effect of an increase in capital on the takeover incentives is

$\frac{\partial TC}{\partial \overline{K}} = -\frac{(C-\rho)}{2} + \frac{(1+2\rho)\overline{K}}{2} > 0 \quad if \quad \overline{K} > \frac{C-\rho}{1+2\rho} \equiv K$ for the domestic bank, and

$\frac{\partial TC}{\partial \overline{K}} = \frac{(C-\rho)}{2} + \frac{\left(1+K_C^*\right)C^*}{4} - \frac{(1+2\rho)\overline{K}}{2} < 0 \quad if$

$\overline{K} > \frac{C-\rho}{1+2\rho} + \frac{\left(1+K_C^*\right)C^*}{2(1+2\rho)} \equiv K_C$ for the multinational bank.

If the capital adequacy ratio is binding only for the domestic bank, the effect of an introduction or an increase on the takeover incentives for every $\overline{K} > K$ is

$-\frac{(C-\rho)}{2} + \frac{(1+2\rho)\overline{K}}{2} > 0$.

If the capital adequacy ratio is binding for the domestic and for the multinational bank, the effect of an introduction or an increase on the takeover incentives for every $\overline{K} > K_C > K$ is

$-\frac{(C-\rho)}{2} + \frac{(1+2\rho)\overline{K}}{2} + \frac{(C-\rho)}{2} - \frac{(1+2\rho)\overline{K}}{2} + \frac{\left(1+K_C^*\right)C^*}{4} = \frac{\left(1+K_C^*\right)C^*}{4} > 0$. This means that, independent of whether the domestic bank only or both the domestic and the

multinational bank are restricted by the capital adequacy ratios, the effect on the takeover activity is positive.

iii) If CAR is introduced in the host country, we now have three possibilities: either the CAR is binding for the domestic bank only, or for the multinational bank only, or for both.

If the CAR is binding for domestic bank only, it must be that $K^* < K_C^*$. In this case, the effect of the CAR is simply the effect of increasing K^* over the optimum of the domestic bank. With a concave maximisation problem, this will reduce the value of the domestic bank. It follows that if

$\overline{K}^* \in (K^*, K_C^*]$, then $\frac{\partial TC}{\partial \overline{K}^*} = -\frac{(C^*-\rho^*)}{2} + \frac{(1+2\rho^*)}{2}\overline{K}^* > 0.$

If the CAR is binding for the multinational bank only, it must be that $K_C^* < K^*$. The effect of the CAR is then that of increasing K_C^* over the optimum of the multinational bank. Here, too, with a concave maximisation problem, this will reduce the value of the multinational bank. it follows that if $\overline{K}^* \in (K_C^*, K^*]$, then

$\frac{\partial TC}{\partial \overline{K}^*} = \frac{(C^*-2\rho)}{2} + \frac{K_C C^*}{4} - \frac{(1+2\rho)\overline{K}^*}{2} < 0.$

If the capital adequacy ratio is binding both for the domestic and for the multinational bank, the total effect of an introduction or an increase of a CAR on the takeover condition is

$\frac{\partial TC}{\partial \overline{K}^*} = \frac{(C^*-2\rho)}{4} - \frac{(1+2\rho)\overline{K}^*}{2} + \frac{K_C C^*}{4} - \frac{(C^*-\rho^*)}{2} + \frac{(1+2\rho^*)\overline{K}^*}{2} > 0 \quad if$
$\overline{K}^* > \overline{K}^{*crit} \equiv \frac{(1-K_C)C^*}{4(\rho^*-\rho)} - \frac{1}{2}.$

If $K^* < K_C^*$, $\overline{K}^{*crit} < K_C^*$. To prove this, assume the opposite:

$\overline{K}^{*crit} > K_C^* \quad \longleftrightarrow \quad \frac{(1-K_C)C^*}{4(\rho^*-\rho)} - \frac{1}{2} > \frac{(1+K_C)C^*-2\rho}{2(1+2\rho)} \quad \longleftrightarrow$

$\rho^* < \rho + \frac{(1-K_C)C^*}{(1+K_C)C^*+1}\left[\rho + \frac{1}{2}\right]$. But this is the condition for $K^* > K_C^*$, so we have a contradiction. From this and from the result for the situation where the CAR is binding only for the domestic bank, it follows that, if $K^* < K_C^*$, then $\frac{\partial TC}{\partial \overline{K}^*} > 0$ always.

If $K^* > K_C^*$, $\overline{K}^{*crit} > K^*$. To prove this, assume again the opposite:

$\overline{K}^{*crit} < K^* \quad \longleftrightarrow \quad \frac{(1-K_C)C^*}{4(\rho^*-\rho)} - \frac{1}{2} < \frac{C^*-\rho^*}{1+2\rho^*} \quad \longleftrightarrow \quad \rho^* > \rho + \frac{(1-K_C)C^*}{(1+K_C)C^*+1}\left[\rho + \frac{1}{2}\right].$
But this is again the condition for $K^* < K_C^*$, so we have a contradiction. From this and from the result for CAR being binding only for the multinational bank, it follows that there exists a $\overline{K}^{*crit} > K^* > K_C^*$ such that if $\overline{K}^* < \overline{K}^{*crit}$, then $\frac{\partial TC}{\partial \overline{K}^*} < 0$, and if $\overline{K}^* > \overline{K}^{*crit}$, then $\frac{\partial TC}{\partial \overline{K}^*} > 0$.

Note in addition that $\frac{\partial \overline{K}^{*crit}}{\partial \rho^*} = \frac{\partial \overline{K}^{*crit}}{\partial (\rho^* - \rho)} = -\frac{(1-K_C)C^*}{4(\rho^*-\rho)^2} < 0$, so the less developed the financial markets of the host country and the larger the difference in price between the home and host country, the larger is the parameter space for which an increase in CAR increases takeover activity.

Proof of Corollary 4

i) An increase in $\overline{K}$ has a direct impact on the probability of success of the domestic banks, since $\frac{\partial \frac{(1+\overline{K})}{2}}{\partial \overline{K}} = \frac{1}{2} > 0$. This is also the effect on the probability of success of the parent bank of an existing multinational bank.

For the host unit of a multinational bank, the increase of capital in the home country equally increases the probability of success:

$$\frac{\partial \left(\frac{1+\overline{K}}{2}\right)\left(\frac{1+K_C^*}{2}\right)}{\partial \overline{K}} = \frac{1}{2}\left(\frac{1+K_C^*}{2}\right) + \left(\frac{1+\overline{K}}{2}\right)\left(\frac{1}{2}\frac{\partial K_C^*}{\partial \overline{K}}\right) > 0.$$

Finally, capital requirements in the home country increase incentives for takeovers. This increases stability in the home country, if $K_C > \overline{K}$, and increases stability in the host country, if $\left(\frac{1+K_C}{2}\right)\left(\frac{1+K_C^*}{2}\right) > \frac{1+K^*}{2}$. As in the Proof of Proposition 9, this will be the case iff $\rho^* > \rho^{*S} \equiv \frac{1+2C^*}{2\left(K_C+K_C^*+K_C K_C^*\right)} - \frac{1}{2}$.

ii) An increase in $\overline{K}^*$ has a direct linear impact on the probability of success of the domestic banks like in the home country: $\frac{\partial \frac{(1+\overline{K}^*)}{2}}{\partial \overline{K}^*} = \frac{1}{2} > 0$. For a subsidiary, however, the dependence on the probability of success of the home country unit diminishes the effect of $\overline{K}^*$ on the probability of success of the subsidiary:

$\frac{\partial \left(\frac{1+K_C}{2}\right)\left(\frac{1+\overline{K}^*}{2}\right)}{\partial \overline{K}^*} = \frac{1}{2}\left(\frac{1+K_C}{2}\right) + \left(\frac{1+\overline{K}^*}{2}\right)\left(\frac{1}{2}\frac{\partial K_C}{\partial \overline{K}^*}\right) > 0$. In addition, the host country capital requirement increases the probability of success of the home country unit via complementarity: $\frac{\partial \left(\frac{1+K_C}{2}\right)}{\partial \overline{K}^*} = \frac{C^*}{2(1+2\rho)} > 0$. As assumed before, this complementarity effect is below the direct effect, i.e. $\frac{C^*}{2(1+2\rho)} < \frac{1}{2}$.

Finally, capital requirements in the host country increase incentives 1) for takeovers for which $K_C^* > K^*$, and

2) for takeovers for which $K_C^* < K^*$ and $\overline{K}^* > \overline{K}^{*crit}$, and

3) decrease takeover incentives for $\overline{K}^* < \overline{K}^{*crit}$, as in Proposition 10. For those subsidiaries that will be taken over, the probability of success is higher if, as before, $\rho^* > \rho^{*S}$. For the subsidiaries that will become domestic banks again, the opposite is true. As $\frac{\partial \overline{K}^{*crit}}{\partial \rho^*} = \frac{\partial \overline{K}^{*crit}}{\partial (\rho^* - \rho)} < 0$ and as $\frac{\partial \rho^{*S}}{\partial \overline{K}^*} < 0$, the minimum capital requirement increases stability by decreasing takeover incentives in countries where they decrease

stability (case 3) and by directing takeovers to countries where foreign banks are more stable relative to domestic banks (cases 1 and 2).

Chapter 5

Concluding Remarks

The aim of the study at hand was to investigate regulation of multinational banks, with an emphasis on the EU banking markets. To begin with, Chapter 1 showed that foreign direct investment in the EU is very much concentrated in the CEE countries, which are small economies, with relatively even smaller financial sectors. What is more, besides the branch structure banks, which are allowed to operate under a single licence within the EU, the fragmented subsidiary structure still remains popular among the multinational banks. Together, these facts point to the direction of the single banking market having not yet developed fully.

Bearing this fragmented market structure in mind, three models, studying the roles of regulatory externalities and the bank's liability structure, the ability of ambiguity as to mandates to compensate for the regulatory time inconsistency problem, and the effect of minimum capital requirements on the market structure, were then developed. Chapter 2 showed that retaining regulatory power at the national regulators may make sense, especially if regulators suffer from time inconsistency problem and tend to exercise forbearance. However, as pointed out in Chapter 3, ECB participation, if properly designed as an ownership structure and size contingent rule, can be welfare-improving, since it enlarges the strategy space of the social planner. Yet, the welfare improvement requires that the agencies are given clear and publicly announced mandates. Finally, Chapter 4 showed that the high concentration of foreign direct investment within the EU may reflect the differences in the levels of development of the financial markets and may be reinforced by the minimum capital requirements at place. However, the increase in international takeovers will be the more stability enhancing, the larger the gap in funds availability.

The work at hand gives rise to some tentative policy conclusions with regard to the

organisation of banking regulation in the EU. In general, as long as the markets are fragmented and heterogeneous, regulatory power should be left at the national level. In particular, the regulation of multinational subsidiary structure banks should remain at the national authorities. In contrast, as soon as the average branch size becomes large enough, transfer of regulatory power to the ECB in case of branch structure banks may be reasonable. Finally, Chapter 3 points at a need for a reformulation of the Article 105(2) in the Treaty on the EU. In particular, ambiguity should be replaced with clear and public mandates in order to avoid strategic reliance on the ECB rescue from the part of the multinational banks.

Modelling the phenomenon of international banking quickly results in complex frameworks. As a consequence, the results are not obtained without compromises. One clear drawback is the lesser focus on the risk sharing aspect of internationalisation. The theme was only handled briefly in the Appendix of Chapter 2, where it was shown that allowing for risk diversification effect did not qualitatively change the main results of the model. Future research will be needed in determining the relations between internationalisation, and systemic as well as credit risk. Another aspect is the interaction of banks and capital markets. In particular, deriving the cost of bank capital is an interesting task that deserves more attention than it was given in the present work. Finally, banks are ever less often just banks but financial conglomerates that may have unforeseen possibilities to risk shifting via liability structure and internationalisation. Although the importance of these aspects is fully acknowledged, they are left for future research.

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Curriculum Vitae

February 2002 - July 2006	Ph.D. in economics (Dr. oec. publ.) Ludwig-Maximilians-Universität, Munich
Jun - Aug 2003 and May - Sept 2001	Economist Bank of Finland, Helsinki
September 1995 - November 2001	Master of Science (econ.) Helsinki School of Economics and Business Administration, Finland
September 1998 - June 1999	Visiting student ESSEC, Cergy-Pontoise, France
June 1995	Matriculation examination Mäkelänrinne Sports High School, Helsinki
March 8th 1976	Born in Vantaa, Finland