Is the Too-Big-To-Fail Problem Resolved?

An evaluation of the stability implications of the bail-in design suggests the answer is no (unless there are significant improvements in that design)

J. Doyne Farmer[1], Charles Goodhart[2] & Alissa M. Kleinnijenhuis[3]

1. Our approach in this exercise

The 2007-2008 financial crisis forced governments to choose between the unattractive alternatives of either bailing out a systemically important bank (SIB) or allowing it to fail disruptively. Bail-in has been put forward as an alternative that potentially addresses the too-big-to-fail and contagion risk problems simultaneously. Though its efficacy has been demonstrated for smaller idiosyncratic SIB failures, its ability to maintain stability in cases of large SIB failures and system-wide crises remains untested. In our longer paper of the same title, (CEPR DP 16509), our main contribution is to assess the financial-stability implications of the bail-in design, explicitly accounting for the multi-layered networked nature of the financial system.

To give a preview of the key take-away message of this blog, our findings indicate that the too-big-to-fail problem remains essentially unresolved at present. Our results suggest that bail-ins under their current design are not a credible alternative to a bail-outs in severe financial crises, such as that experienced in the Great Financial Crisis (GFC), or in cases of idiosyncratic failures of the largest SIBs. On the positive side, our results also suggest that a possible shift towards financial stability remains in the hands of policymakers – even in systemic crises – if bail-in parameters are changed from their "poor" to "good" values. But we fear that political economy incentives make this unlikely. Our findings add to the literature on the too-big-to-fail problem, which includes the work by Berndt et al. (2020) who provide evidence of a decline of too-big-to-fail in the wake of the post-GFC regulatory reforms.

To evaluate the systemic implications of the bail-in design, we built on a multi-layered network model of the European financial system developed by Farmer et al. (2020). In the European system, the Bank Resolution and Recovery Directive (BRRD) governs the bail-in process. Then, we calibrated this model using S&P Global Market Intelligence data and the 2018 European Banking Authority (EBA) disclosures of the stress test results. The calibrated system-wide stress testing model captures the prevailing contagion mechanisms that could endogenously amplify shocks emanating from bail-ins, i.e. exposure loss contagion, overlapping portfolio contagion, funding contagion, bail-in debt revaluations, and bail-in debt

[1] University of Oxford, Institute for New Economic Thinking at the Oxford Martin School, Mathematical Institute, Doyne.Farmer@inet.ox.ac.uk.

[2] London School of Economics, Financial Markets Group, caegoodhart@aol.com.

[3] Stanford University, Stanford Institute for Economic Policy Research, amklein@stanford.edu.

runs originating from concerns over expected losses, uncertainty over prospective losses, or similarity to a recently failed bank; importantly including all their various interactions. These interactions can be seen diagrammatically in Figure 1.

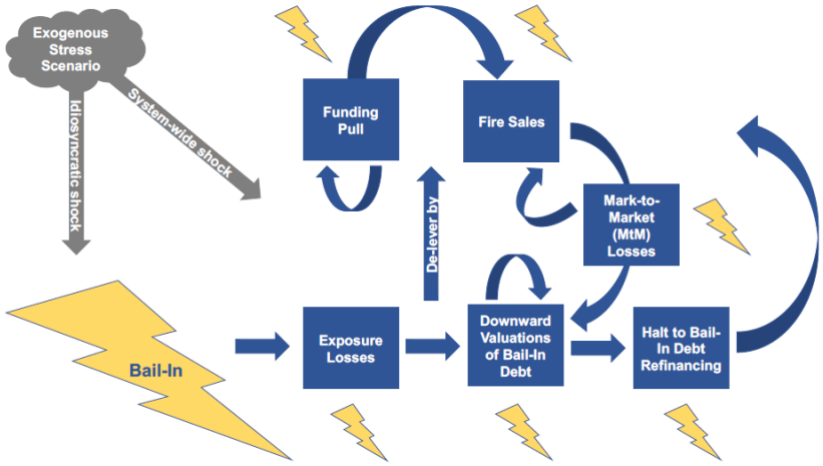

Figure 1: Interaction among Contagion Mechanisms. A bail-in (shown with a lightning bolt) may precipitate interactions between the five contagion mechanisms: exposure losses, revaluations of bail-in debt, halts to roll-overs of bail-in debt, funding contagion and fire sale contagion. These forms of contagion in turn could cause further insolvency-induced or liquidity-induced bail-ins. An exogenous stress scenario may fuel such interactions among contagion mechanisms directly, rather than via the bail-in mechanism, resulting in bail-ins indirectly.

The bail-in design consists of two parts, the "bank-specific" and "structural" bail-in design (see Figure 2). The bank-specific bail-in design consists of the parameters that the resolution authorities must set for each separate bank bail-in. The bank-specific design consists of the failing-likely-to-fail (FLTF) threshold, the *ad-hoc* debt exclusions, the recapitalisation target, and debt-to-equity conversion rates. Once these four parameters have been specified, the resolution authority knows how to carry out the bail-in of a failing bank. The structural bail-in design consists of the parameters that tend to apply structurally through time and across a set of banks. The regulator must determine these in advance of any bail-in taking place. The bank-structural design consists of *a-priori* debt exclusions, loss absorption requirements, uncertainty in the bank-specific bail-in design and the speed to complete a bail-in. Since these key parameters of the bail-in design are typically the same across jurisdictions, we expect our results to be relevant not just in Europe but across jurisdictions, including the United States, even though details of the bail-in process might differ per jurisdiction.

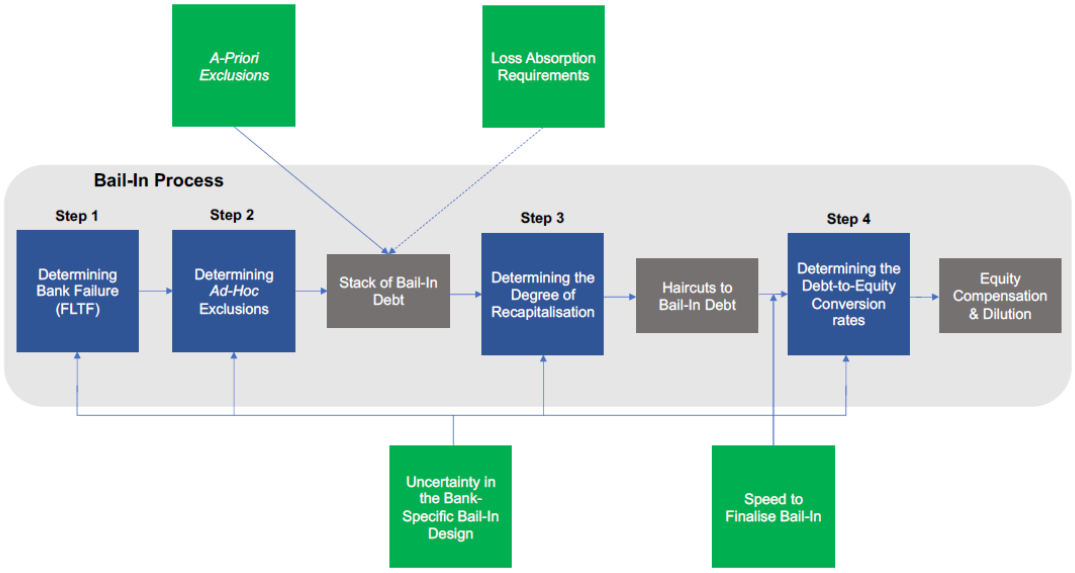

Figure 2: Schematic overview of the bail-in mechanism. The blue blocks denote the parameters of the bank-specific bail-in design and the green blocks the parameters of the structural bail-in design.

We study different bail-in designs by varying parameters and observing how they affect the response of the financial system to the shocks. The parameter space is too large to investigate exhaustively. We simplify the analysis by identifying two extreme values for each parameter, one corresponding to a "good" bail-in design, and the other corresponding to a "poor" bail-in design. These are roughly bounded by the parameter values that the resolution authority indicates they could plausibly pick. Unhappily, however, the design parameters in use so far are generally those that we describe as "poor".

What we then did was to study the effects for setting the parameters of bail-in for both extrema, "good" and "poor", on contagious asset losses for the European system, separately for the banks specific parameters and then for the structural parameters as a group. Then within each group we looked at the individual effects of each constituent parameter on such contagious losses by changing its value from each of the two extrema. This has involved a large number of numerical exercises, and there is only space in this note to go through the two that we consider most salient. These are the effects of the choice within the set of bank-specific design parameters, first, of good and poor values for the failure threshold and then, second, for recapitalisation.

2. The effects of the two most salient design choices

What we find in our numerical exercises is that *the later a bank is bailed-in (i.e. the lower the failing-likely-to-fail threshold is set), the higher the system's contagious losses are*. The reasons why an earlier bail-in promotes stability are twofold. The less important but obvious reason is that a bank that is bailed-in earlier requires fewer haircuts to be recapitalised to a given recapitalisation target, thereby limiting the potential scope of exposure losses to the bank's creditors which could spur further contagion. The more important but non-obvious reason is that banks that are bailed-in early enough such that they remain solvent at the onset of bail-in can typically have their creditors compensated with an equal amount of equity (in book value terms) per incurred haircut without breaching the "No-Creditor-Worse-Off" (NCWO) principle, thereby avoiding net exposure losses altogether at the point of conversion. Hence, an early bail-in can limit contagion. The NCWO principle states that resolution authorities should seek to

ensure that no creditor or shareholder is expected to incur greater net losses than it would have incurred in winding up the bank under normal insolvency proceedings.

Similarly, *contagion remains more limited, if bailed-in banks are more strongly recapitalised*. Superficially, one might have guessed that a stronger recapitalisation undermines stability, since a higher recapitalisation results in more haircuts increasing the scope for exposure losses that could ignite further contagion. So why does a stronger recapitalisation reduce systemic risk?

The first part of the answer is that a stronger (re)capitalisation means that a bank finds it easier to retain market access to funding in our model and keeps its funding cost low (Hanson et al. (2011), Burrows et al. (2012)). Indeed, if the target is set too low, the reputational damage that the failure has of itself caused, could lead, as it has in the past, to continuing outflows of funds and liquidity problems (Carlson and Rose (2016)), which could threaten the longer-term viability of the bank, as well as the stability of the financial system it is embedded in. This part is relatively well-understood in the literature. We model outflows by creditors who stop rolling over maturing funding to bail-in debt that is expected to suffer great losses. Creditors estimate their expected losses by pricing bail-in debt – using a novel methodology in line with Black and Scholes (1973), Merton (1974) and Merton (1976)). In contrast, non-bail-in debt is not subject to roll-over risk in our model, as it is practically immune from losses. Our assumption on the presence or absence of roll-over risk is motivated by the empirical literature showing that uninsured deposits (e.g. deposits falling under the deposit guarantee scheme; and, *de facto*, non-bail-in debt) tend to experience outflows if the bank is under distress, whereas insured deposits do not (see e.g. Egan et al. (2017)).

The second part of the answer is that a stronger recapitalisation means that a bank in our model has less incentives to de-lever to attain a more resilient capital ratio, one that is further removed from its minimum capital ratio where failure is likely. In addition to ours, various papers report on and model this phenomenon, including Greenwood et al. (2015) and Cont and Schaanning (2017).

A point that is insufficiently appreciated so far by resolution authorities, however, is that recapitalising a bank quite strongly such that it meets both its minimum capital requirements plus its combined capital buffers might still compromise stability on the order of trillions of dollars. The reason is that a bank may not be willing to use its regulatory capital buffers (Goodhart et al. (2008), Goodhart (2013), Farmer et al. (2020), Kleinnijenhuis et al. (2020)), because buffer use comes with penalties in its ability to make discretionary payments such as dividends and bonuses. Hesitancy by banks to use regulatory buffers came to the fore at the onset of the COVID-19 pandemic (see e.g. the FED (2020) statement to encourage banks to use their buffers). A bank that is thus recapitalised to the edge of its buffer zone will, with any further exogenous or contagious asset loss, be inclined to de-lever to get out of the penalty zone. Especially in a crisis, it is highly likely that a bank suffers further losses triggering it to de-lever. In our model, a bank starts de-levering once it has used 50% of its regulatory buffers (our results are robust to other usability assumptions). Though de-levering might be individually rational, it tends to be destabilising for the system as a whole (Aymanns et al. (2018)). In sum, the novel point is that banks should be recapitalised sufficiently in excess of their minimum capital requirements and regulatory buffers so that they are unlikely to de-lever or suffer funding outflows following the bail-in.

The overall findings in our paper show, perhaps surprisingly, that a possible shift towards stability remains in the hands of policymakers – even in systemic crises (see Figure 3). Our optimistic finding is that bail-ins may be a credible alternative to bail-in if policymakers set the bail-in parameters to their "good" values as shown with the blue line.

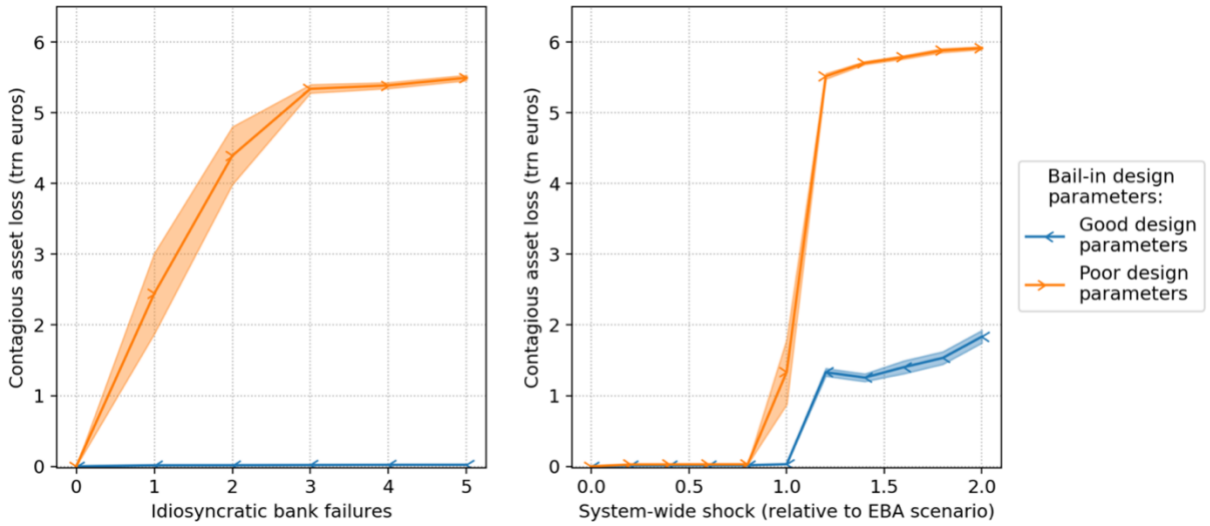

Figure 3: Systemic implications of the bail-in design. The left plot focusses on efficacy of bail-in to maintain financial stability in the case of idiosyncratic bank failures and the right plot focusses on the same thing in the case of a system-wide financial crisis. The y-axis shows the contagious asset loss in trillions of euros (total asset value of the modelled European banking system is about 22 trillion), purposefully excluding the initial loss resulting from the imposed stress scenarios. The left x-axis shows the stress scenario where the x largest SIBs in Europe (by asset size) fail idiosyncratically. The right x-axis shows the system-wide stress scenario applied by the 2018 European Banking Authority (EBA) stress test, where x means the asset losses are x times the losses observed in the 2018 EBA scenario. For x=1 the system-wide crisis scenario is thus equal to that of the 2018 EBA stress test.

Our evidence presented also suggests, however, that the current policy parameters might be in the regime of instability. The present bail-in design will allow idiosyncratic shocks to be handled effectively for smaller SIBs, but its application to more systemic crises and larger SIBs remains, as of now, problematic (see orange lines). The orange lines show that "poorly" designed bail-ins could exacerbate financial distress by increasing contagious asset losses by multiple trillions of euros.

3. The bail-in design choices and their political economy

Our evidence further suggests that the political economy around bail-in design renders an improvement of the current unstable design towards a more stable one unlikely. In the paper, we explain some of the political economy incentives and concerns that the main parties to the running of the bail-in system, notably the regulated banks and the regulatory authorities, but also other stakeholders, will have had. It was difficult enough to get the main principles of bail-in resolution accepted and endorsed by all concerned. For obvious reasons quite a lot of leeway was then left, especially to the regulatory authorities, to interpret and vary the parameters as they, the regulators, thought best. But the devil is in the detail, and as we show in the paper and explain here for the two most salient design choices, that devil has been active.

We discussed that an early bail-in promotes stability. Yet EU and US regulators are prone to bail-in a bank late. US regulators explicitly plan to bail-in a bank late, only when it is or nearly is insolvent (McAndrews et al. (2014)). EU regulators, though legally required to bail-in a bank early when it breaches its minimum capital requirements, may, in practice, bail-in a bank so late that it is close to insolvency. A first reason is that suffered losses are often recognised late in the book equity value of a bank. A second reason is that asset price uncertainty is always an issue, rendering it easy to argue that the bank is in fact compliant with its minimum capital requirements. A third reason is that in contrast to the

market equity value of the bank, the book equity of the bank is not (sufficiently) forward-looking masking impending difficulties (Hanson et al. (2011). Because of these three reasons, the market value of equity oftentimes drops sharply prior to a financial crisis (Matthews et al. 2021), whereas the book equity stays relatively flat (Hanson et al. (2011)). A fourth reason is that a bank's asset value may fall sharply due to a sudden asset loss in a crisis. This suggests setting the failure threshold sufficiently high such that, even if unrecognised losses are discovered and asset value uncertainty prevails, a bank will typically be found to be solvent at the onset of bail-in.

A final reason why regulators tend to bail-in a bank late is that it is in the short-term interest of bank's stakeholders (Avgouleas and Goodhart (2015)). The basic problem is that the incentive structure for almost all those closely involved leads them in the opposite direction from bailing-in early. Indeed, for such reasons, the failure of a bank is hardly ever triggered early by an assessment of its solvency, whether based on market or accounting values. Instead, what normally happens is that various signals, including market valuations, lead informed investors to believe that a bank may be subject to possible failure; so, to avoid loss and having their claim frozen, they withdraw funding. The normal sequence of failure is that a bank thus becomes illiquid, and appeals to the central bank for liquidity support, almost always claiming that it is fully solvent. The scale of support needed in the context then causes the regulatory authorities to send in an independent valuer, (valuation one in the bail-in process), who must be independent from any public authority, to assess the failure criteria. And it is this valuation that typically leads the regulatory authority to claim, at a late stage, that the failure threshold has been triggered. Complementing the regulatory failure trigger with a market-based measure of capital adequacy (see e.g. Sarin and Summers (2016), Brownlees and Engle (2017)) may combat regulatory forbearance manifest in the tendency to bail-in too late. The potential for regulatory forbearance could be further limited if hitting the trigger automatically leads to a resolution (via bail-in), in similar fashion as hitting the trigger of a contingent convertible (CoCo) automatically leads to a debt write-down or conversion (Calomiris and Herring (2013)). An alternative solution could be a metric based on multiple requirements, see Buckmann et al. (2021). A tricky issue that must be resolved for any failure trigger to be effective is how to avoid equity death spirals in anticipation of the trigger event.

We discussed that a strong recapitalisation fortifies resilience. Yet none of the three recapitalisation options advanced by the BRRD recapitalises a bank sufficiently; these being recapitalisation to make a bank meet its minimum capital requirements; recapitalisation to bring the bank's capital ratio into line with its peers; and recapitalisation to ensure a bank also meets its regulatory buffers. All three are too weak.[4] This, obviously, is a somewhat subjective matter, and leaves a lot of leeway for the concerns and incentives of those involved. While the self-interest of the regulatory authorities is for a high target to promote financial resilience, the self-interest and incentives of all those involved in the bank itself are for the lowest possible target.

It would be feasible for the commercial bank, and/or its various creditors, to go to law to claim that the target was too high. In court they could argue that their property rights were infringed upon unduly or that the no-creditor-worse-off principle was violated. Again, as with the trigger, the regulators cannot easily impose a system on the regulated, which the regulated dislike and will try intensely to avoid or evade. The higher the recapitalisation target ratio is, the more the equity shareholders will be diluted, and the less their expected returns, partly because the tax shield of debt will have been reduced. Similarly, the other bail-in creditors will suffer greater haircuts. Haircuts will generate a net loss if they are not compensated fully with a debt-to-equity swap. Even if creditors do not encounter net losses because of the swap, the swap exposes the new equity holders to any future losses by being thrust to the bottom of the claim

[4] And so is the recapitalisation target proposed under BRRD II, which is equal to a bank's minimum capital requirement plus its combined regulatory buffer minus its applicable countercyclical capital buffer.

hierarchy. Some creditors for this reason will not like holding equity. Others may not be allowed institutionally to hold equity. So, for all these reasons, those involved in the commercial banking sector will pressurise the regulators, and the politicians, to impose as low a recapitalisation target as seems consistent with a reasonable chance of successful recovery.

4. Some Conclusions

What we have shown here, and more generally in the main text, is that the design parameters that are now generally in use are "poor" and could well add to the extent of contagious losses in the case of major systemic crises or, in some cases, after idiosyncratic, but systemically important bank, failures. Why has this happened? As a generality, this is because the incentives of both the regulators at the sharp end and the regulated make this the easiest option for themselves. But it would be possible to bring about changes in these parameters, though it would probably require governmental pressure to do so, to shift the bail-in design from the region of instability to conditions wherein the bail-in system could withstand a severe system-wide crisis. But we fear that political economy incentives make this unlikely. So, this suggests that the too-big-to-fail problem remains essentially unresolved at present.

References

Avgouleas, Emilios, and Charles Goodhart. "Critical reflections on bank bail-ins." *Journal of Financial Regulation* 1, no. 1 (2015): 3-29.

Aymanns, Christoph, J. Doyne Farmer, Alissa M. Kleinnijenhuis, and Thom Wetzer. "Models of financial stability and their application in stress tests." In *Handbook of Computational Economics*, vol. 4, pp. 329-391. Elsevier (2018).

Baron, Matthew, Emil Verner, and Wei Xiong. "Banking crises without panics." *The Quarterly Journal of Economics* 136, no. 1 (2021): 51-113.

Berndt, Antje, Darrell Duffie, and Yichao Zhu. "The decline of too big to fail." *Available at SSRN 3497897* (2020).

Black, Fischer, and Myron Scholes. "The pricing of options and corporate liabilities." In *World Scientific Reference on Contingent Claims Analysis in Corporate Finance: Volume 1: Foundations of CCA and Equity Valuation*, pp. 3-21 (2019).

Brownlees, Christian, and Robert F. Engle. "SRISK: A conditional capital shortfall measure of systemic risk." *The Review of Financial Studies* 30, no. 1 (2017): 48-79.

Buckmann, Marcus, Paula Gallego Marquez, Mariana Gimpelewicz, Sujit Kapadia, and Katie Rismanchi. "The more the merrier? Evidence from the global financial crisis on the value of multiple requirements in bank regulation." (2021).

Burrows, Oliver, David Learmonth, Jack McKeown, and Richard Williams. "RAMSI: a top-down stress-testing model developed at the Bank of England." *Bank of England Quarterly Bulletin* (2012): Q3.

Calomiris, Charles W., and Richard J. Herring. "How to design a contingent convertible debt requirement that helps solve our too-big-to-fail problem." *Journal of Applied Corporate Finance* 25, no. 2 (2013): 39-

62.

Cont, Rama, and Eric Schaanning. "Fire sales, indirect contagion and systemic stress testing." *Indirect Contagion and Systemic Stress Testing (June 13, 2017)* (2017).

Carlson, Mark A., and Jonathan Rose. "Can a bank run be stopped? Government guarantees and the run on Continental Illinois." (2016).

Egan, Mark, Ali Hortaçsu, and Gregor Matvos. "Deposit competition and financial fragility: Evidence from the us banking sector." American Economic Review 107, no. 1 (2017): 169-216.

Farmer, J. Doyne, Alissa M. Kleinnijenhuis, Paul Nahai-Williamson, and Thom Wetzer. "Foundations of system-wide financial stress testing with heterogeneous institutions." Bank of England Working Paper (2020).

FED (2020), "SR 20-5: Questions and answers (Q&A) on statement regarding the use of capital and liquidity buffers", Federal Reserve Board
https://www.federalreserve.gov/supervisionreg/srletters/sr2005.htm

Goodhart, Charles. "Liquidity risk management." *Banque de France Financial Stability Review* 11 (2008): 39-44.

Goodhart, Charles. "Ratio controls need reconsideration." *Journal of Financial Stability* 9, no. 3 (2013): 445-450.

Greenwood, Robin, Augustin Landier, and David Thesmar. "Vulnerable banks." *Journal of Financial Economics* 115, no. 3 (2015): 471-485.

Hanson, Samuel G., Anil K. Kashyap, and Jeremy C. Stein. "A macroprudential approach to financial regulation." *Journal of economic Perspectives* 25, no. 1 (2011): 3-28.

Kleinnijenhuis, Alissa, Laura Kodres, and Thom Wetzer. "Usable bank capital." *VoxEU. org. URL https://voxeu. org/article/usable-bank-capital (accessed 10.26. 20)* (2020).

McAndrews, James, Donald P. Morgan, João AC Santos, and Tanju Yorulmazer. "What Makes Large Bank Failures So Messy and What to Do about It?." *Economic Policy Review, Forthcoming* (2014).

Merton, Robert C. "On the pricing of corporate debt: The risk structure of interest rates." *The Journal of finance* 29, no. 2 (1974): 449-470.

Merton, Robert C. "Option pricing when underlying stock returns are discontinuous." *Journal of financial economics* 3, no. 1-2 (1976): 125-144.

Sarin, Natasha, and Lawrence H. Summers. "Understanding bank risk through market measures." *Brookings Papers on Economic Activity* 2016, no. 2 (2016): 57-127.