Cross-Border Resolution of Global Banks

Ester Faia (Goethe Universität Frankfurt and CEPR)
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1. INTRODUCTION

Following the default of Lehman Brothers, governments around the world had to mobilize enormous rescue packages to cope with widespread financial panic. In these efforts a fundamental flaw of the international financial architecture became apparent, namely the inability of national supervisors to orchestrate orderly bank resolutions across borders. Since then, the international regulatory community has made efforts in devising the best approach to resolving large and cross-border banking groups.

Prior to the recent crisis and right after it, banks’ resolutions have been conducted primarily through bail-outs. The arguments were clear. There was primarily the need to implement a fast action to stop financial and banking panics, as the latter have higher costs as they progress. Bail-out packages are enacted much faster than standard bankruptcy procedures, thereby also contributing to reduce the costs of uncertainty.

The recent bail-outs have shown however that those procedures are in fact excessively costly, particularly when a banking panic is already in place, and not very efficient. They are also politically un-palatable: in the midst of a crisis which hits tax payers’ income severely it became hard to justify their financial involvement into banks’ bail-outs.

The Financial Stability Board at first, followed by many other national authorities, had then advocated for bail-in resolution procedures. Bail-in procedures require the statutory power of the resolution authority to restructure the liabilities of a distressed financial

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institutions by writing down unsecured debt and/or converting it to equity (Zhou et al. (2012)). They have many advantages. At first and most evidently, they do not involve tax payers’ money, hence they are politically acceptable. Several other advantages, which we describe in detail in the next section, include: avoidance of long delays, transparency and ex ante commitment (bail-in plans are devised already in normal times and based on stress test scenarios), reduction of banks’ incentives toward risk taking and moral hazard.

Bail-in procedures have also a few drawbacks. The most important one is that they are difficult to implement, particularly so when global systemically important banks are involved (G-SIB since now on). Large and global banking groups have foreign branches and/or subsidiaries. In both cases and to the extent that G-SIBs are involved, a bail-in resolution requires coordination and sometimes long bargaining between two or more resolution authorities. For G-SIBs an important dimension of the bail-in design concerns the identification of the resolution authorities involved. The bail-in regimes can be activated under a single point of entry (SPE hereafter) or under multiple points of entry (MPE hereafter) regimes. In the first case resolution losses are imputed to the bondholders of the G-SIB parent holding (which must guarantee ex ante enough loss absorbing capacity) and the statutory power for resolution is assigned to the authority of the parent holding country. In case of MPE losses are borne by the branches where they are generated and host countries’ authorities have statutory power. Such distinction in regimes has far-reaching consequences. It affects the way in which authorities internalize cross-country spill-overs and their commitment, it affects the way banks function and whether they decide to internationalize, but most importantly it determines the investors of which country bear losses.

This distinction in regimes, so far not widely known nor explored by academics, is the most important innovation in financial regulation in recent decades. For prudential authorities in recent years the choice between SPE and MPE has been the question to be answered. From a theoretical point of view the question is akin to the question regarding optimality of cooperative regimes (currency areas are or pegs) vis-à-vis non-cooperative ones (flexible exchange rates): SPE require indeed an equivalent decision from national policy makers to relinquish their authority in the name of efficiency.

Our paper examines this question. We do so from three angles. First, given the complexity of those resolution procedures, we describe in detail the wording and the economic trade-offs involved through a glossary and a visual inspection (flow charts under each regime). Second, we present some case studies of recent resolution regimes, namely Dexia, Fortis, Banco Espirito Santo, Bankia, Bank of Cyprus, Amagerbanken and HGGA. The description serves the primary purpose of motivating our work by highlighting the importance and the consequences of different resolution regimes. Moreover, while the observations of the case studies are obviously not enough to provide statistical evidence (luckily banks’ resolutions are not so frequent), they do provide some indicative support to the economic arguments discussed in the paper. The case studies are complemented by information obtained from the living wills of systemically important financial institutions: these data, which are based on an extremely
innovative approach, show which regimes are deemed optimal based on a revealed preference argument and give interesting indications on the type of collective action problems involved.

Third, we devise a simple game-theoretic model that embeds the main mechanisms, namely the strategic interaction among national authorities, the investors’ and banks’ costs of uncooperative regimes in which authorities fail to internalize cross-country spillovers and the extent to which banks choose to globalize in the face of different regimes. In our two countries model banks invest and raise liabilities domestically and abroad and face liquidity and equity requirements. Regulatory authorities implement bail-in under SPE with cooperative or uncooperative behaviour and MPE (decentralized policy regime). Results show that the fractions of bail-inable bonds (namely losses to investors) under the non-cooperative regimes are always larger than under the cooperative regimes. In the un-cooperative Nash equilibrium authorities fail to internalize cross-country spillovers and this results in higher losses. An exception occurs when banks raise liabilities only locally (fully decentralized groups): in this case MPE and SPE perform equally. The choice of the resolution regime also bears consequences for financial integration. Ideally more financial integration is superior due to improved risk-sharing possibilities. Our model shows that under SPE the parent holding remains fully liable for foreign subsidiaries’ losses: this reduces its incentives to venture into foreign markets1. Overall, while SPE efficiently minimizes investors’ losses, it also induces financial retrenchment, a clearly sub-optimal outcome.

The rest of the paper is divided as follows. The next section includes a glossary and a literature review, as well as a description of the various regimes through a visual inspection (flow charts). Section 3 reviews the case studies and examines the banks’ living wills. Section 4 presents the model and its results. Section 5 discusses policy implications. Section 6 concludes.

2. UNDERSTANDING THE FUNCTIONING OF THE RESOLUTION REGIMES

The concepts analysed in this paper are certainly innovative as policy makers enacted those reforms only very recently. For this reason it is essential to introduce the reader to the exact definition and to the functioning of those policy regimes. In what follows we do so by providing a glossary definition of the various wordings.

As explained before, bail-outs (injection of public equity capital into the banking systems) have several drawbacks. They are politically unacceptable since they shift the burden of banks’ recapitalization to tax-payers, they require discretionary government actions and foster banks’ risk taking and moral hazard through implicit government guarantees.

For these reasons authorities moved toward bail-in, a procedure that assigns the statutory power to a resolution authority which can enforce the write-down of banks’ bonds and un-secured short term liabilities and/or transform them into equity. The

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1 The comparison between SPE-cooperative and non-cooperative in relation to the degree of financial retrenchment instead depends upon the degree of home bias.
overall aim is to achieve a prompt recapitalization and restructuring without using public funds, but by assigning losses to banks’ bondholders, appropriately compensated by market returns. Bail-in procedures have several merits. They avoid the long delays and the uncertainty of bankruptcy procedures, thereby reducing the risk of panics and contagion. Higher transparency also facilitates the pricing of bail-inable bonds\(^2\). Since plans for allocation of losses are decided ex ante this facilitates commitment. Bail-in procedures do not foster moral hazard: bondholders feel more compelled to monitor and to discipline the bank.

For G-SIB groups, however, bail-in might become particularly complex. Given the presence of branches (but also subsidiaries when we examine currency unions) and their loss generating capacity, one needs to identify ex ante the entity (within each banking group) which should provide up front enough capital and liquidity to absorb losses generated elsewhere in the group. This also requires identifying which resolution authority is in charge of the resolution plan and of its implementation. Under the Single Point of Entry Regime, which is the one chosen by most authorities worldwide including the U.S. and the Euro area, losses are assigned to bondholders of the parent holding. The resolution of G-SIBs is either done by one single authority, like in the case of the Euro area\(^3\), or by local authorities operating in a cooperative fashion. Under the Multiple Points of Entry Regime, losses are assigned to the bondholders of the branch under distress and resolution takes place in a fully un-coordinated fashion. This approach is also known as ring-fencing. Given the well known benefits of coordination for international institutional architecture, the Financial Stability Board (FSB) has issued strong recommendations in favour of SPE and cooperative resolutions in general. In practice however SPE is difficult to implement when various national authorities are involved in the resolution. The need to fulfil political mandates with their electorates makes national authorities unwilling to cooperate. They are also prone to protect national investors from bearing losses, a manifestation of a beggar-thy-neighbour effect. The functioning of SPE regimes also requires shifts of capital and liquidity from the parent holding to the distressed branches: national regulators often tend to limit those flows.

Another new concept in the design of bail-in plans is the TLAC (total loss absorbing capacity) set of rules that home and host authorities shall apply to determine if the G-SIB has enough capacity (capital) to absorb losses before and during the resolution. Two key variables of TLAC requirements are still being set: the level of total TLAC and the location where it will have to be held (so called prepositioning of capital). For instance all capital TLAC could be held at the center (in the holding company) and used to recapitalize losses wherever they occur in the group (downstreaming of capital). However, it is likely that a high proportion of TLAC will have to be prepositioned at subsidiary level to give local authorities intervention powers. Moreover, restrictions will limit the transfer of capital from the subsidiary back to the center (upstreaming of capital). Overall, the final TLAC regulation will have an important impact on the

\(^2\) See also Schäfer et al. (2015).

\(^3\) The Singly Resolution Board, the central authority for the euro area, was established with the Bank Restructuring and Resolution Directive of 2014 (BRRD).
practical design of cross border resolution and on the powers of supervisors in different jurisdictions.

2.2 LITERATURE REVIEW

The structure of the economic problem as well as of the model employed in section 4 is akin to the theoretical underpinnings behind the choice of international monetary regimes. SPE implies relinquishing policy authority as in the fixed exchange rate regimes or in currency areas. The spirit of our model, albeit not the type of regimes and micro-foundations, is indeed close to Giavazzi and Pagano (1988), Bayoumi (1994) and Alesina and Barro (2002). There are currently no papers nor models examining the choice of international financial regulation and/or resolution regimes. The closest recent contribution is Niepman and Schmidt-Eisenlohr (2013) which analyses bail-out regimes using a simple model along the lines of Diamond and Dybvig (1983). Their paper does not consider bail-in regimes nor discusses real-world examples.

Since we are focusing on the case of G-SIBs and on the role of regimes for financial retrenchment, some recent empirical studies are informative for our purpose. The literature generally finds evidence of financial retrenchment in recent years. Gianetti and Laeven (2012a, b) find that banks have increased home bias when their country experienced a banking crisis. Claessens and van Horen (2014) show a sharp reduction in cross-border lending, in particular by advanced countries hit by systemic crisis. De Haas and Van Lelyveld (2014) and Van Rijckeghem and Weder (2014) and Brems and Fratzsch (2015) all document a retreat from cross border lending after the global financial crisis. Similarly, Schoenmaker (2013) presents evidence on a reversal in cross border banking from aggregate and disaggregated data. Battistini et. al. (2014) show that the European periphery banks have increased home bias in their sovereigns’ debt. Moreover, in Europe, the retrenchment is particularly pronounced for banks that received state aid. Tightening regulations at home and host countries explains a large share of the overall reduction in cross border claims as shown by IMF (2015). This observation is in line with one result of our model showing that SPE regimes, by shifting the burden of losses on the parent holding, foster financial dis-integration. Using a model of dynamic entry decisions with Cournot competition and default risk, Faia and Ottaviano (2015) link retrenchment to entry costs, which include regulatory ones.

There is no empirical literature on resolution regimes since the data are scant. Claessens et al. (2010) gives a review of the most famous bail-out cases. While these bail-out cases may be informative to some extent, the strategic behaviour and bank incentives do not necessarily transfer to the bail in regimes. See also Düb (2013) for an overview of liability management in various cases. Schäfer et al. (2015) conduct an event study of resolution cases: their case description is short and solely qualitative since it has only the purpose of identifying and classifying the credit events. Our paper is certainly the first to

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*A related strand of the literature starting with Peek and Rosengren (1997) analyses the transmission of shocks across countries through banks capital reallocation. For instance Cetorelli and Goldberg (2012) find that US global banks do transmit shocks but not indiscriminately. They tend to protect important franchises in certain foreign markets but not in others.*
provide a comprehensive, systematic and quantitative review of all available case studies (including resolution conducted with partial bail-in). This is also complemented by some innovative statistics on the banks’ living wills.

2.3 Visual Inspection of the Single vs Multiple Point of Entry

The regimes examined in this paper, SPE (cooperative and non-cooperative) versus MPE, are institutional innovations. To make the reader familiar with them in this section we describe in detail the functioning of those regimes with specific examples and charts of intra-group flows. The purpose is to disentangle the main economic forces and incentives which provide the basis for our model in section 4.

We start by describing the case of cooperative SPE. Figure 1 shows the intra-group flows in a stylized SPE-cooperative resolution. To fix ideas let’s assume that losses are generated within a subsidiary in country i, the foreign country (we denote by j the home country and to maintain a parallel with the model we lay down the interaction within a two country world). The loss is immediately imputed to the parent holding, which as a result fails to fulfill regulatory capital requirements. If the parent holding is un-compliant, the home country j authority intervenes by activating the bail-in procedure: equity and subordinated debt are written off and senior (bonded) debt is converted into equity. The proceeds are used to recapitalize the subsidiary in country i. If the loss absorbing capital at the holding company is sufficiently large, subsidiaries of the group in other countries will be unaffected. Only if the loss absorbing capital proves insufficient, the home country authority broadens the bail-in base or sells assets of other subsidiaries in the group (including subsidiaries in the home country, in the operating company OpCo, and in the rest of the world, indicated with the acronym ROW in the flow chart.

Figure 1: SPE Cooperative

Notice that the home country authority operates like a global authority since it takes command of a global resolution syndicate, pools the assets of the entire group and identifies which of those can be sold by implementing optimal burden sharing across
parts of the group and across jurisdictions. This minimizes global value destruction, business disruption and systemic risk. This form of SPE regimes corresponds to the perfect cooperative solution or to the single global authority which internalizes spillovers across countries and parts of the group. The role of cooperation or of the benevolent global authority will be one crucial element of our theoretical model below. There are however also SPE regimes which are not implemented in a fully centralized and cooperative way. An example is that of American global groups, which have to be resolved through SPE regimes but would require interventions of several authorities if branches are located in the U.K. or the Euro area. National supervisors in this case pursue different goals and give preference to the subsidiaries located in their own country (see Huertas (2014, p. 124)). It is indeed foreseeable that a subsidiary located in the home country, i.e. in the same jurisdiction as the bank holding company, is likely to receive a more favourable treatment from the domestic supervisor than subsidiaries located in other countries. This form of regulatory capture and preferential treatment will in the end increase losses and destroy value. To see this consider as before that losses generated in one subsidiary are imputed to the parent holding which ends up failing the regulatory requirements. In this case however if loss absorbing capital at the holding is lacking, the domestic authority will be tempted to protect the operating company at home. Authorities in the foreign country might also ring-fence their respective subsidiaries. This brings costs at home and abroad. Due to the favourable treatment the subsidiary in country \( i \) will remain undercapitalized, thereby increasing the likelihood of second-round interventions and disorderly resolution. This in turn has indirect contagion effects on the entire group/countries and generates further losses. Non-cooperative solutions, albeit under SPE regimes, induce higher losses. Our theoretical model in section 4 rationalizes and proves this point using the concept of inefficient Nash (un-cooperative) equilibrium.

**Figure 2: Multiple Points of Entry**

5 For brevity we do not include a flow chart for this case. It is however available upon request.
Figure 3 shows a MPE resolution. Following a loss in country $i$, the local authorities proceed to bail-in creditors. If loss-absorbing capital at the local level is sufficient, the subsidiary is recapitalized. If it is not sufficient, the subsidiary is liquidated causing risks to financial stability in country $i$. Liquidation however has obvious contagion effects (reputation, franchise and confidence). This could prompt further asset sales in other countries with a second round of global losses. Once again uncooperative behaviour amplifies losses.

3 CASE STUDIES OF BANK RESOLUTION IN EUROPE

So far most resolutions have taken place via bail-out procedures. More recently and following the BRRD directive we have witnessed a number of bail-in procedures in Europe. We focus on Europe since the process of the development and instalment of a banking union provides a natural experiment with a shift from a regime in which resolutions were mainly based on bail-out procedures with multiple points of entry toward regimes of single point of entry with a centralized resolution authority. For this reason we review the cases in temporal order. The earlier resolutions (after the 2007 crisis) will highlight the consequence (in terms of losses) of uncoordinated resolutions (MPE), while more recent resolutions are examples of pilot SPE. We complement the information from case studies with a summary of the living wills of systemically important banks (in section 3.1): this is an innovative approach which gives indication on the optimal regimes based on a revealed preference argument.

An overall classification of the cases is reported in Table 1 below. Notice that the first two cases were conducted under MPE since they involved several uncoordinated authorities. For the rest of the cases at least partial bail-in was implemented under the umbrella of the EU (usually the Troika acted as the central authority). An interesting regularity emerges. As the cases progress from MPE to SPE resolutions the amount of losses involved is significantly lower, a clear indication that cooperation maximizes efficiency. Our model in section 4 will also provide support for this.

Let’s now focus more closely on the cases that can be classified as pilot bail-ins. Table 2 shows some quantitative indicators. The first thing to notice is that as banks get recapitalized (capital ratios Tier 1, Core Tier 1 increase) subordinated debt decreases. This means that capital and liquidity injection was done primarily by writing down creditors’ debt, namely through bail-in. The banks examined all had cross-borders liabilities and to assess the coordination failure it would be interesting to see the break-up of loss allocation across countries. We are able to recover this information only for Cyprus (see Figure 1 below). The write down of foreign creditors’ liabilities was larger than that of domestic creditors, a clear indication that this was an uncooperative SPE.
### Table 1: Summary of Resolution Cases

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Amount</th>
<th>Form</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>Fortis</td>
<td>35.6 bn</td>
<td>Several recapitalizations by Belgium, Netherlands and Luxembourg</td>
<td>Bail-out MPE</td>
</tr>
<tr>
<td>2008</td>
<td>Dexia</td>
<td>11.5 bn</td>
<td>Recapitalization by Belgium and France</td>
<td>Bail-out MPE</td>
</tr>
<tr>
<td>2011</td>
<td>Amagerbanken</td>
<td>0.9 bn</td>
<td>Recapitalization by Denmark with bail-in of senior debt and unsecured depositors</td>
<td>Hybrid bail-out/bail-in, SPE</td>
</tr>
<tr>
<td>2012</td>
<td>Bankia</td>
<td>24.6 bn</td>
<td>Recapitalization, mandatory haircut on unsubordinated debt, private creditors contributions (30%)</td>
<td>Hybrid bail-out/bail-in, SPE</td>
</tr>
<tr>
<td>2013</td>
<td>Bank of Cyprus</td>
<td>4.5 bn</td>
<td>Mandatory debt/equity swap for uninsured deposits, haircuts on subordinated debt</td>
<td>Bail-in, SPE</td>
</tr>
<tr>
<td>2014</td>
<td>Banco Espirito Santo</td>
<td>4.9 bn</td>
<td>Shareholders and subordinated debt holders transferred to bad bank (+4.4 bn government loan)</td>
<td>Bail-in (= loan), SPE</td>
</tr>
<tr>
<td>2012</td>
<td>Hypo Alpe Adria</td>
<td>Ongoing</td>
<td>Repeated capital injections, decision to bail in in principle applying BRRD</td>
<td>Bail-out Expected bail-in SPE</td>
</tr>
</tbody>
</table>

Note: Authors’ calculations. For sources see case studies below.

**Figure 1: Bank of Cyprus – Liabilities in billions of €**
Table 2. Data obtained from BankScope and banks’ Annual Reports

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Total capital ratio</td>
<td>7.62</td>
<td>8.5</td>
<td>9.81</td>
<td>12</td>
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<td>Resolution:2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid assets/Total assets</td>
<td>7.0</td>
<td>8.6</td>
<td>4.6</td>
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<td>2.1</td>
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<td>5</td>
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<td>8.3</td>
<td>5.16</td>
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<td>326</td>
<td>4941</td>
<td></td>
<td></td>
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<tr>
<td><strong>Dexia</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Total capital ratio</td>
<td>14.3</td>
<td>10.3</td>
<td>20.9</td>
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<td></td>
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<tr>
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<td>12.5</td>
<td>13.9</td>
<td>17.4</td>
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<tr>
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<td>-0.1</td>
<td>0.9</td>
<td>1.8</td>
<td>1.3</td>
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<td>7.6</td>
<td>19.9</td>
<td>21.4</td>
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<tr>
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<td>6.4</td>
<td>19.7</td>
<td>21.2</td>
<td></td>
</tr>
<tr>
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<td>1691</td>
<td>707</td>
<td>644</td>
<td>498</td>
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<tr>
<td><strong>Bank of Cyprus</strong></td>
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<td></td>
</tr>
<tr>
<td>Total capital ratio</td>
<td>11.9</td>
<td>7.8</td>
<td>0.9</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>Resolution:2013</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid assets/Total assets</td>
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<td>11.7</td>
<td>9.2</td>
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<tr>
<td>Core Tier 1 regulatory ratio</td>
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<td>6.4</td>
<td>19.7</td>
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<td>34</td>
<td>34</td>
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<td><strong>BES</strong></td>
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<tr>
<td>Total capital ratio</td>
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<td>10.7</td>
<td>11.3</td>
<td>11.8</td>
<td></td>
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<td>Resolution:2014</td>
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<td>Liquid assets/Total assets</td>
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<td>Equity/Total assets</td>
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<td>9.4</td>
<td>10.4</td>
<td>10.4</td>
<td>9.5</td>
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<tr>
<td>Core Tier 1 regulatory ratio</td>
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<td>9.2</td>
<td>10.5</td>
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<tr>
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<td>1523</td>
<td>815</td>
<td>775</td>
<td>1002</td>
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</table>

Let’s now proceed to a closer examination of the individual cases to better highlight the incentives and behaviours at work.

**Fortis**

The Fortis Group was a Belgian company with an active international presence, in particular in the Benelux countries. In 2008 it went through a substantial restructuring involving participation from the three Benelux states. Resolution was bargained but uncoordinated. On 29 September 2008 the Belgian Government acquired 49.93% of Fortis Bank Belgium for €4.7 bn, whereas the Government of Luxembourg agreed to invest €2.5 bn in Fortis Banque Luxembourg. Given the uncoordinated fashion of the intervention, further rounds of interventions were needed. Between October 2008 and July 2009 the Belgian Government acquired the rest of Fortis Bank Belgium for an additional €4.7 bn, while the Government of the Netherlands acquired Fortis Bank...

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*Sources: Fortis (p46), European Commission (II, III, IV).*
Netherlands for €16.8 bn\(^7\) and announced a recapitalization for ABN AMRO worth €2.5 bn. A further recapitalization of ABN AMRO for €4.39 bn was announced in January 2010.

**Dexia**\(^8\). This is another case of uncoordinated actions. The Dexia Group has reported significant losses in the last years. The initial losses in 2008 were covered through a recapitalization from the governments of Belgium and France\(^9\). Senior unsecured debt was originally largely guaranteed by the state and hybrid capital securities were not used to cover losses. This was due to the failure of France and Belgium to pass conducive legislation which would have allowed them to amend contractual terms and mandate a book value reduction (Dübel (2013), p. 36). Each government contributed with half of the bill\(^10\). An important part of these funds were used by Dexia Group to recapitalize the most troubled subsidiary, Dexia Crédit Local, to the tune of €3.5 bn. An additional €2.5 bn were used to capitalize the subsidiary Dexia Bank\(^11\). Following the losses in 2011 a major restructuring and orderly resolution plan was designed, which continues today. The plan involved disposing of the major subsidiaries and a major shrinking of the balance sheet size. As part of the orderly resolution plan, which was eventually approved by the Commission on Dec. 28 2012, a second recapitalization worth €5.5 bn took place, with Belgium underwriting €2.915 bn and France underwriting €2.585 bn\(^12\). This takes the overall amount of the recapitalization to €11.5 bn. Once again uncoordinated actions usually require several rounds of interventions due to the failure of devising a global group-wise plan. As with the case of BFA/Bankia, all measures were channelled through the parent company, in this case Dexia S.A., usually referred to as Dexia Group.

**Amagerbanken**\(^13\). Amagerbanken was a relatively small Danish bank which filed for bankruptcy and was declared bankrupt on 7 February 2011, after a loss-recognition exercise that derived in the bank having negative equity. The bank was taken over by the Financial Stability Company (FSC) of Denmark, which is the State-owned winding-up agency. All assets and certain liabilities were transferred to a new bank (Amagerbanken af 2011 A/S), most of which was eventually resold. Prior to the events in February 2011 Amagerbanken had received support from the Danish State: a drawing right from the Danish Central Bank (€403 million), a capital injection approved by the Commission on 3 February 2009 (€148 million), and an individual State Guarantee of €1.8 billion within the framework of the Danish Guarantee Scheme. Of this Guarantee

\(^7\) This transaction involved also the participation Fortis Bank Netherlands in RFS Holdings (which included ABN AMRO), Fortis Insurance Netherlands and Fortis Corporate Insurance.

\(^8\) Sources: Dexia Annual Reports, European Commission ([II, III, IV]).

\(^9\) Recapitalization was for an amount of €6 bn, of which €5.2 was deemed as state aid by the European Commission. see page 4 in the Official Journal of the European Union, vol. 57, 12 April 2014. Additional measures at this stage were refinancing guarantees for €135 bn and impaired asset measures for €3.2 bn.

\(^10\) We must report that we have also gathered somehow different figures on those losses. In the letter of 19 November 2008, C(2008)7388 to the Member states the overall reported amount is €6.4 bn, with Belgium and France providing €3 bn each and Luxembourg providing the rest. In page 4 of the Official Journal of the European Union from 2014 no mention is made to the contribution by Luxembourg. At last in the press release from 2012, see http://europa.eu/rapid/press-release_IP-12-14477_en.htm, in which the Commission approves the major restructuring of the Dexia Group, the amount reported is €5.4 bn. Given this we have chosen to stick to the most recent information which is contained in the article from the Official Journal of the EU.


\(^12\) As of 31 December 2013, the Belgian state is the major stakeholder at Dexia group, owning 50% of the shares, whereas France's stake is at 44.4%.

roughly €277 million were eventually a loss for the Danish State (see Financial Stabilitet report 2011 of the Danish State, p37). At the time of the property transfer to the national authorities, the FSC provided an equity injection of €161 million to the new bank in order to enable it to meet regulatory requirements. An additional €203 million were injected as share capital into Amagerbanken at the time of the transfer, due to uncertainty about the initial assessment of risk-weighted assets.

While it lacks the cross-border dimension, an interesting feature of the Amagerbanken resolution is the bail-in of senior debt and unsecured depositors. This is in fact the first bank for which bail-in was implemented, well in advance of European regulation. The losses borne by this group amounted to roughly €110 million14. The total losses are calculated then as the sum of the bailed-in money, the loss on the guarantee, the two capital injections at the time of transfer and the capital injection prior to the transfer. This sums up to €0.9 billion.

Bankia15. Bankia/BFA is a Spanish banking group created in 2010 after the consolidation of seven regional savings banks (known as “Cajas”). After barely avoiding collapse following the financial crisis, the group was finally forced into resolution in 2012. The recapitalization value, undertaken via several decisions of the Fund for Orderly Bank Resolution (FROB), amounted to €24.6 billion (see Fondo de Reestructuración Ordenada Bancaria, 7 December 2014)16. This was done via BFA, the parent holding company of Bankia, which is controlled by the state via the FROB. This case can therefore be classified as a case of bail-in with single point of entry.

Bank of Cyprus17. After Spain the banking crisis of Cyprus was the second instance where the EU and IMF played a major role in the eventual type of resolution by pressing for bail-in. Troika authorities acted in coordination, hence Cyprus was the first pilot example of coordinated SPE. The Bank of Cyprus was under resolution from 25 March 2013 until 30 July 2013 by the Central Bank of Cyprus, which acts as the resolution authority upon strict guidelines by the Troika. The resolution was implemented via the bail-in of uninsured depositors (deposits above the € 100.000 threshold covered by deposit insurance) through a conversion of 47.5% of such deposits into equity. Holders of debt securities and ordinary shares issued by the Bank contributed to the recapitalization through the absorption of losses. The total amount of money involved in the bail-in was estimated by the IMF (based also on the Central Bank of Cyprus) at €4.5 bn, of which €3.9 bn and €0.6 bn corresponded respectively to uninsured deposits and subordinated debt.

It is notable that in the run up to the resolution cross-border liabilities at the Bank of Cyprus fell from 43% to 14% (Figure 1). This shows that coordinated SPE, while efficient in terms of reducing losses, induces severe cross-border financial retrenchment,
a prediction well in line with a key result of the model in section 4. If SPE is indeed enacted at the centre, the parent holding becomes liable for all intra-group losses. This increases their incentives to reduce foreign exposure.

**Banco Espirito Santo (BES).** Banco Espirito Santo S.A. was as of end June 2014 the third largest banking group in Portugal. It is a universal bank incorporated and domiciled in Portugal, though it is part of a larger group with a vast international reach\(^\text{18}\). The BES group itself has a stake in subsidiaries in different countries. It is indeed a quite complex cross-border structure. Losses (announced on July 30, 2014 for €3.6 billion)\(^\text{19}\) in this case were originated in foreign subsidiaries but the parent holding was deemed responsible, an indication of the centralized nature of the SPE. As a result of the foreign losses BES found itself out of compliance with minimum capital requirements and, following a brief period of high stress and uncertainty, forced the Bank of Portugal to engineer a restructuring/recapitalization plan. The restructuring plan, which was speedily approved by the European Commission, essentially splits the bank in two. BES remains a bad bank and keeps shareholders and subordinated debtors. The latter will be written down against the bad assets from the intra-group exposures. This action effectively formalized the bail-in arrangement for this case\(^\text{20}\). All other balance sheet items were transferred to a new good bank, created to guarantee continuity of the healthy part of BES business\(^\text{21}\). Novo Banco inherits from BES its deposits, healthy assets and senior bondholders. Notice that bondholders have not been bailed in. This decision could actually be seen as contradicting the spirit of the recently approved BRRD, which entered into force in January 2015. According to data presented by Novo Banco, at the time of transfer (and for BES at the individual level) the capital that was not transferred amounted to €6 billion\(^\text{22}\), plus €902 million of unsubordinated debt. Importantly, the equity capital of Novo Banco, which amounts to €4.9 billion, is fully underwritten by Portugal’s Resolution Fund. This case could therefore be classified as a hybrid.

**Hypo Group Alpe Adria (HGGA)**\(^\text{23}\). The HGAA is a banking group based in the Austrian State of Carinthia, but with several cross-border activities, in particular in South Easter Europe (SEE). Over the past years the group has been repeatedly under distress. Already in December 2008 it received €0.7 billion of capital from BayernLB, its major stakeholder at the time (which bought HGAA in 2007). In the same month it also received a €0.9 billion capital injection (with no voting rights) by the Government of Austria under the Austrian bank support scheme. In December 2009 Austria announced further aid measures for HGAA, including a temporary asset guarantee which has since expired, a capital injection (€0.45 billion) and a provision of liquidity. This announcement came also with the news of the nationalization of the bank by Austria,

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\(^{18}\) Again as of June 2014. BES was 25% owned by Espirito Santo Financial Group (ESFG), in turn 49.3% owned by RioForte, in turn owned in full by Espirito Santo International (ESI).

\(^{19}\) For a more detailed account of the structure of whole group and the exposure of BES to different parts of it see http://www.pieria.co.uk/articles/how_its_rmp_off_eu_bank_espresso_santo_style.pdf.

\(^{20}\) These troubled assets are essentially the liabilities of other entities of the Grupo Espirito Santo and of Banco Espirito Santo Angola S.A.

\(^{21}\) The name of the newly created institution in Novo Banco, which literally means “new bank”.

\(^{22}\) This amount goes to €4 billion after other adjustments made to total capital.

\(^{23}\) Sources: European Commission (II, III, IV); Bruegel.
which acquired the group by paying a symbolic sum of €1 to the three major stakeholders (BayernLB, Kärntner Landesholding and Grazer Wechselseitige Versicherung). At this stage, the previous owners agreed to inject €1.05 billion. Further aid measures were provided in December 2010 in the form of additional state guarantees and in December 2012 again in state guarantees and a €0.5 billion capital injection. Along this time frame, plans for restructuring and winding down of parts of the group were drawn and partially implemented. The essence of the restructuring consisted in a strategy for the then remaining pillars of the group: (i) the Austrian bank (HBA), (ii) the SEE network and (iii) the wind-down part (Heta Asset Resolution). The last European Commission decision related to HGAA’s case (Case SA.32554) estimated at the time (September 2013) that until 2017 the cumulative capital needs for the wind-down part amount to about €2.6 billion in a base case and up to €5.4 billion under an adverse stress pessimistic case. Yet, an asset revaluation exercise undertaken between February 28 2015 and March 1 2015 determined that Heta Asset Resolution has a capital shortfall of at least €7.6 billion. In a critical decision following the revaluation, the Austrian Government decided not to continue capitalizing the bad bank and halted payments on more than €11 billion in debts owed by the bad bank. As it stands, the initial phase of the resolution plan involved mainly state aid and guarantees (bail-outs); as time passed the authorities decide to move toward a planning of bail-in. This case is therefore one of hybrid resolution.

These case studies illustrate that there has been a gradual process of moving toward bail-in when resolving European banks. More recent bail-ins have been primarily directed by a centre (a European authority or the Troika).

3.1 LIVING WILLS OF G-SIB

By definition, it is difficult to glean from historic data the effects of a regime that did not exist at the time. Our case studies suffer from this drawback since they are events of resolution in a regime where bail-in was not officially established and bail out (MPE) was the norm. It is fair to assume that the respective banks neither expected nor prepared for bail-in. Thus, looking backwards can inform on the difficulties of various supervisory authorities in coordinating, but the cases are silent on the expected benefits of bail-in as a future regime, let alone on SPE or MPE.

We next take a look forward by analysing the so called living wills of systemically important financial institutions. Over the last years supervisors have required banks to prepare a plan that explains step by step how the recovery or resolution would take place in the event of a severe negative shock. The U.S. plans require simulating a specific failure and explaining the planned reaction to this, but the details are confidential. Only a summary section outlining the strategy is published by the Federal Reserve Board. 24 By analysing these data, we find that the living wills can provide insights on three fronts. They capture the revealed preferences of the bank and of the

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24 The Dodd-Frank Act requires that bank holding companies with total consolidated assets of $50 billion submit resolution plans to the Federal Reserve and the Federal Deposit Insurance Corporation. See http://www.federalreserve.gov/bankinforeg/resolution-plans.htm
home country supervisor on the choice between SPE and MPE, hence providing an indication on the optimality of the regimes. They shed a light on the sheer number and complexity of supervisory bodies and possible collective action problems. At last, they show how banks reacted to the imperative of bail-in resolution across multiple jurisdictions.

Table 3 summarizes the preferred recovery and resolution strategies of banks which fall under the Dodd Frank U.S. reporting requirement but are headquartered in Europe.\textsuperscript{24} The revealed preference of the majority of global banks and of their home regulators is a SPE strategy. Only HSBC and BBVA have MPE as their preferred resolution strategy. Note that the choice of MPE or SPE is not correlated with the size of the bank. HSBC and BBVA are, respectively, the largest and the smallest among those banks in terms of total assets. Instead, the preference for MPE is related to the highly decentralized, retail based business models of the two banks. For instance, BBVA has expanded internationally (mainly in Latin America) through the acquisition of local retail banks, which continue to operate quite independently from headquarters. For such a bank a MPE strategy seems a better fit than for a bank with centralized capital and liquidity management and large intragroup positions (see Fernandez de Lis, 2015). This observation is well in line with results of our model in section 4, which show that under a low degree of home bias (which would be the case with highly decentralized business models) MPE and SPE perform equally in terms of generated losses, while MPE tend to foster financial globalization. Highly decentralized business models imply that banks’ headquarters are unwilling to assume the responsibility of possible risk-taking behaviour from the periphery and that national supervisors find it harder to implement cooperative solutions (as in both countries stakes are higher). It is on the other side fairly intuitive to imagine that SPE would be preferable under a more centralized business model.

Table 3: Preferred Resolution Strategy of European Global Banks,

<table>
<thead>
<tr>
<th>Bank</th>
<th>Currency(bn)</th>
<th>Total Assets</th>
<th>Equity</th>
<th>Preferred Resolution</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barclays</td>
<td>BP</td>
<td>1,358</td>
<td>56.9</td>
<td>SPE</td>
<td>RRP, July 1, 2015</td>
</tr>
<tr>
<td>BBVA</td>
<td>Euro</td>
<td>651</td>
<td>51.6</td>
<td>MPE</td>
<td>Annual Report 2014</td>
</tr>
<tr>
<td>BNP Paribas</td>
<td>Euro</td>
<td>1,800</td>
<td>91.1</td>
<td>SPE</td>
<td>RRP, October 1, 2014</td>
</tr>
<tr>
<td>Credit Suisse</td>
<td>CHF</td>
<td>921</td>
<td>45.0</td>
<td>SPE</td>
<td>RRP, July 1, 2015</td>
</tr>
<tr>
<td>Deutsche Bank</td>
<td>Euro</td>
<td>1,709</td>
<td>73.2</td>
<td>SPE</td>
<td>RRP, July 1, 2015</td>
</tr>
<tr>
<td>HSBC</td>
<td>USD</td>
<td>2,671</td>
<td>190.4</td>
<td>MPE</td>
<td>RRP, July 1, 2014</td>
</tr>
<tr>
<td>RBS</td>
<td>BP</td>
<td>1,028</td>
<td>59.0</td>
<td>SPE</td>
<td>RRP, October 1, 2014</td>
</tr>
<tr>
<td>UBS</td>
<td>CHF</td>
<td>1,062</td>
<td>54.4</td>
<td>SPE</td>
<td>RRP, July 1, 2015</td>
</tr>
</tbody>
</table>

Notes: Resolution and Recovery Plans (RRP) summaries published by FED NY.

\textsuperscript{24} We focus on these banks since they have larger cross border coordination in recovery and resolution problems than American banks.
The living wills also inform about the banks’ expectations on which regime would the regulator deem more appropriate for them to be implemented in the event of distress. The following quote from the Deutsche Bank living will is quite illuminating on this point: “The FMSA and the global Crisis Management Group, which consists of representatives of the principal regulators of the DB Group, are working under the assumption of resolution through bail-in under a single point of entry ("SPE") approach as the preferred resolution strategy, which is intended to cover the whole DB Group, including the DB Group’s U.S. operations…” Banks’ revealed preferences are an indication of the loss minimizing regime also for another reason. Banks have generally an interest to choose regimes that would not let their creditors run away or sell their bonds: in absence of funding banks are unable to operate. To the extent that investors in the home country understand that MPE regimes might increase their loss bearing capacity due to mis-coordination problems with the authority of the subsidiary’s country, they might have an incentive to reduce their exposure to the bonds of G-SIBs.

In relation to this argument (which will again be captured by our model in section 4) this quote from the DB living will is also instructive: “The SPE strategy is viewed by DBAG as the most appropriate for the DB Group, because it will, inter alia, maximize the value of the DB Group for the benefit of its stakeholders, preserve critical operations and otherwise minimize any adverse impact of the DB Group’s failure on financial stability in Germany and the other jurisdictions in which it has material operations, including the United States. (...) This SPE strategy will require globally coordinated action (including among regulators) in order to resolve the DB Group and avoid adverse impacts on financial stability.” The quote also shows banks’ awareness of the complexity behind cooperative actions in this context. Cooperative behaviour is made difficult also by the increasing number of authorities that are currently involved in banks’ supervision and resolution. At the international level, there are both supervisory colleges, which shall coordinate on recovery plans (for banks under distress but not bankrupt) and crisis management groups, which shall coordinate on resolution plans (see BIS (2014)). At the regional level, supervisors of European banks are organized in resolution colleges (EBA (2014)). Table 4, taken from the living will of Credit Suisse, shows the number of material supervisory authorities that have intervention powers for the group. There are 19 out of which 5 are in the United States alone. This seems to give some ground for the fear that coordination may be rather difficult to achieve during a crisis.

**Table 4: Example of Multiple Supervisors: List of Material supervisory authorities of Credit Suisse**

<table>
<thead>
<tr>
<th>Authority</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swiss Financial Market Supervisory Authority (FINMA)</td>
<td>Switzerland</td>
</tr>
<tr>
<td>Federal Reserve Bank of New York</td>
<td>United States</td>
</tr>
<tr>
<td>US Securities and Exchange Commission (SEC)</td>
<td>United States</td>
</tr>
<tr>
<td>New York State Department of Financial Services New York State,</td>
<td>United States</td>
</tr>
<tr>
<td>Financial Industry Regulatory Authority (FINRA)</td>
<td>United States</td>
</tr>
<tr>
<td>US Commodity Futures Trading Commission (CFTC)</td>
<td>United States</td>
</tr>
<tr>
<td>UK Prudential Regulation Authority (PRA)</td>
<td>United Kingdom</td>
</tr>
</tbody>
</table>
At last, notice that living wills give indications on banks’ incentives to de-globalize under certain regimes. G-SIBs have generally reacted to the changed financial architecture by re-organizing their business model to fulfill TLAC standards. In particular all the banks with preferences for SPE have tended to reduce intra-group dependencies. Equally our model in section 4 shows that GSIBs under SPE regimes tend to reduce exposure to foreign assets: the parent holding responsibility for bearing losses elsewhere in the group reduces incentives to globalize.

4. TWO COUNTRY MODEL WITH CROSS-BORDER BANKING UNDER SINGLE POINT OF ENTRY RESOLUTION

Given all our evidence above it must be very clear, almost obvious, that two main externalities and dis-functionalities are potentially associated with the choice of the resolution regimes: a mis-coordination or collective action problem among different authorities, potentially leading to loss amplifications, and a reaction of the bank to the expected regime leading toward financial dis-integration. Both those failures are related to problems of strategic interactions. Hence the appropriate model to address this problem is one in which regimes emerge as an equilibrium result of game-theoretic interactions. The model is akin to those used to study optimal coordination in monetary regimes (see our literature review). To highlight the strategic interactions we deliberately keep the micro-foundations simple. Full-fledged DSGE models would prevent from formally modelling the game-theoretic interactions (in infinite horizons those would normally lead to infinite equilibria, see Benoit and Krishna (1986)) and would generally obscure even the most simple interactions. Despite some simplifications, the model remains complex in that it is solved using dynamic game solution techniques and in that the results on the optimality of the regimes are not univocal and vary with respect to initial conditions. Despite the complex spectrum of the results, they are strikingly in line with the indications gathered from the case studies.

Our model comprises two countries which we label $i$ and $j^{25}$. In each country there is a banking group which has activities in the foreign country and there is also a resolution authority. Resolution authorities can activate bail-ins in coordinated or un-coordinated

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25 A continuous of countries can be nested in our model.
fashion. Banks have cross-border assets, cross-border liabilities and fulfil equity requirements. Variable $A^i$ identifies domestic assets and $A^{i^*}$ identifies foreign assets held by a global bank resident in country $i$ (and with subsidiaries in $j$). Assets’ returns, $R^{A^i}$ and $R^{A^{i^*}}$, are random and follow distributions $f(R^{A^i})$ and $f(R^{A^{i^*}})$. Banks raise funds through deposits and other short term liabilities domestically, $D^i$, which pay a return, $R^D$, to investors. Due to arbitrage risk-free returns $R^D$ are equalized across countries. Cross-border spill-overs take two forms: contagion from asset returns’ correlation and a beggar-thy-neighbour effect as national regulators are tempted to shift the burden of losses outside. We next describe the bank behaviour and the optimization problems in each resolution regime. The solution to the strategic game follows. The equilibrium solution in each regime will be compared in terms of losses to investors and banks’ incentives to de-centralize (achieving financial integration).

We start by describing banks’ behaviour under SPE. Banks determine assets and liabilities to fulfil liquidity and equity constraints, which read as follows:

$$R^{A^i}A^i + R^{A^{i^*}}A^{i^*} \geq R^D(\mu D^i + (1-\mu)D^{i^*}) \quad (1)$$
$$CR = (A^i + A^{i^*} - (\mu D^i + (1-\mu)D^{i^*}))/A^{i^*} \geq \gamma \quad (2)$$

where $\mu$ represents the fraction of liabilities $D^i$, that bank $i$ raises domestically and $\gamma$ is the regulatory equity requirement. When returns on assets fall short of the return on short term liabilities (because of a negative shock from the distributions $f(R^{A^i})$ and $f(R^{A^{i^*}})$) constraint (1) is violated and a run on the banking system emerges. When this happens banks start to sell assets until they meet the repayment of liabilities. In need of liquidity banks start to sell assets; however, they can do so only until the capital requirement is violated. If this happens, banks go technically on default. The capital requirement is devised for SPE regimes as it requires banks in the home country to put up-front enough capital also to cover losses on foreign held assets. The constraints of the foreign banks read symmetrically.

Under MPE banks are required to hold equity capital in both countries to cover for losses on assets. They face two different equity constraints in each country (both national regulators impose regulatory constraints) and in relation to the assets invested in the foreign branch. Raising capital in the periphery country entails some sunk cost, $F$: this cost captures the idea that bank capital raised in peripheral countries is of lower quality and also allows to rule out the equilibrium for which in the face of losses the bank simply walks away from the foreign country (the sunk cost is indeed a device to tie hands). Under MPE banks’ constraints read as follows:

$$CR^i = (A^i - \mu D^i)/A^i \geq \gamma^i \quad (13)$$
$$CR^{i^*} = (A^{i^*} - (1-\mu)D^{i^*})/A^{i^*} - F \geq \gamma^{i^*} \quad (14)$$

27 For simplicity we assume that there are only uninsured deposits. First, insured deposits are actually a small fraction of all short term liabilities. Second, if all liabilities were fully insured shocks to asset returns would not pose any default challenge for the bank.

28 Notice that the probability of a run is given by the joint distribution: $\theta = f(R^{A^i}|R^{A^i}A^i + R^{A^{i^*}}A^{i^*} \leq R^D(\mu D^i + (1-\mu)D^{i^*}) f(R^{A^{i^*}}|R^{A^i}A^i + R^{A^{i^*}}A^{i^*} \leq R^D(\mu D^i + (1-\mu)D^{i^*})).$
Next we describe regulators’ behaviour in each regime. As explained earlier bail-in implies writing down of short term bank’s liabilities and/or transformation of bonds into equities up to the point in which equity requirements are satisfied. In the model bail-in implies a transfer of a fraction \( \phi \) of short term liabilities (STL hereafter) into banks equity capital, \( P_{BK,i}^{li} \) up to the point in which constraint (3) is satisfied. In the non-cooperative solution the regulatory authority of each country chooses a fraction \( \phi \) out of short term liabilities held domestically, namely \( \mu D^i \) for country \( i \) and \( (1 - \mu)D^j \) for the foreign country. In the cooperative solution the resolution authority chooses a fraction \( \phi \) of the total \( (\mu D^i + (1 - \mu)D^j) \).

In any regime the resolution authorities choose \( \phi \) in the bail-in case to minimize a loss function. The resolution authority faces a trade-off between the investors’ costs due to the writing down of STL, which in our model is formally given by \( (\phi \mu D^i / (A^i + A^i_{li}))^2 \), and the deviation of the actual equity capital from the regulatory target or the capital shortfall (in the face of shocks), which in our model is given by \( (CR - \gamma)^2 \). A higher \( \phi \) means that a larger fraction of investors are forced into accept risky equities in exchange of liquid STL. On the other side a higher \( \phi \) by injecting more equities, allows the bank to meet its regulatory capital requirement.

We first examine the properties of the SPE regime under both a cooperative and a non-cooperative solution. In the non-cooperative regime (Nash equilibrium solution) each national regulator decides the fraction of domestic short term liabilities, \( \phi \), that shall be transformed into bank equities, by taking as given the fraction chosen by the other national regulator, \( \phi^* \). Hence the regulator of country \( i \) chooses \( \phi \) to minimize:

\[
L_{\text{bailin}}^i = (\phi \mu D^i / (A^i + A^i_{li}))^2 + (CR - \gamma)^2
\]

subject to:

\[
CR = (A^i + A^i_{li} - (\mu(1 - \phi)D^i + (1 - \mu)(1 - \phi^*)D^j)) / (A^i + A^i_{li}) \geq \gamma
\]

A symmetric Nash equilibrium (obtained by cross-substituting the reaction functions of the two authorities\(^{29} \) delivers:

\[
\phi^{NC} = (\gamma - 1)(A^i + A^i_{li}) / (D^i(2\mu - 1)) + 1/2
\]

In the cooperative regime a single resolution authority chooses \( \phi \) to minimize:

\[
L_{\text{bailin}}^i = (\phi \mu D^i + (1 - \mu)D^j) / (A^i + A^i_{li}))^2 + (CR - \gamma)^2
\]

subject to the constraint (5). The optimal fraction of bail-able bonds is:

\[
\phi^C = (\gamma - 1)(A^i + A^i_{li}) / (2D^j) + 1/2
\]

We can depict optimal losses in each regime using the static game representation:

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\(^{29} \) The first order condition with respect to \( \phi \) delivers the home authority reaction function: \( \phi = (\gamma - 1)(A^i + A^i_{li}) / (2\mu D^j) + 1/2 + (1 - \mu)(1 - \phi^*) / (2\mu) \). The optimization problem as well as the reaction function of the foreign resolution authority are symmetric.
We can then compare losses under the various regimes and determine the most efficient (loss minimizing) regime for a given degree of home bias. For every $\mu \leq 1$, $\varphi^{NC} \geq \varphi^C$ and when $\mu = \mu^* = 1/2$, namely for intermediate degrees of home bias, $\varphi^{NC} \to \infty$. Under the non-cooperative regime the resolution authority does not internalize the spill-overs that its own actions have on foreign investors. In the prisoner’s dilemma equilibrium the costs for bondholders in each country are higher than under the cooperative solution for any degree of home bias which is lower than one. The case of full home bias corresponds to a fully de-centralized G-SIB (in every country subsidiaries raise STL only locally). The result that MPE is efficient in loss minimization only under this case corresponds to the observation obtained by the living wills dataset that MPE is chosen only with highly decentralized banks.

We now turn to examine the policy decision under the MPE regime. In this case the resolution authority of each country is delegated to resolve the local bank branch. This regime can only be solved under a non-cooperative mode. In country $i$ the resolution authority chooses $\varphi$ to minimize:

$$\text{Min}_i L_{bailin,MP} = (\varphi \mu D^i/A^i)^2 + (CR - \gamma^i)^2$$

subject to:

$$CR^i = (A^i - \mu(1 - \varphi)D^i)/A^i \geq \gamma^i$$

The optimization problem solved by the foreign authority is symmetric except that the equity requirement includes the sunk cost of foreign capital, $(E)$. The optimal fraction of bail-inable bonds respectively in the home and foreign country are:

<table>
<thead>
<tr>
<th>Strategies</th>
<th>SPE-coop</th>
<th>SPE-non-coop</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPE-coop</td>
<td>$\varphi^i = \frac{(\gamma - 1)(A^i + A^{i,*})}{2D^i} + \frac{1}{2}$</td>
<td>$\varphi^i = \frac{(\gamma - 1)(A^i + A^{i,*})}{D^i(2\mu - 1)} + \frac{1}{2}$</td>
</tr>
<tr>
<td></td>
<td>$\varphi^j = \frac{(\gamma - 1)(A^i + A^{i,*})}{2D^i} + \frac{1}{2}$</td>
<td>$\varphi^j = \frac{1 + \mu}{2(\gamma - 1)(A^i + A^{i,*})} + \frac{1 + 3\mu}{8\mu}$</td>
</tr>
<tr>
<td>SPE-non-coop</td>
<td>$\varphi^i = \frac{(\gamma - 1)(A^i + A^{i,*})}{D^i(2\mu - 1)} + \frac{1}{2}$</td>
<td>$\varphi^i = \frac{(\gamma - 1)(A^i + A^{i,*})}{D^i(2\mu - 1)} + \frac{1}{2}$</td>
</tr>
<tr>
<td></td>
<td>$\varphi^j = \frac{1 + \mu}{2(\gamma - 1)(A^i + A^{i,*})} + \frac{1 + 3\mu}{8\mu}$</td>
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</tr>
</tbody>
</table>
\[
\phi^{\text{MPE}} = (y - 1)A^i/(2\mu D^j) + 1/2 \\
\phi^{\text{MPE}} = (y - 1 + \bar{E})A^{i*}/(2(1 - \mu)D^j) + 1/2
\]  

(11) 

(12)

Notice that the optimal fraction of bail-able deposits is higher in the foreign country than in the home country. The intuition for this result is as follows. Since equity capital in the foreign country features a cost (part of the capital is wasted due to lower quality), the resolution authority of the foreign country must bail-in a higher fraction of short term liabilities to allow the foreign branch of the bank to meet the equity requirement.

We can now compare losses in the MPE regime for every country with those in the SPE cooperative solution to answer the question on which of those two regimes is better. Once again the answer varies upon a number of parameters (the degree of home bias, sunk costs in foreign markets, exposure to foreign assets), which capture whether the bank business model is a centralized or a decentralized one. Results are summarized in Table 5 below.

**Table 5. Comparison of losses for both countries under MPE and SPE-cooperative**

| \(\phi^{\text{MPE}} = \phi^C\) | \(A^{i*} = 0\) and \(\mu = 1\) |
| \(\phi^{\text{MPE}} \geq \phi^C\) | \((1 - \mu) \geq A^{i*}/A^i\) |
| \(\phi^{\text{MPE}} \geq \phi^C\) | 
| \(\phi^{\text{MPE}} = \phi^C\) | \((1 - \mu) \rightarrow 1\) and \(\bar{E} = 0\) |
| \(\phi^{\text{MPE}} \rightarrow \infty\) | \(\mu \rightarrow 1\) |

Let’s first examine and comment on the comparison of the home country losses under MPE and SPE (namely rows 1 and 2 of Table 5). Intuitively if the degree of home bias in country \(i\), \(\mu\), is maximum and if there are no extra costs from raising capital abroad, we approach the case of a large closed economy. In this case the optimal fraction of bail-able instruments is the same in the ring-fencing and in the fully cooperative approach. Generally speaking the optimal fraction of bail-able instruments in country \(i\) under MPE is larger than the optimal one under the cooperative SPE whenever the degree of home bias of country \(i\) is smaller than \(A^{i*}/A^i - 1\). Intuitively if banks are globally more exposed on the asset side than on the liabilities side, the impact of changes in foreign assets on the capital shortfall out-weights the loss to domestic investors. Because of this the resolution authority will expropriate a larger fraction of short term liabilities in order to cover for the capital shortfall.

Let’s now examine the same comparison but for country \(j\). Intuitively the resolution authority of country \(j\) will generally be forced to bail-in a higher fraction than the resolution authority of country \(i\) since equity capital raised in country \(j\) is of lower capital (it is subject to a cost \(\bar{E}\)). The fraction of bail-able instruments for country \(j\) will then be higher than the one optimally chosen under the cooperative SPE regime if the home bias in country \(j\), \((1 - \mu)\), is small enough. In this case ex ante ring-fencing prevents banks from implementing full risk-sharing on liabilities. Ex post this forces the resolution authority to tax foreign investors more heavily in order to compensate for the capital shortfall. The case in which the degree of home bias is maximum and there is no...
cost of raising capital in the foreign country (raising capital in country $i$ is equivalent to raise capital in country $j$) corresponds in the limit to the closed economy: therefore in this case $\phi^{i, MPE} = \phi^C$. At last, when the degree of home bias is nil, banks are fully dependent on liabilities in country $i$. In this case the resolution authority can only rely on an infinitesimal fraction of domestic liabilities to cover for the ex post capital shortfall, hence it needs to tax domestic investors in full.

In the last part of this section we wish to use the model to answer the question of which regime fosters financial integration. Ideally, financial integration, by reducing asymmetries, is beneficial, more so in centralized policy regimes. Again the parallel with the case of optimal currency areas is obvious.

Banks choose their exposure in anticipation of the policy regime. In our model foreign exposure can be determined by substituting the optimal fraction of bail-inable bonds for each regime within the equity constraint. We do so under the SPE regime and obtain the following equation:

$$A^{i*, SPE} = -A^i + (1 - \phi) (\mu D^i + (1 - \mu) D^j) / (1 - \gamma) \quad (13)$$

There is clearly a negative relation between the level of foreign asset investment and the optimal fraction of bail-inable instruments. Banks have lower incentive to invest in the foreign country if they realize that this choice entails larger resolution costs for banks’ bondholders. This would in fact discourage investors to provide short term funding to banks, thereby impairing their operating abilities. Since we have shown that investors’ losses are generally higher under non-cooperative regimes than under a cooperative regime, it follows that the latter fosters financial integration.

To analyse the comparison for the optimal level of foreign assets between SPE and MPE we focus on comparing the solution under MPE uncoordinated regime and the SPE coordinated regime. Specifically we compare the optimal fraction, $\phi^{i, MPE}$, for country $i$ under the MPE against the optimal fraction, $\phi^C$, under the SPE-cooperative solution. We obtain that:

$$(A^{i*, SPE})^{MPE} \leq (A^{i*, SPE})^{SPE,C} \text{ if } \mu \geq 2 - A^i(1 - \gamma)/D^i. \quad (14)$$

The above result shows that banks invest less in foreign assets under the SPE regime only when the degree of exposure to foreign liabilities is below a certain threshold. As explained in other parts of the paper, under a cooperative SPE the domestic bank is liable for losses generated elsewhere in the group. This regulatory burden induces the domestic bank to retrench and generally refrain from foreign ventures.

### 4.1. Policy Implications

In Europe the Single Supervisory Mechanism has not yet reached one year, while the Single Resolution Mechanism has just started to function. Yet, many regulations and the architecture of financial supervision and resolution are already in place. Much of this

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30 The comparison with the optimal fraction for country $j$ would just be symmetric.
architecture had been devised in discussions of policy circles, but so far no theoretical or empirical background had been given to assess the consequences of such regulations. Our data on the case studies and the living wills, albeit limited, give indications. Our theoretical model rationalizes the policy arguments, provides supports for the indications obtained by the data and attempts to provide implications for financial integration under the various policy regimes.

We have a strong indication that SPE resolution regimes are preferable since they have generated lower losses whenever implemented and they are perceived as more efficient by banks and regulators. Our model provides a rationale for that. In the resolution of large and ramified G-SIB, SPE regimes resolve the policy mis-cooperation problem and reduce the collective action externalities. Cooperative or centralized authorities internalize the spill-overs emerging from the beggar thy-neighbour policy thereby reducing second-round losses. The opposite is true in the MPE regime. In the face of banks’ defaults, ring-fencing by focusing only on local losses makes the G-SIB under-capitalized with respect to the risks emanating from its global operations. Under-capitalized banks remain fragile. This increases the likelihood of future contagion effects (through reputation, franchising and confidence) and of further capital injections through second round write down of investors’ bonds. Such an outcome is likely to be the case under uncoordinated SPE and even more so under MPE.

From the point of view of loss efficiency it seems then that both U.S. and European regulators were right in moving toward centralized SPE.

Optimality of the regimes shall however also take into account how the industry will develop and how banks will react to the policy regime in place. Our model, as well as the observations from the living wills, suggest that a centralized system that puts the regulatory burden solely on the parent holding might discourage financial integration. This is an undesirable outcome since impairing risk sharing possibilities might in the future increase overall banks’ risk. More in general and in analogy to the optimal currency areas area discussions, centralized policy regimes benefit from a high degree of financial integration as this reduces the potential for asymmetric shocks across countries. Notice that the prediction of our model on this front also states that financial retrenchment is larger under the SPE regime if and only if the initial degree of home bias in liabilities is below a certain threshold. In other words, SPE would potentially be able to deliver higher financial integration but solely in well integrated markets.

It is probably this last concern that motivated the Financial Stability Board to issue new guidelines on TLAC (Total Loss Absorbing Capacity) that seem to favour MPE regimes. Those guidelines suggest that any G-SIB should pre-position a sufficient amount of capital (possibly larger than the one required by the SSM and reaching also 20%) in each subsidiary. This indication implies that not only the parent holding but also the subsidiaries shall have enough loss bearing capacity. There are fundamentally two reasons for this new development. First, as discussed earlier centralized SPE resolutions can function if the parent holding has the flexibility of shifting capital and liquidity across countries/subsidiaries. To cover subsidiaries losses in fact the parent holding has two options: a direct transfer of equity capital or a transfer of liquidity, which is then
invested into equity capital. Also due to imperfect financial integration (the 2007-2008 crisis was itself responsible for a financial retrenchment worldwide) those shifts are largely unfeasible. Secondly, putting the regulatory burden solely on the parent holding might end up fostering risk taking by highly decentralized subsidiaries. A periphery bank might have incentives to increase the risk distribution of its asset portfolio if it anticipates that losses would be borne solely by the creditors of the parent holding. This would then be an unintended consequence of the centralized SPE.

On the other hand, the individual subsidiary in an MPE bank may take too much risk since its supervisors will tend to underestimate the external effects of failure on the rest group in other countries. In the extreme, even the rumour an imminent failure of a significant subsidiary might trigger reputation loss and creditor runs across the entire bank. Hence the presumption that the decentralized MPE model would ring fence and shield countries against failure abroad would prove to be an illusion.

5. CONCLUSION

One of the most important revolutions which took place following the 2007-2009 financial crisis has been the re-design of resolution regimes which nowadays in most countries take the form of bail-in procedures with single point of entry regimes. The policy debate which led to the design of this regime lacked an analytical framework and a quantitative analysis. We provide one. More shall be done in the future along two fronts.

First, it is essential a granular collection of banking data that could inform both supervisors and resolution authorities on several yet obscure aspects of the incentives and developments in the banking industry. Second, international economists are left with the huge task of providing models that can inform about the optimal design of the global financial architecture. A literature similar to the one studying international monetary and exchange rate regimes is still missing.

REFERENCES


