DO DEPOSIT RATES SHOW EVIDENCE OF TOO BIG TO FAIL EFFECTS?

An updated look at the empirical evidence through 2012 among US banks

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BACKGROUND ON THE STUDY

Ensuring that a subset of financial firms do not benefit from the perception that they are "too big to fail" (TBTF) is an important, frequently stated goal of ongoing financial regulatory reform efforts. Robustly assessing the empirical evidence of whether market perceptions of TBTF status reduce funding costs for some institutions is challenging but critical. As new financial regulations intended to combat TBTF take effect, ongoing measurements of TBTF funding cost advantages can serve as a scorecard for financial reform efforts to date, and a useful indicator of whether alternative reforms may be needed to succeed in the battle against TBTF.

This working paper describes one result from a broader effort to review and update the empirical evidence of TBTF among US banking institutions. Our aim is to build on the most promising research on funding costs to develop a robust view of TBTF perceptions using the latest available information.

This study was sponsored by The Clearing House Association. All findings below are solely our own.

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EXECUTIVE SUMMARY

This study contributes to the growing research regarding the measurement of so-called "too big to fail" (TBTF) effects on the funding costs of financial institutions by updating one of the most cited and innovative studies on this subject. We measure differences in deposit funding costs by applying the methodology pioneered by Stefan Jacewitz and Jonathan Pogach in their recent working paper, "Deposit Rate Advantages at the Largest Banks" (2013), to an expanded and updated version of the same source data.

Jacewitz and Pogach analyze US branch-level deposit rate data for money market deposit accounts (MMDAs) from 2005-2010, and conclude that the largest banks had a funding cost advantage consistent with implicit or perceived government support of TBTF institutions from 2006-2008. Since the period studied by Jacewitz and Pogach, there have been significant changes in the explicit insurance provided by the FDIC to depositors, including the expiration of unlimited insurance for non-interest bearing transaction accounts and a permanent increase in the standard maximum deposit insurance amount (SMDIA) from $100,000 to $250,000. The period following the enactment of the Dodd-Frank Act in 2010 has also seen major efforts by policymakers to combat TBTF perceptions and associated concerns, including the establishment of heightened capital and liquidity requirements for the largest banks and the FDIC's development of a practical approach for resolving systemically important financial institutions without taxpayer-funded bailouts (known as the single point of entry approach).

We assess if these measures have impacted perceptions of TBTF by extending the analytical approach proposed by Jacewitz and Pogach to banks' cost of deposit funding over the 2010-2012 period. (The updated data set, from the vendor RateWatch, also features a significant expansion in the number of banks covered, to over 4000 by the end of 2012.)

Our key findings are as follows:

- **Deposit funding cost advantages for the largest banks amount to just 4 bps over the 2010-2012 period.** Our results generally coincide with that of the earlier study in finding that large banks had a funding cost advantage of more than 30 bps on uninsured MMDAs prior to 2010. Using updated data, and after controlling for common balance sheet measures of risk, we find that this advantage had shrunk dramatically by the end of 2012.
- **However, the estimated funding cost differences between large and small banks likely incorporate effects unrelated to TBTF perceptions.** Firstly, we find that large banks have a funding cost advantage on accounts that are explicitly insured, and thus should not be affected by TBTF perceptions. Secondly, we find that banks in our sample with total assets of $100 BN-500 BN, none of

which have been designated as Global Systemically Important Banks or are generally discussed as beneficiaries of TBTF beliefs, also accrue funding cost advantages relative to smaller peers in recent years. Both of these findings suggest that the approach proposed by Jacewitz and Pogach, while introducing innovative ways to control for many differences among deposit products offered by different banks, does not distinguish TBTF drivers of funding differences from other factors that influence deposit rates.

1. WHY DEVELOPING AN EMPIRICAL VIEW OF TBTF IS SO IMPORTANT, AND SO DIFFICULT

What is meant by TBTF, and why is combatting it so important? The TBTF problem arises when certain firms, due to their systemic importance, are expected to receive government support in the event of failure or distress, notwithstanding the fact that there is no explicit promise of government support.[1] The creditors of these firms, based on the belief that they have a substantial chance of being shielded from losses due to government intervention, undercharge the firm relative to its credit risk. The firm's managers and shareholders then have an increased incentive to take on more risk, as they will benefit from potentially higher returns but will not face the usual downsides to greater risk-taking, such as increased funding costs and less acceptability as a trading counterparty.

A firm benefiting from lower funding costs because it is perceived to be TBTF thus has an unfair competitive advantage, which may allow it to expand in size and scope, while other firms face incentives to achieve "TBTF status" so they too can reap similar funding cost advantages. The result is a financial system that fosters the growth of larger, more complex firms that take on too much risk – what Andrew Haldane has aptly named the "doom loop" (Haldane, 2012). In this way, a TBTF regime both endangers the stability of the financial system and degrades its ability to support the broader economy and society at large.

Since the bailouts of major financial institutions in 2008, regulators have taken significant actions to address the TBTF problem, and further efforts are in the process of being implemented. In the US, one set of policy changes has focused on reducing the likelihood of failure among financial institutions: stricter capital requirements, liquidity buffers, stress tests, and activity restrictions, to name a few. A second set of policies has focused on limiting the level of government support institutions can receive in the event of failure. The Dodd-Frank Act (DFA) prohibits 2008-style, taxpayer-funded bailouts.[2] New living will requirements and the FDIC's single point of entry resolution model aim to create credible alternatives to government support in the event of distress. It is important that both sets of policies be effective. It is equally important that the market *perceive* them as effective and likely to be enforced, in order to successfully break the TBTF doom loop.

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[1] We note that the term "big" in the phrase "too big to fail" is misleading, as being a large firm (however determined) is neither necessary nor sufficient to benefit from this type of implicit government support. However, we adopt the common TBTF terminology in the interest of consistency and brevity.

[2] Dodd-Frank Act § 214

Since the crisis, a number of studies have attempted to assess such market perceptions by measuring funding cost differentials between smaller banks and those that are designated Global Systemically Important Banks (G-SIBs) or otherwise meet certain size minimums, and estimating the portion of this differential that may be attributable to TBTF perceptions. Such assessments do not come without technical challenges. Funding costs differ across institutions, over time, and by funding type, affected by a wide range of factors unrelated to TBTF perceptions. Disentangling the effects of these factors from TBTF-related market perceptions is one of the most significant analytical challenges in developing empirical evidence about the extent of TBTF effects on funding costs.[3] Below, we present the main considerations in developing a robust empirical view: the choice of institutions in sample, time period, funding source, and controls for non-TBTF drivers of funding costs.

Because TBTF is determined by market perceptions rather than the result of an explicit government policy, each analysis must identify (a priori) a group of firms that may be benefiting from a TBTF subsidy, as well as a comparison group of firms that can be safely assumed to receive no such benefit. No strong consensus has yet emerged among researchers of how best to define these groups, but asset size cut-offs (e.g., > $100 BN, > $500 BN) or regulatory designations that specifically target systemically significant financial institutions (e.g., G-SIB designation) are simple, easy to ascertain, and intuitively appealing. Still, the choice of criteria to identify potential TBTF candidate firms remains subjective, and testing alternative criteria is a common robustness check included in most research on this topic.

Each empirical effort must also define a population of firms that is appropriate for the specific research questions in view – for example, a study based on a population of global banks may offer insights about the global average level of TBTF subsidies, but it will probably be insensitive to the heterogeneity of such effects across different jurisdictions and economies.

A related complication for funding cost analyses among US firms arises from the distinction between being a creditor to a top-level bank holding company (BHC), and being a creditor to its subsidiary bank. A creditor to the bank (whether a depositor, bondholder, or other liability holder) is explicitly and structurally more protected from loss than creditors to the bank's parent BHC.[4] In principle, any TBTF effect should be most pronounced, and thus detectable, in the absence of other (explicit) credit protections. This suggests that BHC liabilities will generally be a more sensitive instrument than bank-level liabilities for

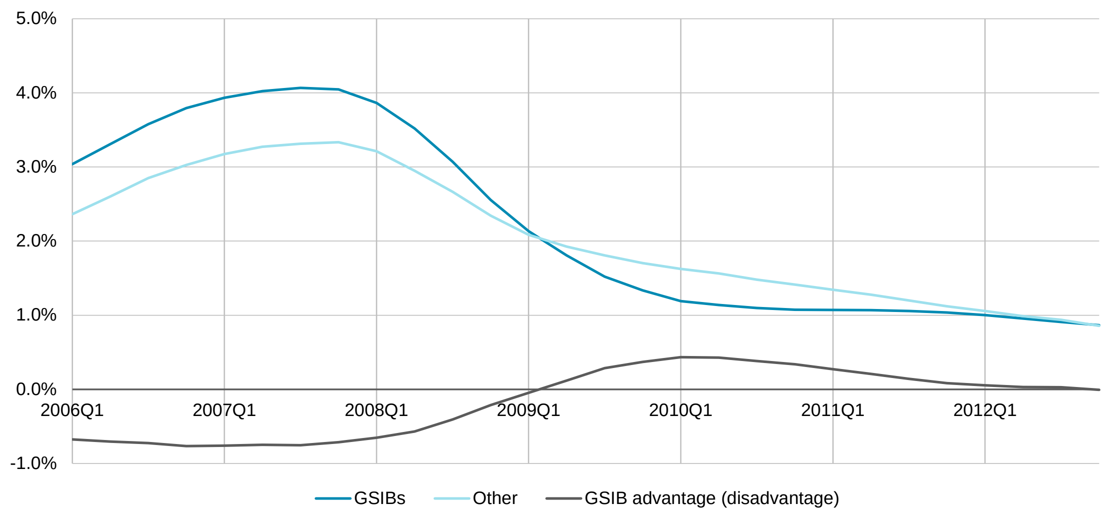
3 For a comprehensive review and assessment of empirical approaches proposed to date, see Kroszner (2013)

4 The degree of structural protection for bank liabilities can and does vary among institutions, with holding companies that have smaller amounts of third-party liabilities providing less protection to their bank subsidiaries. Large banks tend to be part of holding companies with more non-bank balance sheet resources, and thus likely benefit more from the structural subordination of bank liabilities. Neither the study by Jacewitz and Pogach nor our extension of their approach control for such differences.

testing hypotheses about relative funding costs and TBTF effects. However, as deposits are specifically bank-level liabilities, we follow Jacewitz and Pogach in focusing on bank-level observations and control variables.

In addition to defining the appropriate sample of firms, the choice of time period is an important consideration in developing an empirical approach to assess TBTF. To illustrate, we present an aggregated view of observed funding cost differences between US BHCs that have been designated as G-SIBs and other US BHCs.

Exhibits 1: Average aggregate cost of funds (2006Q1 – 2012Q4)

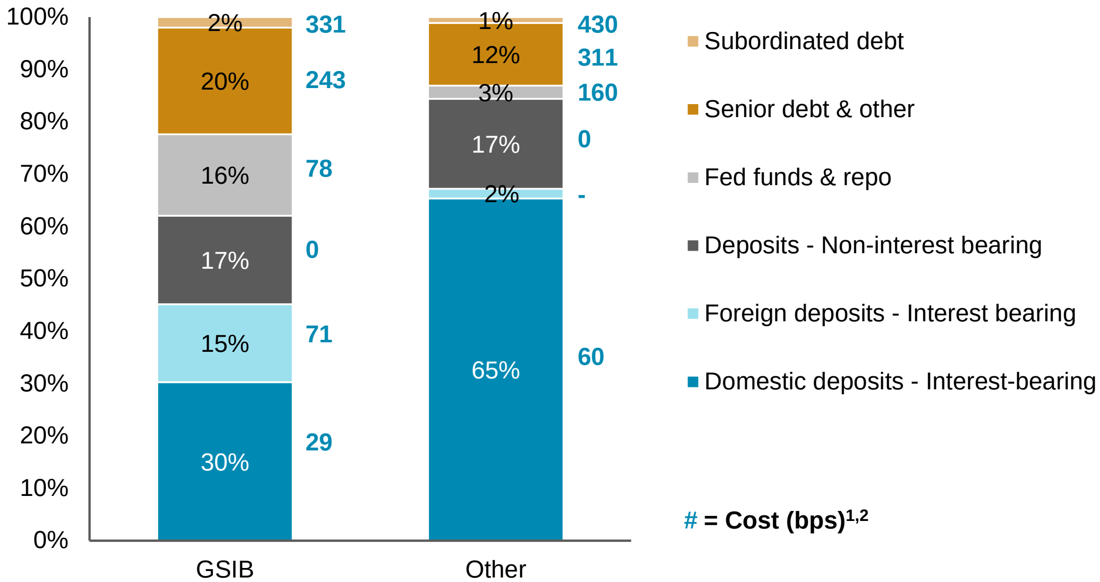


Sources: Oliver Wyman analysis, SNL

Funding cost differentials have changed markedly since the pre-crisis period and, on an aggregate basis, have hovered around zero in the most recent quarters. In 2012Q4, the difference in average aggregate funding costs between the G-SIBs and others was just 1 basis point. The figure illustrates the importance of focusing the analysis of funding cost differentials on the post-crisis period in order to best inform today’s policy debate. Market perceptions relating to TBTF are related to the probability of failure for a given institution, the probability of losses in the event of failure, and the probability of a government-supported rescue of that institution. Perceptions of all three outcomes are likely to vary considerably over time. Focusing on the pre-crisis period when failures (and bail-outs) were arguably not top-of-mind, a number of studies find relatively small funding cost differentials between large and small firms. As the perceived risk of failure for major financial institutions grew during the crisis, and as government actions appeared to validate the notion that some institutions would be rescued from failure, the same studies find that funding cost differentials grew larger.[5] In the face of ever-changing perceptions, the question that is most relevant to policy decisions today is not whether TBTF beliefs previously existed, but whether TBTF effects are sizeable despite the broad package of financial reforms meant to combat them. In the post-crisis period, the Dodd-Frank Act and numerous other regulatory reforms have aimed to change market perceptions of government support. Recent funding cost data will be the most relevant for assessing if post-crisis reforms have succeeded.

The figure above also highlights that funding cost differentials should be measured at the level of specific liability types. Based on a comparison of overall funding costs, large banks appear to pay roughly the same per dollar of funding as their smaller counterparts. However, this top-level view masks important differences in the funding composition of each cohort. Below, we break down aggregate funding costs into specific liability components.

Exhibits 2: Funding cost by source (average over 2012Q1-2012Q4)



1. Sum of interest expense / average quarter-end liability volumes for 2012Q1 – 2012Q4
2. Interest expenses for foreign interest-bearing deposits excluded for smaller banks due to limited observations
Note: Includes data for domestic US bank holding companies, savings and loan holding companies and financial holding companies
Sources: Oliver Wyman analysis, SNL

Smaller banks overwhelmingly rely on inexpensive deposits, while larger banks skew towards more expensive capital markets-based funding. Thus, while the overall funding cost is similar, large banks pay lower interest rates across all funding sources, paying nearly 50% less for deposits and 20% less for

[5] See, for example, Jacewitz and Pogach (2013)

senior debt. Investigations of the effects of TBTF perceptions need to reconcile these differences at the liability level.

Even once isolated to an individual liability class, there are many factors that complicate comparisons of funding costs between firms. Consider the example of senior debt: for any issuance, features such as the maturity date, years to maturity, coupon type and structure, call options, and the presence of collateral or other guarantees will all affect the yield, and therefore the cost of funding for the issuer. But, constructing a sample of bonds that are comparable across each of these features will result in a relatively small set that limits the ability to make statistical inferences. The same is true for deposits (which consist of checking accounts, certificates of deposits, money market deposit accounts, etc., all with vastly different features) and all other liability classes. Constructing a large-enough, comparable set of liabilities remains a formidable challenge for all studies of TBTF-related funding cost advantages.

Another is controlling for firm-specific credit risk and non-risk attributes. Analysis of funding cost differences effectively requires a credit risk model that reflects the “true” difference in credit quality between institutions as a control. Measures of asset quality, profitability, liquidity, and leverage are good indicators; however, like all risk indicators, these are limited approximations.

Funding costs will further be affected by non-credit related, firm-specific factors. The most obvious of these are:

- Priority of claims within the unconsolidated liability stack: In the event of a failure, the FDIC requires that domestic depositors (insured and uninsured) be paid in full before general, unsecured creditors. Creditors may perceive issuances by the largest banks, which typically have a smaller reliance on deposits as a funding source, as safer investments that are more likely to be recovered, and thus deserving of a funding cost advantage.
- Desired volume of larger, uninsured deposits: Individual banks can and do trade off cost (interest rate paid to depositors) and volume (of deposits attracted) for specific deposit products in different ways. For example, large banks may not price deposits as competitively as smaller counterparts, given their ability to raise funds through the capital markets. Furthermore, large banks are subject to different regulations (such as enhanced prudential requirements for liquidity) that make deposits gathered by offering high rates less valuable than they would be to smaller banks subject to different regulation.
- Liquidity premiums: In the case of market-traded funding instruments such as bonds, large banks have a substantial liquidity advantage. In 2010 and 2011, for example, the median number of institutional trades (greater than $1 million) per month for the most actively traded bonds of the G-

SIBs was 89, compared to 18 for banks with > $100 BN in assets (excluding the G-SIBs), and just 1 for smaller US banks.[6]

Since these factors are typically associated with size, disentangling their effects from perceived TBTF advantages is an important consideration in the design of an empirical model.

Finally, assuming that all of these factors have been accounted for and that the set of relevant factors is complete (both big assumptions, which realistically cannot be completely satisfied), the value of the funding cost advantage due to TBTF perceptions emerges.[7]

In the next section, we summarize the primary approaches proposed in prior studies, particularly the study by Jacewitz and Pogach, and highlight similarities and differences to the empirical approach we use in this study.

2. BUILDING ON EXISTING LITERATURE

A number of studies have put forward an empirical view of TBTF effects on funding costs. Most follow a similar approach as the one outlined above, assessing the impact of size on funding costs associated with particular liability types after controlling for available risk metrics and other observable factors. Others rely on credit ratings agencies to have correctly measured TBTF effects in their assessment of ratings for each financial institution. Still others rely on alternate techniques, such as measuring M&A purchase premiums paid to achieve "TBTF status". These are summarized below, followed by a detailed look at the study by Jacewitz and Pogach that provides the foundation of our analysis.

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[6] TRACE; Oliver Wyman analysis

[7] In measuring funding cost differentials between firms, our analysis is focused on assessing market perceptions of direct, institution-specific support. We consider expectations of system-wide support (e.g. future policy changes that would serve to avoid or mitigate the very worst states of the economy or financial system) as less relevant to the TBTF debate as these do not result in an advantage for particular financial institutions.

Exhibit 3: Summary view of notable papers

Focus	Notable papers	Summary of key approaches	Challenges
Deposit rates	Araten and Turner (2012) Jacewitz, Pogach (2013)	• "Top down" approach comparing total deposit interest expense after controlling for macroeconomic and issuer factors • "Bottom up" approach that compares reported interest rates on uninsured deposit accounts, also controlling for macroeconomic, issuer, and issue specific factors as well as value of associated deposit services • Evaluation of "natural experiments" that arise from changes in deposit insurance coverage	• Available data on deposit pricing at the institution and product levels are posted rates, as opposed to actual rates paid • Posted rates may not provide an accurate view of funding costs, particularly for large (uninsured) accounts
Bond spreads	Acharya, Anginer, Warburton (2013) Balasubramnian, Cyree (2012)	• Comparison of senior, unsecured bond spreads, controlling for macroeconomic, issuer, and issue-specific factors • Analysis of spread changes around specific events that affect expectations of government support, e.g. large bankruptcy or bail-out events	• Limited sample of comparable bonds (e.g. similar maturity, embedded optionality, etc.) across bank issuers; broadening sample to other types of financial companies introduces significant heterogeneity • Lack of sample points for small institutions that are less active in debt capital markets than larger peers
CDS spreads	Schweikhard, Tsesmelidakis (2012)	• Examination of CDS spreads for large BHCs and other issuers to determine how default expectations vary	• Limited CDS issuance for small institutions and for all institutions post-crisis
Credit ratings	Ueda, di Mauro (2012) Haldane (2010) Soussa (2000)	• Assessment of expected level of government support based on "standalone" vs. "with support" ratings • Use of historical relationships between credit ratings and funding costs to estimate value of subsidy	• Assumes that credit ratings agency models accurately capture firm-specific risks and market perceptions of TBTF • However, rating assessments appear to be revised infrequently and often as a general matter rather than in an institution-specific way (particularly "with support" ratings)
Other	Brewer and Jagtiani (2011) Gandhi and Lustig (2011)	• Identification of the "purchase premium" that institutions are willing to pay in M&A deals to attain a certain size • Comparison of stock returns for large BHCs and other banks (historically and in response to events that affect expectations of government support)	• Purchase premiums are greatly influenced by individual transaction benefits (e.g. diversification) and market environment, making it difficult to compare across deals at different points in time • Equity prices have weaker linkages to default and external support expectations (relative to debt pricing)

Among the many techniques put forth by participants in the TBTF debate, we find one of the most intriguing, from a data availability, methodology, and materiality perspective, to be the study of deposit funding by Jacewitz and Pogach. As the most important bank funding source, on average making up over 80% of liabilities for non-G-SIBs and 60% of liabilities for G-SIBs, deposits are a natural focal point for analyses of funding cost differences.

The main objective of deposit-based funding analysis is to assess if large banks are able to systematically offer lower interest rates than their smaller counterparts to win customer deposits, and if this difference is due to perceptions that large banks are TBTF. A robust approach must develop a comparable sample of banks and control for drivers of funding cost differences unrelated to TBTF perceptions, as highlighted in the previous section. Below, we discuss these challenges in the context of deposit cost analysis, the ways in which the Jacewitz-Pogach study addresses these challenges, and additional considerations for designing a robust empirical model.

- **Isolating the most comparable set of non-guaranteed deposit products**

  Most relevant to the analysis are funding costs for deposits that are not explicitly insured by the FDIC, i.e. deposits above the FDIC standard maximum deposit insurance amount (SMDIA) of $100,000 until October 2008, and $250,000 thereafter.[8] One way to approximate these costs is to focus only on interest rates offered on large deposit accounts with size minimums above the SMDIA. For several deposit products, such as certificates of deposits and money market deposit accounts (MMDAs), banks report rates offered for accounts with $10,000, $25,000, $100,000 and $250,000 minimums. Since the interest and principal over $100,000 (until 2008) and $250,000 (post-2008) are uninsured, rates offered for these accounts should be indicative of perceived bank-level risk, including perceived TBTF benefits.[9] To create a relatively homogenous set of deposit products, Jacewitz and Pogach further restrict their sample to MMDAs, which comprised over 40% of bank deposits and 35% of total bank liabilities at the end of 2012.[10,11]

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[8] The SMDIA was initially increased to $250K on a temporary basis under the Emergency Economic Stabilization Act. The increase, put into effect on October 2008, was set to expire on December 31, 2009. In July 2010, the Dodd-Frank Act made this increase permanent, retroactively to January 1, 2008.

[9] The actual level of uninsured deposits will vary by account. For example a $100K MMDA pre-2008 with exactly $100K in funds could still have been fully insured, while a similar account with $200K in funds would be only partially insured. Moreover, since the SMDIA applies to the sum of an individual's accounts within one bank (and may vary for joint accounts), the true level of uninsured deposits is unknown based only on account size.

[10] SNL, based on regulatory filings

[11] As discussed in the Jacewitz-Pogach study, the statutory restrictions on MMDAs (as a type of savings deposit) make them relatively uniform across deposit minimums and therefore more suited for the analysis relative to other

- **Unbundling deposits from associated packages of banking services**

  Differences in deposit pricing between banks are not solely attributable to risk, and may exist due to any number of related banking services. For instance, customers may be willing to accept a lower interest rate on checking accounts in exchange for extended ATM and branch networks, reduced ATM fees, mobile banking capabilities to manage and transfer funds, and other services. Similarly, customers may value the convenience of "a one-stop shop" for banking, preferring to house deposits, brokerage accounts, retirement accounts, etc., within the same institution. Unbundling the value of these additional services from deposit funding costs is a key challenge – unfortunately, the data to do so are limited.

  Jacewitz and Pogach introduce a novel way to approximate these effects by using branch-level deposit prices on similar, but fully insured accounts. They examine "risk premiums," defined as within-bank differences in rates for MMDAs with $25K minimums ($25K MMDAs hereafter) versus $100K MMDAs. Prior to the change in SMDIA, $25K MMDAs were in general FDIC-insured, and therefore riskless, whereas portions of $100K MMDAs were not. The differencing method is intended to remove factors that are constant across the two products, such as ATM and branch networks, leaving the premium banks are willing to pay to attract uninsured deposits. After the change in the SMDIA, the premium may be similarly calculated as the difference between $250K MMDAs and $100K MMDAs.

- **Correcting for firm-specific cost-volume trade-offs**

  Deposit funding costs are likely to differ based on each firm's desired volume of deposits. Since large banks are, on average, much less reliant on deposits as a funding source than smaller banks, they may not price deposit products as competitively. We incorporate balance sheet information, namely the growth rate of deposits, as an indicator of a firm's desired level of deposit funding. However, there is no direct way to control for this important driver of funding costs.

To the best of our knowledge, the study by Jacewitz and Pogach offers the only analysis of funding cost differentials associated with deposits accounts that (a) looks at a narrow (and therefore more comparable) set of deposit products and (b) attempts to analyze costs associated with uninsured deposit accounts. Araten and Turner (2012) analyze deposit funding differentials (among other liability classes) but do so at an aggregate level for all insured and uninsured interest-bearing deposits. They find a funding cost advantage for GSIBs of 23 bps over the 2002-2011Q1 period; however, the authors note that, aside from including insured deposit costs in the calculation, they do not control for non-risk factors that

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deposit products. Specifically, restrictions on access (number of withdrawals and withdrawal process) are uniform across all banks and all MMDAs, limiting the differences in service between different MMDA accounts.

may explain this differential. Acharya and Mora (2013) also evaluate deposit rates during the financial crisis, attributing a 14-66 bps reduction in deposit rates by the largest banks to TBTF effects. These estimates again do not control for non-risk factors affecting funding cost or for the portion of the deposits which are explicitly insured. Further, neither study draws conclusions about TBTF perceptions in the post-crisis period, which we view as the most relevant to policy considerations today.

A comprehensive view of the funding cost implications of TBTF will require an evaluation of all major bank funding sources. The study put forth by Jacewitz and Pogach provides a strong start with respect to deposits, and is reflective of the types of methodologies and analytical considerations that need to be replicated across other funding instruments.

3. ANALYSIS OF DEPOSIT FUNDING COSTS

Notwithstanding the limitations of available data in addressing the challenges highlighted in the previous section, we find that Jacewitz and Pogach have put forward a promising approach for estimating the magnitude of potential TBTF effects. In this section, we apply the authors' general approach to a modified and updated dataset that incorporates more recently available deposit data. Given that public perceptions of TBTF have likely changed since the passage of the DFA in 2010, we expect this updated analysis to be most relevant to the policy debate today.

A. Data

We reconstruct the analysis of MMDA rates proposed by Jacewitz and Pogach by using the same underlying data set provided by RateWatch, a data aggregator for branch-level price-setting and product information.[12] RateWatch surveys over 90,000 bank branches on a weekly basis to obtain the latest rates on a variety of deposit products. RateWatch also maintains a record of branches that set rates for others within the same bank network, i.e. instances in which a certain branch is designated as the "rate setter" while other branches in the same geographic area are "rate adopters". The rate setter / adopter relationships are updated to reflect branch openings and closings, mergers and acquisitions, changes in a bank's rate setting structure, etc. We obtain this data for the 2006-2012 period.

In order to aggregate branch level data to the bank level, we extract quarter-end observations of branch MMDA rates, defined as rates reported within 7 days of a quarter-end (and averaged for multiple observations), and calculate a risk premium for each branch-quarter observation. Since our model incorporates credit metrics and other firm information from quarter-end regulatory filings, premiums reported around the same time period are most relevant. For a branch to be included in the sample in any given quarter, we must observe rates for $25K, $100K, and $250K MMDAs in that quarter as well as one quarter before and after (to minimize fluctuations in the average rate driven by branches that irregularly report data). Because far fewer branches report rates for the $250K MMDA than for the $100K and $25K MMDAs, we use the larger dataset for analyses that do not involve the $250K MMDA. To each branch that is included in our datasets, we assign a 'weight' based on the number of associated rate adopters. We then calculate weighted average MMDA rates and premiums for each bank. Finally, we restrict our sample of banks to those that are US-owned and file quarterly call reports.

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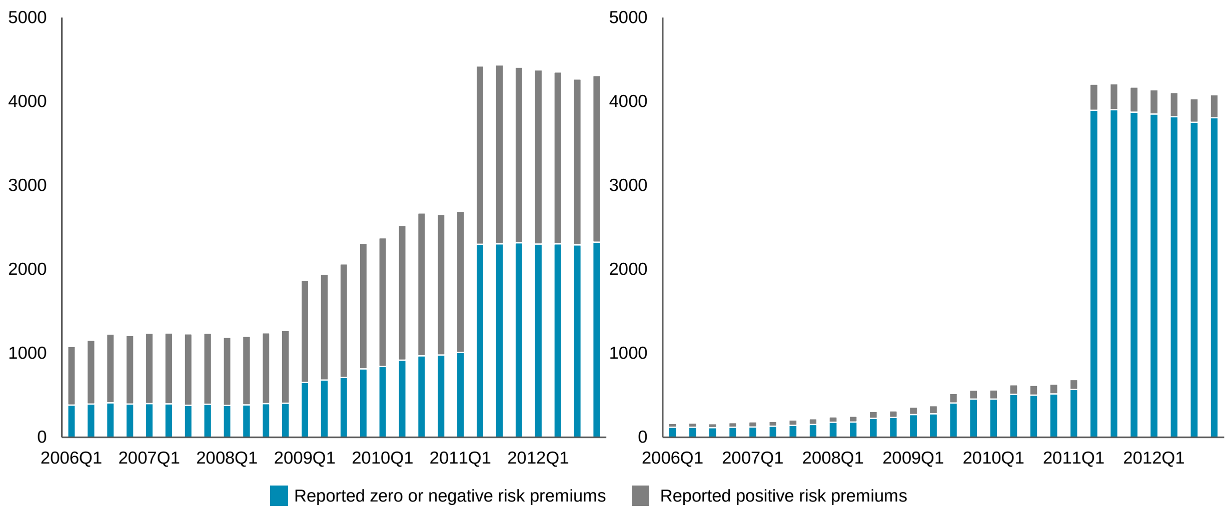
[12] For more information on RateWatch: https://www.rate-watch.com/.

Exhibits 4: Number of banks in sample

A. Number of banks reporting rates on $100K and $25K MMDAs
Risk premium = $100K - $25K rate

B. Number of banks reporting rates on $250K and $100K MMDAs
Risk premium = $250K - $100K rate



Sources: Oliver Wyman analysis, RateWatch

The number of banks reporting both $100K and $25K MMDA rates rises significantly over the sample period, increasing from approximately 1000 in 2006 to over 4000 in 2012. While relatively few banks report rates for $250K MMDAs in earlier periods, we likewise observe a robust sample of over 4000 banks in 2011-2012. The underlying branch data (not shown) also shows a similar increase in observations. Thus both the number of additional banks captured and the number of branches contributing to each bank's calculated average rate are significantly higher in the 2011-2012 period. The increase in number of observations in the second quarter of 2011 is particularly notable; at this time RateWatch expanded its coverage to include over 1500 additional banks, most with <$10 BN in total assets. Additionally, following the permanent increase in the SMDIA, RateWatch began to more systematically collect data on $250K tier products. Since the Jacewitz-Pogach study only includes data to the end of 2010, this update has the advantage of significantly increasing the sample size.

Of most interest in the above figures is the number of banks that do not report a risk premium on uninsured MMDAs. In figure 4.A the risk premium is defined as the difference in rates between $100K MMDAs and $25K MMDAs. Until the change in the SMDIA in the fourth quarter of 2008, we expect banks to offer higher interest rates to attract (partially) uninsured $100K MMDAs relative to insured $25K MMDAs; however over 50% of banks never report a positive risk premium over the entire sample period. In figure 4.B the risk premium is defined as the difference in rates between $250K MMDAs and $100K

MMDAs. Starting in 2008Q4, we similarly expect banks to offer higher interest rates on $250K MMDAs relative to the now-insured $100K MMDAs. However, we find that over 90% of banks never report differentiated pricing for $250K and $100K MMDAs over the 2009-2012 period.

Jacewitz and Pogach exclude banks that never report a positive risk premium from the analysis, assuming that these banks "use a pricing rule that ignores the market's perceived risk of the institution." On the one hand, we expect that deposit markets may indeed be characterized by inefficient pricing of credit risk. This view would severely restrict our ability to extend the authors' original analysis to $250K MMDAs. On the other hand, banks could report zero premiums for a variety of equally plausible reasons – customers may not perceive their uninsured deposits as risky due to expected support from the parent, may not understand or consider deposit insurance limits when choosing a bank, or may be slow to respond to changes in premiums. Moreover, banks may choose not to price uninsured deposits competitively because they can access alternative funding sources. Since the objective of this analysis is to accurately measure how much banks must pay deposit holders for their riskiness, we believe that excluding banks that choose to pay nothing at all to achieve their desired volume of deposit funding would bias the results.

We also recognize that in some instances zero premiums highlight a structural problem with the analysis – which is that banks may not report differentiated rates for large accounts, but nevertheless determine differentiated rates on a relationship basis. (These negotiated arrangements may include concessions on fees or interest rates on other products in return for maintaining a sizeable deposit balance.) Since we cannot systematically assess the gap between actual and reported rates for banks that do and do not report a positive risk premium, we find that excluding only the latter set would also bias the results. Thus, we include these banks in the overall sample.

Using this modified data set, we follow the general approach explained by Jacewitz and Pogach to analyze sources of deposit cost differences between large and small banks. In our baseline specification, we define large banks as those with assets >$500 BN as of 2012Q4[13], although our model tests various size thresholds ($100 BN-$500 BN and $10 BN-$100 BN).

First, we examine mean MMDAs rates for large and other banks over the 2006-2012 period. Across both $100K and $250K MMDAs, we observe, as expected, higher average rates during the crisis period followed by a steady decline to the end of 2012, reflecting the general trend in the federal funds rate over

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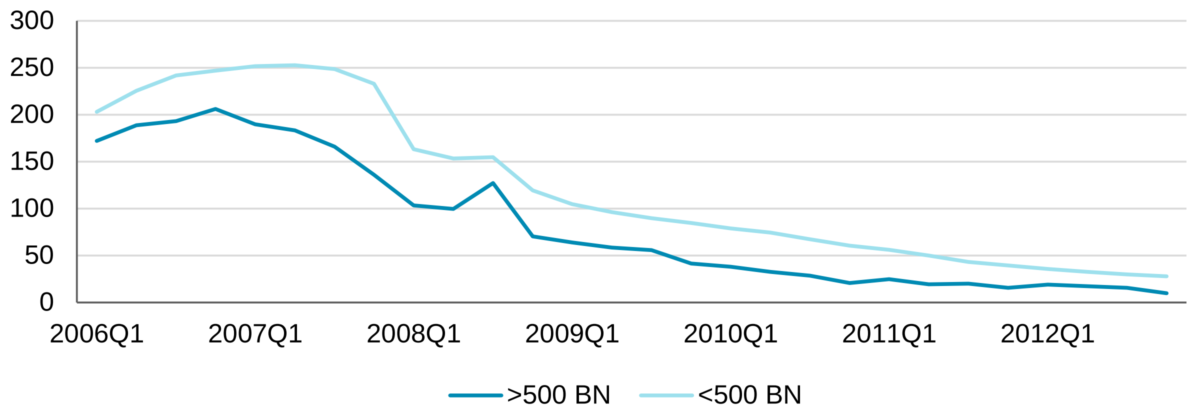
[13] Bank of America, Citibank, JPMorgan Chase Bank, Wells Fargo Bank; see appendix for listing of banks by size category.

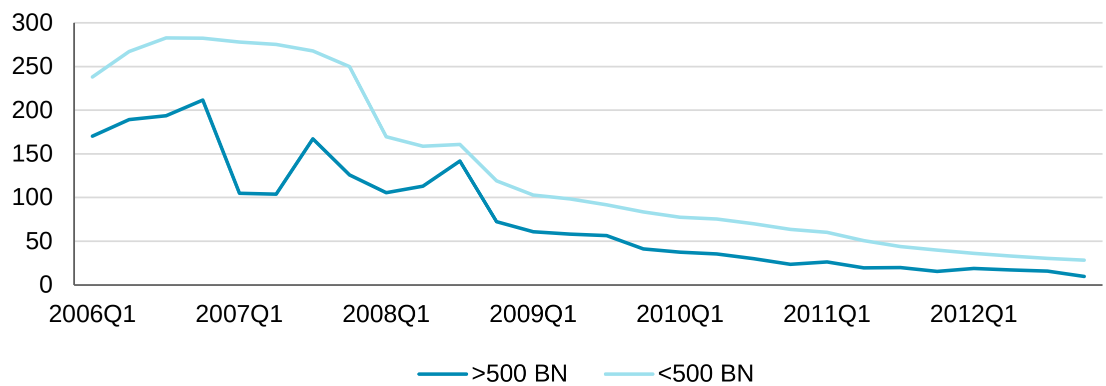
this time. The crisis period is also characterized by high volatility, particularly apparent for the cohort of large banks due to the relatively small sample.

Exhibit 5: Mean MMDA interest rates for large and other banks (2006Q1 – 2012Q4)

A. $100K MMDA mean reported rate (bps)



B. $250K MMDA mean reported rates (bps)



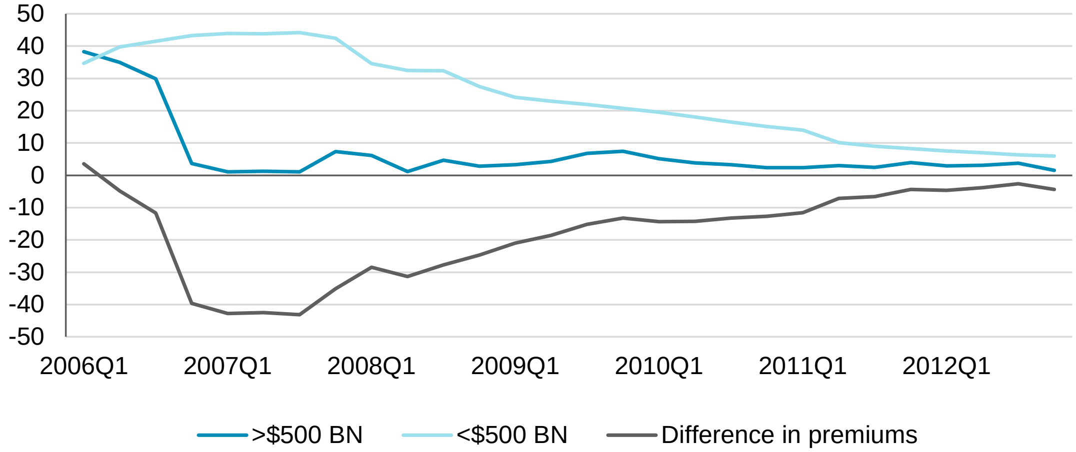
Notes: Bank size is based on 2012Q4 assets. The fluctuation in the average $250K MMDA rate for large banks earlier in the sample is driven almost entirely by Citibank, which reported a much higher than average rate in 2006-07 and did not report a $250K rate to RateWatch in 2007Q1-2007Q2 and 2011Q4
Sources: Oliver Wyman analysis, RateWatch

Next, we examine bank premiums, or the difference between (a) $100K and $25K MMDAs and (b) $250K and $100K MMDAs. As the figures below show, large banks consistently pay a lower premium on $100K MMDAs ($100K premium hereafter), although the difference in premiums between large and small banks declines dramatically from a crisis high of over 40 bps to just 4 bps at the end of 2012. Differences in $250K premiums between large and small firms also narrow dramatically over this time period, due to decreasing rates paid by small firms. As reported in figure 4.B above, over 90% of banks in the sample (and almost all of the large banks) do not report a risk premium on $250K MMDAs; thus, we observe average premiums that are close to zero for the largest banks throughout the observation period.

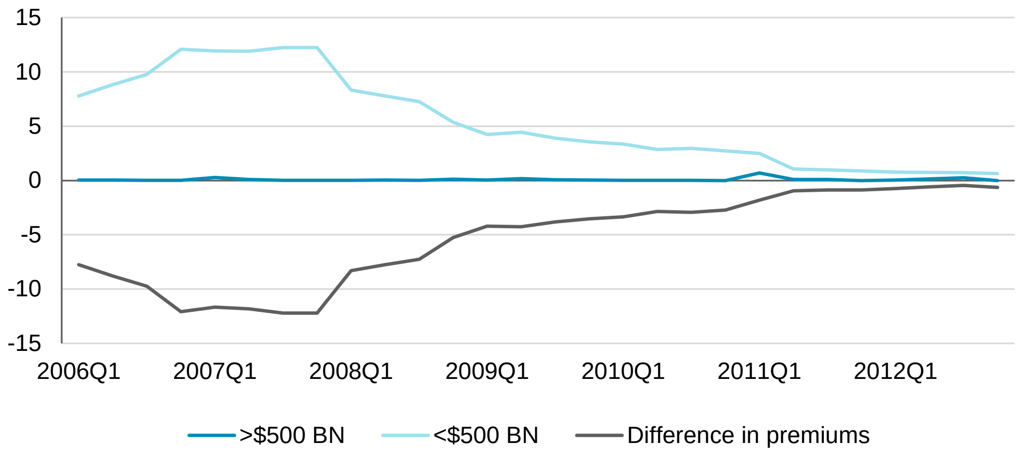
While recognizing the limitations of this data (and all other publically-available data on deposit funding), our objective is to attempt to disaggregate the effects of bank-specific characteristics from the effect of TBTF perceptions on premiums.

Exhibit 6: MMDA premiums for large and other banks (2006Q1 – 2012Q4)

A. Mean premium on $100K MMDAs over $25K MMDAs (bps)



B. Mean premium on $250K MMDAs over $100K MMDAs (bps)



Notes: Bank size is based on 2012Q4 assets. The drop in the average $100K premium for the large bank cohort in early 2006 is driven almost entirely by Citibank, which reported a much higher $25K MMDA rate starting in this period, drastically reducing the $100K risk premium.
Sources: Oliver Wyman analysis, RateWatch

B. Model specification

We use a fixed effects model with interactions between the variable of interest and time as our baseline, expressed as

$$premiums_{it} = \alpha + \beta_k BankControls_{kit} + \gamma\,(Large_i \times\ time\ effects_t) + \epsilon_{it}$$

where subscript i denotes individual banks and t denotes time periods. This baseline model simplifies the methodology proposed in the original study to be more aligned with standard econometric practice.[14]

We duplicate our analyses across two dependent variables – premiums on $100K MMDAs (to establish comparability with the results found by Jacewitz and Pogach and, more importantly, to study potential changes in funding costs in response to the change in deposit insurance coverage) and premiums on $250K MMDAs (to estimate potential large bank funding cost advantages that exist today on uninsured deposit accounts).

Bank-level risk controls are selected from among the dozens of publically reported indicators of asset quality, liquidity, capital, and other metrics. We use a combination of economic intuitiveness, univariate analysis and stepwise regression techniques to select the specific control variables included in the final model. The selected variables are

- Income as a share of average assets
- Liquid assets as a share of total assets
- Volatile liabilities as a share of total assets
- Deposit growth rate, defined as the growth in domestic and foreign office deposits since previous quarter, annualized

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[14] Our baseline model differs from that of Jacewitz and Pogach in two main ways. First, Jacewitz and Pogach use a two-stage regression technique. The first stage regresses the demeaned bank risk premium on demeaned risk variables (excluding the time-invariant *Large* dummy). The second stage regresses the errors from the first stage on the *Large* dummy. We believe that this two-step procedure is likely to result in inconsistent estimates and standard errors. Second, Jacewitz and Pogach segment the panel data by time period, and estimate a different regression for each period. We estimate the regression over the entire panel, using an interaction term (*Large* interacted with time) to obtain time-varying effects. Unreported robustness tests replicate the authors' methodology exactly and find similar results as those reported in the Jacewitz-Pogach study, confirming that the underlying data sample and preparation are comparable across the two studies.

Exhibit 10 in the Appendix provides details on these control variables.

$Large$ is a time-invariant binary variable defined based on assets in 2012Q4; its coefficient γ can be interpreted as the observed effect on deposit pricing associated with being a "large" bank. We test several variants of the model using alternative specifications for $Large$; our aim is to assess whether model-estimated large bank effects on deposit pricing are unique to firms that are presumed TBTF, or observed more broadly across banks that, although relatively large, are unlikely to be perceived as TBTF.

- In the baseline specification, we define banks with >$500 BN in assets as of 2012Q4 as "large" (there are 4 such banks in our sample).
- In an alternate specification, we revise the definition of "large" to apply to banks with $100 BN - $500 BN in assets (7 banks in our sample). Banks with >$500 BN in assets are excluded from this model. Thus, the regression-estimated $Large$ dummy coefficient can be interpreted as the deposit funding (dis)advantages for banks in this cohort relative to smaller banks (with <$100 BN in assets).
- We similarly adjust the definition of "large" to $10 BN - $100 BN (over 50 banks), in each case excluding banks that are larger than the upper limit of the specified size range.

Exhibit 11 in the Appendix lists the firms included in each specification.

Finally, we include a vector of time fixed effects to capture trends that impact deposit pricing for all banks in any given period, such as changes to economic conditions and interest rates. We interact time effects with the variable of interest to obtain time-varying estimates of large bank effects on deposit pricing.

C. Key findings

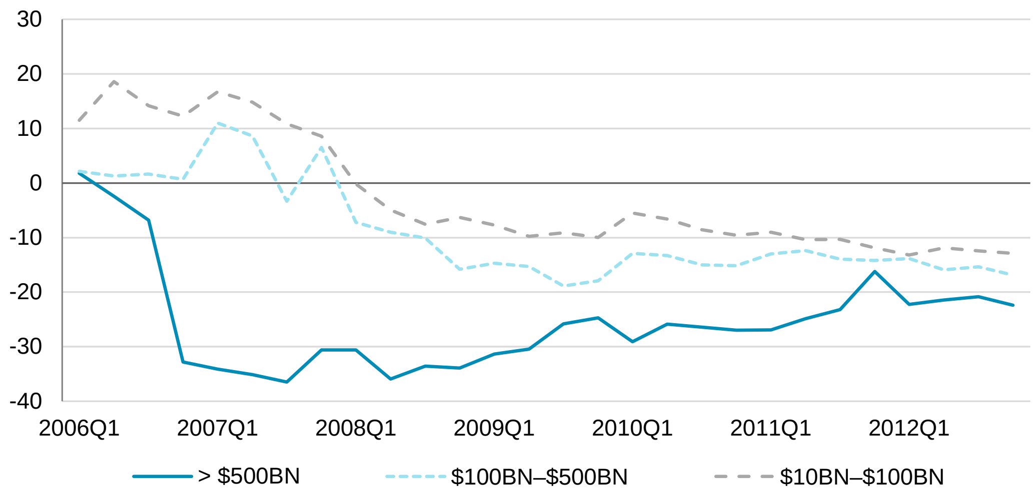
Since incorporating interaction terms allows us to track the large bank effect γ over time, we use it as an indicator for shifting market perceptions of the likelihood of extraordinary government support. We estimate changes in market perceptions on a quarterly basis, as well as over three periods in our sample that correspond to different deposit insurance coverage regimes and other regulatory changes.

First, we estimate the quarterly value of large bank effects on $100K premiums (Exhibit 7.A). In the baseline regression, large banks are defined as >$500 BN in assets; we also report results from two additional regressions that use alternative large bank thresholds. Our results are similar to those of Jacewitz and Pogach, in that the largest banks appear to have a funding cost advantage during the crisis period (estimated to be over 30 bps in our baseline regression). However, even post-2010Q2 when $100K MMDAs are explicitly insured (and thus presumably unaffected by bailout expectations), we find that a sizable funding advantage of over 20 bps persists for these banks. We further note that banks in size cohorts that are not presumed TBTF, such as those with $10 BN-$100 BN in assets, also appear to have funding advantage relative to smaller peers. Both of these findings indicate the presence of non-

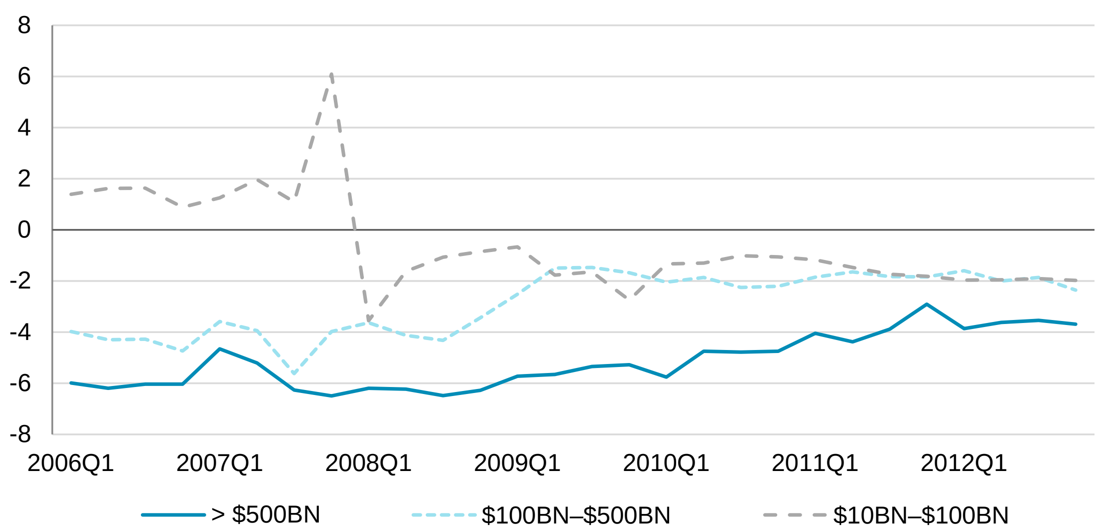
TBTF sources of funding cost advantages that are not explained by other controls in the model, and/or limitations inherent to the underlying posted deposit rate data.

Exhibit 7: Quarterly estimates of 'large' bank effects on deposit funding costs

A. Regression estimates with $100K premiums (bps)



B. Regression estimates with $250K premiums (bps)



Notes: Each figure show results from three separate regressions, under different definitions for "large" bank (by asset size in 2012Q4). The dependent variables are $100K premiums (Exhibit 7.A) and $250K premiums (Exhibit 7B). Full regression results are provided in the Appendix, Exhibits 12 and 13.
Source: Oliver Wyman analysis

Exhibit 7.B reports results using $250K premiums as the dependent variable. The estimated 'large bank effect' for the >$500 BN cohort decreases over this period, from approximately 6 bps in 2006 to under 4 bps in 2012. Furthermore, the estimated advantage of being in the cohort of $10 BN-100 BN during this post-crisis period is generally half of the advantage estimated for the >$500 BN cohort, suggesting (as in the $100K premium analysis), that estimated coefficients are picking up substantial non-TBTF effects, including other influences on deposit rates that would be associated with size but not TBTF perceptions.[15]

These are small absolute differences in terms of deposit rates, likely reflecting the low interest rate environment and especially the reduction in risky spreads, and could understate the absolute rate differences that might be observed in different economic environments.[16] Even so, the available evidence in the post-crisis period clearly points toward very small and declining deposit rate advantages for the largest banks – a marked contrast to the larger rate differentials we observe during 2007-2009, when active intervention by the public sector to support banks likely served to strengthen TBTF perceptions.

To lend further support to these findings, we assess the large bank effect γ over longer periods within our sample: 2006Q1 – 2008Q3 (before the SMDIA change), 2008Q4 – 2010Q2 (post temporary SMDIA change), and 2010Q3 – 2012Q4 (post enactment of the DFA), controlling for the same balance sheet measures incorporated in the above analysis.

In analyzing $100K premiums, we expect potential large bank advantages to be evident in the first period when $100K MMDAs were uninsured and institutional bailouts were an important tool in regulators' crisis response kits. In the second period, we expect these effects to be dampened due to the extension of the SMDIA to $250K, although not fully eliminated since the change was temporary and only retroactively covered the later quarters within this period. The third period offers a view of market perceptions today, under a permanent and explicit SMDIA of $250K, the prohibition of taxpayer-funded institutional bailouts, and other regulatory changes aimed at creating credible alternatives to bailouts. Since $100K MMDAs are explicitly insured in this period, analysis of $250K premiums is likely to offer the most relevant information on whether recent regulatory measures have reduced or eliminated market perceptions of TBTF.

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[15] For example, larger banks may have better access to non-deposit sources of funds; may be less willing to "pay up" to attract deposits, given the less favorable regulatory treatment that large banks receive for price-sensitive deposits; may have more brand recognition, larger advertising budgets, better online access, more prominent branch locations, or other factors that could offset the impact of offering relatively lower rates (and premiums vs. fully insured accounts) than smaller banks.

[16] The low absolute interest rates observed in recent years can be conceptually decomposed into low risk-free rates and low risky spreads (especially as compared to risky spreads during the crisis). The reduction of risky spreads in general, and for banks more particularly, would reduce the estimated market value of any type of credit protection. Therefore, the value of TBTF benefits would depend on both the perceived probability of distress, and the perceived likelihood of support in the event of distress.

Estimates for γ are presented below. For each dependent variable, reported results are for 3 separate panel regressions (specifying alternative definitions of "large" bank).

Exhibit 8: 'Large' bank effects on deposit funding costs across three periods

A. Regression estimates with $100K premiums

	(1)	(2)	(3)
	> $500 BN	**$100 BN - $500 BN**	**$10 BN - $100 BN**
2006Q1 - 2008Q3	-0.252***	0.002	0.088*
2008Q4 - 2010Q2	-0.287***	-0.156***	-0.078**
2010Q3 - 2012Q4	-0.233***	-0.146***	-0.111***

B. Regression estimates with $250K premiums

	(4)	(5)	(6)
	> $500 BN	**$100 BN - $500 BN**	**$10 BN - $100 BN**
2006Q1 - 2008Q3	-0.060***	-0.042***	0.008
2008Q4 - 2010Q2	-0.055***	-0.021	-0.015*
2010Q3 - 2012Q4	-0.040***	-0.019***	-0.017***

Significant at 1%***, 5%**, 10%*
Note: Each column has results from a separate panel regression, testing alternate specifications for 'large'. Detailed panel analysis results for all bank cohorts are included in the appendix, Exhibits 14 and 15
Source: Oliver Wyman analysis

Focusing first on the analysis using $100K premiums as the dependent variable, we estimate that banks with >$500 BN in assets (column 1) received a large bank discount of approximately 25 bps during the 2006Q1 – 2008Q3 period. This discount remains largely unchanged, at 23 bps, in the most recent period when $100K MMDAs are explicitly insured. Further, we note that banks in all size categories receive a "large bank discount" in periods when $100K MMDAs are fully insured. We also see that banks with $100 BN-500 BN in assets, which are not expected to be beneficiaries of implicit government support, receive a funding cost advantage of 15 bps in the most recent period, more than half the advantage observed for the largest banks (column 2). These results suggest that certain size-related benefits may not be captured by other model controls, and the parameter estimates associated with the $Large$ binary indicator cannot be interpreted simply as the result of a perception that the largest banks are TBTF.

Exhibit 8.B above presents panel analysis results for $250K premiums under similar model specifications. We find that the impact of being one of the largest banks is much more muted, at most accounting for a funding cost advantage of 6 bps in 2006-08, and dropping to 4 bps in the post-DFA period (column 4).[17] As with the analysis discussed above, we note that banks with $10 BN-100 BN and $100 BN-500 BN in assets also have a 2 bps advantage in this period (column 6), suggesting that at least half of the funding cost advantages for the largest banks cannot simply be attributed to TBTF perceptions.

[17] We also replicate the analyses above using the natural log of $100K and $250K premiums as our dependent variables, and find similar results. These are reported in the appendix, Exhibits 14 and 15.

4. Conclusions

We do not find strong evidence that large banks derived deposit funding cost advantages that can be attributed to TBTF over the 2010-2012 period. Extending the methodology of Jacewitz and Pogach to uninsured accounts after the change in SMDIA, we find that funding cost advantages for the largest banks amount to 4 bps after controlling for a commonly-used set of bank controls. We draw two main conclusions about these findings.

First, this estimated large bank effect on funding costs, small as it is, can be explained by non-TBTF related factors. We demonstrate that banks that are not generally perceived as TBTF (banks with $10 BN - $500 BN in assets) also receive funding cost advantage relative to smaller peers. This indicates a general size effect that is not adequately explained by other controls in the model. We also demonstrate that the large-bank indicator signals funding cost advantages on insured $100K MMDAs in the most recent period. Since these accounts are explicitly insured by the FDIC and therefore riskless, market perceptions of bank credit risk should not affect funding costs. Again, we conclude that the estimated funding cost advantages for 'large' banks are in fact related to a significant degree to non-TBTF effects.

We point to several alternative drivers of lower funding costs for large banks. For instance, large banks can choose to be less competitive in the deposit markets due to their ability to access a much more diverse set of funding sources relative to smaller banks. Also, larger banks have proportionally less deposit funding, and thus their deposits should benefit more from the credit protection provided by larger amounts of more subordinated non-deposit funding. Creditors may therefore view large bank deposits as safer investments that are more likely to be recovered in the event of failure. The largest banks also face different regulations than smaller banks that likely lead them to place relatively less value on large, rate-sensitive deposits (including a different pricing model for FDIC deposit insurance and more restrictive Basel 3 liquidity and funding ratios).

We find further support for the conclusion that TBTF perceptions are not significant drivers of depositor behavior in recent periods by analyzing the effects of the recently-expired Transaction Account Guarantee Program (TAGP). The TAGP offered unlimited insurance coverage on non-interest bearing transactions accounts beginning in the fall of 2008; at the end of 2012, the coverage limit fell to $250K. In an environment where large banks are perceived to be safer due to TBTF, we would expect to see deposits flow from smaller to large banks with the expiration of explicit insurance. However, we find that quarter-end deposit volumes at smaller banks grow by over 5% between 2012Q3 and 2013Q1, whereas banks with >$500 BN in assets experienced little change.[18]

Overall, our key findings – that the deposit rate advantages of large banks have declined significantly in the post-crisis period, and that most of the measured differences are clearly related to factors other than TBTF perceptions – are consistent with the premise that policy changes meant to combat TBTF have been effective. Of course, part of the intended effect of such policies is to reduce the risk of failure of large financial institutions, which in turn reduces the measured size of any TBTF effect on funding costs, even if the average perception of the likelihood of extraordinary firm-specific support in the event of distress had remained the same. We believe, however, that it is more plausible that the widespread policy efforts to change those perceptions has had an effect on them, in addition to reducing the perceived probability of distress. Ongoing measurement of funding cost differences, especially in different environments where the perceived risk of bank failure is more significant, should be a useful monitoring tool for future policymakers.

[18] Statistics are for bank-level entities; for a more detailed discussion of the TAGP and deposit flows at the BHC level, see Kroszner (2013)

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APPENDIX

Exhibit 9: Control variables for deposit funding analysis

Variable	Description	Mean	25%	Median	75%	StdDev	N
Dep	Annualized growth in deposits since previous quarter (for deposits held in domestic and foreign offices)	0.083	-0.056	0.039	0.153	0.344	65891
Inc	Before tax income to average assets	0.008	0.004	0.011	0.016	0.019	66283
Liq	Sum of cash, securities, fed funds sold, repos, and trading account assets less pledged securities) to total assets	0.216	0.118	0.187	0.283	0.136	66385
Vol	Volatile liabilities (sum of jumbo CD, foreign deposits, FF & repos, other borrowed money <1 yr, trading derivatives less trading derivatives with a negative fair value) to assets	0.137	0.061	0.116	0.194	0.099	66385

Exhibit 10: Bank classification by 2012Q4 assets

>$10 BN

>$100 BN

>$500 BN assets

- Bank of America, NA
- JPMorgan Chase Bank, NA
- Wells Fargo Bank, NA
- Citibank, NA

- Capital One, NA
- PNC Bank, NA
- US Bank NA
- SunTrust Bank

- Fifth Third Bank
- BB&T Company
- Regions Bank

~50 banks

Exhibit 11: Quarterly estimates of large bank effects on $100K premiums – detailed results

Results are for the baseline fixed effects model with $100K premiums as the dependent variable. The variable of interest, *Large*, is interacted with time effects specified for each quarter. Each column reports results from a separate panel analysis, with an alternative definition for *Large* (>$500 BN, $100 BN-$500 BN, $10 BN-$100 BN, based on 2012Q4 assets). Reporting within-estimated coefficients for bank controls and Large*time interaction terms, with errors clustered at the bank level:

Variable	Period	> $500 BN	$100 BN-$500 BN	$10 BN-$100 BN
Intercept		0.124***	0.124***	0.126***
Dep		0.057***	0.058***	0.059***
Inc		-0.217*	-0.219*	-0.228**
Liq		-0.187***	-0.187***	-0.191***
Vol		0.686***	0.687***	0.682***
Large*time	**2006Q1**	0.018	0.021	0.115*
Large*time	**2006Q2**	-0.024	0.013	0.186**
Large*time	**2006Q3**	-0.068	0.016	0.142**
Large*time	**2006Q4**	-0.328***	0.007	0.123**
Large*time	**2007Q1**	-0.341***	0.110	0.167**
Large*time	**2007Q2**	-0.351***	0.086	0.149**
Large*time	**2007Q3**	-0.365***	-0.033	0.109*
Large*time	**2007Q4**	-0.306***	0.065	0.086
Large*time	**2008Q1**	-0.306***	-0.072	-0.001
Large*time	**2008Q2**	-0.360***	-0.090	-0.050
Large*time	**2008Q3**	-0.336***	-0.101*	-0.075**
Large*time	**2008Q4**	-0.339***	-0.158**	-0.063
Large*time	**2009Q1**	-0.313***	-0.147***	-0.077*
Large*time	**2009Q2**	-0.305***	-0.153***	-0.098**
Large*time	**2009Q3**	-0.258***	-0.189***	-0.091**
Large*time	**2009Q4**	-0.247***	-0.179***	-0.100***
Large*time	**2010Q1**	-0.291***	-0.129***	-0.055
Large*time	**2010Q2**	-0.259***	-0.133***	-0.066**
Large*time	**2010Q3**	-0.264***	-0.150***	-0.085***
Large*time	**2010Q4**	-0.270***	-0.152***	-0.096***
Large*time	**2011Q1**	-0.269***	-0.130***	-0.090***
Large*time	**2011Q2**	-0.249***	-0.124***	-0.104***
Large*time	**2011Q3**	-0.232***	-0.139***	-0.103***
Large*time	**2011Q4**	-0.162***	-0.142***	-0.119***
Large*time	**2012Q1**	-0.223***	-0.139***	-0.132***
Large*time	**2012Q2**	-0.214***	-0.159***	-0.119***
Large*time	**2012Q3**	-0.208***	-0.154***	-0.125***
Large*time	**2012Q4**	-0.224***	-0.169***	-0.129***

Significant at 1%***, 5%**, 10%*

Exhibit 12: Quarterly estimates of large bank effects on $250K premiums – detailed results

Results are for the baseline fixed effects model with $250K premiums as the dependent variable. The variable of interest, *Large*, is interacted with time effects specified for each quarter. Each column reports results from a separate panel analysis, with an alternative definition for *Large* (>$500 BN, $100 BN-$500 BN, $10 BN-$100 BN, based on 2012Q4 assets). Reporting within-estimated coefficients for bank controls and Large*time interaction terms, with errors clustered at the bank level:

Variable	Period	> $500 BN	$100 BN-$500 BN	$10 BN-$100 BN
Intercept		0.009**	0.009**	0.009**
Dep		0.013***	0.013***	0.014***
Inc		-0.114*	-0.113*	-0.110*
Liq		-0.021**	-0.021**	-0.022**
Vol		0.136***	0.139***	0.140***
Large*time	**2006Q1**	-0.060***	-0.040***	0.014
Large*time	**2006Q2**	-0.062***	-0.043***	0.016
Large*time	**2006Q3**	-0.060***	-0.043***	0.016
Large*time	**2006Q4**	-0.060***	-0.047***	0.009
Large*time	**2007Q1**	-0.047***	-0.036***	0.013
Large*time	**2007Q2**	-0.052***	-0.039***	0.020
Large*time	**2007Q3**	-0.063***	-0.056***	0.011
Large*time	**2007Q4**	-0.065***	-0.040***	0.061
Large*time	**2008Q1**	-0.062***	-0.036***	-0.036***
Large*time	**2008Q2**	-0.062***	-0.041***	-0.016
Large*time	**2008Q3**	-0.065***	-0.043***	-0.011
Large*time	**2008Q4**	-0.063***	-0.034**	-0.009
Large*time	**2009Q1**	-0.057***	-0.025*	-0.007
Large*time	**2009Q2**	-0.057***	-0.015	-0.018
Large*time	**2009Q3**	-0.053***	-0.015	-0.016
Large*time	**2009Q4**	-0.053***	-0.017	-0.028***
Large*time	**2010Q1**	-0.058***	-0.021***	-0.013*
Large*time	**2010Q2**	-0.048***	-0.019***	-0.013**
Large*time	**2010Q3**	-0.048***	-0.023***	-0.010
Large*time	**2010Q4**	-0.048***	-0.022***	-0.011*
Large*time	**2011Q1**	-0.041***	-0.019***	-0.012**
Large*time	**2011Q2**	-0.044***	-0.016***	-0.015***
Large*time	**2011Q3**	-0.039***	-0.018***	-0.017***
Large*time	**2011Q4**	-0.029***	-0.018***	-0.018***
Large*time	**2012Q1**	-0.039***	-0.016***	-0.020***
Large*time	**2012Q2**	-0.036***	-0.020***	-0.020***
Large*time	**2012Q3**	-0.035***	-0.019***	-0.019***
Large*time	**2012Q4**	-0.037***	-0.024***	-0.020***

Significant at 1%***, 5%**, 10%*

Exhibit 13: Estimates of large bank effects on $100K premiums over three periods – detailed results

Results are for the baseline fixed effects model with **$100K premiums ($100K MMDA rate - $25K MMDA rate) as the dependent variable**. The variable of interest, *Large*, is interacted with time effects specified for three periods: 2006Q1-2008Q3, 2008Q4-2010Q2, 2010Q3-2012Q4. Reporting within estimated coefficients for bank controls and Large*time interaction terms, with errors clustered at the bank level. Each column reports results from a separate panel analysis, with an alternative definition for *Large* based on 2012Q4 assets.

		(1)	(2)	(3)
Variable	**Period**	**> $500 BN**	**$100 BN-$500 BN**	**$10 BN-$100 BN**
Intercept		0.124*** (0.009)	0.124*** (0.009)	0.126*** (0.009)
Dep		0.057*** (0.006)	0.058*** (0.006)	0.059*** (0.007)
Inc		-0.216* (0.112)	-0.218* (0.112)	-0.221** (0.112)
Liq		-0.187*** (0.027)	-0.187*** (0.027)	-0.190*** (0.027)
Vol		0.686*** (0.040)	0.687*** (0.040)	0.682*** (0.041)
Large*time	**2006Q1-2008Q3**	-0.252*** (0.039)	0.002 (0.082)	0.088* (0.051)
Large*time	**2008Q4-2010Q2**	-0.287*** (0.042)	-0.156*** (0.043)	-0.078** (0.033)
Large*time	**2010Q3-2012Q4**	-0.233*** (0.051)	-0.146*** (0.021)	-0.111*** (0.019)

Significant at 1%***, 5%**, 10%*

The model specification shown below is the same as above, using the **natural log of $100K premiums (calculated as ln[$100K MMDA rate / $25KMMDA rate]) as the dependent variable.** Given the log transformation of the dependent variable, we back-transform the coefficient of the interaction terms as e^{γ}. The results can be interpreted as the premium that large banks pay for $100K MMDAs as a percentage of the premium paid by smaller banks. For example, the interaction term for the >$500 BN cohort in 2010-2012 is -0.075, which back transforms to .93, i.e. the largest bank paid 93% of the premium paid by smaller peers. Since smaller banks paid an average $100K premium of 9 bps in this period, this translated into less than 1 bps of funding advantage for banks with >$500 BN in assets.

Variable	**Period**	**> $500 BN**	**$100 BN-$500 BN**	**$10 BN-$100 BN**
Intercept		0.309*** (0.012)	0.310*** (0.012)	0.309*** (0.012)
Dep		0.017*** (0.005)	0.017*** (0.005)	0.017*** (0.005)
Inc		-0.961*** (0.137)	-0.956*** (0.137)	-0.953*** (0.137)
Liq		-0.242*** (0.034)	-0.244*** (0.034)	-0.242*** (0.034)
Vol		0.029 (0.039)	0.029 (0.039)	0.031 (0.040)
Large*time	**2006Q1-2008Q3**	-0.180*** (0.026)	-0.092** (0.045)	-0.041 (0.033)
Large*time	**2008Q4-2010Q2**	-0.165*** (0.033)	-0.074 (0.073)	0.066 (0.051)
Large*time	**2010Q3-2012Q4**	-0.075 (0.065)	-0.143** (0.072)	0.059 (0.044)

Significant at 1%***, 5%**, 10%*

Exhibit 14: Estimates of large bank effects on $250K premiums over three periods – detailed results

Results are for the baseline fixed effects model with $250K premiums as the dependent variable. The variable of interest, *Large*, is interacted with time effects specified for three periods: 2006Q1-2008Q3, 2008Q4-2010Q2, 2010Q3-2012Q4. Reporting within estimated coefficients for bank controls and Large*time interaction terms, with errors clustered at the bank level. Each column reports results from a separate panel analysis, with an alternative definition for *Large* (>$500 BN, $100 BN-$500 BN, $10 BN-$100 BN, based on 2012Q4 assets).

		(4)	(5)	(6)
Variable	**Period**	**> $500 BN**	**$100 BN-$500 BN**	**$10 BN-$100 BN**
Intercept		0.009**	0.009**	0.009**
		(0.004)	(0.004)	(0.004)
Dep		0.013***	0.013***	0.014***
		(0.003)	(0.003)	(0.003)
Inc		-0.114*	-0.112*	-0.111*
		(0.064)	(0.064)	(0.065)
Liq		-0.021**	-0.021**	-0.022**
		(0.010)	(0.010)	(0.010)
Vol		0.136***	0.139***	0.140***
		(0.022)	(0.022)	(0.023)
Large*time	**2006Q1-2008Q3**	-0.060***	-0.042***	0.008
		(0.012)	(0.005)	(0.019)
Large*time	**2008Q4-2010Q2**	-0.055***	-0.021	-0.015*
		(0.010)	(0.015)	(0.009)
Large*time	**2010Q3-2012Q4**	-0.040***	-0.019***	-0.017***
		(0.011)	(0.003)	(0.004)

Significant at 1%***, 5%**, 10%*

The model specification shown below is the same as above, using the **natural log of $250K premiums (calculated as ln[$250K MMDA rate / $100KMMDA rate]) as the dependent variable.** Given the log transformation of the dependent variable, we back-transform the coefficient of the interaction terms as e^{γ}. The results can be interpreted as the premium that large banks pay for $250K MMDAs as a percentage of the premium paid by smaller banks. For example, the interaction term for the >$500 BN cohort in 2010-2012 is -0.029, which back transforms to .97, i.e. the largest bank pay 97% of the premium paid by smaller peers. Since smaller banks paid an average $250K premium of just1 bps in this period, this translates into less than 0.30 bps in funding cost advantage for banks with >$500 BN in assets.

Variable	**Period**	**> $500 BN**	**$100 BN-$500 BN**	**$10 BN-$100 BN**
Intercept		0.020***	0.020***	0.019***
		(0.004)	(0.004)	(0.004)
Dep		0.010***	0.010***	0.010***
		(0.002)	(0.002)	(0.002)
Inc		-0.117*	-0.115*	-0.109*
		(0.062)	(0.062)	(0.063)
Liq		-0.015	-0.015	-0.015
		(0.010)	(0.010)	(0.010)
Vol		0.082***	0.084***	0.088***
		(0.018)	(0.018)	(0.019)
Large*time	**2006Q1-2008Q3**	-0.049***	-0.038***	-0.020**
		(0.009)	(0.004)	(0.008)
Large*time	**2008Q4-2010Q2**	-0.044***	-0.005	-0.001
		(0.009)	(0.030)	(0.014)
Large*time	**2010Q3-2012Q4**	-0.029***	-0.025***	-0.002
		(0.009)	(0.002)	(0.009)

Significant at 1%***, 5%**, 10%*

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