

Internet Appendix to
“The Booms and Busts of Beta Arbitrage”

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Table A1: Event Time *CoBAR*

This table reports some basic statistics of “*CoBAR*,” the excess comovement among low beta stocks over the period 1970 to 2010. At the end of each month, all stocks are sorted into deciles based on their lagged-12-month market beta computed using daily returns. Pairwise partial return correlations (after controlling for the Fama-French three factors) for all stocks in the low beta decile are computed based on weekly stock returns in the previous 12 months. *CoBAR* is the average pair-wise correlation between any two stocks in the low-beta decile in year t . Panel A reports the autocorrelation in *CoBAR* in event time; that is, we form the beta portfolios in year 0, and compute *CoBAR* for the same set of low beta stocks in the following 1, 2, and 3 years. Panel B shows the average *CoBAR* in event time.

Panel A: Autocorrelation in event time				
	Year 0	Year 1	Year 2	Year 3
CoBAR0	1			
CoBAR1	0.152	1		
CoBAR2	0.285	0.584	1	
CoBAR3	0.261	0.399	0.534	1

Panel B: Average <i>CoBAR</i> in event time					
	Mean	Median	Std. Dev.	Min	Max
Year 0	0.105	0.102	0.026	0.037	0.203
Year 1	0.071	0.070	0.027	0.020	0.189
Year 2	0.070	0.066	0.030	0.013	0.186
Year 3	0.072	0.067	0.031	0.022	0.206

Table A2: Regression Analysis

This table reports returns to the beta arbitrage strategy as a function of lagged *CoBAR* and *CoBAR*². At the end of each month, all stocks are sorted into deciles based on their market beta calculated using daily returns in the past 12 months. To account for illiquidity and non-synchronous trading, we include on the right-hand side of the regression equation five lags of the excess market return, in addition to the contemporaneous excess market return. The pre-ranking beta is simply the sum of the six coefficients from the OLS regression. The dependent variable is the four-factor alpha of the beta arbitrage strategy (i.e., a portfolio that is long the value-weight low-beta decile and short the value-weighted high-beta decile). The main independent variable is *CoBAR*, the average pairwise partial weekly three-factor residual correlation within the low-beta decile over the past 12 months. We include both *CoBAR* and *CoBAR*² to take into account non-linearity in months 1-6. We also include in the regression exponentially weighted moving average past inflation (Cohen, Polk, and Vuolteenaho, 2005), a sentiment index (Wurgler and Baker, 2006), aggregate analyst forecast dispersion (Hong and Sraer, 2016), Ted Spread—the difference between the LIBOR rate and the US Treasury bill rate, the *ValueSpread*—the spread in log book-to-market-ratios across the low-beta and high-beta deciles, and market volatility over the past 24 months. The first three columns examine returns to the beta arbitrage strategy in months 1-6, and the next three columns examine the returns in year 3 after portfolio formation. We report results based on Carhart four-factor adjustments. T-statistics, shown in brackets, are computed based on standard errors corrected for serial-dependence with 12 lags. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

<i>DepVar</i>	Four-Factor Alpha to the Beta Arbitrage Strategy					
	Months 1-6			Year 3		
	[1]	[2]	[3]	[4]	[5]	[6]
<i>CoBAR</i>	-0.903*** [0.294]	-0.858*** [0.274]	-1.759*** [0.501]	-0.195*** [0.054]	-0.154*** [0.053]	-0.277*** [0.079]
<i>CoBAR</i> ²	4.558*** [1.227]	4.473*** [1.116]	8.253*** [2.292]			
<i>Inflation</i>		1.210 [1.123]	3.552 [3.229]		1.685* [0.962]	2.793 [3.358]
<i>Sentiment</i>		0.005*** [0.002]	0.001 [0.005]		0.002 [0.002]	0.002 [0.004]
<i>Disagreement</i>			0.004 [0.004]			0.005 [0.003]
<i>Ted Spread</i>			-0.010 [0.010]			0.001 [0.008]
<i>ValueSpread</i>		0.000 [0.004]	0.001 [0.005]		0.001 [0.003]	-0.002 [0.003]
<i>Mktvol24</i>		0.059 [0.104]	-0.009 [0.213]		0.118 [0.150]	0.045 [0.214]
Adj-R ²	0.072	0.094	0.128	0.094	0.128	0.154
No. Obs.	528	528	336	528	528	336

Table A3: Predicting the Security Market Line (20 portfolios)

This table reports regressions of the intercept and slope of the security market line on lagged $CoBAR$ and $CoBAR^2$. At the end of each month, all stocks are sorted into vigintiles based on their market beta calculated using daily returns in the past 12 months. To account for illiquidity and non-synchronous trading, we include on the right-hand side of the regression equation five lags of the excess market return, in addition to the contemporaneous excess market return. The pre-ranking beta is simply the sum of the six coefficients from the OLS regression. We then estimate two security market lines based on these 20 portfolios formed in each period: one SML using monthly portfolio returns in months 1-6, and the other using monthly portfolio returns in year 3 after portfolio formation. The post-ranking betas are calculated by regressing each of the 20 portfolios' value-weighted monthly returns on the corresponding market return. Following Fama and French (1992), we use the entire sample to compute post-ranking betas. The dependent variable in Panel A is the intercept of the SML, while that in Panel B is the slope of the SML. The main independent variable is $CoBAR$, the average pairwise partial weekly three-factor residual correlation within the low-beta decile over the past 12 months. We include both $CoBAR$ and $CoBAR^2$ to take into account non-linearity in months 1-6. We also include in the regressions smoothed inflation, sentiment index, aggregate analyst forecast dispersion, and Ted Spread. Other (unreported) control variables include the contemporaneous market excess return, SMB return, and HML return. Standard errors, shown in brackets, are computed based on standard errors corrected for serial-dependence with 6 or 12 lags, as appropriate. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A: $DepVar = \text{Intercept of SML}$						
	Months 1-6			Year3		
<i>CoBAR</i>	-0.919*** [0.259]	-0.540*** [0.195]	-0.990*** [0.387]	-0.266*** [0.077]	-0.189*** [0.067]	-0.226*** [0.087]
<i>CoBAR</i> ²	4.744*** [1.142]	3.310*** [0.810]	4.879*** [1.740]			
<i>Inflation</i>		2.197*** [0.738]	4.907*** [1.701]		0.422 [1.229]	1.069 [2.157]
<i>Sentiment</i>		0.006*** [0.001]	0.005** [0.002]		-0.001 [0.002]	-0.004 [0.004]
<i>Disagreement</i>			0.003* [0.002]			0.001 [0.003]
<i>Ted Spread</i>			-0.011*** [0.003]			0.004 [0.004]
Adj-R ²	0.110	0.396	0.526	0.119	0.371	0.471
No. Obs.	528	528	336	528	528	336

Panel B: $DepVar = \text{Slope of SML}$						
	Months 1-6			Year3		
<i>CoBAR</i>	1.100*** [0.325]	0.588*** [0.189]	0.900** [0.421]	0.289*** [0.096]	0.207*** [0.069]	0.203** [0.094]
<i>CoBAR</i> ²	-6.256*** [1.524]	-3.469*** [0.767]	-4.475*** [1.895]			
<i>Inflation</i>		-2.058*** [0.755]	-4.963*** [1.743]		-0.833 [1.191]	-0.006 [2.583]
<i>Sentiment</i>		-0.006*** [0.001]	-0.006** [0.003]		0.001 [0.002]	0.005 [0.004]
<i>Disagreement</i>			-0.002 [0.002]			0.000 [0.004]
<i>Ted Spread</i>			0.012*** [0.003]			-0.003 [0.004]
Adj-R ²	0.153	0.686	0.739	0.104	0.468	0.498
No. Obs.	528	528	336	528	528	336

Table A4: Predicting the Security Market Line (10 portfolios)

This table reports regressions of the intercept and slope of the security market line on lagged *CoBAR* and *CoBAR*². At the end of each month, all stocks are sorted into decile portfolios based on their market beta calculated using daily returns in the past 12 months. To account for illiquidity and non-synchronous trading, we include on the right-hand side of the regression equation five lags of the excess market return, in addition to the contemporaneous excess market return. The pre-ranking beta is simply the sum of the six coefficients from the OLS regression. We then estimate two security market lines based on these 10 portfolios formed in each period: one SML using monthly portfolio returns in months 1-6, and the other using monthly portfolio returns in year 3 after portfolio formation. The post-ranking betas are calculated by regressing each of the 10 portfolios' value-weighted monthly returns on the corresponding market return. Following Fama and French (1992), we use the entire sample to compute post-ranking betas. The dependent variable in Panel A is the intercept of the SML, while that in Panel B is the slope of the SML. The main independent variable is *CoBAR*, the average pairwise partial weekly three-factor residual correlation within the low-beta decile over the past 12 months. We include both *CoBAR* and *CoBAR*² to take into account non-linearity in months 1-6. We also include in the regressions smoothed inflation, a sentiment index, aggregate analyst forecast dispersion, and the Ted Spread. Other (unreported) control variables include the contemporaneous market excess return, SMB return, and HML return. Standard errors, shown in brackets, are computed based on standard errors corrected for serial-dependence with 6 or 12 lags, as appropriate. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A: $DepVar = \text{Intercept of SML}$						
	Months 1-6			Year3		
<i>CoBAR</i>	-0.898*** [0.253]	-0.521*** [0.193]	-1.062*** [0.388]	-0.262*** [0.075]	-0.186*** [0.065]	-0.226*** [0.084]
<i>CoBAR</i> ²	4.660*** [1.114]	3.230*** [0.799]	5.144*** [1.750]			
<i>Inflation</i>		2.196*** [0.719]	5.083*** [1.677]		0.474 [1.200]	0.682 [2.086]
<i>Sentiment</i>		0.006*** [0.001]	0.005** [0.002]		-0.001 [0.002]	-0.004 [0.003]
<i>Disagreement</i>			0.003* [0.002]			0.001 [0.003]
<i>Ted Spread</i>			-0.011*** [0.003]			0.004 [0.004]
Adj-R ²	0.110	0.396	0.526	0.120	0.364	0.457
No. Obs.	528	528	336	528	528	336

Panel B: $DepVar = \text{Slope of SML}$						
	Months 1-6			Year3		
<i>CoBAR</i>	1.094*** [0.327]	0.581*** [0.187]	0.975** [0.424]	0.287*** [0.095]	0.206*** [0.069]	0.208** [0.092]
<i>CoBAR</i> ²	-6.242*** [1.536]	-3.447*** [0.763]	-4.763*** [1.914]			
<i>Inflation</i>		-2.050*** [0.741]	-5.198*** [1.718]		-0.863 [1.176]	0.353 [2.535]
<i>Sentiment</i>		-0.006*** [0.001]	-0.006*** [0.003]		0.001 [0.002]	0.005 [0.004]
<i>Disagreement</i>			-0.002 [0.002]			0.000 [0.004]
<i>Ted Spread</i>			0.012*** [0.003]			-0.003 [0.004]
Adj-R ²	0.153	0.687	0.740	0.103	0.465	0.492
No. Obs.	528	528	336	528	528	336

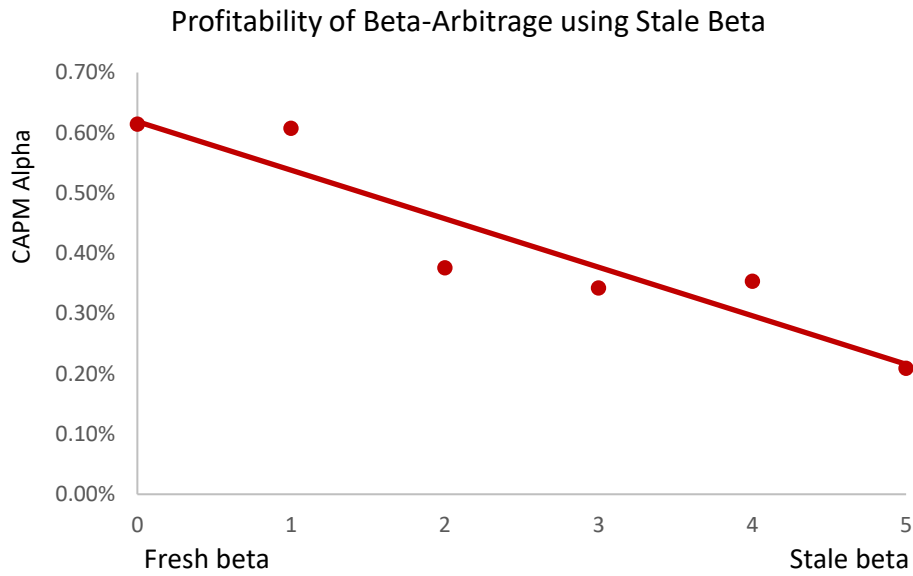


Figure A1: This figure shows how the post-holding return to beta-arbitrage strategies decays as stale estimates of beta are used to form beta-arbitrage strategy. At the end of each month, all stocks are sorted into deciles based on their market beta calculated using daily returns in the past 12 months. To account for illiquidity and non-synchronous trading, we include on the right-hand side of the regression equation five lags of the excess market return, in addition to the contemporaneous excess market return. The pre-ranking beta is simply the sum of the six coefficients from the OLS regression. We then compute the strategy return as the value-weight low-beta decile return minus the value-weight high-beta decile return. We then repeat the analysis using stale betas, computed from daily returns in each of the prior 5 years (thus having different beta portfolios as of time zero for each degree of beta staleness). We plot the corresponding beta-arbitrage strategies' CAPM alphas (averaged over the first six months after portfolio formation) for each of the six beta-arbitrage strategies, ranging from fresh beta to five-year stale beta.