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## Does financial integration make banks act more prudential? Regulation, foreign owned banks, and the lender-of-last resort

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**Does Financial Integration Make Banks Act More  
Prudential?  
Regulation, Foreign Owned Banks, and the Lender-of-Last  
Resort**

Helge Berger and Carsten Hefeker

**Does Financial Integration Make Banks Act More Prudential?  
Regulation, Foreign Owned Banks, and the Lender-of-Last Resort**

Helge Berger and Carsten Hefeker<sup>\*</sup>

January 2006

**Abstract:**

We develop a simple model that looks at the incentives of private banks to behave prudentially and undertake costly efforts to lower the probability of bankruptcy or having to be bailed out by a lender of last resort. Government regulators can force banks to increase efforts beyond the privately optimal level. We contrast the national case under autarky with the case of an integrated banking market with bank cross-holdings. Because banks will exert a greater overall effort to monitor their foreign activities, financial integration might lead to more rather than less prudential behavior. Neither needs financial integration lead to a regulatory race to the bottom. We use the framework to investigate the impact of regulatory coordination on bank efforts and discuss incentives for banks to organize their foreign holdings in the form of branches or subsidiaries. We show that the absence of a common lender of last resort can reduce the probability of a financial crisis.

**JEL Codes:** E 42, E 58, E 61, F 33, F 36.

**Keywords:** Bank regulation, lender of last resort, European financial markets.

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## 1. Introduction

The relation between financial integration and financial fragility is subject to two opposing forces. The ongoing process of consolidation in the European banking sector—one of the more visible signs of financial integration—should make banks (or other financial institutions) more resilient to crises because only profitable banks will survive more competition and concentration.<sup>1</sup> At the same time, banks will become more connected with each other and across borders and this could imply that financial crises will tend to extend beyond the realm of national banking systems, affecting other national banking sectors as well. As a result, increasing cross-border involvement could make the European banking system as a whole more vulnerable to crises. Therefore, it is argued, the process of integration will also force European regulators and supervisors to consider more cooperation and coordination concerning the level of regulation and the requirements they place on their national system (see, among others, Padoa-Schioppa 2004). A more integrated banking system with un-coordinated multiple regulators, it is feared, could lead to a race to the bottom or a free-rider problem among national regulators (e.g., Sanio 2005).

This raises the question if a full centralization of regulation is necessary and who, in the event of a European financial crises, should have the responsibility to act as a Lender-of-Last-Resort (LOLR). Opinions vary widely from those who argue that there should be no lender of last resort (because it would create moral hazard problems), to those who argue that a national bailout might simply be insufficient in a European context.

In this paper we focus on one largely neglected aspect in the debate about the regulatory coordination and the importance of a LOLR in the European context. We argue that an increase in the degree of integration of European banking system might be helpful in the sense that it increases banks' awareness of the positive international externalities of their individual (national) efforts in prudential banking and risk reduction. More specifically, we show that banks undertake more efforts to make themselves less vulnerable to crises in the presence of cross-border holdings. The reason is that cross-border holdings provide partial internalization of the positive repercussions of their own efforts on the systemic stability of the European banking system. Therefore, a more integrated banking system could see an increase in efforts undertaken by private banks and not, as some fear, lower efforts.

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<sup>1</sup> We will use the term banks in an encompassing sense, meaning any kind of financial institution subject to financial sector regulation and possibly eligible for Lender-of-Last-Resort support. Similarly, we will use the terms regulators and/or supervisors to describe government action with regard to banking regulation and oversight.

The same effect might also be at work with regard to national regulators, possibly preventing a “race to the bottom”, in which national regulation is competitively reduced to support “domestic champions”. If regulators start to worry about the health of their clientele’s foreign holdings, they will partly internalize the positive spillovers of more prudential regulation at the national level for the international financial system. However, since national regulators do not fully take into account the international effects of their action (after all, national banks only hold a fraction of foreign assets), the level of regulation will not necessarily be adequate from a European perspective. Full cooperation instead would allow to internalize the positive external effects of individual actions and to take into account the costs of regulation to other governments.

One consequence of the above is that, despite financial integration, the case for a European LOLR is less clear than sometimes argued. Indeed, we show that the *absence* of a LOLR can induce regulators to demand and private banks to provide more efforts and regulation to avoid financial crises. Arguably, the creation of a European banking regulator in turn would imply that part of this creative ambiguity is lost and therefore reduce prudential regulation. Hence, the creation of a European lender of last resort could reduce prudential efforts by private banks and national regulators. Similarly, the creation of a common regulator might reduce prudential regulation because a common regulator would be less ambiguous about the actions of a common lender of last resort.

The paper is structured as follows. In the next section, we discuss some of the main arguments in the literature to put our paper into perspective. Given the great number of contributions, including several surveys, this section is selective rather than complete. In section 3 we provide a brief discussion about the current status of regulation in Europe, while section 4 presents our model. We begin with the national case and the interaction between national banking sectors and regulators in the presence of a national lender of last resort. The next section moves to the case of integrated national banking systems, the possibility of an EMU wide lender of last resort, and a common regulator. The last section points to the limits of our analysis and presents our policy conclusions.

## **2. The Literature**

With the increasing and ongoing integration of the European banking market, a lively discussion about the need of a European regulator has begun. The importance of this discussion has been reinforced by the creation of the European Monetary Union and the prospects of its enlargement. Does an integrated banking market need a common framework

of supervision and regulation? And if so, how should this look? Should it be accompanied by a common lender of last resort? Positions vary widely, and we will briefly present the main arguments pro and con before we look at the current state of cooperation in Europe.<sup>2</sup>

The basis for regulation of the banking industry is the interest to protect consumers and the systemic risks in the banking market. Because of informational asymmetries, consumers are not in a position to assess the safety and soundness of financial institutions which therefore requires official intervention and regulation (Dewatripont and Tirole 1995). Moreover, banks are seen as being particularly prone to systemic risk and vulnerable to contagion, for instance, in the form of fast-spreading bank-runs leading to sector-wide illiquidity and (if unchecked) bankruptcy. Thus, individual crisis-prevention entails sizable positive externalities, while much of the associated effort takes the form of private costs. As a consequence, supervision and regulation is needed to ensure prudential banking and sufficient risk reduction efforts at the bank level (De Bandt and Hartmann 2000). Besides regulation and monitoring a safety net is provided by the so called LOLR, often assumed to be the central bank, which should intervene in case of a systemic crisis and lend to those banks which are temporarily illiquid. It should not intervene if banks are insolvent, reflecting Bagehot's rule.<sup>3</sup>

Arguments in favor of more cooperation between national regulators and supervisory authorities when banks are internationally connected builds on the notion that in its absence there will be too little regulation and that authorities invest too little in the prevention of crisis relative to the social optimum realized by a social planner with an European perspective (see Holthausen and Ronde 2005, Majaha-Jartby and Olafsson 2005).<sup>4</sup> Because of ongoing integration of European financial markets, interdependencies have increased and hence the potential for systemic risk affecting the European markets as a whole (Schoenmaker and Oosterloo 2005). The failure of a national bank might not only put other banks in the respective country at risk but banks in other countries as well.<sup>5</sup> A purely national supervisory structure may lack capability and incentive to assess and address these cross-border risks appropriately and, thus, provide insufficient supervision.

The expected consequence is that the advent of EMU will eventually lead to pressures for some centralized supervisory authority, either within the ECB or independent of it

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<sup>2</sup> A convergence in regulation and supervision might lead to a stronger integration of the markets, so that there could be a positive feedback between integration of markets and regulation.

<sup>3</sup> The LOLR is discussed in Goodhart and Huang (1999) and Giannini (1999), among many others.

<sup>4</sup> Eggert and Schindler (2004) argue that this need not lead to a suboptimal level of regulation. A globalized banking market leads to more competition and reduces excessive risk taking by banks. Hence, the optimal amount of regulation falls.

<sup>5</sup> This argument is based on an international version of the standard bank-run model by Diamond and Dybvig (1983). See Allan and Gale (2000).

(Eichengreen and Ghironi 2001). The extension of EMU to the east will only increase this tendency. Given that the new members tend to have the weakest banking systems in the union, spillovers could be feared for older members.<sup>6</sup>

The expected effects of enlargement notwithstanding, there is already evidence that interdependencies between European banks have increased over the last 15 years.<sup>7</sup> In particular, there are indications of a higher correlation between measures of bank performance during times of duress, such as the 1987 crash and the Nordic banking crises in the early 1990s. This has certainly been supported by the completion of the internal banking market in the response to the second banking directive 1993, and it can therefore be expected that more mergers and acquisitions between European banks will further increase the correlation between banks' profits (Prati and Schinasi 1999).

Another topic highlighted in the literature is whether a more centralized regulation and supervision—if necessary—should be part of the common central bank or remain independent of it (see Kahn and Santos 2002).

The arguments for centralization are twofold. First, the information of the supervisory authority can be useful for the conduct of monetary policy. Second, the central bank must act as a LOLR in case of crisis and needs the information of the supervisory authority in this case (Eichengreen and Ghironi 2001). In order to fulfill its lender of last resort function, the central bank needs timely and adequate information on the liquidity and solvency of private banks. Also, the fact that central banks are independent may enhance their abilities to enforce actions, more than a body under the direction of governments might be able to in certain cases. Padoa-Schioppa (2004, pp. 3-4), speaking for the European Central Bank (ECB) at the time, seems to lean toward this view when he suggests that the existing coordination framework for national regulators and supervisors under the so-called Lamfalussy process, while not without merits, would need to be “exploited to the maximum” to be able to face the challenges of financial market integration ahead—otherwise “more radical solutions” would need to be envisaged. And the ECB's president recently warned that the potential for

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<sup>6</sup> However, the effect of EU enlargement might be less clear than sometimes thought. The new economies, including their financial sectors, are relatively small, which limits the potential danger they pose for EMU. Moreover, many of these banking systems have received large capital inflows from western banks, reducing their vulnerability. On the other hand, these foreign banks are exposed to risks stemming from fast credit growth at (still) high interest rates (Hilbers et al. 2005)—which, after all, is part of their motivation to being there. In addition, foreign banks might be able to avoid complying with national regulatory action, for instance by re-allocating loans to their parent institution or off-shore affiliates.

<sup>7</sup> Evidence on increasing financial integration suggests that bond and equity markets may converge faster than loan credit markets. See, among others, Schüller (2005), Barros et al. (2005), Baele et al. (2004), Adam et al. (2002) and Schoenmaker and Oosterloo (2005). Nicolò and Tiemann (2005) stress that economic integration need not imply a decrease in risk exposure as it limits benefits from diversification.

accounting and regulatory arbitrage in the absence of watertight coordination could bear risks for financial stability.<sup>8</sup>

Arguments against centralization are also twofold. First, the responsibilities of the supervisory function, if linked in any way to the ECB, could conflict with the conduct of monetary policy (i.e. the central bank's policy could become more expansive to save banks and thus create more inflation). The expectations about a possible intervention of the central bank might itself create inflationary expectations and thus make the conduct of monetary policy more difficult. Second, exchange of necessary information can, in principle, also be ensured without housing both responsibilities under one roof. For instance, Sanio (2005, pp. 6-7), speaking as the head of Germany's Federal Financial Supervisory Authority, finds the existing efforts to harmonize the rule book for supervision and enhance cooperation among national supervisors well on track in this regard, suggesting that regulators are "well prepared to handle crisis situations" and "calls for central European supervisory authority...[are] not worth debating at this stage." On the other hand, the LOLR action is usually required very fast, and exchanging information between separate authorities might simply take too long (Eichengreen and Ghironi 2001).

### **3. The Status Quo in the European Union**

As of now, the EU has not made steps into the direction of a full centralization of regulation and supervision of national banking systems.<sup>9</sup> The Economic and Financial Committee (EFC) of the EU merely proposed in a report, endorsed by Ecofin, that arrangements already in place for securities regulation (the Lamfalussy process) should be extended to other financial sectors as well, including the banking sector.<sup>10</sup> Its main principles are the home rule and mutual recognition. Extending to the banking sector, each bank that has a domestic license (a "single passport") can do business in the whole EU under the supervision of the authority that issued the license provided that its foreign activity takes the form of branch-banking. Foreign subsidiaries are, however, supervised and regulated by the foreign authorities.<sup>11</sup> Member states recognize and accept national decisions.

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<sup>8</sup> Trichet at a conference organized by the Committee of European Insurance and Occupational Pension Supervisors in November 2005 (<http://www.globalriskregulator.com/grrnews5.htm>).

<sup>9</sup> The status quo is described, among others, in Schüler (2005), Gulde and Wolf (2005), and Prati and Schinasi (1999).

<sup>10</sup> This might be due to the fact that harmonization and cooperation in supervision has evolved gradually. It is likely that a newly created system would look differently (Gulde and Wolf 2005). Hence, the question is whether such a system should be evolutionary or revolutionary (Gulde and Wolf 2004).

<sup>11</sup> See Padoa-Schioppa (2004) for a discussion. According to him, measured along total assets, branches and subsidiaries are about equally important for EU-wide banking activity.



With the Lamfalussy principle EU member states seem to have accepted the continued coexistence of a multitude of different models of supervision in the union. For instance, a majority of the old EU member states have, with recent changes, now combined their financial markets supervision in a single agency, while as many as three separate branch-authorities governing, for instance, banking and insurance markets, operate in Greece, Portugal, or Spain. Traditionally, bank supervision often lay with the central bank which has not changed through the creation of a common central bank. To some extent, the extension of the Lamfalussy principle might simply be a pragmatic recognition of the continued existence of a diverse set of national supervisory systems.

The cooperation among banking supervisors in the EU is part of a broader and international system of cooperation among central banks and regulators.<sup>12</sup> There are different levels of multilateral and bilateral levels of cooperation. First, there is the Basel Committee on Banking Supervision, aiming to set international standards and to coordinate the work of regulators. It does not possess any formal authority, but formulates guidelines and recommends best standards. Most significant here are the so called Basel II standards that concern minimum capital requirements, rules of disclosure, and assessment processes.

There also exist Memoranda of Understanding (MoU) between European supervisors at the bilateral level. These agreements between national authorities provide a framework for regular exchange of information and define procedures and reciprocal commitments. Nearly all member states have signed such memoranda with each other. In addition, there are MoU between the ECB and national central banks and national banking supervisors on a multilateral basis, for instance among Nordic countries.<sup>13</sup> Finally, in addition to the Committee of European Banking Supervisors (CEBS) operating under the Lamfalussy umbrella, there are several other committees to promote international (and European) cooperation between supervisory authorities, such as a Groupe de Contact (GdC), the Banking Advisory Committee (BAC), the Basel Committee on Banking Supervision, or the Banking Supervisory Committee (BSC) (see, e.g., Schüler 2005).

The application of the Lamfalussy approach to banking is a fairly recent development (the final decision at the EU level dates May 2004), the outcome of the underlying political process being less than certain. A joint proposal by finance ministers Brown and Eichel (of Great Britain and Germany), suggesting the creation of a modern and effective supervisory

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<sup>12</sup> For an international perspective, see Kapstein (2005).

<sup>13</sup> A (non-public) MoU on cooperation between the central banks, Ministries of Finance, and EU Supervisors on crises solution with the main focus on banking supervision came into effect 1 July 2005. See ECB (2005), Sanio (2005).

body at the EU level but leaving financial responsibility with national governments, was opposed by national central banks and stalled. It led, however, to the proposal by the EFC, accepted by Ecofin, eventually approved (with amendments) by the European Parliament, whose main feature it is to extend the Lamfalussy model to other financial sectors and thus to preserve the existing inter-institutional arrangements. This proposal also maintains the role for national central banks and thus finds their support.<sup>14</sup>

The focus of the new structure is primarily the regulatory process. It is aimed to speed up EU legislation to make it more responsive to new market developments. It also aims at making national legislation more compatible with each other, to lead to a convergence of supervisory practices, and to ensure a more consistent implementation of EU directives. The proposal finally aims at speeding up information sharing processes among national regulators in response to the increased interdependencies of banks across countries. The convergence of supervisory activities should also help to deal with multinational banks.<sup>15</sup>

Even within the new framework the ECB does not have an explicit mandate to act as a lender of last resort, nor is it explicitly (other than, were applicable, through its national member banks) involved in banking supervision. Art. 105(5) of the treaty remains rather ambiguous in stating that “the ESCB shall contribute to the smooth conduct of policies pursued by the competent authorities relating to the prudential supervision of credit institutions and the stability of the financial system”. In particular, there is no explanation who the competent authorities might be. Moreover, according to Freixas et al. (2003), financial crises within EMU constrained to national boundaries—to the extent that they (still) exist—may be handled by national authorities, including through limited collateralized credit extended by the respective *national* central bank. On the other hand, there can be little doubt that the ECB will (need to be) involved in any major liquidity crises within the EMU area, in particular if it exceeds national boundaries and approaches systemic levels. This view, probably shared by most observers, seems also to underlie the July 2005 MoU between European banking supervisors, central banks, and finance ministries. The document (albeit not published) explicitly involves the ECB and its member banks in a process of crises-preventing information exchanges and, presumably, advance planning (ECB 2005).

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<sup>14</sup> The two so called Brouwer reports, commissioned by EFC confirm that the current system based on national competencies is appropriate but that there is also a need for more cross-border and cross-sectoral cooperation between national authorities. Bini-Smaghi and Gros (2000) criticize that convergence of regulation does not automatically imply equal application of rules and thus common treatment of national banks.

<sup>15</sup> One problem with this approach may be that it was designed to foster the market integration process in the securities industry (compare Schüler 2005). Issues like the LOLR and the involvement of national central banks are therefore not addressed in this approach.

While the lack of an explicit function of the ECB as a lender of last resort has led to criticism (Prati and Schinasi 1999, Vives 2001), the ECB itself has stressed the positive role of constructive ambiguity, and that private alternatives (such as deposit insurances schemes) and the presence of fiscal authorities might assume the role of bailing out particular banks in case of crisis. It is doubtful, however, that these alternatives would be sufficient and fast enough (Vives 2001).

It might be concluded as well, however, that the ECB has already a role as an implicit lender of last resort. National central banks could rely on so called Emergency Liquidity Assistance (ELA), comprising also assistance by national central banks given to banks in stress. The question, hence, is to what extent the existence of the lender of last resort should be made public or left partly in the dark to exploit constructive ambiguity. As our model will show, a case for the existence and strategic exploitation of such ambiguity can be made.

#### **4. The Model**

In our theoretical analysis, we develop a simple model that focuses on the relation between three national players. There is a private banking sector in each country with  $n$  symmetric *private banks* that compete against each other. A not completely competitive private banking sector would be characterized by fewer banks. Hence,  $n$  is also our measure of competition in the national banking sector. We do not assume that national banks cooperate. National mergers and acquisitions would lead to a fall in  $n$  and we would treat merged banks as single national banks. Given the symmetry of national banks, we will speak of a representative national bank.

The second actor is the national *central bank* whose sole objective is to avoid that the private banking sector fails. In case of large negative shocks which could lead to the failure of the banking system the central bank will intervene and act as a lender-of-last resort to the banking system. This action is however accompanied by some costs for the central bank. For instance, the central bank is forced to increase the monetary base which will subsequently lead to inflation. We assume that the central bank's objective is to minimize the risk of having to bail out private banks because of these costs.

The third player, the national *government* or *regulator*, reflects the interests of private banks and the central bank. It aims at keeping the private banking sector from failing and avoiding systemic crises. It also is affected if the central bank has to intervene. This might imply that the central bank's profits fall and the government obtains less revenue, or it might be that the government suffers from an increase in inflation in the wake of a bailout.

We assume that the central bank is responsible for bailing out private banks should systemic crises arise. The government is assumed to be responsible for the regulation of the banking sector and it can force private banks to undertake “efforts” to reduce the probability they end up in a situation in which the central bank will have to bail out banks. While both, central bank and government, have responsibilities for the stability of the banking system, there is no direct relation between the central bank and the government. This assumption is inspired by the fact that central banks in EU member countries are politically and legally independent from governments.<sup>16</sup>

The government will create rules that, among other things, require private banks to invest in the build up of reserves, to lend prudently, to get rid of bad loans, and to ensure prudent loan risk assessment. These activities are costly for the private banks which, as a consequence, might be reluctant to undertake these measures—at least to the degree demanded by the regulator. The government is likely to consider at least some of these efforts when setting regulatory standards. This could be because the government takes into account potential short- and long-run consequence of reduced risk-taking in the real economy, in particular lower investment and potential growth, or because of successful private-sector lobbying. In what follows, we will focus on the former argument, that is, we assume that the government considers private efforts as a cost of prudential regulation because of efficiency considerations.

However, the government is unlikely to put as much weight on the cost of prudential regulation as the private sector and will, as a rule, demand prudential effort in excess of private interest. One reason is that not all private costs may translate into social costs. Another is that the government takes into account the cost arising from regulatory shortfalls that require central bank bailout. As a consequence, regulatory demands may exceed unrestricted private efforts in this area.

The simple model excludes a number of potentially interesting topics. First, we do not model implementation of regulation—all regulation is enforced ceaselessly. Second, there is no private or explicitly tax-payer supported insurance for banks in case of crises. In our setup the only authority that can support banks in danger of failing is the central bank in its lender-of-last resort function. The assumption mirrors the facts that deposit insurance schemes are rarely intended to cover larger scale or systemic crisis repercussions, may be slow to take effect, and, in an EU wide setting, are likely to involve lengthy discussions about who has to

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<sup>16</sup> In a broader sense, the model involves both the government and the central bank in the regulation of the banking sector. See Prati and Schinasi (1999), Gulde and Wolf (2005) or Schüler (2005) for a description of actual separation of powers between central banks and governments in Europe.

pay how much, which in all likelihood would delay the resolution of a banking crisis (Prati and Schinasi 1999).

Also, we do not explicitly distinguish between the forms in which banks' cooperation (or merger and acquisitions) takes place. There is some literature explicitly distinguishing between branches and subsidiaries (Repullo 2000, Holthausen and Ronde 2005) pointing out that branches are regulated in the home country (by virtue of the single banking pass (Padao-Schioppa 2004)) while subsidiaries are regulated in the host country. We will ask, however, under what circumstances banks prefer opening branches or subsidiaries if they are active in other countries.

Finally, we do not look at "intermediate" forms of cooperation between governments. We only compare the two cases of non-cooperation in regulation and full cooperation in terms of the level of regulation that is set. Simple information sharing is not looked at (see Holthausen and Ronde 2005). Again, this leaves out some forms of cooperation that might be important such as the MoU that should improve information sharing. We assume that governments are perfectly informed about regulation in other countries.

#### **4.1. The Single Economy**

We proceed by first showing the case of the single economy and the equilibrium determined by the private banks' efforts undertaken to reduce vulnerability to shocks and the government's amount of regulation. In the next step, we will see how this equilibrium is changed through integration among private banks in a European setting. To simplify, we only consider two countries, indexed by  $i=1,2$ , representing, for instance, the process of financial market integration between two older member states or between the old member states and new member states.

##### **Private Banks**

The utility function of a representative private bank is given as

$$EU_i^B = f(e_i)E\pi_i - v(e_i) \quad (1)$$

where  $E$  denotes the expectations operator,  $\pi$  are the bank's profits and  $e$  are the bank's efforts undertaken to make it less vulnerable and to increase profits. Efforts might include more careful lending policies, a better control of lenders' behavior, or better monitoring.

The bank's effort,  $e$ , has a twofold effect on expected profits.<sup>17</sup> The first effect is based on the assumption that the effort generates a positive *return* for the bank, perhaps because a more careful balancing of the loan portfolio or an improved risk matching of assets and liabilities. Formally, this can be captured by multiplying expected profits,  $E\pi$ , by a return factor increasing in  $e$ . We shall assume that  $f(e_i)$  takes a simple linear form, specifically:  $f(e_i) = 1 + e_i$ . As to expected profits, we define  $E\pi_i = [p_i \bar{\pi} + (1 - p_i) \underline{\pi}]$ , where  $\bar{\pi}$  are high profits realized in the “good” situation and  $\underline{\pi}$  are negative profits realized under the “bad” outcome, such that  $\underline{\pi} < 0 < \bar{\pi}$ . We assume that the bank will have to close and go out of business if  $\underline{\pi}$  is realized unless it is bailed out.<sup>18</sup>

The second influence of efforts works indirectly on the probability of a negative outcome, for instance, because of greater vigilance in monitoring risks. This can be expressed by a probability function of the general form  $p_i = p_i(e_i, \theta_i)$ ;  $p_{\theta_i}, p_{e_i} > 0$ , where  $\theta_i$  is the exogenously given chance of a “good” development in economy  $i$  (anchored, perhaps, in the national or international macroeconomic environment), which makes  $1 - \theta$  an exogenous measure of the level of systemic risk. Even if  $\theta_i$  is low, the bank can improve its individual chance through reinforced efforts. In what follows, we will use the specification  $p_i = e_i + \theta_i$  with  $0 \leq e_i + \theta_i \leq 1$ .

Finally, the effort spend by the bank will have costs. Specifying a quadratic form  $v(e_i) = \gamma e_i^2$ , where  $\gamma > 0$  measures the bank's aversion to efforts, we can rewrite its expected utility (1) as  $EU_i^B = [p_i \bar{\pi} + (1 - p_i) \underline{\pi}](1 + e_i) - \gamma e_i^2$ .

There is the possibility that the bank is bailed out by the central bank in its capacity as the lender of last resort (LoLR). The size of the bailout will be such that the bank does not go bankrupt, that is, we assume that the bailout  $B$  is sufficient to keep the bank in operation. There will be costs to the bank in terms of lost reputation or the manager being fired of size  $L_B$ , however, in case a bailout becomes necessary. In case of the bank's closure these costs are  $L_C$ . We assume that all these costs are identical across countries and therefore do not index them.

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<sup>17</sup> Cordella and Levy-Yeyati (2004) make similar assumptions with regard to government reform efforts in crisis prevention. Since we argue here that the bank's efforts are of the same nature as the efforts the government will demand from banks through regulators, there is a similarity in perspective. Freixas et al. (2003) make a related point when they distinguish between banks' efforts in screening credit projects in the selection phase (which might shape expected profits) and monitoring thereafter (which might influence the probability of default).

<sup>18</sup> Since this is a one period model we cannot distinguish between solvency and illiquidity of the bank and Bagehot's rule cannot be applied.

However, the individual bank can not be sure that it will be bailed out by the central bank because a single bank's potential failure may or may not put the whole banking system at risk, and the central bank will only spring into action to stop a systemic crisis. Thus, there is only a probability  $0 \leq \tau \leq 1$  that the central bank will bail out an individual bank. The expected payout to the bank's managers, in the case of  $\underline{\pi}$ , is hence given as  $\tau(\underline{\pi} + B - L_B) + (1 - \tau)(\underline{\pi} + 0 - L_C)$ . This expression simplifies to  $\underline{\pi} + \tau B - L$  where we have defined  $L = \tau L_B + (1 - \tau)L_C$  as the expected costs to the bank and its manager under the bad outcome.

Finally, we assume that the bank's probability of being bailed out, while exogenous to the individual private bank, is a negative function of the overall number of private banks operating in the economy. Under symmetry, if there are many banks in the economy, a single bank's failure is less likely to cause a crisis of the entire banking system. If there are only few banks, however, a bank's default is more likely to cause a run on the banking system, rendering it unstable along the logic of Diamond and Dybvig (1983). In this case, the central bank will have to intervene in order to save the system. Assuming that each bank is a Nash-player with respect to other banks and the regulating authority, a reasonable presumption is that for each single bank the probability of being bailed out is simply  $\tau = 1/n$ . The private bank's expected payout in case of a negative shock is then  $\underline{\pi} + \frac{1}{n}B - L$ . In order to save notation, we define  $\bar{x} = \bar{\pi}$  and  $\underline{x}^B = \underline{\pi} + \frac{1}{n}B - L$  with  $\bar{x} - \underline{x}^B > 0$ . Because  $\underline{x}$  is a function of the subjective probability of being bailed out, we index it for the private bank.

Based on these definitions and assumptions we can calculate the representative private bank's optimal prudential efforts by maximizing expected utility (1) as

$$e_1^B = \frac{1}{2} \frac{\theta_i \bar{x} + (1 - \theta_i) \underline{x}^B}{\gamma - (\bar{x} - \underline{x}^B)} \quad (2)$$

The efforts undertaken by the private bank are increasing in the probability that a systemic crisis can be avoided,  $\theta_i$ , (only then the bank can hope to reap the profits from its prudential efforts) and falling in the marginal cost of private effort,  $\gamma$ . Effort also increases in  $\bar{x} - \underline{x}^B$  (i.e., the difference between expected profits in the good state of the world and the bad state of the world), which captures the marginal benefit (or "productivity") of the bank's

prudential efforts. In particular, as  $\bar{x} - \underline{x} = \bar{\pi} - \underline{\pi} + L - \tau B$ , efforts increase in the manager's personal cost of a bailout,  $L$ , and fall in the probability of being bailed out,  $\tau$ . Since this probability is a negative function of the number of banks, competition enhances the efforts of the representative private bank and, thus, the stability of the banking system.<sup>19</sup> Note that, because banks are symmetric, the level of efforts undertaken by the representative bank equals the average level of efforts undertaken by “the banking system”.

### The Central Bank

We turn next to the objective function of the central bank. In this setup, the central bank focuses solely on avoiding a collapse of the banking system. This simplification can be justified, for instance, by pointing to the potentially dire consequence of a financial collapse for price stability and the stability of the real economy. In case of the ECB, price stability is the overarching policy aim.

Assuming that the central bank has no further direct costs from bailing out the banking system, its expected utility is simply given as

$$EU_i^{CB} = -(1 - p_i)B, \quad (3)$$

That is, the central bank benefits from higher prudential efforts by the private banking sector reducing the probability of a banking crisis.

### The Government or Regulator

The government or regulator balances concerns for the stability and profitability of the national banking system and the cost of prudential regulation, that is, the economic costs associated with the efforts by private banks. In addition, however, the government is also concerned with the implications of a bail out for the central bank. The government's objective function is therefore

$$EU_i^G = E\pi_i - \omega(e_i) + \delta EU_i^{CB}, \quad (4)$$

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<sup>19</sup> More precisely  $\partial e / \partial \underline{x} > 0$  if  $(1 - \theta_i)\gamma + (2\theta_i - 1)\bar{x} > 0$ . Since  $\underline{x}$  is increasing in  $\tau$  and falling in  $L$ , a negative  $\underline{x}$  implies that efforts rise in  $L$  and fall in  $\tau$  for  $\theta_i$  large enough.



where  $\delta$  denotes the relative influence of central bank losses and  $\omega(e_i)$  is a positive function of the effort undertaken in the national banking sector. In what follows, we will assume that  $\omega(e_i) = \phi e_i^2$ .

While (4) assumes that the government values a healthy national banking sector, the government's perspective on the cost of prudential effort differs from private banks. First, we have that  $\phi \neq \gamma$ , with a natural assumption being that the government considers a smaller share of the private risk-reducing effort in its target function than the private sector itself (see (1)). Second, the government will take into account the costs that occur if the central bank will intervene to save the banking system should the need arise. While each private bank considers only its own situation, the government considers the probability of any bank requiring bailout. Moreover, other than the individual private bank, the government is aware of the fact that banks are symmetric, implying that if one bank is in trouble the entire system is, which will prompt the central bank to bailout the system. As a consequence, from the government's perspective, the probability of central bank intervention in case of an individual bank failure (which we defined  $\tau$  for the individual bank) takes a value of one. More formally, we have that the bad-case payout considered by the government (and entering the expected bank profit term in (4),  $E\pi_i$ ) is  $\underline{x}^G = \underline{\pi} + B - L$ .

Taking into account the above and maximizing (4), we find the optimal level of effort from the point of view of the government is

$$e_i^G = \frac{1}{2} \frac{\theta_i \bar{x} + (1 - \theta_i) \underline{x}^G + \delta B}{\phi - (\bar{x} - \underline{x}^G)}. \quad (5)$$

Since the government is the regulatory authority, we assume that it can impose its desired level of efforts on the private banks. Defining  $e_i^G$  as the measure of prudential effort or “regulation” demanded by the government, the level of effort provided in the banking system will be

$$e_i^* = \max \{e_i^G, e_i^B\}.$$

Under reasonable assumptions, the level of effort that the government will impose on the economy is larger than the level preferred by the private banking sector. In particular, we will always have  $e_i^G > e_i^B \Rightarrow e_i^* = e_i^G$  if  $\delta > 0$ ,  $\phi < \gamma$ , and  $n$  is not too large (see Appendix 1).

This is because under these assumptions the government has a stronger interest to avoid bailouts, it is less averse against banks' efforts, and banks' incentives to provide efforts are not too strong. In what follows, we will assume that these conditions hold.

## **4.2. An Integrated Banking System**

With financial integration, the well-being of domestic banks will not only depend on their own profits but—through various channels—on the profits of banks abroad. We consider three different cases reflecting possible integration scenarios in the European banking industry.

A first scenario is that financial integration takes the form of domestic banks acquiring shares in a foreign bank, which implies that domestic banks will be sharing foreign profits. Under the so-called home rule, the domestic bank will continue to be regulated by the domestic regulator and the foreign bank will be regulated by the foreign regulator. To distinguish this case from the branch-scenario (see below), we shall assume that the foreign bank, even when becoming a full subsidiary of the domestic bank, will be managed independently from the domestic bank. Secondly, we look at the case of cross-holdings where domestic banks hold shares abroad and foreign banks hold shares of domestic banks. In this case, too, domestic and foreign banks are supervised by their respective national regulators. Finally, we consider a scenario in a multinational bank holds a controlling stake in a foreign bank and contemplates running the foreign bank as a branch or subsidiary. In both cases the domestic bank will provide the prudential effort necessary to run the foreign bank.

In all of these cases, regulation will be carried out by national supervisors. The representative domestic and (where applicable) foreign banks decide in each case about the effort they put into reducing risks and increasing expected profits, and national regulators determine national regulation. The case of centralized regulation by an EU regulator will be considered in section 4.4.

### **Scenario 1: Domestic Bank with Shares in Foreign Banks**

For this case, we assume that a domestic bank (i.e., because of its representative nature, the domestic banking system as a whole) acquires a share  $\lambda$  ( $0 < \lambda < 1$ ) in a foreign bank (i.e., a foreign banking system). The domestic bank is labeled 1, the foreign bank is labeled 2. We consider only country 1. As already noted, we assume that the connection between banks remains loose and that both foreign and domestic banks continue to decide on their efforts individually.

The domestic bank's utility is

$$E\pi_1 - v(e_1) = [p_1\bar{\pi} + (1-p_1)\underline{\pi} + \lambda E\pi_2](1+e_1) - \gamma e_1^2,$$

where  $E\pi_2 = (p_2\bar{\pi} + (1-p_2)\underline{\pi})(1+e_2)$ . In line with the previous section, we have  $p_2 = \theta_2 + e_2$ , but we allow for differing exogenous risk levels, that is  $\theta_1 \geq \theta_2$ . For simplicity, let  $\theta_1 \neq \theta_2$  be the only difference between the two banks at home and abroad, so that the expected gain and losses (as well as the LoLR support) in both countries are equal. In other words, some countries are more likely to be hit by bad shocks than others but all else is symmetric.

Note that the bank's foreign holdings are treated similar to their domestic assets. Domestically banks can increase their profits by exerting costly efforts, for instance, through more closely monitoring their domestic credit projects. The basic idea here is that more of the same effort will also be helpful to increase revenue flows from abroad—for instance, by monitoring foreign bank managers and their credit projects or by ensuring that a larger part of foreign profits is distributed and not diverted to other uses, thereby increasing expected profits for a given level of foreign efforts.<sup>20</sup>

Another crucial feature of the expected utility function is that the domestic bank shares the foreign bank's profits but not its efforts. This reflects the assumed continued independence of the foreign banks—domestic managers do not take into account the efforts paid by foreign managers. They do, however, take into account the positive repercussions of the (given) level of expected foreign profits (linked to a given level of the foreign managers' efforts,  $e_2$ , which influences  $E\pi_2$ ) on their own profits. Obviously, if the domestic bank's share  $\lambda$  in foreign profits is positive and if  $E\pi_2 > 0$ , there is an additional benefit from a marginal increase in domestic effort.

The bank's optimal efforts will thus be

$$e_1^B = \frac{1}{2} \frac{\theta_1\bar{x} + (1-\theta_1)\underline{x}^B + \lambda(1+e_2)(\theta_2\bar{x} + (1-\theta_2)\underline{x}^B + e_2(\bar{x} - \underline{x}^B))}{\gamma - (\bar{x} - \underline{x}^B)}. \quad (6)$$

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<sup>20</sup> A key assumption here is obviously that the type of effort spent to monitor foreign activities is similar to—in effect, identical with—monitoring domestic activity. While this will not apply for *any* type of foreign asset held by the bank, it seems a plausible assumption for an extension of the bank's core business activity to foreign markets.

The higher the domestic bank's share in the foreign bank, the larger is the positive feedback effect it reigns from increasing its own efforts. *Ceteris paribus*, compared to the autarky case discussed in the previous section, this leads to higher domestic efforts and higher expected domestic profits. As a consequence, the overall effort level will increase with financial integration. Moreover, *ceteris paribus*, more efforts by the foreign bank will induce the domestic bank to provide more efforts itself because it increases the payoff from more efforts.

For the government or regulator, we have the same effect. Optimal regulation from a national perspective requires an effort of

$$e_1^G = \frac{1}{2} \frac{\theta_1 \bar{x} + (1 - \theta_1) \underline{x}^G + \lambda(1 + e_2)(\theta_2 \bar{x} + (1 - \theta_2) \underline{x}^B + e_2(\bar{x} - \underline{x}^B)) + \delta B_1}{\phi - (\bar{x} - \underline{x}^G)}, \quad (7)$$

and, as before, regulation is binding in the sense that the effort by the regulator exceeds the effort level that would be privately provided by banks. More specifically, under the assumptions  $\delta > 0$  and  $\gamma > \phi$ , the relation  $e_1^B < e_1^G$  remains unchanged.<sup>21</sup>

In our setup, this result extends to regulators: financial integration need not result in a “race to the bottom”. Like the representative domestic bank, the government takes into account that the domestic banking system's profits are related to the profits of foreign banks. Because the government realizes as well that more foreign efforts make the provision of more efforts more worthwhile, it also increases its regulation of the domestic banking system. Intuitively, this would correspond to a regulator who demands that banks, if they invest in foreign banks, also invest in better surveillance of those banks. In the sense of protecting investors and deposits in domestic banks, regulators require banks to monitor carefully their investments. Thus, contrary to what is often claimed, financial market integration need not lead to less regulation.

## Scenario 2: Cross Holdings between Banking Systems

In the case of cross-holdings, bank 1 shares the profits of bank 2, and bank 2 shares the profits of bank 1. This probably best describes financial integration among equals—within the EU, say—where banks from already well developed banking systems acquire shares in each other. In contrast, the case of one-sided foreign holdings discussed above might characterize a form

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<sup>21</sup> Note that the efforts of bank 2 will equal efforts in the domestic case (see equation (2)) because bank 2 holds no interest in bank 1.

of involvement of old EU member banks in the new EU member banking markets, with, for instance, a Finnish bank acquiring a share in a bank operating in the Baltics.

The objective function of banks in country 1 is, as before, given as

$$E\pi_1 - v(e_1) = [p_1\bar{\pi} + (1 - p_1)\underline{\pi} + \lambda E\pi_2](1 + e_1) - \gamma e_1^2, \text{ but we also assume}$$

$$E\pi_2 = [p_2\bar{\pi} + (1 - p_2)\underline{\pi} + \lambda E\pi_1](1 + e_2).$$

Hence, banks in country 1 will realize that their own efforts also have a positive impact on the profits on the banks in country 2, which in turn feeds back into their own profits. Because foreign banks benefit from domestic efforts, providing domestic efforts now create a positive “second round” effect.

Going through the usual motions, one finds that banks in country 1 will provide efforts of

$$e_1^B = \frac{1}{2} \frac{(1 + \lambda^2(1 + e_2))[\theta_1\bar{x} + (1 - \theta_1)\underline{x}^B] + \lambda\tilde{\pi}_2}{\gamma - (\bar{x} - \underline{x}^B)(1 + \lambda^2(1 + e_2))}, \quad (8)$$

where  $\tilde{\pi}_2 = (1 + e_2)(\theta_2\bar{x} + (1 - \theta_2)\underline{x}^B + e_2(\bar{x} - \underline{x}^B))$ . A similar expression holds for bank 2.

Because of the positive second round effect, banks internalize some of the positive externalities of their own activities, which, in turn, will motivate foreign banks to increase their effort as well. Whereas in the first case, foreign banks had no incentive to increase their efforts due to financial integration, now both domestic and foreign banks will produce higher prudential efforts. The additional boost in the efforts of the representative bank in country 1 is visible in the factor  $\lambda^2(1 + e_2)$ .

In this case, government’s regulation is given as

$$e_1^G = \frac{1}{2} \frac{(1 + \lambda^2(1 + e_2))[\theta_1\bar{x} + (1 - \theta_1)\underline{x}^G] + \lambda\tilde{\pi}_2 + \delta B_1}{\phi - (\bar{x} - \underline{x}^G)(1 + \lambda^2(1 + e_2))}. \quad (9)$$

Following the logic developed earlier, the government will realize the positive feedback from domestic regulation inducing higher prudential efforts at home in the case of cross-holdings. Accordingly, it will demand higher levels of effort from the domestic financial sector. As in scenario 1, financial integration need not lead to a “race to the bottom”.

### Scenario 3: Multinational Banks with a Controlling Stake

Finally, we consider the case of a multinational bank. This could take two forms. First, the bank might acquire a foreign bank and take control of that bank. Examples would include a take-over of, say, a German by an Italian bank or banks from old EU member states taking over banks in the new member states as a subsidiary. The other case would be a domestic bank opening branches abroad. The two cases differ under current EU law because subsidiaries are under the regulation of a foreign regulator, whereas branches are regulated by the domestic regulator. The organizational choice of the bank—or “supervisory arbitrage”, as it is sometime called—is considered in the next subsection. The bank’s optimization with regard to prudential effort, however, is independent of the supervisory structure and will be discussed first.

#### *Optimal Effort*

What are the effort levels at home and abroad that a bank would provide unconstrained by regulators? In the multinational bank scenario—be it in the form of branches or subsidiaries—the domestic bank now has a more profound interest in foreign banks. It shares not only the foreign profits but also the effort undertaken (and the implied cost occurring) abroad. This reflects the fact that the domestic bank is now fully responsible for the behavior and stability of the foreign bank. Assuming that it can set domestic and foreign effort levels separately, its optimal choice will reflect national markets’ characteristics, that is, differences between  $\theta_1$  and  $\theta_2$ .

Expected utility in the multinational bank case is

$$E\pi_1 + E\pi_2 - v(e_1, e_2) = [p_1\bar{\pi} + (1-p_1)\underline{\pi}](1+e_1) + \lambda[p_2\bar{\pi} + (1-p_2)\underline{\pi}](1+e_2) - \gamma(e_1^2 + \lambda e_2^2),$$

where  $e_1$  and  $e_2$ , mark the bank’s efforts in the two countries. Their optimal level will be

$$e_1^B = \frac{1}{2} \frac{\theta_1\bar{x} + (1-\theta_1)\underline{x}^B + \lambda\tilde{\pi}_2(e_2^B)}{\gamma - (\bar{x} - \underline{x}^B)} \quad \text{and} \quad e_2^B = \frac{1}{2} \frac{\theta_2\bar{x} + (1-\theta_2)\underline{x}^B}{\gamma - (\bar{x} - \underline{x}^B)}. \quad (10)$$

Equation (10) shows that private efforts under multinational banking are similar to a situation with the domestic bank holding a non-controlling share on the foreign bank. In

particular,  $e_2^B$  in (10) is similar to the optimal effort depicted by (2), and  $e_1^B$  in (10) is similar to the effort level described by (6). In other words, the outcome does not depend on where the efforts are provided or decided: (6) and (10) yield the same results for banks in country 1 and the multinational's efforts in country 2 are the same as if a bank in country 2 would set the level of efforts independently. Behind the neutrality result is the assumption of identical utility parameters (in particular  $\gamma$ ).<sup>22</sup>

Note that the governments will continue to determine regulation independently and that—mirroring the behavior of private banks—the level of effort required by regulators will be the same as described in case where banks only have shares in foreign banks.<sup>23</sup> This is because under the home rule principle governments set regulatory levels only with respect to national markets.

### *Branches or Subsidiaries?*

In the case of multinational banks that hold controlling interests in foreign banks, the question arises whether banks should open branches in foreign countries and compete with foreign banks or rather try to acquire them. In our simple model, the two strategies only differ in the regulatory authority to which the banks have to refer. As already mentioned, branches are regulated by the home authority (by virtue of the “single banking pass”) while subsidiaries are subject to the host country's regulation.

To understand better the bank's organizational decision, consider a simple thought experiment where the effort levels demanded by governments or regulators in country 1,  $e_1^*$ , and country 2,  $e_2^*$ , differ, reflecting varying views of the national authorities regarding the optimal levels of regulation as given in (7). With a branch structure (indexed b), bank 1 has expected utility of  $EU_1^B|_b = E[\pi_1(e_1) + \lambda\pi_2(e_1)] - \gamma(1 + \lambda)e_1^2$  whereas with a subsidiaries structure (indexed s) it has expected utility  $EU_1^B|_s = E[\pi_1(e_1) + \lambda\pi_2(e_2)] - \gamma e_1^2 - \lambda\gamma e_2^2$ .

It follows that domestic banks will prefer the branch structure over the subsidiaries structure if  $EU_1^B|_b > EU_1^B|_s$  which is equal to

<sup>22</sup> Efforts in the banking system in country 2 would be higher if controlled by the multinational bank than by an independent bank in country 2 if the multinational bank's aversion to efforts are lower than the independent bank's ( $\gamma_1 < \gamma_2$ ) which we have excluded by assumption. In general, there can of course be a difference between effort levels provided by the domestic and the foreign banking system.

<sup>23</sup> Not shown, but the result follows straightforwardly from the findings above.

$$(1 + e_1^*)[\theta_2 \bar{x} + (1 - \theta_2) \underline{x}^B + (\bar{x} - \underline{x}^B)](e_2^* - e_1^*) + (e_2^{*2} - e_1^{*2})[(\bar{x} - \underline{x}^B)(1 + e_1^*)] < \gamma(e_2^{*2} - e_1^{*2}). \quad (11)$$

The condition shows that if country 2 is demanding a higher prudential effort than country 1 and if the domestic bank is sufficiently averse to regulation (i.e., finds it sufficiently costly), it will prefer the branch structure in order to avoid the higher regulatory burden abroad. On the other hand, since regulation improves crisis resilience and expected profits, the bank will subject itself to foreign regulation and chose to enter the foreign market using a subsidiary framework if its aversion to efforts is low. That is, the bank will cast its foreign activity in the organizational form that minimizes the difference between the optimal efforts it would undertake from its own point of view and the (higher) levels of effort that are enforced by regulators at home or abroad.

### **Welfare Considerations**

Two results are particularly relevant from a welfare perspective. First, even when unrestricted by regulators, prudential efforts undertaken by private domestic banks increase if banks share in the profits of foreign banks. The underlying assumption is that the profit flow from the banks' foreign assets, just like profit flows from domestic assets, is increasing in the banks' overall prudential efforts. The increase in efforts is magnified if there are cross-holdings among national banking systems. In this case banks realize that there will be feedback-effects from their own efforts: higher domestic efforts will increase the profits of foreign banks, which, in turn, will lead to higher domestic profits. As a consequence, internationally active banks will not necessarily reduce their prudential efforts.

Second, although banks benefit from providing more efforts, these efforts in general will be too low from a social planner's perspective. Especially large banks can expect to be bailed out in case of a financial crises and this expectation reduces their efforts. Therefore, national regulators, taking into account the costs of such bail outs will, as a rule, require more efforts from banks. With internationally active banks, regulators will additionally increase the level of regulation because they realize that the financial health of national banks depends to some extent on how prudent banks handle their international investments. Financial integration thus need not lead to a race to the bottom in regulation. Regulators will continue to demand more efforts from private banks than these are willing to provide themselves because banks do not internalize the costs of a potential bailout and hence provide too little efforts to avoid such a situation.



The question remains whether the amount of effort enforced by national regulators is optimal from an European (or international) planer's perspective? In general, the answer is no. The reason is that national regulators do not take into account how national regulatory efforts impact crisis probabilities in other countries—in our model, national regulators are only concerned with the possible feedback effects of domestic regulation on *national* financial stability. Appendix 2 demonstrates that from a European point of view, national regulation will be inadequately low because it does not take these spillovers into account. For instance, in the case of a national bank holding a share in the foreign bank, the regulator in country 2 remains ignorant of the fact that more efforts in country 2 induce banks in country 1 to provide more efforts. Hence, regulation in country 2 is too low from a European perspective. Since regulation in country 1 is increasing in  $e_2^G$ , it is too low as well from a European perspective. The same logic applies to the case of cross-holdings. Here, too, national regulators react positively to effort levels provided by foreign banks but ignore that domestic regulatory levels influence foreign regulators.

What are the policy implications of inefficiently low levels of national regulation? To address this question, we now consider the role of a common lender of last resort and the case of a European wide regulator of banking activities.

### 4.3. The Lender-of-Last-Resort

Monetary integration in Europe changes the setup under which private banks and governments or regulators operate. A common central bank implies that national lenders-of-last resort disappear. National central banks can no longer independently bail out national banking systems in case of negative shocks because they are part of the Eurosystem.<sup>24</sup> To the extent that EU members that are not yet members of the euro area have already joined ERM2 and, thereby, restricted exchange rate movements to the euro, this constraint will be binding for them as well. In what follows, we will assume that both the domestic and the foreign country are part of the euro area in this wider sense.

Assume that the common central bank, the ECB, is concerned with the stability of the international banking system as a whole—for instance, because both country 1 and country 2 are euro area members or because country 1 represents the euro area and country 2 is an ERM2 member at the brink of joining the euro area. More specifically, we assume that it is concerned with a weighted average of national banking systems of member states. That is, the

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<sup>24</sup> This might not literally be the case as the discussion above has indicated. But powers of national central banks are significantly reduced and national governments can no longer be sure of the intervention of the central bank.

ECB's utility function is a weighted sum of the national banking systems, depending on the national probabilities to be hit by a negative shock (a function of national efforts) and the bailouts that would be necessary to save the national banking systems in the EU

$$EU^{ECB} = \frac{1}{2}EU_1^{CB} + \frac{1}{2}EU_2^{CB}. \quad (12)$$

The ECB, like the national central banks before it, will aim to minimize the probability that the banking system is faced with collapse—only that it takes an area-wide perspective. It will intervene, however, only if the banking system is hit by a crisis large enough to make the entire system collapse. If only one national banking system is hit, the ECB might decide not to intervene in order to avoid that private banks and national regulators revise their subjective probability of private banks being bailed out and reduce their own prudential efforts or regulatory demands (the often mentioned moral hazard effect of a LoLR).

As a consequence, private prudential efforts will increase under a European bailout scheme. The argument is quite straightforward: in all domestic and financial integration scenarios discussed so far, private prudential effort,  $e_1^B$ , is increasing in  $1/\tau$ . At the same time, for any single national bank, the probability of being bailed out by the common central bank was  $\tau = \frac{1}{n}$ , with  $n$  representing the number of domestic banks. Under ECB-rule, however, the denominator will increase and  $\tau$  will fall by a factor proportional to the number of countries that are members of the euro area (or the group of countries the ECB takes into consideration because of other reasons). In the symmetrical case, we have  $\tau = \frac{1}{2n}$ . Thus, prudential efforts of private banks across the area will be higher if bailouts are delegated to the area level than under a national bailout-regime. Financial integration without a single central bank does not have this effect, because only a single central bank creates more ambiguity and hence induces more efforts from private banks.

A similar result holds for national regulators or governments. With a national LoLR, national authorities calculated the aggregate probability of a central bank bailout in case of systemic bank failure as unity. However, for national regulators, too, this probability is now a declining function of the size of the area subjected to the ECB regime. Accordingly, in the

two-country case, the bailout probability falls to  $\tau = 1/2$ .<sup>25</sup> At the same time, national authorities take into account bailout costs occurring at the ECB level by a correspondingly smaller factor (i.e., cost are shared). This leaves the overall impact of monetary integration in the balance: on the one hand, a decrease in the probability of a bailout should increase national regulatory demand; on the other, a reduced government concern for bailout costs points in the other direction. Appendix 3 shows that regulatory demands are likely to be higher under the ECB regime compared to a national LoLR setup if national authorities pay little attention to regulation costs occurring at the private level (i.e., if  $\phi$  is low).

This logic can directly be extended to the case of the absence of a LoLR at the area level—which is linked to the case for creative ambiguity.<sup>26</sup> In this case, both governments or regulators and private banks will set the bailout probability to zero. Therefore, in our model, the absence of a LoLR unambiguously increases prudential efforts undertaken by private banks and the demand for such regulation by the national authorities.

#### 4.4. Coordination of Regulators

So far, we have assumed that the regulators in the two regions set their regulations independently. But apart from creating (or not creating) a common LoLR, regulating authorities might go beyond the current degree of cooperation and information sharing following the Lamfalussy-model and opt for a more centralized solution. Arguably, if financial markets in the EU continue to integrate and if private sector interdependencies increase further, national governments might decide that the time has come for a common regulator.

In this case it is reasonable to expect that this common regulator would apply the same level of regulation to all member countries and thus follow as “one size fits all” strategy.<sup>27</sup> This would also imply that it would no longer matter for private banks whether they operate subsidiaries or branches because they would be subject to the same level of regulation independent of where they are located and what type of banking business they operate. Following this notion, we finally consider the case of a common regulator paired with one area-wide LoLR. We assume that the area regulator maximizes a target function that represents a weighted average of the objective functions of national regulators. That is

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<sup>25</sup> With  $m$  member countries the subjective probability of a national regulator would be  $\tau = 1/m$ . Thus, national regulators increase their regulatory demands from national banks with the number of member countries.

<sup>26</sup> . Arguably, such a scenario captures elements of the euro area status quo, where a clear LoLR responsibility has not been assigned to the ECB. This ignores opinions that argue that the ECB de facto has this function nevertheless (see discussion above).

<sup>27</sup> Here the common regulator deviates from what the social planner would do. The latter would allow for nationally differentiating levels of regulation which is unlikely to be possible in practice.

$$EU^{CR} = \frac{1}{2}(E\pi_1 - \omega(e) + \delta B_1) + \frac{1}{2}(E\pi_2 - \omega(e) + \delta B_2). \quad (13)$$

Optimal regulated prudential effort in this case would be

$$e^{CR} = \frac{1}{4} \frac{[\theta_1 \bar{x} + (1 - \theta_1) \underline{x}^G] + [\theta_2 \bar{x} + (1 - \theta_2) \underline{x}^G] + 2\delta B}{\phi - (\bar{x} - \underline{x}^G)}, \quad (14)$$

where  $B_1 = B_2 = B$  because the potential bailout for the two banking system is the same under our assumption that  $\bar{x} - \underline{x}^G$  is equal across countries. In contrast to national regulators, the common regulator will naturally adopt an EU-wide perspective. In particular, this implies the regulator takes into account that the ECB intervenes if national banking systems are in trouble. While every national government or regulator assigns a probability of  $\tau = 1/2$  to the central bank's intervention, the common regulator assigns  $\tau = 1$  to this possibility.

There are two opposing forces determining the area-wide regulators demand for prudential effort. On the one hand, the common regulator is aware the lender of last resort will intervene if the European banking system is in danger of failure. Therefore, the creative ambiguity created by the common LoLR in case of national regulators is lost and regulatory demand for prudential effort falls. On the other, the common regulator will take full account of the bailout costs arising for the common central bank and LoLR, while national authorities ignored the share of cost paid for abroad. This will tend to increase demanded precautionary effort from private banks. Appendix 3 suggests, however, that the former effect is likely to dominate. As a consequence, a common regulator will be less demanding on banks than a national regulator in the presence of a common lender of last resort.

## 5. Conclusion

The paper develops a simple model of financial integration between national banking systems. The basic mechanism builds on the twofold impact of prudential effort by private banks: more prudential selection and monitoring of lending and other asset-related activities will both reduce the probability of financial crises and increase expected profits. If more of the same effort will also be helpful to increase revenue flows from foreign banking assets held by domestic banks (e.g., through better monitoring foreign bank managers or their credit projects), international financial integration in this sense can increase the national banking

system's overall prudential efforts. Thus, financial integration need not imply, as is often feared, more crisis prone banking systems. Along similar lines, if national regulators take into account at least some of these effects, it is less likely that financial integration will lead to "a race to the bottom" between regulators. That does not mean, however, that private efforts or uncoordinated national regulation reach efficient levels. As a rule, private efforts will fall short of the effort level demanded by regulators. And because regulators do not fully internalize the external effects of their activities on other member states in an international (or European) context, the level of prudential effort demanded by national regulators tends to be suboptimally low.

While this would justify a centralization of regulation at the European level, a European regulator may be problematic from another perspective. This is because the prudential efforts of private banks and the level of regulation set by national authorities are decreasing functions of the subjective probability that the central bank would intervene as a lender of last resort in case of a crisis. European monetary integration and the creation of the ECB have lowered the probability that a central banks would intervene to save individual banks or single national banking systems in the euro area as well as, arguably, in EU member countries that have hard-pegged their exchange rate to the euro, for instance through the ERM2 mechanism. The creation of a common regulator at the European level, however, could imply that the positive effect of this "creative ambiguity" vis-à-vis national regulators is lost. A common regulator may have less uncertainty about an eventual intervention of a common lender of last resort and regulatory requirements from national financial systems might therefore be lower with a common regulator. The implication of this result is that centralizing financial regulatory authority may not be desirable in the presence of a centralized LoLR.

In fact, within the boundaries of the simple model discussed here, there seems to be a tradeoff between area-wide centralizing LoLR and regulatory functions. By abolishing national central banks and not explicitly creating a European lender of last resort, individual national regulatory and private efforts to avoid financial crises are reinforced through the "creative ambiguity" channel. Likewise, centralizing national regulators in the absence of a common (or national) LoLR will lead to more prudential effort because the area-wide regulator internalizes externalities that national authorities ignore. However, centralizing both the LoLR and the regulatory function may actually reduce the level of prudential efforts.

### Appendix 1: The condition for $e_i^G > e_i^B$

The condition for  $e_i^G > e_i^B$  is  $(\theta\bar{x} + (1-\theta)\underline{x}^G + \delta B)(\gamma - (\bar{x} - \underline{x}^B)) > (\phi - (\bar{x} - \underline{x}^G))(\theta\bar{x} + (1-\theta)\underline{x}^B)$   
or

$$\theta\bar{x}[(\gamma - (\bar{x} - \underline{x}^B)) - (\phi - (\bar{x} - \underline{x}^G))] + [(1-\theta)\underline{x}^G + \delta B](\gamma - (\bar{x} - \underline{x}^B)) - [(1-\theta)\underline{x}^B](\phi - (\bar{x} - \underline{x}^G)) > 0$$

It is clear that  $\underline{x}^G > \underline{x}^B$  because the expected bailout is larger for the government. Moreover,  $[(\gamma - (\bar{x} - \underline{x}^B)) - (\phi - (\bar{x} - \underline{x}^G))] = \gamma - \phi - B(1 - \frac{1}{n}) > 0$  if  $n$  is not too large and if  $\gamma$  is sufficiently larger than  $\phi$ . In this case, the bank will not provide more effort by itself than the government or regulator will request. In this case, the first term is clearly positive and so is the second because of the influence of  $\delta B$ .

### Appendix 2: Comparison of private efforts and optimal efforts

The area-wide (or European) social planner will maximize a weighted sum of the utilities of national governments. If countries are symmetric, this implies a relative weight of one-half for each country. We begin with the case of a unilateral holding of shares of banking system 1 in banking system 2. A European welfare function would be given by

$$EU^W = \frac{1}{2}EU_1^G + \frac{1}{2}EU_2^G.$$

Optimizing the level of efforts for banking system 1, it follows that  $e_1^W = e_1^G$ , that is, the level of regulation set by country 1 is adequate from a European point of view. The optimal level of regulation for country 2 follows as

$$e_2^W = \frac{1}{2} \frac{[\theta_2\bar{x} + (1-\theta_2)\underline{x}^G](1 + \lambda(1 + e_1)) + \delta B_2}{\phi - (\bar{x} - \underline{x}^G)(1 + \lambda(1 + e_1))}. \quad (A1)$$

This level is different from what the regulator in country 2 would set. Not taking into account that foreign banks have a stake in its banking system, the government would set a level corresponding to (5). Comparing (5) with (A1), it follows directly that  $e_2^W > e_2^G$ .

Moreover, the reaction function (7) establishes that regulation in country 1 is increasing in regulatory levels in country 2. Since, level of regulation in country 2 is too low in an uncoordinated manner it also follows that the level of regulation in country 1 is too low.

Likewise, a European welfare function optimized in the case of cross-holdings would also yield results different from what can be obtained in the uncoordinated setting of regulatory levels in both countries. The level of coordination set by the European social planner would be following as

$$e_1^w = \frac{1}{2} \frac{(1 + \lambda^2(1 + e_2)) [\theta_1 \bar{x} + (1 - \theta_1) \underline{x}^G] + \lambda \tilde{\pi}_2 (1 + \lambda) + \delta B_1}{\phi - (\bar{x} - \underline{x}^G) (1 + \lambda(1 + \lambda)(1 + e_2))},$$

with a similar expression for country 2 (because of the assumption of full symmetry). Again, we find that  $\partial e_1^w / \partial e_2^w > 0$ .

The level of regulation demanded without full coordination, however, is given by (9) in the text. It thus follows that  $e_1^w > e_1^G$ . By the same logic, we have that regulation would be higher if set in a cooperative manner or by a social planner for the entire EU.

### Appendix 3: Comparison of regulation with a national and a common central bank

The condition for  $e_i^G|_{CB} > e_i^G|_{ECB}$ , where CB refers to the national central bank and ECB to the common central bank by using (5) is,  $[(1 - \theta_i + \delta B)(\phi - \bar{x}) - \theta_i \bar{x}](\underline{x}^G|_{CB} - \underline{x}^G|_{ECB}) > 0$ . Because  $(\underline{x}^G|_{CB} - \underline{x}^G|_{ECB}) = B/2$ , regulation in the monetary union will increase if  $(1 + \theta_i)\bar{x} > \phi$ . If the government's aversion to regulation  $\phi$  is rather small, this condition is likely to be fulfilled.

This general logic can be extended to international banks as well and applies hence to all cases that we have discussed.

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