Supervising Cross-Border Banks: Theory, Evidence and Policy

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Abstract

This paper analyzes the distortions that banks' cross-border activities, such as foreign assets, deposits and equity, can introduce into regulatory interventions. We find that while each individual dimension of cross-border activities distorts the incentives of a domestic regulator, a balanced amount of cross-border activities does not necessarily cause inefficiencies, as the various distortions can offset each other. Empirical analysis using bank-level data from the recent crisis provides support to our theoretical findings. Specifically, banks with a higher share of foreign deposits and assets and a lower foreign equity share were intervened at a more fragile state, reflecting the distorted incentives of national regulators. We discuss several implications for the supervision of cross-border banks in Europe.

Keywords: Bank regulation, bank resolution, cross-border banking

JEL classification: G21, G28

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1 Introduction

The problematic resolution of failing cross-border banks in Europe during the current crisis has focused academics' and policy makers' attention alike on the misalignment of geographic boundaries of banks and their supervision. The resolution of Fortis on the national level, undertaken separately by Dutch, Belgian and Luxembourg authorities has confirmed Charles Goodhart's and Mervyn King's point that "banks are international in life and national in death." The failure of the Icelandic banks, with wide-ranging economic and political repercussions has shed doubts on the viability of large multinational banks in small countries. The recent reform debate has - among other items - focused on issues of national versus supra-national supervision, the responsibility, obligation and capacity of home country supervisor relative to host country supervisor to resolve large cross-border banks and, in general, the need to coordinate the resolution of large international banks across borders. On the political level, arguments over national sovereignty and the role of European institutions are being used to argue in favor or against the establishment of a European-level bank supervisory authority. But what are the distortions of national supervision of international banks? What are the rationales behind national and supra-national supervisors; what are the trade-offs of national versus supra-national resolution authority?

This paper first presents a simple theoretical model that demonstrates the distorted incentives that national supervisors face when deciding to intervene in failing banks with activity outside their borders. Specifically, we show that national supervisors' incentives to intervene in a timely manner into a weak bank increase in the foreign equity share and decrease in the share of foreign deposits and assets. The intuition for this result is, chiefly, that the gains from letting a weak bank continue mainly accrue to equity, while the costs accrue to debt holders and other stakeholders in the economy. The result is robust to variations in the utility function of the regulator, endogenizing risk choice by banks and type of intervention (bank closure or bailout). Second, we provide empirical evidence consistent with the model using a sample of intervened banks during the crisis of 2007-2009. Taking their CDS spread at the time of intervention as a measure of regulatory lenience, we find that higher foreign asset and deposit shares and a lower foreign equity share are associated with more lenient regulatory decisions.[1] These findings are robust to including an array of bank-level and country-level control

[1] Although not the focus of our analysis, we also find that cross-border activities affect the *likelihood* of bank intervention consistent with the idea that regulators are more lenient when a larger share of the gains from continuation accrue domestically.

variables, testing for anticipation effects and controlling for selection bias. We link our theoretical and empirical analysis to a discussion of the current regulatory arrangements for cross-border banking in Europe and recent reform discussions.

Our paper is related to a small but growing theoretical literature on the regulation of cross-border banks.[2] Loranth and Morrison (2007) discuss the implications of capital requirements and deposit insurance for cross-border banks and show that capital requirements set at a level to off-set the safety net subsidy of deposit insurance result in too little risk-taking in the case of multinational banks. Dell'Arricia and Marquez (2006) show that competition between national regulators can lead to lower capital adequacy standards, since national regulators do not take into account the external benefits of higher capital adequacy standards in terms of higher stability in other countries. A supra-national central regulator is therefore more likely to emerge among more homogeneous countries if it sets regulatory standards higher than those of the country with the highest individual standards. Acharya (2003), however, shows that coordinating capital adequacy ratios across countries without coordinating on other dimensions of the regulatory framework, such as resolution policies, can have detrimental effects. Freixas (2003) and Goodhart and Schoenmaker (2009) show that ex-post negotiations on recapitalization of failing cross-border banks can lead to underprovision of the necessary resources and prove the advantage of ex-ante burden sharing agreements in helping overcome coordination problems between regulators. Holthausen and Ronde (2002) consider cooperation between home and host country supervisor on the intervention decision for a multinational bank. Given that national regulators represent national interests, a misalignment of interests leads to suboptimal exchange of information and distorted intervention decisions. Our paper is most closely related to Calzolari and Loranth (2011) who show how the organization structure of multi-national banks can influence regulatory behavior. Specifically, organization of foreign presence through branches leads to higher incentives to intervene as the home country regulator can draw on all assets, while at the same time it reduces the incentives if the regulator is responsible for repaying all deposits, including in foreign branches. There is also a more institutionally oriented literature on legal differences across countries in the treatment of domestic and foreign creditors (e.g. Krimminger, 2007). Osterloo and Schoenmaker (2007) and Schoenmaker (2010) discuss the importance of regulation of cross-border banks within Europe. Allen et al. (2011) discuss policy options for the regulation of cross-border banks

[2] For an early discussion, see White (1994).

in the European Union. The contribution of our paper is to show that different dimensions of cross-border activities can result in different distortions of national regulators when deciding to intervene in a weak cross-border bank. Unlike previous work, we therefore distinguish specifically between the equity, deposit and asset dimensions of cross-border bank activities and show their different impact on intervention decisions by national regulators. Unlike previous papers, we explicitly test our theoretical predictions, using data from the recent crisis. Finally, we embed both theoretical model and the empirical findings into the current discussion on the revamping of the European financial safety net.

The resolution of cross-border banks during the recent crisis is consistent with our theoretical analysis. Intervention into large cross-border banks came often at a late stage and often with conflicts between home and host country supervisors. While the lack of an effective bank resolution framework in most European countries was certainly an important factor in explaining the late and uncoordinated intervention into failing bank, incentives for domestic regulators facing weak international banks have played an important role as well (Claessens et al., 2010). This became most obvious in the case of Fortis, a Benelux based cross-border bank that was split up along national lines for resolution purposes. Similarly, the late intervention into the Icelandic banks likely reflects not only lack of regulatory strength and competence but also distorted incentives of national regulators.[3]

This paper contributes to the literature on regulation of cross-border banks by focusing on one specific aspect, the intervention decision of supervisors. While the previous literature has focused on capital regulations and deposit insurance across borders, this paper analyzes the implications of cross-border banking for the intervention into failing banks. In focusing on this specific aspect, we hold constant other elements, such as capital requirements and deposit insurance. We also abstract from market discipline to focus exclusively on supervisory discipline. While the basic set-up of this model is similar to Calzolari and Loranth (2011), we differ along several dimensions, including the distinction between cross-border activities in terms of assets, deposits and equity. In addition, we provide empirical evidence on regulatory bias in intervention decisions during the recent crisis.

The remainder of the paper is organized as follows. The next section discusses trends in cross-border banking across Europe and the development of the corresponding regulatory frameworks. Section 3 presents the theoretical model. Section 4 contains the empirical analysis. The final section

[3]For an in-depth discussion of the recent Icelandic crisis, see Benediktsdottir, Danielsson and Zoega (2011).

derives policy conclusions.

2 Cross-border banking in Europe - trends and regulations

Cross-border banking has gained importance across Europe in recent decades, as part of a larger globalization wave in financial services. Even more impressive has been the transformation of many banking systems in Central and Eastern Europe, which went from state-owned mono-bank systems to foreign-bank dominated systems within a period of 10 years. Figure 1 illustrates this trend towards increasing importance of cross-border banks across European financial systems. Hand in hand with an increase in cross-border banking went an increase in bank concentration. As reported by Cihak and Decressin (2007), before the crisis 16 large cross-border financial institutions accounted for about one third of EU banking assets. The trend towards cross-border banking can also be illustrated for individual banks in Europe. The percentage of foreign assets in total assets is 82 percent for Deutsche Bank, 64 percent for Santander, 62 percent for UniCredit, 41 percent for BNP Paribas and 29 percent for Societe Generale (Allen et al., 2011).

The patterns of cross-border banking, however, are very different in the "old" EU member countries of Western Europe and the new EU member countries of Central and Eastern Europe. Financial integration in Western Europe has been a more gradual process though at accelerated speed over the past decade. The introduction of the Single Banking License in 1989 through the Second Banking Directive was a decisive step towards a Unified European Financial Market, which subsequently led to a convergence in financial legislation and regulation across member countries. The introduction of the Euro in 1999 eliminated currency risk and provided a further push for financial integration (Kalemli-Ozcan et al., 2010). In addition to cross-border lending, the increase in financial integration also came in the form of cross-border mergers and acquisitions. Among the most high-profile cases were the take-over of Hypobank in Germany by the Italian Unicredito, the takeover of the British Abbey National by the Spanish Santander and the takeover of the Dutch ABN Amro Bank in 2007 by Fortis (Belgium), Royal Bank of Scotland and Banco Santander.

While Western European countries have been both home and host of large cross-border banks, Central and Eastern Europe has been exclusively host of such banks. The ownership transformation of the banking system, from a state-owned mono-bank system towards a privately owned market-based financial system was key to achieving macroeconomic stability in the late 1990s, with countries

finalizing the ownership transformation process the fastest also being the first ones to successfully emerge out of the systemic banking crises of the 1990s.

The expansion of banks across national borders has raised the issue of regulatory and supervisory responsibility. Across the world and in Europe, primary responsibility for bank regulation and supervision lies with national authorities, even after the recent crisis. In the context of European financial integration, the Second Banking Directive of 1993 introduced home-country control and mutual recognition, resulting in a "single passport" for branching across the EU: any bank licensed in an EU country is allowed to open branches in other EU countries provided it meets some common, minimum standards. In spite of this, however, many banks still choose to establish subsidiaries with separate capital, which might be driven by bank specific factors and country circumstances (Cerrutti et al., 2007). On the supervisory level, Memorandums of Understanding and colleges of supervisors for specific banks have become a common tool of cooperation across borders. However, in spite of regulatory convergence and increased supervisory cooperation in the early 2000s, important differences remained across EU countries in regulatory frameworks, supervisory standards and especially in bank resolution frameworks. Most countries did not have bank-specific insolvency frameworks, which limited the options towards failing banks during the crisis to either liquidation in regular bankruptcy procedures with all the interruptions that such a long drawn-out process would bring with it or bailout with tax-payer money.

The crisis of 2008 has clearly shown the deficiencies of both national resolution frameworks, but especially of cross-border resolution frameworks. The Dutch-Belgian Fortis bank is a good example for that. In 2007, the Belgian Fortis was allowed to participate in the take-over of Dutch ABN Amro in spite of already facing solvency problems, which points to both regulatory capture in Belgium and the lack of information exchange between Belgian and Dutch supervisors. The conflict between Belgian and Dutch supervisors following the take-over about who would be lead supervisor of Fortis made cooperation during the subsequent crisis in 2008 difficult. Initial coordinated recapitalization failed to calm the markets, which resulted in each national government taking their own actions, ultimately not only nationalizing resolution of the individual bank pieces in Belgium, Luxembourg and Netherlands, but nationalizing the banks themselves. Insiders stress that cooperation ultimately broke down when the Ministers of Finance got involved.

Another, very different, example are the Icelandic banks. The late intervention by the Icelandic

supervisors is consistent with the theoretical model presented below and can be explained by the high shares of foreign assets and deposits that Icelandic banks were holding, while equity was almost exclusively held by domestic agents. The fact that a large share of deposits were collected through branches rather than subsidiaries exacerbated the situation for host country supervisors as they had little information and even less power to intervene in time.

In the wake of the crisis, attempts have been made to address these deficiencies both on the national but also on the European level. The De Larosière Report (2009) acknowledged the need for better coordination among Member States, in order to allow for a well-functioning Single Market in banking, without recommending, however, full centralization of EU regulation and supervision. Following the report, the European Banking Authority (EBA) was established to more intensively coordinate micro-regulation issues, while the European Systemic Risk Board (ESRB) is in charge of addressing macro-prudential issues. Among other tasks, the EBA is charged to facilitate agreement between national supervisory authorities, where necessary settling any disagreements, including within colleges of supervisors, to ensure supervisors take a more coordinated approach. On the other hand, the EBA does not have any direct supervisory power over banks and cannot legally force the intervention into weak banks or specific resolution techniques.

Further reaching reform suggestions, such as creating a European-level supervisor with intervention powers or a European deposit insurance fund with resolution powers modeled after the U.S. FDIC or the Canadian CDIC were rejected. Explanations are manifold; one institutional explanation is the principle of subsidiarity which states that policy areas can only be transferred to the European level if they cannot be undertaken at the national level. There is also a political economy argument that banking is considered too critical a sector for individual countries to delegate regulatory powers to a supranational level. In addition, resolution of large banks often involves taxpayer money; transferring the authority to commit taxpayers' money to the European level is seen as violating national sovereignty. Finally, there is the legal challenge that a new institution cannot be created without a new European treaty, which is politically difficult. While these political and constitutional constraints continue to weight against a supranational supervisor on the European level, the Eurozone's reaction to the ongoing sovereign debt crisis with more fiscal centralization on the European level suggests that these constraints might lose weight over time.

3 Theoretical analysis

We present a simple model of bank supervision, with three periods, 0, 1 and 2. For ease of analysis, we assume that the discount factor and the deposit interest rate are zero.[4] There is a single representative bank whose balance sheet is normalized to 1 and that issues debt d and equity k, so that $d + k = 1$. In period 0, the bank invests its resources into an investment project whose success is random and outside the control of the bank. Specifically, with probability λ ($\lambda \in (0, 1)$), the investment succeeds and yields a return $R > 1$ in period 2, and with probability $1 - \lambda$, the project fails and yields zero gross return in period 2.

While the supervisor has imperfect information about λ at date 0,[5] λ becomes known at date 1. Based on this information, a supervisor can decide whether to intervene in the bank or to allow it to continue. If the supervisor decides to intervene in the bank, she can recover the initial investment of one. This intervention can take different forms, ranging from liquidation to a purchase and assumption operation involving another bank. If the supervisor decides to not intervene and allows the bank to continue to period 2, with probability λ , the bank will be successful and be able to repay its debt and equity holders. With probability $1 - \lambda$, the bank will fail and there are external costs of c.[6]

We assume that the supervisor maximizes domestic welfare, consisting of the returns to domestic debt, equity minus domestic external costs (we will relax this assumption below). In the case of a purely domestic bank, her intervention decision will hence coincide with the one that maximizes (world) welfare. The intervention threshold is given by the λ which equates the expected returns from continuation with the return from immediate liquidation. We have

$$\lambda R - (1 - \lambda)c = 1. \tag{1}$$

Solving for λ gives

$$\lambda^* = \frac{1 + c}{R + c}. \tag{2}$$

Quite intuitively, we can see that intervention becomes more likely when bank failure costs, c, increase

[4] The deposit rate itself does not matter. What matters though is that it is risk-insensitive, for example, because there is deposit insurance with a flat premium.

[5] Since the supervisor takes actions at date 1 only, the nature of date-0 uncertainty is irrelevant.

[6] For a discussion on the external costs that bank failure can impose on the remaining financial system and the real economy, see Beck (2011). In principle, intervention at date 1 may also incur some costs, however, we would think that such costs are of orders lowers than the ones arising from bank failure at date 2. Including external costs in period 1 does not change the main conclusions of our model under reasonable parameterizations.

(the latter follows from $\lambda^{*\prime}(c) > 0$ for $R > 1$). By contrast, a higher return R reduces the intervention probability.

While we assume throughout the paper that λ becomes perfectly known at date 1, we can easily introduce a noisy signal on λ. As long as the signal is symmetrically distributed around the true λ, the intervention threshold is the same. This can be seen by noting that the benefits from continuation are linear in λ (left hand side of equation 1).

3.1 The Incentives of a National Supervisor with Cross-Border Banking

We now introduce cross-border banking into our model. For this we allow the bank to be partially financed by foreign deposits and foreign equity, as well as having asset holdings abroad. More specifically we denote with β_D the foreign share of deposits, with β_E the foreign share of equity and with β_A the share of foreign firms (assets) financed by the bank.

The introduction of cross-border banking obviously does not modify the efficient intervention threshold as it does not affect total payoffs in the world economy (thus including foreigners). It only affects the share of the payoffs that accrue to domestic agents. As national supervisors only care about domestic payoffs, this can change the intervention incentives for the domestic supervisor and drive a wedge between the socially efficient and the domestic intervention point.

The domestic intervention point can be derived as follows. As before, if the domestic regulator intervenes at the intermediate date, the bank will be liquidated. Total (world) proceeds from this are 1. Domestic depositors obtain $(1-\beta_D)d$ and domestic equity obtains $(1-\beta_E)(1-d)$ of these proceeds. Total payoff in the domestic economy is thus $(1-\beta_D)d+(1-\beta_E)(1-d)$. In case there is no intervention the bank succeeds with probability λ. In this case domestic depositors obtain $(1-\beta_D)d$, while equity obtains $(1-\beta_E)(R-d)$. With probability $1-\lambda$ the bank fails. In this case both equity and debt holders do not obtain any return and the country in addition suffers $(1-\beta_A)c$ due to bank failure costs. Total expected domestic payoff is hence $\lambda((1-\beta_D)d+(1-\beta_E)(R-d))-(1-\lambda)(1-\beta_A)c$. The domestic intervention threshold is defined by

$$\lambda((1-\beta_D)d+(1-\beta_E)(R-d))-(1-\lambda)(1-\beta_A)c=(1-\beta_D)d+(1-\beta_E)(1-d). \quad (3)$$

Rearranging for λ gives

$$\widehat{\lambda} = \frac{(1-\beta_D)d + (1-\beta_E)(1-d) + (1-\beta_A)c}{(1-\beta_D)d + (1-\beta_E)(R-d) + (1-\beta_A)c}. \tag{4}$$

Note that for $\beta_D = \beta_E = \beta_A$ we obtain $\widehat{\lambda} = \lambda^*$. That is, when the resident balance sheet is proportional to the entire balance sheet of the bank, liquidation decisions are efficient. Thus, if the cross-border ownership share equals the other two cross-border shares, the domestic regulator always takes efficient decisions *regardless of* the overall level of cross-border activities. The intuition for this is straightforward: if cross-border engagement is the same along all three dimensions, the domestic regulator will simply perceive a fraction of both benefits and costs of intervention. Since this fraction is the same for the costs and benefits, her decision will not be distorted.

We next derive comparative statics for the intervention threshold with respect to the various domestic shares..

Proposition 1 . *The intervention threshold of the domestic supervisor, λ^D, is*

i) decreasing in the share of foreign deposits β_D,

ii) increasing in the share of foreign equity β_E,

iii) decreasing in the share of foreign assets β_A.

Proof. *Follows from taking the derivative of the intervention threshold $\widehat{\lambda}$ with respect to β_D, β_E and β_A.* ■

The intuition behind these results is as follows.

Deposits. Since the national regulator only cares about domestic depositors, a higher share of foreign deposits will reduce the costs for her in period 2 and thus make intervention in period 1 less likely. A higher share of domestic deposits, in turn, makes the domestic regulator less inclined to gamble on bank success in the second period. Hence, with a higher share of domestic deposits, the domestic regulator becomes more likely to intervene, that is, the range of $\lambda's$ where intervention takes place increases.

Equity. Shareholders have a relatively higher interest in continuing the bank due to the standard risk-shifting problems (the costs of bank failure are partly borne by debt holders and firms). A higher share of domestic shareholders aligns the interests of the regulator more with the one of shareholders. This makes interventions less likely, that is, the threshold decreases. If, on the other hand, the share

of foreign equity holders is higher, the regulator is more likely to intervene in period 1.

Assets. When a higher share of bank assets is domestically invested, this raises the domestic external costs of bank failure. This, in turn, makes the domestic regulator more averse to continuation. As a result, she becomes stricter at date 1 (the minimum required success probability increases). On the other hand, a higher share of foreign assets involves that a higher share of external costs in period 2 are being borne by agents outside the home economy, which makes the regulator more reluctant to intervene in period 1.

Note that the comparative statics are a direct consequence of the fact that in our model the gains from continuation accrue at the margin to equity at the cost of the other two stakeholders. If this feature is modified, the comparative statics may change. For example, there might be a cost of liquidation also at date 1. If this cost is mainly borne by debtors (or affects primarily the holders of assets), equity may (in relative terms) lose when the bank is continued. Similarly, continuation incentives may be reversed in the presence of a (large) interest rate on debt that only accrues at date 2 (thus only when the bank is not liquidated at date 1). In such situations our comparative static results may no longer hold.

Proposition 1 has straightforward welfare implications. We know that for $\beta_D = \beta_E = \beta_A = 1$, domestic and efficient liquidation thresholds coincide. Since we also know, for example, that the domestic liquidation threshold is increasing in the share of domestic deposits, it follows that when $\beta_D > 0$ and $\beta_E = \beta_A = 0$ we have $\widehat{\lambda} < \lambda^*$. This implies that there is a range of λ ($\lambda \in [\widehat{\lambda}, \lambda^*]$) where it is efficient to liquidate but the domestic supervisor decides to let the bank continue to operate (the domestic regulator is then too lenient).

The following corollary summarizes this welfare result, alongside with the corresponding ones for foreign equity and assets.

Corollary 1 . *When there is cross-border banking, domestic and efficient interventions generally do not coincide. In particular we have:*

i) If cross-border banking takes place only via deposits ($\beta_D > 0$ and $\beta_E = \beta_A = 0$): there are ranges for λ where the domestic regulator lets the bank continue even though this is inefficient (the domestic regulator is too lenient);

i) If cross-border banking takes place only via equity ($\beta_E > 0$ and $\beta_D = \beta_A = 0$): there are ranges for λ where the domestic regulator liquidates the bank even though this is inefficient (the

domestic regulator is too strict);

iii) If cross-border banking takes place only via assets ($\beta_A > 0$ and $\beta_D = \beta_E = 0$): there are ranges for λ where the domestic regulator lets the bank continue even though this is inefficient (the domestic regulator is too lenient).

Proof. *Follows directly from Proposition 1 and $\widehat{\lambda} = \lambda^*$ for $\beta_D = \beta_E = \beta_A = 0$.* ■

If cross-border banking takes place through more than one channel, the welfare results obviously depend on the strength of each channel. For example, if there are both cross-ownership of deposits and equity, the biases created by each channel go in opposite directions and hence tend to offset each other. If there is mainly foreign deposit-taking but little foreign ownership, we are then likely to end up with a too lenient domestic regulator, and vice versa. This implies that in order to evaluate the efficiency properties of cross-border banking, one has to look at all aspects of cross-border banking jointly, and not only at one channel in isolation.

3.2 Discussion

Our analysis focuses exclusively on cross-border activities as the source of inefficient liquidation decisions. It is for this reason that we have assumed that intervention decisions maximize domestic welfare. There are several reasons why even in the domestic case regulatory interventions are not efficient. In their presence, the distortions induced by cross-border banking have to be evaluated relative to these inefficiencies.

3.2.1 Objectives of the Regulator

We have assumed that the domestic authority responsible for the intervention decision maximizes the returns to all domestic stakeholders. If this is not the case, other distortions can arise, which can either strengthen or weaken the initial bias. If, for example, the authority which decides on interventions is the (domestic) deposit insurance fund, intervention behavior will tend to be tougher as the deposit insurer will try to maximize returns to domestic depositors rather than domestic equity holders. If the central bank is in charge of intervention decisions, there may likewise be a tendency towards strict interventions, if the central bank primarily cares about external failure costs. On the other hand, if intervention decisions are taken by an independent supervisor, interventions may be relatively lenient, in case of regulatory capture by domestic equity holders.

However, for our comparative static results it is not important that the domestic regulator maximizes welfare. Proposition 1 continues to hold as long as the regulator puts a (positive) weight on the returns of each of the stakeholders. The latter assumption seems plausible since many stakeholders are involved in the resolution of large cross-border banks and one can hence expect their interests to be reflected to at least some degree. Formally, suppose the regulator puts weights of ϕ_D, ϕ_E, ϕ_A on domestic debt, equity, and asset holders. Condition (3) in the baseline model then becomes

$$\lambda((1-\beta_D)\phi_D d+(1-\beta_E)\phi_E(R-d))-(1-\lambda)(1-\beta_A)\phi_A c = (1-\beta_D)\phi_D d+(1-\beta_E)\phi_E(1-d). \quad (5)$$

Rearranging for λ gives

$$\widehat{\lambda} = \frac{(1-\beta_D)\phi_D d + (1-\beta_E)\phi_E(1-d) + (1-\beta_A)\phi_A c}{(1-\beta_D)\phi_D d + (1-\beta_E)\phi_E(R-d) + (1-\beta_A)\phi_A c}. \quad (6)$$

Note that for $\gamma_i' := \gamma_i\phi_i$ ($i \in \{D, E, A\}$) this expression is the same as in the baseline model (equation (4)). It hence follows that the (signs of the) comparative statics for $\widehat{\lambda}$ with respect to γ_i are the same as long as $\frac{\partial\gamma_i'}{\partial\gamma_i} > 0$, that is, when $\phi_i > 0$.

3.2.2 Endogenous Risk Taking

Our baseline model has abstracted from a risk choice of the bank. Such a risk choice can be introduced as follows. Assume that the probability of success λ (which is learned at date 1) is distributed on $[0, 1]$. At date 0 the manager of the bank can make an effort choice e which (stochastically) affects this success probability λ. Effort leads to private costs $m(e)$ and we assume that $\frac{\partial E[\lambda(e)]}{\partial e} > 0$, $\frac{\partial^2 E[\lambda(e)]}{\partial^2 e} < 0$ and $m'(e), m''(e) > 0$. We assume that the supervisor cannot commit to a date-1 intervention schedule and hence has to decide on the intervention in a time-consistent manner.

At date 1, the supervisor observes the realization of λ. Since effort at this point has been already chosen, the regulator faces precisely the same situation as in the baseline model: taking λ as given, she compares the pay-off from continuation with the pay-off from intervention. In particular, condition (1) readily applies and the interventions decisions are thus the same as in the baseline model. Hence the comparative statics of Proposition 1 on which we base our empirical analysis, continue to apply.

However, the time-consistent intervention no longer leads to welfare maximization – even in the domestic case. This is because the effort choice will generally be inefficient. As we show in the

appendix, effort can then be either under- or overprovided.

3.2.3 Bailouts

In our model intervention in the bank takes the form of a liquidation of the bank. An alternative form of intervention, which has been often used during the crisis of 2007-2009, is a bailout.[7]

Bailouts can be introduced in our model as follows. Suppose that instead of having the option to liquidate the bank at date 1, the supervisor can decide to inject equity in the bank. Assume that if a bailout takes place, the supervisor injects an amount of equity d in the bank, which is just sufficient to avoid bank failure in case the project is not successful at date 2. We also assume that bailouts incur some efficiency losses $K > 0$ to the economy, for example, because of the cost of public funds or because bailouts distort financing decisions in the economy (in the absence of such costs it would always be optimal to bailout a purely domestic bank as bailouts have no costs but can avoid the external cost of bank failures c). In return for the equity injection the supervisor takes an equity stake of α in the bank.[8]

The intervention decision in a cross-border bank is now subject to the following considerations. In case the supervisor does not intervene, domestic pay-offs are the same as in the baseline model: $\lambda((1-\beta_D)d + (1-\beta_E)(R-d)) - (1-\lambda)(1-\beta_A)c$. When the supervisor intervenes, he incurs costs of $d+K$ at date 1. If the project succeeds, pay-offs for debt and equity are d and R at date 2 and if the project fails debt receives d and equity zero. Hence total domestic pay-offs at date 1 and 2, including the return on the supervisor's stake in the bank, are $-(d+K) + \lambda((1-\beta_D)d + (1-\beta_E)(1-\alpha)R + \alpha R) + (1-\lambda)(1-\beta_D)d$. The intervention decision is thus given by

$$\begin{aligned}\lambda((1-\beta_D)d + (1-\beta_E)(R-d)) - (1-\lambda)(1-\beta_A)c \quad < \quad & -(d+K) + \lambda((1-\beta_D)d + (1-\beta_E)(1-\alpha)R + \\ & \alpha R) + (1-\lambda)(1-\beta_D)d. \end{aligned} \tag{7}$$

Rearranging gives

$$K + d < \lambda(1-\beta_E)(d-\alpha R) + \lambda\alpha R + (1-\lambda)(1-\beta_A)c + (1-\beta_D)d. \tag{8}$$

[7] For an evaluation of bank recapitalization during the recent crisis, see Mariathasan and Merrouche (2012).

[8] Governments may also interfere with bank operations after a bailout in order to scale down bank risk. This can be interpreted as a partial liquidation of the project in the baseline model and would hence lead to the same comparative statics.

The left hand side of the equation is the cost of bailouts. The right hand side gives us the domestic benefits from bailouts. They arise because of higher pay-offs for shareholders, $\lambda(1-\beta_E)(d-\alpha R)$, the government's return on its stake, $\lambda\alpha R$, lower external failure costs accruing domestically, $(1-\lambda)(1-\beta_A)c$, and higher payouts to domestic debtors, $(1-\beta_D)d$.

We assume that the bailout stake α is set such that the supervisor breaks even in expectation.[9] Given that the expected return on his equity stake is $\lambda\alpha R$, the breakeven stake is determined by $d=\lambda\alpha R$. Rearranging gives

$$\alpha = \frac{d}{\lambda R}. \tag{9}$$

Inserting into the equation for the liquidation threshold we obtain

$$K < (1-\lambda)((1-\beta_A)c-(1-\beta_E)d)+(1-\beta_D)d. \tag{10}$$

Solving for the critical λ gives us:

$$\widehat{\lambda} = 1-\frac{K-(1-\beta_D)d}{(1-\beta_A)c-(1-\beta_E)d}. \tag{11}$$

Noting that we need $K-(1-\beta_D)d>0$ and $(1-\beta_A)c-(1-\beta_E)d>0$ for an interior maximum for $\widehat{\lambda}$ ($\widehat{\lambda}<1$), it follows that $\widehat{\lambda}'((1-\beta_D))>0$, $\widehat{\lambda}'((1-\beta_E))<0$ and $\widehat{\lambda}'((1-\beta_A))>0$. Hence, Proposition 1 continues to hold. Bailouts thus lead to the same comparative statics as liquidation decisions. The efficiency implications in the case of bailouts are also the same as in the baseline model – which can be appreciated from the fact that in contrast to the two previous extensions of the model, there are no distortions in the absence of cross-border banking.

3.3 Numerical analysis

The analysis suggests that the intervention decision of a domestically-oriented supervisor depends in principle on the various dimensions of a bank's cross-border activities. An interesting question is whether the cross-border activities can also be quantitatively important for the intervention decision. Only if this is the case, can we expect significant welfare losses to result from cross-border activities.

This subsection contains a simple numerical exercise, with the aim of providing some sense of the potential quantitative implications of cross-border activities. For this we parameterize the baseline

[9] Including also the efficiency loss K for this will not affect the results.

model and analyze the intervention threshold for different assumptions on cross-border activities. We assume a return on investment R in period 2 of 1.085 (thus a net return of 8.5% conditional on success of the project) and a debt share d of 0.9. We take external failure costs in period 2 as $c = 0.5$. In Box 1 we report the resulting intervention thresholds $\widehat{\lambda}$ (calculated from equation (4)) for different foreign activity levels. We consider four cases: a purely domestic bank and banks that have respectively 50 percent of either foreign assets, deposits or equity. Next to the intervention threshold we also calculate the implied CDS spread at the time of intervention.[10] We can see that under the chosen parameters the critical intervention threshold for a domestic bank is 0.946. This translates into a CDS spread of 536bps (by means of comparison, the average spread of 55 intervened banks considered in the empirical analysis of Section 4 is 417bps). A bank with 50% foreign deposits sees a higher critical CDS spread of 749bps. Next, we see that a bank with 50% foreign assets has a critical spread of about 637bps. Finally, we see that a bank that has 50% foreign equity has a critical CDS spread of only 284bps, suggesting a much stricter regulator.

A key implication of our analysis is that a bank with substantial foreign activities still can be subject to efficient regulatory treatment – as long as its activities are balanced along the various dimensions. In order to better understand the trade-offs involved in achieving balance, figure 2 shows the combinations of the cross-border shares for which the regulatory intervention is efficient (the x-axis is domestic deposits, the y-axis is domestic assets and the z-axis (vertical axis) is domestic equity). Above the surface the regulator is too lenient (domestic equity is too high given the banks cross-border mix of deposits and assets), while below the surface the regulator is too strict (domestic equity is too low for efficiency). We can see that the trade-offs between the various shares are fairly linear and reasonable. For example, for most combinations of domestic assets and deposits, there exists a domestic (equity) ownership share that avoids regulatory inefficiency. This implies that achieving balance is feasible for banks regardless of how international they are. We can also see that none of the three activity-shares is dominating, that is, each activity share can be offset by appropriate shares along the other two dimensions.

[10] Noting that the expected loss at the critical value is $(1 - \widehat{\lambda}) \cdot 1$ and assuming that the CDS premium reflects the expected loss on the underlying asset, we obtain a corresponding CDS spread of $CDS = 1 - \widehat{\lambda}$.

3.4 Branches versus subsidiaries

Our model can be used to discuss regulatory implications of different organizational forms for international banks in establishing their presence in host markets. Banks have two main ways to undertake foreign operations: through branches or by establishing a foreign subsidiary. The key difference between branches and subsidiaries is that in the case of a branch the supervisor in the country of the parent bank has responsibility (home supervisor), while in the case of a subsidiary it is the regulator in the country where the supervisor is located (host supervisor). Our model can be used to understand the relative regulatory attractiveness of either mode of foreign entry in terms of their welfare properties.

Consider first the case of a subsidiary. From the perspective of the host country regulator, the subsidiary has a large share of foreign equity as the profits of the subsidiary will return to the parent company (high β_E). Since the subsidiary will typically lend largely domestically in the host economy, the share of domestic assets is, however, large (low β_A). In addition, the subsidiary might also source deposits largely locally (low β_D). Thus, applying our model, from the perspective of the host supervisor, cross-border banking largely takes place through foreign equity ownership. Corollary 1 tells us that regulation and supervision will hence tend to be too strict.

Consider next branching. Under branching, the home country supervisor has responsibility for supervision and the intervention decision. This supervisor can decide to intervene in the foreign branch but only jointly with intervention at the parent bank. We distinguish in the following between two cases: i) the size of the branch is small relative to the parent bank and, ii), the size of the branch is large relative to the parent bank. To focus ideas, we also assume that the health of the parent and the foreign branch are fully correlated (in terms of the model: both have the same realization of λ at date 1), an assumption we relax below. In the case of the parent bank having more than one foreign operation (possibly in different countries), relative size is defined as the combined size of all foreign branches relative to the parent company.

Consider first the case where the foreign operations are small. From the perspective of the home regulator there is hence effectively no cross-border banking. Her liquidation decision is hence unbiased and efficient. In the case of large foreign operations, things play out as follows. Due to presence of foreign lending by the foreign branches, there is a substantial part of foreign assets (β_A high). In addition, there are also foreign deposits (β_D high), while there is no foreign equity (β_E low). Using

Corollary 1 we thus obtain that the domestic supervisor is too lenient.

What does this imply for the regulatory desirability of branching versus representation through a subsidiary? In the case of a small foreign operation, branching is preferred as this leads to unbiased intervention decisions. When the foreign operation is large, there is a trade-off. In the case of a subsidiary, intervention in the foreign operation might be too strict, especially in countries with effective resolution frameworks. In the case of a branch, intervention is too lenient. In either case, this leads to inefficient liquidation decisions both domestically and abroad.

Conclusion 1 . *When (total) foreign operations are small relative to the size of the parent bank, cross-border banking should take place through branching. When (total) foreign operations are large relative to the size of the parent bank, either branches or subsidiaries may be preferred to obtain an efficient intervention decision.*

Relaxing the assumption of perfect correlation between λ in the home and the host countries complicates things somewhat in the case of large cross-border activity. If $(1-(1-\beta_A))\lambda_F + (1-\beta_A)\lambda_D < \widehat{\lambda}$, where F denotes foreign and D domestic, the home country supervisor will intervene. If the two λs are sufficiently different, this might imply that external costs of failure resolution are imposed on a country where the banking operation is perfectly healthy (i.e. high λ). As the home country supervisor internalizes only $(1-\beta_A)c$, the supervisor is more lenient towards negative signals from the host countries. This can be further complicated if the home country supervisor receives only a noisy signal about λ in the host countries. While not affecting the intervention threshold, it will increase both Type 1 and Type 2 errors and thus reduce welfare.

Comparing the regulatory effects of branch versus subsidiary structure with the actual decision of international banks shows that banks with large cross-border retail operations prefer indeed subsidiaries, while banks with small cross-border operations prefer branches (Cerutti et al., 2007). The recent expansion of some European banks (e.g. Icelandic banks and Nordea) in the form of branches, however, provides serious regulatory challenges, as we have shown in this sub-section.

In this respect it is interesting to note that our model suggests that banks may use branching excessively from a welfare perspective. This is because branching leads to lenient intervention, which benefits equity holders. In case where a subsidiary is the desirable form of organization from a welfare perspective, there is thus a potential inefficiency as banks may have an incentive to form foreign operations in the form of branches.

4 Empirical analysis

The failure and intervention of Icelandic banks provide an illustrative example for our theoretical model. The late intervention by the Icelandic supervisors can be explained by the high shares of both foreign assets and deposits that Icelandic banks were holding, while equity was almost exclusively held by domestic agents. The fact that a large share of deposits were collected through branches rather than subsidiaries exacerbated the situation for host country supervisors as they had little information and even less power to intervene in time.

In the following, we subject our theoretical model to a formal empirical test by exploring a sample of 55 banks across 15 countries that failed and were intervened between 2007 and 2009. Specifically, we use the CDS spread at the time of intervention as indicator of regulatory lenience or strictness and relate it to the mix of foreign equity, assets and deposits of these banks, controlling for an array of other bank characteristics. We first explain the methodology, before presenting the data and discussing the results.

4.1 Methodology

In our model, information about bank health (λ) is realized at a single point in time (date 1). This means that the regulator intervenes whenever the realization of λ is anywhere below the critical λ. In reality, bank health will rather evolve in a more continuous fashion. This suggests that regulators will intervene precisely when the health has deteriorated to the degree that the critical λ is reached – at least if the regulator does not perceive an option value of not closing down the bank. As a consequence, the CDS spread at the time of intervention would be a good indicator of regulatory lenience or strictness. An option effect may arise from the fact that a regulator may prefer not to close down a bank that has reached the critical threshold because there is the chance that the bank will recover in the future and end up above the threshold. Such a consideration would simply serve to reduce the critical threshold at which the regulator intervenes – but the threshold would still depend on the various dimensions of "foreignness" as outlined in the analysis of the previous section. Hence, it remains appropriate to study how bank health at the time of intervention (as a measure of regulatory lenience) depends on foreignness. Figure 3 shows the evolution of CDS spreads for the 55 banks in our sample over the 90 days before intervention, normalized by 100 for the day of intervention. Consistent with our discussion, the spread increases over these 90 days, with the increases accelerating in the weeks before

intervention. Looking beyond the average, we find that for 48 of the 55 banks, the spread is higher three days before intervention than 90 days before, for 45 banks, the spread is higher three days before intervention than 60 days before, and for 37 banks, the spread is higher three days before intervention than 30 days before. Also, when considering different percentiles in CDS spreads, as defined either 90 days before intervention, three days before intervention or on the average over the 90 days leading up to intervention, we find that banks at the 25th, 50th and 75th percentiles see an increase over the 90 days leading up to intervention.

Proposition 1 (which was derived assuming that the continuation value of the bank mainly accrues to equity) and the discussion above suggest the following testable hypothesis:

The CDS-spread at the time of intervention i) decreases in the share of foreign equity, ii) increases in the share of foreign assets, and iii) increases in the share of foreign deposits.

We test this hypothesis with the following empirical specification:

$$y_i = \alpha + \beta \cdot \mathbf{F}_i + \theta \cdot \mathbf{Z}_i + \varepsilon_i. \tag{12}$$

where $\mathbf{F}_i$ is a vector of cross-border activities (share of foreign deposits, assets and equity) and $\mathbf{Z}_i$ is a vector of control variables. The dependent variable y_i is the log of the CDS spread (*CDS*) or the difference between log of CDS spread and the log of CDS index for the region where the bank is located (*CDS spread relative to index*). This second variable allows for the possibility that regulatory lenience not only depends on a bank's financial health but also on the general situation in the banking sector. The set of control variables includes different bank characteristics that can possibly explain the timing of regulatory intervention, but are outside our theoretical model. We include bank size, defined as the log of bank total assets, as there might be a regulatory bias towards intervening large banks too late, a phenomenon known as too-big- or too-complex-to-fail. In robustness tests, we also use the share of bank assets in total assets of the banking system instead of its size. We include the logs of the tier-1 capital ratio, as regulators face higher pressure to intervene undercapitalized banks, while lower liquidity, as measured by the ratio of liquid assets to total assets, might provide an additional indication of fragility and thus trigger regulatory intervention.[11] As an alternative to those bank balance variables we also use the CDS spread of a bank 12 months preceding its intervention

[11] Some of these variables might be endogenous although we measure them at the end of the year before intervention.

for robustness tests. We take this CDS spread as a proxy of the bank's historical health.

In addition, we control for government ownership and timing of intervention. The considerations when intervening in banks with an equity stake owned by the government are presumably different ones and this is may be reflected in bank CDS spreads. For this reason, we use a dummy (*State ownership*) in all specifications which indicates that the government has a stake of more than 5 percent in the bank. We also include a crisis dummy (*Post-Lehman period)* in our empirical model to isolate the effect of Lehman Brothers' collapse on CDS spreads – as this event has arguably increased pressure on regulators to intervene weak banks. The bailout dummy takes the value of 0 prior to September 2008 and 1 afterwards. We expect to find a negative association of the *Post-Lehman period dummy* and the *State-Dummy* with the intervention threshold.

Moreover, we include several measures gauging the regulatory structure of countries. The dummy *Central Bank* takes the value of one if the central bank is involved in the supervision of banks and the dummy variable *Single Agency* indicates whether more than one agency is involved in the supervision of banks. As discussed above, we expect central banks to be more stringent supervisors when being granted with such supervisory function. In addition, we expect that intervention decisions are more lenient in the case of multiple supervisors, as coordination problems may make it more difficult to agree on intervention. CDS spreads at intervention should hence be higher. In robustness tests, we also use a variable that measures deposit insurance coverage relative to GDP per capita as a proxy for the costs faced by national supervisors.

Finally, in unreported robustness tests, we also control for an alternative explanation for cross-bank variation in CDS spreads. We use a measure of CDS liquidity defined as the difference between the bid and ask for debt insurance of a particular bank (*Bid Ask spread*) normalized by the CDS spread. It is expected that lower levels of liquidity will lead to higher CDS spreads. As a result, the CDS spreads that we observe can also reflect a higher compensation for liquidity risk rather than information about deterioration of bank financial health.

The table in appendix B lists all variables used in regressions as well as their definitions and data sources.

4.2 Data

Our analysis is based on a unique hand-collected bank-level dataset, which contains information on cross-border activities of European and U.S. banks that were intervened during the financial crisis in the period between 2007 and 2009. Our main sources of information on foreign assets and deposits are annual reports and the accompanying notes to bank financial statements from the fiscal year preceding bank intervention. When data on foreign assets are missing, we use the share of foreign loans or deposits instead. In a similar way, we use the available data on foreign assets and loans as a complement for missing shares of foreign deposits.[12] In the case of foreign equity, we collect data from Bankscope on ownership by foreign shareholders. Since equity shares are likely to change quickly within a year, the share of foreign ownership is taken at the last available time period prior to the month of bank intervention.

Intervention dates are taken from the dataset compiled by Laeven and Valencia (2010), complemented with own collected data. Table 1 reports the intervention dates. We measure regulatory lenience or strictness by the CDS spread of the bank at the time of intervention. The idea is that a higher CDS spread at intervention reflects that the regulator has waited for bank health to deteriorate significantly before intervening, that is, her critical λ is low.[13] Such a regulator is lenient in the language of our model. Conversely, a regulator who tends to intervene already at low CDS spreads is considered a stricter regulator. We collect daily observations on five year senior debt CDS spreads from Datastream before bank intervention. Ideally we would like to use the values of the CDS spreads immediately prior to the first release of a public announcement on bank intervention. However, the CDS spread at the day of intervention (or the previous day) may already reflect intervention expectations. In order to mitigate this problem, we use CDS spreads 3 days prior to intervention. As a bank's CDS spread might partly be driven by overall market movements, we use the difference between the log of a bank CDS spread and the log of a CDS index as alternative indicator. A CDS index from Datastream about the European bank sector is used if the bank is located in Europe and the Datastream CDS index pertaining to the US banking sector if the bank is located in the US. In addition, looking at the difference to the CDS index will also help to control for non-bank-specific risk factors

[12] The missing share of foreign assets is replaced with data on foreign loans and deposits in 3 and 4 cases, respectively. Replacement of missing data on foreign deposits with available data on foreign loans or assets occurs in 8 cases.

[13] Recalling that λ is the likelihood of project success and that the LGD in our model is 100%, the relationship between CDS spread and threshold lambda is: $CDS = 1 - \lambda$.

in CDS spreads, such as economy-wide risk and liquidity premia. These premia have been shown to be an important part of CDS prices (see Amato (2005) and Bongaerts, de Jong and Driessen (2011)) but should in principle not affect regulatory intervention decisions. The CDS spreads and bank-level variables in all regressions are winsorized at the 5 percent level and bank size is also taken in logs.

Table 2 provides summary statistics for the variables included in our baseline analysis. On average, the cross-border activities of banks in our sample seem balanced - the mean share of bank foreign equity is 35 percent and the average share of foreign assets and deposits is 33 and 32 percent, respectively. There is a large variation in CDS spreads three days before intervention across banks. While the mean (unwinsorized) CDS spread is approximately 417 bps around the time of intervention, it varies between 52 and 3626 basis points across banks. The three major Icelandic banks and the U.S.-based bank Washington Mutual Inc. have the highest CDS spread at time of intervention in the dataset. On the other tail of the distribution, we have BNP Paribas and Credit Agricole SA with the lowest CDS spreads at the time of intervention. On average, bank total assets are over 450 billion Euros. The tier 1 ratio is, on average, eight percent and the share of liquid assets 21 percent. 16 percent of banks had state ownership before intervention and 67 percent of banks in our sample were intervened after the Lehman Brothers failure. About half of intervened banks are located in countries where a single agency is in charge of bank supervision and about 60 percent in a country where the central bank has a supervisory function.

Table 3 reports correlations among the key variables used in regressions. The pair-wise correlations between the CDS-based measures of lenience and the shares of foreign bank activities have the expected signs but are not significant at the 10 percent level. The CDS spread for example is decreasing in foreign equity and increasing in the share of foreign assets and deposits. The insignificance of the correlation estimates may reflect that we need to control for various other factors that influence the intervention decision. Next we look at the control variables and their correlation with our measures of lenience. Bank size and the liquid asset ratio have a statistically significant and negative correlation with the CDS-based measures and the expected signs, while the Tier 1 ratio has a statistically significant and positive one. There is a high correlation between foreign assets and deposits suggesting that their joint inclusion in regressions can lead to multicollinearity. Thus in regressions we either use their average or include them in separate specifications.

4.3 Results

The results in Table 4 provide evidence consistent with the hypotheses derived from our model. Here, we regress the CDS spread three days before intervention on the various foreign activity shares, controlling for other bank and country variables. In column 1 of Table 4 we fit a model that includes foreign equity and foreign deposits while in column 2 the share of foreign deposits is replaced with the share of foreign assets. Due to high correlation between foreign assets and deposits, we include the average of both in column 3. In column 4, we fit the same model as in column 3 but also include our set of additional controls.[14] The coefficient estimates of the variables of interest have signs consistent with the theoretical model. Banks' foreign equity share is negatively associated with the CDS spread at time of intervention, with coefficient estimates that are statistically significant either at the one or the five percent level. An increase in the share of bank foreign equity by one percentage point is associated with a decrease in CDS spreads around the period of intervention between 0.84 and 0.98 percent, ceteris paribus. Similarly, the coefficient estimates of foreign assets and deposits are significant and have the expected positive sign and this is also the case when the average share of foreign assets and deposits is included. One percentage point increase in those shares is associated with an increase in CDS spreads between 0.78 and 1.3 percent. In columns 5 to 8 of Table 4 we replace the log of bank CDS spread as the dependent variable with the log of the CDS spread relative to the log of the regional CDS index as a measure of relative lenience. We confirm our results both in statistical as in economic significance. We note that a better fit (as indicated by the R-squared) is obtained for the regressions with the relative CDS spreads, i.e. our variables explain a larger share of the variation of relative rather than absolute CDS spreads at time of intervention.

Turning to the control variables, we find that bank size is negatively and significantly associated with the CDS spread at time of intervention, suggesting that regulators intervene earlier into big banks. Banks that were intervened after September 2008 were intervened at lower CDS spreads, suggesting a stricter regulatory approach after this event. Similarly, the negative and significant sign on state ownership suggests a stricter approach of regulators towards these banks. In columns (4) and (8), we also find that a higher level of bank liquidity is associated with earlier intervention. We do not find evidence that the institutional structure of supervision matters for intervention thresholds. Neither the

[14] We include some of the variables only in column 4 as they are not available for all banks and thus reduce the sample size.

involvement of the central bank nor the existence of multiple supervisors is consistently significantly associated with the CDS spread at time of intervention.

In unreported robustness tests (available on request) we included several other bank- and country-variables that might be related to the CDS spread at intervention. First, we include a measure of deposit insurance coverage relative to GDP per capita as a proxy of the costs that a regulator will anticipate upon bank failure. The main message is confirmed (though we lose significance for foreign asset and deposits in the regressions with the relative CDS index), while deposit insurance coverage enters negatively and significantly only when using the CDS spread relative to the index as dependent variable, suggesting earlier intervention in countries where deposit insurance coverage is higher. Second, we control for the relative importance of a bank to national economies and replace bank size by the share of bank assets in total assets of the national banking system. Our cross-border variables continue to enter significantly, while the market share variable enters significantly in the majority of specifications, with a negative sign when using the CDS spread and a positive sign when using the CDS spread relative to the index. Third, we include our measure of CDS liquidity (bid-ask spread) in the regression. While this variable does not enter significantly, our main findings continue to hold, though sometimes at lower significance levels. Finally, we also estimate our model using as dependent variable CDS spreads taken at different points in times before the intervention date. When using the CDS coefficient two weeks before intervention, the coefficient estimates of the variables of interest are of lower statistical significance, with higher standard errors. This is to be expected since CDS spreads may then not fully reflect the deterioration in bank health that is very likely to take place just prior to the intervention. As we move farther away from the intervention date, the significance of the coefficient estimates becomes lower.

Next, we address the concern that the market may partly anticipate interventions. CDS spreads before the intervention date may then not only reflect bank health but also the effect of the intervention itself. This may bias our results if the anticipation effect is systemically related to the foreign shares. In Table 5 we report results of regressions where we regress the difference between CDS spreads at time of intervention and four weeks prior to intervention (the anticipation effect) on the foreign shares and others controls. All the foreign shares are insignificant at the 5% level. Thus, any anticipation effect that may be present is unrelated to the foreign shares and hence there is no reason to expect that our results might be biased.

We also test whether our results are driven by selection bias as our sample so far contains only intervened banks. We use a Heckman model to control for possible sample selection, where the first stage explains the probability of a bank to be intervened or not. For this we include next to our sample of failed banks also 40 banks that were not intervened during the sample period. We use the same controls as in the baseline model plus the loan-asset ratio and the ratio of non-performing loans in the first stage; these asset risk proxies should be good predictors of whether a bank will face problems and hence is likely to be intervened. At the same time, there is no reason to believe that (past) asset risk affects the threshold at which a regulator intervenes in a bank, that is, the second stage.[15] Table 6 reports the first and second stages of the Heckman regression. The first-stage results suggest that a higher share of foreign equity and a lower share of foreign assets and deposits make an intervention more likely. Although not the focus of our analysis, we note that this is consistent with Proposition 1 in that foreign equity makes the regulator stricter (and hence more likely to intervene), while foreign deposits and assets make the regulator more lenient and induce him to intervene less frequently. Critically, the second-stage results are consistent with our previous findings. All cross-border variables enter significantly, with coefficients of similar size as in Table 4. Bank size, the Post-Lehman period dummy and the state ownership dummy also enter negatively and significantly, as in Table 4. The inverse of the Mills-ratio, lambda, is insignificant suggesting absence of sample selection problems. Overall, the Table 6 results show that our findings are not driven by selection bias.

In a further robustness test (available on request) we test the validity of our intervention model for a sample of 25 banks that were not intervened during the financial crisis and for which we have also CDS spread data available. If our model provides a reasonable description of intervention thresholds, the spreads of non-intervened banks should tend to be below their predicted intervention threshold. We test this by calculating the predicted intervention thresholds for non-intervened banks (using the estimated coefficients from regression 3 in Table 3). We then compare these predicted spreads to the actual spreads of these banks during the sample period. On average, 98 percent of daily spreads are below predicted spreads before Lehman Brothers' collapse and about 87 percent afterwards. For many banks, 100 percent of CDS spreads are below the predicted intervention threshold, with a few outliers, such as the Spanish Banco Popular, Barclays and the US financial conglomerate MetLife Inc.

[15] The intervention threshold (right hand side of equation (4)) depends only on the foreign activity shares, debt and failure costs but not on asset risk at date 0.

that have a substantial period with CDS spreads above the predicted threshold after Lehman Brothers' failure. Overall, this lends support to our empirical specification of the intervention decision since the model (when estimated on intervened banks) tends to predict that non-intervened banks' CDS spreads are below the intervention threshold.

5 Conclusions and Policy Implications

This paper uses a simple model to illustrate the trade-offs involved when intervening in cross-border banks. We show that foreign assets and deposits, on the one hand, and foreign equity, on the other hand, have different implications for the intervention decisions of home country regulators. Critically, a mix of the three can lead to the same intervention threshold as a purely domestic bank. Our model can inform both the discussion on national versus supra-national bank supervision and the discussion on the optimal organization of cross-border activity from the regulator's viewpoint. While regulators may not want to directly control imbalances in cross-border activities of individual banks, it should be the task of the European Systemic Risk Board to monitor such imbalances since they lead to inefficient supervision of banks.

Our empirical analysis using a sample of intervened banks during the recent crisis confirms the predictions of the model. Banks with a higher share of foreign equity were intervened relatively early as their financial health deteriorated, while banks with a high share of foreign deposits and assets were intervened relatively late. These results clearly support the prediction of the theoretical model that national regulators have biased incentives when dealing with cross-border banks. The message that emerges has obvious implications for the ongoing debate on the reform of resolution regimes around the world.

A supra-national supervisor could, in principle, always improve welfare because this supervisor would also take into account the effects that materialize outside the country. However, supra-national supervision might itself also be subject to imperfections. First, a global supervisor may have imperfect knowledge about the success probability at date 1, receiving only a noisy signal.[16] This means that the supra-national supervisor, even though having the correct incentives, will make sometimes wrong decisions due to imperfect knowledge of the success probability. The benefits from delegation to a supra-national supervisor (arising because it avoids the distorted incentives of domestic

[16] See Holthausen and Ronde (2002) for a similar argumentation.

supervision) thus have to be weighed against the costs arising because the global supervisor has an informational disadvantage. Second, the external costs from failure in period 2 might be higher for the affected economies under supra-national supervision, as intervening and resolving a bank that is present in markets with different legal frameworks can result in lengthy and costly resolution. Again, this presents an additional cost to supranational supervision.

Our theoretical and empirical analyses can also be seen in the broader context of a trilemma of financial integration (Schoenmaker, 2010) that states that financial integration, financial stability and national sovereignty in bank regulation cannot be achieved simultaneously and one has to give. We have shown – both theoretically and empirically – that this is the case due to imbalances in multinational banks. Presuming that one wants to maintain financial stability, the options are hence either a move towards national banking systems, with stand-alone, fire-walled subsidiaries or a move towards supra-national supervision, with the caveats mentioned above. Such a regime can in principle improve the failure resolution for imbalanced banks.

However, one condition for this is that the jurisdiction of the supra-national supervisor corresponds to the geographical area of bank activities. As shown by Osterloo and Schoenmaker (2007) and Schoenmaker (2010), the largest 25 European have, on average, 25% of their assets outside their home country in other European countries. This share ranges from two percent in the case of BBVA (which has 31% of assets outside Europe) to the Nordea Group, with 74% of assets outside its home countries in other European countries (and no assets outside Europe). A European-level supervisor can only alleviate distortions to the extent that they arise from imbalances within the Europe – but not the ones arising from external imbalances. In addition, such a supervisor can only improve on a purely national resolution framework if equipped with the necessary means and resources to resolve a bank efficiently. The resolution powers also have to come with the necessary supervision and monitoring tools; a close relationship with national supervisors is therefore critical.

Different institutional options have been discussed for a European-level bank supervisor. Allen et al. (2011) suggest to combine the functions of deposit insurance and resolution for large European cross-border banks within a European equivalent of the Federal Deposit Insurance Corporation (FDIC). Such an institution could operate either in parallel to the European Banking Authority (EBA) or be merged with it. An alternative suggestion would be a choice-based model where EU member states can opt to delegate supervision of their largest banks to the ECB. Such a model allows for more

flexibility and is likely to face less political resistance than the creation of a pan-European institution (Hertig et al. 2010).

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Appendix A: Efficiency of Effort Provision

In this appendix we analyze the bank's effort choice that arises when regulators act in a time-consistent manner at date 1 and compare this to the (socially) efficient effort choice.

Denote with λ^* the intervention decision of the regulator in a domestic bank (as we have argued before, this threshold is identical to equation (2) of the baseline model). Bank effort is determined as follows. The pay-off to bank equity is $1-d$ in the case of intervention and $R-d$ in the case of project success. In the case of failure the pay-off is zero. We hence have for bank effort:

$$e^{*B} = \arg\max_e W^B(e) = (1-d)E[\lambda(e) < \lambda^*] + E[\lambda(e)(R-d) \mid \lambda(e) \geq \lambda^*] \tag{13}$$

The first order condition for bank effort is

$$W^{B\prime}(e) = (E[\lambda(e) \mid \lambda(e) \geq \lambda^*](R-d) - (1-d))\frac{\partial E[\lambda(e) \geq \lambda^*]}{\partial e} + (R-d)\frac{\partial E[\lambda(e) \mid \lambda(e) \geq \lambda^*]}{\partial e} - m'(e) = 0.$$

The first term is the benefit from higher effort because the bank can now continue in more states of the world (this effect arises because the bank takes into account that its own effort choice affects the regulatory decision). The second term is the benefit arising because when the bank can continue, average λ will be higher. The third terms are the effort costs.

By contrast, efficient effort in the economy maximizes welfare. Given that payoffs are the same as in the baseline model – except that we also have to take into account the effort costs $m(e)$) – efficient effort solves

$$e^* = \arg\max_e W(e) = E[\lambda(e) < \lambda^*] + E[\lambda(e)R - (1-\lambda(e))c \mid \lambda(e) \geq \lambda^*] - m(e). \tag{14}$$

The efficiency condition is hence

$$W'(e) = (E[\lambda(e) \mid \lambda(e) \geq \lambda^*](R+c) - c - 1)\frac{\partial E[\lambda(e) \geq \lambda^*]}{\partial e} + \frac{\partial E[\lambda(e) \mid \lambda(e) \geq \lambda^*]}{\partial e}(R+c) - m'(e) = 0.$$

The first term is the effect that arises because a change in effort affects also the optimal liquidation threshold. This effect is zero due to the envelope theorem. The condition hence simplifies to

$$W'(e) = \frac{\partial E[\lambda(e) \mid \lambda(e) \geq \lambda^*]}{\partial e}(R+c) - m'(e) = 0. \tag{15}$$

Note that $W'(e)$ is larger than the term $\frac{\partial E[\lambda(e)|\lambda(e)\geq\lambda^*]}{\partial e}(R-d)$ in $W^{B\prime}(e)$. Intuitively, this is because a bank does not take into account that higher effort has benefits for depositors and asset holders. However, the condition for private optimality has also the term, $(E[\lambda(e) \mid \lambda(e) \geq \lambda^*](R-d) - (1-d))\frac{\partial E[\lambda(e)\geq\lambda^*]}{\partial e}$. This term is positive because higher effort increases the likelihood that the bank can continue, which increases bank pay-off (but not welfare since at the λ^* the economy is indifferent to continuation). There are thus two offsetting effects. Effort can hence be either under- or overprovided even in an economy without cross-border banking.

Appendix B: Variable Definitions

Variable name	Description	Source
CDS spread	CDS spread of a bank 3 days before intervention; in logs and winsorized at the 5 percent level	Datastream
CDS spread relative to index	Difference between bank CDS spread 3 days before intervention and CDS spread index about the region where the bank is located; in logs and winsorized at the 5 percent level	Datastream
Foreign ownership	Share of bank foreign ownership	Bankscope
Foreign assets	Share of bank foreign assets	Annual reports and authors' own collected data
Foreign deposits	Share of bank foreign deposits	Annual reports and authors' own collected data
Size (in mil. EUR)	Total assets; in logs and winsorized at the 5 percent level	Bankscope
Liquid assets	Ratio of liquid assets over total assets winsorized at the 5 percent level	Bankscope
Tier 1 ratio	Tier 1 capital ratio winsorized at the 5 percent level	Bankscope
Post-Lehman period	A monthly dummy that takes the value of 1 after Lehman Brother's collapse in September 2008, and 0 otherwise	Authors ' calculations
State ownership	A dummy that takes the value of 1 if a government has a stake in a bank of more than 5 percent, and 0 otherwise	Bankscope
Central bank	A dummy that takes the value of 1 if the central bank supervises banks, and 0 otherwise	World Bank's Banking Regulation Survey (June 2008), question 12.1.1, Barth et al. (2008)
Single agency	A dummy that takes the value of 1 if there is a single agency to supervise banks & financial institutions in a given country, and 0 otherwise	World Bank's Banking Regulation Survey (June 2008), question 12.1.4, , Barth et al. (2008)

Note: This table provides an overview of definitions and sources of all variables used in the empirical analysis. Bank balance sheet variables are from the last fiscal period prior to bank intervention. BankScope denotes Bureau van Dijk's BankScope database and Datastream - Thomson Reuters Datastream.

Box 1: Implied Intervention Thresholds

	(1)	(2)	(3)	(4)
	Fully domestic	50% For. deposits	50% For. assets	50% For. equity
Foreign deposits	1	0.5	1	1
Foreign assets	1	1	0.5	1
Foreign equity	1	1	1	0.5
Lambda	0.946	0.925	0.936	0.972
CDS spread (in basis points)	536	749	637	285

Note: Box 1 reports the intervention threshold for bank with different degrees of cross-border activities.

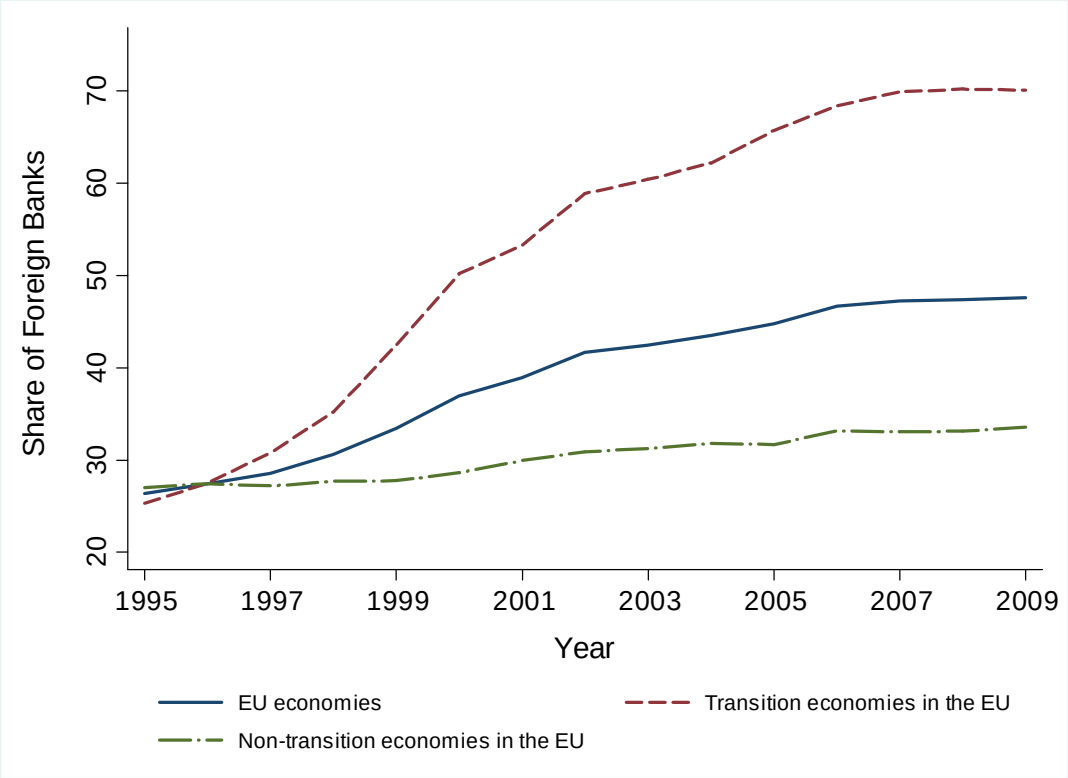

Figure 1: Cross-Border Banking in European Union

Note: This figure shows the share of foreign banks among total banks in the European Union between 1995 and 2009. Source: Claessens and van Horen (2012)

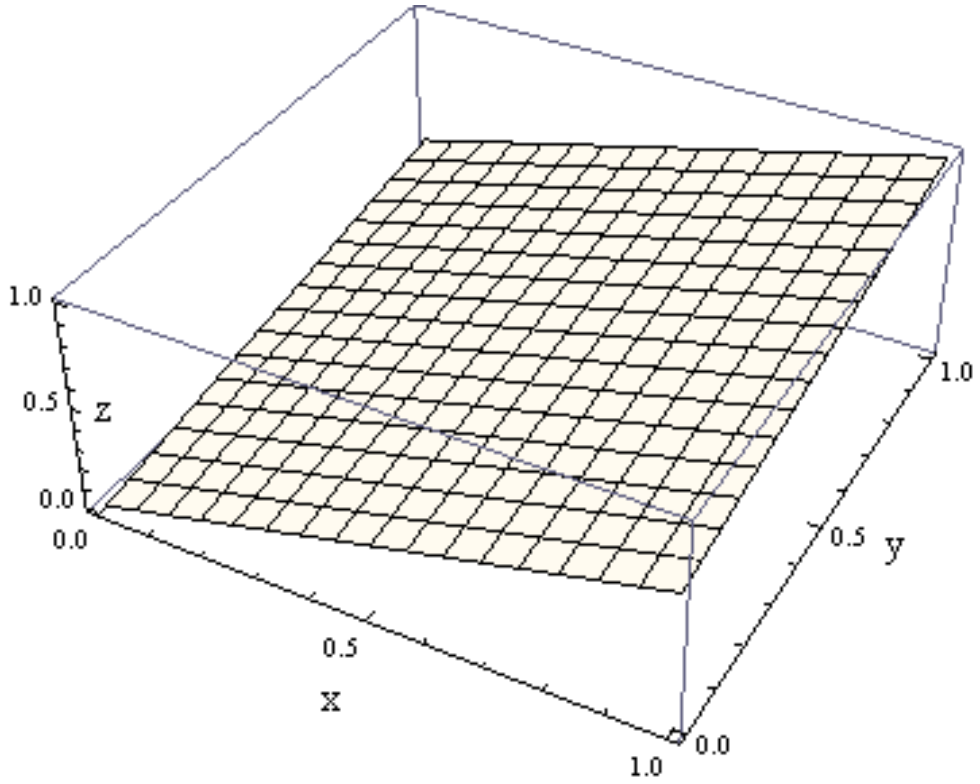

Figure 2: Efficient Regulatory Intervention

Note: This graph shows the combination of the three domestic shares (given by 1 minus the foreign share) for which regulatory intervention is efficient. The estimation is based on the parameter values listed in Box 1. X-axis is domestic deposits, y-axis is domestic assets, z-axis (verical axis) is domestic equity. Above the surface the regulator is too lenient (domestic equity is too high given the bank's cross-border mix of deposits and assets), while below the surface the regulator is too strict (domestic equity is too low for efficiency).

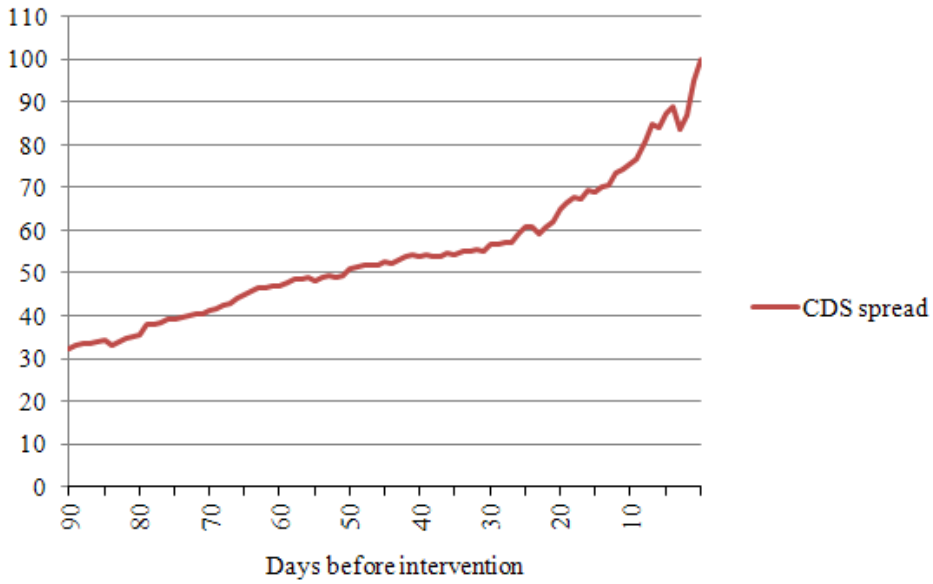

Figure 3: Average CDS Spread before Intervention

Note: This figure shows the average daily CDS spread of the 55 failed banks in our database up to 90 days before being intervened. The average CDS spread at any given day is scaled relative to the average CDS spread at the time of intervention. We use CDS spreads 3 days before intervention as the benchmark in order to exclude the direct intervention effect. Source: Thomson Reuters DataStream and authors' calculations.

Table 1: List of Intervened Banks

Bank	Intervention date	Bank	Intervention date
ABN AMRO NV	29-Sep-08	HSH Nordbank AG	3-Apr-09
AEGON Bank NV	12-Nov-08	IKB Deutsche Industriebank AG	1-Aug-07
Alliance & Leicester Plc	14-Jul-08	ING Bank NV	20-Oct-08
Allied Irish Banks plc	12-Feb-09	Intesa Sanpaolo	20-Mar-09
Anglo Irish Bank Plc	19-Dec-08	JP Morgan Chase & Co.	13-Oct-08
BNP Paribas	20-Oct-08	KBC Bank NV	1-Dec-08
Banca Monte dei Paschi di Siena	27-Mar-09	Kaupthing Bank hf	9-Oct-08
Banca Popolare di Milano SCaRL	25-Mar-09	Landesbank Baden-Wuerttemberg	15-May-09
Banco Popolare	19-Jun-09	Landsbanki Islands hf	7-Oct-08
Bank of America Corporation	30-Oct-08	Lehman Brothers Holdings Inc.	15-Sep-08
Bank of Ireland	11-Mar-09	Lloyds Banking Group Plc	20-Oct-08
Bayerische Landesbank	4-Dec-08	Merrill Lynch & Co., Inc.	15-Sep-08
Bear Stearns Companies LLC	14-Mar-08	Morgan Stanley	27-Oct-08
Bradford & Bingley Plc	29-Sep-08	Natixis	31-Jul-09
Caixa Geral de Depositos	17-Dec-08	Norddeutsche Landesbank	18-Dec-08
Citibank NA	14-Oct-08	Northern Rock Plc	18-Feb-08
Commerzbank AG	3-Nov-08	Raiffeisen Zentralbank AG	30-Jan-09
Countrywide Financial Corp.	11-Jan-08	Royal Bank of Scotland Group	20-Oct-08
Credit Agricole CIB	20-Oct-08	SNS Bank N.V.	12-Nov-08
Danske Bank A/S	1-May-09	Société Générale	20-Oct-08
Dexia	30-Sep-08	Swedbank AB	4-Nov-08
Dexia Crédit Local SA	30-Sep-08	UBS AG	16-Oct-08
Erste Group Bank AG	30-Oct-08	US Bancorp	3-Nov-08
Fortis Bank Nederland N.V.	29-Sep-08	UniCredit SpA	18-Mar-09
Fortis Bank SA/ NV	29-Sep-08	Wachovia Corporation	29-Sep-08
Glitnir Bank	29-Sep-08	Washington Mutual Inc.	25-Sep-08
HBOS Plc	18-Sep-08	Wells Fargo & Company	28-Oct-08

Note: This table lists the banks in our dataset. The sample consists of 55 banks that have been intervened between 2007 and 2009 in Western Europe and in the USA.
Source: Laeven and Valencia (2010) and author collected data.

Table 2: Summary Statistics

Variable	Observations	Mean	Median	St. Dev.	Min.	Max.	Min. (unwinsorized)	Max. (unwinsorized)
CDS spread	55	338.74	201.6	351.40	51.7	1331	51.7	3626
CDS spread relative to index	55	0.31	0.24	0.80	-0.79	2.01	-.79	3.03
Foreign ownership	55	0.35	0.29	0.25	0	1	0	1
Foreign assets	55	0.33	0.33	0.24	0	0.90	0	0.90
Foreign deposits	55	0.32	0.27	0.25	0	1	0	1
Size (in mil. EUR)	55	456,541	309,476	389,052	5,528	1,306,283	5,528	2,586,701
Single agency	55	0.47	0	0.50	0	1	0	1
Central bank	55	0.58	1	0.50	0	1	0	1
Tier 1 ratio	49	.08	.08	.01	.06	.12	0.05	0.21
Liquid assets	55	.21	.20	.12	.04	.40	0.01	0.57
Post-Lehman period	55	0.67	1	0.47	0	1	0	1
State ownership	55	0.16	0	0.37	0	1	0	1

Note: This table lists summary statistics of the key variables used in regressions. Definitions and sources of variables are listed in Appendix B. Bank level variables are reported after being winsorized at the 5 percent level on both tails of the distribution and before being taken in logs. The last two columns of the table show the minimum and maximum values of each variable before being winsorized.

Table 3: Correlation Matrix

	Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
[1]	CDS spread	1							
[2]	CDS spread relative to index	0.851***	1						
		(0.000)							
[3]	Foreign ownership	-0.164	-0.156	1					
		(0.231)	(0.256)						
[4]	Foreign assets	0.033	0.037	0.242*	1				
		(0.814)	(0.787)	(0.075)					
[5]	Foreign deposits	0.146	0.128	0.171	0.691***	1			
		(0.288)	(0.353)	(0.211)	(0.000)				
[6]	Size	-0.419***	-0.538***	0.098	0.126	0.025	1		
		(0.001)	(0.000)	(0.478)	(0.359)	(0.859)			
[7]	Tier 1 ratio	0.247*	0.283**	0.381***	0.313**	0.202	-0.206	1.000	
		(0.087)	(0.048)	(0.007)	(0.028)	(0.165)	(0.156)		
[8]	Liquid assets	-0.251*	-0.306**	-0.082	0.379***	0.248*	0.419***	0.085	1.000
		(0.065)	(0.023)	(0.550)	(0.004)	(0.068)	(0.001)	(0.561)	

Note: This table lists the pairwise correlations of selected variables used in regressions. The sample consists of 55 banks that have been intervened between 2007 and 2009 in the U.S. and Western Europe. Definitions and sources of variables are listed in Appendix B. Numbers in brackets indicate p- values and ***, **, * correspond to the one, five and ten percent level of significance.

Table 4: Regulatory Lenience and Cross-Border Activities - Baseline Model

	log(CDS spread)				log(CDS spread) -log(CDS index)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign ownership	-0.919***	-0.981***	-0.983***	-0.842**	-0.744***	-0.813**	-0.800***	-0.923***
	0.279	0.337	0.302	0.416	0.268	0.308	0.285	0.312
Foreign deposits	0.931**				0.630*			
	0.363				0.335			
Foreign assets		0.780*				0.647*		
		0.425				0.361		
Average foreign asset and deposit share			1.015**	1.330***			0.758**	1.131***
			0.410	0.395			0.359	0.315
Size	-0.293***	-0.313***	-0.305***	-0.214**	-0.345***	-0.361***	-0.354***	-0.296***
	0.0735	0.0830	0.0797	0.0909	0.0632	0.0663	0.0648	0.0729
Post-Lehman period	-0.888***	-0.841***	-0.876***	-0.629*	-0.828***	-0.804***	-0.826***	-0.872***
	0.197	0.205	0.202	0.316	0.179	0.176	0.178	0.218
State ownership	-0.651**	-0.702**	-0.697**	-0.459	-0.336**	-0.388**	-0.374**	-0.326*
	0.273	0.296	0.280	0.297	0.159	0.181	0.166	0.183
Single Agency	-0.00760	-0.0292	-0.0134	0.0479	0.0964	0.0849	0.0950	0.117
	0.184	0.196	0.186	0.185	0.142	0.147	0.142	0.155
Central bank	0.00876	-0.118	-0.0349	-0.100	-0.215	-0.290**	-0.234	-0.221
	0.209	0.213	0.210	0.183	0.146	0.142	0.142	0.142
Tier 1 ratio				3.031				2.726
				7.069				6.128
Liquid asset share				-2.227**				-1.285**
				0.846				0.556
Constant	9.839***	10.20***	10.00***	8.656***	5.387***	5.631***	5.484***	4.726***
	0.983	1.080	1.044	1.531	0.867	0.900	0.891	1.268
Observations	55	55	55	49	55	55	55	49
R-squared	0.501	0.483	0.501	0.485	0.601	0.603	0.608	0.674

Note: In this table, the dependent variables are the log of a bank CDS spread three days before intervention and the log of a bank CDS spread taken relative to the log of a bank CDS index for the region where the bank is located. Definitions and sources of variables are listed in Appendix B. Bank balance sheet regressors are based on data from the last fiscal year before intervention. All models report OLS estimates with robust standard errors and ***, **, * correspond to the one, five and ten percent level of significance.

Table 5: Anticipation Effect

	△CDS spread		
	(1)	(2)	(3)
Foreign ownership	0.399	0.379	0.403
	0.266	0.257	0.260
Foreign deposits	-0.343		
	0.254		
Foreign assets		-0.110	
		0.300	
Average foreign asset and deposit share			-0.269
			0.307
Size	0.139	0.143	0.143
	0.0852	0.0860	0.0869
Post-Lehman period	0.632***	0.603***	0.619***
	0.123	0.119	0.121
State ownership	-0.0705	-0.0777	-0.0650
	0.128	0.133	0.128
Single agency	-0.0480	-0.0354	-0.0421
	0.116	0.118	0.116
Central bank	-0.100	-0.0377	-0.0682
	0.101	0.106	0.105
Constant	-2.242**	-2.375**	-2.323**
	1.069	1.068	1.074
Observations	55	55	55
R-squared	0.473	0.454	0.463

Note: In this table, the dependent variables is the difference between bank CDS spread 3 days before intervention and its value four weeks in advance. Definitions and sources of variables are listed in Appendix B. Bank balance sheet regressors are based on data from the last fiscal year before intervention. All models report OLS estimates with robust standard errors and ***, **, * correspond to the one, five and ten percent level of significance

Table 6: Sample Selection Analysis

	CDS spread					
	(1)		(2)		(3)	
	First stage	Second stage	First stage	Second stage	First stage	Second stage
Foreign ownership	3.153***	-1.055***	2.956***	-1.020**	3.308***	-1.095***
	1.098	0.408	0.979	0.453	1.111	0.424
Foreign deposits	-3.596***	1.150***				
	1.333	0.367				
Foreign assets			-3.248*	0.681*		
			1.813	0.414		
Average foreign asset and deposit share					-4.087**	1.056**
					1.610	0.415
Size	1.099***	-0.313***	1.064***	-0.321***	1.131***	-0.321***
	0.285	0.0766	0.361	0.0856	0.304	0.0827
Post-Lehman period	11.30***	-1.029**	12.42***	-0.966**	12.26***	-1.017**
	1.202	0.429	1.875	0.461	1.509	0.419
State ownership	2.680***	-0.580**	2.420***	-0.608**	2.610***	-0.621**
	0.866	0.263	0.676	0.274	0.742	0.267
Single agency	0.482	0.0585	0.558	0.0210	0.452	0.0396
	1.017	0.170	0.887	0.183	0.949	0.172
Central bank	0.606	0.0329	0.310	-0.127	0.449	-0.0420
	0.829	0.207	0.743	0.205	0.787	0.203
Loans to Assets ratio	1.821*		1.351*		1.442*	
	0.957		0.732		0.817	
Non-performing loans	0.196		0.419		0.313	
	0.336		0.351		0.340	
Constant	-13.25***	10.10***	-11.89***	10.42***	-13.13***	10.31***
	3.815	1.236	3.882	1.387	3.585	1.295
Lambda		0.00397		-0.102		-0.0631
		0.271		0.295		0.250
Observations	95	95	95	95	95	95

Note: This table reports results from the first and second stage of a Heckman-type of regression with maximum likelihood estimation. The dependent variable is the log of a bank CDS spread three days before intervention. Lambda is the estimate of the sample correction bias, reported here with its standard error. The loan-to-asset ratio and the ratio of non-performing loans to gross loans are included as additional control variables in the first stage (probit) model of estimation. Definitions and sources of variables are listed in Appendix B. Bank balance sheet regressors are based on data from the last fiscal year before intervention. All models report robust standard errors and ***, **, * correspond to the one, five and ten percent level of significance.