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Abstract

We say that a large financial institution is "resolvable" if policymakers would allow it to go through unassisted bankruptcy in the event of failure. The choice between bankruptcy or bailout trades off the higher loss imposed on the economy in a potentially disruptive bankruptcy resolution against the incentive for excessive risk–taking created by an assisted resolution or a bailout. The resolution plans ("living wills") of large financial institutions contain information needed to evaluate this trade–off. In this paper, we propose a tool to complement the living will review process: an impact score that compares expected losses in the economy stemming from a resolution in bankruptcy with those expected under an assisted resolution or a bailout, based solely on objective characteristics of a bank holding company. We provide a framework that allows us to discuss the data needed and the concepts that underlie the construction of such a score. Importantly, the same firm characteristics may be ascribed different impacts under different resolution methods or crisis scenarios, and these impacts can depend on policymakers' assessments. We say that a firm's structure is acceptable if its impact score under bankruptcy is lower than that of any other resolution method. We study the current score used to designate firms as GSIBs and propose a modified version that we view as a starting point for an impact score.

Keywords: Resolution, Bankruptcy, Financial Regulation, Safety Net.
JEL codes: G01, G21, G28, G33.

1 Introduction

Financial troubles experienced by large, critical financial institutions were major contributors to the 2007-08 financial crisis and garnered significant public attention.[1] The U.S. decision to intervene in the financial system to prevent the collapse of troubled firms is commonly attributed to the fear

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[1] White and Yorulmazer (2014) documents the largest firms to receive financial aid from public sources during the 2007-08 crisis, and the types of interventions used to help them.

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that the failure of such firms could be very damaging to financial stability and the real economy. A typical concern with these types of interventions is that they provide incentives for firms to engage in excessive risk–taking, given that shareholders and creditors expect public support in the event of financial distress (i.e., the implicit public support expected by creditors, or "safety net," creates a moral hazard problem). In the aftermath of the 2007-08 crisis, reforms have emphasized macro–prudential regulations in an attempt to ensure that critical firms behave in a way that promotes financial stability, and that the system is sufficiently protected against the collapse of these institutions.

These new regulations, following mandates in the Dodd–Frank Act (DFA), require that large, critical financial firms be subject to enhanced prudential regulation and require that those with assets larger than $50 billion submit a resolution plan, or "living will."[2] A living will (LW) is meant to give details on the "structure" of the firm, as well as describe in detail how, if the firm fails, it would be resolved through bankruptcy, without government support (its "plan" for orderly wind–down). The idea is for policymakers to be able to anticipate the consequences of unassisted failures and to make sure such consequences are acceptable. Regulators may conclude that the LW has deficiencies either because the "plan" fails to outline a feasible means of unwinding the firm without government aid, or because the firm is structured in a way that makes it hard to resolve through bankruptcy in a pre–specified series of crises scenarios, even under the best plan. If the LW has "deficiencies" it is deemed "non–credible" and the firm is required to revise it and resubmit it. If regulators are not satisfied with subsequent revisions of the LW the firm can potentially face pressure to restructure. Over the last four years, starting in 2012, the Board of Governors (Board) and the FDIC have been jointly reviewing the LW submissions for the largest of these firms. In 2015, several of the firms' LWs were found to contain deficiencies so that the LWs were considered non–credible, either because of problems with their plans or because of inadequate structures, and regulators engaged with the firms in an iterative process to remedy these deficiencies.[3]

LWs should help deter moral hazard if, when no deficiencies are found in a LW, market participants revise down their priors on whether policymakers will be tempted to bail out the firm in the event of financial trouble. If expectations of a bailout are reduced, creditors will monitor risk–taking and charge a premium for it, effectively controlling excessive risk–taking.

In practice, however, LWs are lengthy and hard to digest, since they include significant amounts of qualitative information and nonstandardized content across firms. In addition, only a small portion of the information contained in each firm's LW is made public. These factors have created opacity and uncertainty about the review process; indeed there have been calls to make public more information regarding either the evaluation framework or the results of the LW process.[4]

[2]For information on the living will process, see https://www.federalreserve.gov/supervisionreg/resolution-plans.htm.

[3]The Federal Reserve and the FDIC do no typically refer to an LW that is acceptable – requiring no significant modifications – as "credible." Instead such a LW is referred to, in press releases and letters to the firm, as containing no deficiencies that would "trigger a resubmission" of the LW or even more ""stringent reqirements" (Board of Governors and Federal Deposit Insurance Corporation, 2017). For simplicity, in our paper, we will call a plan that meets supervisory standards "acceptable."

[4]For example, see Hoenig (2015) or GAO (2016).

In the absence of this increased transparency, however, it is difficult to know how the market is interpreting LW evaluation outcomes, and hence the role that resolution plans may be able to play in ending the too–big–to–fail problem.[5][6]

Our objective in this article is to clarify the factors that influence a bailout decision and, in particular, the way in which the structure of a firm may influence it. Given the opacity of the LW review process, we propose a new tool to complement the process: an impact score that provides a quantitative evaluation of how fit a firm's structure is for unassisted resolution. We consider a score, based on publicly–available data on firm characteristics, which compares the impact on the economy if the firm files for bankruptcy with the impact of a resolution involving various levels of public support. Our framework highlights that the decision to aid a failing firm trades off the loss imposed on the economy by a potentially inefficient bankruptcy procedure against the potential incentives for excessive risk–taking from offering an assisted resolution or a bailout. Taking this moral hazard cost into account, a firm will be considered resolvable if the estimated impact stemming from its failure is smaller or equal under bankruptcy than under any other method that involves government support. Hence, in our framework, only if bankruptcy yields the lowest impact score will a firm's structure be deemed acceptable. We focus our analysis on how a firm's structure translates into cost to society in the event of its failure, and we do not consider the parts of a LW that relate to the wind–down plan, since these plans are confidential and also lend themselves less naturally to a quantitative assessment.

In practice, constructing this impact score requires two main ingredients: a list of firm characteristics that can be measured and compared across firms, and weights for each of these characteristics that reflect their relative importance to the overall impact on the economy of the failure of the firm. Though in this paper we stop short of providing a score that is usable for policy, we suggest a list of firm characteristics that could be included in such a score, and we collect some real firm data on these characteristics. Because some of the content in the LWs is confidential, we focus on a score that uses only publicly available information. However, the framework we provide could also be employed by supervisors using non public information to construct a confidential impact score.

There are two ways to think about our impact score. One is normative, in which empirical research on the ties between firm characteristics and social costs from failure informs our weights and helps determine the firm structure that could maximize welfare to society. Unfortunately, research on this topic is still limited and far from being able to provide a quantitative basis for our weights.[7] The second way to think about the score is in a positive way, describing preferences or beliefs of policymakers about this mapping of firm characteristics into externalities. In this latter case, the score is analogous to a Taylor rule for monetary policy (which maps inflation and macroeconomic indicators into a desired interest rate) or to capital requirement rules (which map capital ratios to the odds of failure). If we had data on all the characteristics included in our impact score for the large firms that were operating during financial stress times such as the 2007 crisis,

[5] As a response to the GAO report, the Board of Governors and the FDIC published a description of the living will review process and a summary of commonly found deficiencies in the plans (see Board of Governors and FDIC, 2016.)

[6] See Jarque and Athreya (2015) for a discussion of the role of living wills in resolution.

[7] For a review of both models and evidence on firesales effects, for example, see Schleifer and Vishny (2011).

we could estimate the preferences of the policymakers who managed their failures. In other words, we could learn from past policymakers' actions (to provide assistance or allow failures) what their beliefs about the contribution of each firms' characteristics to impact of failure must have been at the time when they decided on their resolution. In the absence of this data, we instead provide hypothetical weights to illustrate the sensitivity of resolvability determinations to variation in the beliefs of policymakers.

Within the positive approach, similar to Taylor rules or capital requirements, making public the weights that determine the resolvability score may provide some credibility. Even with the understanding that some flexibility will be needed to tackle the particular circumstances at the time of a firm's failure, publishing the details of the score, ex–ante, amounts to announcing a "rule"; one could argue that announcing the rule makes it costly to deviate from it and may provide some commitment to not bail out, helping curb moral hazard problems. More specifically, our quantitative evaluation of the acceptability of a firm's structure, which can be understood as a proxy for the LWs, but using only publicly available information, could be valuable in two main respects. First, it would allow regulators to more easily compare how resolvable different firms are or track progress toward resolvability for a given firm over time. Second, it may make communication to the market, about firm resolvability, more transparent and credible.

We are going to argue in this paper that a good starting point for an impact score could be the quantitative score used for the designation of Global Systemically Important Banks (GSIBs).[8] The GSIB score collects information on firm characteristics that are thought to lead to economy–wide disruptions in the event of GSIB failure. In this article, we evaluate to what extent this GSIB score captures resolvability, and how it could be modified to provide a better evaluation of failure costs.

To illustrate how an impact score would work, we use real firm data, in combination with several sets of weights representing views of different hypothetical policymakers, to compute examples. We use the different sets of weights as mere examples —which are, for now, without empirical foundation — that allow us to illustrate the sensitivity of the designation of firms as resolvable given different policymakers' preferences. Our exercise also highlights how, to be able to use an impact score in practice, we would need empirical data from a number of financial crises to determine the links between firm characteristics and impact from failure. These links would provide empirical foundation for the weights used in the impact score so that it could be used as a normative tool (evaluating the merits of different bailout policies). On the other hand, gathering detailed firm data from past crises would also allow us to use the score as a positive tool if the weights were set to replicate actual bailout decisions for troubled firms in the past.

In the next section, we lay out our framework and introduce our impact score. In Section 3 we evaluate whether the existing GSIB score is a good starting point for this impact calculation. We discuss how each characteristic in the GSIB score relates to expected losses imposed on society by a firm's failure. In Section 4 we discuss other characteristics that would be useful for our purpose but are missing in the current GSIB score. Last, in Section 5 we discuss reasonable restrictions on the weights and provide our computed examples of the score. Potential extensions of our score are

[8] The capital surcharge for GSIBs is a recent regulatory requirement for large, systemic institutions. This capital surcharge is, in the U.S., part of enhanced prudential standards mandated by the Dodd-Frank Act.

suggested in Section 6. We conclude in Section 7. Details on the construction of our examples are relegated to the Appendix.

2 A quantitative approach

Discussions of how to deal with the too–big–to–fail problem suggest that a large financial institution is "resolvable" if policymakers are willing to let it file for unassisted bankruptcy in the event of failure. This decision trades off the ability of bailouts to lower the loss imposed on the economy from a potentially disruptive bankruptcy procedure against the potential incentives for excessive risk–taking produced by an assisted resolution or bailout. The losses imposed on the economy (the "impact" of the failure) may include disruptions in the provision of key services (payments, asset custody, lending relationships, brokerage, counterparty provision for derivatives, hedging), as well as contagion to other financial institutions, either because they are direct creditors of the failing firm, or because the value of their assets is affected by the failure. These costs are typically associated with "externalities" because the distress in the financial system may affect not only the parties contracting directly with the failing firm but also the functioning of the economy (for example, increasing the cost of funds for investment).

It is important to realize that a firm will be considered resolvable when the estimated costs stemming from its failure are smaller or equal under bankruptcy than under any other method that involves government support, i.e., a relative comparison of costs, and not when these costs are necessarily "low" in absolute terms. In this section, we expand on this idea by formalizing the decision of policymakers in the context of the LW review process. A LW will pass the review process only if the plan and the structure it outlines imply that, in the event of failure, resolving the firm through bankruptcy will be the preferred option (lowest estimated impact on the economy). If financial markets understand this process, for a firm whose LW passes the review process, expectations of a bailout will be reduced and creditors will monitor risk–taking and charge a premium for it, effectively controlling excessive risk–taking. Our proposal is to complement the LW review process by constructing an impact score that evaluates whether a firm's structure is acceptable for bankruptcy. We start by providing some definitions.

Definition: *A firm is resolvable if policymakers are comfortable with it filing for bankruptcy in the event of failure, i.e., the consequences for the economy of its liquidation without government support are deemed preferable to the potential incentives for excessive risk–taking that a bailout may provide to the financial system.*

The DFA gave regulators the task of crafting measures that would make large financial firms resolvable. The LW review process is part of the regulatory implementation of this objective. The FDIC and the Board have worked together to provide a template for LWs that establishes the information needed on the firm's structure (financial structure, legal structure, and other relevant characteristics) and its wind–down plan for unassisted resolution in a pre–established set of crisis scenarios. Within this context, regulators evaluate the LWs annually. We can think about the evaluation of these LWs as consisting of two distinct, but related, evaluations: of the structure of the firm, and of the plan.

Definition: *A firm's structure is acceptable if, under the best plan for resolution within a bankruptcy procedure, this structure does not imply important difficulties that may make a bailout or other government involvement preferable to bankruptcy.*

For example, a LW may not pass the review process if the firm is considered too large or too complex to be dealt with in bankruptcy with the proposed strategy. It is plausible, for example, that policymakers are likely to be comfortable allowing a relatively small firm to file for bankruptcy, but they may feel compelled to bail out a very large firm, and may decide instead to intervene in the failure of a middle–sized firm by separating its assets across a "good bank" and a "bad bank," effectively bailing out only some of its debt holders. Another example would be a firm having an inadequate legal structure.[9]

Definition: *A plan is adequate if it offers a feasible means of liquidating a firm of a given structure, in a given crisis scenario, within a bankruptcy procedure without resorting to public funds.*

Supervisors analyze the proposed plans to ensure that they comply with requirements. For example, some plans have been deemed deficient because their resolution strategies rely on cooperation among international regulators to permit recapitalization (i.e., no "ring–fencing" of assets), though regulators think such cooperation should not be counted on (see Goldman Sachs' feedback letter, 2015). Another deficiency identified by supervisors is the lack of appropriate models to evaluate recapitalization needs. Firms are required to estimate the resources needed to recapitalize systemic subsidiaries across different crises scenarios. They also should set triggers for bankruptcy filing that ensure that there is a large enough capital buffer remaining in the firm to help with the recapitalization of such subsidiaries.

Using both the concept of an adequate plan and an acceptable structure of the firm, we define the criteria for a LW to pass the review process as follows:

Definition: *A LW passes the review process if the structure of the firm that it describes is acceptable and the plan it proposes for each scenario is adequate.*

2.1 An impact score

Plans are confidentially submitted to supervisors as part of the LWs, so market participants (outside of employees of the submitting firm) must rely on the determination of supervisors to learn about their adequacy. In contrast, in regard to the GSIB's structure, while some details provided in the LWs are also confidential, market participants have much better information thanks to regulatory documents that are made publicly available. We propose using this public information to construct a narrow evaluation of the firm's structure that can be a proxy for the nonpublic assessment of supervisors about the adequacy, for resolution, of the firm's structure. We label this evaluation, or calculation, an impact score.

Definition: *An impact score is a mapping from measurable characteristics of a firm into a quantification of the disruption in the economy from the failure of such firm given a certain scenario*

[9] The December 2016 feedback letter to Wells Fargo cited "deficiencies related to Legal Entity Rationalization and Shared Services" as one of the reasons for their LW not passing the review process.

(i.e., circumstances surrounding the firm's failure) and a method of resolution (bankruptcy versus other strategies that may involve various levels of government support).

An impact score will use information on a subset of firm characteristics, such as size, volume of payments, or the structure of its short–term funding.[10] We will denote a generic characteristic as X_{ij}, where the subscript i denotes a given firm in our sample, $i \in \{1, ..., N\}$, and the subscript j denotes a given characteristic on our score: $j \in \{1, ..., J\}$. A firm i will be represented by a vector $\mathbf{X}_i = \{X_{i1}, ..., X_{iJ}\}$ of firm characteristics. The score collects the raw value of these firm characteristics (typically reported in \$) across a relevant group of global financial institutions and constructs a normalized version, denoted x_{ij}, by dividing each raw amount by the sum of that characteristic's entry across all firms in the group. Hence, x_{ij} is a normalized value that can be interpreted as a relative importance measure, or a market share in that characteristic. We can think of a firm as a collection of normalized values for each characteristic. Then, the impact score of a firm is a weighted sum of these normalized characteristics, where w_j represents the weight for characteristic x_{ij} :

$$\sum_j \frac{X_{ij}}{\sum_{i' \neq i} X_{i'j}} w_j = \sum_j x_{ij} w_j.$$

2.2 Using the impact score

In order to use the score for our purpose of determining the acceptability of a firm's structure, we need to compute this impact for alternative crisis scenarios and different resolution methods, each of which may affect the potential consequences that the firm's resolution have on the broader economy.

Claim: *An impact score may vary under alternative crisis scenarios.*

A given bank structure may have very different systemic impacts in the event of failure depending on whether the failure is due to an idiosyncratic bank shock or to an aggregate financial crisis. For example, the failure of an important provider of credit may translate into higher disruptions if other firms are also in distress, and these other firms do not have enough capital or liquidity to increase their lending to take on the initial firm's borrowers.

Claim: *An impact score needs to be contingent on a resolution method.*

It is the comparison of the impact score under alternative resolution methods that allows us to establish that a given structure is acceptable, because the effect that the failure of a firm will have on the economy will depend on how its failure is managed and its characteristics.

To illustrate this idea, in this article we consider a stylized set of three resolution methods: the firm files for bankruptcy, is resolved using the Orderly Liquidation Authority (OLA) process, or receives a bailout. We use T to denote a generic resolution method and use the following notations to denote the three alternatives: Bk (bankruptcy court), OLA, B (bailout). For simplicity, we do not distinguish between filing for bankruptcy (Chapter 7) or reorganization (Chapter 11). Also, when

[10] For a recent paper on the effect of short–term financing on the economy through the possibility of runs, see Covitz et al. (2013).

we refer to a bailout, we consider both situations in which there are explicit capital injections with public funds that allow the firm to continue to operate (such as the financing of the reorganization of GM in 2009) and interventions that may not result in the survival of the failing firm, such as the assisted purchase of Bear Stearns by JPMorgan Chase in March 2008, since these can also involve a government subsidy.

For our analysis, the main relevant dimensions in which these methods will differ are the expected duration of the wind down, the availability of funds to finance a bridge company, the possibility of delaying the exemptions to the automatic stay for qualified financial contracts (QFCs), the possibilities for international coordination among the authorities involved in the wind–down, or the adherence to bankruptcy's established debt priorities. More generally, our proposed framework can accommodate any number of relevant features across resolution methods that we may not be considering here. Hence, our methodology can be used to evaluate any bankruptcy reform proposals or any other new institutionalized resolution method that may replace OLA. For example, some bankruptcy reform proposals introduce the idea of specialized judges or the possibility of government subsidized borrowing (Jackson, 2014).

In terms of scenarios, we consider in our analysis two types of shocks: idiosyncratic and aggregate. The framework, however, can accommodate any number of crisis scenarios. For example, some specific aggregate shocks we could consider include a high domestic unemployment rate, a bubble bursting in the U.S. housing market, a sustained recession in China, or any other internationally driven crisis. Specific idiosyncratic shocks may include damage to computer systems, rogue traders, or subsidiaries of a BHC that specialize in different business lines.

Allowing the weights ($w_j^{s,T}$) of each characteristic x_j in the score to differ according to the state of the economy, s, and the resolution method, T, results in our impact score, which is indexed by the scenario s and the resolution method T, for a firm i with characteristics summarized in a vector $\mathbf{X}_i$:

$$I\left(\mathbf{X}_i|s,T\right) = \sum_j x_{ij} w_j^{s,T} + m^{s,T},$$

where $m^{s,T}$ represents the moral hazard cost of method T in a shock of type s. In our framework, this impact score captures the relevant information needed by policymakers in order to decide on the appropriate resolution method to employ once a particular scenario has materialized:

Assumption: *The preferred resolution method for a firm i in each scenario s,* denoted $T^*\left(s\right)$ *will be the one that has the lowest impact on the economy: $T^*(s)$ is such that $I(X_i|s,T^*) \leq I(X_i|s,T)$ for all T other than T^*.*

Note that the impact score under a bailout ($T = B$) deserves special consideration. Given that firms are not liquidated if they receive a bailout, the costs of this resolution method are not necessarily best captured with contingent weights given to specific characteristics but instead with a lump–sum cost ($m^{s,B}$) representing future inefficiencies in the economy due to increased moral hazard, or a combination of the two. In our analysis, we will impose that all the weights $w_j^{s,T}$ be zero for all j's and shocks, though this could be generalized to have the total cost of a bailout depend as well on the firm structure. For OLA, we will assume a combination of costs, with

$m^{s,OLA} < m^{s,B}$ capturing the fact that OLA implies a liquidation and will always impose higher costs on shareholders than a bailout, where the firm survives.

In summary, under the assumption that the impact score captures all the relevant implications for the economy of a firm's liquidation, and that resolvability is defined as a requirement that needs to be satisfied in each scenario described in the LW review process, we re–state, here, our definition of an acceptable structure and express it in terms of our score.

Definition: *A firm's structure is acceptable if, under the best plan for resolution within a bankruptcy procedure, the preferred resolution method for a firm with this structure is bankruptcy, i.e., if the impact of its failure when resolved using bankruptcy is less than or equal to the (moral hazard) cost of bailing it out or of resolving it using some kind of government support, in each of a list of given scenarios:* $I(X_i|s, C) \leq I(X_i|s, T)$ *for all* T *different than* C*, and for all* s*.*

The mapping between this definition and the criteria for a LW to pass the review process is not direct, because, as we noted earlier, our score does not account for the adequacy of the "plan."[11]

2.3 Limitations of the score

There are three important limitations to any attempt to use our impact score as a means of evaluating the structure of a firm. First, the score does not provide a framework to determine the optimal choices of firm structure. Second, it can never capture relevant information about the structure of the firm that is not measurable or verifiable by regulators. And, third, the score cannot capture all possible shock scenarios or include an exhaustive list of the relevant characteristics needed to determine the impact of a firm's failure. This last limitation is particularly important, because it leaves the door open to moral hazard and time inconsistencies (i.e., it does not solve the too–big–to–fail problem even when the score indicates that all firms are resolvable). We discuss each of these limitations in the next paragraphs.

First, we discuss the issue of the optimal choice for the firm characteristics, $\mathbf{X}$. Given our framework, one might imagine that a simple means of ensuring that firms have an acceptable structure is to directly constrain their choices of $\mathbf{X}$ — for example, require firms to restrict their short–term debt to less than a set percentage of all liabilities, or mandating a cap on firm asset size. However, policymakers face important constraints on their ability to do so. Policymakers must account for the costs of regulations or constraints, because such actions are likely to introduce distortions, increasing banks' costs of providing socially valuable financial services. GSIB failures are expected to occur very infrequently, so that when taking actions to influence firm choices, regulators will be forced to trade off long–lived distortionary costs that a conservative limitation on

[11] Under these definitions, having a structure that is acceptable according to the impact score is a necessary (but not sufficient) condition for a LW to pass the examination of supervisors. This is because we make the convenient assumption that the structure is evaluated assuming the best plan possible is in place. One could think, perhaps more realistically, that the determination of whether the structure is acceptable depends on the plan. In practice, when calculating our score, this would mean that a characteristic that could, in principle, bear a high impact weight, would be compensated by a LW that deals in its plan with the main difficulties that the characteristic would imply in bankruptcy. However, this would not make it possible for us to evaluate firm characteristics independently of the confidential information contained in the LWs.

firm choices of **X**s would impose in normal times (noncrisis scenarios) against the lower expected impact in the event of failure.

Expected impact of a firm's failure can be calculated by assigning probabilities to the different crisis scenarios being considered:

$$E\left[I\left(\mathbf{X}_i\right)\right] = \sum_s \Pr\left(s\right) I\left(\mathbf{X}_i | s, T^*\left(s\right)\right).$$

The calculation of these expected distortions in order to evaluate the trade–off faced by policymakers is outside the scope of this paper. For our analysis, hence, we take the firm's choices of **X** as given. In other words, our impact score is simply meant to be a tool that, for given **X**, determines whether the firm's structure is acceptable.

It is worth noting that, as the LW review process is described in the DFA, policymakers are required to ensure that no LWs have deficiencies. As we have mentioned previously, for those firms that don't meet this requirement, revisions to the documents are requested and, if that does not solve deficiencies identified in the review, even changes to firm structure (**X**) may be required. In light of our model, this Dodd–Frank requirement implies that lawmakers evaluated the trade–off between distortions and benefits that we just described and decided that all GSIBs should be required to have an acceptable structure. In principle, however, it is possible that such evaluation would determine that the costs of resolvability in terms of efficiency are too high for some firms and, hence, they should be allowed to remain nonresolvable (for example, on the basis of their economies of scale or scope). This determination is, as we have pointed out, outside of our model.

A second limitation when using a tool such as our impact score – or, more broadly, when supervisors are reviewing a firm's LW — is the problem of asymmetric information: policymakers do not have all the relevant information needed to evaluate a firm's business strategies. In other words, many considerations go into choosing a firm's structure ($\mathbf{X}_i$) and business strategies. Supervisors must rely on limited firm disclosures (for example, from financial statements and discussions with firms), which are likely to be insufficient to fully evaluate a firm's choices. This complicates further the calculation of the relevant trade–off of costs and benefits of **X**'s choices.

A third limitation would arise even if the first two limitations were surmountable: the inability of any practical score to consider all possible shock scenarios and to gather information from the firms on all the characteristics that could potentially be relevant for determining the impact of a failure. Unfortunately, game theory tells us that any room for a bailout (in an unforeseen scenario, or because of revelations of a firm characteristic that makes its failure unexpectedly costly) will translate into a window to moral hazard: if the firm knows there are some states of the world in which it will receive a bailout, it will take more risk than society would want it to. If the policymaker understands this, he may want to commit to not bail out. That is, when the firm fails, he decides a bailout is best, despite the moral hazard cost, because of the unforeseen impact of failure. However, because he anticipates that the firm is choosing riskier projects because it knows it will be bailed out in this scenario, he wishes he could commit not to bail out, i.e., he suffers from a time–inconsistency problem. In this case, a firm that was deemed as resolvable or having an adequate structure may end up being "too messy to fail," in a manner that the impact score or the LW review process was unable to anticipate.

2.4 A proposed impact score based on the GSIB score

In this section, we evaluate whether the current score used to designate firms as GSIBs is a good candidate for an impact score. We argue that the GSIB score, as measured, captures several metrics of BHC structure and activity that are considered informative about the potential size of losses the economy may suffer in the event of a crisis. As a result, the GSIB score should be a good starting point to measure losses imposed in the economy in the event of failure.

The Basel Committee on Banking Supervisions (BCBS) has developed a methodology for designating global banks as systemically important. The BCBS recommends a capital surcharge to make these banks more resilient. The U.S. implementation of this recommendation can be found in "Regulatory Capital Rules: Implementation of Risk–Based Capital Surcharges for Global Systemically Important Bank Holding Companies; Final Rule."[12] As part of this U.S. regulation, Form FR Y-15 collects from BHCs of $50 billion or more the information needed to construct a GSIB score.

This GSIB score is meant to capture the "systemic footprint" of an institution, i.e., the "loss given default" that the institution would impose on society.[13] The GSIB rule seems to equate systemic footprint, or loss given default, to "externalities." In policy circles, externalities from the failure of a large financial institution are mostly believed to stem from contagion effects or firesale effects.[14] Contagion effects occur when the failure of one institution has an impact on the health of its counterparties. Firesale effects occur when the failing institution, in the process of trying to meet repayment demands, sells a large quantity of assets of one particular class, lowering the price of that class of assets in the market – and all other firms holding this asset class, as a consequence, suffer a diminished value of their assets. Higher externalities imply higher loss given default.

In order to calibrate capital requirements for GSIBs, an extra buffer of capital is required only for global banks that have been designated as systemic, regulators estimate a probability of loss and the implied expectation of loss given default for given firm characteristics and a level of capital:[15]

$$E[\text{Loss}] = Pr(\text{default} \mid \text{capital requirements}) * \text{Loss given Default},$$

where higher capital requirements translate into a lower probability of default but are costly for the firm and hence the economy. Regulators calibrate the GSIB capital surcharge to keep expected loss to a common level across systemic and nonsystemic institutions:

[12] A link to the Federal Register notice containing the rule and associated documents can be found at: https://www.federalreserve.gov/newsevents/press/bcreg/20150720a.htm. The surcharges imposed by the rule were phased in beginning January 1, 2016, and become fully effective January 1, 2019.

[13] See page 1 of "The G-SIB Assessment Methodology – Score Calculation," Basel Committee on Bank Supervision, November 2014.

[14] For discussions of firesale effects see Diamond and Rajan (2011) and Allen and Gale (1994); for contagion effects see Allen and Gale (2000).

[15] The rule determines the GSIB surcharge according to the "bucket" into which a firm's score falls (i.e., a step function that relates capital requirements to probability of default, as estimated using historical data on bank failures). GSIB surcharge designations are available for 2013-15, with the same eight U.S. BHCs having been designated as GSIBs in each of those years. JPMorgan Chase and Citigroup have repeatedly been the highest scoring firms, each receiving a 3.5% surcharge in 2015. Bank of America, Goldman Sachs, Morgan Stanley, and Wells Fargo have received surcharges between 1% and 2% in each year. Of the eight banks, Bank of New York Mellon and State Street have consistently scored the lowest, receiving 1% surcharges each year.

$$
\begin{aligned}
& Pr(\text{default} \mid \text{Basel III capital requirements} + \text{GSIB surcharge}) * \text{Loss given Default for GSIB} \\
= \; & Pr(\text{default} \mid \text{Basel III capital requirements}) * \text{Loss given Default of NON–GSIB.}
\end{aligned}
$$

This implicitly assumes that without the extra capital buffer that the GSIB regulation imposes, two different institutions, one qualifying as a GSIB and the other not, may receive the same capital requirements under Basel III even though the failure of the GSIB may have a larger systemic effect (i.e., loss given default) than the other. That is, there are firm characteristics that determine loss given default that are not captured by the standard capital requirement calculations. The form FR Y–15 collects information on these characteristics. The GSIB score aggregates the information about systemic characteristics that is collected in form FR Y–15 into a unique number that can be compared across firms internationally.[16] Firms having a score above a certain threshold are designated as GSIBs. In the 2016 exercise, there were 30 GSIBs; eight were U.S. based.[17]

3 The GSIB score

In this section we review in detail the firm characteristics included in the GSIB score to understand the impact measured by each. The GSIB score tracks 12 indicators across six conceptual categories shown in Table 1.[18] In order to have a normalized value of the indicator, it divides each firm's individual entry by the sum of that entry across the largest 75 global banks according to a measure of size.[19] The final score, under the GSIB rule, is the weighted sum of each normalized indicator (most of the indicators are, themselves, made up of several "items," which correspond to what we have been referring to as "firm characteristics").

The U.S. implementation of the GSIB score calculates both the internationally consistent score (Method 1) presented in Table 1, as well as an alternative (Method 2) that replaces the three Substitutability indicators with the Short–Term Wholesale Funding indicator. Note that the weights imply each schedule is given equal importance in the final score. Method 2 has slightly modified weights to better capture improvements common to all banks but is harder to interpret as relative contributions to the score. The GSIB surcharge applied in the U.S. is the maximum of the surcharges that would be applied by either of these methods, which, in practice, is frequently Method 2.

[16] The FR Y-15 is the basis of information collected from U.S. banks. Other countries collect information with their own similar forms.

[17] See FSB, "2016 list of global systemically important banks (G-SIBs)," November 2016, for a list of the GSIB-designated firms in the 2016 exercise. On top of the extra capital buffer (the GSIB surcharge), GSIBs need to comply with added capital and long–term debt requirements as mandated in Total Loss Absorbing Capacity (TLAC) regulation as well as extra resolvability and internal control requirements. The TLAC regulation is available in the Federal Register: Federal Reserve System 12 CFR 252 [Regulations YY; Docket No. R-1523] RIN 7100-AE37 (2017)

[18] See Board of Governors of the Federal Reserve System, "Report Forms: FR Y-15, Banking Organization Systemic Risk Report." Available at: https://www.federalreserve.gov/apps/reportforms/reportdetail.aspx?sOoYJ+5BzDaRHakir9P9vg== , accessed August 8, 2017.

[19] The value of this denominator, for each characteristic, is published annually by the Bank for International Settlements (see http://www.bis.org/bcbs/gsib/index.htm).

Category	Indicator	Weights
Size	Total Exposures	20%
Interconnectedness	Intrafinancial System Assets	6.67%
	Intrafinancial System Liabilities	6.67%
	Securities Outstanding	6.67%
Substitutability	Payments Activity	6.67%
	Assets Under Custody	6.67%
	Underwritten Transactions in Debt and Equity Markets	6.67%
Complexity	Notional Amount of Over–the–Counter Derivative Contracts	6.67%
	Trading and Available–for–Sale Securities	6.67%
	Level 3 Assets	6.67%
Cross–Jurisdictional Activity	Cross–Jurisdictional Claims	10%
	Cross–Jurisdictional Liabilities	10%

Table 1: Firm characteristics included in the GSIB score, and corresponding weights

Schedule A: Size	
Total Exposures	Derivative exposures
	Securities financing transactions exposures
	Other on–balance–sheet exposures
	Other off–balance–sheet exposures

Table 2: Components of Schedule A of the GSIB score.

In the next paragraphs, we discuss in some detail the specific items in each category: we study what are the features of a firm's structure that they capture, we conjecture why the designers of the Y-15 form thought that these may be informative about losses stemming from failure, and we evaluate whether they belong in our impact score.

Schedule A: Size, or "Total Exposures" (TE) This schedule attempts to estimate the volume of financial activity undertaken by each institution (see Table 2 for details). Even though the title of this schedule is "Size," we see this schedule as a way of capturing the "value" that the firm brings to the economy. To capture that value, one needs a measure of both the direct lending provided by the firm and the financial services it provides. The former is captured in a straightforward way from the balance sheet. The latter is harder to value, but regulators have developed measures that capture some of the services produced by banks by performing some adjustments to balance sheet items: the "Total Exposures" (TE) measure from capital requirement regulation (Basel III).[20] For example, when counting securities financing transactions, the measure adjusts the value of

[20] "Total Exposures" is the size measure in the Supplementary Leverage Ratio that applies to Advanced Approaches organizations. Interestingly, the order of the individual entries in the two forms is different – perhaps indicating that the Y-15 wants to emphasize the importance of derivatives and securities financing transactions for systemic importance of firms.

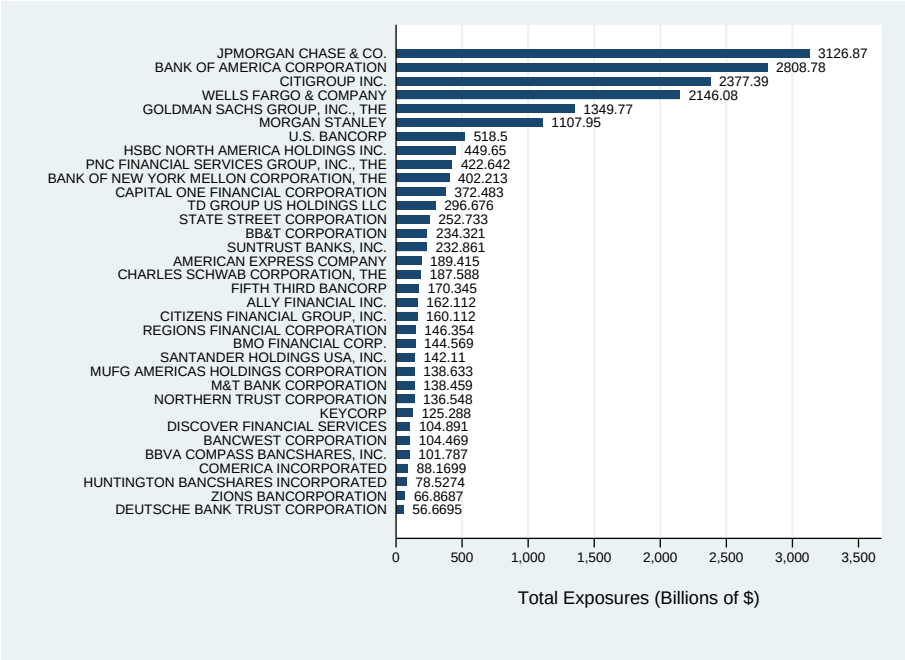


Figure 1: Total Exposure of U.S. BHC that file the Y-15 form (from largest to smallest), for the year 2015.

repurchase agreements, or "Repos," but also includes the following items, which are part of the activity of the firm but are not included in the balance sheet under current accounting standards:

- Derivatives exposure that is not on balance sheet. Only derivatives with a positive fair value are on the balance sheet as assets – or, if their value is negative, on the balance sheet as liabilities. However, derivatives that currently have a fair value of zero (for example, an interest rate swap that was just created) still are valuable to both counterparties, so the TE measure adds an estimate of their value.

- Other off–balance–sheet items (credit lines, etc.), measured using credit–equivalent adjustments.

It is reasonable to think that the larger the size (including services) of the firm, the more market disruption its failure will cause.

We might worry about double counting the effect of size, since disruptions through contagion are also captured in Schedule B of the score ("Interconnectedness"). However, the focus of Schedule B is on how much of the activity is within the financial system or through very tradable instruments (securities). The focus of Schedule A, instead, is on providing an estimate of sheer size, so we think it is important to look at both measures.

We consider the TE measure to be a valid method of measuring an important feature of a firm's structure, and it should be part of our impact score. Figure 1 presents the firms in the 2015 sample for the Y-15 form, with their values of total exposures, ranked from largest to smallest. When

Schedule B: Interconnectedness	
Intra–Financial System Assets	Funds lent to financial institutions (FIs)
	Unused Portion of committed lines extended to FIs
	Holdings of securities issues by other FIs
	Net positive current exposure of securities financing transactions with FIs
	OTC derivative contracts with FIs that have a positive fair value
Intra–Financial System Liabilities	Deposits due to FIs
	Borrowings obtained from FIs
	Unused portion of committed lines from FIs
	Net negative current exposure of securities financing transactions with FIs
	OTC derivative contracts with FIs that have a negative fair value
Securities Outstanding	Secured debt securities
	Senior unsecured debt securities
	Subordinated debt securities
	Commercial Paper
	Certificates of deposit
	Common Equity
	Other subordinated Funding

Table 3: Components of Schedule B of the GSIB score (Interconnectedness).

discussing the next items in the score, we will compare the ranking of firms in these subsequent characteristics to that of size by including the corresponding scatter plots.

Schedule B: Interconnectedness The Interconnectedness schedule is made up of three separate indicators: intrafinancial system assets, intrafinancial system liabilities, and securities outstanding (see Table 3 for details). The likely objective behind tracking intrafinancial system assets and liabilities is to measure how much of a firesale effect the failure of the reporting firm would have in the system (assets) or how much contagion it would spread (liabilities). As for securities outstanding (a subset of all liabilities issued by the reporting firm), regulators may be using this measure to capture the contagion effect that the failure of the institution would have for the rest of the economy: the value of its securities decline, and the balance sheets of all the holders of these securities are negatively affected.

It is worth mentioning that, in our sample, the indicator for securities outstanding is highly correlated with TE, suggesting that the amount of a firm's outstanding securities is roughly proportional to its TE. Note also that the securities outstanding indicator captures all the borrowing that the firm is doing in the form of securities, regardless of who is holding them (inside or outside of the financial system). So it is a look at the liabilities side without the narrow focus on the financial system alone.

Because securities outstanding is only a subset of liabilities (deposits, fed funds borrowings, and repo liabilities are not included), the focus of the GSIB score appears to be on tradability and

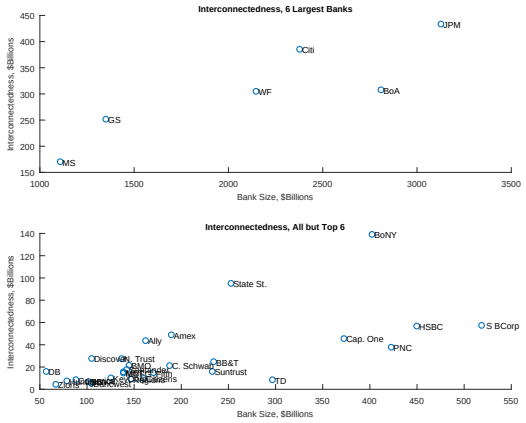


Figure 2: Scatterplot of Interconnectedness and Size.

Schedule C: Substitutability	
Payments Activity	Payments made in the last four quarters
Assets Under Custody	Assets held as a custodian on behalf of customers
Underwritten Transactions	Equity underwriting activity Debt underwriting activity

Table 4: Components of Schedule C of the GSIB score (Substitutability)

therefore firesale concerns related to securities. It is worth noting that certificates of deposit (CDs) are included in the item, even though small–denomination CDs are typically not traded. However, according to FDIC information, for the largest eight U.S. banks, 66 percent of their CDs are large denomination (over $250,000), suggesting that including CDs in securities outstanding is consistent with the idea of capturing potential firesale effects. Also, these are individual banks' securities, so we wonder if there is enough exposure in the economy to each of these individual GSIBs for the failure of one of them to cause large losses for other firms. Perhaps the Y-15 designers have in mind a domino effect, in which modest losses prompt further liquidation of other assets, and contagion occurs.

Overall, we think that the Interconnectedness measure provides a valid way of measuring an important feature of a firm's structure, and it should be part of our impact score. As Figure 2 shows, the ranking of firms according to their interconnectedness data in 2015 differs from the ranking of the firms by Size, suggesting there is extra information to be gained from including Interconnectedness in the score.

Schedule C: Substitutability Indicators Schedule C gathers information on each GSIB's volume of payments activity, its volume of assets under custody, and its volume of underwritten transactions in debt and equity markets (see Table 4 for details). We agree that these measures of financial services are a good indicator of the level of impact that the failure of a firm may have on the financial system and the economy. Some refinements of this information may be valuable but

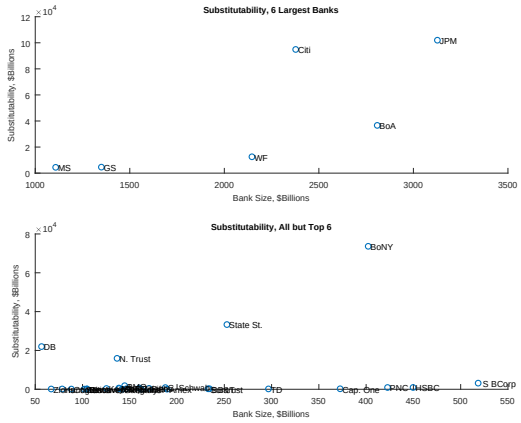


Figure 3: Scatterplot of Substitutability and Size.

may be difficult to implement.

One refinement would be to include information that helps regulators evaluate firms that are important in these three categories also in terms of the risk they take in their business model.[21] For example, a tri–party broker could choose two different business models: in one, it would simply be a broker that performs custodian activities and derives its income mainly from service fees; in another model, it would exploit its client relationships to also engage in providing intraday credit to its clients, earning interest on such loans. We expect that loss given default would be much higher in the second scenario.

Another refinement could be to capture information on the credit services that are associated with underwriting of debt and equity issuance. It seems relevant to evaluate potential impact by recognizing whether these "dealers" or "brokers" are also often the default buyers of the equity or debt that they underwrite. As the importance of credit provision increases, loss given default is amplified.

We recognize, however, the difficulties of measuring risk–taking and these two forms of credit provision.[22] Hence, overall, we think the characteristics captured in this schedule are relevant as they are measured and should be part of our impact score. Figure 3 presents the scatterplot of Substitutability and Size in 2015 for the Y-15 filers. It shows clearly that the ranking of firms according to their substitutability data differs from the ranking of the firms by Size. In particular, firms like State Street and BoNY, both of which have relatively small TEs but are responsible for a significant fraction of the provision of custodian services (high payments and assets under custody scores), are clearly outliers in the scatterplot. This suggests there is extra information to be gained from including substitutability in the score.

Schedule D: Complexity Indicators There are three components in the complexity score: OTC derivatives, trading and available for sale (AFS) securities, and level 3 assets (see Table 5 for

[21] For an argument along these lines, see Duffie (2014).

[22] See Begenau, Piazzesi and Schneider (2015) for a study of risk–taking by the main broker-dealers in the U.S.

Schedule D: Complexity	
Notional OTC Derivatives	OTC derivative contracts cleared through central counterparty OTC derivative contracts settled bilaterally
Trading and AFS Securities	Trading securities Available–for–sale (AFS) securities
Level 3 Assets	Assets valued for accounting purposes using Level 3 measurement inputs

Table 5: Components of Schedule D of the GSIB score (Complexity).

	Trading	Available–for–Sale (AFS)	Held to maturity
Selling restrictions	Expected to be sold within, approximately, one year	Meant to be held longer than a year but expected to besold before they reach maturity	Meant to be held to maturity, not sold
Accounting valuation method	Fair value	Fair value	Book value
Accounting of unrealized changes in value	Recorded in the income statement as earnings	Do not affect earnings and are only recorded in a separate form (shareholders' value) until they are realized	Not reported

Table 6: Classification of securities

details). We discuss each of those in turn.

OTC derivatives OTC Derivatives are bilateral contracts (even if cleared through a CCP), and hence they may be used to hedge trades and risks specific to the firm's counterparty. They likely are counted toward loss given default in the GSIB score, because, if the institution fails, its counterparty in these derivatives may have difficulty finding a new counterparty that desires an equivalent position.

Trading and available–for–sale securities Securities are classified, at the time of purchase, into one of the following three categories for accounting purposes: trading, available–for–sale (AFS), and held–to–maturity. Mark–to–market changes in the valuation of trading securities and AFS securities have different consequences for income: changes in the value of trading securities appear as expenses/income in the income statement, while changes in the value of AFS securities affect only equity. Changes in the value of held–to–maturity securities do not affect either income or equity. Table 6 summarizes the differences.

Note that classification occurs at the time of purchase and can only be changed at the next reporting period. Moreover, FASB guidance states that only reclassifications from AFS to held–to–maturity are viewed as normal. Other reclassifications require special reporting and justification (acceptable reasons for the reclassification of held–to–maturity include, for example, the risk of a

credit rating downgrade).

The score adds together trading and AFS securities but subtracts the subset that gets a high liquidity rating in the Liquidity Coverage Ratio (LCR) regulation (Level 1 and Level 2 assets).[23] It seems reasonable that the less liquid assets in these categories are harder to value, or "complex."

Despite the differences described in Table 6, the GSIB score treats AFS and trading securities equally. The score does not penalize (count) securities classified as held–to–maturity (the outstanding amount of which is recorded only as a memoranda item). Two possible explanations come to mind for the inclusion of trading and AFS securities in the score, both a consequence of the sensitivity of security prices to market developments.[24]

First, the price of securities in trading and AFS may be more likely to be sensitive to news about the financial health of the firm or institution issuing them, or industry developments that may affect profitability. This sensitivity could be the reason why the firm plans to actively trade them, hoping to benefit from changes in their value. But this also implies that prices may react to news about distress of a firm that is holding large quantities of a certain security in its trading book; if the market concludes that a decrease in the value of that security may be behind the financial distress of the firm, the price of this security is likely to decrease as a reaction to this "news," affecting other holders of that security. Note that there is no need for the firm to sell these assets for this effect to occur, and hence this is not a firesale effect. It is reasonable to assume that in some instances the market's inference about the value of some securities may be incorrect; in such instances, any decrease in the price of these securities will be caused by the failure, will not reflect a change in the fundamental value of the securities, and therefore is an impact of the failure.

Second, we conjecture that regulators are concerned with potential loss given default caused by the price declines triggered by a firm in distress selling off securities in trading and AFS to get liquidity. These potential firesale effects would hurt other companies that hold the same type of securities. The idea behind considering only AFS and trading securities is that in the days leading up to failure, such securities are more likely to be first in line to be liquidated. According to FASB recommendations, held–to–maturity securities can also be sold in such a financial distress condition, but a justification needs to be provided, since sales of held–to–maturity securities are not typically expected. Thus, there is a positive cost for tapping the held–to–maturity pool of securities, and hence the firm is likely to sell trading and AFS securities first. We find support for this conjecture of a firesale concern in the fact that, to produce the score, securities with very broad markets (such as Treasuries) are subtracted from both AFS and trading securities – given that firm's sale of large amounts of such securities are unlikely to move market prices, due to the size of the market for such securities, and hence less likely to produce firesales when sold.

One may think that assets that the firm classifies as held–to–maturity should perhaps be counted

[23] The LCR will establish an enhanced prudential liquidity standard consistent with section 165 of the DFA. Large and internationally active banking organizations will be required to hold high–quality, liquid assets (HQLA) such as central bank reserves and government and corporate debt that can be converted easily and quickly into cash in an amount equal to or greater than its projected cash outflows minus its projected cash inflows during a 30-day stress period. The ratio of the firm's liquid assets to its projected net cash outflow is its "liquidity coverage ratio," or LCR. U.S. firms will be required to be fully compliant with the rule by January 1, 2017.

[24] See Basel Committee on Banking Supervision (2011) for support of these views.

in the impact score given that their value could be more opaque (since they are accounted at book value and traded less often). As it turns out, this is already taken care of by the "Level 3 assets" item in the score, which we discuss next.

Level 3 assets[25] "Level 3" is an accounting classification for assets that are deemed complex to evaluate (because there is no clear market price or a standard valuation model). The score likely penalizes them because complexity implies less value in bankruptcy, or in a rushed sale when attempting to avoid bankruptcy, and hence implies more losses to debt holders. Because the discount that these assets would suffer in a rushed sale is due to complexity, and not due to a large quantity of them being sold in the market, we do not consider this a firesale effect.

The FASB rule specifying which types of assets are classified as Level 3 (FAS 157) has a somewhat tenuous classification criterion: those measured "using significant unobservable inputs."[26] For example, if a market price is available, the asset is considered Level 1; if an option can be priced using the Black–Scholes model, that option is considered a Level 2 item, because a model is used but data on volatility can be gathered from past behavior of prices. In contrast, the valuation of the stock of a private company requires making assumptions about the future profitability of that company – needing what accountants call "assumptions about market assumptions": what the company thinks the market will use as the valuation for an asset, etc., so is classified as a Level 3 item.

Note that the score attempts to gather information that is comparable (or harmonized) internationally; hence, rather than choosing a list of specific asset classes that regulators view as complex, they pick an international classification of assets (Level 3) that is typically applied to complex assets.

Overall, we find that schedule D accounts for important firm characteristics and that all of its items should be included in our impact score. As Figure 4 shows, the ranking of firms according to their complexity data in 2015 differs from the ranking of the firms by Size, suggesting there is extra information to be gained from including complexity in the score.

Schedule E: Cross–Jurisdictional Activity Indicators As Table 7 indicates, this schedule essentially collects just two figures: 1) The sum of all amounts owed – including positive values of derivatives – to the filing bank by foreign persons, public institutions, financial firms, and nonfinancial firms; and 2) the sum of all amounts owed by the filing bank to foreigners (including amounts owed by the filer's foreign offices — amounts owed in both local and nonlocal currencies of these offices).[27] The idea here is that assets and liabilities that cross national borders are more complex to collect if the borrower becomes troubled, because of differences in bankruptcy treatment across countries and the chance that assets might be ring–fenced. We think this is a valid concern, and

[25] Note that Level 1,2,3 in FASB is different than Level 1 and 2 liquid assets in the previous point (that classification is instead derived from the LCR calculation in 12 CFR 249.20(a)).

[26] See Financial Accounting Standards Board, "Original Pronouncements, As Amended, Statement of Financial Accounting Standards No. 157, Fair Value Measurements." P. 29, available at: http://www.fasb.org/jsp/FASB/Document_C/DocumentPage?cid=1218220130001&acceptedDisclaimer=true.

[27] For U.S. Y-15 filers, these data are reported on FFIEC Form 009 and the Treasury International Capital reports.

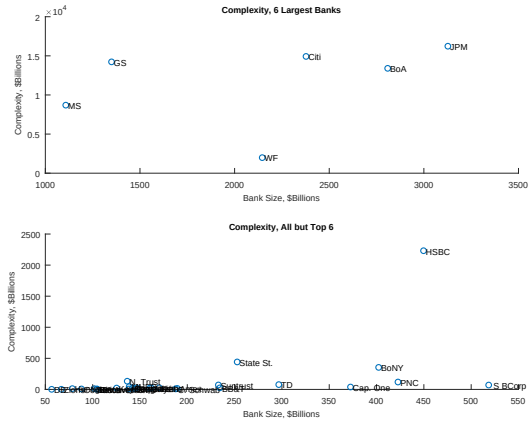


Figure 4: Scatterplot of Complexity and Size.

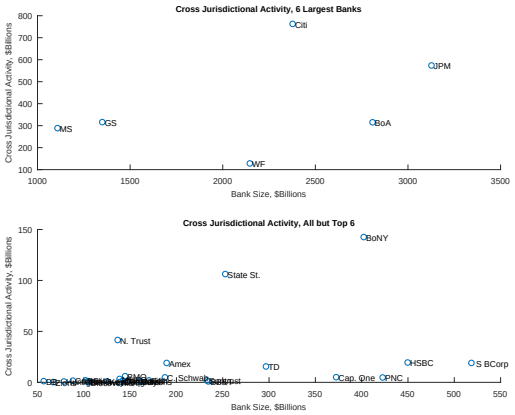


Figure 5: Scatterplot of Cross–Jurisdictional Activity and Size

that the items in this schedule should be part of our impact score. As Figure 5 shows, the ranking of firms according to their cross–jurisdictional activity data in 2015 differs from the ranking of the firms by Size, suggesting there is extra information to be gained from including this characteristic in the score.

Schedule G: Proportion of risk–weighted assets that are funded through short–term debt This schedule is an attempt to quantify the potential losses to the economy that might arise when a GSIB firm is a heavy user of certain types of short–term funding. Details on the information collected are in Table 8. Use of short–term debt is measured as a percentage of risk–weighted assets. GSIBs only began completing Schedule G in December 2016, and data will not be released until November 2017, so as of this writing, the currently available GSIB scores do not incorporate data from this new schedule.

The schedule collects information on how the debt of the firm is distributed across different characteristics including remaining maturity, liquidity of collateral, whether the debt is obtained

Schedule E: Cross–Jurisdictional Activity	
Cross–Jurisdictional Claims	Foreign claims on an ultimate–risk basis
Cross–Jurisdictional Liabilities	Foreign liabilities

Table 7: Components of Schedule E of the GSIB score (Cross–Jurisdictional Activity).

Schedule G: Short–Term (ST) Wholesale Funding	
ST Wholesale Funding	Funding secured by Level 1 (LCR) liquid assets
	Retail brokered deposits and sweeps
	Unsecured wholesale funding obtained outside the financial sector
	Firm short positions involving Level 2B liquid assets or non–HQLA
	Funding secured by Level 2A (LCR) liquid assets
	Covered asset exchanges (Level 1 to Level 2A)
	Funding secured by Level 2B (LCR) liquid assets
	Other covered asset exchanges
	Unsecured wholesale funding obtained within the financial sector
	All other short–term wholesale funding

Table 8: Components of Schedule G of the GSIB score (Short–Term Wholesale Funding).

from inside or outside the financial sector, and whether it has FDIC insurance coverage. Weights are then assigned to these characteristics (lines in the schedule), reflecting the beliefs of regulators about how the characteristics translate into severity of losses. In particular, higher weights (implying larger expected systemic losses) are assigned to:

- Shorter–term debt: the shorter the term, the greater the impact on creditors from not repaying. Additionally, shorter–term debt may be more likely to run prior to failure, which may prompt the troubled GSIB to quickly sell assets, perhaps at firesale prices, thereby producing an external impact, as well as weakening the firm and imposing larger losses on its remaining long–term creditors.

- Unsecured Debt with counterparties within the financial sector: creditor losses will be higher on uncollateralized debt, and losses in the financial system may have a greater impact in the economy as a whole than losses outside of the financial system, through relationship–based lending. Further, firms in the financial system may be more sensitive to the timing of repayments than nonfinancial firms or individuals.

- Borrowing that is secured by less–liquid assets: the value of these assets would be more uncertain in a distressed market. The degree of liquidity of collateral is determined using HQLA liquidity classifications from the LCR regulation.

Note also that Schedule G does not assign different weights depending on whether the debt instruments are QFCs. Qualified financial contracts are repo loans, commodity contracts, forward contracts, swap agreements, and securities contracts and are exempt from bankruptcy's automatic

stay. A key component of bankruptcy, the automatic stay prevents, upon a debtor's bankruptcy filing, most creditors from attempting to collect on their claims. The primary objective of the stay is to avoid the separation of complementary assets and to preserve the going–concern value of a firm. QFCs, however, are exempt from the automatic stay so that investors who hold them have the ability to immediately take possession (and sell, if they wish) any collateral that backs their loans or derivatives. This is beneficial because it avoids contagion to counterparties. QFCs are, hence, mostly used by counterparties who are particularly sensitive to the timing of repayments, and would be particularly hurt by an automatic stay.[28] As we have mentioned, a potential cost of the exemption from the stay is the separation of complementary assets. However, the collateral backing QFCs is typically not complementary to other assets of the firm, nor will QFC collateral be important to the firm's going–concern value. For example, QFC collateral often consists of highly marketable or cash–like securities (for example Treasury debt instruments), which can be removed from the firm without reducing the value of other firm assets. Broadly, therefore, QFCs are exempt from bankruptcy's stay because they are considered especially "systemic" instruments while, at the same time, the collateral that backs QFCs consists mainly of assets that can be removed from the failing firm without producing a large impact on the failing firm's liquidation value.

The fact that Schedule G does not assign special weight to QFCs seems to implicitly assume that there might be losses imposed on creditors even if they are lending to GSIBs through QFCs. Perhaps the designers of the GSIB score considered the possibility that, while QFC–based lending allows creditors to protect themselves by quickly seizing collateral in bankruptcy, creditors still may suffer losses if they sell the seized collateral en masse, producing firesale losses. If that is the case, losses might also extend beyond the creditors of a bankrupt GSIB to other holders of similar assets.

Overall, we think that it is important for any impact score to include information about a firm's short–term debt structure. However, we have some suggestions on ways to capture this structure in a way that may be more informative about the failure's impact. Mainly, the weighted short–term debt instruments are normalized in the GSIB score by dividing by risk–weighted assets, with only the normalized ratio entering the GSIB score calculation. But because risk–weighted assets generally discount assets like Treasuries, which are very liquid and hence less likely to imply losses if they need to be liquidated to meet short–term debt obligations, we believe it would be more appropriate to simply use assets as the denominator for the Schedule G indicator. In other words, using risk–weighted assets to normalize may inappropriately penalize those GSIBs that have large holdings of very liquid assets. In fact, a high proportion of short–term funding is less troublesome if the GSIB matches this funding with an equivalent portion of liquid assets. As a result, a measure that compares short–term debt with liquid assets (such as the one that the LCR rule requires), which we propose to use (see next section), would be even more informative about the impact of short–term debt use in a firm's resolvability.

Moreover, we propose that the total amount of QFCs and of non–QFC short–term debt be recorded and evaluated separately. In the next section, we discuss this idea and propose specific

[28] See Pellerin and Walter (2012) for a discussion of the idea that QFCs are in a special class of financial instruments (p. 20) and of the role of QFCs in resolution (p. 19-24).

New items: structure of short–term (ST) debt	
QFCs	Fed funds and repo borrowing Derivatives purchased with negative fair value Derivatives sold with negative fair value
QFCs/ Assets	QFCs (as defined above) over total assets
Non–QFC ST debt	Commercial paper Other borrowed money with remaining maturity of one year or less Uninsured deposits
Non–QFC ST debt / Assets	Our measure of non–QFC ST debt above, over total assets
1/LCR	Our measure of non–QFC ST debt plus Fed funds and repo borrowing, all divided by the amount of high quality liquid assets

Table 9: New items in the impact score.

ways to measure the impact of the short–term debt structure of firms.

4 New items for the score

In this section, we discuss some firm characteristics that we view as valuable additions our impact score, above and beyond what the GSIB score considers. Because the Y-15 does not collect these items, we assemble them from other regulatory filings, specifically from financial statements for bank holding companies (FR Y-9C) and financial statements for banks ("Call Reports" – FFIEC 031). Table 9 lists these new items, which all relate to the structure of a firm's short–term debt. The appendix contains the details on how we construct each of them.

The amount and structure of short–term funding is important for resolution because these features determine, to an important extent, post–failure outcomes: the DIP financing needs of the firm; the potential for firesales; and possible losses to creditors. Importantly, differing resolution methods (bankruptcy, OLA, or bailout) will likely influence these outcomes because the resolution method chosen may result in different treatment of debtors. In order for our score to address these important differences, in what follows we split the main impact of the structure of short–term debt into (i) inability to perform financial functions essential to the economy because of the lack of DIP financing, (ii) firesale effects, and (iii) contagion effects. We propose measurable firm characteristics to be added as items in the score and discuss why each of them would be informative about each of the three effects.

Inability to perform financial functions essential to the economy because of a post–failure lack of sufficient DIP financing

We expect the amount of short–term debt to be an indicator of DIP financing requirements post–failure: if we assume all short–term creditors pull out prior to failure, the firm will require DIP financing to replace this funding following failure and allow the firm to continue its former activities.[29] The larger the quantity of DIP financing required, the more challenging will be the job

[29] It is difficult to anticipate how much of a troubled firm's short-term financing will remain at the time failure is

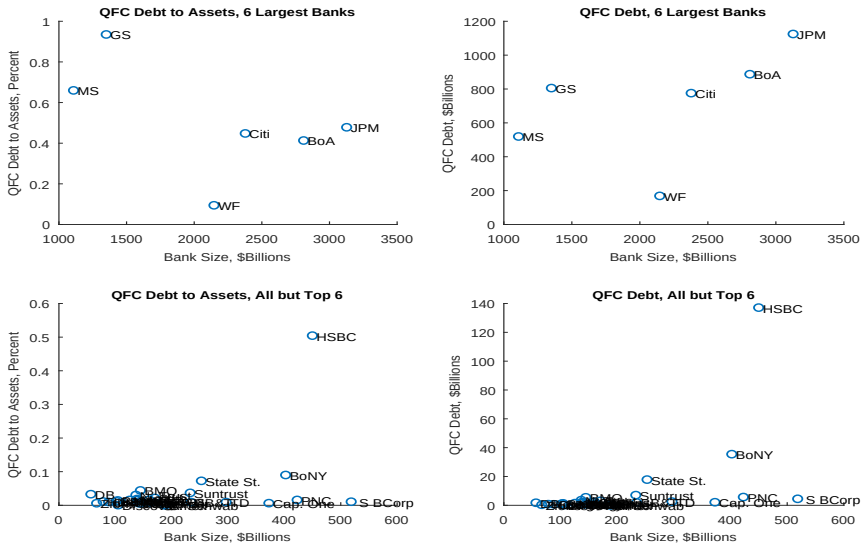


Figure 6: Scatterplot of QFC financing (right), and its ration to assets (left), and size.

of finding a lender with sufficient capacity to provide the needed DIP loan. Lack of DIP funding will make it more difficult for the firm to keep healthy subsidiaries working and performing financial functions that may be essential to the economy. The firm characteristics that can be informative about this effect are:

- QFC financing: These financing sources will disappear even if they do not run prior to failure, because they are exempt from bankruptcy's automatic stay.
- Non–QFC short–term debt: These financing sources can run prior to failure, but not after, so assuming all of this debt runs before failure provides an upper bound on impact.

Figure 6 presents the scatterplot of the ratio to assets (left) and the amount (right) of QFC financing and size, while Figure 7 presents the non–QFC debt counterparts.

Contagion to creditors of the failing firm

There are two main types of debt holders: short–term creditors and long–term creditors. Because their treatment in a failure may differ according to the resolution method, we discuss the informativeness of short–term debt structure about contagion to each of these two classes of creditors separately.

declared because creditors often detect the firm's problems and withdraw funding in the days leading up to a failure. In our analysis, we consider both extreme scenarios (prior to failure either all debt runs or, alternatively, none of it runs) in order for our score to capture the largest impact a failure might produce.

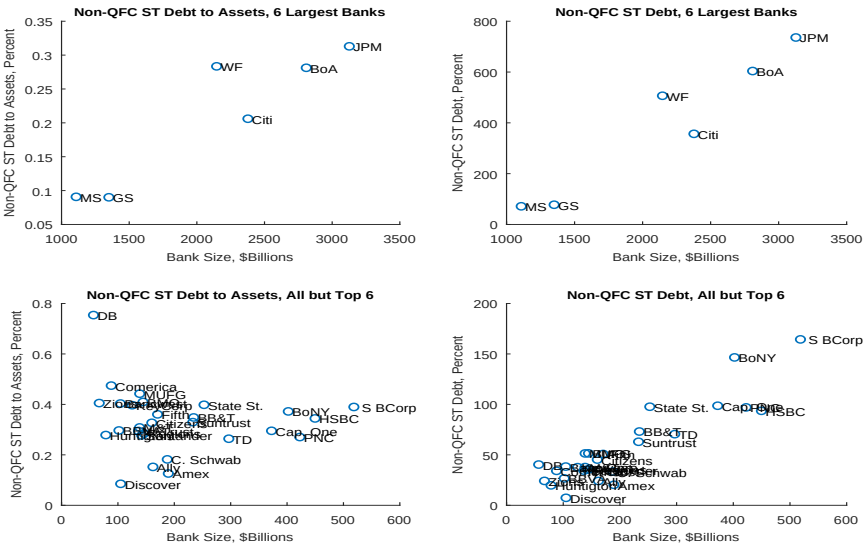


Figure 7: Scatterplot of non–QFC short–term debt to assets (left) and amount (right) and Size.

First, we'd like to be able to estimate the contagion effect to short–term debt holders due to a delayed (and possibly partial) repayment of the short–term obligations of the failing firm. We would like an estimate of the impact on counterparties, who are counting on timely repayment so they can cover their own short–term obligations (obligations due sooner than the time taken to complete a resolution) but will not receive such repayment (and, therefore, suffer from the "contagion" effect). If the assets of the failing firm are not very standard, as we might expect, borrowing against bankruptcy claims may not be without a cost, and hence the short–term creditors may face liquidity problems, on top of any capital losses that the expectation of partial repayment may trigger.

When taking into account this contagion effect, knowing the amount of short–term debt with very short maturity (e.g., maturity of less than 30 days) would be useful but is not currently available (this is information that will become available when the Y-15 is next revised). Using instead financial information available in the Y-9C bank holding company report and in banks' Call Reports, we propose to include in our score the following firm characteristics that can be informative about the contagion effect to short–term debt holders:

- QFC financing: QFC creditors (such the failing firm's repo creditors) can seize their collateral immediately upon default, so QFC financing is only a concern for contagion if some kind of mini–stay is imposed (as in OLA).

- Non–QFC short–term debt: if we assume none of this debt runs before failure, we can use

this amount as an upper bound on this impact.

Second, we would like to estimate potential losses to long–term debt holders (and any short–term creditors who do not run) from the liquidation of assets to repay short–term debt that has run. For this objective, we need information about the relative importance of losses for the firm stemming from the rushed liquidation of those assets; this will be informative about the decrease in the value of total assets that the run of the short–term debt will impose and hence on the losses imposed on long–term debt holders by decreasing the value of the firm's assets in bankruptcy. Note, as discussed below, that some policymakers may be more concerned with this firesale effect than others – in other words, some policymakers may believe it unlikely that asset values can be driven below fundamental values. Using financial information from the Y-9C and Call Reports, we propose to include in our score the following firm characteristics that can be informative about this contagion effect to long–term debt holders:

- Ratio of QFC financing to assets: for these debt instruments, typically, there will be margins on derivatives, or haircuts on repo collateral, to compensate counterparties for the risk of default on the contract. Such instruments imply losses for the failed firm when its QFC contracts are terminated, which translates into lower recovery rates for the failed firm's non–QFC creditors.

- Non–QFC short–term debt to assets ratio: similar to the case of QFCs, but here losses, if any, would come from a firesale effect, where the liquidation of assets to cover running non–QFC debt can drive the value of these assets below their fundamental values. If we assume all short–term debt runs, this provides an upper bound for this impact.

- Inverse of LCR: the proportion of highly liquid assets to short–term debt (inverse of the LCR) provides a measure of expected losses that might be suffered by long–term debt holders from the rushed liquidation of assets to repay short–term obligations that are removed prior to failure: a firm that relies heavily on short–term debt but has very liquid assets may avoid large losses in the days leading up to failure, while one that has to sell illiquid assets is likely to suffer losses on such sales. A higher ratio will mean lower losses on the proportion of the balance sheet that is financed by short–term debt.

Figure 8 presents the scatterplot of the inverse of the LCR (short–term debt over assets) and size.

Contagion to third parties through a balance–sheet effect of firesales of assets

If creditors become unwilling to roll over the troubled firm's short–term debt in the weeks or days leading up to the failure of a firm, the amount of a firm's short–term financing will be an ex–ante indicator of potential firesale effects: the larger the amount of short–term debt, the larger the amount of assets that will have to be liquidated by the troubled firm (to repay creditors that are unwilling to roll over) to try to maintain the firm's solvency, and the greater the potential for firesales. The firm characteristics that can be informative about this effect are:

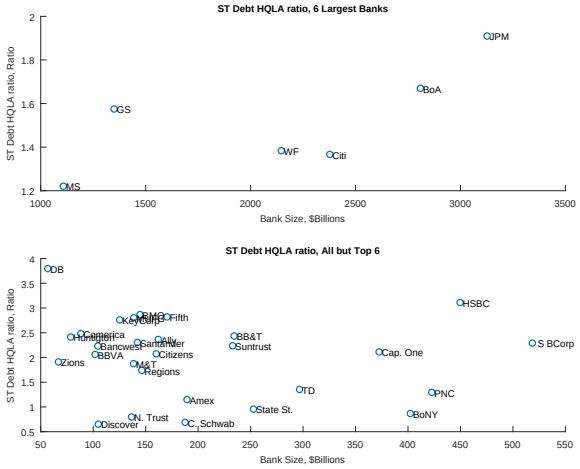


Figure 8: Scatterplot of the inverse of the LCR ratio (short–term debt over assets) and Size.

- QFC financing: because these instruments are exempt from the automatic stay, even if QFC–based funding doesn't run prior to failure, this funding will be liquidated upon failure. As a result of this liquidation, the collateral may land in the hands of a counterparty which values the collateral less than the failed firm. Alternatively, the collateral may go to a creditor that does not want to hold it, leading to the sale of a large quantity of the collateral. Either may depress the asset's market price.

- Non–QFC short–term debt: any of this type of debt may also have a firesale effect if it runs before the automatic stay is declared. Hence, assuming all of it runs we can use this amount as an upper bound on this effect.

As the discussion in this section makes clear, there are different possible costs and benefits to a GSIB firm's heavy use of QFCs, and the sum of the costs and benefits, should the firm fail, is unclear for the financial system or the economy as a whole. Further, as we will discuss in more detail below, different policymakers may weight each of these costs and benefits differently.

4.1 A snapshot of large U.S. firms using our new impact–relevant characteristics

Figure 9 presents the raw data on both the GSIB original firm characteristics and the new characteristics we have proposed as relevant to calculate impact, for the 34 BHCs in 2015. We use a color scheme to illustrate the relative importance of each number (red corresponds to larger numbers, yellow to intermediate, and green to smaller). Firms are ordered according to their size (as measured by Total Exposures), from largest to smallest. This allows us to compare all characteristics at the same time, as opposed to one by one, to size, as we did in the scatterplot figures above. Green

colors in the top rows, or red colors on the bottom rows, indicate deviations from a proportional relationship of the characteristic being measured and size. For example, Bank of New York Mellon and State Street both score very high on substitutability given their size, because of their roles as intermediaries in the Tri–party repo market (they have a disproportionately high number of assets under custody). As another example, Wells Fargo scores relatively low in Substitutability, Complexity and Cross–Jurisdictional activity, given that it is the 4th largest bank.

It is worth discussing the facts regarding some of our new items. QFC amount is fairly proportional to size, but this is less true for QFC/Assets. More importantly, even though the amount of non–QFC short–term debt is proportional to size, the ratio of this type of debt to assets displays an almost inverse relationship to size. This inverse relationship is also somewhat present in our approximation of the inverse of the LCR, with many large firms showing a high proportion of liquid assets to short term debt, and instead many smaller firms showing high levels of illiquidity as measured by our ratio.

Differences in these characteristics of the debt structure may translate into important differences in impact following failure, as we have discussed. In the next section we will illustrate how differences of opinion regarding the mapping of these characteristics into impact may affect judgement calls on whether firms have an acceptable structure for resolution through bankruptcy.

5 Evaluating acceptable firm structures

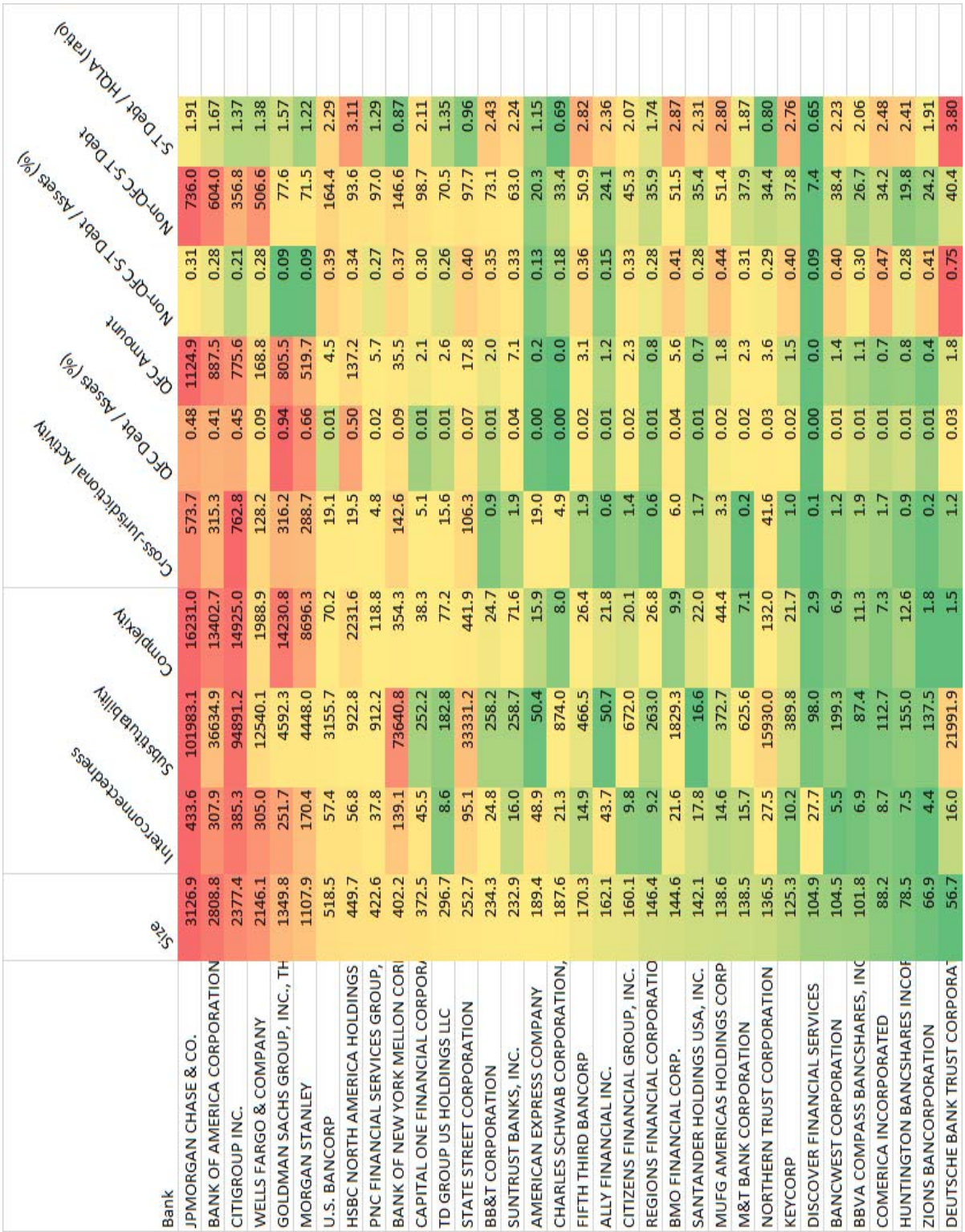
We have discussed how a modified version of the existing GSIB score could be a good candidate for a measure meant to establish whether a firm's structure is acceptable for resolution in bankruptcy — an impact score. We now illustrate how to use weights in the score to account for the fact that the same objective quantity recorded for a given firm characteristic may translate into different levels of impact depending on the resolution method used to deal with the troubled firm or on the crisis scenario being considered. We will use the score in a positive way, as an instrument to portray different opinions that hypothetical policymakers may have concerning the impact associated with these characteristics. With this exercise we want to emphasize that these scores may be influenced by subjective beliefs of policymakers.

In our examples, we use actual data on firm characteristics (collected by the Y-15, plus estimates of the importance of short–term funding and of the use of QFCs that we calculate using publicly available data from the Y-9C and the Call Report). We combine these data with three different sets of weights (see Figure 10), which we created in order to represent views of three "types" of policymakers. The combination of actual firm data with weights that we devised produces hypothetical scores that we use to study these hypothetical policymakers' views about various firms' resolvability.[30]

In the next paragraphs we discuss, for several indicators, reasons that could be behind any difference of opinion on how the impact of a given firm characteristic would differ across different

[30] An Excel spreadsheet to calculate our impact score is available as an online appendix. It allows readers to adjust policymaker's weights, based on their own views of the likely impacts associated with various firm characteristics, scenarios, and resolution methods, and examine how such changes shift scores for the 34 institutions required to file the Y-15 in 2015.

Figure 9: Raw data for BHCs in 2015, in Billions of $US. Firms are ordered according to size (Total Exposures), from largest to smallest. The colour scheme reflects relative size of the figures (red is larger, green smaller).



Bank	Size	Interconnectedness	Substitutability	Complexity	Cross-Jurisdictional Activity	OFC Debt / Assets (%)	OFC Amount	Non-OFC S-T Debt / Assets (%)	Non-OFC S-T Debt	S-T Debt / HQLA (ratio)
JPMORGAN CHASE & CO.	3126.9	433.6	101983.1	16231.0	573.7	0.48	1124.9	0.31	736.0	1.91
BANK OF AMERICA CORPORATION	2808.8	307.9	36634.9	13402.7	315.3	0.41	887.5	0.28	604.0	1.67
CITIGROUP INC.	2377.4	385.3	94891.2	14925.0	762.8	0.45	775.6	0.21	356.8	1.37
WELLS FARGO & COMPANY	2146.1	305.0	12540.1	1988.9	128.2	0.09	168.8	0.28	506.6	1.38
GOLDMAN SACHS GROUP, INC., TH	1349.8	251.7	4592.3	14230.8	316.2	0.94	805.5	0.09	77.6	1.57
MORGAN STANLEY	1107.9	170.4	4448.0	8696.3	288.7	0.66	519.7	0.09	71.5	1.22
U.S. BANCORP	518.5	57.4	3155.7	70.2	19.1	0.01	4.5	0.39	164.4	2.29
HSBC NORTH AMERICA HOLDINGS	449.7	56.8	922.8	2231.6	19.5	0.50	137.2	0.34	93.6	3.11
PNC FINANCIAL SERVICES GROUP,	422.6	37.8	912.2	118.8	4.8	0.02	5.7	0.27	97.0	1.29
BANK OF NEW YORK MELLON COR	402.2	139.1	73640.8	354.3	142.6	0.09	35.5	0.37	146.6	0.87
CAPITAL ONE FINANCIAL CORPOR	372.5	45.5	252.2	38.3	5.1	0.01	2.1	0.30	98.7	2.11
TD GROUP US HOLDINGS LLC	296.7	8.6	182.8	77.2	15.6	0.01	2.6	0.26	70.5	1.35
STATE STREET CORPORATION	252.7	95.1	33331.2	441.9	106.3	0.07	17.8	0.40	97.7	0.96
BB&T CORPORATION	234.3	24.8	258.2	24.7	0.9	0.01	2.0	0.35	73.1	2.43
SUNTRUST BANKS, INC.	232.9	16.0	258.7	71.6	1.9	0.04	7.1	0.33	63.0	2.24
AMERICAN EXPRESS COMPANY	189.4	48.9	50.4	15.9	19.0	0.00	0.2	0.13	20.3	1.15
CHARLES SCHWAB CORPORATION,	187.6	21.3	874.0	8.0	4.9	0.00	0.0	0.18	33.4	0.69
FIFTH THIRD BANCORP	170.3	14.9	466.5	26.4	1.9	0.02	3.1	0.36	50.9	2.82
ALLY FINANCIAL INC.	162.1	43.7	50.7	21.8	0.6	0.01	1.2	0.15	24.1	2.36
CITIZENS FINANCIAL GROUP, INC.	160.1	9.8	672.0	20.1	1.4	0.02	2.3	0.33	45.3	2.07
REGIONS FINANCIAL CORPORATIO	146.4	9.2	263.0	26.8	0.6	0.01	0.8	0.28	35.9	1.74
BMO FINANCIAL CORP.	144.6	21.6	1829.3	9.9	6.0	0.04	5.6	0.41	51.5	2.87
SANTANDER HOLDINGS USA, INC.	142.1	17.8	16.6	22.0	1.7	0.01	0.7	0.28	35.4	2.31
MUFG AMERICAS HOLDINGS CORP	138.6	14.6	372.7	44.4	3.3	0.02	1.8	0.44	51.4	2.80
M&T BANK CORPORATION	138.5	15.7	625.6	7.1	0.2	0.02	2.3	0.31	37.9	1.87
NORTHERN TRUST CORPORATION	136.5	27.5	15930.0	132.0	41.6	0.03	3.6	0.29	34.4	0.80
KEYCORP	125.3	10.2	389.8	21.7	1.0	0.02	1.5	0.40	37.8	2.76
DISCOVER FINANCIAL SERVICES	104.9	27.7	98.0	2.9	0.1	0.00	0.0	0.09	7.4	0.65
BANCWEST CORPORATION	104.5	5.5	199.3	6.9	1.2	0.01	1.4	0.40	38.4	2.23
BBVA COMPASS BANCSHARES, INC	101.8	6.9	87.4	11.3	1.9	0.01	1.1	0.30	26.7	2.06
COMERICA INCORPORATED	88.2	8.7	112.7	7.3	1.7	0.01	0.7	0.47	34.2	2.48
HUNTINGTON BANCSHARES INCOF	78.5	7.5	155.0	12.6	0.9	0.01	0.8	0.28	19.8	2.41
ZIONS BANCORPORATION	66.9	4.4	137.5	1.8	0.2	0.01	0.4	0.41	24.2	1.91
DEUTSCHE BANK TRUST CORPORAT	56.7	16.0	21991.9	1.5	1.2	0.03	1.8	0.75	40.4	3.80

resolution methods and scenarios. We then use these different arguments to characterize the beliefs, or weights, of our three hypothetical policymakers: we propose a ranking of the weights within each characteristic and come up with numbers in our example (Figure 10) that will satisfy these rankings.

Policymaker 1 has two sets of weights, labeled (a) and (b), representing his views at two points in time. The weights in (a) can be thought of as representing a Policymaker that currently agrees with LW reviewers at the Federal Reserve and the FDIC, who have recently determined that all of the large firms have acceptable LWs. As we will see when we present the results of our examples, we set this first set of weights on firm characteristics such that, in fact, all the firms in our sample have an acceptable structure. For contrast, the weights for Policymaker 1 in case (b), though matching the relative importance of each characteristic with those in case (a), are twice as large for each characteristic. This will imply, as we will see, that some of the firm's structures are not acceptable in a hypothetical case (a). With these two contrasting weights we want to capture: 1) some policymakers' views that the TBTF problem has become less severe as a result of the legislative and regulatory efforts in the last 10 years geared toward assuring less costly large firm resolution; and 2) views that policymakers might have held before these changes were implemented.

In particular, we are focusing on the shifts that were driven by international regulations such as Basel III and several important legislative and regulatory changes introduced since the financial crisis of 2007 – 2008. These legislative and regulatory changes include TLAC, new liquidity standards, and implementation of the living will process. Because of these measures, we model Policymaker 1's beliefs as shifting from (b) (before the crisis) to (a) (currently). Current weights represent the belief that the failure of a bank is likely to lead to considerably less economic impact than would have occurred prior to these changes.

When modelling the shift in beliefs of Policymaker 1 from (a) to (b), we also adjust the estimates for the cost of government intervention. As we discuss in detail in the next subsection, these costs can include not only efficiency losses due to risk shifting (i.e., moral hazard costs) but also bailout "outrage" costs. In particular, in case (b), before the big bailouts of 2008, these outrage costs may have been lower than today (case (a)). Intense public protests and legislator criticism of bailouts and other forms of government assistance, following the crisis, imply that policymakers can anticipate similar opposition in response to any future bank bailout or assistance. Moreover, it seems possible that the last decade's regulatory efforts imply an increase in the moral hazard consequences of a bailout: if, after all the costly LW process and other efforts, a firm gets bailed out, other firms in the financial system and their creditors are likely to increase expectations of a future bailout out.

Alternatively, we could interpret case (b) for Policymaker 1 as representing the views of a current policymaker who is not convinced that legislative and regulatory shifts have yet been sufficient to significantly reduce the economic impact of a large bank's failure. Therefore, for this policymaker, the TBTF problem has not been reduced.

To further illustrate how our "acceptability" determinations depend on weights, we propose two more policymakers (2 and 3) who share Policymaker's 1(b) estimates of the cost of government intervention, but disagree with him in some of their weights. This choice of the cost of government intervention for Policymakers 2 and 3 is purely out of convenience (we need variation in the resolv-

Policymaker 1(a)		Size	Interconnectedness	Substitutability	Complexity	Cross-Jurisdictional Activity	QFC Debt / Assets (%)	QFC Amount	Non-QFC S-T Debt / Assets (%)	Non-QFC S-T Debt	S-T Debt / HQLA (ratio)	Cost of Gov. support
Idiosyncratic Failure	Bankruptcy	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.4	0.3	0
	OLA	0.4	0.4	0.5	0.5	0.25	0.13	0.13	0.24	0.28	0.24	600
	Bailout	0	0	0	0	0.00	0	0	0	0.00	0.00	2000
Aggregate Failure	Bankruptcy	1	2	0.5	1.5	0.25	1.0	1.0	0.8	0.9	0.8	0
	OLA	0.6	1.6	0.5	1	0.1	0.25	0.75	0.6	0.7	0.6	450
	Bailout	0	0	0	0	0.00	0	0	0	0	0.00	1600
Factor of weights (a/b)		0.5										
Policymaker 1(b)												
Idiosyncratic Failure	Bankruptcy	1	1	1	1	1	1	1	0.6	0.7	0.6	0
	OLA	0.8	0.8	1	1	0.5	0.25	0.25	0.48	0.56	0.48	150
	Bailout	0	0	0	0	0.0	0	0	0	0	0	600
Aggregate Failure	Bankruptcy	2	4	1	3	0.5	2	2	1.5	1.8	1.5	0
	OLA	1.2	3.2	1	2	0.3	0.5	1.5	1.2	1.4	1.2	60
	Bailout	0	0	0	0	0.0	0	0	0	0	0	350
Policymaker 2												
Idiosyncratic Failure	Bankruptcy	1	0.5	1	0.5	1.0	0.5	0.2	0.3	0.4	0.3	0
	OLA	0.8	0.5	1.0	0.5	0.5	0.13	0.3	0.24	0.28	0.24	150
	Bailout	0	0	0	0	0	0	0	0	0	0	600
Aggregate Failure	Bankruptcy	2	2	1	1.5	0.5	1	0.4	0.75	1	1	0
	OLA	1.2	1.6	1.0	1	0.3	0.25	0.6	0.6	0.7	0.6	60
	Bailout	0	0	0	0	0.0	0	0	0	0	0	350
Policymaker 3												
Idiosyncratic Failure	Bankruptcy	7.89	0	0	0	0	0	0	0	0	0	0
	OLA	5.46	0	0	0	0	0	0	0	0	0	150
	Bailout	0	0	0	0	0	0	0	0	0	0	600
Aggregate Failure	Bankruptcy	16.72	0	0	0	0	0	0	0	0	0	0
	OLA	11.97	0	0	0	0	0	0	0	0	0	60
	Bailout	0	0	0	0	0	0	0	0	0	0	350

Figure 10: Weights assigned to different firm characteristics and to moral hazard costs by three hypothetical policymakers in our examples. Policymaker 1 has lower weights (by a factor of 0.5) in case (a) and higher in (b); Policymaker 1(b) and 2 agree on most of their weights, except 1 worries about the effect of firesales and Policymaker 2 does not; weights that are different between them as a result of this disagreement are in red. Policymaker 3 uses a simple rule based only on the size measure and moral hazard costs.

ability determinations to illustrate how our score works), but in no sense do we mean to imply that Policymaker 1's weights in (b) are more realistic, or reasonable.

Policymaker 1 (a and b) worries about firesales. Policymaker 2, instead, does not believe that the firesales are a significant concern. Hence, the weights on characteristics that may involve firesale estimates will be typically higher for Policymaker 1 than for Policymaker 2 (the weights that differ are indicated in red in Figure 10). One can think of Policymaker 1 as being broadly representative of those policymakers who are very worried about external effects emanating from the failure of a GSIB and Policymaker 2 as representative of those more skeptical about such effects.[31]

Policymaker 3 wants a simple score based only on size. He has the same weights as Policymaker 1, but he only analyzes the individual firm characteristics for the largest five holding companies. Then, he chooses alternative weights (in red in Figure 10) that will, on average, replicate these scores for these five companies using only their size information. He uses these new weights to construct scores for the rest of the companies looking only at their size information. This way, he does not need to construct individual measures about short–term debt structure for all the firms in the sample. Also, going forward, these same weights can be used in future years with only information about size, even if filing a form such as the Y-15 is no longer required. Much systemic risk regulation is size–based, meaning institutions smaller than a specified asset–size cutoff are exempt, indicating that the simplicity of such straightforward cutoffs can be attractive to policymakers.[32]

Determination of the cost of government support In order to determine whether the structure of a firm is acceptable, the impact score under bankruptcy and OLA needs to be compared to the impact score of a bailout. In our examples, when we consider the impact score of a bailout, we set the weight of each characteristic to zero. This choice is based on the fact that a troubled firm is allowed to continue in business after it is bailed out, so there is no failure. However, we assume that there is still an impact in the economy from a government intervention, mainly in the form of a moral hazard cost, but also including redistributional distortions and political cost from public outrage about the help received by financial institutions.

Throughout our examples, moral hazard cost depends on the resolution method and the crisis scenario. Moral hazard costs are generated when a bailout causes market participants (financial firms and creditors) to revise upward their expected probability of a future bailout, reducing par-

[31] These contrasting views were apparent in several policymakers' statements in the aftermath of the crises. For example, see a comparison in Steve Williamson's blog post (June 2010) of views expressed by Narayana Kocherlakota and Jeffrey Lacker while they were both presidents of Federal Reserve Banks. Williamson quotes a May 2010 policy piece by Kocherlakota, in which he defines firesales: "During financial crises, many financial institutions may have to sell assets or collateral at the same time. These simultaneous sales will put downward pressures on the assets' prices. A given financial institution will not internalize the impact of its sales on the price of other institutions' assets." On the other hand, Lacker is quoted from a speech he gave on May 26, 2010, in which he dismisses this price effect and contagion effects as being caused by failures: "Arguments that one firm's failure can spark costly runs at other firms rely on the logic of panics as self-fulfilling prophecies. While this logic is correct as far as it goes, it provides an unsatisfactory guide for policymakers, because it does not provide a means for determining whether creditors are justified in pulling away from other firms. After all, news that one firm has failed can be genuinely informative about fundamental prospects at other firms with similar exposures."

[32] An example of such a policy is the DFA's $50 billion threshold for enhanced prudential standards.

ticipants' incentive to monitor risk–taking. The policymakers in our example believe that a bailout that occurs in an aggregate shock scenario implies less of a revision in this probability than a bailout if the shock is idiosyncratic: because impacts are known to be larger in an aggregate shock, a bailout in this state is not informative about the threshold for impact that would trigger a bailout in an idiosyncratic shock. However, a bailout in an idiosyncratic shock scenario indicates that if the same firm were to fail in an aggregate shock, this would also grant a bailout. Moreover, it is reasonable to assume that the probability of an idiosyncratic shock is higher than that of an aggregate shock; hence, the effect of an upward revision of a bailout in an idiosyncratic shock will affect the expected return of debt holders more than that of a bailout in an aggregate shock. Because of these two arguments, we assume that the moral hazard cost we assign to a bailout is higher in the idiosyncratic scenario (see Moral Hazard column in Table 10).

Our policymakers hypothesize that there might also be some moral hazard cost associated with an OLA resolution (though smaller than the moral hazard cost created by a bailout), for two main reasons: the possibility of subsidized borrowing from the OLF, and the possibility of violations of the bankruptcy priority rights for creditors (i.e., the prioritization of short–term debt repayment for systemic reasons). In particular, OLA may violate the bankruptcy priority rules by fully protecting short–term debt holders, who, under bankruptcy resolution, might instead be expected to stand in line to receive less–than–complete repayment with other general creditors. These types of assistance may cause market participants to increase their estimate of future assistance, hence decreasing their incentives to curb excessive risk–taking of the firm they are financing. We capture this moral hazard cost as a lump–sum cost for OLA, but it could easily be generalized to be dependent on the amount or proportion of short–term funding.

All policymakers agree that the moral hazard cost will be the highest if a troubled firm is propped up with a bailout so that its creditors suffer no losses. They also agree that there is no moral hazard cost (cost equals zero) if a troubled firm is resolved in bankruptcy, because no degree of public assistance is typically forthcoming in bankruptcy.

To illustrate the sensitivity of our score to the moral hazard cost estimates, we present weights for Policymaker 3 who cares only about size (as measured by total exposures). In this case, we can see that the resolvability determination, for given weights on size, depends strongly on values assigned to the moral hazard cost: because the impact is a linear function of size, by choosing the moral hazard cost number we are effectively deciding what is the threshold value of size that will make a firm's structure acceptable. For Policymakers 1 and 2, as we discuss after presenting the results on Figure 11, a moral hazard cost does not imply a cutoff in terms of size, since they consider all 10 characteristics of the firms and these are not proportional to size.

Weights on Total Exposure Note that in this and the next sections discussing weights for other characteristics, we will focus on the ranking of the weights across crisis scenarios and resolution methods, rather than their values. Because of this, we will discuss case (a) and (b) for Policymaker 1 together: since his weights in case (b) are simply double those in case (a), the relative importance he places on characteristics is constant throughout the two cases.

Policymaker 1's weights for Total Exposures (TE) satisfy the following ranking:

$$w_{TE}^{OLA,I} < w_{TE}^{OLA,A} < w_{TE}^{Bk,I} < w_{TE}^{Bk,A}.$$

Recall that the TE indicator consists primarily of assets, derivative exposures, and credit commitments (e.g., undrawn lines of credit). Under an idiosyncratic shock, the impact of a firm with a large TE is likely to be fairly large — the BHC has acquired valuable information about the credit–worthiness of those to whom it lends, and this information is likely to be lost as a result of its failure. Other BHCs will find it expensive to pick up this missing lending service as a result of the absence of this private credit–worthiness information, increasing the total borrowing costs faced by firms or preventing some of this lending from being replaced at all. Still, many of the failed firm's debtors could have similar relationships with other banks, partially offsetting this effect. In the case of an aggregate shock, however, Policymaker 1 believes that this problem is considerably worse – not only is it less likely that other lenders with a relationship with the failing institutions' clients will be healthy enough to substitute for the disappearing relationship, but there may be no banks willing or able to pick up the lending at all. As a result, TE receives a lower weight in an idiosyncratic shock scenario than in an aggregate shock scenario.

The importance of the TE indicator may also depend on the resolution method and the shock because of DIP financing concerns. This follows from the fact that larger firms are more likely to need large DIP financing loans, which in turn can allow time to resolve the firm in a way that maximizes the value of liquidated assets and also allow the firm to continue providing some of its services. Then, on one hand, the shock is important because the state of the economy could be very relevant in determining whether other firms are healthy enough to provide the private DIP financing. On the other hand, if a BHC is resolved using OLA, DIP financing may be more readily available: subject to certain limitations set forth by the DFA, an institution under receivership (FDIC–overseen) can borrow from the Orderly Liquidation Fund (OLF).

Is size the only thing that matters? Asset size is typically thought of as an important determinant of loss given default. In fact, all U.S. BHCs over $50 B are automatically subjected to enhanced prudential standards.[33] Therefore it seems natural to consider the possibility that size is a sufficient indicator of the impact of a firm's failure. As we have seen in our scatterplots (Figures 1-9), changes in size do not always translate into similar magnitude changes in the other firm characteristics. To evaluate the implications of only looking at size to determine the impact of a firm's failure, we include in our examples a "policymaker 3" who puts zero weights on indicators other than TE.

Weights on Interconnectedness Policymaker 1's weights for interconnectedness satisfy the following ranking:

$$w_{Interc.}^{OLA,I} < w_{Interc.}^{Bk,I} < w_{Interc.}^{OLA,A} < w_{Interc.}^{Bk,A}.$$

[33] In the context of the GSIB score, Passmore and von Hafften (2017) ask this question and perform a principal components analysis to establish the extra information added by indicators other than TE.

Interconnectedness measures two main firm characteristics. First, it measures the importance of intrafinancial assets. These may be a source of disruption to the financial system through a balance–sheet influence due to a firesale effect on prices. Policymaker 1 cares about these and believes that they are mainly a concern in an aggregate shock, in which case having OLA financing would prevent the liquidation of assets and hence lower the cost. Policymaker 2 does not put weight on this effect.

Second, this item measures intrafinancial liabilities and securities outstanding, both being measures of borrowing by the failing firm. The main concern for disruption is through contagion to counterparties expecting repayment. Policymaker 1 feels that the special financing possibilities that are available in OLA to guarantee the debt of the failing firm, as well as the ability to violate priority rules to prioritize repayment for systemic debt holders, will make the impact of failure lower under this resolution method. On the other hand, if the shock is idiosyncratic, this policymaker believes that the expected contagion effect would be lower to start with, and therefore an OLA resolution may imply the same impact on the economy as a bankruptcy resolution. Policymaker 2 agrees with this reasoning, and hence his weights satisfy the same ranking but will be lower because he does not believe in firesales.

Weights on substitutability Policymaker 1's weights for substitutability satisfy the following ranking:

$$w_{Subs.}^{OLA,I} = w_{Subs.}^{OLA,A} = w_{Subs.}^{Bk,I} = w_{Subs.}^{Bk,A}.$$

Substitutability includes payments activity, assets under custody, and underwriting activity. Contrary to the TE example, Policymaker 1 finds little reason to believe that the impact associated with a firm scoring high on substitutability will vary drastically between an idiosyncratic and aggregate shock scenario or between resolution methods. Policymaker 2 holds the same views – given that firesale concerns are not at play here.

To illustrate why Policymaker 1 holds this view (similar impact regardless of type of scenario or resolution method), consider the loss of payments services due to the failure of a BHC.[34] The failure certainly has an impact in the economy due to the fixed cost of recreating the client–specific payments processes at a new bank. Still, the policymaker believes that this cost may not differ much under different crisis scenarios, given that it seems likely that banks will be no more hesitant to pick up additional payment clients during an aggregate shock than when just one bank fails (an idiosyncratic shock). Since banks would be able to generate fee–based income by picking up payment clients, and this extra business should not modify the riskiness of their portfolio, they would likely be happy to take on the additional business. Therefore, under these policymaker's beliefs, the size of the effect of payments activity will not vary considerably with these two types of crises. Using a similar argument, since the main costs associated with replacing the lost payments provider are the switching costs of clients having to shift from the failing firm to other payments firms, this policymaker does not believe that alternative resolution methods would affect these

[34] See Lacker (2004) for a study of the effects of payment disruptions following the September 11, 2001, attacks in New York. In our paper, the focus is on whether the impact of the failure of one key firm in the payments system would be different across shocks and resolution methods, rather than on a quantification of the impact.

costs. For example, OLA's readily available funding could allow a bridge company to continue processing payments for some time, but Policymaker 1 does not believe that this extra time would significantly decrease the switching costs of its clients.

Since the primary cost associated with the loss of custodial services is the fixed cost of transferring assets to another bank, a similar argument to the one used for payments applies.[35] It is worth pointing out, however, that if custodial services are packaged together with intraday credit provision, as they were, to a large extent, in the tri–party repo business before the financial crises, the considerations used by Policymaker 1 regarding TE (where credit provision was an important component) would be relevant for Assets under Custody. To better judge whether weights for Assets under Custody should mirror those of TE, it would be useful to require separate disclosure of intraday credit provision (a point we have made earlier when discussing the details of the substitutability GSIB schedule). On the other hand, if custodial services are not exclusive relations, the substitutability of intraday credit would be easier, and weights might not need to differ across scenarios and resolution methods after all.

For the last component of the substitutability item, underwriting services, again Policymaker 1 bases his weights on the fact that this is a service provision that needs to be substituted, paying a cost that may not be very different across shocks or resolution methods. Note that, even if underwriting implies an evaluation of credit worthiness, and there is likely to be a cost from substituting long–term relationships for which accumulated knowledge may be destroyed, again this replication of the credit–worthiness monitoring cost is not likely to differ significantly across crises scenarios or resolution methods.

Weights on complexity Policymaker 1's weights for complexity satisfy the following ranking:

$$w^{OLA,I}_{Compl.} = w^{Bk,I}_{Compl.} < w^{OLA,A}_{Compl.} < w^{Bk,A}_{Compl.}.$$

Complexity measures capture both concerns about losses from rushed liquidation of hard–to–evaluate assets (as reflected in the sub–item "Level 3 assets"), contagion due to updated information on the value of the assets that the firm typically trades, or through a firesale–like effect (both concerns captured in the sub–items "trading book" and "available–for–sale assets"). Policymaker 1 believes that, in an idiosyncratic shock, losses from the liquidation of complex assets are not likely to depend on the type of resolution method. The impact on the economy of a revaluation of trading book and AFS assets may be more severe if other firms are in trouble too, however. Hence, he sets a higher weight on complexity in an aggregate shock.

Moreover, Policymaker 1 believes that if there were demand for DIP financing during liquidation, in order to provide time for potential buyers to evaluate complex assets, meeting this demand could be difficult during an aggregate shock, when this financing is likely to be scarce in the market. Hence, he believes that the availability of OLF funding – under an OLA resolution – could reduce the failing GSIB's impact on the economy.

[35] For a historical example of a disruption in custodian services due to a computer problem at BoNY in 1986, see Ennis and Price (2015). Here, again, our focus is on whether the disruption would be different depending on the shock and resolution and not on whether there would be a cost or not.

Policymaker 2 agrees with Policymaker 1 on the ranking of weights but attaches lower weights overall because he discounts the existence of firesale effects.

Weights on cross–jurisdictional activity Policymaker 1 has weights on the amount of cross–jurisdictional activity that satisfy the following ranking:

$$w^{OLA,A}_{Cross-jur.} < w^{OLA,I}_{Cross-jur.} < w^{Bk,A}_{Cross-jur.} < w^{Bk,I}_{Cross-jur.}.$$

Cross–jurisdictional activity complicates resolutions because of the need for the U.S. authority in charge of the resolution to coordinate with authorities in other countries. Policymaker 1 believes that coordination among the U.S. supervisors in charge of an OLA resolution and any foreign supervisory authorities would be more straightforward than among a U.S. bankruptcy judge and foreign authorities, given that U.S. and foreign supervisors are likely to interact frequently with one another, for example when setting international regulatory standards.[36] Also, he believes that, given the fixed costs of these interactions among policymakers across jurisdictions, in an aggregate event it is more likely that efforts may be put into effect that facilitate any cross–border resolutions under OLA, since policymakers may anticipate that several firms may benefit from them, compared to when just one firm may benefit from these efforts. Hence, under OLA Policymaker 1 gives a lower weight to cross–jurisdictional activity in an aggregate shock than in an idiosyncratic one. Under bankruptcy he believes this coordination would be difficult, but it may be more likely in an aggregate shock because of potential pressure of regulators for jurisdictions to coordinate. Since this is not directly related to firesale concerns, Policymaker 2 agrees with the weights chosen by Policymaker 1.

Weights on amount of QFCs As we discussed earlier, whether a firm's short–term funding is in the form of QFCs will determine potential contagion effects to counterparties (lower value to long–term creditors but speedier repayment to the counterparties of the QFCs) and potential firesale effects. Also, the total amount of QFC financing may be informative about DIP financing needs. The relative importance of these effects is a particularly controversial matter, and we illustrate how different opinions may affect impact estimates by presenting weights for a second policymaker (who we call Policymaker 2) that contrasts with that of Policymaker 1.

We assume that Policymaker 1 and 2 agree on the DIP financing needs that come from QFC use and that these needs are more of a concern under bankruptcy than under OLA because of the availability of OLF funding. They also agree that QFCs are useful in minimizing the contagion effect to short–term creditors. However, Policymaker 1 believes that these benefits to short–term creditors are outweighed by the negative effect that the liquidation of the assets backing the QFCs will have on third parties that are holding these same assets. That is, Policymaker 1 believes that there will be a firesale–like effect on asset prices that will affect the financial system through the balance sheet channel. Policymaker 2 does not think that prices will be affected by the sale of the

[36] As an example of this idea, FDIC General Counsel Michael H. Krimminger noted in 2011 testimony that: "the regulatory authorities who will administer the OLA are in a far better position to coordinate with foreign regulators in the failure of an institution with significant international operations."

assets per se. For illustration, we assume that this disagreement between the two Policymakers is important enough that overall the combination of these three effects results in a lower weight for OLA for Policymaker 1, while Policymaker 2 estimated the impact to be lower under bankruptcy.

Policymaker 1 has weights on the amount of QFC short–term funding that satisfy the following ranking:

$$w_{QFC}^{OLA,I} < w_{QFC}^{Bk,I} < w_{QFC}^{OLA,A} < w_{QFC}^{Bk,A}.$$

Policymaker 2 has weights on the amount of QFC short–term funding that satisfy the following ranking:

$$w_{QFC}^{Bk,I} < w_{QFC}^{OLA,I} < w_{QFC}^{Bk,A} < w_{QFC}^{OLA,A}.$$

Again, these effects are more important in an aggregate shock.

Weights on the ratio of QFC to assets Typically there are margins on derivatives, or haircuts on repo collateral, to compensate counterparties for the risk of default on the contract. As a result, when QFC contracts default and collateral (including margin and haircut amounts) is seized, the defaulting firm suffers a loss equal to the amount of the margin or haircut, and fewer assets remain for non–QFC creditors. Hence, a higher ratio of QFCs to assets normally means higher losses to non–QFC creditors in the case of default. We assume that Policymaker 1 and 2 have equivalent concerns for the contagion that flows from the seizure of collateral and haircuts to losses to long term creditors. Policymaker 1 also believes that the liquidation of the collateral will lead to further price decreases due to firesale effects. This disagreement means that Policymaker 1's weights on this characteristic will be higher than those of Policymaker 2.

OLA's mini–stay can imply smaller losses on QFCs because it allows for the transfer of the contracts, rather than liquidation. The mini–stay can imply, thereby, less contagion to long–term debt holders. For example, for contracts such as derivatives, the stay period means more time to identify counterparties to take on the same side of a hedge, which may mean losses smaller than the margin amount, since a similarly positioned firm may value the contract more than the counterparty. Hence, OLA's mini–stay may translate into a higher liquidation value of the failing firm, benefiting non–QFC creditors. This effect will be directly related to the fraction of assets that are financed through QFCs, and hence the ratio of QFCs to assets, rather than the absolute QFC amount. Therefore, the ratio is the relevant measure to consider here. Because of this benefit of the QFC mini–stay, losses under bankruptcy (where QFC holders are allowed to seize collateral plus margins and haircuts immediately) will be weighted as larger than under OLA. Moreover, these losses to long–term creditors may be more of a concern in an aggregate shock. Policymaker 1 and Policymaker 2's weights, that reflect this thinking, will satisfy:

$$w_{QFC/Assets}^{OLA,I} < w_{QFC/Assets}^{OLA,A} < w_{QFC/Assets}^{Bk,I} < w_{QFC/Assets}^{Bk,A}.$$

Weights on amount of non–QFC Short–term Funding The amount of non–QFC short–term funding can be informative, as we described in previous sections, about three different types of impacts: DIP financing needs, direct contagion to the troubled firm's short–term creditors and indirect contagion to the financial system through firesale effects.

Concerning the first impact (DIP financing needs), any short–term funding that would be subject to the automatic stay will have incentive to run at the earliest sign of financial trouble. Because of this, Policymaker 1 takes the amount of non–QFC short–term debt as indicative of potential DIP financing needs (since any short–term debt that does not run before failure will be subject to the stay, it will not translate into financing needs, so non–QFC short–term funding may be less of a concern for this effect than QFCs). DIP financing needs will be more of a concern under bankruptcy than OLA because, again, of the availability of funds from the OLF.[37]

Second, Policymaker 1 believes there will be an impact of non–QFC short–term debt in the form of contagion of financial troubles to counterparties that are not repaid. This applies to non–QFCs that do not run and are subject to the automatic stay once the firm fails. Moreover, Policymaker 1 believes that the availability of a credit line from the Treasury under OLA would mainly be useful in bailing out short–term debt. This implies that he gives non–QFC short–term financing a lower weight under OLA than under bankruptcy.

Third, Policymaker 1 believes that whenever short–term funding does not roll over, the firm will need to liquidate assets, potentially affecting market prices for similar assets (meaning have a firesale effect). Again because not all short–term debt will necessarily run before failure, Policymaker 1 has lower firesale concerns for this debt than for QFCs.

DIP financing needs, contagion and firesale concerns are all larger problems in an aggregate shock scenario, because financing may well be scarce (or expensive) in the market, on one hand, and because firms likely to be hurt by firesales or nonrepayment (contagion) would be in a weaker state in an aggregate shock.

Moreover, the difference between Policymaker 1's OLA and Bankruptcy weights is larger in an aggregate than idiosyncratic shock, because he believes that the political willingness to bail out short–term debt will be stronger in an aggregate shock (or the potential opposition will be weaker). Hence, Policymaker 1's weights on non–QFC short–term debt will be ranked as follows:

$$w^{OLA,I}_{ST\ Fund} < w^{Bk,I}_{ST\ Fund} < w^{OLA,A}_{ST\ Fund} < w^{Bk,A}_{ST\ Fund}.$$

Policymaker 2 agrees with Policymaker 1 on the problems that might arise when attempting to raise DIP financing and about the risk of contagion to the failing firm's short–term creditors if they are unable to withdraw funds during a stay. However, Policymaker 2 differs from Policymaker 1 in that he does not worry about firesale effects so the third impact (firesale effects) is not relevant for him.

In summary, the ranking of weights for Policymaker 2 coincides with those for Policymaker 1, but the weights will be lower because he does not worry about firesale effects.

[37] There is nothing in the bankruptcy code that prevents the Treasury from providing DIP financing in a bankruptcy process. There are, however, very few examples of this. Some notable cases were the GM and Chrysler bankruptcy process in 2009. There are several reasons that should make this financing from the Treasury more difficult and slower to obtain than under OLA. First, trustees of the failing company need to argue in front of the bankruptcy judge that ordinary course financing is not available in the market (Reference GM arguing in front of the courts). Second, any funding approved by the Treasury would be subject to the usual scrutiny in the U.S. political system and could come at a high political cost to the administration.

Weights on the ratio of non–QFC Short–term Funding to assets As already noted, this ratio is informative about losses to long–term debt holders; a troubled firm will be forced to liquidate assets as short–term financing is withdrawn prior to failure (at least to the extent that short–term creditors are aware of the firm's troubles). Policymaker 1 believes that there might be a firesale effect that drives down the price of the assets being sold to cover short–term debt withdrawals. As far as the effect of a run on short–term debt in the days leading up to failure, there should be little or no difference between bankruptcy and OLA in the amount of loss to long–term debt holders, given that non–QFC short–term funding withdrawals can only occur before resolution and both bankruptcy and OLA resolution impose a stay on withdrawals. On the other hand, once the firm fails, assets will need to be liquidated in order to repay creditors. If OLA modifies debt priority rules to favor short–term creditors to the detriment of long–term creditors (which Dodd–Frank allows),[38] then long–term debt holders may be worse off under OLA than under bankruptcy, where debt priority rules may result in a split of losses that is more favorable to long–term debt holders. However, if OLA makes use of the OLF to protect short–term creditors, less liquidation may be needed. Depending on the extent to which OLF is used, this latter effect may dominate, making losses less of a concern under OLA. In our weights we assume that this latter effect does indeed dominate. As usual, it seems reasonable to assume these concerns of contagion are larger in an aggregate state, and we assume for illustration purposes that the weights for both resolution methods are the largest in an aggregate shock. Policymaker 1's weights, then, satisfy the following ranking:

$$w^{OLA,I}_{ST\ Fund/Assets} < w^{Bk,I}_{ST\ Fund/Assets} < w^{OLA,A}_{ST\ Fund/Assets} < w^{Bk,A}_{ST\ Fund/Assets}.$$

The ranking of weights for Policymaker 2 will be the same, but Policymaker 2's weights will be lower, especially in an aggregate shock, because he is not concerned about firesale effects.

Weights on the inverse of the Liquidity Coverage Ratio As we argued above, a firm with a higher "inverse of the LCR" will suffer more losses if its short–term debt holders run prior to its failure. Such a firm will also suffer more losses if its QFCs get liquidated thanks to an exemption to the stay once the firm is in bankruptcy. Hence, a high inverse of the LCR translates into contagion to long–term debt holders because there are fewer resources remaining in the firm. Note that we are already penalizing firms that have high ratios of QFC/Assets and Non–QFC debt/assets. The reason to include the inverse of the LCR is that, for two firms with similar values of these two ratios, long–term creditors of the firm with the higher inverse will suffer more losses in the event of failure. Hence the ranking weights here will mimic that of the other two characteristics:

$$w^{OLA,I}_{1/LCR} < w^{Bk,I}_{1/LCR} < w^{OLA,A}_{1/LCR} < w^{Bk,A}_{1/LCR}.$$

Also, Policymaker 1 will have higher weights than Policymaker 2 because of his extra concern with firesales.

[38] See Pellerin and Walter (2012), p. 11, 16-17.

5.1 Resolvability determinations under three types of policymakers

Figure 11 presents the results for our examples: they show how these different sets of weights would translate into different designations of firms' structures as acceptable. The actual scores that determine these designations are included in a table in the Appendix. For this exercise, we normalize each firm's entry for each characteristic by the sum of that characteristic for the 34 firms that we have in our sample for the year 2015.

These illustrative examples are constructed so that for each of the four policymakers a different list of firms is considered resolvable. We now discuss the commonalities and disagreements as a way to better understand the sensitivity of the score to the policymaker's weights. For Policymaker 1(a), by construction, all firms are considered acceptable. Hence, we will focus on disagreements among the other Policymakers: P1(b), P2 and P3. An Excel spreadsheet that computes our score is available as an online appendix, so that readers can modify weights themselves and explore implications for the list of firms.

First, note that all disagreements between P1(b) and P2 (columns 2 and 3 in the table of Figure 11) can be tracked to disagreements about the weights in our score that capture impact due to firesales (see weights in red in Figure 10). Most of these disagreements relate to debt structure. Looking at the detailed scores for the firms (listed in Figure 13 in the appendix) we see that for U.S. Bancorp, PNC Financial Services, and Capital One, OLA is the preferred choice for P1(b) in an aggregate shock, while P2 chooses bankruptcy. Disagreements about the importance of firesales will be most important for middle–sized firms, for which the scores on debt–related characteristics can make a meaningful difference in their final score. In other words, P1(b) and P2 disagree about the best method to resolve U.S. Bancorp, PNC Financial Services, and Capital One Financial because, for the characteristics for which these policymakers agree on weights, the measured values are low enough that a disagreement on the weights of interconnectedness, complexity, and new debt–related terms tilts the comparison between costs of bankruptcy and costs of OLA. The policymaker not concerned with firesales (P2) gives these three firms much lower partial scores based on their interconnectedness, complexity, and debt structure in bankruptcy, and this makes the bankruptcy score the lowest and the firms resolvable. For the largest six companies, on the other hand, their high numbers on size, substitutability, and cross–jurisdictional activity drive the comparison of the scores, even for the policymaker who discounts the fire–sale effect from the rest of the characteristics. This can also be understood by focusing on HSBC and Bank of New York Mellon (BoNY), which are similar in size to PNC. While the partial score attached to short–term debt items is also low for these two firms when fire sales are not considered, their measures of complexity (HSBC) and substitutability (BoNY) are at least one order of magnitude higher than those of PNC and hence the relative disadvantages of bankruptcy for dealing with complexity and substitutability end up implying that these firms are not resolvable. Lastly, a firm such as Deutche Bank Trust Corporation, of relatively small size in this sample, would normally be considered resolvable but it has very high entries for non–QFC short–term debt to assets ratio, and for illiquidity of its assets, so P1 considers OLA the best method to resolve it in an aggregate shock.

To see the difference that looking beyond size can make in resolvability determinations, we compare Policymaker's (3) results with the rest of the columns. Policymaker 3 considers the structure of

	Policymaker 1 (a)	Policymaker 1 (b)	Policymaker 2	Policymaker 3
JPMORGAN CHASE & CO.	TRUE	FALSE	FALSE	FALSE
BANK OF AMERICA CORPORATION	TRUE	FALSE	FALSE	FALSE
CITIGROUP INC.	TRUE	FALSE	FALSE	FALSE
WELLS FARGO & COMPANY	TRUE	FALSE	FALSE	FALSE
GOLDMAN SACHS GROUP, INC., THE	TRUE	FALSE	FALSE	FALSE
MORGAN STANLEY	TRUE	FALSE	FALSE	FALSE
U.S. BANCORP	TRUE	FALSE	TRUE	FALSE
HSBC NORTH AMERICA HOLDINGS INC.	TRUE	FALSE	FALSE	FALSE
PNC FINANCIAL SERVICES GROUP, INC., THE	TRUE	FALSE	TRUE	FALSE
BANK OF NEW YORK MELLON CORPORATION, THE	TRUE	FALSE	FALSE	FALSE
CAPITAL ONE FINANCIAL CORPORATION	TRUE	FALSE	TRUE	FALSE
TD GROUP US HOLDINGS LLC	TRUE	TRUE	TRUE	FALSE
STATE STREET CORPORATION	TRUE	FALSE	FALSE	FALSE
BB&T CORPORATION	TRUE	TRUE	TRUE	TRUE
SUNTRUST BANKS, INC.	TRUE	TRUE	TRUE	TRUE
AMERICAN EXPRESS COMPANY	TRUE	TRUE	TRUE	TRUE
CHARLES SCHWAB CORPORATION, THE	TRUE	TRUE	TRUE	TRUE
FIFTH THIRD BANCORP	TRUE	TRUE	TRUE	TRUE
ALLY FINANCIAL INC.	TRUE	TRUE	TRUE	TRUE
CITIZENS FINANCIAL GROUP, INC.	TRUE	TRUE	TRUE	TRUE
REGIONS FINANCIAL CORPORATION	TRUE	TRUE	TRUE	TRUE
BMO FINANCIAL CORP.	TRUE	TRUE	TRUE	TRUE
SANTANDER HOLDINGS USA, INC.	TRUE	TRUE	TRUE	TRUE
MUFG AMERICAS HOLDINGS CORPORATION	TRUE	TRUE	TRUE	TRUE
M&T BANK CORPORATION	TRUE	TRUE	TRUE	TRUE
NORTHERN TRUST CORPORATION	TRUE	TRUE	TRUE	TRUE
KEYCORP	TRUE	TRUE	TRUE	TRUE
DISCOVER FINANCIAL SERVICES	TRUE	TRUE	TRUE	TRUE
BANCWEST CORPORATION	TRUE	TRUE	TRUE	TRUE
BBVA COMPASS BANCSHARES, INC.	TRUE	TRUE	TRUE	TRUE
COMERICA INCORPORATED	TRUE	TRUE	TRUE	TRUE
HUNTINGTON BANCSHARES INCORPORATED	TRUE	TRUE	TRUE	TRUE
ZIONS BANCORPORATION	TRUE	TRUE	TRUE	TRUE
DEUTSCHE BANK TRUST CORPORATION	TRUE	FALSE	TRUE	TRUE

Figure 11: Resolvability determinations. Firms are ordered from largest to smallest according to Total Exposures. A firm's structure is acceptable if the impact score under Bankruptcy is smaller than under OLA or a bailout in both crises scenarios. TRUE = acceptable, FALSE = non—acceptable.

TD Group non–acceptable (OLA is his preferred resolution alternative in an aggregate shock), while Policymakers 1(b) and (2) think of it as acceptable. The reason for the difference is that the firm is fairly large and therefore receives a high impact score from Policymaker 3, who discriminates only based on size. At the same time, it has fairly low readings on their non–size characteristics (such as Interconnectedness, Substitutability, and Non–QFC Short–Term Debt/Assets), which leads Policymakers 1(b) to view the firm as resolvable in bankruptcy. In general, for Policymaker 3, OLA will be the preferred option for firms with a middle–of–the–range size: OLA has a lower impact weight, but it does carry a moral hazard impact as well. A simple way to rationalize this is to think of the parameters of the linear function of size that is behind the score: the impact of size under OLA has a lower slope, but a higher intercept, while the bailout score is independent of size. This implies two thresholds in size that determine the firms that will be best resolved under bailout, OLA, and bankruptcy.

It is interesting to compare our Policymaker 1(a) determination of adequate structure with the determinations of the FDIC and the Board about the credibility of LWs. For the 2015 review process, either the Board or the FDIC (or both) determined that the LWs of most of the firms being reviewed that year had deficiencies important enough to fail the review process.[39] Neither of the two agencies found deficiencies in Citigroup's LW. To square our results, which indicate that for Policymaker 1(a) all firms have an acceptable structure, with the fact that these LW reviews found deficiencies, it is necessary to recall that one important limitation of our exercise is that we lack information on the "plan" in the LWs. As a result of this limitation, some deficiencies that are not necessarily associated with characteristics cannot be captured in our impact score. For example, one deficiency found in Bank of America's LW was the failure to specify clear triggers under which the parent company would provide liquidity to its subsidiaries, which is a plan item rather than a firm characteristic that we can pick up in our financial–report–based score.[40]

As a final comment on our results, we want to emphasize again that our main contribution in this paper is conceptual. The exercise presented in Figure 11 is just for illustration and our score is far from being ready for policy use. More work is needed both to expand the list of scenarios considered in it, to include any missing relevant characteristics of the firms, and to have the weights be empirically based.

5.2 Comparison to the GSIB score

Another way of understanding what the new firm characteristics add to the determination of resolvability is to compare the ranking of firms according to the Basel GSIB score with our impact score. We choose the comparison with the bankruptcy aggregate impact because that is likely to be the assumption under which Basel understands the weights they use. Figure 12 presents the results. The main differences in ranking are for smaller firms: while the GSIB score ranks them low, the impact scores assign them more impact due to their relatively high numbers in the short-term debt ratios and liquidity measures. This means that the smallest firm in the sample, Deutche Bank

[39] The list of firms whose LWs had deficiencies in 2015 is: Bank of America, Bank of New York Mellon, JP Morgan Chase, State Street, Wells Fargo, Goldman Sachs, and Morgan Stanley.

[40] Bank of America Living Will Feedback Letter (2016).

Trust Corporation, is raked 13 out of 34 according to our impact score, while it was 34 under the GSIB.

6 Extensions

In this section, we highlight a few other firm characteristics that would be relevant to calculate the impact of a failure. These are characteristics that are difficult to measure and we leave their inclusion in the impact score for future research: information on counterparties, data on network structure, measures of impact outside of the financial system, legal complexity, core businesses and services, and aspects of capital structure.

6.1 Information about counterparties

In the LWs, filers are asked to identify their "major counterparties ... and describe the interconnections, interdependencies and relationships with such major counterparties."[41] Schedule B (Interconnectedness Indicators) can be thought of as a "rough," publicly available, measure of these interconnections. Although privacy concerns must be taken into account, we think it would be beneficial to construct, in the spirit of the LCR, a summary measure, based on average trades, that captures the importance of the filing BHC to other financial institutions or to companies outside of the financial system. For example, given that an individual firm knows to whom it is lending and, and from these firms' 10-Ks, the total amount of borrowing of each of its borrowers, a firm could fairly easily estimate the percent of each of its major borrowers' total funding that it represents. Then, the firm could be required to report the total number of companies for which it represents more than a threshold percent. Presumably, reporting of such a count would not reveal private information.

6.2 Network structure

Even though there is information about the overall amount of interconnectedness in Schedule B, the schedule ignores the network structure of counterparties, which is important for financial system resilience in the event of failure (Allen and Gale, 2000). The recent literature on networks has developed summary statistics that help characterize contagion propensity of different classes of networks (see, for example, Gai and Kapadia, 2007). Including such statistics in the score, if feasible, would be informative about contagion effects. Further work is necessary to establish the optimal statistic and to deal with information revelation concerns.

6.3 Interconnectedness outside the financial system

We care greatly about contagion within the financial system because disturbances to the financial system are thought to have a greater impact on economic output than disturbances in other sectors.

[41] "Federal Reserve System Reporting Requirements Associated with Regulation QQ (Resolution Plans Required), Model Template for §165(d) Tailored Resolution Plan." January 31, 2016, p. 18. Available at: https://www.federalreserve.gov/bankinforeg/resolution-plans/tailored-resolution-model-template.pdf.

	GSIB		Impact score			
Bank	Score (approx.)	Ranking (GSIB)	Impact score under Bankruptcy resolution and Aggregate shock (1(a))(*)	Ranking (1)	Impact score under Bankruptcy resolution and Aggregate shock (2)(*)	Ranking (2)
JPMORGAN CHASE & CO.	192	1	148	1	166	1
BANK OF AMERICA CORPORATION	124	3	110	3	121	3
CITIGROUP INC.	178	2	117	2	135	2
WELLS FARGO & COMPANY	88	5	72	5	86	5
GOLDMAN SACHS GROUP, INC., THE	95	4	85	4	87	4
MORGAN STANLEY	78	6	63	6	67	6
U.S. BANCORP	14	10	19	10	22	10
HSBC NORTH AMERICA HOLDINGS INC.	16	9	28	8	29	9
PNC FINANCIAL SERVICES GROUP, INC., THE	12	12	15	12	17	11
BANK OF NEW YORK MELLON CORPORATION, THE	58	7	34	7	44	7
CAPITAL ONE FINANCIAL CORPORATION	8	13	13	13	15	13
TD GROUP US HOLDINGS LLC	7	14	10	21	11	20
STATE STREET CORPORATION	42	8	26	9	33	8
BB&T CORPORATION	5	18	11	16	13	16
SUNTRUST BANKS, INC.	5	19	11	17	12	18
AMERICAN EXPRESS COMPANY	6	16	7	32	8	30
CHARLES SCHWAB CORPORATION, THE	7	15	7	33	8	29
FIFTH THIRD BANCORP	4	24	11	18	12	19
ALLY FINANCIAL INC.	5	21	9	24	10	23
CITIZENS FINANCIAL GROUP, INC.	3	27	8	26	9	25
REGIONS FINANCIAL CORPORATION	3	28	7	30	8	31
BMO FINANCIAL CORP.	5	20	12	14	13	14
SANTANDER HOLDINGS USA, INC.	4	23	9	23	10	22
MUFG AMERICAS HOLDINGS CORPORATION	4	22	12	15	12	17
M&T BANK CORPORATION	3	26	8	27	9	27
NORTHERN TRUST CORPORATION	14	11	10	19	13	15
KEYCORP	3	29	10	20	10	21
DISCOVER FINANCIAL SERVICES	3	25	4	34	4	34
BANCWEST CORPORATION	2	33	8	25	9	26
BBVA COMPASS BANCSHARES, INC.	2	31	7	31	8	32
COMERICA INCORPORATED	2	32	9	22	10	24
HUNTINGTON BANCSHARES INCORPORATED	2	30	8	28	8	28
ZIONS BANCORPORATION	1	34	7	29	8	33
DEUTSCHE BANK TRUST CORPORATION	6	17	15	11	17	12

Figure 12: Comparison of the score and the ranking of firms according to the GSIB score and our impact score, under two different policymaker's weights.

Accordingly, Schedule B is focused on capturing the direct impact of the failure of the reporting firm for the financial system and holders of GSIB–issued securities. However, we think it would be valuable to capture more generally the impact on the rest of the economy. At some level, the TE measure can be thought of as a measure of potential contagion to all the economy, but nevertheless, more specific information on the importance of a firm for the rest of the economy would be worth collecting and including in the score. For example, we would estimate higher impact if the GSIB is a major payments provider to a major nonfinancial firm or a major lender to the airline industry.

6.4 Legal complexity, critical operations, and core businesses

We analyzed the feedback letters arising from the 2016 LW review process to look for firm characteristics that were singled out as problematic for resolution (as opposed to shortcomings in the plans for resolution). We found that regulators highlighted, in letters to several banks, an overly complex legal entity structure (JP Morgan, State Street, and Wells Fargo). One concern, noted in letters, is the location of entities in multiple jurisdictions. Another concern was the existence of cross–guarantees, whereby a parent company bears unlimited liability for contracts created by its subsidiaries. Such guarantees produce strong links between the solvency of different subsidiaries, which may even be in different jurisdictions, and can create complications during resolution due to the possibility of ring–fencing (whereby one jurisdiction prevents assets located within its border from being used to repay debt holders in a different jurisdiction). Given these examples, we would expect a measure of this legal complexity to be included in the GSIB score; but no such measure is incorporated, probably due to the difficulty constructing quantitative and informative measures that can be comparable across firms and over time. This is an area of work that should be prioritized when thinking about resolution.[42]

LWs also require firms to identify both the core businesses of the company and the critical operations that it performs for the financial system. While it appears that information regarding critical operations is already captured in the GSIB score, we argue that information on core businesses is not captured.

Critical operations are those, which, if shut down due to firm failure, would produce a strong negative economic impact. To a large extent, the designation of critical operations is independent of the firm's structure and instead reflects the services provided to the economy. In our view, Schedule C, Substitutability, which records the volume of payments, assets under custody, and underwriting of securities, constitutes a reasonable measure of the importance of a firm's critical operations.

Core businesses are defined as business lines and associated services that are important sources of revenue for the firm. In the event of a wind down, knowing these sources could be helpful, so that they can be protected as much as possible. As an example, IT for a whole BHC may be located in one single subsidiary. In a scenario in which this particular subsidiary becomes insolvent, the most orderly way of winding down the firm may involve using the parent company as a source of strength for the troubled subsidiary, rather than enforcing firewalls (that are intended to prevent the spread of the troubles of one subsidiary to others). It is clear that information about core businesses should inform the "plan" included in LWs. In our example, a resolution plan that proposes to

[42] Schedule E provides minimal information on related ring-fencing concerns. See our discussion above.

sell a troubled subsidiary to minimize its impact on the remainder of the firm might not recognize the importance of IT as a core business line or service. However, readiness for resolution as far as core businesses protection is concerned could also be evaluated in the firm's structure and hence be captured in an impact score. In our example, if a BHC replicates IT services across subsidiaries so that subsidiaries can be sold independently, in a resolution, this should translate into a lower impact score. As with legal complexity, at this point, it is not clear in what way such information could be incorporated into our quantitative impact score in an objective, general, and comparable manner, but it may be an area for future attention.

6.5 Measuring the GSIB's capability to recapitalize systemically important subsidiaries

Another important aspect when evaluating the impact of a failure is the ability of the firm to recapitalize systemically important subsidiaries using either an appropriate trigger for bankruptcy (i.e., filing with enough capital buffer) or through the conversion of long–term debt into capital, as mandated by TLAC. This ability to recapitalize depends both on whether maturity transformation takes place at the parent company or at the subsidiaries (whether the BHC is "clean" or not, according to TLAC requirements) and on the "plan" of resolution that the firms develop. A lack of such ability to recapitalize has been pointed out as a source of deficiency in the evaluation of LWs.[43] The guidance for preparation of LWs issued by the Board and the FDIC in April of 2016 emphasized the need for both external and internal TLAC, as well as the need to pre–position capital and liquidity in certain subsidiaries and to have governance arrangements in place such as early bankruptcy triggers. These are all measures aimed at ensuring the ability of the failing firm to recapitalize all subsidiaries that perform key services in the financial system.[44]

Current capital ratios may be informative about a firm's ability to recapitalize subsidiaries that provide critical services. However, for the purpose of our impact score, specific measures of capital needs of each particular subsidiary may be desirable. As of now, using Y-15 data, we can only construct a score at the BHC level. More work is needed to find publicly available data to construct indicators of the structure of liquidity and capital across subsidiaries and parent companies.

7 Conclusion

Making the resolution of large, systemically important firms feasible without public support (i.e., making the firms "resolvable") has been a priority in recent regulatory changes. One important effort has centered on having firms describe in resolution plans (also known as living wills – LWs) their structures and the means by which these structures, together with a wind–down strategy, contribute to making unassisted bankruptcy the preferred method of resolution. The evaluation of these LWs by regulators is complicated and has been deemed nontransparent to outsiders. In this paper, we seek to develop tools, based on publicly available information, which can complement the LW review process.

[43] See Board of Governors and FDIC (2016a).
[44] See Board of Governors and FDIC (2016c).

Our main contribution is to develop a conceptual framework to illustrate how to quantitatively evaluate whether a firm is resolvable. We consider using a score that maps a firm's financial data into costs imposed on the economy — the impact — of resolving this failing firm via different resolution methods and in different economic scenarios. For a given firm's structure, bankruptcy is preferable — from a certain policymaker's point of view – to other resolution alternatives that involve government support if the resulting impact calculated by the score is the lowest. Our framework makes clear an important concept in the evaluation of LWs: though the failure of a large firm is always going to be disruptive for the economy, the relevant question for resolvability is whether the extra losses stemming from unassisted resolution in bankruptcy are larger than the moral hazard costs of providing support.

We discuss the data needs and difficulties of constructing such an impact score by proposing a simplified two–scenario version of it. For this we use as a starting point the current Basel–developed GSIB score. This score was created as a means of designating global banks as systemic and for setting supplemental capital requirements. It measures how much economic damage a firm might impose by its failure based on firm characteristics (financial data). We discuss each of the firm characteristics included in the GSIB score and evaluate what failure costs each is meant to capture. We supplement the original list of firm characteristics in the GSIB score with information on the structure of debt of the firm, with emphasis on short–term debt and QFCs, as well as liquidity measures. While our objective here is to measure resolvability, our modified score can also be useful in thinking about refinements to this macro–prudential tool. Indeed, in what we think is a step in the right direction, the revisions to the GSIB score for the U.S. implementation of the capital surcharge that are being implemented in 2017 somewhat expand required disclosures on the structure of short–term financing.

The moral hazard problem behind TBTF implies that, as long as firms put a positive probability on assistance in some states of the world, they will have incentive to change their structure or operations in ways that exploit the safety net. It follows from our analysis that the more realistic and complete the set of scenarios the score considers, the more useful this instrument will be in curbing the TBTF problem. In other words, expanding the set of scenarios may help policymakers signal credibly that a firm will not be bailed out in a wide enough range of financial distress scenarios so that creditors believe that the safety net will not protect them from losses under most circumstances

To illustrate the concept of an impact score we compute the simplified two–scenario version of our score with actual firm data and examples of how policymakers may evaluate impact. With these examples, we seek to emphasize how the decisions to bail out a failing firm depend on policymakers' beliefs about how a given firm's characteristics may translate into costs to society. In practice, to make our score a positive tool (describing actual bailout decisions) or a normative tool (evaluating the merits of different bailout policies) we would need empirical data from a number of financial crises to determine the links between firm characteristics and impact from failure. Our work highlights the need for future research along these lines.

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8 Appendix

8.1 Construction of short–term debt items in score

For the purpose of our examples of the impact score in the remainder of the paper, and because data on Schedule G is not yet available, we construct our own measure of short–term borrowing using Y-9C and Call Report data.[45] In the following description of our calculations we provide the item number for Y-9C figures in parenthesis.

- Short-term debt = commercial paper (bhck2309) + "Other borrowed money with a remaining maturity of one year of less," (bhck2332) + "fed funds and repo borrowings" (bhck3353, an average over the last quarter) + uninsured deposits (collected from FDIC data for each institution). Compared to the level of detail on short–term debt borrowing that the schedule G gathers, our measure is fairly coarse. We are not able to break down short–term debt by maturity or identify the portion of short–term debt emanating from within the financial system. These are relevant details in the evaluation of the impact of failure. Once the revised Y-15 form goes into effect, it may be feasible to refine our impact score using this detailed information.

- QFCs = "fed funds and repo borrowings" (bhck3353, an average over the last quarter) + "derivatives purchased with negative fair value ("w.n.f.v.")" (bhckc222) + derivatives sold w.n.f.v. (bhckc220) + derivatives (interest rate swaps) w.n.f.v., traded (bhck8737) and non–traded (bhck8745) + derivatives (foreign exchange) w.n.f.v., traded (bhck8738) and non–traded (bhck8746) + derivatives (equity) w.n.f.v., traded (bhck8739) and non–traded (bhck8747) + derivatives (commodities) w.n.f.v., traded (bhck8740) and nontraded (bhck8748)

[45] The Y-9C, Consolidated Financial Statements for Holding Companies, is a regulatory report, collected by the Federal Reserve gathers "basic financial data from a domestic bank holding company (BHC), a savings and loan holding company (SLHC), a U.S intermediate holding company (IHC) and a securities holding company (SHC) on a consolidated basis in the form of a balance sheet, an income statement, and detailed supporting schedules, including a schedule of off balance-sheet items." The Call Report, or more formally, Consolidated Reports of Condition and Income, is completed by all U.S. banks and savings associations and is submitted to the Federal Financial Institutions Examination Council, an interagency body representing the various U.S. banking supervisors. The Call Report gathers detailed information on depository institution balance sheets, income statements, and off balance sheet items. The Report includes a line item for "Estimated amount of uninsured deposits."

  - Note that, ideally, we would want to leave out of the QFC measure the amount of fed funds borrowings. However, measurements of only repo borrowings are only available as an end-of-quarter measure, which is subject to window-dressing concerns (i.e., that firms may substitute this form of borrowing only on the days in which their accounting information is used for regulatory filings, in order to get a more favorable capital requirement). Hence, we use the entry for both fed funds borrowings and repos, which is provided as an average over the quarter. Because in recent years fed funds borrowings have been relatively low, we think this is a reasonable approximation.

- QFC/Assets: the above measure over "Total Assets" (bhck2170)
- Non–QFC–short–term debt = our above measure of short–term debt - "fed funds and repo borrowings" (bhck3353, an average over the last quarter)
- Non–QFC–short–term debt ratio = our above measure of Non–QFC–short–term debt over "Total Assets" (bhck2170)
- Inverse of Liquidity Coverage Ratio = our above measure of short–term debt over our measure of high-quality liquid assets (HQLA), following the classification used to compute the LCR,[46] where
  - HQLA = HQLA class 1 assets + 0.85 * HQLA class 2a assets, where, in turn,
  - HQLA class 1 assets = hqla_1_1 (bhckd958) + hqla_1_2 (bhckd962) + hqla_1_3 (bhckd967) + hqla_1_4 (bhckd977),
  - HQLA class 2a assets = hqla_2a_1 (bhck1295) + hqla_2a_2 (bhck1298) + hqla_2a_3 (bhckg305) + hqla_2a_4 (bhckg307) + hqla_2a_5 (bhckg379)

About the Repo measure: the list of QFCs includes repos, derivatives contracts such as swaps, forwards, futures, and options. Because the Y-15 does not record separately the importance of QFCs, we calculate our own measure using data from the Y-9C. Our calculation includes only liability-related QFCs, because only GSIB liabilities can produce losses for creditors; so we include repo borrowings and credit derivatives (sold or purchased) with a negative net value.

Although there are other types of derivatives that constitute a liability of the firm, beyond those that we include in our calculation, only for these credit derivatives we can find their current net value. Hence, we are underestimating the amount of liabilities in QFCs. Moreover, we have no information about the maturity of the borrowing, or the liquidity of the collateral in these contracts, which could be useful in considering their relative importance for contagion effects and firesale concerns, as we argue below. This information will be collected by the revised Y-15, allowing for future refinement of our impact score.

About the inverse LCR: while the mapping between liquidity classification (HQLA) from the LCR regulation and firesale concerns is not unambiguous, it could act as a first approximation.

[46] Data on the LCR for GSIBs and large foreign organizations are collected at high frequencies by regulators, but they are not publicly available.

For Level 1 collateral (cash, central bank reserves, certain sovereign debt, and securities backed by central banks) firesales are likely to be of little concern, because the total market volumes of Level 1 items are probably too large for a single institution to affect their price through a rushed sale. For Level 2a assets (securities or debt issued by government agencies and riskier sovereign debt) and Level 2b assets (certain mortgage backed securities and corporate debt and equity), the concern might be stronger, and probably, for our measure, we would be the most concerned with any debt backed with assets with a rating below 2b. Because of this, we do not include them as HQLA.

The next tables present the scores we calculated for the 34 BHC in 2015, for each policymaker.

Figure 13: Scores according to the three policymakers in our examples.

	IMPACT SCORE - Policymaker 1(a)						IMPACT SCORE - Policymaker 1(b)					
	Idiosyncratic Failure			Aggregate Failure			Idiosyncratic Failure			Aggregate Failure		
	Bankruptcy	OLA	Bailout	Bankruptcy	OLA	Bailout	Bankruptcy	OLA	Bailout	Bankruptcy	OLA	Bailout
JPMORGAN CHASE & (	715	1101	2000	1482	1529	1600	1430	1153	600	2964	2217	350
BANK OF AMERICA CC	502	944	2000	1097	1236	1600	1005	838	600	2195	1632	350
CITIGROUP INC.	600	1013	2000	1172	1292	1600	1200	976	600	2344	1743	350
WELLS FARGO & COMI	305	841	2000	722	982	1600	610	633	600	1445	1125	350
GOLDMAN SACHS GRC	392	841	2000	850	1024	1600	783	631	600	1701	1208	350
MORGAN STANLEY	302	792	2000	628	874	1600	603	534	600	1256	908	350
U.S. BANCORP	77	662	2000	186	591	1600	154	274	600	371	342	350
HSBC NORTH AMERIC/	119	675	2000	280	636	1600	238	299	600	560	432	350
PNC FINANCIAL SERVI	57	647	2000	147	558	1600	114	244	600	293	275	350
BANK OF NEW YORK M	182	749	2000	337	718	1600	365	448	600	673	597	350
CAPITAL ONE FINANCI	51	641	2000	131	549	1600	102	231	600	261	258	350
TD GROUP US HOLDIN	41	632	2000	97	521	1600	81	214	600	193	203	350
STATE STREET CORPOI	137	712	2000	256	652	1600	273	374	600	513	464	350
BB&T CORPORATION	45	636	2000	114	538	1600	91	223	600	229	235	350
SUNTRUST BANKS, INC	44	635	2000	108	531	1600	89	219	600	217	222	350
AMERICAN EXPRESS C	28	622	2000	72	504	1600	57	193	600	143	169	350
CHARLES SCHWAB COI	29	625	2000	69	503	1600	59	199	600	137	165	350
FIFTH THIRD BANCORI	43	634	2000	106	532	1600	86	218	600	213	224	350
ALLY FINANCIAL INC.	33	626	2000	90	519	1600	66	203	600	180	199	350
CITIZENS FINANCIAL G	34	627	2000	84	514	1600	68	203	600	168	189	350
REGIONS FINANCIAL C	29	623	2000	72	506	1600	58	197	600	145	171	350
BMO FINANCIAL CORF	49	638	2000	121	543	1600	97	225	600	242	245	350
SANTANDER HOLDING	36	629	2000	93	521	1600	71	207	600	185	202	350
MUFG AMERICAS HOLI	46	637	2000	116	539	1600	92	223	600	232	239	350
M&T BANK CORPORAT	32	625	2000	80	511	1600	64	200	600	160	183	350
NORTHERN TRUST COI	54	644	2000	102	530	1600	109	238	600	204	221	350
KEYCORP	39	631	2000	97	525	1600	78	212	600	193	210	350
DISCOVER FINANCIAL	14	611	2000	39	480	1600	28	172	600	78	120	350
BANCWEST CORPORA	34	627	2000	84	515	1600	68	203	600	168	190	350
BBVA COMPASS BANC	29	623	2000	72	506	1600	59	196	600	144	172	350
COMERICA INCORPOR	37	630	2000	94	523	1600	75	209	600	187	207	350
HUNTINGTON BANCSH	31	625	2000	79	511	1600	63	201	600	159	182	350
ZIONS BANCORPORAT	29	623	2000	72	507	1600	58	196	600	145	174	350
DEUTSCHE BANK TRUS	66	654	2000	155	573	1600	132	258	600	310	307	350

	IMPACT SCORE - Policymaker 2						IMPACT SCORE - Policymaker 3					
	Idiosyncratic Failure			Aggregate Failure			Idiosyncratic Failure			Aggregate Failure		
	Bankruptcy	OLA	Bailout	Bankruptcy	OLA	Bailout	Bankruptcy	OLA	Bailout	Bankruptcy	OLA	Bailout
JPMORGAN CHASE & (	935	938	600	1660	1336	350	1331	1072	600	2820	2079	350
BANK OF AMERICA CC	623	676	600	1207	969	350	1196	978	600	2533	1874	350
CITIGROUP INC.	833	812	600	1350	1071	350	1012	851	600	2144	1595	350
WELLS FARGO & COMI	412	504	600	865	699	350	914	783	600	1935	1446	350
GOLDMAN SACHS GRC	456	514	600	870	690	350	575	548	600	1217	932	350
MORGAN STANLEY	375	445	600	671	542	350	472	477	600	999	775	350
U.S. BANCORP	99	232	600	220	223	350	221	303	600	468	395	350
HSBC NORTH AMERIC/	129	248	600	292	261	350	191	283	600	405	350	350
PNC FINANCIAL SERVI	71	210	600	171	183	350	180	275	600	381	333	350
BANK OF NEW YORK M	288	400	600	438	419	350	171	269	600	363	320	350
CAPITAL ONE FINANCI	62	201	600	151	172	350	159	260	600	336	301	350
TD GROUP US HOLDIN	51	191	600	114	142	350	126	237	600	268	252	350
STATE STREET CORPOI	211	332	600	327	324	350	108	224	600	228	223	350
BB&T CORPORATION	53	193	600	128	156	350	100	219	600	211	211	350
SUNTRUST BANKS, INC	52	192	600	121	150	350	99	219	600	210	210	350
AMERICAN EXPRESS C	37	179	600	83	121	350	81	206	600	171	182	350
CHARLES SCHWAB COI	40	184	600	84	123	350	80	205	600	169	181	350
FIFTH THIRD BANCORI	49	190	600	117	148	350	73	200	600	154	170	350
ALLY FINANCIAL INC.	38	181	600	99	135	350	69	198	600	146	165	350
CITIZENS FINANCIAL G	39	181	600	93	130	350	68	197	600	144	163	350
REGIONS FINANCIAL C	33	177	600	80	121	350	62	193	600	132	155	350
BMO FINANCIAL CORF	55	194	600	130	159	350	62	193	600	130	153	350
SANTANDER HOLDING	40	183	600	100	136	350	61	192	600	128	152	350
MUFG AMERICAS HOLI	50	191	600	124	154	350	59	191	600	125	150	350
M&T BANK CORPORAT	36	179	600	87	126	350	59	191	600	125	149	350
NORTHERN TRUST COI	82	219	600	130	164	350	58	190	600	123	148	350
KEYCORP	44	185	600	104	140	350	53	187	600	113	141	350
DISCOVER FINANCIAL	17	164	600	45	94	350	45	181	600	95	128	350
BANCWEST CORPORA	37	179	600	90	129	350	44	181	600	94	127	350
BBVA COMPASS BANC	33	176	600	78	120	350	43	180	600	92	126	350
COMERICA INCORPOR	40	182	600	99	137	350	38	176	600	80	117	350
HUNTINGTON BANCSH	34	178	600	84	124	350	33	173	600	71	111	350
ZIONS BANCORPORAT	31	175	600	76	119	350	28	170	600	60	103	350
DEUTSCHE BANK TRUS	77	216	600	168	195	350	24	167	600	51	97	350