A GAME THEORY APPROACH TO OPTIMIZING THE BANKING AND FINANCIAL RESOLUTION FRAMEWORK

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Abstract

Before the 2007-2008 financial crisis, credit institutions were assured (though not officially or formally) that if they were large enough they would be rescued with tax-payers' money, an action also known as bail-out, denoting what became known as the "too big to fail" paradigm. The introduction of the Bank Recovery and Resolution Directive (2014/59/EU) proposes a legal framework that aims at eliminating the possibility of bailing-out institutions. This paper has the objective of assessing through a game theory approach to what extent the BRR Directive has the potential to achieve its purpose and if there are identifiable possible improvements to this framework that could be considered for practical purposes or for a possible future review of the legal framework. The term institution, for the purpose of this paper, refers to credit institutions but can also be read as referring to other types of financial institutions such as investment firms or insurance companies.

Introduction

Following the financial crisis of 2007-2008, the European Parliament introduced in 2014 through the Bank Recovery and Resolution Directive (BRRD), at European level, a legal framework with the main purpose to prevent public funds to be used for saving failing credit institutions, a salvage action also known as "bail-out".

The economic cost of the financial crises has been significant, the median output loss (computed as deviations of actual output from its trend) reaching 25 percent of GDP in recent crises (Laeven and Valencia, 2010). A total of 5.1 trillion euro were approved by the EU as
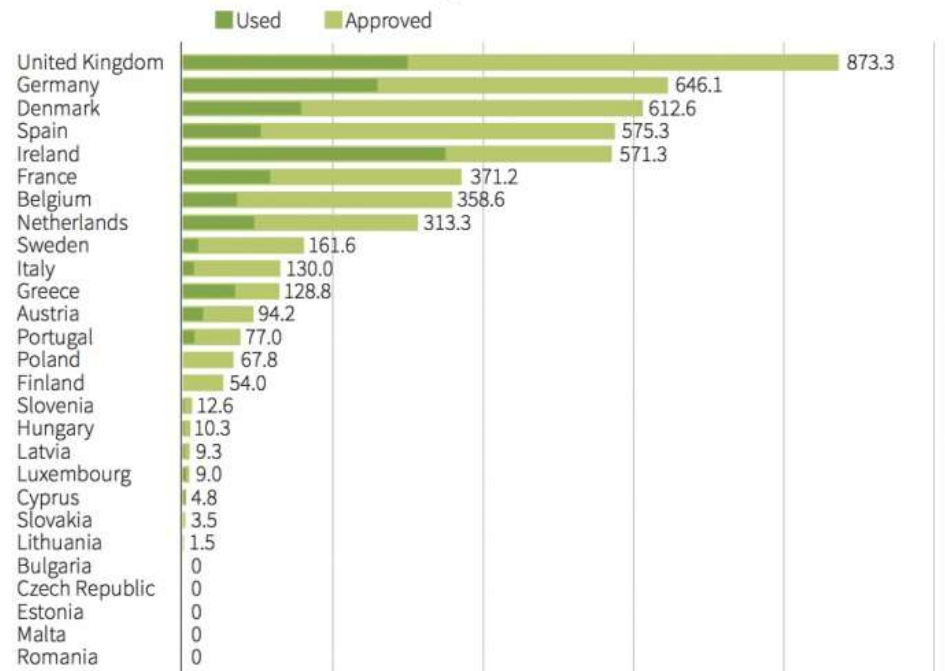
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state aid in 2008-2012, out of which 1.6 trillion euro have been used – Figure 1 displays the European bank bailouts:

Figure no. 1: Amounts of aid to financial institutions by instrument type - trillions of euros
Source: Thomson Reuters (2017)[†]

[†] https://blogs.thomsonreuters.com/answerson/eu-bank-bailout-trillion-euros-allocated-graphic/

The BRRD framework aims at reducing drastically the possibility of further bail-outs and "should ensure that shareholders bear losses first and that creditors bear losses after shareholders", as stated in paragraph 5 of the BRRD's Recital and further in its provisions. Provisions of the BRRD refer to credit institutions and investment firms but, where appropriate and based on similitudes, can be adapted to insurance companies and pension schemes as well.

The purpose of this paper is to assess, through game theory analysis, to what extent this framework covering bank resolution has the potential and ability to meet its purpose in practice.

What is a bail-out?

The original "bail-out" term[‡] evokes own salvation from a crashing aircraft by parachuting oneself. In the financial world, the bail-out refers to "a capital infusion offered to a business with a national or multi-national footprint that is in danger of bankruptcy, insolvency, or total liquidation", according to an on-line dictionary[§] definition.

What is BRRD?

BRRD stands for the Banking Recovery and Resolution Directive, the everyday name of the *Directive 2014/59/EU of the European Parliament and of the Council of 15 May 2014 establishing a framework for the recovery and resolution of credit institutions and investment firms.*

This legal framework proposes an harmonized legislation for dealing with failing institutions at European level and also introduces several tools and mechanisms to allow the operationalization of the also newly created regulatory bodies called resolution authorities: a framework for living-wills (recovery plans drawn up by the institutions themselves) and resolution plans drawn up by resolution authorities, new reporting requirements, additional liabilities requirements in the form of the MREL[**], special tools and powers (detailed below) at the disposal of the resolution and competent(supervisory) authorities, a resolution fund etc.

What is a resolution?

According to the BRRD, 'resolution' means the application of a resolution tool (sale of business, bridge institution, asset separation, bail-in) in order to achieve one or more of the resolution objectives ((a) to ensure the continuity of critical functions; (b) to avoid a significant adverse effect on the financial system, in particular by preventing contagion, including to market infrastructures, and by maintaining market discipline; (c) to protect public funds by minimizing reliance on extraordinary public financial support; (d) to protect depositors covered by Directive 2014/49/EU and investors covered by Directive 97/9/EC; (e) to protect client funds and client assets).

A 'resolution action' means the decision to place an institution under resolution, pursuant to meeting the resolution conditions (the institution is failing or is likely to fail, there is no

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[‡] https://dictionary.cambridge.org/dictionary/english/bail-out
[§] https://financial-dictionary.thefreedictionary.com
[**] Minimum Requirement for own funds and Eligible Liabilities

reasonable prospect that any alternative private sector measures, including early intervention measures, or the write down or conversion of relevant capital instruments would prevent the failure of the institution within a reasonable timeframe and a resolution action is necessary in the public interest) and the application of one or more resolution tools, or the exercise of one or more resolution powers (BRRD, 2014).

In simpler words, should an institution fail, first option should be (orderly) liquidation and secondly solving it by employing resolution tools and containing all costs relating to the failure of the institution to parties that are in connection with it. Any bail-out should or usage of taxpayers' money should be an exception to be used in certain limiting conditions.

What is a bail-in?

One of the novelties introduced by BRRD is the bail-in tool. The stated purpose is to minimize the costs of the resolution of a failing institution borne by the taxpayers. The bail-in tool achieves this objective by ensuring that shareholders and creditors of the failing institution suffer appropriate losses and bear an appropriate part of the costs arising from the failure of the institution (BRRD, 2014). For this instrument to be fully enforceable and effective, the BBRD also requires institution to build up an adequate level of MREL.

1.   Literature review

While there is an enormous number of papers and articles concerning each one of the topics covered by this paper - game theory, financial stability and bank failure & resolution - the approach hereby proposed is new and lightly explored, probably due to the relatively novelty of the BRRD (2014) and data derived from its application being therefore limited and mostly uncertain.

In view of documenting for this paper, we could identify three articles that envisage a game theory analysis with regard to banking resolution:

- *A macro approach to international bank resolution* (Schoenmaker, 2017);
- *Strategic Games with Incomplete Information* (Trost, 2013);
- *A theory of failed bank resolution: Technological change and political economics* (DeYoung, Kowalik and Reidhil, 2012).

The first article in the above enumeration examines the decision for the best resolution strategy (single point of entry or multiple point of entry – SPE vs. MPE) through game theory – it is of no relevance for our paper as it focuses on a specific type of negotiation during the resolution planning phase between the involved resolution authorities, a different topic altogether than our present purpose.

The second article in the above list studies, through game theory analysis, the strategies of two depositors of a likely to fail bank – their strategies, based on different scenarios based on sets of information (incomplete and asymmetric) with regard to their decisions to withdraw their deposits or not – an assessment of how bank runs occur pushed by a liquidity crisis driven by depositors. This article is also out of scope with regard to our purposes in the present paper.

1.1. DeYoung, Kowalik and Reidhil (2012) game

The third article in the above list models the failed bank resolution process as a repeated game between a utility-maximizing government Resolution Authority (RA) and a profit-maximizing banking industry. The paper's conclusion is that due to limits of resolution tools and due to political & economic pressure incentives are created for the RA to bail-out failed complex banks; the inability of the RA to credibly commit to closing failing complex banks creates an incentive for bank complexity (DeYoung, Kowalik and Reidhil, 2012).

The analysis of DeYoung et al. was performed before the introduction in 2014 of the BRRD framework. The BRRD resolution framework works exactly towards increasing the limits and potentiating the powers of the resolution tools available for RA and towards decreasing the economic and political pressure for RA, with the purpose, among others, to eliminate bail-outs.

The questions that will drive further our analysis are:

- In light of the BRRD provisions could the DeYoung et al. game be updated to reflect this new legal framework?
- What are the solutions to the game in light of the BRRD framework?
- How could the BRRD be enhanced to allow for game solutions?

2. Analysis

2.1 Bank failure, contagion and liquidity crunch

One of the core principles of a free economy is that failing of economic agents, even if they are credit institutions, cannot be avoided and should not be avoided in order to allow the exit from the market of underperforming players. Salvaging failing institutions can be translated as rewarding the weakest performers in the economy and not the best-performers.

Banks are a special kind of institutions in the sense that chiefly their cash base is established by depositors' funds (depositor becoming bank's creditors); banks link through their payment services different economic players enabling fast and reliable trading; last but not least most of banks' assets are very difficult to be valuated (due to their complexity), more so in an economic crunch (high volatility of assets) and in a short time-frame. As such, authorities have plenty of incentives to save a failing credit institution in order to preserve the market functioning, trust among participants and preserve depositors' funds, further avoiding contagion economy wide. Several articles area treating in detail the statements from this paragraph. Below are some concluding excerpts of these articles:

What happens when a bail-out occurs: "the financial market liquidity of today is preserved at the cost of increasing the moral hazard incentives of financial market participants in the future. In other words, policymakers trade market discipline in exchange for market liquidity" (DeYoung, Kowalik and Reidhil, 2012).

"Since [everyone] has expected a bailout when Lehman Brothers failed, bailout which did not occur, market participants began to wonder if authorities have the power to rescue

financial institutions that are collapsing and hence panic installed, leading to a second wave of collapses" (Cochrane, 2010).

"The more complex the financial instrument, the harder it is to evaluate it. Credit Rating agencies, being paid for their evaluation by the issuer, hence in a questionable moral hazard situation, have proceeded to issuing positive recommendations of the financial instruments" (Căpraru, 2017).

"The players in the market are interconnected. Due to the difficulty in evaluation, it cannot be fully assessed what is the risk position of any participant and what would be the actual loss given its default. This is part of the contagion effect: financial companies are not aware which of their counterparties hold substantial risk and hence stop conducting business with them" (NBR, 2008).

"Also, there seem to be different causes to the failure of a bank, and its spread through contagion to the system, such as macroeconomic failures, deficiencies of financial sector supervision and regulatory policies and practices, excess of poorly understood innovations in financial engineering and imprudence of large private financial institutions" (Truman, 2009).

2.2 The DeYoung, Kowalik & Reidhil game

The DeYoung et al. model puts face to face a profit seeking banking industry and resolution authorities that want to limit costs of bank failures to taxpayers and also want to preserve financial stability. The players choices are described by DeYoung et al.: "The regulator in the model faces a tradeoff: it can close a failed bank, and by doing so impose market discipline that reduces moral hazard incentives, or it can bailout the bank, and by doing so preserve market liquidity and avoid potential systemic harm to financial markets and the macro-economy. The banks in the model can choose to run a "complex" business strategy that is both highly prone to failure and, in the case of failure, imposes large reductions in market liquidity; given limited technologies for resolving failed banks, this can pose a too-complex-to-resolve (TCTR) problem for the resolution authority similar to the TBTF problem present in most of the existent literature."
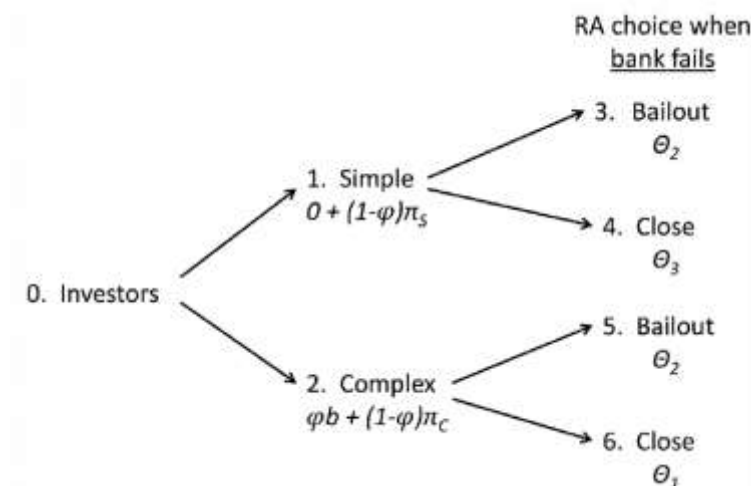
RA choice when
<u>bank fails</u>

3. Bailout
Θ_2

1. Simple
$0 + (1-\varphi)\pi_S$

4. Close
Θ_3

0. Investors

5. Bailout
Θ_2

2. Complex
$\varphi b + (1-\varphi)\pi_C$

6. Close
Θ_1

Figure no. 2: DeYoung, Kowalik & Reidhil game tree

The game is solved in an infinitely repeated game: the RA always closes a failed simple bank. Furthermore, the RA is indifferent in expected payoffs between closing or bailing out a failed complex bank and chooses closure with a certain probability. Banks always choose the simple business model. Banks are indifferent in expected payoffs between the simple and complex business models and choose the simple model with a certain probability.

2.3. Liquidation, bail-out or resolution action – the practice

Although the BRRD framework is clear that bail-outs should be quasi non-existent, closing through insolvency procedure should be the norm and tools for resolution actions are well defined and should be enforced, the actual bank failing occurrences show that high stress was exerted on RA, forcing them to ponder the economic and political pressure and the market discipline versus using public funds, as defined in the DeYoung, Kowalik, Reidhil model although clear superior resolution technology exists.

Recent examples of such occurrences are of Banca Popolare di Vicenza S.p.A. and Veneto Banca S.p.A. in Europe: ECB made a clear statement in June 2017 of the failing of the Italian banks; in the same day, SRB although agreed to ECB's failing determination, has concluded that for these two banks, resolution action is not warranted in the public interest. However, the Italian government could have not afforded that hundreds of thousands of depositors would, at least temporarily, lose their access to their funds and hence resorted to a scheme that allowed for the business transfer to an acquirer, conditional of the injection of cash and of the provision of guarantees by the Italian government (European Parliament, 2017), so to an extent applying bail-out as a result of economic and political pressure in the face of a liquidity squeeze. The cash amount injected by the Italian government amounted to EUR 4.78 billion in addition to EUR 6.8 billion non-cash / guarantees. The actions described in the cases of the two Italian banks are not singular and are emphasized by several public statements out of which some passages are extracted below.

"In view of the existing mismatch between European oversight and national liability, the objectives and interests of the several stakeholders involved are not aligned. As of now, we can ponder whether the intrinsic goal of preserving financial stability is being superseded by a self-protective interpretation of the European institutions' mandate" (Costa, 2017).

"Prohibiting bailouts is not necessarily desirable, however: it induces intermediaries to become too liquid from a social point of view and may, in addition, leave the economy more susceptible to a crisis" (Keister, 2010).

As shown above, both theoretic literature, as well as practical cases show that short-run political or economic pressure support a too-big-to-fail (TBTF) paradigm; the inability of regulators to credibly commit to closing failed complex banks encourages continued or increased bank complexity, a conclusion presented also in the original game developed by DeYoung et al.

2.4 The updated game

The BRRD framework introduces some tools at the disposal of the RA and requires shareholders and creditor to support part of the costs before using any of the taxpayers' money. These rules should decrease the public pressure of RA to use a bail-out and the magnitude of any potential bail-out. In addition to the resolution tools, there are new requirements for the institution in terms of reporting and most importantly the requirement to draw up resolution plans and eliminate any identified obstacles in the path of applying the preferred resolution strategy – these provisions should diminish the complexity of institutions and should allow for easier intervention of the RA.

2.4.1 Eliminating bail-out subsidy incentive

An update to the original game design refers to the suppression of the expected bail-out subsidy. The BRRD clearly states that before applying any resolution action, shareholders and creditors should bear losses, and a minimum of 8% the bank's liabilities and share capital should be used to cover the losses before accessing any kinds of state aid. Furthermore, before receiving any bail-out subsidy, it is most likely that the original shares have been reduced to zero, hence the original shareholder are no longer a party for the institution. Any received subsidy in the form of a bail-out will no longer be received by the original shareholders.

Although there could still be a bail-out, given the limited conditions that would allow for such a development and considering that the shareholders that would take advantage are no longer the original ones, for the purposes of modelling the game, in our view, it is reasonable to reduce to 0 the bailout subsidy from the original game.

2.4.2 Introducing size – why does size matter?

One other modification we propose to the original game is to introduce the size of an institution (group) in addition to its complexity as a parameter of the game, more exactly as an outcome for the bank's action. The original model discarded size as having relevance for

the decision of the authorities; we believe that size could actually be directly linked to the economic and political pressure that RA face when deciding to bail-out or not. The complexity of an institution is a direct driver for the time needed to perform an evaluation and for the confidence in the evaluation (that could be translated in an additional discount in case of sale). The size of the bank implies that there will be more counterparties involved, more depositors and creditors that would bear losses and hence contribute to a potential liquidity crunch.

In their 2014 paper, Laeven, Ratnovski and Tong find that systemic risk increases with bank size. Their results indicate that one standard deviation increase in total assets increases the bank's contribution to systemic risk by about one third its standard deviation when measured by CoVAR, and by half its standard deviation when measured by SRISK.

One more argument for introducing bank size as a parameter is linked directly to the BRRD: in order to decide for course of liquidation or resolution, the RA has to decide upon the public interest aspect. Also not clearly defined, the public interest is highly linked to size: the relevance of the institution in providing critical functions (which in turn are linked to the institution size, market share, number of clients etc.), the volume and number of deposits and clients' assets. All of these could be simply summed up under the umbrella of "size".

Table 1: States of a credit institution based on the original game complexity criterion together with the new size criterion

		Complexity	
		Simple	Complex
Size	Small	A	B
	Large	C	D

To better define size and complexity, the following elements are taken into considerations:
- Size is measured by total liabilities of the bank, as ultimately the bank (and indirectly the accountable authorities) are responsible for safeguarding and preserving the values entrusted by the depositors and creditors.
- Complexity is measured by the proportion of complex assets in total assets. These are the assets that require more time and effort to be valued and due to the specific of these types of uncommon assets might be subject to higher discount rates in case of a fire-sale. We follow the definition of complex assets introduced in the original model: complex loans are difficult to value and the complex loan production process (e.g., originate, securitize and sell; financial market rather than deposit funding; off-balance sheet obligations) is opaque and difficult to unwind in bankruptcy and hence generates larger failure externalities.

RA would rather want all banks to be in A state, that would be most easily to allow for effortless and without economic contagion liquidation. Banks, on the other hand, would like to be in D state that allows for synergies and more efficient cost allocations, cash-flow distributions (as a matter of size) and more profitable output (as a matter of complexity).

2.4.3 What is the difference between size and complexity

States B & C are borderline between the A and D states and are more likely intermediary states that institution follow from their inception (state A) to their target state D.

These two intermediary states (small & complex and large & simple) would most likely allow for resolution action without the need to apply bail-out. These states would probably not allow the RA to apply for liquidation but would allow it to resolve them through resolution with minimum adverse effect on the real economy. Although in real life scenarios large and simple institutions are not similar to small and complex ones, for the purpose of modelling the current game we assume that from the point of view of a resolution authority the probabilities of closing, applying resolution action or bailing-out out are the same in the two states B and C. Again, for modelling purposes, we assume that the institution is indifferent, from a profitability point of view, of finding itself in state B or C.

RA would apply liquidation in states B & C with probability p_4, and resolution action with probability p_5 ($p_4 < p_5$) whereas in state A liquidation is the only action taken by RA. In state D, RA would apply liquidation (closure) with probability p_7, resolution action with p_8 and bail-out with p_9, where $p_9 > p_8$.

2.4.4 What about MREL?

The minimum requirement for own funds and eligible liabilities (MREL) consist of the institution's capital requirements and additional financial instruments that would allow the institution to absorb losses and, where necessary, recapitalize a firm after resolution.

"The recent developments in Spain and Italy showed that investors will shy away from acquiring banks in an early stage of distress and wait for the opportunity to bid for these banks in a resolution context at distressed prices or under liquidation proceedings. At the same time, in the current context where MREL compliance is far from being attained, whenever an event changes risk perception, short-term investors in that institution's 'bail-in-able' securities will trample over each other to reach the exit before bail-in. As they form a disorderly queue at the exit, the price of these securities will collapse, triggering a series of contagious mechanisms including rating downgrades and ultimately bank runs, potentiated by the corporate deposit base." (Costa, 2017).

"Faced with collapsing prices, and declining confidence, the rating agencies will downgrade bail-in securities. More stoic holders of bail-in securities who had resisted the urge to sell in the first wave will now be forced to sell as a result of investment mandates limiting the holdings of low-rated instruments. (...) However, there will be wider knock -on effects where these instruments are being used as collateral for other instruments or where their prices are used to price other, less liquid, assets. Hedge fund clients will bolt for the exit, forcing hedge funds to raise liquidity by selling otherwise unconnected assets. These indirect effects will give an impression that strong, hidden undercurrents are driving financial markets, which will cause aggregate uncertainty to rise, triggering a general risk aversion and further liquidation of assets. There are many avenues through which the correlation of asset prices tends towards 1 during a period of stress. Collapsing asset prices will undermine the position

of banks. Bail-in securities will bring forward and spread a crisis, not snuff it out." (Persaud, 2014).

Based on the fact that the exact MREL requirements are not yet set, there are important concerns that these instruments might not fulfill their intent (as cited above) and probably more important, the MREL cannot safeguard an institution in case the issue is related to liquidity, we choose not to take into account this feature in the game design. In case of liquidity issues, only cash injection (alongside recovery in terms of market confidence) can restore previous state.

2.5 Solving the updated game

The new game, following the original DeYoung et al. game and updating it according to the above discussion has the following decision tree:
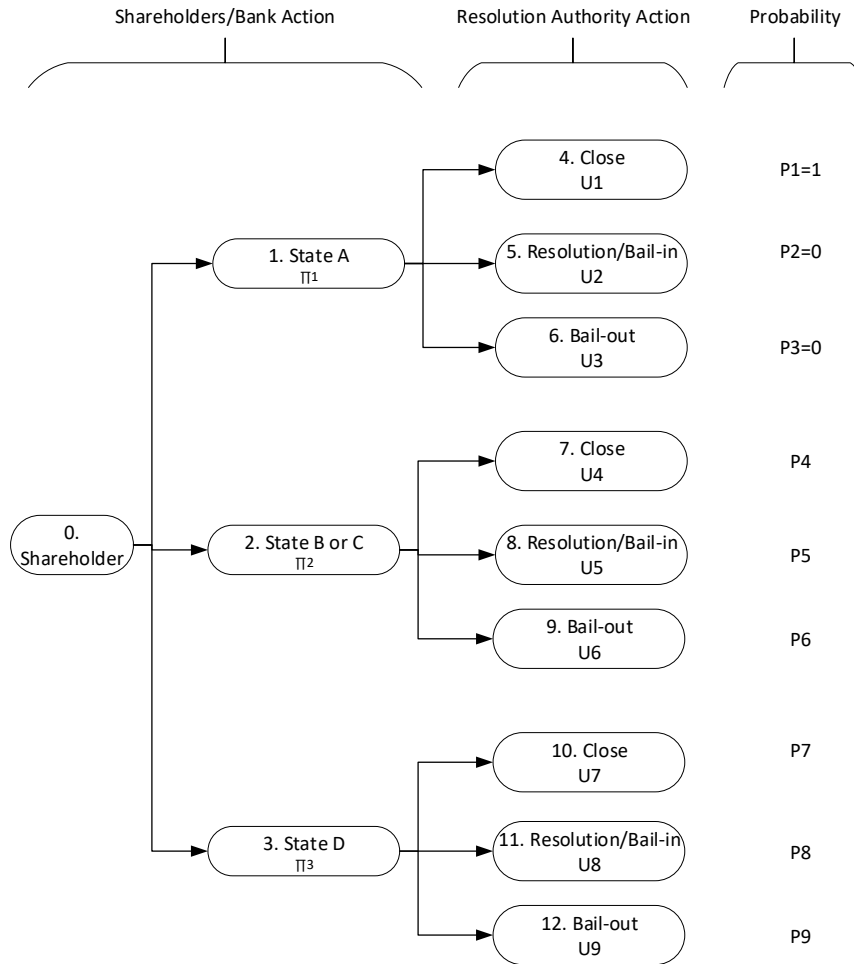
Figure no. 3: Updated game tree

Where:
- Profits of the bank fall under the condition: $\prod 1 < \prod 2 < \prod 3$
- Utilities for the Resolution Authority fall under the conditions: U1>U2>U3; U5~>U4~>U6; U9~>U8~>U7.

The Banks have a "dominant strategy", respectively to choose the D state that offers the highest profit. As there is no correlation between size & complexity and probability of default (there cannot be attributed a higher chance of default to D state bank than to an A state bank) and given that under closure or bail-out, shareholders are either way subject of bail-in, banks have a dominant strategy, choosing the same path irrelevant of what RA's action: more profit.

RA's strategy consists of a "best reply strategy": liquidation with almost certainty[††] in State A of a bank, closure or resolution action with certain probability (and almost certainly no bail-out) in States B and C of a bank and closure or resolution action with a certain probability and most likely a bail-out in case the bank is in State D.

The game is of imperfect information due to the fact that the actions of the Resolution Authority are not certain and depend on the moment's incentive for policy enforcement or liquidity preservation.

The BRRD framework tries to foster a dominant strategy for RA represented by the closure or resolution action: bail-out to be left out and use of resolution actions if in the public interest. As we have shown above, the application of resolution tools could also require public funds (even if limited to state guarantees). The larger and the more complex the bank, the higher the probability that public funds (in a way or another) would be used (maybe only temporarily) to solve the failing institution.

The question, in these circumstances, is how to incentives the banks to play "State A", action that would allow for an equilibrium in dominant strategies, being also in the public interest in terms of resolving banks without utilizing public funds. Before the BRRD there were two equilibrium states, based on the size and complexity of the bank: closure or bail-out. Now, regulation urges for only one equilibrium by eliminating bail-out.

The response to this question comes from different resolution authorities' proposals: Bank of England's ring-fencing proposal, Deutsche Bundesbank's view on "small banking box" and the Federal Reserve Bank of Minneapolis' Plan to End Too Big to Fail (TBTF) and United States regulatory agencies that have recently (end of 2017) announced plans to ease requirements for small and medium-sized institutions

Bank of England's proposal is straightforward and proposes a structural reform, also known as "ring-fencing", with the purpose to separate banks' retail banking activities from their wholesale and investment banking activities. This will address both size and complexity matters discussed above, forcing banks to adopt the A state action.

FED Minneapolis' plan is much deeper and has more proposed actions; two fundamental aspects address the question raised above: individual large banks that are systemically important are subject to extraordinary increases in capital requirements, leading many to fundamentally restructure themselves and reduce unnecessary regulatory burden on smaller banks. These are two actions that force and incentivize at the same time the banks to choose the State A. Although this action does not lead to a 100% closure action from RA in case of failing, the institution will be more easily resolvable and would highly decrease any economic and political stress on the RA with regard to its action.

Deutsche Bundesbank's "small banking box" proposes to incentives banks to go for the A state by allowing fewer and more permissive regulation is the bank is small and is not a threat to financial stability in case it is failing.

[††] It can be argued that under severe systemic stress, RA could opt to save even small /un-complex institutions, hence a probability of 1 cannot be attributed even in this scenario.

Conclusions

Banking is probably the industry with the highest rate of bail-outs. Governments are reaching for legal frameworks that would discourage such salvage actions that require public financing, however, the path is not clear. If the past literature showed that resolution tools capable of dealing with failing banks were needed, recent bank failures show that not the actual resolution technologies are the limit, but rather pressure of economic and political nature drives the resolution authorities' decision.

Through a game theory approach we showed that banks are incentivized by their profits into reaching complex and large forms, both of which inhibit liquidation or resolution action.

The tools introduced through the BRRD (special reporting for resolution purposes, the resolution plan, the actual resolution tools and the MREL) work toward increasing the technology available for RA when dealing with failing institutions. Moreover, special requirements in the legal framework work toward reducing the economic and political pressure from RA from performing bail-outs. However, very recent history showed this is not enough. Moreover, these resolution tools are not able to cope with failing institutions in case of liquidity issues.

In our view, the response for ending the too big to fail paradigm should be a path for banks to have simpler and smaller structures, through a coercive approach (progressive capital requirements, mandatory separation of riskier business activities from commercial lending and deposit taking activities) and an incentivizing approach (simpler regulation for smaller banks, smaller -progressive - capital requirements). A small and uncomplex bank could go into liquidation even if the root cause of the failing is linked to liquidity.

Measures to prevent failure cannot and should not be envisaged in a free market. Underperforming players should be allowed to exit the market. For banks, these market exists should occur with minimal externalities, a desideratum that can be achieved by means of limiting the size and the complexity of each bank.

Other considerations

In this section, there are two types of additional information that found their place in this final chapter. Additional considerations (from other research papers or from own analysis) that support the implied players' decisions in the game design. Of equal importance but in a different direction is an insight of future potential developments and consideration: the principles herein described do not have to be limited to banking institutions but could be used equally for other types of financial institutions.

Are we sure banks want to become larger?

Shiang (2013) "finds a significantly positive connection between bank size and profitability in the fixed effect model. This positive relationship could be explained in two ways. On one hand, banks can take advantage of the economies of scale during the financial crisis. On the

other hand, the positive relationship also suggests that the Federal Reserve offered more support to large banks to prevent the potential collapse. The great support allowed banks to maintain profitability of large banks during the crisis. It may also be that large banks have more diversified portfolios and earn higher profits during recessions.

Secondly, the positive relationship between size and return indicates that the economy of scale exists in the US banking industry during the financial crisis. In other words, the banks in large size can take advantage of their size. Economies of scale could be regarded as the cost advantage that banks obtain due to size, with cost per unit generally decreasing with increasing scale. Operational efficiency of banking is also greater with increasing scale […]."

Medley, from FED Kansas (2016), observes a "tend toward larger banks - the banking industry has undergone significant restructuring over the last three decades. Since the mid-1980s, the number of commercial banks has declined, while the asset size of banks has continued to increase.

Banks have good reason to believe profitability and size are related. Increasing bank size can increase profitability by allowing banks to realize economies of scale."

Based on our own research we found that banks that are larger output higher profitability and also have less variance in this indicator compared to smaller banks. Based on data from the ECB we can show that the larger the bank (group), the higher the profits (on average) and the stable they are through time. This should be incentives for banks to aim for a larger size.
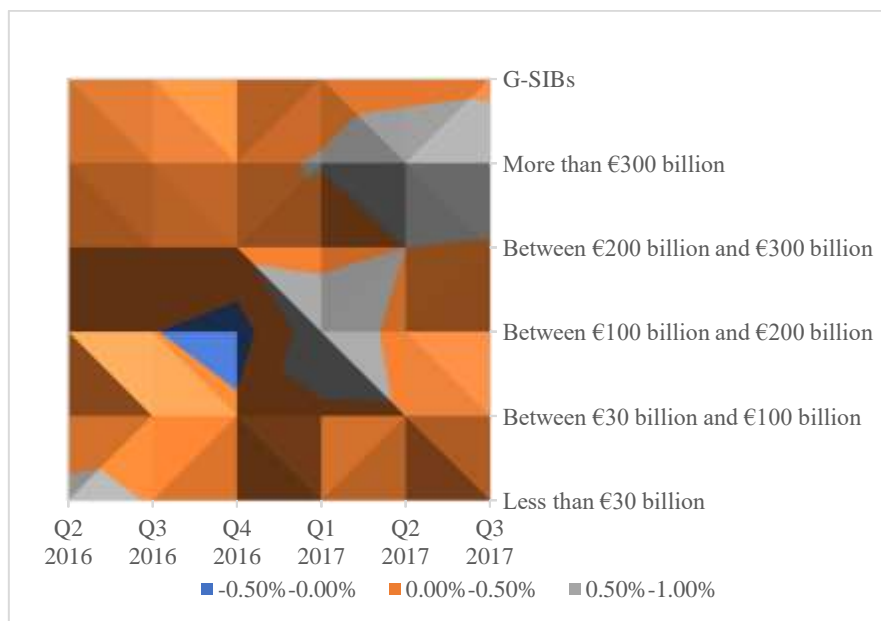
Figure no. 4: Return on assets depending on bank size. Data from ECB quarterly reports, own graphic representation
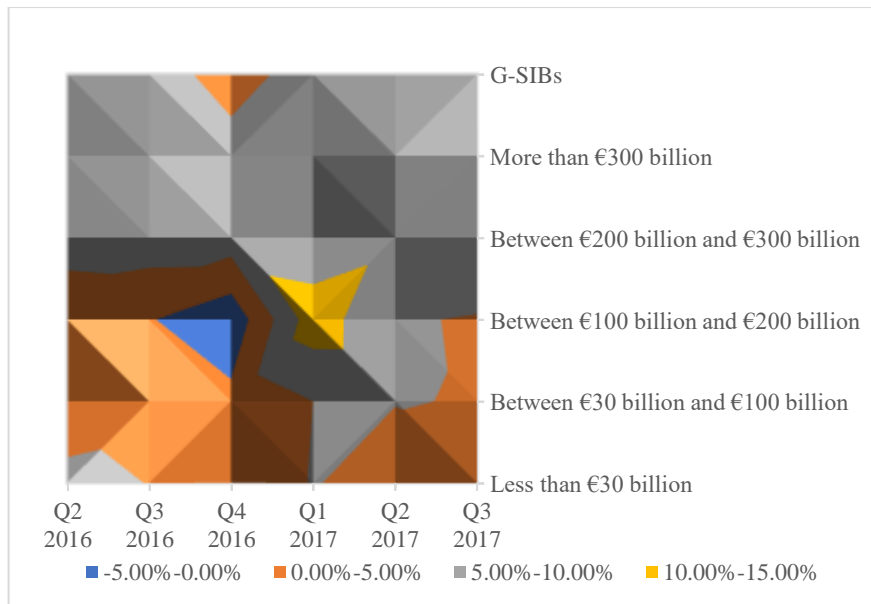
Figure no. 5: Return on equity depending on bank size. Data from ECB quarterly reports, own graphic representation

Beyond banking and into other financial institutions' realm

The current paper analyzed the credit institutions' actions and their regulation. However, the legislation that covers banks is applicable, in similar manner, to other types of financial institutions: investment firms, asset management companies, insurance companies etc. Their main difference to credit institutions is that they are not allowed to take on deposits, so authorities are not liable for the coverage of funds attracted from investors. Still, the failing of any such large financial institution is bound to trigger financial instability: trust is lost, funds can vanish, contagion is generated and liquidity is squeezed. These other types of financial institutions are similar to credit institutions, they can become large and complex (depending on the types of assets they rely on for conducting their business) and force authorities to bail them out (as has already happened during the 2008 financial crisis).

To a high extent, we believe that all the incentives and constraints descried in this paper for credit institutions and for their resolution authorities are applicable to other types of financial institutions and their regulatory bodies.

All the insights, proposals and conclusions directed for the economic agents called "credit institutions" are applicable for other types of financial institutions, with adjustments or directly. Hence, the paper could be read as referring to any of those financial institutions and not limited to banks.

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