Cash Holdings and Bank Compensation[1]

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Abstract: *We propose a transparent and operationalizable cash requirement for financial firms with the objective of inducing conservatism in risk-taking and thereby limiting the expected social cost from their failure. The cash requirement increases in the leverage of the firm and in its vulnerability to aggregate stress. The requirement can be met by deferring employee compensation in the form of an escrowed cash reserve account with a vesting schedule, but with contingent transfer to the firm in case of stress to repay its creditors. We provide illustrative numerical calculations for the proposed cash requirement based on data covering the financial crisis of 2007-08.*

Key words: Financial stability, risk management, managerial incentives, deferred cash compensation

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[1] The views expressed in the paper are those of the authors and are not necessarily reflective of views at the Federal Reserve Bank of New York or the Federal Reserve System.

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1. Introduction

Executive pay in banks and the possible incentives it provides for excessive risk-taking has been the focus of considerable attention in the wake of the financial crisis. An issue of particular concern is that compensation has traditionally been designed to align management's interests with those of equityholders but not those of creditors or other stakeholders such as taxpayers. From a regulatory perspective, the challenge, it would appear, is to modify this design in a way that continues to encourage value creation even as it discourages excessive risk-taking that could lead to bank failures.

In this paper, we offer a simple set of guidelines for this purpose. Our approach, which relies on the use of *cash* rather than debt or equity, offers, more generally, a simple and transparent framework for thinking about the role of cash in a bank's capital structure and for identifying a lower bound on the amount of cash banks should be required to hold to avoid systemic crises. Simplicity, transparency and operationalizability of the cash-requirement rules are key. Our objective is to draw on the various properties of cash as part of a bank's assets to furnish us with a benchmark level of cash holdings that are optimal from a regulatory standpoint.

Distilled to its basics, our approach is to use cash compensation in banks as a *contingent asset* of the banks. We propose that incentive compensation in banks involve a substantial cash component; that this component be deferred and placed in an escrow account with a vesting schedule; and that ownership of the account revert to the bank in stressed times (subject to creditors' forfeitures) allowing the bank to access this cash to pay down its debt or otherwise bolster its assets.

Our proposal is closely related to, but distinct from, the notion of "contingent capital." Contingent capital is debt which converts to equity under pre-specified triggers, thus reducing the leverage ratio of the bank in stressed times. As such, contingent capital is effectively a contingent *liability* of the bank, whereas the cash in our model represents a contingent *asset*; of course, to the extent that cash may be viewed as negative debt, this terminological distinction may not in itself be that important. But unlike contingent capital, the contingent asset in our proposal is intended to come entirely from deferred executive compensation, so directly affects risk-taking incentives of the executive. Moreover, there is no dilution of existing equity from the trigger in our approach. Further, the cash is compensation that has already been paid out by the bank but which is held in escrow and which it claws back in poor times; it is a not a liability owed by the bank. Importantly, we do not pin down the absolute size of cash holdings but determine this in relative terms as a function of the bank's choice of equity levels and other parameters; *inter alia*, as the equity cushion decreases, our proposed cash holding requirement increases. As an alternative to holding more cash, banks can choose to deleverage to bring down the minimum required cash holdings.

For "typical" numbers for US banks, we find a cash requirement of around 18%-25% of equity value. However, empirical analysis suggests the numbers are highly variable depending on the actual asset mix used by a bank at a given point in time; we find that cash requirements for many US financial institutions (including those like Fannie and Freddie that later failed) often comfortably exceeded 50%-60% even by late-2006 and early-2007.

Finally, an important if obvious caveat to our proposal. Since a major focus of our analysis is on avoiding bank failures in stressed times, the cash holdings we derive will necessarily be more than required in "normal" times. We regard this as the natural cost of avoiding the macroeconomic/systemic costs of financial system disruptions stemming from bank failures.

Our proposal is outlined in Section 2; a discussion of its empirical properties follows in Section 3. Section 4 provides a discussion on the use of deferred cash in compensation and its role in promoting financial stability relative to other instruments such as inside debt or deferred equity. The model underlying the proposal is presented in Section 5.

2. The Proposal

In Section 5 below, we derive our minimum cash holding rule in a simple and transparent model. We find that a bank's minimum cash holding C must satisfy

$$C \geq (1-q)D - qE(1-MES). \tag{1}$$

or, equivalently, that

$$\frac{C}{E} \geq (1-q)\frac{D}{E} - q(1-MES). \tag{2}$$

where D is the amount of the bank’s debt, $1-q$ is the potential loss in asset value that would result from a liquidation in stressed times, E is the equilibrium value of the bank’s equity (assuming implementation of our proposal), and MES is the marginal expected shortfall of bank equity conditional on stressed times.

A Numerical Illustration

Suppose that

1. The initial capital structure is $D/E = 9.0$
2. The loss in asset value from forced liquidation is 6%, so $q = 0.94$.
3. In a stress scenario, the bank loses 50% of equity value in a crisis: $MES = 0.50$.

Then, plugging in these numbers into the RHS of expression (2), we obtain the condition

$$\frac{C}{E} \geq (0.06 \times 9.0) - [0.94 \times 0.50] = 0.07,$$

meaning that the bank's cash holding should be around 7% of its equity value. Of course, cash requirements would climb steeply as losses in liquidation mount. For example, if we assume $1 - q = 8\%$, the the required minimum cash ratio rises sharply to 26%, while at $1 - q = 10\%$, the required minimum escrowed cash holding surges to 45% of equity value.

3. Empirical Analysis

Using historical estimates of MES from the NYU Stern School of Business V-Lab—which provides these as Long Run Marginal Expected Shortfall ($LRMES$) in a stress scenario (modeled as 40% decline in the S&P500 index return)—along with an assumption concerning q, the model can be used to compute the required cash holding to equity ratio for banks.[5] Of course,

[5] For more discussion see Acharya, Pedersen, Philippon and Richardson, 2010; Acharya, Engle and Richardson, 2012; and Brownlees and Engle, 2011.

these numbers are only meant to be indicative. Different values for q and for anticipated equity-value losses in a stressed situation will give rise to different numbers.

Figure 1 presents computed values of this ratio for five banks that survived the crisis—Bank of America, Citigroup, JP Morgan Chase, Goldman Sachs, and Morgan Stanley—from March 2000 to July 2013 on a monthly basis. Computations are made assuming $q = 0.94$ (so the loss in asset value from forced liquidation is $1 - q$ = 0.06 or 6%). For each month, the calculated values are smoothed by taking the average of the cash to equity ratio over the past three months.

Figure 2 presents the same information with a different scale on the y-axis. Note that even prior to the collapse of Bear Stearns in mid-March 2008, three of these banks had computed cash to equity ratios greater than 20% according to the model. That is, anticipating their losses in a future market downturn of 40% decline, these firms were well over the desired leverage ratio as of the date of collapse of Bear Stearns.

Of course, the model can also be used to compute cash to equity ratios for institutions that actually failed during the crisis. Figures 3 and 4 present this information for Bear Stearns, Lehman Brothers, Fannie Mae, Freddie Mac, and Wachovia. Figure 3 displays the computed ratios from July 2000 to August 2008 showing that the cash requirements explode as these firms approach severe distress, near-failure or failure.

Figure 4 focuses on just the period July 2006 to August 2008. This figure illustrates that for all of these institutions except Wachovia, the cash requirement was already much higher than 20% even by March 2007. Fannie and Freddie, in particular, would have required cash-to-equity ratios exceeding 60% even by late 2006, reflecting their steeply rising debt levels during this period.

Figure 1: Minimum Recommended Cash Holdings by Bank

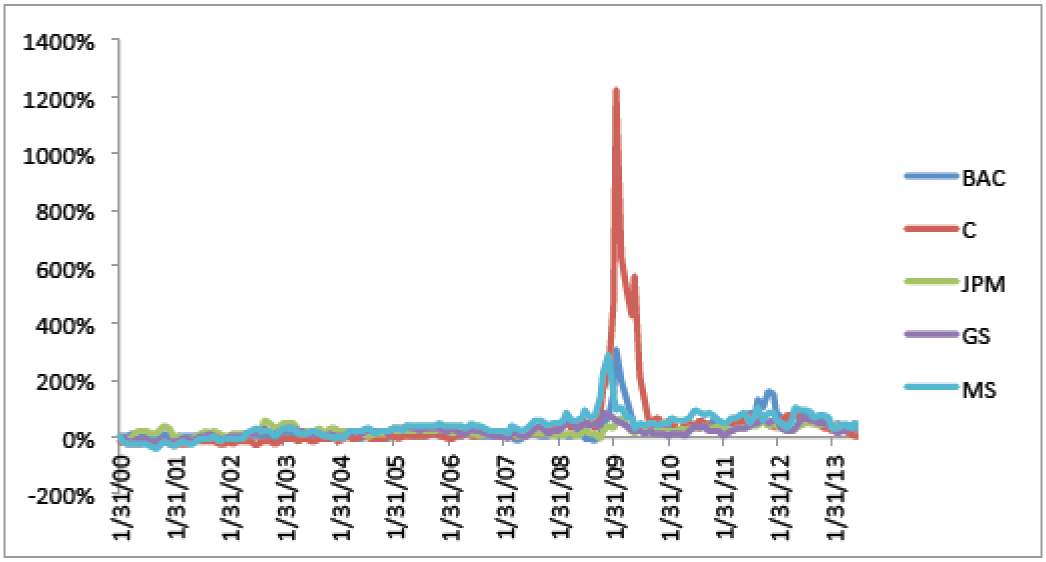


Figure 2: Minimum Recommended Cash Holdings by Bank

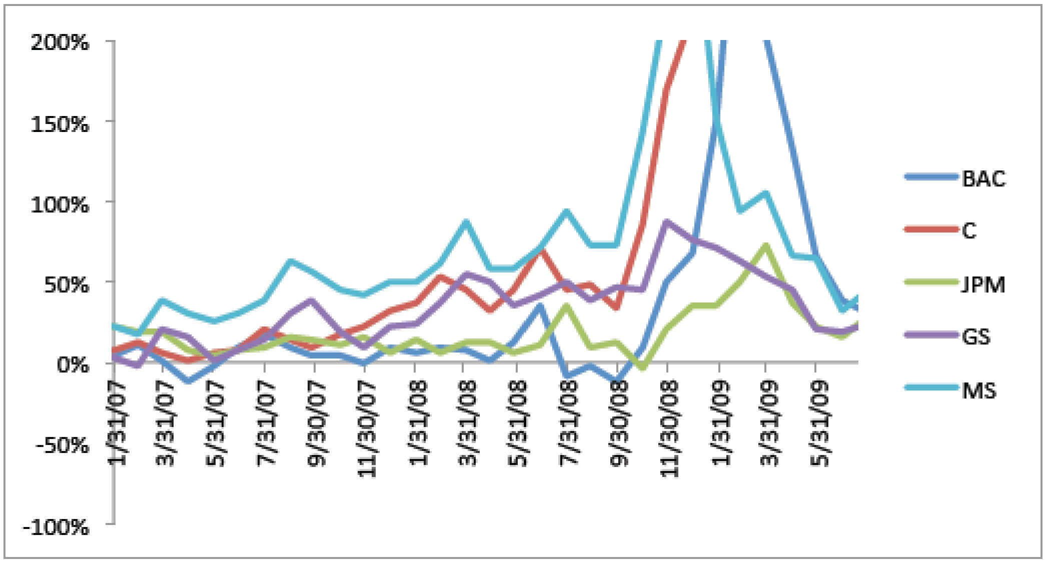


Figure 3: Cash-to-Equity Ratios: Selected Institutions

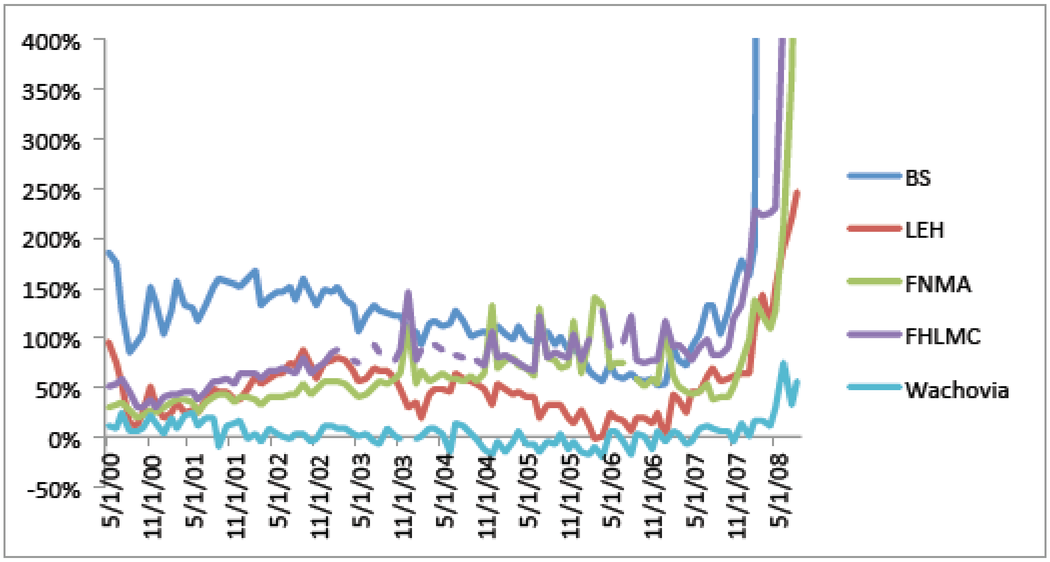
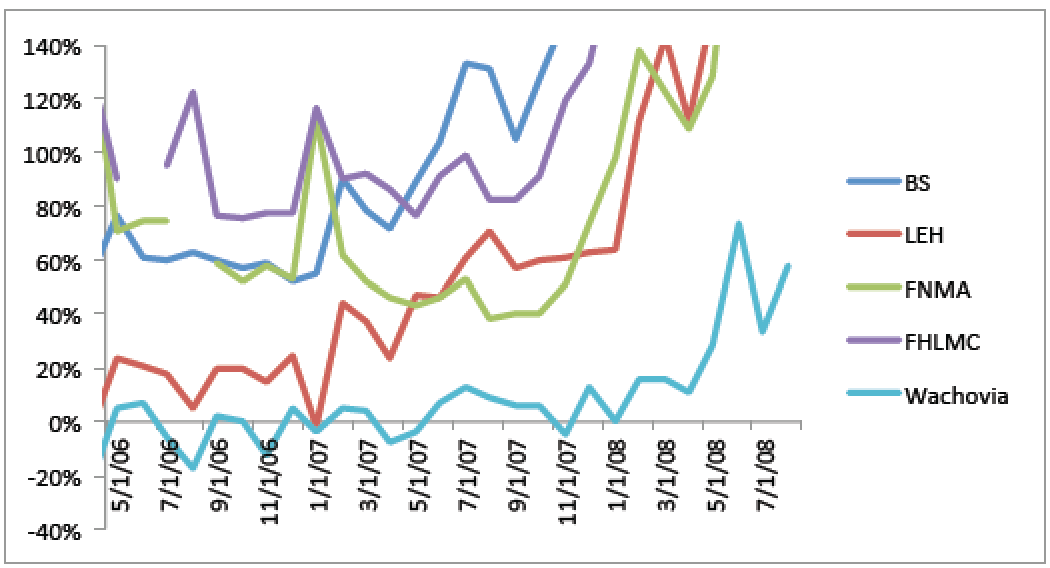


Figure 4: Cash-to-Equity Ratios: Selected Institutions



4. Why Cash and Not Inside Debt or Deferred Equity?

An executive receiving deferred cash compensation is akin to one holding a debt claim on the firm—in this case, such holdings constitute "inside" debt, i.e., debt held by those inside the firm. Debt holding by executives provides incentives to undertake corporate policies that protect the value of these fixed claims, thereby lowering the firm's default risk (Jensen and Meckling, 1976). Such policies could include some or all of: investing in safer projects, lowering the firm's leverage, reducing payouts (e.g., dividends) to other claimholders, hoarding cash, and engaging in diversification activities that lower risk (even those that may sometimes be value-reducing).[6] A number of recent papers have confirmed that debt-like compensation reduces incentives for risk-taking (Bebchuk and Spamann, 2009; Edmons and Liu, 2011; Mehran, 2008; Sundaram and Yermack, 2007; Wei and Yermack, 2011). For instance, Sundaram and Yermack (2007) find that higher holdings of inside debt by managers reduce the likelihood of firm default. Along similar lines, Wei and Yermack (2011) find that firms in which CEOs had larger pensions and deferred pay in their pay packages exhibited lower credit spreads and higher bond prices, implying that markets were pricing in the lowered risk-incentives stemming from the deferred debt-like claims. The findings for financial firms mirror those for non-financial firms. For example, Bennett et al. (2015) document that a higher incidence of inside debt relative to inside equity in a CEO pay package in 2006 is associated with lower default risk and better performance during the crisis period 2007-2008; and that higher bank internal examination CAMELS ratings (specifically, capital, management, earnings, and sensitivity to market risk ratings) are associated with greater CEO inside debt compensation.

[6] There is substantial evidence supporting the idea that the form of managerial compensation affects corporate policies (e.g., Murphy, 1999, or Frydman and Jenter, 2010). On the theoretical side, compensation ideas have been developed in the context of financial firms by Mehran (2008) and Bolton, Mehran, and Shapiro (2015).

There are, however, two important differences between our deferred cash proposal and the inside debt approach that lead us to prefer our proposal over the inside debt approach. First, under our proposal, ownership of the (escrowed) deferred cash compensation reverts to the bank in stress times for repaying its debts (or more generally, for repaying any non-equity liabilities failure to repay which could constitute a default). Thus, almost by definition, the deferred cash compensation of insiders in our proposal is *junior* to all other debt. In contrast, to the best of our knowledge, current inside debt proposals would give insiders a slice of bank debt that is *pari passu* with other debts[7]

Second, deferred cash under our proposal would be escrowed and management and shareholders would not have the discretion to deploy the cash for risk-taking purposes. While rewarding insiders with debt (rather than cash) would preserve the bank's cash, the current inside debt proposals do not explicitly require that this retained cash be outside of managerial and shareholder discretion. Indeed, if inside debt is not the senior-most debt of the firm, there would be incentives for management and shareholders to deploy the cash for risk-taking purposes, with the intention of shifting risk to the senior creditors.

Finally, we note that deferred equity or equity-linked claims (including options) do not provide quite the same incentives towards conservatism as deferred cash- or debt-like claims. Although the deferral aspect will induce some risk-aversion, equity, as the residual claimant on the firm's assets, *benefits* from an increase in form volatility. Hence, the incentive to reduce risk is smaller with deferred equity than that with deferred cash or inside debt.

[7] Parenthetically, we observe too in this context that the transfer of ownership of cash compensation from insiders to the bank in the event of stress does *not* constitute (in a technical sense) "default" by the bank on its creditors. In contrast, failure to pay on inside debt would constitute a default unless the terms of the contract explicitly allow for the possibility.

5. The Model Underlying the Proposal

Consider a single-period binomial model for distribution of the value of non-cash assets of a bank. The current value of assets is A. At the end of the period, the assets may be worth A^h in state H which arises with a probability of $p \epsilon (0,1)$, or worth A^l in state L which arises with a probability of $(1-p)$, where $A^h > A^l$.

The bank owners have an option at date 0 to alter the quality of non-cash assets from the benchmark cash flow structure to a riskier cash flow structure, such that the future value of assets in states H and L is given respectively by $A^{h'}$ and 0, and the probability of these states is altered as well to p' and $(1-p')$, respectively. In this case, the current value of the assets will be denoted as A'.

The bank has legacy debt of face value D which is due at the end of the period and has a starting stock of *contingent* cash assets worth C which are assumed to be riskless with no fluctuation in value across the states H and L. The cash C is to be thought of as an escrow account carrying the deferred cash compensation of bank employees. However, if the bank cannot meet its creditor payments, then the escrow account would be made available to fulfill these payments; only if creditor payments can be met fully from asset cash flows will the deferred cash compensation be paid out to bank employees.

The discount rate is assumed to be zero throughout, which is also the rate of return on cash assets. Bank owners as well as creditors are assumed to be risk-neutral. Debt claims are assumed senior to all other claims and there is no violation in any state of this priority structure. Under these assumptions, it follows that

$$A = pA^h + (1-p)A^l \tag{3}$$

$$A' = p' A^{h'} \quad (4)$$

We will assume further that an interim and perfect signal about the future state of the world becomes available to bank owners as well as creditors. Upon receipt of this signal, if it is optimal for creditors to "run" on the bank's assets and force them to be liquidated, then the liquidation value of assets is a fraction $q \in [0,1)$ of the future value. We assume that $A^l > D > qA^l$, so that even if the bank has no cash assets ($C = 0$), creditors can be paid in full in state L if they wait for realization of the value of non-cash assets, but if they force early asset liquidation, then they incur a haircut in their recovered payoff relative to the promised payoff. We also assume that in contrast $qA^h > D$ and $qA^{h'} > D$, so that in state H creditors can be paid in full even if the bank has no cash assets and early liquidation is forced.

We will assume for now that due to a coordination problem, creditors may "run" on the bank in state L (in case of the benchmark assets) and force asset liquidation provided that

$$qA^l + C < D \quad (5)$$

This run can be rationalized as a "sun spot" along the lines of Diamond and Dybvig (1983).

In what follows, we calculate what cash levels can enable the bank to avoid a run in the state L, preserve equity value in this state, and in turn, preserve ex-ante incentives of bank owners not to switch from the benchmark asset to the alternative riskier asset.

Analysis

We first calculate the value of bank equity in benchmark assets case assuming run and no run, denoted as E^r and E^{nr}, respectively.

- Run: In case of a run in state L, bankowners and employees are left with no residual cash flows; in state H, creditors are paid off from cash flow A^h, cash is paid out to employees, and the residual $(A^h - D)$ is residual cash flow that accrues to bank equity. As a result,

$$E^r = p(A^h - D). \tag{6}$$

- No run: In case there is no run in state L, the bankowners are left with a residual cash flow $(A^l - D)$ and employees are paid out the cash C. As a result,

$$E^{nr} = p(A^h - D) + (1 - p)(A^l - D) = A - D \tag{7}$$

It can be readily observed that $E^r < E^{nr}$ for all D.

Next, it is straightforward to see that the value of bank equity in riskier assets case is given by

$$E' = p'\left(A^{h'} - D\right). \tag{8}$$

Since there is no cash flow from assets in state L in the riskier assets case, it is irrelevant for bank equity valuation whether there is a run or not.

We analyze now the incentives of bank equity at the beginning of the period to alter the riskiness of non-cash assets from the benchmark case to the riskier one:

- Run: In case they anticipate a run in state L in benchmark assets case, bankowners switch to the riskier asset if and only if

$$E^r < E'. \tag{9}$$

- No run: In case they do not anticipate a run in state L in benchmark assets case, bankowners switch to the riskier asset if and only if

$$E^{nr} < E'. \tag{10}$$

Then, we obtain the standard asset-substitution or risk-shifting (Jensen and Meckling, 1976) result that there is incentive to switch to the riskier asset whenever the debt level of the firm is sufficiently high:

Lemma 5.1 $E^r < E' \ if\ and\ only\ if\ D > \overline{D}^r \equiv \frac{pA^h - p'A^{h'}}{p-p'}$.

Similarly,

Lemma 5.2 $E^{nr} < E' \ if\ and\ only\ if\ D > \overline{D}^{nr} \equiv \frac{A - p'A^{h'}}{1-p'}$.

And,

Proposition 5.3 $\overline{D}^{nr} > \overline{D}^{r}$.

Or in other words, risk-shifting incentives are weaker when there is no expectation of a run in state L in the benchmark assets case. The intuition is that this preserves equity value in state L and reduces the benefits of gambling for resurrection by switching to the riskier assets.

Therefore, we can now ask what level of cash assets would be necessary to avoid a run which has the desirable effect of reducing bankowners' risk-shifting incentives. There is no run in state L in benchmark assets case provided

$$qA^l + C \geq D, \tag{11}$$

or in other words, provided

$$C \geq D - qA^l. \tag{12}$$

Define Expected Shortfall (ES^{nr}) of the bank to be the percentage change in equity valuation between beginning of the period and state L, in case of no run. Then,

$$ES^{nr} = 1 - \frac{(A^l - D)}{(A - D)}. \tag{13}$$

Rearranging this equation, we can express A^l in terms of ES as:

$$A^l = D + (A - D)(1 - ES^{nr}), \quad (14)$$

$$= D + E^{nr}(1 - ES^{nr}). \quad (15)$$

Substituting in the condition for no run, we obtain our main result:

Proposition 5.4 *The cash requirement for the bank that avoids the run can be expressed as*

$$C \geq (1 - q)D - qE^{nr}(1 - ES^{nr}). \quad (16)$$

Since the asset liquidation losses $(q < 1)$ *are generally incurred during systematic states of nature, we can substitute* ES^{nr} *by* MES^{nr}*, which is the marginal expected shortfall of bank equity, conditional on an adverse market or aggregate state.*

Finally, we note that if we consider risk-shifting incentives from the standpoint of bank management that owns all of bank equity but also factors in its cash payouts, then we obtain again that there is risk-shifting when bank debt is sufficiently high. The critical debt levels in case of run and no run above which risk-shifting occurs are given respectively by $\overline{D}^{r,m} = \overline{D}^{r} + C$, and $\overline{D}^{nr,m} = \overline{D}^{nr} + C$. In turn, it follows that $\overline{D}^{nr,m} > \overline{D}^{r,m}$. Risk-shifting incentives are weakened compared to the case where risk choices are made by bankowners since management also has liability from its deferred cash compensation. However, the relative risk-shifting incentives between run and no run case are unaffected, so that if it is desirable to avoid the run to reduce risk-shifting incentives, then the desired cash requirement is exactly identical to the one in proposition above.

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