Internet Appendix to "CAPM for estimating cost of equity capital: Interpreting the empirical evidence"

This document contains supplementary material to the paper titled "CAPM for estimating cost of equity capital: Interpreting the empirical evidence." Appendix A describes the procedures we adapt from Jagannathan, Kim, and Skoulakis (2010) to correct the biased cross-sectional regression estimates for the errors-in-variables problem. Appendix B presents results from additional cross-sectional regressions where we drop one real option proxy at a time.

A. Bias Correction in Three-Stage Cross-Sectional Regression

The cross-sectional regressions in Section 4.2 and Tables 5 and 6 are ran in three stages. In the first stage, we estimate betas using a rolling-window time-series regression with a window length equal to 60 months. In the second stage, we conduct real options adjustment by projecting returns and betas on option-related stock characteristics in the cross-section and compute the residuals. In the third stage, we regress option-adjusted returns on option-adjusted betas and other return anomaly variables in the cross-section following the Fama-MacBeth (1973) procedure.

Since betas are estimated with errors in the first stage, we will have an errors-in-variables problem in the final cross-sectional regression, resulting in biased risk premium estimates as observed by Kim (1995). The procedures described here are adapted from procedures in Jagannathan, Kim, and Skoulakis (2010).

In the first stage, for each stock, at time T, we estimate the beta(s) using a rolling window time-series regression from T - K to T - 1 as follows:

$$R_{i,t} = \alpha_i + \beta_i x_t + \varepsilon_{i,t}, \qquad \text{(A-1)}$$

where β_i and x_t are M by 1 vectors. We ignore the time T subscript throughout the appendix. To further simplify notation, we define the following:

$$R_i = \begin{pmatrix} R_{i,T-1} \\ \cdots \\ R_{i,T-K} \end{pmatrix}$$

$$X = \begin{pmatrix} x_{T-1}^1 & \cdots & x_{T-1}^M \\ \cdots & \cdots & \cdots \\ x_{T-K}^1 & \cdots & x_{T-K}^M \end{pmatrix}$$

$$\varepsilon_i = \begin{pmatrix} \varepsilon_{i,T-1} \\ \cdots \\ \varepsilon_{i,T-K} \end{pmatrix}$$

(A-1) can be rewritten in matrix form as follows:

$$R_i = (1 \quad X) \begin{pmatrix} \alpha_i \\ \beta_i \end{pmatrix} + \varepsilon_i. \tag{A-2}$$

After de-meaning R_i and X for simple notation, we get:

$$\beta_i^{OLS} = (X'X)^{-1}X'R_i = \beta_i + (X'X)^{-1}X'\varepsilon_i. \tag{A-3}$$

In the second stage, at each time T, we run cross-sectional regressions without constants to compute option-adjusted returns and residual betas:

$$\begin{gathered} R = ZA + \tilde{R}, \\ \beta^{OLS} = ZB + \tilde{\beta}^{OLS}, \end{gathered} \tag{A-4}$$

where Z is an N by P matrix of real option proxies (assuming to be measured without errors). Estimates of loadings are:

$$\begin{gathered} \hat{A} = (Z'Z)^{-1}Z'R, \\ \hat{B} = (Z'Z)^{-1}Z'\beta^{OLS} \end{gathered}$$

As a result:

$$\begin{gathered} \tilde{R} = KR, \\ \tilde{\beta}^{OLS} = K\beta^{OLS}, \\ K = I - Z(Z'Z)^{-1}Z'. \end{gathered}$$

K is N by N symmetric and idempotent. It rotates the original returns and betas to remove the option effect from the cross-section. The CAPM holds better with the option-adjusted returns and betas.

In the third stage, we run Fama-MacBeth cross-sectional regressions. At time T, we have the cross-sectional regression:

$$KR_{i,t} = \gamma_0 + \gamma_1 K\beta_i + \gamma_2 V_{i,t} + \varepsilon_{i,t}, \tag{A-5}$$

where $\gamma_0 = \gamma_2 = 0$ under the null. V captures additional characteristics measured without error. $V_{i,T}$ and γ_2 are L by 1 vectors. To simplify notation, we define:

$$KR_T = K\begin{pmatrix} \gamma_{1,T} \\ \cdots \\ \gamma_{N,T} \end{pmatrix}, K\beta = K\begin{pmatrix} \beta'_1 \\ \cdots \\ \beta'_N \end{pmatrix}, KB = K\begin{pmatrix} \beta_1^{OLS'} \\ \cdots \\ \beta_N^{OLS'} \end{pmatrix}$$

$$\varepsilon_T = \begin{pmatrix} \varepsilon_{1,T} \\ \cdots \\ \varepsilon_{N,T} \end{pmatrix}, V = \begin{pmatrix} V'_{1,T} \\ \cdots \\ V'_{N,T} \end{pmatrix}, \varepsilon = \begin{pmatrix} \varepsilon_1 \\ \cdots \\ \varepsilon_N \end{pmatrix}$$

(A-5) can be rewritten as:

$$KR_T = \gamma_0 + K\beta\gamma_1 + V\gamma_2 + \varepsilon_T$$

$$= \gamma_0 + KB\gamma_1 + V\gamma_2 - K\varepsilon' X(X'X)^{-1}\gamma_1 + \varepsilon_T,$$

or:

$$[1 \quad KB \quad V]' KR_T = [1 \quad KB \quad V]'[1 \quad KB \quad V] \begin{bmatrix} \gamma_0 \\ \gamma_1 \\ \gamma_2 \end{bmatrix} + [1 \quad KB \quad V]'[-K\varepsilon' X(X'X)^{-1}\gamma_1 + \varepsilon_T]$$

Multiplying both sides by $[1 \quad KB \quad V]'[1 \quad KB \quad V]^{-1}$, we have:

$$\begin{bmatrix} \gamma_0 \\ \gamma_1 \\ \gamma_2 \end{bmatrix}^{OLS} = \begin{bmatrix} \gamma_0 \\ \gamma_1 \\ \gamma_2 \end{bmatrix} + [[1 \quad KB \quad V]'[1 \quad KB \quad V]]^{-1} \begin{bmatrix} 1 \\ KB \\ V \end{bmatrix} [-K\varepsilon' X(X'X)^{-1}\gamma_1 + \varepsilon_T]. \qquad \text{(A-6)}$$

We assume $\mu_y = \lim_{N\to\infty} \sum_{i=1}^{N} \frac{y_i}{N}$, a cross-sectional mean of a vector of random variables, and

$$\mu_{xy} = \lim_{N\to\infty} \sum_{i=1}^{N} \frac{(x_i - \mu_x)(y_i - \mu_y)}{N},$$

a cross-sectional covariance of vectors of random variables. We also assume all the second moments to be finite and the usual orthogonality condition holds.

We focus on the second term of the RHS in Equation (A-6). As $N \to \infty$:

$$\begin{bmatrix} 1'1 & 1'KB & 1'V' \\ B'K'1 & B'K'KB & B'K'V \\ V'1 & V'KB & V'V \end{bmatrix}^{-1} \begin{bmatrix} 1' \\ B'K' \\ V' \end{bmatrix} \left[[-K\varepsilon' X(X'X)^{-1}\gamma_1 + \varepsilon_T]\right]$$

$$= \begin{bmatrix} 1'1 & \frac{1'KB}{N} & \frac{1'V'}{N} \\ \frac{B'K'1}{N} & \frac{B'K'KB}{N} & \frac{B'K'V}{N} \\ \frac{V'1}{N} & \frac{V'KB}{N} & \frac{V'V}{N} \end{bmatrix} \begin{bmatrix} \frac{-K\varepsilon' X(X'X)^{-1}}{N}\gamma_1 + \frac{1'\varepsilon_T}{N} \\ \frac{-B'K'K\varepsilon' X(X'X)^{-1}}{N}\gamma_1 + \frac{B'K'\varepsilon_T}{N} \\ \frac{-VK'\varepsilon' X(X'X)^{-1}}{N}\gamma_1 + \frac{V'\varepsilon_T}{N} \end{bmatrix} \to -Q \begin{bmatrix} \gamma_0 \\ \gamma_1 \\ \gamma_2 \end{bmatrix} \qquad \text{(A-7)}$$

Where:

$$Q = \begin{bmatrix} 1 & E[KB] & E[V] \\ E[B'K'] & E[B'K'KB] & E[B'K'V] \\ E[V'] & E[V'KB] & E[V'V] \end{bmatrix}^{-1} \begin{bmatrix} 0 & 0 & 0 \\ 0 & S & 0 \\ 0 & 0 & 0 \end{bmatrix}.$$

In the expression above, E[·] denotes the cross-sectional means, estimated using sample moments. $S = (X'X)^{-1}X'\Sigma_K X(X'X)^{-1}$, where $\sum_K = E[\varepsilon K' K \varepsilon']$.

B. Additional Cross-sectional Regression Results

We report results from additional cross-sectional regressions after real option adjustment (with bias-correction) where we drop one real option proxy at a time. Table B1 (excluding Ivol), B2 (excluding BM), and B3 (excluding ROA) present results on our full sample. Table B4 (excluding Ivol), B5 (excluding BM), and B6 (excluding ROA) present the corresponding results on the subsample, where we remove about 14% of the stocks whose betas are most likely to be measured with noise.

Overall, our main conclusions are robust to the exclusion of any of the three real option proxies. In all six tables, the CAPM betas are associated with positive and significant coefficients. When comparing Table B1-B6 in the Appendix to Table 5-6 in the paper, we find all three real option proxies to be useful. The standard CAPM (Model 1) always perform better with smaller intercept term and higher risk premium estimate when all three real option proxies are included.

In the paper, we have used BM as a real option proxy. Berk (1995) argues that BM in general will be a good proxy for expected return as well, even in an economy where the CAPM holds, and could be a better expected return proxy when the beta is estimated with error. In such an economy, the book-to-market ratio will drive out historical betas in explaining the cross-section of stock returns. Hence, our finding that the CAPM beta helps to explain the cross-section of returns after controlling for BM only strengthens our argument in favor of the CAPM for project cost of capital calculation. Nevertheless, we also consider excluding BM as a real option proxy and report the bias-corrected regression results in Table B2 and B5. The key finding here is that the CAPM beta remains highly significant and the intercept term becomes insignificant in the subsample. The anomaly variables become slightly more significant after the exclusion of BM in the real option adjustment, which is not too surprising as BM is considered as an important real option proxy.

Table B1: Bias-Corrected Cross-Sectional Regression with Real Option Adjustment: *Full Sample*

The dependent variable is option adjusted monthly excess returns; independent variables are beta, betas of Fama-French three-factor ($Beta_{\_MKT}$, $Beta_{\_SMB}$, and $Beta_{\_HML}$), and the return anomaly variables. The regression coefficients for the sample period of 1970/07-2008/06 are first corrected using procedures described in the Internet Appendix and averaged across time. T-values (in parentheses) are computed using the Fama-MacBeth procedure and the Newey-West (1987) formula with a lag of 36. Log-transformations are applied to Size and BM. The option adjusted variables are constructed as the residuals from regressing the raw variables with independent variables of BM and ROA (excluding Ivol).

	Const.	Beta	$Beta_{\_MKT}$	$Beta_{\_SMB}$	$Beta_{\_HML}$	Ast_gw	Inv	Lret	Sue	Momt	Adj R^2
Model 1	0.0027	0.0035	-	-	-	-	-	-	-	-	1.90%
	(2.51)	(2.19)									
Model 2	0.0028	0.0043	-	-	-	-0.0058	-	-	-	-	2.03%
	(2.60)	(2.68)				(-3.50)					
Model 3	0.0028	0.0041	-	-	-	-	-0.0068	-	-	-	2.02%
	(2.58)	(2.55)					(-2.04)				
Model 4	0.0026	0.0040	-	-	-	-	-	-0.0006	-	-	2.02%
	(2.77)	(2.43)						(-1.44)			
Model 5	0.0023	0.0030	-	-	-	-	-	-	0.0015	-	2.08%
	(2.26)	(1.88)							(8.73)		
Model 6	0.0019	0.0025	-	-	-	-	-	-	-	0.0080	2.92%
	(2.11)	(1.74)								(6.89)	
Model 7	0.0016	-	0.0043	0.0012	0.0032	-	-	-	-	-	1.34%
	(2.32)		(2.74)	(0.83)	(1.99)						
Model 8	0.0017	-	0.0048	0.0014	0.0029	-0.0043	-	-	-	-	1.51%
	(2.43)		(3.12)	(0.91)	(1.83)	(-2.78)					
Model 9	0.0017	-	0.0047	0.0014	0.0029	-	-0.0057	-	-	-	1.47%
	(2.41)		(3.02)	(0.96)	(1.83)		(-2.13)				
Model 10	0.0016	-	0.0047	0.0011	0.0030	-	-	-0.0007	-	-	1.52%
	(2.57)		(3.04)	(0.75)	(1.87)			(-1.88)			
Model 11	0.0013	-	0.0037	0.0013	0.0031	-	-	-	0.0013	-	1.50%
	(1.98)		(2.33)	(0.88)	(1.98)				(8.57)		
Model 12	0.0012	-	0.0030	0.0016	0.0035	-	-	-	-	0.0051	2.06%
	(1.84)		(1.97)	(1.00)	(1.81)					(2.76)	

Table B2: Bias-Corrected Cross-Sectional Regression with Real Option Adjustment: *Full Sample*

The dependent variable is option adjusted monthly excess returns; independent variables are beta, betas of Fama-French three-factor ($Beta_{\_MKT}$, $Beta_{\_SMB}$, and $Beta_{\_HML}$), and the return anomaly variables. The regression coefficients for the sample period of 1970/07-2008/06 are first corrected using procedures described in the Internet Appendix and averaged across time. T-values (in parentheses) are computed using the Fama-MacBeth procedure and the Newey-West (1987) formula with a lag of 36. Log-transformations are applied to Size and BM. The option adjusted variables are constructed as the residuals from regressing the raw variables with independent variables of Ivol and ROA (excluding BM).

	Const.	Beta	$Beta_{\_MKT}$	$Beta_{\_SMB}$	$Beta_{\_HML}$	Ast_gw	Inv	Lret	Sue	Momt	Adj R^2
Model 1	0.0027	0.0050	-	-	-	-	-	-	-	-	1.54%
	(2.93)	(3.22)									
Model 2	0.0028	0.0061	-	-	-	-0.0082	-	-	-	-	1.76%
	(3.02)	(3.93)				(-3.80)					
Model 3	0.0028	0.0058	-	-	-	-	-0.0090	-	-	-	1.75%
	(3.01)	(3.62)					(-2.35)				
Model 4	0.0027	0.0059	-	-	-	-	-	-0.0013	-	-	1.75%
	(3.04)	(3.76)						(-2.45)			
Model 5	0.0026	0.0043	-	-	-	-	-	-	0.0013	-	1.77%
	(2.83)	(2.74)							(7.70)		
Model 6	0.0024	0.0037	-	-	-	-	-	-	-	0.0082	2.56%
	(2.78)	(2.59)								(7.14)	
Model 7	0.0010	-	0.0054	0.0026	0.0048	-	-	-	-	-	1.12%
	(2.51)		(3.60)	(1.58)	(2.68)						
Model 8	0.0011	-	0.0061	0.0027	0.0044	-0.0055	-	-	-	-	1.25%
	(2.70)		(4.16)	(1.67)	(2.49)	(-3.60)					
Model 9	0.0011	-	0.0059	0.0027	0.0044	-	-0.0064	-	-	-	1.34%
	(2.65)		(3.96)	(1.69)	(2.50)		(-2.46)				
Model 10	0.0011	-	0.0061	0.0026	0.0043	-	-	-0.0010	-	-	1.38%
	(2.78)		(4.13)	(1.60)	(2.49)			(-2.82)			
Model 11	0.0009	-	0.0048	0.0026	0.0049	-	-	-	0.0011	-	1.44%
	(2.24)		(3.12)	(1.60)	(2.73)				(6.95)		
Model 12	0.0008	-	0.0043	0.0027	0.0050	-	-	-	-	0.0048	1.89%
	(2.08)		(2.93)	(1.75)	(2.84)					(3.63)	

Table B3: Bias-Corrected Cross-Sectional Regression with Real Option Adjustment: *Full Sample*

The dependent variable is option adjusted monthly excess returns; independent variables are beta, betas of Fama-French three-factor ($Beta_{\_MKT}$, $Beta_{\_SMB}$, and $Beta_{\_HML}$), and the return anomaly variables. The regression coefficients for the sample period of 1970/07-2008/06 are first corrected using procedures described in the Internet Appendix and averaged across time. T-values (in parentheses) are computed using the Fama-MacBeth procedure and the Newey-West (1987) formula with a lag of 36. Log-transformations are applied to Size and BM. The option adjusted variables are constructed as the residuals from regressing the raw variables with independent variables of Ivol and BM (excluding ROA).

	Const.	Beta	$Beta_{\_MKT}$	$Beta_{\_SMB}$	$Beta_{\_HML}$	Ast_gw	Inv	Lret	Sue	Momt	Adj R^2
Model 1	0.0015	0.0049	-	-	-	-	-	-	-	-	1.81%
	(2.46)	(3.08)									
Model 2	0.0015	0.0057	-	-	-	-0.0056	-	-	-	-	1.98%
	(2.56)	(3.69)				(-3.27)					
Model 3	0.0015	0.0054	-	-	-	-	-0.0055	-	-	-	1.98%
	(2.53)	(3.40)					(-1.59)				
Model 4	0.0013	0.0052	-	-	-	-	-	-0.0003	-	-	1.98%
	(2.66)	(3.25)						(-0.82)			
Model 5	0.0011	0.0040	-	-	-	-	-	-	0.0021	-	2.05%
	(2.11)	(2.48)							(10.31)		
Model 6	0.0010	0.0036	-	-	-	-	-	-	-	0.0092	2.86%
	(1.95)	(2.41)								(7.99)	
Model 7	0.0007	-	0.0051	0.0022	0.0028	-	-	-	-	-	1.22%
	(2.13)		(3.30)	(1.35)	(1.67)						
Model 8	0.0008	-	0.0056	0.0023	0.0025	-0.0043	-	-	-	-	1.31%
	(2.31)		(3.79)	(1.44)	(1.51)	(-2.95)					
Model 9	0.0008	-	0.0055	0.0023	0.0025	-	-0.0048	-	-	-	1.41%
	(2.25)		(3.59)	(1.45)	(1.51)		(-1.84)				
Model 10	0.0007	-	0.0055	0.0021	0.0025	-	-	-0.0004	-	-	1.30%
	(2.26)		(3.58)	(1.28)	(1.52)			(-1.22)			
Model 11	0.0005	-	0.0042	0.0022	0.0027	-	-	-	0.0018	-	1.56%
	(1.51)		(2.62)	(1.37)	(1.68)				(10.03)		
Model 12	0.0005	-	0.0036	0.0028	0.0034	-	-	-	-	0.0060	1.81%
	(1.56)		(2.30)	(1.59)	(1.49)					(2.81)	

Table B4: Bias-Corrected Cross-Sectional Regression with Real Option Adjustment: *Subsample*

The dependent variable is option adjusted monthly excess returns; independent variables are beta, betas of Fama-French three-factor ($Beta_{\_MKT}$, $Beta_{\_SMB}$, and $Beta_{\_HML}$), and the return anomaly variables. The regression coefficients for the sample period of 1970/07-2008/06 are first corrected using procedures described in the Internet Appendix and averaged across time. T-values (in parentheses) are computed using the Fama-MacBeth procedure and the Newey-West (1987) formula with a lag of 36. Log-transformations are applied to Size and BM. The option adjusted variables are constructed as the residuals from regressing the raw variables with independent variables of BM and ROA (excluding Ivol).

	Const.	Beta	$Beta_{\_MKT}$	$Beta_{\_SMB}$	$Beta_{\_HML}$	Ast_gw	Inv	Lret	Sue	Momt	Adj R^2
Model 1	0.0021	0.0044	-	-	-	-	-	-	-	-	1.48%
	(1.73)	(2.33)									
Model 2	0.0020	0.0053	-	-	-	-0.0052	-	-	-	-	1.65%
	(1.71)	(2.76)				(-3.23)					
Model 3	0.0020	0.0051	-	-	-	-	-0.0064	-	-	-	1.65%
	(1.74)	(2.64)					(-1.74)				
Model 4	0.0019	0.0050	-	-	-	-	-	-0.0004	-	-	1.65%
	(1.77)	(2.57)						(-1.29)			
Model 5	0.0018	0.0038	-	-	-	-	-	-	0.0015	-	1.73%
	(1.57)	(1.97)							(8.02)		
Model 6	0.0014	0.0030	-	-	-	-	-	-	-	0.0087	2.64%
	(1.48)	(1.78)								(7.81)	
Model 7	0.0009	-	0.0053	0.0011	0.0028	-	-	-	-	-	0.88%
	(1.29)		(2.70)	(0.64)	(1.43)						
Model 8	0.0009	-	0.0058	0.0012	0.0026	-0.0037	-	-	-	-	0.98%
	(1.31)		(2.95)	(0.71)	(1.32)	(-2.49)					
Model 9	0.0010	-	0.0057	0.0012	0.0025	-	-0.0052	-	-	-	1.05%
	(1.41)		(2.84)	(0.76)	(1.27)		(-1.71)				
Model 10	0.0009	-	0.0059	0.0009	0.0025	-	-	-0.0006	-	-	0.99%
	(1.34)		(3.02)	(0.57)	(1.26)			(-2.07)			
Model 11	0.0007	-	0.0045	0.0012	0.0027	-	-	-	0.0012	-	1.10%
	(1.09)		(2.30)	(0.70)	(1.41)				(7.31)		
Model 12	0.0007	-	0.0057	-0.0019	-0.0024	-	-	-	-	0.0063	1.59%
	(1.13)		(2.51)	(-0.72)	(-0.49)					(2.55)	

Table B5: Bias-Corrected Cross-Sectional Regression with Real Option Adjustment: *Subsample*

The dependent variable is option adjusted monthly excess returns; independent variables are beta, betas of Fama-French three-factor (Beta_MKT, Beta_SMB, and Beta_HML), and the return anomaly variables. The regression coefficients for the sample period of 1970/07-2008/06 are first corrected using procedures described in the Internet Appendix and averaged across time. T-values (in parentheses) are computed using the Fama-MacBeth procedure and the Newey-West (1987) formula with a lag of 36. Log-transformations are applied to Size and BM. The option adjusted variables are constructed as the residuals from regressing the raw variables with independent variables of Ivol and ROA (excluding BM).

	Const.	Beta	Beta_MKT	Beta_SMB	Beta_HML	Ast_gw	Inv	Lret	Sue	Momt	Adj R^2
Model 1	0.0015	0.0071	-	-	-	-	-	-	-	-	1.26%
	(1.73)	(3.91)									
Model 2	0.0014	0.0084	-	-	-	-0.0083	-	-	-	-	1.54%
	(1.55)	(4.50)				(-3.56)					
Model 3	0.0014	0.0081	-	-	-	-	-0.0098	-	-	-	1.48%
	(1.63)	(4.17)					(-2.24)				
Model 4	0.0012	0.0083	-	-	-	-	-	-0.0013	-	-	1.48%
	(1.51)	(4.48)						(-2.70)			
Model 5	0.0014	0.0063	-	-	-	-	-	-	0.0012	-	1.52%
	(1.75)	(3.40)							(6.86)		
Model 6	0.0014	0.0053	-	-	-	-	-	-	-	0.0087	2.30%
	(1.88)	(3.21)								(8.02)	
Model 7	0.0001	-	0.0068	0.0028	0.0044	-	-	-	-	-	0.65%
	(0.15)		(3.24)	(1.55)	(1.96)						
Model 8	0.0000	-	0.0076	0.0029	0.0039	-0.0052	-	-	-	-	0.73%
	(0.09)		(3.52)	(1.63)	(1.75)	(-3.64)					
Model 9	0.0001	-	0.0074	0.0030	0.0039	-	-0.0064	-	-	-	0.76%
	(0.16)		(3.38)	(1.67)	(1.76)		(-2.06)				
Model 10	0.0000	-	0.0077	0.0029	0.0038	-	-	-0.0009	-	-	0.84%
	(0.10)		(3.55)	(1.64)	(1.78)			(-3.50)			
Model 11	0.0000	-	0.0062	0.0028	0.0044	-	-	-	0.0010	-	0.84%
	(0.03)		(2.84)	(1.57)	(2.00)				(5.03)		
Model 12	0.0001	-	0.0052	0.0031	0.0049	-	-	-	-	0.0052	1.50%
	(0.20)		(2.53)	(1.77)	(2.22)					(3.85)	

Table B6: Bias-Corrected Cross-Sectional Regression with Real Option Adjustment: *Subsample*

The dependent variable is option adjusted monthly excess returns; independent variables are beta, betas of Fama-French three-factor ($Beta_{\_MKT}$, $Beta_{\_SMB}$, and $Beta_{\_HML}$), and the return anomaly variables. The regression coefficients for the sample period of 1970/07-2008/06 are first corrected using procedures described in the Internet Appendix and averaged across time. T-values (in parentheses) are computed using the Fama-MacBeth procedure and the Newey-West (1987) formula with a lag of 36. Log-transformations are applied to Size and BM. The option adjusted variables are constructed as the residuals from regressing the raw variables with independent variables of Ivol and BM (excluding ROA).

	Const.	Beta	$Beta_{\_MKT}$	$Beta_{\_SMB}$	$Beta_{\_HML}$	Ast_gw	Inv	Lret	Sue	Momt	Adj R^2
Model 1	0.0009	0.0061	-	-	-	-	-	-	-	-	1.69%
	(1.66)	(3.50)									
Model 2	0.0009	0.0070	-	-	-	-0.0053	-	-	-	-	1.85%
	(1.62)	(4.04)				(-3.16)					
Model 3	0.0009	0.0068	-	-	-	-	-0.0055	-	-	-	1.81%
	(1.65)	(3.74)					(-1.43)				
Model 4	0.0008	0.0066	-	-	-	-	-	-0.0003	-	-	1.81%
	(1.65)	(3.67)						(-0.81)			
Model 5	0.0007	0.0051	-	-	-	-	-	-	0.0019	-	1.96%
	(1.45)	(2.83)							(9.13)		
Model 6	0.0006	0.0044	-	-	-	-	-	-	-	0.0095	2.70%
	(1.31)	(2.75)								(8.57)	
Model 7	0.0003	-	0.0060	0.0023	0.0022	-	-	-	-	-	0.88%
	(0.88)		(3.21)	(1.30)	(1.10)						
Model 8	0.0003	-	0.0066	0.0024	0.0020	-0.0038	-	-	-	-	1.01%
	(0.91)		(3.51)	(1.40)	(0.98)	(-2.86)					
Model 9	0.0003	-	0.0064	0.0025	0.0019	-	-0.0044	-	-	-	0.97%
	(0.99)		(3.34)	(1.42)	(0.94)		(-1.47)				
Model 10	0.0002	-	0.0065	0.0022	0.0018	-	-	-0.0004	-	-	1.01%
	(0.85)		(3.47)	(1.26)	(0.91)			(-1.28)			
Model 11	0.0001	-	0.0050	0.0023	0.0021	-	-	-	0.0017	-	1.15%
	(0.45)		(2.62)	(1.32)	(1.08)				(8.20)		
Model 12	0.0001	-	0.0052	0.0013	-0.0013	-	-	-	-	0.0100	1.41%
	(0.32)		(3.16)	(0.70)	(-0.38)					(5.11)	