Internet Appendix to "Leverage Constraints and Asset Prices: Insights from Mutual Fund Risk Taking"

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In this Internet Appendix, we provide further discussion and additional empirical results to evaluate robustness of the inverse relation between return loadings on changes in leverage constraint tightness (LCT) and future returns of mutual funds and stocks.

I. Robustness to Modifying LCT Estimation Methods

A. Excluding Funds that Use Leverage from the Sample

In the paper, we retain funds that are permitted to use leverage because even when their investment policies permit borrowing, funds seldom engage in it (Almazan, Brown, Carlson, and Chapman, 2004) and because identifying such funds cleanly is challenging empirically. We now attempt to do so and evaluate the sensitivity of our results to excluding these funds. Specifically, we drop from the sample all funds that have used leverage, proxied for by the asset allocation to equity above 100%, at any point in their existence. This approach introduces a look-ahead bias, but can allow us to better identify funds that are allowed to use leverage.[1] We summarize the results in Table A1. Our findings are little affected by this change in the empirical method. For example, the difference in performance of mutual fund portfolios with low and high LCT loadings is 0.50% monthly both here and in the base-case results in Table 4 of the paper. For stocks, the corresponding numbers are 0.73% and 0.74%.

B. Accounting for Aggregate Mutual Fund Cash Holdings

We obtain aggregate cash holdings of actively managed U.S. equity funds from Morningstar. The data are well-populated starting from 1995.[2] The resultant time series,

[1] We have also considered using an expanding window approach that at time t excludes funds that have used leverage at any point from inception to t. The results are similar to those we describe here.

[2] CRSP data on cash holdings is not ideal for our purposes. Exact asset composition dates are not available before the 1990s, and whatever data are available until the end of 1998 is only annual. Complicating matters

which we plot in Figure A1, shows that the aggregate cash-to-asset ratio is very stable, declining gradually from about 8% in 1995 to just over 3% in recent years. The average (median) absolute change from one month to the next is just 0.14% (0.10%), negligible relative to monthly variation in LCT. Consequently, the correlation between a cash-adjusted LCT series and the one used in the paper is 0.99. More importantly, the correlation between changes in cash-adjusted LCT and changes in LCT used in the paper is also 0.99. We get similar numbers focusing on the subsample of cash holdings available from CRSP. As a result, our findings are not sensitive to adjusting for cash. For example, the difference in performance of the low-minus-high portfolio constructed with and without taking cash into account when calculating LCT is only 1 basis point a month (untabulated). This is not surprising given how stable aggregate cash holdings are, and given that they account for only a small fraction of the overall asset holdings.

C. Addressing Passive Changes in the Aggregate Mutual Fund Beta

The beta of mutual fund stockholdings can change for three reasons. First, the manager may actively decide to buy or sell assets. Second, the beta may change passively if betas of individual stocks shift. Last, it may change passively as portfolio weights fluctuate with past returns. As long as managers have the ability to counteract/undo unwanted changes in fund betas due to either changes in betas of individual assets or changes in portfolio weights, it is the overall risky-asset beta that is important for our analysis. For example, consider a manager who started a period with a risky-asset beta of 1. To make the example more concrete, suppose the portfolio is composed of two equally weighted stocks, with betas of 0.5 and 1.5. Now, if the manager wants to increase the risky-asset beta to 1.2 by the end of the period, what can she do it? The manager would assess how betas and portfolio weights of the existing stocks changed during the period, and then buy or sell stocks as needed to arrive at the desired beta of 1.2. Several situations are interesting to consider:

more, several years ago WRDS has changed the source of their asset composition data, and, as a result, the cash positions are only available for a handful of funds between 1998 and 2002 in the current CRSP data vintage. After 2002, the CRSP data are available quarterly.

- At the end of the period, the risky-asset beta is below the desired amount of 1.2. In this case, the manager would have to buy high-beta stocks to arrive at the target beta.

- If stock betas did not change, but the high-beta stock did particularly well during the period, the risky-asset beta could now be above the target. For example, if the first stock fell by half, but the second stock doubled in value, the first stock now has a portfolio weight of 0.2, and the new portfolio beta would be $0.5 \times 0.2 + 1.5 \times 0.8 = 1.3$, in which case the manager would actually have to add to the low-beta stock to arrive at the desired beta.

- The portfolio weights did not change, but beta of the first (low-beta) stock increased to 1, which results in the overall risky-asset beta of 1.25. In this case the manager again would have to add to the low-beta stock to arrive at the target beta.

This simple example demonstrates that just because we see the manager buying low-beta stocks does not necessarily imply that leverage constraints are becoming less tight. What matters is the overall risky-asset beta, and it is economically irrelevant whether this beta emerged as a result of changes in portfolio weights, changes in individual asset betas, or trading.

In practice, however, managers might not update passive changes to the betas of their stock holdings in real time. To account for possible beta changes, we repeated the analysis with a one-month lagged beta. That is, we used period-end portfolio weights, but stock betas computed as of the start of the period. The results, summarized in Table A2, are similar to the base case results in the paper.

In light of this discussion, it is also informative to foreshadow the results of Table A4, where we use 36-month stock betas to estimate LCT. Recent changes in beta have negligible impact on the long-horizon beta estimates, and the strong results we observe in that table further confirm that our findings are not driven by passive changes in stock-level betas.

D. Treating LCT Outliers

Several spikes that we observe in the time series of LCT could, at least in part, reflect measurement error. To treat the outliers, in Table A3 we winsorize LCT at 5th and 95th percentiles. The results that are similar to those in the base case reported in the paper.

E. Using Long-Horizon Stock Betas to Estimate LCT

The aggregate mutual fund beta is the weighted sum of individual stocks' market betas. In the paper, we estimate stock betas from daily returns within a month. This approach allows for timely estimates of stock betas. We now evaluate robustness to using 36 monthly observations for estimation. The resultant betas can be expected to be less noisy, but potentially stale as betas of individual firms can change over time. We use the approach of FP to estimate betas, and refer the readers to that paper for details. Table A4 shows that our key results remain robust. For example, monthly CAPM alphas of the low-minus-high LCT loading portfolios are 0.61% ($t = 3.41$), 0.86% ($t = 4.97$), and 0.87% ($t = 3.48$) for mutual funds, mutual funds with back-testing, and stocks, respectively.

F. Correlations Between LCT and Proxies for Funding Conditions

We now revisit the correlations between quarterly residuals in LCT and variables capturing funding conditions. Instead of assuming a random walk model, as we do in Table 1 of the paper, we now use Akaike's Information Criterion (AIC) to select the best model from the $ARMA(p, q)$ class with p and q ranging from 0 to 3. $ARMA(1, 3)$ provides the best fit for quarterly LCT. For the broker-dealer asset growth, the broker-dealer leverage factor, and the bond-implied funding liquidity factor, $ARMA(3, 3)$, $ARMA(3, 2)$, and $ARMA(3, 1)$ are chosen, respectively. $ARMA(1, 1)$ models are selected for the TED spread and the VIX, and an $AR(1)$ model for the Pástor and Stambaugh (2003) liquidity factor. The Sadka factor is already defined as innovation, and the best fit is given by the random walk. Table A5 repeats the analysis of Table 1 of the paper using residuals from these optimal $ARMA$ models.

II. Robustness to Modifying $\boldsymbol{\beta}^{\mathbf{LCT}}$ Estimation Methods

A. Estimating $\boldsymbol{\beta}^{\mathbf{LCT}}$ as Loadings on ARMA Model Residuals of LCT

In the paper, we calculate β^{LCT} as return loadings on first differences in LCT, implicitly assuming that LCT follows a random walk. While LCT is positively autocorrelated, its first differences have a significant negative autocorrelation, which reflects the noise in the estimation. We now estimate LCT loadings from regressions of fund or stock returns on $ARMA$ model residuals of LCT. We first consider an $AR(1)$ model, which generates LCT residuals that are do not exhibit serial correlation. The results of our main tests, summarized in Table A6, are similar to those reported in the paper.

While LCT innovations from the $AR(1)$ model are not serially correlated, this model might not provide the best fit for the time series. To allow for a more structured approach, we estimate $ARMA(p, q)$ models with p and q ranging from 0 to 11, and select a model using AIC. An $ARMA(4, 5)$ model was selected as providing the best trade-off between model fit and parsimony. When we estimate β^{LCT} as return loadings on residuals from this model in Table A7, we again observe statistically and economically significant results.

Additionally, first differences in LCT estimated using 36-month betas are not serially correlated, and so the results of Table A4 provide further evidence that our findings are not driven by the particular approach chosen to estimate LCT.

B. Using Longer-Window Regressions to Estimate $\boldsymbol{\beta}^{\mathbf{LCT}}$

In Tables 4, 5, and 8 of the paper, we summarize robustness to using 24 months to estimate betas of mutual funds and stocks. While the magnitude of the difference in returns of low- and high-beta portfolios declines somewhat, it remains statistically and economically significant in all specifications. The same holds true when we consider longer estimation horizons. Table A8 presents the full set of results for 24-month and 60-month estimation periods. Even when the LCT loadings are estimated using a long horizon of 60 months, we observe strong performance of the low-high portfolios. For example, monthly CAPM alphas are 0.35% ($t = 2.90$), 0.59% ($t = 4.34$), and 0.58% ($t = 3.77$) for mutual funds, mutual funds with back-testing, and stocks, respectively.

References

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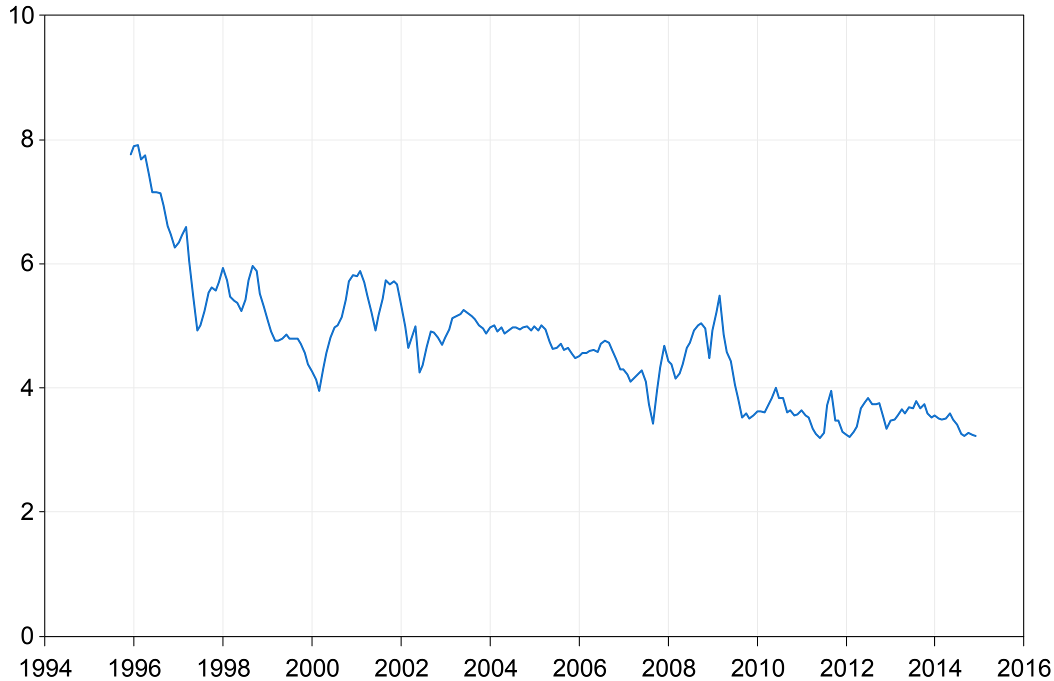

Figure A1. Aggregate cash holdings of actively managed U.S. equity funds. This figure plots monthly aggregate cash holdings of actively managed U.S. equity funds as a percentage of their aggregate total net assets under management. The data are from Morningstar.

Table A1
Performance of Leverage Constraint Tightness Portfolios:
Robustness to Excluding Mutual Funds that Use Leverage

This table reports average excess returns and alphas, in percent per month, and loadings from the five-factor model regressions for the portfolios of actively managed U.S. equity funds (Panels A and B) and stocks (Panel C) sorted by β^{LCT}. β^{LCT} is estimated from rolling regressions of a fund's or a stock's excess returns on changes in leverage constraint tightness. Leverage constraint tightness is computed after excluding mutual funds have used leverage, proxied for by the asset allocation to equity above 100%, at any point in their existence. Newey and West (1987) t-statistics are in square brackets. Funds and stocks are assigned into groups at the end of every month t, and the portfolios are held during month $t+1$. For brevity, mutual fund results are shown for deciles 1 (Low), 3, 5 (Med), 8, and 10 (High). The five factors are market (MKT), value (HML), size (SMB), momentum (UMD), and Pastor-Stambaugh liquidity (PS). The sample period is 1981 to 2014.

	Excess	Alphas from			5-factor loadings				
Portfolio	return	CAPM	4-factor	5-factor	β^{MKT}	β^{HML}	β^{SMB}	β^{UMD}	β^{PS}
A. Mutual fund portfolios (as Panel A of Table 4 of the paper)									
Low	0.81	0.18	0.13	0.14	0.99	0.04	0.26	0.04	-0.02
	[3.35]	[1.99]	[1.55]	[1.63]	[47.8]	[1.27]	[9.07]	[1.92]	[-0.76]
	0.69	0.07	0.02	0.03	0.99	0.07	0.14	0.02	-0.01
Med	0.57	-0.05	-0.07	-0.07	0.99	0.02	0.15	0.01	-0.01
	0.47	-0.18	-0.18	-0.17	1.00	-0.05	0.24	0.02	-0.01
High	0.31	-0.39	-0.30	-0.29	1.02	-0.22	0.41	0.01	-0.02
	[1.14]	[-3.43]	[-3.43]	[-3.30]	[49.7]	[-7.10]	[14.1]	[0.77]	[-0.76]
Low-High	0.50	0.57	0.43	0.43	-0.03	0.26	-0.15	0.02	0.00
	[3.24]	[3.73]	[2.84]	[2.81]	[-0.94]	[4.77]	[-2.88]	[0.66]	[0.00]
B. Back-tested mutual fund portfolios (as Panel A of Table 5 of the paper)									
Low	0.92	0.31	0.25	0.27	0.96	0.03	0.28	0.06	-0.03
	[3.85]	[3.11]	[2.73]	[2.86]	[43.7]	[0.75]	[9.18]	[2.91]	[-1.18]
	0.77	0.17	0.12	0.13	0.96	0.05	0.19	0.03	-0.02
Med	0.66	0.06	0.03	0.04	0.95	0.02	0.19	0.03	-0.02
	0.40	-0.27	-0.24	-0.23	1.04	-0.06	0.19	-0.01	-0.01
High	0.20	-0.51	-0.42	-0.43	1.06	-0.18	0.34	-0.01	0.00
	[0.73]	[-4.63]	[-4.48]	[-4.44]	[47.3]	[-5.38]	[10.7]	[-0.35]	[0.03]
Low-High	0.72	0.82	0.68	0.69	-0.10	0.21	-0.06	0.07	-0.03
	[4.42]	[5.14]	[4.16]	[4.21]	[-2.69]	[3.56]	[-1.02]	[1.86]	[-0.69]
C. Stock portfolios (as Panel A of Table 8 of the paper)									
Low	0.94	0.24	0.30	0.32	1.06	-0.03	0.32	-0.09	-0.02
	[3.37]	[1.92]	[2.63]	[2.70]	[38.7]	[-0.66]	[8.31]	[-3.65]	[-0.74]
	0.79	0.20	0.15	0.15	0.98	0.10	-0.01	0.00	0.01
Med	0.69	0.11	0.06	0.06	0.97	0.09	-0.10	0.00	0.00
	0.48	-0.12	-0.12	-0.14	0.99	0.04	-0.07	-0.03	0.03
High	0.21	-0.56	-0.43	-0.42	1.16	-0.18	0.26	-0.08	-0.01
	[0.70]	[-4.58]	[-3.70]	[-3.60]	[42.4]	[-4.35]	[6.81]	[-3.06]	[-0.46]
Low-High	0.73	0.80	0.73	0.73	-0.09	0.15	0.06	-0.02	-0.01
	[3.89]	[4.26]	[3.79]	[3.78]	[-2.08]	[2.20]	[0.92]	[-0.36]	[-0.17]

Table A2
Performance of Leverage Constraint Tightness Portfolios: Robustness to Using Lagged Stock Betas for LCT Estimation

This table reports average excess returns and alphas, in percent per month, and loadings from the five-factor model regressions for the portfolios of actively managed U.S. equity funds (Panels A and B) and stocks (Panel C) sorted by β^{LCT}. β^{LCT} is estimated from rolling regressions of a fund's or a stock's excess returns on changes in leverage constraint tightness. Leverage constraint tightness for month t is computed using month-end portfolio weights and stock betas computed as of the end of month $t-1$. Newey and West (1987) t-statistics are in square brackets. Funds and stocks are assigned into groups at the end of every month t, and the portfolios are held during month $t+1$. For brevity, mutual fund results are shown for deciles 1 (Low), 3, 5 (Med), 8, and 10 (High). The five factors are market (MKT), value (HML), size (SMB), momentum (UMD), and Pastor-Stambaugh liquidity (PS). The sample period is 1981 to 2014.

	Excess	Alphas from			5-factor loadings				
Portfolio	return	CAPM	4-factor	5-factor	β^{MKT}	β^{HML}	β^{SMB}	β^{UMD}	β^{PS}
A. Mutual fund portfolios (as Panel A of Table 4 of the paper)									
Low	0.81	0.18	0.13	0.14	0.99	0.04	0.26	0.03	-0.02
	[3.35]	[1.98]	[1.53]	[1.61]	[48.0]	[1.32]	[8.95]	[1.78]	[-0.69]
	0.68	0.06	0.01	0.02	0.99	0.06	0.14	0.02	-0.01
Med	0.59	-0.03	-0.06	-0.05	0.99	0.03	0.15	0.01	-0.01
	0.47	-0.18	-0.17	-0.17	1.00	-0.05	0.24	0.02	-0.01
High	0.32	-0.38	-0.29	-0.28	1.02	-0.22	0.42	0.02	-0.02
	[1.17]	[-3.32]	[-3.32]	[-3.18]	[49.7]	[-7.16]	[14.4]	[0.81]	[-0.78]
Low-High	0.49	0.56	0.42	0.42	-0.03	0.26	-0.16	0.02	0.00
	[3.15]	[3.63]	[2.77]	[2.73]	[-0.91]	[4.84]	[-3.10]	[0.55]	[0.05]
B. Back-tested mutual fund portfolios (as Panel A of Table 5 of the paper)									
Low	0.92	0.31	0.25	0.27	0.96	0.03	0.27	0.05	-0.03
	[3.85]	[3.13]	[2.75]	[2.87]	[44.0]	[0.85]	[8.85]	[2.60]	[-1.08]
	0.77	0.17	0.12	0.12	0.96	0.05	0.18	0.03	-0.02
Med	0.65	0.05	0.02	0.03	0.95	0.02	0.18	0.03	-0.02
	0.40	-0.27	-0.24	-0.24	1.03	-0.06	0.19	0.00	-0.01
High	0.21	-0.50	-0.42	-0.42	1.06	-0.18	0.34	-0.01	0.00
	[0.76]	[-4.54]	[-4.40]	[-4.36]	[47.3]	[-5.44]	[10.8]	[-0.25]	[-0.01]
Low-High	0.71	0.81	0.67	0.68	-0.10	0.21	-0.07	0.06	-0.03
	[4.35]	[5.09]	[4.14]	[4.18]	[-2.73]	[3.67]	[-1.34]	[1.62]	[-0.61]
C. Stock portfolios (as Panel A of Table 8 of the paper)									
Low	0.92	0.22	0.29	0.30	1.06	-0.02	0.32	-0.09	-0.02
	[3.32]	[1.81]	[2.48]	[2.56]	[38.3]	[-0.56]	[8.30]	[-3.58]	[-0.80]
	0.78	0.19	0.14	0.14	0.98	0.11	-0.01	-0.01	0.01
Med	0.69	0.12	0.07	0.08	0.96	0.09	-0.10	0.00	0.00
	0.48	-0.13	-0.13	-0.15	1.00	0.04	-0.08	-0.02	0.03
High	0.23	-0.54	-0.40	-0.39	1.16	-0.18	0.28	-0.09	-0.02
	[0.77]	[-4.45]	[-3.55]	[-3.43]	[42.9]	[-4.29]	[7.35]	[-3.54]	[-0.71]
Low-High	0.69	0.77	0.69	0.69	-0.10	0.15	0.04	0.00	0.00
	[3.70]	[4.11]	[3.60]	[3.57]	[-2.11]	[2.20]	[0.69]	[-0.08]	[-0.06]

Table A3
Performance of Leverage Constraint Tightness Portfolios:
Robustness to Winsorizing LCT

This table reports average excess returns and alphas, in percent per month, and loadings from the five-factor model regressions for the portfolios of actively managed U.S. equity funds (Panels A and B) and stocks (Panel C) sorted by β^{LCT}. β^{LCT} is estimated from rolling regressions of a fund's or a stock's excess returns on changes in leverage constraint tightness. Leverage constraint tightness is winsorized in the full sample at the 5th and 95th percentiles. Newey and West (1987) t-statistics are in square brackets. Funds and stocks are assigned into groups at the end of every month t, and the portfolios are held during month $t+1$. For brevity, mutual fund results are shown for deciles 1 (Low), 3, 5 (Med), 8, and 10 (High). The five factors are market (MKT), value (HML), size (SMB), momentum (UMD), and Pastor-Stambaugh liquidity (PS). The sample period is 1981 to 2014.

	Excess	Alphas from			5-factor loadings				
Portfolio	return	CAPM	4-factor	5-factor	β^{MKT}	β^{HML}	β^{SMB}	β^{UMD}	β^{PS}
A. Mutual fund portfolios (as Panel A of Table 4 of the paper)									
Low	0.81	0.19	0.13	0.13	0.99	0.08	0.24	0.03	0.00
	[3.38]	[2.06]	[1.43]	[1.44]	[47.3]	[2.56]	[8.22]	[1.34]	[-0.17]
	0.68	0.07	0.02	0.03	0.99	0.07	0.13	0.01	-0.01
Med	0.58	-0.04	-0.07	-0.07	0.99	0.03	0.15	0.01	-0.01
	0.50	-0.15	-0.14	-0.13	0.99	-0.06	0.25	0.02	-0.02
High	0.31	-0.39	-0.28	-0.27	1.01	-0.26	0.43	0.02	-0.02
	[1.14]	[-3.30]	[-3.21]	[-3.05]	[49.1]	[-8.30]	[14.5]	[0.93]	[-1.03]
Low-High	0.50	0.58	0.41	0.40	-0.02	0.34	-0.18	0.01	0.02
	[3.11]	[3.62]	[2.66]	[2.57]	[-0.58]	[6.21]	[-3.55]	[0.25]	[0.49]
B. Back-tested mutual fund portfolios (as Panel A of Table 5 of the paper)									
Low	0.89	0.29	0.22	0.23	0.95	0.05	0.28	0.05	-0.02
	[3.76]	[2.91]	[2.40]	[2.49]	[43.7]	[1.62]	[8.95]	[2.34]	[-0.90]
	0.75	0.15	0.09	0.10	0.96	0.06	0.19	0.04	-0.02
Med	0.64	0.04	0.00	0.00	0.95	0.02	0.18	0.03	-0.01
	0.39	-0.29	-0.26	-0.25	1.05	-0.07	0.19	0.00	-0.01
High	0.16	-0.56	-0.46	-0.45	1.07	-0.22	0.34	0.00	-0.01
	[0.57]	[-4.94]	[-4.78]	[-4.67]	[46.7]	[-6.30]	[10.6]	[-0.18]	[-0.45]
Low-High	0.73	0.85	0.68	0.69	-0.11	0.27	-0.07	0.05	-0.01
	[4.43]	[5.26]	[4.21]	[4.20]	[-2.92]	[4.67]	[-1.21]	[1.44]	[-0.25]
C. Stock portfolios (as Panel A of Table 8 of the paper)									
Low	0.97	0.27	0.29	0.30	1.08	0.01	0.35	-0.05	-0.01
	[3.43]	[2.04]	[2.32]	[2.35]	[36.5]	[0.22]	[8.50]	[-1.91]	[-0.42]
	0.81	0.22	0.16	0.16	0.98	0.14	-0.01	-0.01	-0.01
Med	0.70	0.12	0.10	0.09	0.96	0.07	-0.10	-0.01	0.02
	0.48	-0.12	-0.12	-0.13	0.99	0.03	-0.09	-0.02	0.02
High	0.19	-0.58	-0.43	-0.41	1.16	-0.16	0.20	-0.11	-0.05
	[0.63]	[-4.96]	[-3.86]	[-3.63]	[43.6]	[-4.09]	[5.28]	[-4.28]	[-1.54]
Low-High	0.78	0.85	0.72	0.71	-0.08	0.17	0.16	0.05	0.03
	[4.04]	[4.37]	[3.63]	[3.51]	[-1.74]	[2.44]	[2.33]	[1.23]	[0.60]

Table A4
Performance of Leverage Constraint Tightness Portfolios: Robustness to Using 36-month Betas for LCT Estimation

This table reports average excess returns and alphas, in percent per month, and loadings from the five-factor model regressions for the portfolios of actively managed U.S. equity funds (Panels A and B) and stocks (Panel C) sorted by β^{LCT}. β^{LCT} is estimated from rolling regressions of a fund's or a stock's excess returns on changes in leverage constraint tightness. Leverage constraint tightness is computed using stock-level betas estimated over the past 36 monthly observations. Newey and West (1987) t-statistics are in square brackets. Funds and stocks are assigned into groups at the end of every month t, and the portfolios are held during month $t+1$. For brevity, mutual fund results are shown for deciles 1 (Low), 3, 5 (Med), 8, and 10 (High). The five factors are market (MKT), value (HML), size (SMB), momentum (UMD), and Pastor-Stambaugh liquidity (PS). The sample period is 1981 to 2014.

	Excess	Alphas from			5-factor loadings				
Portfolio	return	CAPM	4-factor	5-factor	β^{MKT}	β^{HML}	β^{SMB}	β^{UMD}	β^{PS}
A. Mutual fund portfolios (as Panel A of Table 4 of the paper)									
Low	0.71	0.19	0.11	0.12	0.86	0.17	0.10	0.00	-0.02
	[3.53]	[2.43]	[1.39]	[1.50]	[47.4]	[5.98]	[3.89]	[-0.13]	[-0.93]
	0.63	0.04	-0.01	-0.01	0.96	0.10	0.07	0.01	0.00
Med	0.57	-0.05	-0.06	-0.06	0.98	0.03	0.11	0.00	0.01
	0.48	-0.19	-0.18	-0.18	1.04	-0.08	0.30	0.04	-0.01
High	0.39	-0.41	-0.30	-0.28	1.13	-0.33	0.61	0.06	-0.04
	[1.21]	[-2.90]	[-3.48]	[-3.21]	[55.5]	[-10.8]	[21.0]	[3.12]	[-1.97]
Low-High	0.33	0.61	0.41	0.40	-0.27	0.50	-0.51	-0.06	0.03
	[1.63]	[3.41]	[3.02]	[2.90]	[-8.35]	[10.3]	[-11.1]	[-2.06]	[0.72]
B. Back-tested mutual fund portfolios (as Panel A of Table 5 of the paper)									
Low	0.82	0.30	0.22	0.24	0.85	0.12	0.16	0.03	-0.04
	[4.02]	[3.47]	[2.53]	[2.73]	[41.5]	[4.01]	[5.62]	[1.55]	[-1.68]
	0.70	0.12	0.06	0.07	0.93	0.08	0.16	0.03	-0.02
Med	0.68	0.07	0.04	0.05	0.96	0.00	0.18	0.03	-0.01
	0.38	-0.30	-0.29	-0.29	1.07	-0.06	0.22	0.01	0.01
High	0.23	-0.56	-0.44	-0.43	1.15	-0.27	0.42	0.01	-0.01
	[0.74]	[-4.32]	[-4.22]	[-4.14]	[46.9]	[-7.35]	[12.1]	[0.25]	[-0.30]
Low-High	0.60	0.86	0.66	0.67	-0.30	0.40	-0.26	0.02	-0.03
	[3.03]	[4.97]	[4.04]	[4.09]	[-7.83]	[6.81]	[-4.76]	[0.66]	[-0.70]
C. Stock portfolios (as Panel A of Table 8 of the paper)									
Low	0.83	0.28	0.16	0.19	0.91	0.20	0.11	0.03	-0.06
	[3.61]	[2.32]	[1.32]	[1.57]	[31.6]	[4.49]	[2.75]	[1.12]	[-2.04]
	0.75	0.23	0.15	0.15	0.90	0.15	-0.14	0.01	-0.01
Med	0.63	0.04	0.04	0.03	0.97	0.03	-0.09	-0.01	0.02
	0.46	-0.28	-0.12	-0.15	1.13	-0.14	0.10	-0.14	0.05
High	0.33	-0.59	-0.28	-0.26	1.31	-0.41	0.37	-0.19	-0.02
	[0.89]	[-3.45]	[-1.82]	[-1.74]	[36.7]	[-7.60]	[7.36]	[-5.51]	[-0.52]
Low-High	0.50	0.87	0.44	0.46	-0.40	0.61	-0.26	0.22	-0.04
	[1.96]	[3.48]	[1.94]	[1.96]	[-7.12]	[7.14]	[-3.27]	[4.08]	[-0.71]

Table A5
Correlations of Leverage Constraint Tightness and Proxies of Funding Conditions: Robustness to Defining Changes from Optimally Selected ARMA Model

This table reports the correlation matrix of quarterly innovations in leverage constraint tightness with those of the broker-dealers' leverage factor, the Treasury security-based funding liquidity measure, broker-dealers' asset growth rate, the TED spread, the VIX index, the Pástor and Stambaugh (2003) factor, and the Sadka (2006) permanent price impact factor. The innovations are obtained from the $ARMA(p,q)$ model, $0 \leq p, q \leq 3$, with the lowest AIC. We sign all proxies such that positive shocks indicate a worsening of funding conditions. Significant correlations are indicated by an asterisk. The sample period is 1980 to 2014, except for broker-dealer leverage (ending in 2012), bond-implied funding liquidity, the TED spread, and the VIX index (all starting in 1986), and the Sadka factor (1983-2012) due to data availability.

Variable		(p, q)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1)	Leverage constraint tightness	(1,3)							
(2)	$-1\times$Broker-dealer asset growth	(3,3)	0.13*						
(3)	$-1\times$Broker-dealer leverage factor	(3,2)	-0.05	0.52*					
(4)	Bond-implied funding liquidity	(3,1)	0.19*	0.25*	0.19*				
(5)	TED spread	(1,1)	0.01	-0.05	-0.37*	0.30*			
(6)	VIX	(1,1)	-0.12*	0.18*	0.04	0.28*	0.30*		
(7)	$-1\times$Pastor-Stambaugh Factor	(1,0)	0.02	0.29*	0.15*	0.08	0.09	0.38*	
(8)	$-1\times$Sadka Factor	(0,0)	0.07	0.10	-0.10	0.31*	0.52*	0.42*	0.21*

Table A6
Performance of Leverage Constraint Tightness Portfolios: Robustness to Using AR(1) Residuals to Compute LCT Loadings

This table reports average excess returns and alphas, in percent per month, and loadings from the five-factor model regressions for the portfolios of actively managed U.S. equity funds (Panels A and B) and stocks (Panel C) sorted by β^{LCT}. β^{LCT} is estimated from rolling regressions of a fund's or a stock's excess returns on changes in leverage constraint tightness (LCT). Changes in LCT are residuals from $AR(1)$ model. Newey and West (1987) t-statistics are in square brackets. Funds and stocks are assigned into groups at the end of every month t, and the portfolios are held during month $t+1$. For brevity, mutual fund results are shown for deciles 1 (Low), 3, 5 (Med), 8, and 10 (High). The five factors are market (MKT), value (HML), size (SMB), momentum (UMD), and Pastor-Stambaugh liquidity (PS). The sample period is 1981 to 2014.

	Excess	Alphas from			5-factor loadings				
Portfolio	return	CAPM	4-factor	5-factor	β^{MKT}	β^{HML}	β^{SMB}	β^{UMD}	β^{PS}
A. Mutual fund portfolios (as Panel A of Table 4 of the paper)									
Low	0.77	0.17	0.09	0.11	0.99	0.12	0.25	0.02	-0.04
	[3.11]	[1.68]	[0.90]	[1.09]	[42.2]	[3.25]	[7.36]	[0.78]	[-1.47]
	0.62	0.02	-0.03	-0.02	0.99	0.06	0.15	0.01	-0.01
Med	0.60	0.00	-0.03	-0.03	0.99	0.03	0.13	0.02	-0.01
	0.46	-0.16	-0.15	-0.15	0.99	-0.07	0.25	0.02	0.00
High	0.32	-0.38	-0.28	-0.28	1.03	-0.27	0.44	0.02	0.00
	[1.09]	[-3.01]	[-2.95]	[-2.93]	[47.2]	[-8.09]	[13.9]	[1.11]	[0.01]
Low-High	0.46	0.55	0.37	0.39	-0.04	0.39	-0.19	-0.01	-0.04
	[2.52]	[3.07]	[2.14]	[2.24]	[-1.10]	[6.32]	[-3.31]	[-0.15]	[-0.87]
B. Back-tested mutual fund portfolios (as Panel A of Table 5 of the paper)									
Low	0.93	0.33	0.24	0.27	0.94	0.07	0.28	0.05	-0.04
	[3.82]	[3.03]	[2.39]	[2.58]	[39.4]	[2.04]	[8.22]	[2.14]	[-1.65]
	0.74	0.14	0.09	0.11	0.95	0.03	0.18	0.04	-0.04
Med	0.71	0.10	0.06	0.08	0.95	0.01	0.16	0.04	-0.03
	0.42	-0.25	-0.22	-0.23	1.04	-0.07	0.17	-0.01	0.02
High	0.29	-0.43	-0.32	-0.33	1.06	-0.22	0.35	-0.02	0.01
	[1.01]	[-3.70]	[-3.23]	[-3.26]	[45.1]	[-6.18]	[10.3]	[-1.10]	[0.46]
Low-High	0.64	0.76	0.57	0.60	-0.11	0.30	-0.06	0.07	-0.06
	[3.53]	[4.29]	[3.18]	[3.31]	[-2.70]	[4.64]	[-1.07]	[1.85]	[-1.20]
C. Stock portfolios (as Panel A of Table 8 of the paper)									
Low	0.79	0.12	0.08	0.11	1.09	0.14	0.32	-0.08	-0.05
	[2.75]	[0.87]	[0.63]	[0.83]	[35.0]	[3.01]	[7.15]	[-2.63]	[-1.54]
	0.76	0.20	0.15	0.17	0.95	0.13	0.00	-0.02	-0.04
Med	0.66	0.11	0.03	0.02	0.97	0.11	-0.07	0.04	0.02
	0.50	-0.11	-0.08	-0.09	1.04	-0.03	-0.11	-0.02	0.02
High	0.16	-0.64	-0.43	-0.45	1.21	-0.31	0.27	-0.09	0.03
	[0.47]	[-4.30]	[-3.15]	[-3.24]	[37.4]	[-6.28]	[5.89]	[-3.08]	[0.85]
Low-High	0.64	0.76	0.52	0.56	-0.11	0.45	0.05	0.02	-0.08
	[2.68]	[3.23]	[2.20]	[2.37]	[-2.09]	[5.39]	[0.59]	[0.32]	[-1.37]

Table A7
Performance of Leverage Constraint Tightness Portfolios:
Robustness to Using ARMA(4,5) Residuals to Compute LCT Loadings

This table reports average excess returns and alphas, in percent per month, and loadings from the five-factor model regressions for the portfolios of actively managed U.S. equity funds (Panels A and B) and stocks (Panel C) sorted by β^{LCT}. β^{LCT} is estimated from rolling regressions of a fund's or a stock's excess returns on changes in leverage constraint tightness (LCT). Changes in LCT are residuals from $ARMA$(4,5) model, the optimal model selected by the AIC from the class of $ARMA$ models. Newey and West (1987) t-statistics are in square brackets. Funds and stocks are assigned into groups at the end of every month t, and the portfolios are held during month $t+1$. For brevity, mutual fund results are shown for deciles 1 (Low), 3, 5 (Med), 8, and 10 (High). The five factors are market (MKT), value (HML), size (SMB), momentum (UMD), and Pastor-Stambaugh liquidity (PS). The sample period is 1981 to 2014.

	Excess	Alphas from			5-factor loadings				
Portfolio	return	CAPM	4-factor	5-factor	β^{MKT}	β^{HML}	β^{SMB}	β^{UMD}	β^{PS}
A. Mutual fund portfolios (as Panel A of Table 4 of the paper)									
Low	0.77	0.18	0.10	0.12	0.97	0.12	0.24	0.01	-0.03
	[3.12]	[1.68]	[0.94]	[1.10]	[39.8]	[3.19]	[6.82]	[0.63]	[-1.29]
	0.64	0.05	0.00	0.01	0.98	0.06	0.16	0.01	-0.02
Med	0.59	-0.01	-0.04	-0.04	0.99	0.03	0.12	0.01	-0.01
	0.47	-0.15	-0.15	-0.15	1.00	-0.06	0.24	0.02	0.00
High	0.32	-0.38	-0.28	-0.28	1.05	-0.27	0.44	0.03	0.00
	[1.09]	[-3.01]	[-2.98]	[-2.94]	[47.1]	[-7.98]	[13.8]	[1.24]	[-0.09]
Low-High	0.45	0.56	0.38	0.40	-0.08	0.39	-0.20	-0.01	-0.03
	[2.37]	[3.03]	[2.16]	[2.23]	[-1.88]	[6.18]	[-3.45]	[-0.30]	[-0.71]
B. Back-tested mutual fund portfolios (as Panel A of Table 5 of the paper)									
Low	0.93	0.34	0.25	0.27	0.93	0.09	0.28	0.05	-0.03
	[3.87]	[3.10]	[2.41]	[2.56]	[38.3]	[2.32]	[8.08]	[2.11]	[-1.24]
	0.77	0.17	0.12	0.13	0.95	0.04	0.18	0.04	-0.02
Med	0.69	0.09	0.05	0.05	0.95	0.02	0.17	0.03	-0.01
	0.39	-0.28	-0.27	-0.27	1.05	-0.05	0.18	0.00	0.01
High	0.27	-0.47	-0.36	-0.37	1.08	-0.22	0.34	-0.01	0.00
	[0.92]	[-3.98]	[-3.63]	[-3.62]	[45.7]	[-6.00]	[10.1]	[-0.63]	[0.18]
Low-High	0.67	0.81	0.62	0.64	-0.14	0.30	-0.06	0.06	-0.04
	[3.60]	[4.48]	[3.41]	[3.48]	[-3.34]	[4.67]	[-0.96]	[1.57]	[-0.81]
C. Stock portfolios (as Panel A of Table 8 of the paper)									
Low	0.78	0.13	0.06	0.10	1.07	0.18	0.32	-0.06	-0.07
	[2.74]	[0.89]	[0.46]	[0.73]	[33.3]	[3.62]	[6.96]	[-2.07]	[-2.12]
	0.74	0.19	0.12	0.14	0.96	0.19	-0.01	-0.04	-0.04
Med	0.66	0.11	0.07	0.06	0.94	0.05	-0.05	0.02	0.03
	0.50	-0.13	-0.09	-0.10	1.06	-0.06	-0.12	-0.01	0.02
High	0.16	-0.64	-0.41	-0.43	1.20	-0.36	0.29	-0.10	0.05
	[0.47]	[-3.99]	[-2.76]	[-2.90]	[34.7]	[-6.87]	[5.82]	[-3.00]	[1.19]
Low-High	0.62	0.76	0.47	0.53	-0.13	0.54	0.03	0.03	-0.12
	[2.43]	[3.05]	[2.08]	[2.22]	[-2.24]	[6.06]	[0.39]	[0.64]	[-1.87]

Table A8
Performance of Leverage Constraint Tightness Portfolios: Robustness to Using Longer Horizons to Compute LCT Loadings

This table reports average excess returns and alphas, in percent per month, for the portfolios of actively managed U.S. equity funds (Panels A and B) and stocks (Panel C) sorted by β^{LCT}. β^{LCT} is estimated from rolling regressions of a fund's or a stock's excess returns on changes in leverage constraint tightness, using 24 or 60 months of data. Newey and West (1987) t-statistics are in square brackets. Funds and stocks are assigned into groups at the end of every month t, and the portfolios are held during month $t+1$. For brevity, mutual fund results are shown for deciles 1 (Low), 3, 5 (Med), 8, and 10 (High). The five factors are market (MKT), value (HML), size (SMB), momentum (UMD), and Pastor-Stambaugh liquidity (PS). The sample period is 1981 to 2014.

	24 months of data to compute β^{LCT}				60 months of data to compute β^{LCT}			
	Excess	Alphas from			Excess	Alphas from		
Portfolio	return	CAPM	4-factor	5-factor	return	CAPM	4-factor	5-factor
A. Mutual fund portfolios (as Panel A of Table 4 of the paper)								
Low	0.75	0.11	0.05	0.06	0.71	0.09	0.02	0.02
	[3.10]	[1.35]	[0.68]	[0.76]	[3.05]	[1.26]	[0.37]	[0.29]
	0.64	0.03	-0.01	0.00	0.63	0.03	-0.02	-0.03
Med	0.56	-0.05	-0.07	-0.07	0.53	-0.09	-0.11	-0.11
	0.50	-0.15	-0.13	-0.12	0.53	-0.12	-0.11	-0.10
High	0.41	-0.29	-0.22	-0.21	0.44	-0.26	-0.18	-0.16
	[1.51]	[-2.68]	[-2.74]	[-2.58]	[1.63]	[-2.54]	[-2.61]	[-2.29]
Low-High	0.33	0.41	0.27	0.27	0.27	0.35	0.21	0.18
	[2.37]	[2.92]	[2.01]	[1.96]	[2.20]	[2.90]	[1.95]	[1.68]
B. Back-tested mutual fund portfolios (as Panel A of Table 5 of the paper)								
Low	0.85	0.24	0.18	0.20	0.79	0.19	0.13	0.13
	[3.60]	[2.62]	[2.11]	[2.30]	[3.45]	[2.32]	[1.73]	[1.73]
	0.72	0.12	0.09	0.10	0.74	0.14	0.09	0.10
Med	0.68	0.09	0.05	0.06	0.63	0.03	0.00	0.02
	0.46	-0.22	-0.18	-0.18	0.41	-0.27	-0.24	-0.24
High	0.30	-0.41	-0.34	-0.34	0.31	-0.40	-0.32	-0.31
	[1.10]	[-3.94]	[-3.78]	[-3.76]	[1.14]	[-3.94]	[-3.78]	[-3.63]
Low-High	0.55	0.65	0.52	0.54	0.48	0.59	0.46	0.45
	[3.58]	[4.37]	[3.44]	[3.53]	[3.44]	[4.34]	[3.35]	[3.26]
C. Stock portfolios (as Panel A of Table 8 of the paper)								
Low	0.82	0.10	0.12	0.13	0.85	0.12	0.15	0.13
	[2.86]	[0.79]	[1.05]	[1.16]	[3.01]	[1.11]	[1.56]	[1.34]
	0.78	0.17	0.14	0.13	0.73	0.12	0.08	0.07
Med	0.67	0.11	0.03	0.03	0.69	0.12	0.06	0.05
	0.58	-0.03	0.00	-0.01	0.63	0.03	0.05	0.05
High	0.30	-0.48	-0.30	-0.28	0.35	-0.46	-0.26	-0.21
	[1.01]	[-4.20]	[-2.86]	[-2.66]	[1.12]	[-3.70]	[-2.61]	[-2.15]
Low-High	0.52	0.58	0.42	0.41	0.50	0.58	0.42	0.35
	[2.89]	[3.24]	[2.33]	[2.28]	[3.22]	[3.77]	[2.68]	[2.24]