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Overview and Assessment of the Methodology Used to Calibrate the U.S. GSIB Capital Surcharge

May 2016

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SUMMARY

In July 2015, the Federal Reserve issued a final rule specifying a capital surcharge for global systemically important bank holding companies (GSIBs) in the United States.[1] As part of its final rule, the Federal Reserve published a white paper describing the methodology it used to determine the capital surcharge for each U.S. GSIB.[2] In short, the methodology is intended to identify a surcharge for each GSIB such that the odds of the GSIB's failure are reduced proportionately to the systemic cost were the GSIB to fail.

While the methodology is reasonable in principle, we identify two material shortcomings in its implementation that call into question the appropriateness of the surcharges it produces:

- First, the methodology does not estimate the systemic losses that would occur if each GSIB were to fail. Instead, the losses are simply assumed to be proportional to a specific weighted sum of selected bank characteristics. Different, equally reasonable, assumptions governing the relationship between systemic loss given default and bank characteristics would deliver materially different surcharges.
    - *Because the systemic loss given default is assumed, not estimated, the GSIB surcharge is neither "calibrated" in any real sense of the term nor substantiated.*
    - *Moreover, the surcharges are not adjusted for numerous other supervisory and regulatory requirements of GSIBs expressly designed to reduce their systemic loss given default.*
- Second, although the methodology does estimate empirically the relationship between capital levels and the odds of failure, the estimate is very sensitive to the number of banks included and the time period used in the calibration exercise.
    - *Changing the composition of the sample to be more in line with the limited set of banks subject to the GSIB surcharge and/or excluding observations for earlier periods when the regulatory environment differed in significant ways would lower the surcharges substantially.*

1 See 80 Fed. Reg 49082 at 49093.

2 See "Calibrating the GSIB Surcharge," Federal Reserve Board, July 20, 2015.

ABOUT THE GSIB SURCHARGE

The Dodd-Frank Act requires the Federal Reserve to adopt enhanced capital standards for the largest banks to mitigate the risks posed to financial stability by a systemically important financial institution. The GSIB surcharge is intended to reduce the probability of failure of a U.S. GSIB relative to that of a non-GSIB to offset the relatively greater systemic costs of a GSIB's failure. In addition, increasing capital requirements for the largest banks creates incentives for GSIBs to shrink their systemic footprint and offset purported funding advantages perceived to be associated with being "too-big-to-fail."[3] The GSIB capital surcharge is an additional capital buffer that U.S. GSIBs will need to hold, over and above the capital buffer that apply to non-GSIBs.[4] The buffer applies to all risk-based minimum capital requirements (common equity tier 1, tier 1, and total) and is being phased in through the end of 2018. The Federal Reserve has also indicated that it is considering incorporating some or all of the GSIB capital surcharge into the minimum requirements that it evaluates in its annual Comprehensive Capital Analysis and Review (CCAR) stress testing exercise.[5]

As noted in its white paper, the Federal Reserve has calibrated the GSIB surcharge using what it calls the "expected impact" framework. This framework calibrates the surcharge by equating the "expected loss" (EL) from a GSIB's failure—that is, the systemic loss that would occur were that GSIB to fail (the systemic loss given default, or SLGD) times the probability of failure (PD)—to the expected loss of a non-GSIB reference bank (denoted by 'r' hereafter):

$$\mathrm{EL}_{\mathrm{GSIB}} = \mathrm{EL}_{\mathrm{r}}, \qquad (1)$$

where $\mathrm{EL}_{\mathrm{i}} = \mathrm{PD}_{\mathrm{i}} \times \mathrm{SLGD}_{\mathrm{i}}$. This formula assumes that the SLGD of a GSIB failure is greater than the SLGD of a non-GSIB, and thus to equalize the two the framework lowers the probability of default of a GSIB by requiring it to hold more capital. The calibration methodology the Federal Reserve uses relies on three key inputs: (i) a method to quantify a bank's systemic loss given default; (ii) identification of a non-GSIB reference bank; and (iii) a function that relates a bank's probability of failure to its capital ratio.

A PROXY FOR THE SYSTEMIC LOSS GIVEN DEFAULT

The white paper does not attempt to estimate the systemic loss given default of GSIBs or the reference non-GSIB. Instead, as a proxy for systemic loss given default, it uses a systemic indicator score based on five sets of bank characteristics that are correlated with a bank's systemic importance. There are two methods to calculate the aggregate systemic indicator score. "Method 1" is based on the international Basel Committee framework for identifying GSIBs and depends on measures of the following bank characteristics: size, interconnectedness, complexity, cross-jurisdictional activity, and substitutability. Interconnectedness, substitutability, and complexity each have three subcomponents, cross-jurisdictional activity has two, and size only one. "Method 2" re-

3 The objective of eliminating "too big to fail" may be moot. In a recently released study, the General Accounting Office reported that the majority of models it estimated found that large banks do not have a funding advantage relative to smaller banks. See "Large Bank Holding Companies; Expectations of Government Support," GAO-14-621, July 2014.

4 Unlike minimum capital requirements, banks' capital levels can dip into "buffers," but, in that case, the banks face increasingly stringent limits on dividend payments and executive compensation.

5 See 80 Fed. Reg 49082 at 49093.

places substitutability with a measure of a bank's reliance on short-term wholesale funding. The Federal Reserve requires that the surcharge be calculated under both methods, with the larger of the two used. We focus on the method 2 score because it generally delivers a higher surcharge for each GSIB and thus is very likely to be the method by which the specific GSIB surcharges are determined in the United States.

To calculate the method 2 score, the subcomponents of the indicators are normalized, weighted, and then added together. The 9 total subcomponents of the first four indicators are normalized by the aggregate global measure for that subcomponent over previous years, defined as the sum across all 75 largest global banks. The weights for those subcomponents are chosen so that each subcomponent within an indicator receives equal weight, and also so that each of the four indicators, in turn, receives equal weight. Short-term wholesale funding is normalized by average risk-weighted assets across all global systemically important banks and multiplied by a fixed conversion factor chosen to give equal weight to all 5 systemic indicators under method 2.[6]

REFERENCE NON-GSIB

Another important input in the Federal Reserve's calibration of the GSIB surcharge is the reference non-GSIB to which each GSIB is compared. Both methods for calculating the proxy for systemic loss given default result in a sharp drop in the systemic indicator score between the eighth and ninth bank, with the same eight banks receiving the highest scores using both methods. The Federal Reserve concludes that a surcharge is appropriate for those eight banks, and chooses as its proxy for the SLGD of its reference non-GSIB, a hypothetical systemic indicator score that is just above the score of the ninth bank. Specifically, the Federal Reserve finds that estimated method 2 scores drop from 213 for the eighth bank (the lowest scoring GSIB) to 85 for the next smallest bank, and it uses 100 as the score of the reference non-GSIB.[7] We adopt the same approach in the analysis discussed below.

CAPITAL AND PROBABILITY OF DEFAULT

The expected impact framework requires an estimate of the relationship between each GSIB's and the reference non-GSIB's capital level and its probability of default. To obtain this mapping of capital levels to probabilities of default, the white paper estimates a specific functional form to the actual percentiles of the annual return on risk-weighted assets (RORWA), using as its sample set the historical loss experience of the top 50 U.S. bank holding companies over a time period beginning in 1986 and ending in 2014.[8] Specifically, the regression is defined as follows:

$$RORWA_i = \alpha + \beta \ln[P(x \leq RORWA_i)] \quad (2)$$

where $P(x \leq RORWA_i)$ is the probability that

6 In addition, the indicators are multiplied by 10,000 to convert to basis points and then doubled. It is unclear why the scores are doubled; the doubling does not change the surcharge implied by the calculation method described here and in the white paper.

7 The score of the reference non-GSIB and the resulting GSIB surcharge levels are inversely related. The lower is the score of the reference non-GSIB (i.e., the less systemically important the reference non-GSIB is assumed to be), the higher is the GSIB surcharge (i.e., the greater extent to which the GSIB's probability of default must be reduced such that the systemic loss given default of the two banks are equalized).

8 Annual returns are measured quarterly and calculated as four-quarter moving averages.

a particular realization of $RORWA_i$, x, will be less than or equal to a specified level over a given year. The white paper shows that the capital surcharge of a GSIB, k_{GSIB}, that equates the expected impact of its default to that of a reference non-GSIB is:

$$k_{GSIB} = \beta \ln\left(\frac{SLGD_{GSIB}}{SLGD_r}\right). \quad (3)$$

Thus, to estimate the GSIB capital surcharge, this formula requires (i) the slope coefficient of the regression; (ii) the GSIB's SLGD score; and (iii) the reference non-GSIB's SLGD score. Given uncertainty about the estimated coefficient, β, a 99 percent confidence interval is used to estimate the range of the capital surcharge. Chart 1 shows both (i) the estimated surcharge range that is implied under the Federal Reserve's calibration methodology using method 2 scores and (ii) the actual surcharge range that is implied under the Federal Reserve's calibration methodology and (ii) the actual surcharge, calculated under both methods, for each GSIB at the time of the final rule. The Federal Reserve set the binding surcharge, which in all cases is the same as the method 2 surcharge (yellow diamonds), to be below the lower bound of the capital surcharge range in all but one instance.[9]

CHART 1: GSIB SURCHARGE ESTIMATIONS *Data as of 2015Q1*

Source: Federal Reserve Board

KEY OBSERVATIONS

1. *The use of the systemic indicator score as a measure of systemic loss given default is unsubstantiated.*

The Federal Reserve's final rules and calibration white paper do not contain any assessment or evaluation of the extent to which a bank's systemic indicator score is predictive of the systemic losses that would occur if that bank failed. As a result, there is no empirical basis, validation or back-testing of the various bank attributes that determine the GSIB scores and their relationship to systemic loss given default. Moreover, the weighting of the attributes in the calculation of the GSIB score is arbitrary, and the relative impact of each attribute on a bank's systemic impact implied by its weighting is neither explained nor empirically assessed.

9 The GSIB surcharges depicted in Chart 1 are as of the first quarter of 2015. Since then, some of the reported surcharges may have changed as a result of balance sheet or other changes made by the GSIBs.

While it does indeed seem likely that each of the components of the systemic indicator score is positively correlated with the systemic costs of the bank's default, alternative assumptions about the weights of the bank characteristics or the relationship between the score and the loss given default can preserve that positive correlation and yet generate very different GSIB surcharges. To see this, it helps to consider some examples. The score produced by methods 1 or 2 in the white paper can be defined as follows:

$$X_i = \sum_{j=1}^{J} \omega_j Y_{ij}, \qquad (4)$$

where X_i denotes the systemic indicator score of bank i, Y_{ij} represents characteristic j of bank i, and ω_j is the weight applied to the bank characteristic. The systemic loss given default given the systemic indicator score can then be approximated as

$$SLGD_i = a + bX_i + cX_i^2 \,. \qquad (5)$$

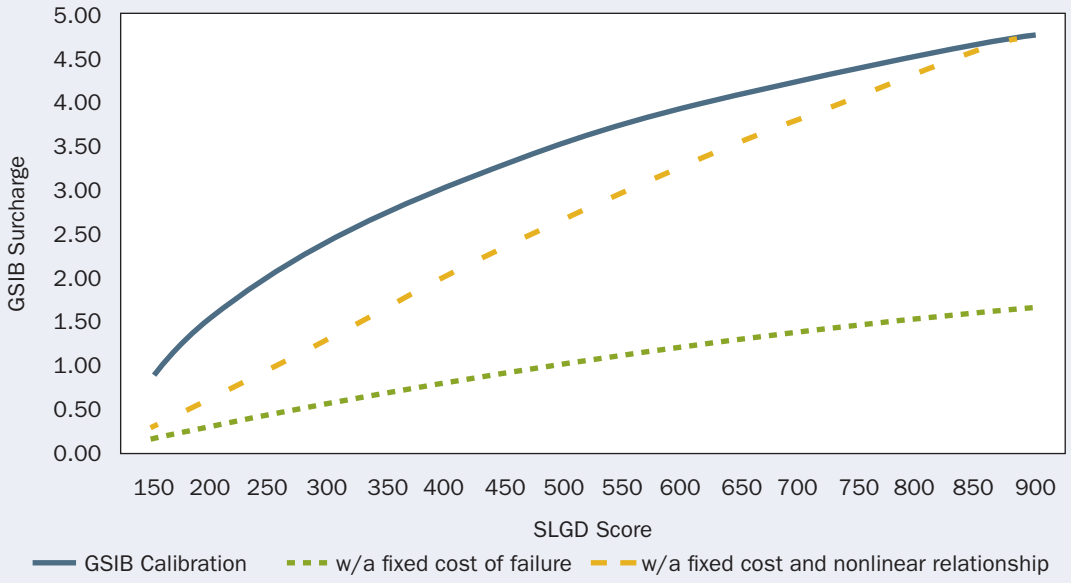
As long as the weights in equation (4) and the parameters 'b' and 'c' in equation (5) are positive, the systemic loss in equation (5) is increasing in bank characteristics. However, the GSIB surcharges that equalize the expected impact of failure depend importantly upon the specific weights and parameters chosen.

Clearly, changing the weights used to calculate the systemic score will change the GSIB surcharge. The Federal Reserve's white paper provides a good example. If the set of bank characteristics in equation (4) are defined to include a combination of the bank characteristics used in method 1 and the bank characteristics used in method 2, then the scores obtained by each method differ only from the choice of weights (where weights of zero would be applied to those characteristics excluded in either method).

With respect to the relationship between the systemic score and the systemic loss given default (5), the white paper assumes for simplicity that the parameters 'a' and 'c' are both zero. The parameter 'a' is zero only if there are no fixed costs of failure – that is, costs of bank failure that do not increase with the bank's systemic score. There are, however, likely many such fixed costs. For example, one source of contagion is the possibility that investors in banks with similar portfolios to the failed bank would pull away, forcing a firesale of those other banks' assets. Contagion of that form is largely independent of the systemic score of the failed bank. Chart 2 illustrates the effect on the GSIB surcharges of including an arbitrary fixed cost of failure. The GSIB surcharge with the white paper's assumption of no fixed cost of failure—the solid blue line—always results in a higher surcharge relative to the case with a fixed cost of failure—the dashed green line. The GSIB surcharge declines when there are fixed systemic costs of failure because the surcharge depends on the ratio of the GSIB's systemic score to the reference bank's systemic score and the ratio declines when the same amount is added to the numerator and the denominator. Intuitively, as fixed systemic costs go up, the relative importance of the systemic score declines, and the systemic costs of failure of the GSIB and the reference bank become relatively more similar.

The parameter 'c' is only zero if all the systemic costs caused by a bank's failure increase propor-

CHART 2: SENSITIVITY OF THE RELATIONSHIP BETWEEN SLGD SCORE AND GSIB SURCHARGE



tionally to the bank's systemic characteristics. As noted in the white paper, however, "…there is reason to believe that the function relating the scores to systemic LGD increases at an increasing rate…"[10] In that case, the parameter 'c' would be greater than zero. The dashed-yellow line in Chart 2 illustrates the GSIB surcharges calculated for one such case where the parameter 'c' is positive, and the parameters 'a', 'b', and 'c' are chosen to leave the surcharge of the GSIB with the highest score unchanged. Because, in this case, the systemic cost of failure is a convex function of the score, the surcharges for all the other GSIBs are lower than those derived under the Federal Reserve's simplifying assumption that the parameters 'a' and 'c' are zero.

While the parameters 'a' and 'c' chosen to calculate the alternative GSIB surcharges in Chart 2 are arbitrary, they are no more arbitrary than the choice made in the white paper of setting both parameters to zero. Ideally, the relationship between bank characteristics and the systemic cost of failure would be estimated using data on the actual costs incurred during past bank failures. Such statistical analysis could provide estimates of the weights in equation (4) and the parameters in equation (5) as well information on the confidence intervals around those estimates.

Lastly, the systemic indicator score does not take into account a range of important regulations that have been and are being implemented to reduce a key component of the surcharge's calibration—the systemic impact of a GSIB's failure. These regulations include the ISDA resolution stay protocol, more stringent credit limits for inter-SIFI exposures, single point of entry resolution strategies, a shift from short to long-term liabilities under the total loss absorbing capacity standard, and a number of changes being

10 "Calibrating the GSIB Surcharge," p. 4.

required before the living wills are considered credible. All these regulatory initiatives were adopted by regulators to significantly decrease the likelihood and impact of a GSIB failure. Importantly, all these changes reduce the expected impact of a GSIB failure but not the expected impact of a non-GSIB failure. Consequently, the SLGD of the GSIB relative to the SLGD of the non-GSIB reference bank is declining as these regulations are implemented, implying, under the Federal Reserve's methodology, that the GSIB surcharge should also be declining.

2. Estimating the relationship between capital and the probability of failure is very sensitive to the bank types and period of analysis included in the sample, and the GSIB surcharge significantly increases as a result of the incorporation of (i) an unrepresentative variety of bank types and (ii) observations for earlier periods when the regulatory environment was substantially different.

The Federal Reserve's dataset for the regression only includes RORWA observations in the bottom five percent of the sample. The sample starts in the third quarter of 1986, which is the date on which FR Y-9C regulatory reports begin, and ends in 2014.[11] One choice that has a significant impact on the ultimate GSIB surcharge is the number of banks that is included each quarter in the sample. Since the GSIB surcharge applies only to the largest banks, and the objective of the RORWA analysis is to estimate the relationship between capital levels and probability of default for those banks, it would seem reasonable to include only similar types of banks in the analysis. However, the Federal Reserve's white paper includes the largest 50 banks each quarter in the RORWA sample, a sample size that extends to banks that are so small that their experience may not be relevant. For example, at the end of the sample period, the set of 50 banks whose earnings were used to calculate the GSIB surcharge had assets as low as $24 billion. However, in a 2014 response to a GAO study, the Federal Reserve expressed the view that it is inappropriate to compare such small banks to GSIBs. Specifically, the Federal Reserve noted, that "a bank holding company with $10 billion in assets is too small to make a meaningful comparison to a bank holding company with $1 trillion in assets… A bank holding company of $50 billion in assets would provide a more relevant comparison…"[12] Using this same logic, we present regression results below that use 33 banks per quarter, which is the cutoff that includes, at the end of the sample period, only banks with assets greater than $50 billion.

A second choice that has a significant impact on the ultimate GSIB surcharge is the period of observation. This sensitivity is germane because there are important changes in

11 The bank holding company data, also known as FR Y-9C, is available at the Federal Reserve Bank of Chicago's website (https://www.chicagofed.org/banking/financial-institution-reports/bhc-data). The report includes basic financial data from bank holding companies in the form of a balance sheet, an income statement, and supporting schedules.

12 Government Accountability Office, "Large Bank Holding Companies, Expectations of Government Support," GA-14-621 (July 2014) p. 60. Similarly, the BCBS study "Calibrating regulatory minimum capital requirements and capital buffers: a top-down approach" (2010), which looked at a multi-country analysis for the calibration of minimum regulatory capital requirements and capital buffers, included only the 20 largest internationally active banks in its sample.

TABLE 1: SENSITIVITY OF THE GSIB SURCHARGE TO CHANGES IN SAMPLE COMPOSITION AND PERIOD OF ANALYSIS

	Slope Coefficient	*GSIB surcharge for bank with average SLGD Score*	*Change relative to TCH Replication*
1. GSIB white paper	*2.18 (0.11)*	*3.56*	—
2. TCH Replication	*2.03 (0.08)*	*3.32*	—
3. Top 33 Banks	*1.58 (0.10)*	*2.58*	*-0.74*
4. Top 10 banks	*0.90 (0.05)*	*1.47*	*-1.85*
5. Top 50; after 1996:Q1 only	*1.80 (0.04)*	*2.94*	*-0.38*
6. Memo: Top50; FCBT excluded	*1.81 (0.05)*	*2.95*	*-0.36*

Note: FCBT is an abbreviation for First City Bancorporation of Texas.

the regulation of banks since 1986 that are likely to make older historical observations less relevant to GSIB and reference non-GSIB probabilities of default. For example, substantial interstate banking restrictions remained in effect until enactment of the Riegle-Neal Interstate Banking and Branching Efficiency Act in 1994, which improved banks' ability to expand geographically and thereby increase their ability to attract deposits and diversify credit risk, and which was enacted in response to the large number of community bank and thrift failures during the 1980s. In addition, risk-weighted asset information — crucial to the RORWA approach in the calibration white paper — is only available from 1996 onwards.[13] Taken together, these two factors suggest that using data after 1994 or 1996 might be a more reasonable approach given the availability of actual, reported risk-weighted assets and a more relevant sample of banks.

Table 1 presents results on the sensitivity of the GSIB surcharge to the sample of banks and time series period included in the analysis. The table reports the slope coefficient, β , and the GSIB surcharge for a hypothetical bank with the average SLGD score. In lines 1 and 2 of the table, we show that we are able to replicate, with fair but not perfect precision, the regression results provided in the Federal's Reserve white paper.[14] In particular, the slightly lower slope coefficient that we obtain in our regression is still within the 99 percent confidence interval of the slope coefficient reported in the

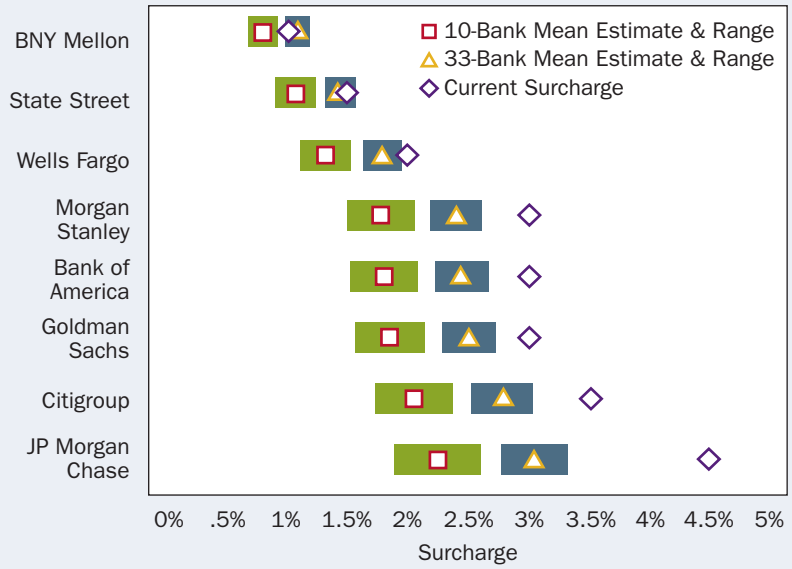
13 To address this data gap, the calibration white paper estimates imputed risk-weighted asset data over the period prior to 1996 by "back-fitting" the post-1996 ratio between risk-weighted assets and total assets onto pre-1996 total assets data.

14 We believe the small difference in our regression results is due to minor differences in the preparation of the data.

white paper (that is, between 1.9 and 2.4). As shown in line 3, the GSIB surcharge for the hypothetical GSIB declines about 75 basis points relative to the results reported in line 2 if we include only the largest 33 banks each quarter, the sample size that corresponds, at the end of the sample period, to the peer cohort suggested by the Federal Reserve's response to the GAO report described above (i.e., banks with $50 billion or more in assets). As shown in line 4, if one were to further limit the sample size to only the largest 10 banks each quarter — a size cutoff that seems even more likely to generate a ROWRA distribution relevant for the eight banks for which the GSIB surcharge applies — the GSIB surcharge for the hypothetical GSIB falls 185 basis points relative to line 2. Finally, as shown in line 5, if we retain the white paper's sample size (i.e., largest 50 banks) but include only data after 1996, the GSIB surcharge for the hypothetical GSIB drops 38 basis points relative to line 2.

The findings summarized in Table 1 also demonstrate that the regression results are very sensitive to RORWA outliers. These outlier observations tend to be driven by smaller banks which are much less diversified than GSIBs in terms of both product set and geography. For example, the now defunct First City Bancorporation of Texas, one of the ten smallest banks in the sample at $11.2 billion in assets, failed in the late 1980s because of its concentrated exposure to energy and agricultural markets. It was also geographically highly concentrated, with 59 of its 60 subsidiaries located in Texas.[15] As shown in line 6, inclusion of this bank in the sample accounts for 36 basis points of the GSIB surcharge for the hypothetical GSIB, reported in line 2.[16]

CHART 3: GSIB SURCHARGE ESTIMATIONS *Data as of 2015Q1*



Note: Estimates combine the effects of including the largest 10 or 33 of banks per quarter and starting the dataset after RWA data becomes available (1996:Q1 – 2014:Q4).

Source: TCH Analysis and Federal Reserve Board

Chart 3 shows the capital surcharges for each GSIB that would be implied if the various alternative assumptions were incorporated into the Federal Reserve's expected impact framework, as follows:

- The purple diamonds represent the current capital surcharge for each GSIB.
- The yellow triangles represent the GSIB surcharge using the largest 33 banks per quarter and post-1996 data.

15 https://www.fdic.gov/bank/historical/managing/history2-05.pdf at p. 58

16 Furthermore, the exclusion of First Republic Bank Corporation, which was also highly exposed to the Texas economy and failed in 1988, would lead to a decline of the GSIB surcharge for the hypothetical GSIB by an additional 24 basis points.

» The bars represent the 99 percent confidence interval for each new estimate.

» The red squares represent the GSIB surcharge using the largest 10 banks per quarter and post-1996 data.

As Chart 3 illustrates, the capital surcharge is overall quite sensitive to the composition of the sample. In particular, for 6 out of the 8 GSIBs, the surcharge would be lower if the regression were estimated using both (i) a sample that includes only the largest 33 banks each quarter and (ii) post-1996 data – a difference that translates to roughly $40 billion in capital requirements across all U.S. GSIBs. If one used both (i) a sample that includes only the largest 10 banks each quarter and (ii) post-1996 data, the capital surcharge would be considerably lower for all U.S. GSIBs – a difference that translates to roughly $90 billion in capital requirements across, or 11 percent of common equity tier 1 capital held by, all U.S. GSIBs.