

Deleveraging Risk

Internet Appendix

Scott Richardson
London Business School
AQR Capital Management
srichardson@london.edu
Tel: +44 20 3130 7808

Pedro Saffi
Judge Business School and CERF
University of Cambridge
psaffi@jbs.cam.ac.uk
[Tel: +44 1223 768491](tel:+441223768491)

Kari Sigurdsson
AQR Capital Management
kari.sigurdsson@aqr.com
Tel: +44 20 3130 7808

Table IA.1: Value-Weighted and Return-Weighted Stock Portfolio Returns sorted on Proxies for Short-Selling Intensity

Table IA.1 shows regressions of value-weighted (VW) and return-weighted (RW) stock portfolio returns sorted on alternative proxies of short-selling intensity, ONLOAN, UTILIZATION, SHORTVOLUME, and SHORTINTEREST, using daily U.S. stock returns between July 2006 and May 2013. We rank stocks into quintiles based on values of short-selling proxies in the previous day and compute returns of the portfolio that sells high short-selling intensity stocks and buys low short-selling intensity stocks. Value-weighted portfolios are constructed using a stock's market capitalization in the previous day to form weights, while return-weighted (RW) portfolios use a stock's gross return in the previous day as in Asparouhova et al. (2013). ONLOAN is the total amount on loan divided by market capitalization; UTILIZATION, defined as the number of shares on loan divided by the number of shares available to borrow; and SHORTVOLUME, the number of shares traded short divided by the total number of traded shares on the NYSE SuperDOT system. SHORTINTEREST is the number of shares sold short divided by the total number of outstanding shares. SHORTVOLUME is only available for the July 2006 to June 2012 period. Returns and risk factors MKT, SMB, HML, MOM and SPREAD are measured at period t , while other explanatory variables are measured at period $t-1$. Explanatory variables are described in Table 3. We report White-adjusted standard deviations in brackets and significance levels are as follows: ***(**)=significant at the 1% (5%) level.

Short-Selling Variable		ONLOAN		UTILIZATION		SHORTVOLUME		SHORTINTEREST	
Portfolio Weighting		VW	RW	VW	RW	VW	RW	VW	RW
Coeff.	Predicted Sign	(1)	(2)	(5)	(6)	(3)	(4)	(5)	(6)
Intercept	+	0.056*** [0.013]	0.055*** [0.015]	0.062*** [0.011]	0.065*** [0.014]	0.076*** [0.014]	0.076*** [0.014]	0.028** [0.012]	0.045*** [0.015]
β_{MKT}	-	-0.581*** [0.024]	-0.792*** [0.024]	-0.262*** [0.019]	-0.677*** [0.023]	-0.083*** [0.024]	-0.096*** [0.022]	-0.553*** [0.019]	-0.794*** [0.024]
β_{SMB}	-	-0.567*** [0.046]	-0.625*** [0.053]	-0.729*** [0.042]	-0.608*** [0.055]	-0.257*** [0.055]	-0.186*** [0.047]	-0.627*** [0.039]	-0.651*** [0.052]
β_{HML}	-	-0.021 [0.046]	-0.053 [0.055]	-0.163*** [0.044]	-0.092* [0.052]	-0.011 [0.044]	0.020 [0.043]	0.271*** [0.038]	-0.024 [0.054]
β_{MOM}	+	0.249*** [0.022]	0.180*** [0.026]	0.280*** [0.019]	0.193*** [0.025]	0.157*** [0.023]	0.084*** [0.024]	0.049** [0.019]	0.139*** [0.026]
β_{SPREAD}	+	0.002 [0.015]	0.046** [0.018]	-0.031* [0.018]	0.014 [0.018]	0.018 [0.013]	0.041*** [0.014]	0.024* [0.012]	0.044** [0.019]
$\beta_{Ret(MKT)<-2.5}$	-	-0.173 [0.134]	-0.215* [0.121]	0.014 [0.113]	-0.160 [0.130]	-0.018 [0.149]	0.014 [0.128]	-0.002 [0.115]	-0.137 [0.118]
β_{QUANT}	-	-1.400*** [0.127]	-1.572*** [0.074]	-2.011*** [0.428]	-2.208*** [0.281]	-1.743*** [0.410]	-2.253*** [0.551]	-1.290*** [0.116]	-1.408*** [0.136]
β_{LEHMAN}	-	-1.792*** [0.347]	-2.344*** [0.404]	-2.336*** [0.623]	-2.850*** [0.585]	-1.301*** [0.352]	-1.473*** [0.300]	-1.472*** [0.495]	-2.284*** [0.380]
$\beta_{\Delta VIX}$	-	-2.700*** [1.003]	-3.582*** [0.946]	0.699 [0.801]	-2.966*** [0.986]	-0.691 [1.389]	-2.015* [1.149]	-0.606 [0.853]	-2.975*** [0.948]
$\beta_{\Delta TED}$	-	-0.296 [0.311]	-0.477 [0.389]	-0.144 [0.256]	-0.543 [0.363]	0.042 [0.413]	-0.189 [0.393]	-0.598** [0.283]	-0.596 [0.393]
$\beta_{\Delta HAIRCUT}$	-	-0.188* [0.100]	-0.192 [0.118]	-0.062 [0.080]	-0.185 [0.115]	-0.191** [0.095]	-0.166* [0.099]	-0.062 [0.077]	-0.132 [0.118]
$\beta_{\Delta NOISE}$	-	-0.184*** [0.062]	-0.150** [0.069]	-0.166*** [0.047]	-0.184*** [0.068]	0.112 [0.103]	0.171* [0.094]	-0.174*** [0.058]	-0.153** [0.072]
$\beta_{\Delta CDS5y}$	-	-1.214* [0.622]	-1.654** [0.749]	-0.786** [0.356]	-1.393** [0.640]	-0.852 [0.600]	-1.355*** [0.393]	-0.661 [0.503]	-1.525** [0.743]
# Days		1,755	1,594	1,594	1,594	1,467	1,467	1,594	1,594
Adj. R2		0.870	0.853	0.834	0.849	0.261	0.192	0.784	0.850

Table IA.2: Value-Weighted Stock Portfolios Sorted on SHORTINTEREST (1990–2013)

Table IA.2 displays regressions of stock portfolios sorted on SHORTINTEREST, with daily U.S. stock

returns between January 1990 and August 2013. We form portfolios by ranking stocks into quintiles

based on SHORTINTEREST at the end of the previous month and carrying these ranks forward daily until

the next month. Our dependent variable is the value-weighted daily return of selling high

SHORTINTEREST stocks and buying low SHORTINTEREST stocks. SHORTINTEREST is the number of

shares sold short divided by the total number of outstanding shares. Returns and risk factors MKT, SMB,

HML, MOM and SPREAD are measured at period t , while other explanatory variables are measured at

period $t-1$. Explanatory variables are the same as in Table 3 and defined in the appendix. We report

White-adjusted standard deviations in brackets and significance levels are indicated as follows:

***(**)=statistical significance at the 1% (5%) level.

Coeff.	Predicted Sign	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	+	-0.010 [0.007]	-0.007 [0.007]	-0.010 [0.007]	-0.010 [0.007]	0.016* [0.009]	-0.013* [0.007]	0.013* [0.008]
β_{MKT}	-	-0.415*** [0.008]	-0.420*** [0.008]	-0.416*** [0.008]	-0.415*** [0.008]	-0.400*** [0.013]	-0.415*** [0.008]	-0.411*** [0.012]
β_{SMB}	-	-0.313*** [0.020]	-0.312*** [0.020]	-0.313*** [0.020]	-0.313*** [0.020]	-0.676*** [0.023]	-0.318*** [0.020]	-0.672*** [0.021]
β_{HML}	-	0.146*** [0.016]	0.146*** [0.015]	0.145*** [0.016]	0.147*** [0.016]	0.448*** [0.029]	0.138*** [0.016]	0.412*** [0.025]
β_{MOM}	+	-0.043*** [0.011]	-0.045*** [0.011]	-0.043*** [0.011]	-0.043*** [0.011]	0.025 [0.016]	-0.044*** [0.011]	-0.009 [0.014]
β_{SPREAD}	+	0.041*** [0.007]	0.042*** [0.006]	0.041*** [0.007]	0.041*** [0.007]	0.012 [0.010]	0.044*** [0.006]	0.011 [0.009]
$\beta_{Ret(MKT)<-2.5\sigma}$	-		-0.141** [0.069]					
β_{QUANT}	-		-1.031** [0.465]					
β_{LEHMAN}	-		-1.657*** [0.401]					
$\beta_{\Delta VIX}$	-			1.051 [0.674]				
$\beta_{\Delta TED}$	-				-0.301* [0.156]			
$\beta_{\Delta HAIRCUT}$	-					-0.097* [0.058]		
$\beta_{\Delta NOISE}$	-						-0.016 [0.022]	
$\beta_{\Delta CDS5y}$	-							-0.370 [0.376]
# Days		5,964	5,964	5,963	5,963	1,965	5,689	2,427
Adj. R2		0.574	0.579	0.574	0.575	0.758	0.568	0.766

Table IA.3: Cumulative Returns of Value-Weighted Stock Portfolios Sorted on ONLOAN

Table IA.3 displays regressions of stock portfolio returns sorted by ONLOAN, using daily U.S. stock returns between July 2006 and May 2013 and based on equation (2) in the text. The dependent variable $RET_{i,t+j}$ is the cumulative returns from t to $t+j$ after portfolio formation. We form portfolios by ranking stocks into quintiles based on *ONLOAN* in the previous day and computing value-weighted daily returns of selling high ONLOAN stocks and buying low ONLOAN stocks. ONLOAN is the total amount on loan divided by market capitalization. MKT is the excess market return above the risk-free rate. SMB is the return on a portfolio of small stocks minus the return on a portfolio of big stocks. HML is the return on a portfolio of high book-to market (value) minus low book-to-market (growth) stocks. MOM is the return on a portfolio of prior winners minus the return on a portfolio of prior losers. And SPREAD is the return on a portfolio of high-spread minus low-spread stocks.

$D_{Ret(MKT)<2.5\sigma}$ is an indicator variable equal to one if the standardized market return in the previous day is 2.5 standard deviations below (above) the mean. D_{QUANT} is an indicator variable equal to one in the period between August 6 and August 8, 2007, and zero otherwise. D_{LEHMAN} is an indicator variable equal to one in the period between September 16 and September 18, 2008, and zero otherwise. ΔVIX is the daily change in the VIX volatility index. ΔTED is the daily change in the Treasury-Eurodollar spread in the previous day. $\Delta HAIRCUT$ is the daily change in the spread of convertible bonds relative to their fair price from Mitchell and Pulvino (2012). $\Delta NOISE$ is the illiquidity measure used by Hu et al. (2013), $\Delta CDS5Y$ is the change in five year credit default swap prices for the U.S. banking sector, and $\Delta PC1$ is the change in the first principal component of funding liquidity variables estimated in Table 3. Returns and risk factors MKT, SMB, HML, MOM and SPREAD are measured at period t , while other explanatory variables are measured at period $t-1$. We report HAC standard errors in brackets using the optimum lag-selection algorithm proposed by Newey and West (1994). Significance levels are indicated as follows: ***(**)=significant at the 1% (5%) level.

$t+j$	$D_{Ret(MKT)}^{<-2.5\sigma}$	D_{QUANT}	D_{LEHMAN}	ΔVIX	ΔTED	$\Delta HAIRCUT$	$\Delta NOISE$	$\Delta CDS5y$	$\Delta PC1$
	(1a)	(1b)	(1c)	(2)	(3)	(4)	(5)	(6)	(7)
1	-0.223	-1.392***	-2.096***	-3.816***	-1.051***	-0.209*	-0.266***	-1.242	-0.818***
2	-0.356***	-2.842***	-3.462***	-7.516***	-1.311**	-0.193	-0.252**	-2.551**	-1.304***
3	-0.559***	-3.716***	-4.388***	-8.244***	-1.576***	-0.407*	-0.319***	-3.415**	-1.570***
4	-0.462**	-3.538***	-4.302***	-10.813***	-2.210***	-0.488*	-0.247*	-4.436***	-2.032***
5	-0.567**	-2.617***	-4.280***	-11.747***	-2.621***	-0.446	-0.418**	-4.585***	-2.273***
20	-1.695***	1.045***	-1.946	-12.832***	-2.539	-1.000**	-0.428	-12.055***	-3.293***
60	-1.542***	2.889**	-4.212**	-16.033***	-2.567**	-0.625**	-0.108	-10.680**	-3.355***
80	1.538**	3.071***	-3.815**	6.227*	-1.767	0.528*	0.747	-2.465	1.526*

Table IA.4: Cumulative Returns of Return-Weighted Stock Portfolios Sorted on ONLOAN

Table IA.4 displays regressions of stock portfolio returns sorted by ONLOAN, using daily U.S. stock returns between July 2006 and May 2013 and based on equation (2) in the text. The dependent variable $RET_{i,t+j}$ is the cumulative returns from t to $t+j$ after portfolio formation. We form portfolios by ranking stocks into quintiles based on ONLOAN in the previous day and computing return-weighted daily returns of selling high ONLOAN stocks and buying low ONLOAN stocks. Return-weighted (RW) portfolios use a stock's gross return in the previous day as in Asparouhova et al. (2013) to compute portfolio weights. ONLOAN is the total amount on loan divided by market capitalization. MKT is the excess market return above the risk-free rate. SMB is the return on a portfolio of small stocks minus the return on a portfolio of big stocks. HML is the return on a portfolio of high book-to market (value) minus low book-to-market (growth) stocks. MOM is the return on a portfolio of prior winners minus the return on a portfolio of prior losers. And SPREAD is the return on a portfolio of high-spread minus low-spread stocks. $D_{Ret(MKT)<2.5\sigma}$ is an indicator variable equal to one if the standardized market return in the previous day is 2.5 standard deviations below (above) the mean. D_{QUANT} is an indicator variable equal to one in the period between August 6 and August 8, 2007, and zero otherwise. D_{LEHMAN} is an indicator variable equal to one in the period between September 16 and September 18, 2008, and zero otherwise. ΔVIX is the daily change in the VIX volatility index. ΔTED is the daily change in the Treasury-Eurodollar spread in the previous day. $\Delta HAIRCUT$ is the daily change in the spread of convertible bonds relative to their fair price from Mitchell and Pulvino (2012). $\Delta NOISE$ is the illiquidity measure used by Hu et al. (2013), $\Delta CDS5Y$ is the change in five year credit default swap prices for the U.S. banking sector, and $\Delta PC1$ is the change in the first principal component of funding liquidity variables estimated in Table 3. Returns and risk factors MKT, SMB, HML, MOM and SPREAD are measured at period t , while other explanatory variables are measured at period $t-1$. We report HAC standard errors in brackets using the optimum lag-selection algorithm proposed by Newey and West (1994). Significance levels are indicated as follows: ***(**)=significant at the 1% (5%) level.

$t+j$	$D_{Ret(MKT)}_{<-2.5\sigma}$	D_{QUANT}	D_{LEHMAN}	ΔVIX	ΔTED	$\Delta HAIRCUT$	$\Delta NOISE$	$\Delta CDS5y$	$\Delta PC1$
	(1a)	(1b)	(1c)	(2)	(3)	(4)	(5)	(6)	(7)
1	-0.305**	-1.572***	-2.659***	-4.663***	-1.348***	-0.223*	-0.264**	-1.656	-1.657***
2	-0.454***	-3.087***	-4.795***	-9.018***	-1.871***	-0.291*	-0.291*	-3.368**	-2.126***
3	-0.723***	-4.088***	-6.272***	-11.513***	-2.308***	-0.477*	-0.382**	-4.658**	-2.621***
4	-0.673***	-4.102***	-6.511***	-14.087***	-3.109***	-0.582*	-0.327*	-5.980***	-3.011***
5	-0.771**	-3.301***	-6.743***	-16.042***	-3.554***	-0.538	-0.534**	-6.425***	-1.743**
20	-2.949***	-0.333	-5.583**	-18.190***	-3.858**	-1.343**	-0.675**	-15.984***	-4.973***
60	-3.559***	-1.555	-7.965**	-26.948***	-4.472***	-1.325***	-0.328	-16.012**	0.174
80	0.914	-1.084	-8.941***	2.597	-4.004	-0.131	0.505	-3.883	1.526*