Online Appendix for "The Effect of Prime Brokers' Balance Sheet Constraints on Hedge Fund Performance: Evidence from the GSIB Surcharge"

Section OA.1 further introduces the capital requirements under the Basel III framework. In Section OA.2, we document the proof for the theoretical model in Section 3. Section OA.3 describes how we compute the portfolio beta of fund family equity holdings. Section OA.4 presents the data processing process for mutual fund sample. Sections OA.5 and OA.6 introduce the details for our robustness checks in Section 7.1. In Section OA.7, we exploit the use of leverage by hedge funds to examine the heterogeneous effects of average surcharge.

OA.1 Capital Requirement under Basel III Framework

In this section, we provide more details of the capital requirements under the Basel III framework. As mentioned in Section 2, there are three common types of regulatory capital with different liquidity levels: CET1 capital, Tier 1 capital, and total capital. The CET1 capital is discussed in Sections 2.1 and OA.5. We now briefly introduce Tier 1 and total capital in below. Tier 1 capital includes CET1 and additional tier 1 capital. The latter includes noncumulative, nonredeemable preferred stock and related surplus, and qualifying minority interest.[1] These items can also absorb loss, although they are not qualified for CET1. Total capital is the sum of Tier 1 and Tier 2 capital. Tier 2 capital includes hybrid capital instruments, loan-loss and revaluation reserves, as well as undisclosed reserves. It has a lower standard than Tier 1 and is harder to liquidate.

In Section OA.5 of the main text, we use CET1 capital requirement as an alternative balance sheet constraint measure. It consists of the minimum CET1 ratio and a capital conservation buffer (CCB). The CCB is an add-on requirement on CET1 ratio and it can only be covered with CET1 capital. The buffer is 2.5% for all banks and is gradually phased-in

[1] See, for example, the definition of regulatory capital in Basel III at https://www.bis.org/fsi/fsisummaries/defcap_b3.pdf.

since 2016. If the buffer falls below 2.5%, there will be automatic constraints on the capital distribution of banks, which impact dividends, share buyback, and bonus payments decisions. That is, banks have to meet this additional buffer to operate smoothly. Thus, we include the CCB on top of the CET1 ratio in our analysis.

As mentioned in Section 2.3, non-US GSIBs and US GSIBs surcharge levels are determined in different ways. In particular, there are two methodologies for setting the surcharge level, commonly referred to as Method 1 and Method 2 respectively. Method 1 is set by the Financial Stability Board in consultation with the Basel Committee on Banking Supervision. Method 2 is set by the Federal Reserve Board exclusively for US GSIBs. For both methods, the final surcharge level is determined by two steps. The surcharge level of non-US GSIBs are solely determined by Method 1. For US GSIBs, their surcharge level is set as the higher one from the two methods. The first step calculates the systemically important financial institution (SiFi) score, which is derived as a weighted sum of multiple quantitative systemic importance indicators. The second step maps the SiFi score to the corresponding surcharge. The two methods differ in both the systemic importance indicators in the first step as well as the mapping in the second step. Table OA.18, which replicates Tables A1, A2, A3, and A4 in Favara et al. (2021), reports the systemic importance indicators and the surcharge mapping for the two methods. We see that Method 2 replaces the Substitutability category in Method 2 by the Short-term wholesale funding in measuring the SiFi score.

Under the Basel III framework, there are other capital requirements which consider banks' off-balance-sheet activities. One example is the Basel III Tier 1 leverage ratio. Firstly introduced in 2009, the Basel III Tier 1 leverage ratio is a capital adequacy tool that measures a bank's Tier 1 capital divided by its total exposures, including average consolidated assets, derivatives exposures, and off-balance sheet items. The minimum requirement of the Basel III Tier 1 leverage ratio is 3%. For US banks, they have an additional leverage requirement, known as the supplementary leverage ratio (SLR), which is the US counterpart of the Basel III Tier 1 leverage ratio. The SLR is required to be even higher (between 5% and 6%). This can also acts as a constraint on bank balance sheets. Du et al. (2018) discuss that leverage ratio regulation limits CIP arbitrage activities. As explained in Section 2.1 of the main text, such non-risk-based capital requirements are out of the scope of this study.

OA.2 Proof of Results in Section 3

We first consider the unbinding case with $0 < \delta^* < \overline{\delta}$. Plugging $\delta^* = (\mu_r - c)/\gamma\sigma_r^2 - 1$ into (4), we have

$$\mathsf{E}(R^*) = \frac{(\mu_r - c)^2}{\gamma\sigma_r^2} + c, \qquad \mathsf{var}(R^*) = \frac{(\mu_r - c)^2}{\gamma^2\sigma_r^2},$$

and

$$\mathsf{S}(R^*) = \frac{\mu_r - c}{\sigma_r} + \frac{\gamma \sigma_r c}{\mu_r - c}.$$

Note that for the unbinding case, the risk aversion coefficient satisfies

$$\frac{\mu_r - c}{\sigma_r^2(1+\bar{\delta})} \leq \gamma \leq \frac{\mu_r - c}{\sigma_r^2}. \tag{OA.1}$$

In the unbinding case, only the increasing cost channel is at play. We take the derivative of the performance metrics with respect to the leverage cost c. For the expected return $\mathsf{E}(R^*)$, we have

$$\frac{d\mathsf{E}(R^*)}{dc} = -\frac{2(\mu_r - c)}{\gamma \sigma_r^2} + 1 < 0.$$

The last inequality uses $\gamma \leq (\mu_r - c)/\sigma_r^2$ in (OA.1). For the return variance, we have

$$\frac{d\mathsf{var}(R^*)}{dc} = -\frac{2(\mu_r - c)}{\gamma^2 \sigma_r^2} < 0$$

by the assumption $c < \mu_r$. Thus, the expected return and variance decrease in the leverage cost. Finally, the derivative of Sharpe ratio can be computed as:

$$\frac{d\mathsf{S}(R^*)}{dc} = -\frac{1}{\sigma_r} + \frac{\gamma \mu_r \sigma_r}{(\mu_r - c)^2} = \frac{\gamma \mu_r \sigma_r^2 - (\mu_r - c)^2}{(\mu_r - c)^2 \sigma_r}.$$

It is negative if $\gamma \leq (\mu_r - c)^2/(\mu_r \sigma_r^2)$, which falls in the range of (OA.1).

For the binding case, the optimal leverage is set at the maximum level, $\delta^* = \bar{\delta}$. The corresponding expected return, variance, and Sharpe ratio are given by:

$$\mathsf{E}(R^*) = (1+\bar{\delta})\mu_r - \bar{\delta}c, \qquad \mathsf{var}(R^*) = (1+\bar{\delta})^2 \sigma_r^2,$$

and

$$\mathsf{S}(R^*) = \frac{\mu_r}{\sigma_r} - \frac{\bar{\delta}c}{1+\bar{\delta}\sigma_r}.$$

In the binding case, both the increasing cost and decreasing provision channels affect the hedge fund performance. Thus, we check both of them by taking the partial derivative with respect to c and $\bar{\delta}$. For expected return, we have

$$\frac{\partial \mathsf{E}(R^*)}{\partial c} = -\bar{\delta} < 0 \quad \text{and} \quad \frac{\partial \mathsf{E}(R^*)}{\partial \bar{\delta}} = \mu_r - c > 0.$$

Thus, both increasing c and reducing $\bar{\delta}$ decrease the expected return. The variance $\mathsf{var}(R^*)$ is clearly unaffected by c and increases in $\bar{\delta}$. That is, the decreasing provision channel reduces the variance. Finally, the derivatives of the Sharpe ratio can be computed as:

$$\frac{\partial \mathsf{S}(R^*)}{\partial c} = -\frac{\bar{\delta}}{1+\bar{\delta}\sigma_r} < 0 \quad \text{and} \quad \frac{\partial \mathsf{S}(R^*)}{\partial \bar{\delta}} = -\frac{c}{(1+\bar{\delta}\sigma_r)^2} < 0.$$

Thus, increasing cost decreases the Sharpe ratio, while decreasing provision increases it.

OA.3 Computation of Fund Portfolio Beta

We describe how we compute the hedge fund portfolio beta used in Section 4.3 of the main text. We first estimate the market beta of each stock j at each quarter end. We run the following regression using the stock's daily returns in the past one-year window:

$$R_{jt} - r_{ft} = \alpha_j + \beta_j(R_{Mt} - r_{ft}) + e_{jt},$$

where R_{jt} is the return of stock j on day t; R_{Mt} denotes the market return downloaded from the Kenneth R. French website; r_{ft} is the one-month U.S. treasury bill rate.

At the end of each quarter, we calculate a market value-weighted portfolio beta for each hedge fund family in our sample. The weights are calculated using the equity holding data from the Thomson Reuters 13F fillings. For fund (family) i at quarter end q, its portfolio beta is defined as :

$$\text{FundBeta}_{i,q} = \sum_j \frac{\text{MV of stock } j \text{ holding}}{\text{MV of total equity holding}} \times \beta_{j,q} = \frac{1}{\sum_j p_{j,q} h_{i,j,q}} \sum_j p_{j,q} h_{i,j,q} \times \beta_{j,q},$$

where $p_{j,q}$ denotes the market price of stock j at the end of quarter q and $h_{i,j,q}$ denotes the shares of stock j held by family i in the quarter.

OA.4 Data Processing for Mutual Funds Sample

In this section, we briefly describe how we process the sample for mutual funds, which is used in our placebo tests in Section 5.1.

For mutual funds, their brokerage relationship data is obtained from the N-SAR and N-CEN fillings. In particular, we extract Forms N-SAR and N-CEN through the SEC's Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system. Form N-SAR was rescinded on June 1, 2018 and was replace by Form N-CEN afterwards. Under the Investment Company Act of 1940, all registered investment companies are required to file Form N-SAR on a semi-annual basis. Similarly, Form N-CEN needs to be filed once a year by all registered investment companies. Following Han et al. (2024), we collect the Item 20 in Form N-SAR, which reports the brokerage commissions paid to the top ten brokers that receive the most commissions from an investment company, which may include multiple mutual funds in our sample. We assume the these are the brokers used by the mutual funds within the investment company and use them to compute the average GSIB surcharge. Same information is collected from the Item C.16 in Form N-CEN.[2] We combine the data from the two forms to construct a broker-mutual fund relationship panel from 2013 to 2021.

We obtain data on mutual fund monthly returns, total net assets (TNA), fund age, turnover, and fund expenses from the CRSP Survivor-Bias-Free Mutual Fund Database. In the analysis, we only include U.S domestic equity funds, which are identified using the investment objective code (*crsp_obj_cd*). We classify mutual funds as active or passive using the CRSP index fund flag (index fund flag = "D" means the fund is pure index fund).

In Forms N-SAR and N-CEN, the investment companies use the central index key (CIK) as identifiers. On the other hand, the CRSP Mutual Fund Database use the fund number (*crsp_fundno*) as identifier. We link the two databases using the form *crsp_cik_map* from CRSP. Same as our main analysis for hedge funds, we assume the mutual funds use the same set of brokers if they belong to the same investment company.

[2]Form N-CEN reports the top ten brokers at the series (mutual fund) level. Consistent with the N-SAR data, we aggregate the commissions at the investment company level and select the top ten brokers based on total commissions.

Table OA.1: Definitions of Variables related to Mutual Fund Sample (see Section 5.1 of the Main Text)

Variable	Definition
Dependent Variables	
Excess return	Monthly mutual funds return less T-bill return. The data is obtained from the CRSP mutual fund database.
Alpha	Monthly hedge funds excess returns adjust by Fama French three factor.
Volatility	12-month mutual funds excess returns volatility.
Sharpe Ratio	12-month mutual funds average excess returns divided by volatility.
Information Ratio	12-month mutual funds average alpha divided by alpha's volatility.
Independent Variables	
AvgSurcharge	For each mutual fund, we average surcharges of its all broker's bank holding company. If a broker's bank holding company is non-GSIB, the surcharge is zero. The broker and mutual fund relationship is obtained from Form N-SAR and N-CEN. Surcharges for Non-US banks are from Financial Stability Board. Surcharges for US banks are from 10-K fillings.
log(TNA)	Logarithm of mutual fund Total Net Assets (in USD).
log(age)	Logarithm of mutual fund age in months.
Expense ratio	The expense ratio of a fund/share class
Turn ratio	The turnover rate of a fund/share class

OA.5 CET1 Requirement as Alternative Measure

As a robustness check in Section 7.1, we use the CET1 requirement ratio as an alternative measure for broker's balancing sheet constraints. In the follows, we describe the set-ups for this test and discuss the results.

We use the CET1 capital requirement under the Basel III regulatory framework (see Section 2). The CET1 requirement is the sum of two parts: the minimum CET1 ratio and a mandatory capital conservation buffer. In our sample, the minimum CET1 ratio starts at 3.5% in 2013 and increases to 4.5% by 2015.[3] The mandatory capital conservation buffer (CCB) is implemented in 2016 at an initial level of 0.625% and increases to 2.5% by 2019. The values of the CET1 ratio and the CCB in each year are reported in Table OA.4.[4] The CET1 capital

[3] https://www.bis.org/bcbs/basel3/basel3_phase_in_arrangements.pdf

[4] There is another buffer called countercyclical capital buffer. The Basel III countercyclical capital buffer is calculated as the weighted average of the buffers in effect in the jurisdictions to which banks have a credit exposure. This buffer is zero in United States till 2023. Since it is based on banks worldwide credit exposure

requirement is uniform to all banks, but does not apply to non-bank institutions.

For fund i in month t, we define the prime brokers' balance sheet constraint measure based on the CET1 requirement as:

$$AvgCET1_{i,t} = \frac{1}{|B_{i,t}|} \sum_{j \in B_{i,t}} (CET1_{j,t} + Surcharge_{j,t} \times \text{Phase-in ratio}_t), \tag{OA.2}$$

which is analogous to (3). In above, the first term $CET1_{j,t}$ is the CET1 capital requirement (minimum ratio plus CCB) of broker j; the last term denotes the effective GSIB surcharge as described in Section 2.1. For GSIB brokers, both the two terms are positive. For non-GSIB bank-affiliated brokers, only the first term is positive. Non-bank affiliated brokers are not subject to the CET1 or GSIB capital requirement, i.e., having a ratio of zero in the right hand side of (OA.2). We then estimate the panel regression in (25) in the main text, using the $AvgCET1_{i,t}$ constructed in above.

Table OA.5 presents the regression results for (25) based on the CET1 capital requirement. The findings are consistent with those in Table 10 using the GSIB surcharge as the balance sheet constraint measure. In general, higher $AvgCET1_{i,t}$ tends to decrease the fund's return, alpha, volatility, Sharpe ratio, and information ratio in the next 12 months. The results hold both with and without the fund fixed effects, suggesting the impact of CET1 capital requirement arises from both cross-sectional variation among funds and within-fund variation over time. By column (2), the coefficient β_1 is -0.088 for monthly excess return (with a t-statistics of 1.92). Thus, a one-standard-deviation increase in $AvgCET1_{i,t}$ is associated with a 2.8% (0.088×12×2.64) decrease in the hedge fund's annualized return. This magnitude is similar to that of $AvgSurcharge$ (about 3.3%) discussed in Section 4.2. By columns (3) and (4), $AvgCET1_{i,t}$ negatively impacts the risk-adjusted alpha. The effects are slightly larger and significant at the 5% level.

As shown in columns (5) - (10), the hedge funds with higher average CET1 requirement are associated with lower future volatility, Sharpe ratio, and information ratio. The effects are statistically significant at the 5% level in most cases. With both fixed effects included, a one-standard-deviation increase in $AvgCET1_{i,t}$ decreases the monthly return volatility by 0.41% (0.157×2.64). With only $Style \times Month$ fixed effect, a one-standard-deviation increase in $AvgCET1_{i,t}$ is associated with a 0.042 (resp. 0.047) drop in the 12-month ahead Sharpe ratio (resp. information ratio), which is about 7.8% (resp. 10.9%) of its sample standard deviation.

Using the CET1 capital requirements faced by all banks, we find consistent evidence on how prime brokers' balance sheet constraints affect the hedge fund performance. The results

in different jurisdiction, we drop this buffer in the analysis.

are similar to those obtained with the GSIB surcharge in our main specification, and are in line with the theoretical model developed in Section 3.

[Insert Table OA.5, Table OA.4 here]

OA.6 Difference-in-difference Analysis

As discussed in Section 7.1, we use a difference-in-difference (DiD) framework to reveal the impact of the GSIB surcharge on hedge fund returns. We now provide more details of the DiD analysis.

For each month t, we classify the leveraged hedge funds in our sample to two groups. We compute a hedge fund's GSIB-broker ratio as its number of GSIB brokers divided by the number of all its brokers. We define the GSIB-dependent (resp. non GSIB-dependent) group as the hedge funds with the GSIB-broker ratio above (resp. below) the median in each month. Note that the GSIB list is determined by the Financial Stability Board in 2012. Thus, the GSIB status of brokers can be determined in advance before 2016.

We then compare the difference in excess return between the two groups before and after the implementation of the GSIB surcharge in 2016. We perform the following DiD analysis:

$$y_{i,t+1} = \beta_0 + \beta_1 \times \text{Treat}_{i,t} \times \text{Post}_t + \beta_2' X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}, \tag{OA.3}$$

where $y_{i,t+1}$ is the fund's excess return or alpha in next month; the treatment group dummy $\text{Treat}_{i,t}$ equals one if fund i is in the GSIB-dependent group in month t and zero otherwise;[5] Post_t is a dummy which takes value of one if month t is in or after 2016; $X_{i,t}$ denotes fund-level control variables, which are the same as those in Sections 4.1 and 4.2. We include both the fund and the $Style \times Month$ fixed effects. We expect the coefficient β_1 to be negative, i.e., the hedge funds in the GSIB-dependent group are associated with a larger decrease in their returns after the implementation of GSIB surcharge.

The estimation results are reported in Table OA.6. We see that the coefficient β_1 is indeed significantly negative for both excess return and alpha (at the 5% level). This shows that the implementation of GSIB surcharge decreases the return of the hedge funds that are more dependent on the GSIB brokers relative to those that are not. The magnitude is -0.79% (resp. -0.60%) for excess return (resp. alpha). This is inline with our main findings given the $AvgSurcharge_{i,t}$ is about 1.65 and 0.65 for the GSIB-dependent and non GSIB-dependent

[5] As the connections between prime brokers and hedge funds are sticky. the treatment status for a hedge fund is relatively stable (see discussion in Section 4.3). The proportion of changed treatment status between adjacent months is about 5% in our sample.

groups after 2016. Thus, the DiD analysis again shows that the balance sheet constraints of prime brokers are associated with lower future returns of their hedge funds.

The DiD analysis in (OA.3) relies on the assumption that the hedge fund returns in the GSIB-dependent and non GSIB-dependent groups exhibit similar trends prior to the implementation of GSIB surcharge. We validate such assumption by estimating the dynamic effects of being more dependent on the GSIB brokers. We perform the following regression:

$$y_{i,t+1} = \Sigma_{\tau=2013,\tau\neq 2015}^{2021}\beta_\tau \times \text{Treat}_{i,t} \times \mathbb{1}\{t \in \text{Year}_\tau\} + \beta_2' X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}, \tag{OA.4}$$

where $\text{Treat}_{i,t}$ and $X_{i,t}$ are defined as in the DiD analysis (OA.3); $\mathbb{1}\{t \in \text{Year}_\tau\}$ is a dummy variable that takes value of one if month t is in year τ. In (OA.4), we allow the treatment effect to vary for each year τ via the interaction terms $\text{Treat}_{i,t} \times \mathbb{1}\{t \in \text{Year}_\tau\}$. To avoid multi-collinearity issue, we exclude the year 2015 and use it as the base year for comparison. Same as our DiD analysis, we include both the fund and the $Style \times Month$ fixed effects.

Figure OA.1 plots the estimated β_τ's and their 95% confidence intervals with the dependent variable being the excess return in (OA.4). We see that the coefficients of the interaction term are statistically indifferent from zero in the years prior to 2016. That is, the effect of being in the GSIB-dependent group does not show up before the implementation of GSIB surcharge, suggesting no pre-trends in the excess returns of the two groups. By contrast, for most of the years after 2015, the estimated β_τ is significantly negative at the 5% level (for 2017, β_τ is negative and insignificant). These patterns are in line with our DiD analysis. They show that after the implementation of GSIB-surcharge, relying more on the GSIB brokers tends to decrease the hedge fund's future return. This again reflects the impact of prime brokers' balance sheet constraints on hedge fund performance.

[Insert Figure OA.1, Table OA.6 here]

OA.7 Heterogeneous Effect for High Leveraged Funds

As a robustness check, we investigate how the effects of average GSIB surcharge vary by the leverage usage of hedge funds. We expect the prime brokers' balance sheet constraints to have stronger impacts on hedge funds with higher leverage usage, as they rely more on the funding from prime brokers.

To test this hypothesis, we firstly identify the hedge funds that are more likely to use high physical leverage. We define a fund type dummy $leverageHigh$ that takes the value of one if the fund satisfies both of the following conditions. First, the hedge fund only uses margin loan or FX credit to get leverage according to the information in TASS database. Second, the hedge fund's primary category is one of the following: Convertible Arbitrage, Fixed Income Arbitrage, Long/Short Equity Hedge, Equity Market Neutral, and Long-only. The two criteria are justified as follows. First, hedge funds obtain leverage mainly from two sources: physical leverage from borrowings or synthetic leverage using derivatives (McNamara and Metrick, 2019). Thus, we exclude hedge funds that use derivatives or futures for leverage exposure as derivatives take less balance sheet usage of prime brokers. Second, the five primary categories of hedge funds listed above usually employ higher leverage than others.[6]

In sum, the $leverageHigh$ dummy identifies the hedge funds that are more likely to obtain high leverage using the balance sheets of their prime brokers. However, one limitation of the above classification is that TASS only has snapshot data of a fund's leverage status. Thus, it cannot reflect the change in the fund's leverage status over time.

Similar to (19), we use the following regression to explore the heterogeneous effects of prime brokers' balance sheet constraints by hedge fund leverage status:

$$\begin{aligned} y_{i,t+1,t+12} &= \beta_0 + \beta_1 AvgSurcharge_{i,t} + \beta_2 AvgSurcharge_{i,t} \times leverageHigh_i \\ &+ \beta_3' X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}. \end{aligned} \tag{OA.5}$$

Here we do not include $leverageHigh_i$ separately in the regression as it is absorbed by the fund fixed effect. The coefficient of our interest is β_2. If $\beta_2 < 0$, it indicates that the impact of average GSIB surcharge is larger for high leverage funds.

Table OA.13 reports the results for (OA.5) with dependent variables being monthly excess return or risk-adjusted alpha. We see that β_2 is significantly negative in all cases. For example, with both $Style \times Month$ and fund fixed effects included, β_2 is -0.379 and -0.377 for excess return and alpha respectively, both significant at the 5% level. This suggests that the impacts of average GSIB surcharge is larger for high leverage funds, which is in line with our conjecture. The results further reveal the negative impacts of prime brokers' balance sheet constraints on hedge fund returns.

[6] For example, arbitrage strategies often use high leverage, see at https://www.capitalfundlaw.com/blog/common-hedge-fund-strategies.

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Table OA.2: Average GSIB Surcharge and Hedge Fund 12-month Performance: Fama-MacBeth Regressions

This table reports results of the Fama-MacBeth regression of hedge fund next 12-month performance on prime brokers average surcharge. *AvgSurcharge* measures hedge funds' average exposure to capital surcharges on GSIB-affiliated prime brokers. The time period is from January 2016 to November 2021. t-statistics are based on Newey and West (1987) standard errors with 12 lags. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively.

	(1) return	(2) return	(3) alpha	(4) alpha	(5) volatility	(6) volatility	(7) SR	(8) SR	(9) IR	(10) IR
AvgSurcharge	-0.377***	-0.383***	-0.294***	-0.384***	-0.640***	-0.324*	-0.081**	-0.098***	-0.053	-0.086***
	(-5.68)	(-6.26)	(-3.27)	(-4.97)	(-3.90)	(-1.69)	(-2.38)	(-3.19)	(-1.03)	(-2.91)
log_AUM		-0.025		0.018		-0.050*		0.007*		0.011*
		(-1.20)		(0.78)		(-1.70)		(1.72)		(1.89)
log_age		0.056		-0.014		0.581***		-0.023		-0.033*
		(0.92)		(-0.29)		(4.44)		(-0.81)		(-1.87)
ManagementFee		-0.315**		-0.218		-0.782**		-0.006		0.031
		(-2.61)		(-1.39)		(-2.45)		(-0.12)		(0.63)
IncentiveFee		0.018		0.027**		0.069***		0.001		0.003
		(1.07)		(2.16)		(3.72)		(0.15)		(1.10)
LockUpPeriod		-0.002		0.004		0.030***		-0.005***		-0.002
		(-0.20)		(0.65)		(4.06)		(-3.91)		(-1.63)
HighWaterMark		0.320**		0.302**		-0.297		0.094		0.082*
		(2.41)		(2.62)		(-1.06)		(1.62)		(1.81)
PersonalCapital		-0.093		-0.093		0.715**		-0.038		-0.009
		(-0.56)		(-1.17)		(2.61)		(-0.73)		(-0.27)
log_minInvest		0.010		-0.004		0.088		-0.011		0.003
		(0.41)		(-0.09)		(1.20)		(-0.73)		(0.18)
RedemptionNoticePeriod		0.001		-0.001		0.000		0.002**		0.000
		(0.70)		(-0.64)		(0.13)		(2.51)		(1.16)
Style Dummy	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
N	9731	9731	9731	9731	9731	9731	9731	9731	9731	9731
adj. R^2	0.055	0.135	0.065	0.146	0.062	0.242	0.030	0.196	0.050	0.238

Table OA.3: Standardized Average GSIB Surcharge and Hedge Fund Performance: Fama-MacBeth Regressions

This table reports the results of the Fama-MacBeth regression (14) of hedge fund next 12-month performance on prime brokers average surcharge. *std.AvgSurcharge* a standardized average surcharge measure, with a mean of zero and standard deviation of one for each month. The time period is from January 2016 to November 2021. t-statistics are based on Newey and West (1987) standard errors with 12 lags. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively.

	(1) return	(2) return	(3) alpha	(4) alpha	(5) volatility	(6) volatility	(7) SR	(8) SR	(9) IR	(10) IR
std. AvgSurcharge	-0.261***	-0.254***	-0.237***	-0.267***	-0.545***	-0.334*	-0.056***	-0.056***	-0.059**	-0.067***
	(-4.46)	(-6.47)	(-4.18)	(-5.18)	(-2.92)	(-1.91)	(-3.39)	(-3.50)	(-2.49)	(-3.74)
log_AUM		-0.025		0.018		-0.050*		0.007*		0.011*
		(-1.20)		(0.78)		(-1.70)		(1.72)		(1.89)
log_age		0.056		-0.014		0.581***		-0.023		-0.033*
		(0.92)		(-0.29)		(4.44)		(-0.81)		(-1.87)
ManagementFee		-0.315**		-0.218		-0.782**		-0.006		0.031
		(-2.61)		(-1.39)		(-2.45)		(-0.12)		(0.63)
IncentiveFee		0.018		0.027**		0.069***		0.001		0.003
		(1.07)		(2.16)		(3.72)		(0.15)		(1.10)
LockUpPeriod		-0.002		0.004		0.030***		-0.005***		-0.002
		(-0.20)		(0.65)		(4.06)		(-3.91)		(-1.63)
HighWaterMark		0.320**		0.302**		-0.297		0.094		0.082*
		(2.41)		(2.62)		(-1.06)		(1.62)		(1.81)
PersonalCapital		-0.093		-0.093		0.715**		-0.038		-0.009
		(-0.56)		(-1.17)		(2.61)		(-0.73)		(-0.27)
log_minInvest		0.010		-0.004		0.088		-0.011		0.003
		(0.41)		(-0.09)		(1.20)		(-0.73)		(0.18)
RedemptionNoticePeriod		0.001		-0.001		0.000		0.002**		0.000
		(0.70)		(-0.64)		(0.13)		(2.51)		(1.16)
Style Dummy	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	9731	9731	9731	9731	9731	9731	9731	9731	9731	9731
Adjusted R^2	0.055	0.135	0.065	0.146	0.062	0.242	0.030	0.196	0.050	0.238

Table OA.4: Common Equity Tier 1 (CET1) Minimum Requirement and Conservation Buffer

This table shows minimum requirement and capital conservation buffer for CET1 ratio. Capital conservation buffer is established above the regulatory minimum capital requirement. Capital distribution constraints will be imposed on a bank when capital levels fall into the conservation range. The capital conservation buffer achieves full implementation by 2019.

Year	2013	2014	2015	2016	2017	2018	2019
Minimum CET1 ratio	3.5	4	4.5	4.5	4.5	4.5	4.5
Capital conservation buffer (CCB)	0	0	0	0.625	1.25	1.875	2.5
Minimum CET1 + CCB	3.5	4	4.5	5.125	5.75	6.375	7

Table OA.5: Panel Regressions of Hedge Fund Performance on Average CET1 Requirement

This table reports the results of panel regression to examine the effects of hedge funds' average exposure to Common Equity Tier 1 capital requirement on fund's performance. We estimate the following regression equation: $y_{i,t+1,t+12} = \beta_0 + \beta_1 AvgCET1_{i,t} + \beta_2^{'} X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}$. The dependent variable is average excess return, average alpha, volatility, sharpe ratio, and information ratio over 12 months. $AvgCET1_{i,t}$ measures hedge funds' average exposure to Common Equity Tier 1 capital requirement on bank-affiliated prime brokers. GSIB surcharge is included in CET1 requirement if the broker is also GSIB-affiliated. t-statistics in parenthesis are based on standard errors clustered at fund level. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively. The sample period spans from January 2013 to November 2021.

	(1) return	(2) return	(3) alpha	(4) alpha	(5) volatility	(6) volatility	(7) SR	(8) SR	(9) IR	(10) IR
AvgCET1	-0.079***	-0.088*	-0.083***	-0.103**	-0.176**	-0.157***	-0.016***	-0.022	-0.018***	-0.029**
	(-4.69)	(-1.92)	(-4.54)	(-2.21)	(-2.38)	(-2.75)	(-3.19)	(-1.20)	(-3.96)	(-2.10)
Fund FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Style $\times$ Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17500	17483	17500	17483	17500	17483	17500	17483	17500	17483
Adjusted R^2	0.244	0.362	0.130	0.321	0.271	0.733	0.348	0.527	0.231	0.452

Table OA.6: GSIB Broker Dependence and Hedge Fund Performance: Difference-in-Difference Analysis

This table reports the results of difference in difference estimation. We estimate the following equation: $y_{i,t+1} = \beta_0 + \beta_1 \times \text{Treat}_{i,t} \times \text{Post}_t + \beta_2' X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}$, where α_i and $\eta_{s,t}$ capture fund and style by month fixed effects, respectively. $\text{Treat}_{i,t}$ takes value of one if a hedge fund's GSIB-affiliated prime brokers ratio are greater than cross-sectional median. Post_t takes value of one if the year of the month is greater equal than 2016. The dependent variable is the fund's next month excess return or alpha. t-statistics in parenthesis are based on standard errors clustered at fund level. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively. The sample period spans from January 2013 to November 2021.

	(1) return	(2) alpha
Treat × Post	-0.789***	-0.604***
	(-4.35)	(-3.44)
Fund FE	Yes	Yes
Style × Month FE	Yes	Yes
Controls	Yes	Yes
Observations	17442	17442
Adjusted R^2	0.174	0.074

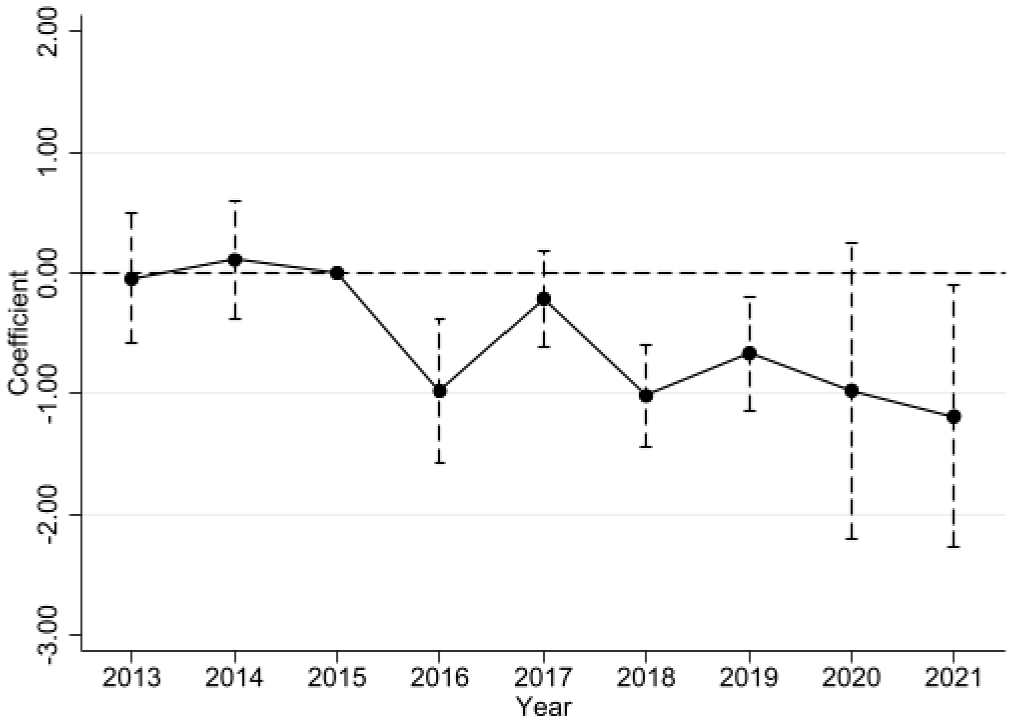

Figure OA.1: Dynamic Effects of GSIB Broker Dependence on Hedge Fund Returns

This figure compares hedge fund monthly excess return by GSIB dependent and non-GSIB dependent hedge funds. It displays the estimates of β_τ for in the following equation: $y_{i,t+1} = \Sigma_{\tau=2013,\tau\neq 2015}^{2021} \beta_\tau \times \text{Treat}_{i,t} \times \mathbb{1}\{t \in \text{Year}_\tau\} + \beta_2' X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}$, where α_i and $\eta_{s,t}$ capture fund and style by month fixed effects, respectively. $\text{Treat}_{i,t}$ is an indicator that is equal to 1 if hedge fund i proportion of GSIB prime brokers is greater than median at month t. $\mathbb{1}\{t \in \text{Year}_\tau\}$ is a dummy variable that takes value of one if month t is in year τ. 95 percent confidence intervals are computed using standard errors clustered at fund level. The sample period spans from January 2013 to November 2021.

Table OA.7: Panel Regressions of Hedge Fund Performance on Rank-weighted Average GSIB Surcharge Exposure

This table reports the results of panel regressions (16) to examine the effects of hedge funds' average exposure to GSIB surcharges on fund's performance. The dependent variable is hedge funds performance over next 12 months. *WAvgSurcharge* measures hedge funds' rank-based weighted exposure to capital surcharges on GSIB-affiliated prime brokers. The definition of *WAvgSurcharge* can be found in equation (26) of the main text. t-statistics in parenthesis are based on standard errors clustered at fund level. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively. The sample period spans from January 2013 to November 2021.

$$y_{i,t+1,t+12} = \beta_0 + \beta_1 \, WAvgSurcharge_{i,t} + \beta_2^{'} X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}$$

	(1) return	(2) return	(3) alpha	(4) alpha	(5) volatility	(6) volatility	(7) SR	(8) SR	(9) IR	(10) IR
WAvgSurcharge	-0.316***	-0.300**	-0.355***	-0.295**	-0.578**	-0.568***	-0.069***	-0.054	-0.100***	-0.090**
	(-4.32)	(-2.51)	(-4.67)	(-2.30)	(-2.29)	(-3.68)	(-3.79)	(-1.13)	(-5.35)	(-2.58)
Fund FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Style × Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17500	17483	17500	17483	17500	17483	17500	17483	17500	17483
Adjusted R^2	0.246	0.366	0.137	0.323	0.265	0.737	0.349	0.527	0.239	0.454

Table OA.8: Hedge Fund Performance on Average GSIB Surcharge: Different Surcharge Timing

This table reports the results of panel regressions (16) to examine the effects of hedge funds' average exposure to GSIB surcharges on fund's performance. The dependent variable is average excess return or average alpha over 12 months. *Surcharge_ante* uses the surcharge that is announced for next year. *Surcharge_interpolate* uses a linear interpolation for each month with the GSIB surcharge levels for the current and next year. t-statistics in parenthesis are based on standard errors clustered at fund level. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively. The sample period spans from January 2013 to November 2021.

$$y_{i,t+1,t+12} = \beta_0 + \beta_1 AvgSurcharge_{i,t} + \beta_2' X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}$$

	Anticipated Surcharge		Interpolated Surcharge	
	(1) return	(2) alpha	(3) return	(4) alpha
Surcharge_ante	-0.287**	-0.298**		
	(-2.47)	(-2.41)		
Surcharge_interpolate			-0.290**	-0.297**
			(-2.49)	(-2.40)
Fund FE	Yes	Yes	Yes	Yes
Style × Month FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	17483	17483	17483	17483
Adjusted R^2	0.365	0.324	0.365	0.324

Table OA.9: Hedge Fund Performance on Average GSIB Surcharge: All Sample Result

This table reports the results of panel regressions (16) to examine the effects of hedge funds' average exposure to GSIB surcharges on fund's performance. The sample include both leveraged hedge funds and un-leveraged hedge funds in the merged sample. The dependent variable is hedge funds performance over next 12 months. *AvgSurcharge* measures hedge funds' average exposure to capital surcharges on GSIB-affiliated prime brokers. t-statistics in parenthesis are based on standard errors clustered at fund level. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively. The sample period spans from January 2013 to November 2021.

$$y_{i,t+1,t+12} = \beta_0 + \beta_1 AvgSurcharge_{i,t} + \beta_2' X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}$$

Panel A: Average excess return

	(1)	(2)	(3)
AvgSurcharge	-0.312***	-0.317***	-0.290***
	(-4.95)	(-4.90)	(-2.80)
Fund FE	No	No	Yes
Style × Month FE	Yes	Yes	Yes
Controls	No	Yes	Yes
Observations	20811	20811	20794
Adjusted R^2	0.236	0.243	0.371

Panel B: Average alpha

	(1)	(2)	(3)
AvgSurcharge	-0.338***	-0.359***	-0.267**
	(-5.48)	(-5.67)	(-2.47)
Fund FE	No	No	Yes
Style × Month FE	Yes	Yes	Yes
Controls	No	Yes	Yes
Observations	20811	20811	20794
Adjusted R^2	0.126	0.132	0.324

Panel C: Volatility of excess return

	(1)	(2)	(3)
AvgSurcharge	-0.615***	-0.527**	-0.473***
	(-2.59)	(-2.37)	(-3.21)
Fund FE	No	No	Yes
Style × Month FE	Yes	Yes	Yes
Controls	No	Yes	Yes
Observations	20811	20811	20794
Adjusted R^2	0.222	0.253	0.748

Panel D: Sharpe ratio

	(1)	(2)	(3)
AvgSurcharge	-0.067***	-0.077***	-0.072*
	(-4.73)	(-4.90)	(-1.70)
Fund FE	No	No	Yes
Style × Month FE	Yes	Yes	Yes
Controls	No	Yes	Yes
Observations	20811	20811	20794
Adjusted R^2	0.384	0.401	0.583

Panel E: Information ratio

	(1)	(2)	(3)
AvgSurcharge	-0.095***	-0.108***	-0.092***
	(-6.58)	(-6.71)	(-2.87)
Fund FE	No	No	Yes
Style × Month FE	Yes	Yes	Yes
Controls	No	Yes	Yes
Observations	20811	20811	20794
Adjusted R^2	0.301	0.319	0.529

Table OA.10: Hedge Fund Performance on Average GSIB Surcharge: Subsample Analysis

This table reports the results of panel regressions (16) to examine the effects of hedge funds' average exposure to GSIB surcharges on fund's performance. The dependent variable is average excess return or average alpha over 12 months. *AvgSurcharge* measures hedge funds' average exposure to capital surcharges on GSIB-affiliated prime brokers. The first two columns use sample from January 2013 to December 2019. Columns (3) and (4) only include hedge funds that are alive in TASS database. t-statistics in parenthesis are based on standard errors clustered at fund level. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively. The sample period spans from January 2013 to November 2021.

$$y_{i,t+1,t+12} = \beta_0 + \beta_1 AvgSurcharge_{i,t} + \beta_2' X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}$$

	Before COVID-19		Live Hedge Funds	
	(1) return	(2) alpha	(3) return	(4) alpha
AvgSurcharge	-0.355***	-0.481***	-0.351**	-0.354**
	(-3.74)	(-3.92)	(-2.39)	(-2.59)
Fund FE	Yes	Yes	Yes	Yes
Style × Month FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	14072	14072	7854	7854
Adjusted R^2	0.381	0.359	0.325	0.244

Table OA.11: Hedge Fund Performance on Average GSIB Surcharge: Different Time Horizons

This table reports the results of panel regressions (16) to examine the effects of hedge funds' average exposure to GSIB surcharges on fund's performance. The dependent variable is average excess return or average alpha over one, three and six months. *AvgSurcharge* measures hedge funds' average exposure to capital surcharges on GSIB-affiliated prime brokers. t-statistics in parenthesis are based on standard errors clustered at fund level. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively. The sample period spans from January 2013 to November 2021.

$$y_{i,t+1,t+h} = \beta_0 + \beta_1 AvgSurcharge_{i,t} + \beta_2^{'} X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}$$

	1 month		3 month		6 month	
	(1) return	(2) alpha	(3) return	(4) alpha	(5) return	(6) alpha
AvgSurcharge	-0.334***	-0.345***	-0.331***	-0.312**	-0.312***	-0.294**
	(-2.91)	(-2.63)	(-2.82)	(-2.34)	(-2.61)	(-2.19)
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes
Style × Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17442	17442	17483	17483	17483	17483
Adjusted R^2	0.173	0.074	0.220	0.133	0.278	0.211

Table OA.12: Hedge Fund Performance on Average GSIB Surcharge: Using TASS Snapshot Data

This table reports the results of panel regressions (16) to examine the effects of hedge funds' average exposure to GSIB surcharges on fund's performance. We obtain a one-time fund-level snapshot of prime brokers as of July 2023 from the TASS database. The sample is based on leveraged hedge funds. The dependent variable is average monthly excess return and risk-adjust alpha over 12 months. *AvgSurcharge* measures hedge funds' average exposure to capital surcharges on GSIB-affiliated prime brokers. t-statistics in parenthesis are based on standard errors clustered at fund level. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively. The sample period spans from January 2013 to November 2021.

$$y_{i,t+1,t+12} = \beta_0 + \beta_1 AvgSurcharge_{i,t} + \beta_2^{'} X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}$$

	(1) return	(2) return	(3) alpha	(4) alpha	(5) volatility	(6) volatility	(7) SR	(8) SR	(9) IR	(10) IR
AvgSurcharge	-0.176***	-0.137*	-0.157***	-0.101	-0.177	-0.313**	-0.050**	-0.021	-0.043**	-0.015
	(-3.51)	(-1.93)	(-3.02)	(-1.31)	(-0.85)	(-2.23)	(-2.36)	(-0.82)	(-2.31)	(-0.64)
Fund FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Style × Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	37506	37406	37506	37406	37506	37406	37506	37406	37506	37406
Adjusted R^2	0.186	0.316	0.105	0.252	0.187	0.732	0.258	0.430	0.199	0.353

Table OA.13: Hedge Fund Performance on Average GSIB Surcharge: Funds with High Leverage

This table reports the results of panel regressions (OA.5) to examine the effects of hedge funds' average exposure to GSIB surcharges on fund's performance. The dependent variable is average monthly excess return and risk-adjust alpha over 12 months. *leverageHigh* is a dummy which takes one if funds only use physical leverage and employ intensive leverage investment strategies. t-statistics in parenthesis are based on standard errors clustered at fund level. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively. The sample period spans from January 2013 to November 2021.

$$\begin{aligned} y_{i,t+1,t+12} =& \beta_0 + \beta_1 AvgSurcharge_{i,t} + \beta_2 AvgSurcharge_{i,t} \times leverageHigh_i \\ & + \beta_3' X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t} \end{aligned}$$

	(1) return	(2) return	(3) alpha	(4) alpha
AvgSurcharge	-0.309***	-0.286**	-0.343***	-0.289**
	(-4.26)	(-2.46)	(-4.62)	(-2.34)
AvgSurcharge × leverageHigh	-0.195*	-0.379**	-0.327***	-0.377***
	(-1.87)	(-2.54)	(-2.95)	(-2.98)
Fund FE	No	Yes	No	Yes
Style × Month FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	17500	17483	17500	17483
Adjusted R^2	0.247	0.368	0.140	0.326

Table OA.14: Results for Alpha: Adjusted by Fung and Hsieh and Liquidity Factors

This table reports the results of panel regressions (16) to examine the effects of hedge funds' average exposure to GSIB surcharges on fund's alpha. Alpha is adjusted by Fung and Hsieh (2004) seven factors and traded liquidity factor. The dependent variable is hedge funds performance over next 12 months. *AvgSurcharge* measures hedge funds' average exposure to capital surcharges on GSIB-affiliated prime brokers. t-statistics in parenthesis are based on standard errors clustered at fund level. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively. The sample period spans from January 2013 to November 2021.

$$Alpha_{i,t+1,t+12} = \beta_0 + \beta_1 AvgSurcharge_{i,t} + \beta_2^{'} X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}$$

	Alpha based on FH seven factors and liquidity factor		
	(1)	(2)	(3)
AvgSurcharge	-0.353***	-0.366***	-0.300**
	(-4.61)	(-4.55)	(-2.35)
Fund FE	No	No	Yes
Style × Month FE	Yes	Yes	Yes
Controls	No	Yes	Yes
Observations	17500	17500	17483
Adjusted R^2	0.117	0.125	0.318

Table OA.15: Hedge Fund Performance on Average GSIB Surcharge: Alternative Clustering Schemes

This table reports the results of panel regressions (16) with alternative errors clustering schemes. The dependent variable is average monthly excess return, risk-adjust alpha, volatility, Sharpe ratio, and information ratio over 12 months. In Panel A and Panel B we cluster standard errors by fund family level or both fund and month level. In Panel C, the standard errors are estimated by Driscoll and Kraay (1998) standard errors with 12 lags. $*$, $**$, and $***$ indicate that the coefficients estimated are statistically significant at the 10%, 5%, and 1% level, respectively. The sample period spans from January 2013 to November 2021.

$$y_{i,t+1,t+12} = \beta_0 + \beta_1 AvgSurcharge_{i,t} + \beta_2^{'} X_{i,t} + \alpha_i + \eta_{s,t} + \varepsilon_{i,t}$$

Panel A: Cluster by Fund Family Level

	(1) return	(2) return	(3) alpha	(4) alpha	(5) volatility	(6) volatility	(7) SR	(8) SR	(9) IR	(10) IR
AvgSurcharge	-0.313***	-0.293*	-0.349***	-0.297*	-0.565**	-0.558***	-0.077**	-0.069	-0.104***	-0.095**
	(-3.17)	(-1.77)	(-3.74)	(-1.84)	(-2.07)	(-2.76)	(-2.56)	(-1.09)	(-3.83)	(-2.21)
Fund FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Style × Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17500	17483	17500	17483	17500	17483	17500	17483	17500	17483
Adjusted R^2	0.246	0.365	0.136	0.323	0.264	0.737	0.350	0.528	0.240	0.454

Panel B: Cluster by Fund and Month Level

	(1) return	(2) return	(3) alpha	(4) alpha	(5) volatility	(6) volatility	(7) SR	(8) SR	(9) IR	(10) IR
AvgSurcharge	-0.313***	-0.293**	-0.349***	-0.297**	-0.565**	-0.558***	-0.077***	-0.069	-0.104***	-0.095***
	(-4.23)	(-2.44)	(-4.48)	(-2.36)	(-2.32)	(-3.28)	(-3.92)	(-1.51)	(-5.19)	(-2.72)
Fund FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Style × Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17500	17483	17500	17483	17500	17483	17500	17483	17500	17483
Adjusted R^2	0.246	0.365	0.136	0.323	0.264	0.737	0.350	0.528	0.240	0.454

Panel C: Using Discoll-Kraay Standard Errors

	(1) return	(2) return	(3) alpha	(4) alpha	(5) volatility	(6) volatility	(7) SR	(8) SR	(9) IR	(10) IR
AvgSurcharge	-0.313***	-0.293**	-0.349***	-0.297***	-0.565***	-0.558**	-0.0773**	-0.0689	-0.104***	-0.0951***
	(-4.20)	(-2.41)	(-4.32)	(-3.16)	(-2.93)	(-2.05)	(-2.50)	(-1.55)	(-4.10)	(-3.03)
Fund FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Style × Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Driscoll-Kraay SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	17683	17683	17683	17683	17683	17683	17683	17683	17683	17683

Table OA.16: Fund Characteristics Related to Leverage Demand Elasticities

This table presents the fund-level characteristics that can affect leverage demand elasticities.

Characteristics	Impact	Reasoning
Fund size	lower	Large funds are more risk-averse, leading to a lower leverage demand elasticity (e.g., Hu et al., 2011, Lim et al., 2016).
Fund age	lower	Old funds are more risk-averse, leading to a lower leverage demand elasticity (e.g., Hu et al., 2011, Lim et al., 2016).
Closed-end feature	lower	Closed end funds are less elastic to leverage cost. Closed end funds have less liquidity transformation needs, thus they are less sensitive to leverage cost (Nanda et al., 2000, Cherkes et al., 2008).
Redemption frequency	lower	Funds with low redemption frequency have less liquidity transformation needs, thus they are less sensitive to leverage cost (Chordia, 1996, Çötelioğlu et al., 2021).
Incentive fee	lower	A high incentive fee, due to its option-like payoff, aligns a manager's incentives with high-risk, high-return strategies. This makes the fund's demand for leverage highly inelastic with respect to the rising cost in our sample period (e.g., Lim et al., 2016).

Table OA.17: Matching Variables in Coarsened Exact Matching

This table reports estimation results of panel regressions (16) after matching firms based on fund style, age, size, whether the fund is closed-end, the redemption frequency dummy, and incentive fee dummy. For each hedge fund in treated group, we match the a fund in control group with coarsened matching variables. t-statistics in square brackets are based on standard errors clustered at fund level.

Case	Style	Age Group	Size Group	ClosedEnd	RedempFreq Low	High IncenFee	Return	Alpha	Volatility
1	✓						$-0.300^{**}[-2.55]$	$-0.287^{**}[-2.32]$	$-0.588^{***}[-4.26]$
2	✓	✓					$-0.369^{***}[-2.74]$	$-0.369^{***}[-2.92]$	$-0.629^{***}[-3.93]$
3	✓		✓				$-0.312^{**}[-2.59]$	$-0.312^{***}[-2.60]$	$-0.661^{***}[-4.73]$
4	✓			✓			$-0.279^{***}[-2.62]$	$-0.267^{**}[-2.27]$	$-0.498^{***}[-3.77]$
5	✓				✓		$-0.383^{***}[-2.99]$	$-0.331^{***}[-2.64]$	$-0.708^{***}[-4.61]$
6	✓					✓	$-0.317^{***}[-2.70]$	$-0.300^{**}[-2.40]$	$-0.604^{***}[-4.26]$
7	✓	✓	✓				$-0.448^{***}[-2.90]$	$-0.471^{***}[-3.40]$	$-0.658^{***}[-3.67]$
8	✓	✓		✓			$-0.336^{**}[-2.37]$	$-0.326^{**}[-2.59]$	$-0.625^{***}[-3.62]$
9	✓	✓			✓		$-0.327^{**}[-2.16]$	$-0.349^{**}[-2.55]$	$-0.608^{***}[-3.76]$
10	✓	✓				✓	$-0.356^{**}[-2.41]$	$-0.383^{***}[-2.77]$	$-0.740^{***}[-4.59]$
11	✓		✓	✓			$-0.295^{**}[-2.27]$	$-0.284^{**}[-2.39]$	$-0.624^{***}[-3.63]$
12	✓		✓		✓		$-0.359^{***}[-2.72]$	$-0.356^{***}[-2.89]$	$-0.728^{***}[-4.28]$
13	✓		✓			✓	$-0.293^{**}[-2.33]$	$-0.291^{**}[-2.43]$	$-0.678^{***}[-4.52]$
14	✓			✓	✓		$-0.378^{***}[-3.07]$	$-0.362^{***}[-3.10]$	$-0.630^{***}[-3.86]$
15	✓			✓		✓	$-0.308^{***}[-2.82]$	$-0.291^{**}[-2.38]$	$-0.497^{***}[-3.68]$
16	✓				✓	✓	$-0.406^{***}[-3.07]$	$-0.341^{***}[-2.75]$	$-0.694^{***}[-4.24]$
17	✓	✓	✓	✓			$-0.466^{***}[-2.77]$	$-0.434^{***}[-2.87]$	$-0.581^{**}[-2.51]$
18	✓	✓	✓		✓		$-0.457^{***}[-2.68]$	$-0.462^{***}[-2.99]$	$-0.475^{**}[-2.38]$
19	✓	✓	✓			✓	$-0.356^{**}[-2.08]$	$-0.390^{**}[-2.71]$	$-0.695^{***}[-3.39]$
20	✓	✓		✓	✓		$-0.352^{**}[-2.55]$	$-0.332^{***}[-2.85]$	$-0.400^{**}[-2.40]$
21	✓	✓		✓		✓	$-0.337^{**}[-2.20]$	$-0.340^{**}[-2.43]$	$-0.647^{***}[-3.52]$
22	✓	✓			✓	✓	$-0.288^{*}[-1.74]$	$-0.308^{**}[-2.08]$	$-0.661^{***}[-3.90]$
23	✓		✓	✓	✓		$-0.431^{***}[-2.93]$	$-0.340^{***}[-2.67]$	$-0.408^{*}[-1.87]$
24	✓		✓	✓		✓	$-0.283^{**}[-2.01]$	$-0.248^{**}[-2.14]$	$-0.636^{***}[-3.33]$
25	✓		✓		✓	✓	$-0.336^{**}[-2.46]$	$-0.310^{**}[-2.50]$	$-0.717^{***}[-4.00]$
26	✓			✓	✓	✓	$-0.373^{***}[-2.99]$	$-0.354^{***}[-3.24]$	$-0.612^{***}[-3.53]$
27	✓	✓	✓	✓	✓		$-0.574^{***}[-3.12]$	$-0.547^{***}[-3.64]$	$0.006\ [0.04]$
28	✓	✓	✓	✓		✓	$-0.367^{*}[-1.97]$	$-0.392^{***}[-2.66]$	$-0.473^{*}[-1.90]$
29	✓	✓	✓		✓	✓	$-0.380^{**}[-2.16]$	$-0.357^{**}[-2.26]$	$-0.521^{**}[-2.45]$
30	✓	✓		✓	✓	✓	$-0.312^{**}[-2.21]$	$-0.303^{***}[-2.66]$	$-0.371^{**}[-2.08]$
31	✓		✓	✓	✓	✓	$-0.428^{***}[-2.67]$	$-0.283^{**}[-2.22]$	$-0.376[-1.53]$
32	✓	✓	✓	✓	✓	✓	$-0.514^{**}[-2.38]$	$-0.394^{**}[-2.42]$	$0.022[0.09]$

Table OA.18: Methodologies for GSIB Surcharge: Method 1 and Method 2

Panel A and panel B show weights assigned to systemic importance indicators used to calculate Method 1 and Method 2 score of each bank. Panel C shows the Method 1 and Method 2 surcharge of each bank as function of its score.

Panel A: Systemic Importance Indicator Weights for Method 1

Category	Systemic Importance Indicator	Weight (%)
Size	Total Exposure	20
Interconnectedness	Intra-financial system assets	6.67
Interconnectedness	Intra-financial system liabilities	6.67
Interconnectedness	Securities outstanding	6.67
Substitutability	Payments activity	6.67
Substitutability	Assets under custody	6.67
Substitutability	Underwritten transactions in debt and equity markets	6.67
Complexity	Notional Amount of OTC derivatives	6.67
Complexity	Trading and AFS securities	6.67
Complexity	Level 3 assets	6.67
Cross-Jurisdiction Activity	Cross-jurisdictional claims	10
Cross-Jurisdiction Activity	Cross-jurisdictional liabilities	10

Panel B: Systemic Importance Indicator Weights for Method 2

Category	Systemic Indicator	Weight (%)
Size	Total Exposure	4.423
Interconnectedness	Intra-financial system assets	12.007
Interconnectedness	Intra-financial system liabilities	12.49
Interconnectedness	Securities outstanding	9.056
Short-term wholesale funding	Short-term wholesale funding score	1
Complexity	Notional Amount of OTC derivatives	0.155
Complexity	Trading and AFS securities	30.169
Complexity	Level 3 assets	16.1177
Cross-Jurisdiction Activity	Cross-jurisdictional claims	9.277
Cross-Jurisdiction Activity	Cross-jurisdictional liabilities	9.926

Panel C: Method 1 and Method 2 score and GSIBs surcharge

Method 1 Score	Surcharge (%)	Method 2 Score	Surcharge (%)
130 or less	0	130 or less	0
130–299	1	130–299	1
230–329	1.5	230–329	1.5
330–429	2	330–429	2
430–529	2.5	430–529	2.5
530 or more	3.5 + 1.0 for each 100 bps above 530	530–629	3
		630–729	3.5
		730–829	4
		830–929	4.5
		930–1029	5
		1030–1129	5.5
		1130 or more	6.5 +0.5 for each100 bps above1130