

Online Appendix for  
“Left-Tail Momentum: Underreaction to Bad News,  
Costly Arbitrage and Equity Returns”

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**Table I****Short-sale constraints**

This table presents return comparisons between equity deciles formed monthly based on VaR1 between 1962 and 2014. Portfolio 1 is the portfolio of stocks with the lowest value-at-risk and Portfolio 10 is the portfolio of stocks with the highest value-at-risk. The table reports the one-month-ahead five-factor alphas for each decile. The last column shows the differences of monthly abnormal returns between deciles 10 and 1. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). Sample A includes the union set of the 30% of stocks with the largest size and the 30% of the stocks with the highest liquidity in our original sample. Sample B includes the union set of the 20% of stocks with the largest size and the 20% of the stocks with the highest liquidity in our original sample. Sample C includes the union set of the 30% of stocks with the largest size and the 30% of the stocks with the highest liquidity in the full CRSP sample without price screens. Sample D includes the union set of the 20% of stocks with the largest size and the 20% of the stocks with the highest liquidity in the full CRSP sample without price screens. VaR1 is defined in Table 1. Newey-West (1987) adjusted  $t$ -statistics are presented in parentheses.

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Sample A	0.05 (0.53)	0.01 (0.16)	0.13 (2.10)	0.01 (0.09)	-0.05 (-0.77)	0.01 (0.20)	-0.04 (-0.45)	0.01 (0.14)	-0.15 (-1.16)	-0.54 (-3.06)	-0.58 (-2.49)
Sample B	0.07 (0.75)	-0.07 (-0.91)	0.15 (2.22)	0.06 (0.89)	-0.08 (-1.26)	-0.03 (-0.45)	0.02 (0.20)	0.03 (0.24)	-0.12 (-0.99)	-0.41 (-2.20)	-0.48 (-1.95)
Sample C	0.04 (0.54)	0.04 (0.63)	0.09 (1.66)	-0.02 (-0.27)	0.01 (0.12)	-0.01 (-0.08)	0.11 (1.16)	-0.02 (-0.17)	-0.16 (-1.18)	-0.49 (-2.81)	-0.54 (-2.34)
Sample D	0.05 (0.59)	0.02 (0.31)	0.14 (2.25)	-0.02 (-0.30)	-0.04 (-0.57)	0.00 (0.02)	-0.01 (-0.09)	0.14 (1.31)	-0.10 (-0.78)	-0.46 (-2.52)	-0.52 (-2.12)

**Table II****Bivariate portfolio analysis with independent sorts**

This table presents results from the value-weighted bivariate portfolios based on independent double sorts of various firm-specific attributes and VaR1 between 1962 and 2014. For the independent sorts, all stocks are grouped into decile portfolios based on independent ascending sorts of both a firm-specific attribute and VaR1 each month. The intersections of each of the decile groups are used to form the portfolios. The table reports one-month-ahead five-factor alphas associated with each decile. The last column shows the differences of monthly alphas between VaR1 deciles 10 and 1 for each firm-specific attribute. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). VaR1 and firm-specific attributes are defined in Table 1. Newey-West (1987) adjusted  $t$ -statistics are presented in parentheses.

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Beta	0.17 (1.00)	0.15 (1.79)	0.08 (1.04)	0.04 (0.53)	-0.06 (-0.76)	-0.03 (-0.37)	-0.05 (-0.76)	-0.25 (-3.00)	-0.25 (-3.13)	-0.66 (-5.41)	-0.96 (-3.75)
Size	0.29 (3.55)	0.29 (3.92)	0.25 (3.49)	0.24 (3.77)	0.24 (3.89)	0.14 (2.18)	0.11 (1.69)	-0.10 (-1.38)	-0.22 (-2.68)	-0.65 (-5.72)	-0.95 (-5.44)
BM	0.14 (1.64)	0.16 (2.38)	0.04 (0.57)	-0.02 (-0.23)	0.03 (0.45)	-0.02 (-0.27)	0.05 (0.51)	-0.15 (-1.53)	-0.43 (-4.04)	-0.64 (-4.74)	-0.82 (-4.29)
MOM	0.27 (2.33)	0.16 (2.60)	-0.02 (-0.27)	0.02 (0.38)	-0.08 (-1.05)	-0.07 (-0.85)	-0.05 (-0.50)	-0.28 (-2.71)	-0.35 (-2.97)	-0.73 (-4.70)	-0.95 (-3.82)
STR	0.08 (0.82)	0.13 (1.96)	0.05 (0.82)	0.03 (0.51)	0.04 (0.54)	-0.04 (-0.50)	-0.04 (-0.42)	-0.21 (-2.07)	-0.34 (-3.01)	-0.84 (-5.92)	-0.87 (-3.58)
Illiq	0.14 (1.61)	0.15 (2.19)	0.11 (1.73)	0.11 (1.75)	0.06 (0.87)	0.01 (0.16)	-0.03 (-0.49)	-0.23 (-3.51)	-0.36 (-4.59)	-0.81 (-7.77)	-0.94 (-5.49)
Coskew	0.08 (0.82)	0.06 (1.09)	-0.02 (-0.27)	-0.03 (-0.58)	-0.01 (-0.11)	-0.05 (-0.68)	-0.01 (-0.13)	-0.17 (-1.76)	-0.35 (-2.83)	-0.71 (-5.71)	-0.89 (-4.15)
Betadown	0.31 (0.99)	-0.08 (-0.87)	-0.02 (-0.28)	-0.04 (-0.59)	-0.07 (-0.90)	-0.08 (-1.03)	-0.06 (-0.78)	-0.29 (-3.66)	-0.38 (-4.36)	-0.76 (-5.73)	-1.03 (-2.64)
IVOL	0.21 (1.66)	0.18 (1.55)	-0.02 (-0.19)	-0.07 (-0.89)	-0.05 (-0.59)	-0.14 (-1.94)	-0.02 (-0.24)	-0.16 (-1.77)	-0.38 (-4.02)	-0.53 (-3.73)	-0.59 (-2.13)
MAX	0.12 (1.21)	0.07 (0.90)	0.02 (0.27)	0.02 (0.36)	-0.02 (-0.25)	-0.04 (-0.61)	0.04 (0.50)	-0.18 (-1.88)	-0.08 (-0.71)	-0.34 (-2.40)	-0.52 (-2.27)
VOLDU	0.07 (0.86)	0.12 (1.75)	0.11 (1.62)	0.03 (0.43)	0.00 (0.00)	-0.02 (-0.21)	-0.01 (-0.16)	-0.25 (-3.24)	-0.35 (-3.87)	-0.72 (-6.66)	-0.79 (-5.29)
GKM	0.04 (0.44)	0.12 (1.55)	-0.13 (-1.84)	-0.16 (-1.95)	-0.14 (-1.59)	-0.15 (-1.46)	-0.01 (-0.07)	-0.18 (-1.54)	-0.45 (-3.32)	-0.74 (-4.61)	-0.77 (-3.70)

**Table III****Bivariate portfolio analysis for trading volumes**

This table presents results from the value-weighted bivariate portfolios based on dependent and independent double sorts of VOLDU or GKM and VaR1 between 1962 and 2014. For the dependent sorts, first, decile (tercile) portfolios are formed every month based on VOLDU (GKM). Next, additional decile portfolios are formed based on VaR1 within each VOLDU or GKM group. Portfolio 1 is the combined portfolio of stocks with the lowest value-at-risk in each VOLDU or GKM group. Portfolio 10 is the combined portfolio of stocks with the highest value-at-risk in each VOLDU or GKM group. For the independent sorts, all stocks are grouped into decile (tercile) portfolios based on independent ascending sorts of both VOLDU (GKM) and VaR1 each month. The intersections of all sorted groups are used to form the portfolios. Panels A and C report results for stocks listed in NYSE. Panels B and D report results for stocks listed in NASDAQ and AMEX. Results for dependent sorts are presented in Panels A and B whereas results for independent sorts are presented in Panels C and D. The table reports one-month-ahead five-factor alphas associated with each decile. The last column shows the differences of monthly alphas between VaR1 deciles 10 and 1 for each firm-specific attribute. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). VaR1, VOLDU and GKM are defined in Table 1. Newey-West (1987) adjusted  $t$ -statistics are presented in parentheses.

*Panel A. NYSE stocks & Dependent sorts*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
VOLDU	0.07 (0.78)	0.08 (1.22)	0.14 (2.08)	0.08 (1.25)	0.05 (0.70)	-0.02 (-0.32)	-0.18 (-2.15)	-0.08 (-0.84)	-0.31 (-3.27)	-0.45 (-4.47)	-0.52 (-3.66)
GKM	0.05 (0.44)	0.08 (1.02)	-0.05 (-0.73)	0.01 (0.08)	-0.20 (-1.74)	-0.17 (-1.55)	-0.29 (-2.60)	-0.17 (-1.18)	-0.28 (-1.87)	-0.61 (-3.42)	-0.66 (-2.77)

*Panel B. NASDAQ/AMEX stocks & Dependent sorts*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
VOLDU	0.26 (2.74)	0.25 (2.71)	0.31 (3.49)	0.15 (1.76)	0.27 (3.04)	0.10 (1.03)	-0.01 (-0.07)	-0.19 (-1.89)	-0.26 (-2.59)	-0.72 (-6.33)	-0.98 (-6.18)
GKM	0.04 (0.39)	0.18 (1.42)	0.26 (2.13)	0.31 (2.12)	0.28 (1.92)	0.06 (0.44)	-0.14 (-0.97)	-0.35 (-1.82)	-0.25 (-1.45)	-0.72 (-3.00)	-0.76 (-2.67)

*Panel C. NYSE stocks & Independent sorts*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
VOLDU	0.03 (0.34)	0.11 (1.57)	0.10 (1.57)	0.07 (0.95)	0.11 (1.65)	-0.04 (-0.56)	-0.10 (-1.19)	-0.17 (-1.88)	-0.25 (-2.61)	-0.51 (-4.77)	-0.60 (-3.99)
GKM	0.05 (0.46)	0.10 (1.10)	0.12 (1.35)	-0.11 (-1.09)	-0.06 (-0.57)	-0.13 (-1.16)	-0.33 (-2.81)	-0.23 (-1.79)	-0.32 (-2.90)	-0.52 (-3.11)	-0.60 (-2.72)

*Panel D. NASDAQ/AMEX stocks & Independent sorts*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
VOLDU	0.24 (1.85)	0.14 (1.21)	0.21 (2.00)	0.23 (2.32)	0.23 (2.38)	0.10 (1.12)	-0.11 (-1.11)	-0.04 (-0.35)	-0.43 (-3.23)	-0.79 (-5.47)	-1.06 (-5.06)
GKM	0.29 (2.09)	0.11 (0.83)	0.02 (0.12)	0.46 (3.19)	0.25 (2.02)	0.45 (2.94)	-0.04 (-0.25)	-0.11 (-0.73)	-0.53 (-2.89)	-0.70 (-3.32)	-1.07 (-4.02)

**Table IV**

## Firm-level cross-sectional regressions with institutional ownership interaction

This table presents results from the cross-sectional regressions of future equity returns on VaR1 and various control variables between 1962 and 2014. Regressions are estimated for one-month-ahead returns using the ordinary least squares (OLS) methodology. Reported coefficients are time-series averages from monthly Fama-MacBeth (1973) regressions and the associated *t*-statistics are reported using the Newey-West (1987) procedure. Average *R*-squared statistics for each regression are presented in the last row. VaR1 and firm-specific characteristics are defined in Table 1. OINST denotes the fraction of total shares outstanding that are owned by institutional investors as of the end of the last fiscal quarter end or prior to month *t* orthogonalized by the logarithm of market value of equity (SIZE). VaR1×OINST denotes the interaction term between this variable and value-at-risk.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
VaR1	-0.1061 (-3.30)	-0.0936 (-3.86)	-0.1222 (-5.57)	-0.1164 (-5.95)	-0.0940 (-5.07)	-0.1056 (-5.50)	-0.1052 (-5.28)	-0.1049 (-5.45)	-0.1039 (-5.35)	-0.0577 (-3.30)	-0.0562 (-3.26)	-0.0590 (-3.37)	-0.0562 (-3.18)
OINST	-0.0038 (-1.20)	-0.0034 (-1.19)	-0.0043 (-1.47)	-0.0050 (-1.67)	-0.0066 (-2.20)	-0.0057 (-1.84)	-0.0055 (-1.75)	-0.0054 (-1.72)	-0.0055 (-1.75)	-0.0055 (-1.74)	-0.0055 (-1.75)	-0.0052 (-1.66)	-0.0058 (-1.81)
VaR1×OINST	0.1063 (1.98)	0.0962 (1.91)	0.1030 (2.02)	0.1062 (2.02)	0.1545 (3.02)	0.1330 (2.56)	0.1336 (2.55)	0.1292 (2.48)	0.1293 (2.49)	0.1271 (2.44)	0.1254 (2.44)	0.1194 (2.36)	0.1273 (2.50)
Beta		-0.0002 (-0.10)	0.0015 (0.84)	0.0017 (0.91)	0.0000 (0.01)	0.0004 (0.20)	0.0002 (0.10)	0.0003 (0.14)	0.0024 (1.05)	0.0025 (1.10)	0.0028 (1.30)	0.0027 (1.23)	0.0028 (1.27)
Size			-0.0009 (-2.92)	-0.0009 (-2.86)	-0.0009 (-2.83)	-0.0008 (-2.53)	-0.0009 (-2.79)	-0.0009 (-2.85)	-0.0009 (-2.72)	-0.0011 (-3.31)	-0.0011 (-3.47)	-0.0012 (-3.64)	-0.0013 (-3.96)
BM				0.0004 (1.25)	0.0005 (1.63)	0.0006 (1.70)	0.0006 (1.92)	0.0006 (1.85)	0.0006 (1.87)	0.0005 (1.68)	0.0005 (1.66)	0.0005 (1.57)	0.0003 (1.02)
MOM					0.0061 (3.39)	0.0059 (3.01)	0.0058 (2.94)	0.0058 (2.93)	0.0058 (2.98)	0.0059 (3.01)	0.0060 (3.09)	0.0062 (3.20)	0.0062 (3.20)
STR						-0.0282 (-6.43)	-0.0282 (-6.41)	-0.0283 (-6.50)	-0.0284 (-6.52)	-0.0264 (-6.08)	-0.0248 (-4.46)	-0.0260 (-4.58)	-0.0272 (-4.66)
Illiq							-0.0002 (-2.01)	-0.0003 (-2.07)	-0.0003 (-2.10)	-0.0002 (-1.47)	-0.0002 (-1.36)	-0.0002 (-1.50)	0.0000 (-0.28)
Coskew								0.0000 (0.06)	-0.0001 (-1.02)	-0.0001 (-0.95)	0.0000 (-0.69)	0.0000 (-0.66)	0.0000 (-0.58)
Betadown									0.0023 (-1.74)	0.0022 (-1.68)	-0.0017 (-1.36)	-0.0015 (-1.23)	-0.0015 (-1.21)
IVOL										-0.1761 (-6.39)	-0.1742 (-6.39)	-0.1941 (-6.39)	-0.2184 (-6.39)
MAX											-0.0207 (-4.04)	-0.0036 (-0.07)	-0.0085 (-0.17)
VOLDU												0.0001 (1.60)	0.0001 (1.34)
GKMHI													0.0032 (6.20)
GKMLO													-0.0045 (-8.45)
Intercept	0.0139 (6.42)	0.0132 (6.08)	0.0186 (6.12)	0.0180 (6.24)	0.0161 (5.88)	0.0164 (5.78)	0.0174 (5.95)	0.0174 (5.93)	0.0170 (5.81)	0.0189 (6.35)	0.0193 (6.53)	0.0199 (6.61)	0.0214 (6.94)

**Table V****Long-term returns for institutional ownership quintiles**

This table presents future return differences between extreme value-at-risk quintiles for institutional holdings quintiles between 1962 and 2014. Stocks are independently sorted with respect to VaR1 and institutional holdings into quintiles. Then, the future value-weighted returns are calculated for the 25 intersection portfolios up to seven months ahead. The return differences between the highest and lowest VaR1 quintiles and corresponding five-factor alphas are calculated for each institutional holdings quintile up to a horizon of seven months. Panels A and B present the excess return and five-factor alpha differences between extreme VaR1 quintiles within each institutional holdings quintile. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). *INST* denotes the fraction of total shares outstanding that are owned by institutional investors as of the end of the last fiscal quarter end or prior to month  $t$ . Newey-West (1987) adjusted  $t$ -statistics are presented in parentheses.

*Panel A. Excess returns*

	INST1	INST2	INST3	INST4	INST5
t+2	-1.13 (-2.85)	-1.53 (-3.06)	-0.89 (-1.79)	-0.51 (-1.20)	-0.59 (-1.69)
t+3	-1.30 (-3.51)	-1.45 (-3.28)	-1.07 (-2.11)	-0.31 (-0.76)	-0.47 (-1.39)
t+4	-1.20 (-3.19)	-1.39 (-3.07)	-0.60 (-1.19)	-0.48 (-1.11)	-0.56 (-1.56)
t+5	-1.04 (-2.50)	-1.24 (-2.99)	-0.53 (-1.18)	-0.60 (-1.51)	-0.44 (-1.30)
t+6	-0.76 (-1.91)	-1.15 (-2.88)	-0.87 (-1.95)	-0.56 (-1.44)	-0.49 (-1.44)
t+7	-0.65 (-1.80)	-0.89 (-2.26)	-0.83 (-1.77)	-0.53 (-1.43)	-0.44 (-1.33)

*Panel B. Alphas*

	INST1	INST2	INST3	INST4	INST5
t+2	-0.62 (-2.60)	-1.26 (-3.44)	-0.41 (-1.28)	-0.09 (-0.36)	-0.35 (-1.47)
t+3	-0.90 (-2.61)	-1.17 (-3.24)	-0.68 (-2.02)	0.13 (0.48)	-0.19 (-0.77)
t+4	-0.87 (-2.48)	-1.15 (-3.57)	-0.08 (-0.22)	0.04 (0.15)	-0.26 (-1.04)
t+5	-0.76 (-2.06)	-0.97 (-3.01)	0.00 (0.01)	-0.18 (-0.74)	-0.19 (-0.76)
t+6	-0.54 (-1.47)	-0.87 (-2.97)	-0.31 (-0.91)	-0.12 (-0.51)	-0.19 (-0.74)
t+7	-0.44 (-1.34)	-0.63 (-1.79)	-0.26 (-0.74)	-0.08 (-0.38)	-0.15 (-0.70)

**Table VI****Alternative proxies of investor attention**

This table presents results from the value-weighted portfolios based on bivariate sorts of various firm-specific attributes and VaR1 between 1962 and 2014. First, tercile portfolios are formed every month based on a firm-specific attribute. Next, additional quintile portfolios are formed based on VaR1 within each firm-specific attribute tercile. The table reports one-month-ahead five-factor alphas for each quintile. The last row in each panel shows the differences of monthly alphas between VaR1 quintiles 5 and 1 for each firm-specific attribute tercile. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). Panels A and B present results for firm size and illiquidity, respectively. Newey-West (1987) adjusted *t*-statistics are presented in parentheses.

*Panel A. Firm size*

	SIZE1	SIZE2	SIZE3
Port1	0.47 (4.22)	0.23 (3.04)	0.03 (0.39)
Port2	0.38 (3.62)	0.17 (2.31)	0.08 (1.74)
Port3	0.19 (1.67)	0.12 (1.71)	-0.03 (-0.50)
Port4	-0.07 (-0.69)	-0.07 (-1.04)	0.00 (-0.01)
Port5	-0.46 (-4.36)	-0.58 (-5.57)	-0.28 (-2.11)
High-Low	-0.93 (-6.55)	-0.81 (-5.23)	-0.31 (-1.61)

*Panel B. Illiquidity*

	ILLIQ1	ILLIQ2	ILLIQ3
Port1	0.04 (0.59)	0.10 (1.38)	0.16 (1.73)
Port2	0.04 (0.90)	0.09 (1.23)	0.14 (1.34)
Port3	-0.01 (-0.25)	0.05 (0.68)	0.01 (0.11)
Port4	-0.04 (-0.41)	-0.12 (-1.71)	-0.21 (-1.88)
Port5	-0.36 (-2.51)	-0.59 (-5.52)	-0.66 (-5.95)
High-Low	-0.40 (-2.03)	-0.69 (-4.61)	-0.83 (-6.57)

**Table VII****Costly arbitrage with alternative arbitrage index**

This table presents results from the value-weighted bivariate portfolios based on independent double sorts of the arbitrage index and VaR1 between 1962 and 2014. To calculate the arbitrage index, stocks are sorted each month into deciles according to their idiosyncratic volatility, illiquidity, level of institutional holdings, analyst coverage, and firm age. Decile ranks are attributed to each stock increasing in their idiosyncratic volatility and illiquidity, and decreasing in their level of institutional holdings, analyst coverage, and firm age. The decile ranks for each attribute are added together and a monthly arbitrage index (AI) that has a maximum value of 50 is constructed. The last column shows the differences of monthly five-factor alphas between arbitrage index quintiles within each value-at-risk quintile. The last row shows the differences of five-factor alphas between value-at-risk quintiles within each arbitrage index quintile. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). Newey-West (1987) adjusted *t*-statistics are presented in parentheses.

	AI1	AI2	AI3	AI4	AI5	Alpha
Port1	0.09 (1.14)	0.12 (1.19)	0.29 (2.16)	0.20 (1.44)	0.38 (1.69)	0.28 (1.33)
Port2	-0.05 (-0.71)	0.03 (0.38)	0.00 (-0.04)	0.15 (1.08)	0.22 (1.41)	0.26 (1.61)
Port3	-0.14 (-1.04)	-0.08 (-0.59)	-0.07 (-0.56)	-0.05 (-0.42)	0.25 (1.75)	0.33 (1.74)
Port4	0.24 (1.16)	-0.21 (-1.27)	0.10 (0.74)	-0.24 (-1.77)	-0.33 (-2.31)	-0.58 (-2.11)
Port5	-0.13 (-0.49)	-0.45 (-1.74)	-0.62 (-2.91)	-0.75 (-3.18)	-0.82 (-4.83)	-0.73 (-2.49)
Alpha	-0.25 (-0.86)	-0.57 (-1.79)	-0.91 (-3.24)	-1.02 (-3.34)	-1.26 (-4.02)	



**Table VIII****Alternative factor models**

This table presents results from the time-series regressions of the monthly value-weighted excess return differences between extreme VaR1 deciles on various asset pricing factors between 1962 and 2014. Portfolio 1 (Portfolio 10) is the portfolio of stocks with the lowest (highest) value-at-risk. The dependent variable in each regression is the excess return of Portfolio 10 minus the excess return of Portfolio 1 calculated monthly. In Panel A, CAPM includes the market factor, three-factor model adds the size and value factors of Fama and French (1993) and four-factor model adds the momentum factor of Carhart (1997). In Panel B, the baseline FFCPS model includes the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). In Panel C, the baseline FF5 model includes the market, size, value, profitability, and investment factors of Fama and French (2015). In Panel D, the baseline  $Q$ -model includes the market, size, investment, and profitability factors of Hou, Xue and Zhang (2015). The results for these baseline models are presented in the first column of each panel. The second column of each panel augments the baseline models by the betting against beta (BAB) factor of Frazzini and Pedersen (2014). The third column of each panel augments the baseline models by a factor that captures lottery demand (FMAX). The fourth column of each panel augments the baseline models by a factor that captures idiosyncratic volatility (FIVOL). FMAX (FIVOL) factor is calculated based on 2x3 independent sorts on firm size and MAX (IVOL) using NYSE breakpoints. The table presents the intercepts, coefficient estimates and the associated Newey-West (1987) adjusted  $t$ -statistics.  $R$ -squared statistics for each regression are presented in the last row.

*Panel A. CAPM, Three-factor model and Four-factor model*

	(1)	(2)	(3)
Constant	-0.0090 (-2.90)	-0.0118 (-5.79)	-0.0093 (-4.67)
MKT	0.2492 (3.83)	0.6689 (7.21)	0.6181 (7.75)
SMB		1.2534 (15.48)	1.2565 (13.54)
HML		-0.6491 (-4.55)	-0.7369 (-5.67)
WML			-0.2822 (-3.40)
$R^2$	0.3726	0.6841	0.7061

**Table VIII (continued)***Panel B. Extending the FFCPS model with BAB, MAX, and IVOL factors*

	(1)	(2)	(3)	(4)
Constant	-0.0094 (-4.42)	-0.0065 (-2.76)	-0.0041 (-2.78)	-0.0042 (-2.93)
MKT	0.6208 (7.71)	0.6579 (10.67)	0.1246 (2.60)	0.0744 (1.48)
SMB	1.2077 (12.12)	1.2163 (14.27)	0.6109 (8.48)	0.4116 (5.07)
HML	-0.7539 (-5.87)	-0.4508 (-4.60)	-0.1997 (-3.26)	-0.1358 (-2.30)
WML	-0.3088 (-3.60)	-0.1939 (-3.08)	-0.2019 (-3.91)	-0.1708 (-3.42)
PS	-0.1057 (-1.55)	-0.0771 (-1.33)	-0.0487 (-1.09)	-0.1042 (-2.04)
BAB		-0.5707 (-4.82)		
FMAX			1.3102 (16.10)	
FIVOL				1.3976 (17.87)
$R^2$	0.7124	0.7573	0.8506	0.8557

*Panel C. Extending the FF5 model with BAB, MAX, and IVOL factors*

	(1)	(2)	(3)	(4)
Constant	-0.0063 (-3.75)	-0.0042 (-2.35)	-0.0038 (-2.74)	-0.0044 (-3.19)
MKT	0.5356 (7.79)	0.5769 (11.44)	0.1401 (2.80)	0.0943 (1.80)
SMB	0.9821 (10.09)	1.0342 (10.94)	0.5751 (7.08)	0.3867 (4.45)
HML	-0.4006 (-3.12)	-0.2640 (-2.44)	-0.0861 (-1.11)	-0.0731 (-0.81)
RMW	-1.0575 (-7.47)	-0.8313 (-6.28)	-0.3718 (-3.11)	-0.2875 (-2.70)
CMA	-0.8722 (-4.69)	-0.6783 (-4.75)	-0.3670 (-3.00)	-0.2164 (-1.73)
BAB		-0.4977 (-4.95)		
FMAX			1.2207 (15.63)	
FIVOL				1.3333 (15.70)
$R^2$	0.7494	0.7820	0.8430	0.8483

**Table VIII (continued)***Panel D. Extending the Q-factor model with BAB, MAX, and IVOL factors*

	(1)	(2)	(3)	(4)
Constant	-0.0057 (-2.57)	-0.0039 (-1.82)	-0.0038 (-2.41)	-0.0049 (-3.07)
MKT	0.6565 (8.52)	0.6811 (12.01)	0.1386 (2.63)	0.0950 (1.69)
ME	0.8753 (6.81)	0.9597 (9.17)	0.4685 (5.81)	0.2874 (3.20)
IA	-1.3338 (-7.66)	-0.9462 (-6.52)	-0.4695 (-4.49)	-0.2440 (-2.67)
ROE	-0.7249 (-4.38)	-0.5002 (-3.83)	-0.2729 (-3.03)	-0.2066 (-2.12)
BAB		-0.5875 (-4.74)		
FMAX			1.3289 (14.25)	
FIVOL				1.4427 (15.97)
$R^2$	0.6894	0.7401	0.8433	0.8478

**Table IX****Left-tail momentum factor**

This table presents results from the time-series regressions of the monthly left-tail momentum factor on the contemporaneous values of asset pricing factors from alternative factor models between 1962 and 2014. In June of each year  $t$ , all stocks in the sample are ranked based on their market value of equity and split into two groups. Next, all stocks are split in three value-at-risk groups based on the breakpoints for the bottom 30%, middle 40% and top 30% each month. Six portfolios are constructed from the intersections of two size and three value-at-risk groups every month and the monthly value-weighted returns on the six portfolios are calculated. The value-at-risk based factor is calculated as the difference between the simple average of the returns on the two high value-at-risk portfolios and the simple average of the returns on the two low value-at-risk portfolios. In columns (1-3), the size and value-at-risk breakpoints are based on only NYSE stocks whereas in columns (4-6), the size and value-at-risk breakpoints are based on all stocks in our sample. The factor model in columns 1 and 4 include the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). The factor model in columns 2 and 5 include the market, size, value, profitability and investment factors of Fama and French (2015). The factor model in columns 3 and 6 include the market, size, investment and profitability factors of Hou, Xue and Zhang (2015). The table presents the intercepts, coefficient estimates and the associated Newey-West (1987) adjusted  $t$ -statistics.  $R$ -squared statistics for each regression are presented in the last row.

	NYSE breakpoints			Sample breakpoints		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.0053 (-4.56)	-0.0034 (-3.49)	-0.0025 (-2.01)	-0.0095 (-7.41)	-0.0066 (-6.31)	-0.0055 (-3.77)
MKT	0.4942 (12.38)	0.4251 (12.58)	0.4677 (12.55)	0.4975 (10.63)	0.4092 (10.67)	0.4607 (10.49)
SMB	0.6142 (10.35)	0.5113 (12.42)		0.8337 (10.91)	0.6453 (12.55)	
HML	-0.4822 (-12.79)	-0.2807 (-4.36)		-0.5809 (-13.29)	-0.3466 (-5.56)	
WML	-0.1713 (-3.13)			-0.2210 (-3.08)		
PS	0.0381 (1.19)			-0.0052 (-0.15)		
RMW		-0.5549 (-9.53)			-0.8683 (-11.01)	
CMA		-0.4766 (-4.80)			-0.5651 (-4.91)	
ME			0.4465 (7.16)			0.5875 (7.48)
IA			-0.8290 (-8.32)			-1.0008 (-7.10)
ROE			-0.4142 (-4.45)			-0.6328 (-5.56)
$R^2$	0.7347	0.7698	0.7406	0.7399	0.8098	0.7562

**Table X****Alternative stock samples and breakpoints**

This table presents return comparisons between equity deciles formed based on VaR1 between 1962 and 2014. Portfolio 1 (Portfolio 10) is the portfolio of stocks with the lowest (highest) value-at-risk. The table reports five-factor alphas associated with the value-weighted returns for each decile. The last row shows the differences in alphas between deciles 10 and 1. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). For samples (1) and (2), the full CRSP universe is used and decile cut-off points are calculated using either all CRSP stocks or only NYSE-traded stocks, respectively. Sample (3) excludes stocks with an end-of-month price of less than \$5 and decile cut-off points are calculated using only NYSE-traded stocks. Sample (4) excludes stocks whose market capitalization falls in the lowest NYSE size decile each month. Sample (5) excludes stocks whose liquidity falls in the lowest NYSE liquidity decile each month. Sample (6) is the intersection set of samples (3), (4) and (5). For samples (4), (5) and (6), decile points are calculated using the stocks in each respective sample. Newey-West (1987) adjusted *t*-statistics are presented in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Port 1	0.06 (0.93)	0.10 (1.63)	0.13 (2.07)	0.05 (0.63)	0.01 (0.13)	0.01 (0.16)
Port 2	0.09 (1.93)	0.08 (1.30)	0.02 (0.33)	0.09 (1.67)	0.09 (1.71)	0.07 (1.21)
Port 3	-0.03 (-0.59)	-0.01 (-0.12)	0.02 (0.39)	0.06 (1.04)	0.04 (0.71)	0.09 (1.63)
Port 4	0.10 (1.38)	-0.02 (-0.30)	-0.04 (-0.49)	-0.03 (-0.52)	0.05 (0.74)	-0.03 (-0.54)
Port 5	0.03 (0.36)	0.11 (1.24)	0.06 (0.73)	0.04 (0.51)	0.01 (0.10)	0.08 (0.99)
Port 6	-0.03 (-0.27)	-0.09 (-0.94)	-0.09 (-1.14)	0.09 (1.08)	0.08 (0.85)	0.00 (-0.02)
Port 7	-0.25 (-2.12)	-0.27 (-2.94)	-0.22 (-2.36)	-0.02 (-0.18)	-0.01 (-0.07)	-0.01 (-0.10)
Port 8	-0.51 (-3.16)	-0.17 (-1.57)	-0.24 (-2.08)	0.00 (0.02)	-0.07 (-0.59)	-0.03 (-0.21)
Port 9	-0.97 (-4.49)	-0.26 (-1.89)	-0.34 (-3.01)	-0.29 (-2.20)	-0.36 (-2.55)	-0.25 (-1.85)
Port 10	-1.01 (-4.51)	-0.77 (-4.23)	0.67 (-4.21)	-0.66 (-3.18)	-0.68 (-3.63)	-0.70 (-4.51)
High - Low	-1.07 (-4.24)	-0.87 (-4.18)	-0.80 (-4.16)	-0.71 (-3.23)	-0.69 (-2.96)	-0.71 (-3.52)

**Table XI****Orthogonalization with respect to idiosyncratic volatility and other characteristics**

This table presents results from the cross-sectional regressions of future equity returns on orthogonalized VaR1 and various control variables between 1962 and 2014. In regressions 1 to 6 (7 to 12), orthogonalization is done by running a contemporaneous regression of VaR1 on only IVOL (all control variables). Regressions 1 to 3 and 7 to 9 (4 to 6 and 10 to 12) present results estimated using the OLS methodology (the WLS methodology of Asparouhova, Bessembinder, and Kalcheva (2013)). Reported coefficients are time-series averages from monthly Fama-MacBeth (1973) regressions and the associated *t*-statistics are reported using the Newey-West (1987) procedure. Average *R*-squared statistics for each regression are presented in the last row.

	OLS/IVOL			WLS/IVOL			OLS/All variables			WLS/All variables		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VaR1_orth	-0.0414 (-2.01)	-0.0405 (-2.00)	-0.0414 (-2.00)	-0.0627 (-2.98)	-0.0574 (-2.81)	-0.0611 (-2.89)	-0.0415 (-2.00)	-0.0415 (-2.00)	-0.0414 (-2.00)	-0.0619 (-2.92)	-0.0609 (-2.88)	-0.0611 (-2.89)
Beta	0.0019 (1.12)	0.0024 (1.46)	0.0021 (1.23)	0.0017 (1.01)	0.0021 (1.30)	0.0021 (1.26)	0.0012 (0.64)	0.0018 (1.01)	0.0014 (0.80)	0.0006 (0.34)	0.0011 (0.61)	0.0011 (0.65)
Size	-0.0014 (-4.61)	-0.0013 (-4.33)	-0.0014 (-4.72)	-0.0014 (-4.45)	-0.0013 (-4.31)	-0.0014 (-4.56)	-0.0012 (-3.75)	-0.0011 (-3.63)	-0.0012 (-3.88)	-0.0010 (-3.24)	-0.0010 (-3.25)	-0.0011 (-3.41)
BM	0.0014 (2.06)	0.0013 (1.95)	0.0013 (1.92)	0.0014 (2.13)	0.0014 (2.01)	0.0013 (1.98)	0.0014 (1.91)	0.0014 (1.84)	0.0013 (1.81)	0.0015 (2.02)	0.0014 (1.94)	0.0014 (1.90)
MOM	0.0018 (0.76)	0.0019 (0.79)	0.0019 (0.80)	0.0025 (1.05)	0.0025 (1.07)	0.0026 (1.10)	0.0016 (0.67)	0.0017 (0.69)	0.0017 (0.70)	0.0024 (0.99)	0.0025 (1.01)	0.0025 (1.03)
STR	-0.0731 (-7.11)	-0.0619 (-5.73)	-0.0688 (-6.94)	-0.0687 (-6.62)	-0.0598 (-5.53)	-0.0616 (-6.16)	-0.0724 (-6.94)	-0.0623 (-5.73)	-0.0671 (-6.74)	-0.0676 (-6.41)	-0.0600 (-5.51)	-0.0594 (-5.89)
Illiq	-0.0005 (-2.13)	-0.0005 (-2.07)	-0.0005 (-2.03)	-0.0006 (-2.69)	-0.0006 (-2.64)	-0.0006 (-2.55)	-0.0005 (-2.30)	-0.0005 (-2.24)	-0.0005 (-2.20)	-0.0007 (-2.91)	-0.0007 (-2.88)	-0.0006 (-2.75)
Coskew	-0.0001 (-1.18)	0.0000 (-1.01)	0.0000 (-0.98)	0.0000 (-0.93)	0.0000 (-0.61)	0.0000 (-0.88)	0.0000 (-1.00)	0.0000 (-0.86)	0.0000 (-0.82)	0.0000 (-0.79)	0.0000 (-0.54)	0.0000 (-0.75)
Betadown	-0.0013 (-1.36)	-0.0013 (-1.39)	-0.0010 (-1.08)	-0.0011 (-1.17)	-0.0010 (-1.08)	-0.0010 (-1.03)	-0.0013 (-1.37)	-0.0012 (-1.33)	-0.0010 (-1.08)	-0.0013 (-1.29)	-0.0011 (-1.17)	-0.0011 (-1.15)
IVOL	-0.2367 (-5.70)		-0.1571 (-1.86)	-0.1925 (-4.82)		-0.0556 (-0.70)	-0.2142 (-6.36)		-0.1133 (-1.36)	-0.1581 (-4.97)		0.0021 (0.03)
MAX		-0.1848 (-6.02)	-0.0709 (-1.20)		-0.1586 (-5.28)	-0.1209 (-2.13)		-0.1716 (-6.63)	-0.0891 (-1.50)		-0.1361 (-5.46)	-0.1424 (-2.48)
VOLDU	0.0101 (3.79)	0.0100 (3.77)	0.0100 (3.74)	0.0102 (3.82)	0.0100 (3.81)	0.0100 (3.76)	0.0097 (3.84)	0.0095 (3.82)	0.0095 (3.81)	0.0098 (3.87)	0.0096 (3.87)	0.0096 (3.83)
GKMHI	0.0035 (7.16)	0.0034 (6.99)	0.0035 (7.16)	0.0031 (6.01)	0.0030 (5.93)	0.0031 (6.02)	0.0036 (7.25)	0.0035 (7.09)	0.0036 (7.23)	0.0032 (6.16)	0.0031 (6.09)	0.0032 (6.14)
GKMLO	-0.0039 (-8.55)	-0.0040 (-8.47)	-0.0039 (-8.61)	-0.0036 (-7.90)	-0.0037 (-7.86)	-0.0036 (-7.95)	-0.0040 (-8.75)	-0.0041 (-8.69)	-0.0040 (-8.76)	-0.0038 (-8.18)	-0.0038 (-8.15)	-0.0037 (-8.19)
Intercept	0.0179 (6.43)	0.0169 (6.31)	0.0181 (6.53)	0.0174 (6.32)	0.0169 (6.31)	0.0175 (6.43)	0.0179 (6.38)	0.0174 (6.42)	0.0181 (6.53)	0.0172 (6.25)	0.0172 (6.38)	0.0175 (6.43)
Avg. <i>R</i> <sup>2</sup>	0.1028	0.1029	0.1054	0.1040	0.1042	0.1066	0.1028	0.1030	0.1054	0.1039	0.1043	0.1066

**Table XII****Alternative risk measures**

This table presents results from various analyses that utilize alternative risk measures between 1962 and 2014. LPM (UPM) is the downside (upside) variance or the expected value of the squared negative (positive) deviations from the mean return calculated for each stock in each month. CATFIN is a measure of aggregate systemic risk proposed by Allen, Bali and Tang (2012). CATFIN Beta is estimated as the monthly slope coefficients from regressions of monthly individual equity returns on CATFIN over the past 60 months. FLPM, FUPM, and FCATFIN are factors that are calculated based on 2x3 independent sorts on firm size and the corresponding risk measures using NYSE breakpoints. Panel A presents five-factor alphas from the value-weighted bivariate portfolios based on dependent double sorts of alternative risk measures and VaR1. Portfolio 1 is the portfolio of stocks with the lowest value-at-risk and Portfolio 10 is the portfolio of stocks with the highest value-at-risk. The last column of Panel A shows the differences of monthly alphas between deciles 10 and 1. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). Newey-West (1987) adjusted *t*-statistics are presented in parentheses. Panel B presents results from the cross-sectional regressions of one-month-ahead equity returns on VaR1 and various control variables. The first two rows present results estimated using the ordinary least squares (OLS) methodology. The last two rows present results estimated using the weighted least squares (WLS) methodology of Asparouhova, Bessembinder, and Kalcheva (2013). Reported coefficients are time-series averages from monthly Fama-MacBeth (1973) regressions and the associated *t*-statistics are reported using the Newey-West (1987) procedure. Panel C presents results from the time-series regressions of the monthly value-weighted excess return differences between extreme VaR1 deciles on various asset pricing factors. The dependent variable in each regression is the excess return of the decile of stocks with the highest value-at-risk minus the excess return of the decile of stocks with the lowest value-at-risk calculated monthly. The regressions augment the FFCPS, FF5 and *Q*-models explained in Table VIII with the FLPM, FUPM, and FCATFIN factors. The panel presents the intercepts, coefficient estimates and the associated Newey-West (1987) adjusted *t*-statistics. *R*-squared statistics for each regression are presented in the last row.

*Panel A. Bivariate analysis*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
LPM	-0.01 (-0.10)	-0.07 (-1.15)	-0.05 (-0.83)	-0.11 (-1.93)	-0.19 (-2.87)	-0.10 (-1.25)	-0.04 (-0.56)	-0.26 (-2.71)	-0.36 (-4.10)	-0.50 (-4.96)	-0.50 (-3.94)
UPM	0.09 (1.46)	0.0002 (0.42)	-0.04 (-0.68)	-0.06 (-1.00)	-0.21 (-2.84)	-0.14 (-2.13)	-0.31 (-3.69)	-0.27 (-2.97)	-0.34 (-4.25)	-0.48 (-5.42)	-0.58 (-4.89)
CATFIN Beta	0.22 (2.45)	0.09 (1.02)	0.16 (1.97)	0.14 (2.01)	0.03 (0.43)	0.00 (0.02)	-0.09 (-1.08)	-0.18 (-2.01)	-0.14 (-1.07)	-0.53 (-3.73)	-0.75 (-3.67)

*Panel B. Cross-sectional regressions*

VaR1	LPM	UPM	CATFIN		Size	BM	MOM	STR	Illiq	Coskew	Beta down	IVOL	MAX	VOLDU	GKM HI	GKM LO	Int.
-0.0421 (-2.73)	-0.2894 (-6.13)	-0.0341 (-0.94)	-0.0055 (-1.59)	0.0025 (1.36)	-0.0014 (-4.64)	0.0003 (0.98)	0.0064 (4.34)	-0.0397 (-6.85)	-0.0002 (-1.37)	0.0000 (-0.69)	-0.0015 (-1.37)	0.0288 (0.46)	-0.0400 (-0.76)	0.0004 (2.85)	0.0030 (6.37)	-0.0034 (-7.98)	0.0180 (7.25)
-0.0499 (-3.20)	-0.3174 (-6.89)	-6.8944 (0.06)	-0.0055 (-1.60)	0.0025 (1.38)	-0.0014 (-4.55)	0.0004 (1.21)	0.0072 (4.84)	-0.0346 (-6.54)	-0.0003 (-1.85)	0.0000 (-0.28)	-0.0013 (-1.20)	0.0738 (1.24)	-0.0675 (-1.39)	0.0005 (3.01)	0.0026 (5.35)	-0.0032 (-7.07)	0.0177 (6.94)

**Table XII (continued)**

*Panel C. Factor models*

	FFCPS model extended				FF5 model extended				Q-model extended			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	-0.0056 (-3.65)	-0.0047 (-3.14)	-0.0100 (-4.03)	-0.0050 (-3.05)	-0.0056 (-4.17)	-0.0042 (-3.06)	-0.0057 (-2.80)	-0.0046 (-2.91)	-0.0055 (-3.25)	-0.0041 (-2.59)	-0.0049 (-2.04)	-0.0036 (-2.11)
MKT	0.0635 (1.17)	0.0777 (1.50)	0.4061 (3.49)	0.1003 (1.56)	0.0844 (1.53)	0.0871 (1.68)	0.2739 (2.63)	0.0559 (0.81)	0.0720 (1.26)	0.0815 (1.44)	0.4032 (3.34)	0.0625 (0.92)
SMB	0.5655 (8.14)	0.5697 (7.53)	1.0163 (8.03)	0.5380 (7.36)	0.5244 (6.58)	0.5232 (6.38)	0.6629 (6.35)	0.4173 (5.06)				
HML	-0.2407 (-4.16)	-0.2220 (-3.94)	-0.7672 (-6.16)	-0.2236 (-3.22)	-0.1517 (-1.86)	-0.1095 (-1.39)	-0.4436 (-3.61)	-0.1293 (-1.71)				
WML	-0.1857 (-3.48)	-0.1748 (-3.42)	-0.2063 (-2.64)	-0.2008 (-3.26)								
PS	-0.0652 (-1.30)	-0.0561 (-1.23)	-0.0823 (-1.02)	-0.0620 (-1.16)								
RMW					-0.3696 (-3.00)	-0.3847 (-3.28)	-1.0441 (-9.67)	-0.4420 (-3.69)				
CMA					-0.2845 (-2.30)	-0.3589 (-3.21)	-0.6514 (-4.00)	-0.3170 (-2.41)				
ME									0.3938 (4.75)	0.4247 (5.18)	0.7568 (5.14)	0.3972 (5.06)
IA									-0.4221 (-3.94)	-0.5158 (-5.26)	-1.3016 (-8.27)	-0.5088 (-4.54)
ROE									-0.2468 (-2.55)	-0.2619 (-2.91)	-0.7061 (-4.76)	-0.2910 (-3.30)
FLPM	1.2660 (17.59)			0.5645 (3.98)	1.1930 (16.52)			0.4004 (2.62)	1.3157 (15.77)			0.3860 (2.69)
FUPM		1.2649 (16.04)		0.7611 (4.45)		1.1889 (15.79)		0.7265 (4.19)		1.2913 (14.72)		0.8885 (4.93)
FCATFIN			-0.5637 (-5.28)	0.0181 (0.21)			-0.6326 (-5.82)	-0.1880 (-2.32)			-0.5156 (-3.37)	-0.0817 (-0.91)
R <sup>2</sup>	0.8464	0.8494	0.7519	0.8584	0.8421	0.8477	0.7979	0.8557	0.8343	0.8441	0.7458	0.8539



**Table XIII****Right-tail of the return distribution**

This table presents results from various analyses that utilize VaR99 between 1962 and 2014. VaR99 corresponds to the 99<sup>th</sup> percentile of daily returns in the past year. Panel A presents return comparisons between equity deciles formed monthly based on VaR99. Portfolio 1(10) is the portfolio of stocks with the lowest (highest) value of VaR99. The panel reports the one-month-ahead excess returns and various alphas for each decile. The last column shows the differences of monthly excess returns and alphas between deciles 10 and 1. Alphas are calculated using the FFCPS, FF5 and  $Q$ -models explained in Table VIII. Panels B and C present results from the value-weighted bivariate portfolios based on dependent double sorts of VaR1 and VaR99. In Panel B, Portfolio 1 (10) is the combined portfolio of stocks with the lowest (highest) value of VaR1 in each VaR99 decile. In Panel C, Portfolio 1 (10) is the combined portfolio of stocks with the lowest (highest) value of VaR99 in each VaR1 decile. The panel reports the one-month-ahead excess returns and various alphas for each decile. The last column shows the differences of monthly excess returns and various alphas between deciles 10 and 1. Panel D presents results from the time-series regressions of the monthly value-weighted excess return differences between extreme VaR1 or VaR99 deciles on various asset pricing factors. The dependent variable in regressions 1 to 3 is the excess return of the decile of stocks with the highest value of VaR1 minus the excess return of the decile of stocks with the lowest value of VaR1 calculated monthly. The dependent variable in regressions 4 to 6 is the excess return of the decile of stocks with the highest value of VaR99 minus the excess return of the decile of stocks with the lowest value of VaR99 calculated monthly. The regressions augment the FFCPS, FF5 and  $Q$ -models with the FVaR1 or FVaR99 factors. FVaR1 (FVaR99) is a factor that is calculated based on 2x3 independent sorts on firm size and VaR1 (VaR99) using NYSE breakpoints. The panel presents the intercepts, coefficient estimates and the associated Newey-West (1987) adjusted  $t$ -statistics.  $R$ -squared statistics for each regression are presented in the last row.

*Panel A. Univariate analysis*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
VaR99	0.0304	0.0418	0.0495	0.0568	0.0643	0.0726	0.0821	0.0937	0.1095	0.1482	
Excess Return	0.49	0.53	0.63	0.48	0.52	0.66	0.54	0.56	0.35	-0.05	-0.54
	(3.41)	(3.05)	(3.28)	(2.30)	(2.11)	(2.68)	(1.88)	(1.76)	(1.01)	(-0.12)	(-1.60)
FFCPS Alpha	0.08	0.03	0.09	-0.15	-0.17	-0.03	-0.13	-0.10	-0.33	-0.65	-0.73
	(1.18)	(0.55)	(1.61)	(-2.40)	(-2.05)	(-0.40)	(-1.46)	(-0.76)	(-2.64)	(-3.29)	(-3.10)
FF5 Alpha	-0.01	-0.10	0.01	-0.20	-0.14	0.05	-0.01	0.05	-0.07	-0.24	-0.23
	(-0.15)	(-2.00)	(0.10)	(-2.75)	(-1.89)	(0.63)	(-0.15)	(0.44)	(-0.62)	(-1.58)	(-1.30)
$Q$ -Alpha	-0.02	-0.10	0.02	-0.28	-0.18	0.01	-0.01	0.07	0.01	-0.14	-0.12
	(-0.33)	(-1.24)	(0.32)	(-3.25)	(-1.98)	(0.12)	(-0.09)	(0.44)	(0.04)	(-0.60)	(-0.43)

*Panel B. Bivariate analysis across VaR1 deciles*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Excess Return	0.66	0.61	0.69	0.55	0.59	0.51	0.52	0.34	0.0031	0.18	-0.49
	(3.58)	(2.80)	(3.04)	(2.31)	(2.43)	(2.05)	(2.01)	(1.25)	(1.12)	(0.64)	(-3.30)
FFCPS Alpha	0.08	0.01	0.05	-0.11	-0.08	-0.12	-0.13	-0.33	-0.33	-0.42	-0.50
	(1.18)	(0.16)	(0.89)	(-1.56)	(-1.20)	(-1.58)	(-1.64)	(-4.31)	(-4.19)	(-4.41)	(-4.24)
FF5 Alpha	0.07	0.03	0.11	-0.03	-0.01	-0.05	-0.07	-0.0026	-0.33	-0.49	-0.56
	(1.07)	(0.41)	(1.82)	(-0.56)	(-0.16)	(-0.80)	(-0.93)	(-3.40)	(-4.28)	(-5.25)	(-4.47)
$Q$ -Alpha	0.08	0.02	0.08	-0.01	-0.01	-0.04	-0.08	-0.0026	-0.28	-0.37	-0.45
	(1.06)	(0.29)	(1.03)	(-0.20)	(-0.16)	(-0.46)	(-1.01)	(-2.90)	(-3.05)	(-3.21)	(-3.00)

Panel C. Bivariate analysis across VaR99 deciles

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Excess Return	0.52 (2.65)	0.46 (2.05)	0.52 (2.17)	0.46 (1.94)	0.46 (1.83)	0.54 (2.18)	0.50 (1.96)	0.47 (1.81)	0.03 (2.36)	0.44 (1.65)	-0.07 (-0.49)
FFCPS Alpha	0.05 (0.60)	-0.15 (-2.18)	-0.13 (-1.99)	-0.15 (-2.32)	-0.20 (-3.00)	-0.12 (-1.90)	-0.19 (-2.84)	-0.19 (-2.27)	0.00 (0.02)	-0.21 (-2.22)	-0.26 (-2.01)
FF5 Alpha	-0.12 (-1.97)	-0.20 (-2.78)	-0.13 (-2.08)	-0.15 (-2.56)	-0.16 (-2.62)	-0.09 (-1.38)	-0.07 (-1.15)	-0.12 (-1.61)	0.11 (1.50)	-0.07 (-0.70)	0.05 (0.43)
Q-Alpha	-0.01 (-0.17)	-0.18 (-1.81)	-0.16 (-2.24)	-0.15 (-2.16)	-0.19 (-2.87)	-0.09 (-1.16)	-0.09 (-1.07)	-0.09 (-0.96)	0.16 (1.50)	-0.04 (-0.31)	-0.03 (-0.15)

Panel D. Factor analysis

	Dependent Variable: VaR1			Dependent Variable: VaR99		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.0046 (-3.30)	-0.0046 (-3.47)	-0.0043 (-2.85)	-0.0030 (-1.85)	-0.0007 (-0.46)	-0.0001 (-0.03)
MKT	-0.0062 (-0.12)	0.0299 (0.57)	0.0325 (0.60)	-0.0980 (-1.92)	-0.0363 (-0.68)	-0.1019 (-1.74)
SMB	0.3406 (4.08)	0.2943 (3.69)		0.5004 (4.91)	0.4422 (5.58)	
HML	-0.1847 (-3.34)	-0.0759 (-0.92)		-0.2099 (-2.20)	-0.1972 (-2.23)	
WML	-0.2134 (-4.45)			0.0181 (0.29)		
PS	0.0227 (0.48)			-0.0696 (-1.11)		
RMW		-0.4295 (-4.13)			-0.8533 (-8.19)	
CMA		-0.2987 (-2.99)			-0.4015 (-2.73)	
ME			0.1850 (2.26)			0.2652 (2.36)
IA			-0.3301 (-3.47)			-0.3360 (-2.69)
ROE			-0.3349 (-5.01)			-0.3617 (-3.54)
FVaR99	1.3465 (18.28)	1.2423 (15.25)	1.3517 (15.93)			
FVaR1				1.3355 (13.30)	1.0696 (13.00)	1.3900 (13.28)
R <sup>2</sup>	0.8656	0.8618	0.8594	0.8196	0.8551	0.8203

**Table XIV****Skipping a month between portfolio formation month and holding period**

This table presents return comparisons between equity deciles formed monthly based on VaR1 between 1962 and 2014. Portfolio 1 is the portfolio of stocks with the lowest value-at-risk and Portfolio 10 is the portfolio of stocks with the highest value-at-risk. The table reports the two-month-ahead excess returns and five-factor alphas for each decile. The last column shows the differences of monthly excess returns and alphas between deciles 10 and 1. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). Panel A presents results for value-weighted portfolio returns. Panel B presents results for equal-weighted portfolio returns. Newey-West (1987) adjusted *t*-statistics are presented in parentheses.

*Panel A. Value-weighted returns*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Excess Return	0.47 (3.21)	0.60 (3.56)	0.59 (3.17)	0.57 (2.84)	0.58 (2.53)	0.56 (2.19)	0.59 (2.20)	0.51 (1.72)	0.30 (0.89)	-0.18 (-0.48)	-0.65 (-2.12)
Alpha	-0.04 (-0.77)	0.01 (0.15)	-0.06 (-1.43)	-0.07 (-1.45)	-0.03 (-0.57)	-0.02 (-0.24)	0.07 (0.91)	-0.02 (-0.21)	-0.15 (-1.60)	-0.55 (-4.55)	-0.51 (-3.48)

*Panel B. Equal-weighted returns*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Excess Return	1.13 (7.59)	1.23 (7.04)	1.25 (6.45)	1.31 (6.31)	1.32 (5.81)	1.26 (5.18)	1.28 (4.85)	1.08 (3.81)	0.98 (3.09)	0.54 (1.60)	-0.59 (-2.17)
Alpha	0.72 (4.82)	0.83 (4.69)	0.84 (4.32)	0.90 (4.30)	0.91 (3.99)	0.86 (3.48)	0.87 (3.28)	0.67 (2.34)	0.57 (1.79)	0.13 (0.38)	-0.59 (-2.17)

**Table XV****Effect of outliers**

This table presents return comparisons between equity deciles formed monthly based on VaR1 after VaR1 is truncated at the 1% level each month between 1962 and 2014. Portfolio 1 is the portfolio of stocks with the lowest value-at-risk and Portfolio 10 is the portfolio of stocks with the highest value-at-risk. The table reports the one-month-ahead excess returns and five-factor alphas for each decile. The last column shows the differences of monthly excess returns and alphas between deciles 10 and 1. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). Panel A presents results for value-weighted portfolio returns. Panel B presents results for equal-weighted portfolio returns. Panel C presents results for median returns. Newey-West (1987) adjusted *t*-statistics are presented in parentheses.

*Panel A. Value-weighted returns*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Excess Return	0.48 (3.25)	0.61 (3.62)	0.57 (3.11)	0.55 (2.64)	0.58 (2.54)	0.57 (2.19)	0.61 (2.27)	0.52 (1.68)	0.37 (1.08)	-0.26 (-0.66)	-0.74 (-2.27)
Alpha	0.05 (0.66)	0.10 (1.99)	0.01 (0.24)	-0.09 (-1.24)	-0.04 (-0.46)	-0.08 (-0.90)	-0.03 (-0.25)	-0.13 (-1.06)	-0.33 (-2.71)	-0.83 (-4.67)	-0.88 (-4.00)

*Panel B. Equal-weighted returns*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Excess Return	0.71 (4.61)	0.81 (4.62)	0.85 (4.38)	0.89 (4.20)	0.92 (4.01)	0.89 (3.61)	0.88 (3.38)	0.70 (2.41)	0.54 (1.71)	0.12 (0.34)	-0.60 (-2.19)
Alpha	0.22 (2.72)	0.25 (3.68)	0.21 (3.06)	0.20 (3.19)	0.19 (3.05)	0.13 (2.02)	0.11 (1.85)	-0.08 (-1.26)	-0.20 (-2.48)	-0.51 (-5.29)	-0.73 (-4.93)

*Panel C. Median returns*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Excess Return	0.34 (2.36)	0.39 (2.36)	0.39 (2.14)	0.35 (1.76)	0.32 (1.50)	0.22 (0.93)	0.10 (0.40)	-0.16 (-0.59)	-0.47 (-1.62)	-1.13 (-3.62)	-1.46 (-6.05)
Alpha	-0.11 (-1.36)	-0.14 (-2.00)	-0.20 (-2.87)	-0.30 (-4.37)	-0.35 (-5.04)	-0.49 (-6.89)	-0.62 (-9.01)	-0.91 (-12.34)	-1.15 (-12.75)	-1.72 (-15.26)	-1.61 (-11.28)

**Table XVI****Subsample Analysis**

This table presents value-weighted returns and five-factor alphas to the zero-cost portfolio that buys stocks in the highest VaR1 decile and sells stocks in the lowest VaR1 decile each month during various subsamples between 1962 and 2014. CFNAI refers to the level of the Chicago National Activity Index. JLN refers to the macroeconomic uncertainty index created by Jurado, Ludvigson and Ng (2015, JLN). DEF refers to the default spread defined by the yield difference BAA-rated and AAA-rated corporate bonds. The full sample period is divided into two sub-sample periods based on whether CFNAI is less than or greater than zero, JLN is greater than or less than its sample median, or DEF is greater than or less than its sample median. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). Newey-West (1987) adjusted *t*-statistics are presented in parentheses.

	Return	Alpha
CFNAI < 0	-1.30 (-2.15)	-1.35 (-3.60)
CFNAI ≥ 0	-0.55 (-1.54)	-0.66 (-2.97)
JLN > Median	-1.21 (-2.23)	-1.03 (-3.44)
JLN ≤ Median	-0.30 (-0.91)	-0.76 (-3.20)
DEF > Median	-1.27 (-1.83)	-1.92 (-5.15)
DEF ≤ Median	-0.58 (-1.52)	-0.46 (-2.19)

**Table XVII****Alternative measures of left-tail risk**

This table presents return comparisons between equity deciles formed monthly based on VaR5, ES1 and ES5 between 1962 and 2014. Portfolio 1 (Portfolio 10) is the portfolio of stocks with the lowest (highest) value-at-risk. The table reports the average left-tail risk metrics, one-month-ahead value-weighted excess returns and five-factor alphas for each decile. The last column shows the differences of monthly excess returns and alphas between deciles 10 and 1. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). Panel A presents results for value-at-risk at the 5% level. Panel B presents results for expected shortfall at the 1% level. Panel C presents results for expected shortfall at the 5% level. The left-tail risk metrics are defined in Table 1. Newey-West (1987) adjusted *t*-statistics are presented in parentheses.

*Panel A. VaR5*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
VaR5	0.0150	0.0218	0.0256	0.0290	0.0325	0.0362	0.0405	0.0456	0.0522	0.0661	
Excess Return	0.51	0.53	0.61	0.54	0.57	0.59	0.54	0.42	0.24	-0.23	-0.74
	(3.47)	(3.35)	(3.32)	(2.66)	(2.56)	(2.31)	(1.86)	(1.29)	(0.67)	(-0.55)	(-2.01)
Alpha	0.08	0.03	0.05	-0.02	-0.11	-0.08	-0.12	-0.22	-0.47	-0.85	-0.93
	(1.02)	(0.49)	(0.91)	(-0.32)	(-1.42)	(-0.81)	(-1.06)	(-1.88)	(-2.91)	(-4.35)	(-3.94)

*Panel B. ES1*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
ES1	0.0342	0.0465	0.0547	0.0625	0.0705	0.0794	0.0895	0.1024	0.1214	0.1763	
Excess Return	0.47	0.61	0.55	0.56	0.61	0.62	0.47	0.48	0.28	0.01	-0.46
	(3.20)	(3.64)	(2.96)	(2.69)	(2.70)	(2.49)	(1.71)	(1.69)	(0.88)	(0.02)	(-1.80)
Alpha	0.05	0.08	-0.02	-0.08	-0.02	0.04	-0.15	-0.21	-0.33	-0.47	-0.51
	(0.64)	(1.44)	(-0.36)	(-1.17)	(-0.27)	(0.49)	(-1.30)	(-2.10)	(-2.84)	(-3.71)	(-3.08)

*Panel C. ES5*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
ES5	0.0238	0.0319	0.0372	0.0421	0.0470	0.0523	0.0584	0.0657	0.0754	0.0971	
Excess Return	0.49	0.59	0.57	0.54	0.59	0.60	0.55	0.53	0.19	-0.36	-0.85
	(3.43)	(3.50)	(3.15)	(2.58)	(2.49)	(2.28)	(1.93)	(1.74)	(0.54)	(-0.90)	(-2.50)
Alpha	0.07	0.07	0.04	-0.13	-0.06	-0.04	-0.10	-0.11	-0.55	-0.88	-0.95
	(0.91)	(1.32)	(0.64)	(-1.81)	(-0.71)	(-0.43)	(-0.97)	(-0.98)	(-3.73)	(-5.28)	(-4.48)

**Table XVIII****Probability distribution versus size of the loss**

This table examines whether the probability distribution or the size of the 1% VaR predicts future returns between 1962 and 2014. Panel A reports the five-factor alphas for each probability of the loss decile. Panel B presents the five-factor alphas for each size of the loss decile. The last column in Panels A and B shows the differences of FFCPS alphas between deciles 10 and 1. Panel C presents one-month-ahead five-factor alphas for the value-weighted bivariate portfolios based on dependent double sorts of the probability and size of the loss. First, decile portfolios are formed every month based on the probability of loss. Next, additional decile portfolios are formed based on the average size of the loss within each probability of loss decile. Portfolio 1 (10) is the combined portfolio of stocks with the lowest (highest) average size in each probability of loss decile. The last column in Panel C shows the differences of monthly alphas between deciles 10 and 1. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). Newey-West (1987) adjusted *t*-statistics are presented in parentheses.

*Panel A. Univariate analysis for the probability of the loss*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Alpha	0.08	-0.03	-0.15	-0.11	0.09	0.02	-0.09	0.06	0.10	-0.02	-0.10
	(1.60)	(-0.34)	(-1.65)	(-1.38)	(0.79)	(0.26)	(-1.23)	(0.63)	(1.13)	(-0.19)	(-0.87)

*Panel B. Univariate analysis for the size of the loss*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Alpha	0.03	0.11	-0.0002	-0.13	0.05	-0.05	-0.05	-0.21	-0.43	-0.80	-0.82
	(0.39)	(1.94)	(-0.31)	(-1.82)	(0.64)	(-0.55)	(-0.48)	(-1.91)	(-3.45)	(-5.12)	(-4.18)

*Panel C. Bivariate portfolio analysis*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
Alpha	0.26	0.14	0.16	0.33	0.13	0.53	0.03	-0.26	-0.39	-0.90	-1.18
	(1.87)	(0.91)	(1.03)	(2.36)	(1.26)	(2.66)	(0.19)	(-1.47)	(-1.53)	(-2.35)	(-2.89)

**Table XIX**  
Mutual funds

This table reports return and value-at-risk results for decile portfolios of active U.S. equity mutual funds sorted on VaR1 and VaR5. The sample includes all funds with assets under management over 25 million dollars and whose stock holdings ratio is at least 90%. Portfolio 1 is the portfolio of funds with the lowest value-at-risk and Portfolio 10 is the portfolio of funds with the highest value-at-risk. Panel A presents the one-month-ahead value-weighted five-factor alphas for each decile. Alphas are calculated after adjusting for the market, size, value, and momentum factors of Fama and French (1993) and Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003). Panel B presents the average value-at-risk for the stocks held by funds in each decile. First, for each fund, we calculate the value-weighted average value-at-risk of the stocks held by the mutual fund where weights are taken as percentages that are invested in a specific stock every month. Next, within each fund decile, we calculate value-weighted averages of these fund-specific average value-at-risk measures by using monthly total net assets of each fund to construct the weights. The last columns show the differences of monthly alphas or average value-at-risk measures between deciles 10 and 1. Newey-West (1987) adjusted *t*-statistics are presented in parentheses.

*Panel A. Fund returns*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
VaR1	0.11 (1.45)	-0.02 (-0.35)	-0.10 (-1.69)	-0.11 (-2.89)	-0.12 (-2.82)	-0.15 (-2.78)	-0.15 (-2.87)	-0.16 (-3.00)	-0.32 (-3.83)	-0.28 (-1.74)	-0.39 (-2.03)
VaR5	0.11 (1.83)	0.03 (0.63)	-0.14 (-3.39)	-0.10 (-2.15)	-0.09 (-1.97)	-0.11 (-2.00)	-0.17 (-2.71)	-0.18 (-2.95)	-0.33 (-3.96)	-0.35 (-2.05)	-0.46 (-2.26)

*Panel B. Fund holdings*

	Port1	Port2	Port3	Port4	Port5	Port6	Port7	Port8	Port9	Port10	High-Low
VaR1	0.0372	0.0402	0.0408	0.0418	0.0419	0.0438	0.0462	0.0469	0.0488	0.0453	0.0083 (6.58)
VaR5	0.0367	0.0394	0.0404	0.0416	0.0430	0.0445	0.0462	0.0479	0.0492	0.0457	0.0094 (8.26)