Online Appendix

A. Replication using Trace Data

We replicate the results provided in Table 1 through 5 of the main text using bond transaction data reported in the TRACE. For each firm in each month, we estimate public debt returns using value-weighted averages of bond returns available TRACE. We first construct daily prices using volume-weighted transaction prices and calculate monthly bond returns using the most recent prices available within one week from month ends. Private debt returns are estimated using the public debt returns from the TRACE, following the procedure outlined in the paper. The sample period is from 2003 through 2012.

B. Replication using LSTA Loan Pricing Data

For the sample period from 1999 to 2004, we use loan data available in the LSTA loan pricing service to construct asset returns. Public debt return data are obtained from the Reuters Fixed Income Database as described in the text. We group firms into three leverage buckets instead of five, since the number of observation in the loan data is rather small.

C. Replication using the KMV Methodology

In this appendix, we replicate our main tables using asset returns constructed following Bharath and Shumway (2008). We replicate Table 1 through 5 of the main text. The sample period is from 1980 to 2012. We only include firm-month observations for which the iterative method converges and also asset return data are available in the main sample.

D. Replication using the naïve approach

In this approach, we construct asset returns by assuming that the market values of debt are the same as their book values and returns on debt are the same as one-month T-bill rate. We replicate Table 1 through 5 of the main text. The sample period is from 1980 to 2012. We only include firm-month observation with available asset return in the main sample.

E. Long Maturity Implied Volatility

We provide the sample summary statistics for long maturity implied volatility in Table E.1 and also the regression and variance decomposition of long maturity implied volatility in Table E.2.

F. Variance Decomposition of Equity Volatility Differences

In Table F, we examine how much of the variation in the difference between implied and EGARCH volatility $\sigma_{Implied} - \sigma_{EGARCH}$ is driven by the difference between implied and realized volatility $\sigma_{Implied} - \sigma_{Realized}$ and the difference between realized and EGARCH volatility $\sigma_{Realized} - \sigma_{EGARCH}$, using a variance decomposition.

G. Test of the CAPM for Equity and Asset Portfolio Returns

Table G provides the full estimation results for all decile portfolios in Table 7 of the main text.

References

Bharath, S.T., and Shumway, T., 2008, “Forecasting Default with the Merton Distance to Default Model”, *Review of Financial Studies* 21, 1339-1369.

Table A.1: Summary Statistics

The sample includes nonfinancial firms with asset returns constructed using TRACE data available from 2003 to 2012 and is restricted to firms with at least 12 contiguous observations and with at least $100 million in market assets. For each year, we sort firms into five leverage buckets (from zero leverage to high leverage) based on the market-assets-to-market-equity ratio at the end of the previous year. *# of Firms* is the number of firms that have been allocated in each leverage bucket. Because the sorting is performed for each year, a firm can be allocated to multiple buckets in different years. *A/E* is the cross-sectional average of market assets to market equity within each bucket. *Mkt. Cap.*is the cross-sectional average of market capitalizations of firms' equity in millions of dollars. *Average return* is the cross-sectional average of monthly excess returns within each leverage bucket. *Beta* is regression coefficients of monthly returns with respect to the CRSP value-weighted returns for each leverage bucket. *Volatility* is the cross-sectional average of standard deviation of monthly excess returns. *Skewness* and *Kurtosis* are cross-sectional averages for firms' skewness and kurtosis measures of monthly excess returns.

				Average Return		Beta		Volatility		Skewness		Kurtosis	
Leverage Quintile	# of Firms	A/E	Mkt. Cap.	Equity	Asset	Equity	Asset	Equity	Asset	Equity	Asset	Equity	Asset
Zero	1514	1.00	1366.2	1.20%	1.20%	1.30	1.30	16.4%	16.4%	0.56	0.56	2.29	2.29
1	399	1.14	18430.5	0.72%	0.68%	1.05	0.93	9.8%	8.8%	0.02	-0.01	0.71	0.69
2	499	1.31	10629.9	0.77%	0.67%	1.21	0.95	10.8%	8.5%	0.07	0.01	0.76	0.69
3	505	1.60	6444.3	0.89%	0.66%	1.41	0.93	11.7%	7.9%	0.13	0.00	0.92	0.71
High	383	3.15	3753.5	1.06%	0.54%	1.76	0.81	16.0%	7.1%	0.44	0.04	2.25	1.55

Table A.2: Pooled Regression of Equity Implied Volatility: Full Sample Analysis

The sample includes firms with both asset returns data detailed in Table A.1 and option implied volatility data from Optionmetrics available for the period from 2003 to 2012. Using monthly data, we perform a pooled regression of log implied volatility on either log leverage or log Black-Scholes adjusted leverage and log asset volatility. The implied volatility $\sigma_{E,t+1}$ is one-month maturity at-the-money standardized call option volatility known at time *t*; leverage *A/E* is the market-assets-to-equity ratio at time *t*; the Black-Scholes adjusted leverage $\frac{A}{E}N(d_1)$ is the market-assets-to-equity ratio multiplied by the delta; and the asset volatility $\sigma_{A,t+1}$ is the conditional volatility of time *t+1* asset return (R_{t+1}^{asset}) estimated using the EGARCH as in Table 5. The Black-Scholes delta $N(d_1)$ is calculated using one-year treasury yield, asset volatility from the EGARCH, and average time-to-maturity of debt weighted by face values. The numbers in parenthesis are Newey-West robust standard errors with 12 month lags.

Pooled Regression of Equity Implied Voltility

Intercept	$\frac{A}{E}$	$\frac{A}{E}N(d_1)$	σ_A	R^2	N
-0.89	-0.02			0.0%	70,093
(0.01)	(0.02)				
-0.88		-0.10		0.5%	70,093
(0.01)		(0.02)			
-0.26			0.58	46.5%	70,093
(0.01)			(0.01)		
-0.19	0.53		0.75	59.3%	70,093
(0.01)	(0.01)		(0.01)		
-0.19		0.53	0.75	57.0%	70,093
(0.01)		(0.02)	(0.01)		

Table A.3: Determinants of Equity Volatility: Leverage and Asset Volatility

The sample includes firms with both asset returns data detailed in Table A.1 and option implied volatility data from Optionmetrics available for the period from 2003 to 2012. For each leverage quintile bucket, we perform a pooled regression of log implied volatility on log leverage and log asset volatility (in both level and difference):

$$\log \sigma_{E,t+1} = b_1 \log \frac{A_t}{E_t} + b_2 \log \sigma_{A,t+1} + \varepsilon_t$$

$$\Delta \log \sigma_{E,t+1} = c_1 \Delta \log \frac{A_t}{E_t} + c_2 \Delta \log \sigma_{A,t+1} + \varepsilon_t$$

The implied volatility $\sigma_{E,t+1}$ is one-month maturity at-the-money standardized call option volatility known at time *t*; leverage *A/E* is the market-assets-to-equity ratio at time *t*; and the asset volatility $\sigma_{A,t+1}$ is the conditional volatility of time $t+1$ asset returns estimated using the EGARCH as in Table A.5. The regression is performed both in level (Panel A) and difference (Panel B). The leverage buckets are formed each year based on the market-asset-to-market-equity ratios available at the end of the previous year. The reported estimates are from the pooled OLS regressions. We also perform variance decompositions of equity implied volatility using the regression coefficients from the pooled regressions for both levels and differences:

$$Var(\log \sigma_{E,t+1}) = Cov(\log \sigma_{E,t+1}, b_1 \log \frac{A_t}{E_t}) + Cov(\log \sigma_{E,t+1}, b_2 \log \sigma_{A,t+1})$$

$$Var(\Delta \log \sigma_{E,t+1}) = Cov(\Delta \log \sigma_{E,t+1}, c_1 \Delta \log \frac{A_t}{E_t}) + Cov(\Delta \log \sigma_{E,t+1}, c_2 \log \Delta \sigma_{A,t+1})$$

The reported variance decompositions are fractions out of the explained portion of equity volatility. The numbers in parentheses are Newey–West standard errors.

Table A.4 (Continued)

Panel A: Level

	Regression					Variance Decomposition	
Leverage Quintile	Intercept	A/E	σ_A	N	R^2	A/E	σ_A
Zero Leverage	-0.24		0.66	32,679	36.0%	0.0%	100.0%
	(0.01)		(0.02)				
1	-0.23	1.25	0.82	7,831	56.0%	8.7%	91.3%
	(0.04)	(0.11)	(0.03)				
2	-0.39	1.12	0.74	7,445	58.6%	14.7%	85.3%
	(0.03)	(0.06)	(0.02)				
3	-0.38	0.90	0.74	8,192	66.2%	18.2%	81.8%
	(0.03)	(0.04)	(0.01)				
High Leverage	-0.09	0.47	0.77	7,257	70.9%	32.3%	67.7%
	(0.04)	(0.02)	(0.02)				

Panel B: Difference

	Regression					Variance Decomposition	
Leverage Quintile	Intercept	A/E	σ_A	N	R^2	A/E	σ_A
Zero Leverage	-0.01		0.64	31,721	3.6%	0.0%	100.0%
	(0.00)		(0.02)				
1	0.00	1.18	0.59	7,066	14.6%	19.9%	80.1%
	(0.00)	(0.14)	(0.03)				
2	0.00	0.73	0.51	6,778	12.8%	26.8%	73.2%
	(0.00)	(0.09)	(0.03)				
3	0.00	0.67	0.47	7,485	14.1%	41.2%	58.8%
	(0.00)	(0.05)	(0.03)				
High Leverage	0.00	0.28	0.53	6,631	11.1%	31.1%	68.9%
	(0.00)	(0.04)	(0.04)				

Table A.4: EGARCH Volatility Estimation for Equity and Asset Returns

The sample includes firms with asset returns available from 2003 to 2012, as detailed in Table A.1. We perform stacked estimations for the EGARCH(1,1) model in equation (4) by normalizing returns using each firm's unconditional volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage quintile buckets are formed each year based on the market-asset-to-market-equity ratios available at the end of the previous year. α is the ARCH coefficient, β is the GARCH coefficient, and γ the asymmetry coefficient in the EGARCH(1,1) model. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

Leverage		Equity Volatility Estimates			Asset Volatility Estimates			H_0	
Quintiles	Obs.	α	β	γ	α	β	γ	$\beta_E = \beta_A$	$\gamma_E = \gamma_A$
Zero	66,975	0.18	0.78	-0.71	0.18	0.78	-0.71		
		(0.02)	(0.03)	(0.09)	(0.02)	(0.03)	(0.09)		
1	9,713	0.18	0.79	-0.80	0.14	0.73	-0.65	3.43	2.91
		(0.02)	(0.02)	(0.09)	(0.02)	(0.03)	(0.14)	[0.06]	[0.09]
2	10,101	0.16	0.77	-1.08	0.20	0.72	-0.62	4.26	9.64
		(0.02)	(0.02)	(0.12)	(0.02)	(0.02)	(0.07)	[0.04]	[0.00]
3	10,866	0.23	0.81	-0.69	0.21	0.73	-0.56	5.25	2.86
		(0.02)	(0.01)	(0.06)	(0.01)	(0.01)	(0.05)	[0.02]	[0.09]
High	10,771	0.25	0.88	-0.65	0.18	0.76	-0.37	16.22	6.89
		(0.01)	(0.01)	(0.04)	(0.01)	(0.01)	(0.03)	[0.00]	[0.01]

Table A.5A: EGARCH Idiosyncratic Volatility Estimation for Equity and Asset Returns

The sample includes firms with asset returns available from 1980 to 2012, as detailed in Table A.1. Idiosyncratic returns are first estimated for both asset and equity returns using the Fama-French three-factor model and idiosyncratic volatilities are estimated using the EGARCH(1,1) model. We perform stacked estimations for the EGARCH(1,1) model by normalizing idiosyncratic returns using each firm's unconditional idiosyncratic volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage quintile buckets are formed for each year based on the market-asset-to-market-equity ratios available at the end of the previous year. α is the ARCH coefficient, β is the GARCH coefficient, and γ is the asymmetry coefficient. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

Leverage		Equity Volatility Estimates			Asset Volatility Estimates			H_0	
Quintiles	Obs.	α	β	γ	α	β	γ	$\beta_E = \beta_A$	$\gamma_E = \gamma_A$
Zero	66,975	0.09	0.70	-0.34	0.09	0.70	-0.34		
		(0.01)	(0.03)	(0.05)	(0.01)	(0.03)	(0.05)		
1	9,713	0.13	0.87	-0.18	0.15	0.69	-0.13	4.88	2.13
		(0.01)	(0.02)	(0.07)	(0.02)	(0.05)	(0.07)	[0.03]	[0.14]
2	10,101	0.18	0.75	-0.27	0.17	0.71	-0.14	3.49	2.54
		(0.02)	(0.04)	(0.06)	(0.02)	(0.03)	(0.06)	[0.06]	[0.11]
3	10,866	0.22	0.79	-0.30	0.21	0.72	-0.22	4.37	3.82
		(0.02)	(0.02)	(0.05)	(0.02)	(0.02)	(0.05)	[0.04]	[0.05]
High	10,771	0.30	0.85	-0.36	0.17	0.75	-0.13	7.73	4.02
		(0.02)	(0.01)	(0.03)	(0.03)	(0.05)	(0.09)	[0.01]	[0.04]

Table A.5B: EGARCH Idiosyncratic Volatility Estimation with Operating Leverage

The sample includes firms with asset returns available from 2003 through 2012, as detailed in Table A.1. We estimate idiosyncratic volatilities using the following specification:

$$\log \sigma_{t+1}^2 = c + \alpha \left(\left| \varepsilon_t \right| - E \left| \varepsilon_t \right| + (\gamma_0 + \gamma_1 f_t) \varepsilon_t \right) + \beta \log \sigma_t^2$$

where ε_t is idiosyncratic return estimated from the Fama-French three-factor model and f_t is firms' operating leverage estimated using quarterly Compustat data as SG&A costs divided by SG&A costs plus costs of goods sold, *XSGAQ/(XSGAQ+COGSQ)*. We perform stacked estimations for idiosyncratic volatilities by normalizing idiosyncratic returns using each firm's unconditional idiosyncratic volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage quintile buckets are formed for each year based on the market-asset-to-market-equity ratios available at the end of the previous year. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ_0 coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

Leverage		Equity Volatility Estimates				Asset Volatility Estimates				H_0	
Quintiles	Obs.	α	β	γ_0	γ_1	α	β	γ_0	γ_1	$\beta_E = \beta_A$	$\gamma_{0E} = \gamma_{0A}$
Zero	57,284	0.09	0.73	-0.09	-0.19	0.09	0.73	-0.09	-0.19		
		(0.01)	(0.03)	(0.11)	(0.19)	(0.01)	(0.03)	(0.11)	(0.19)		
1	9,269	0.13	0.87	0.08	-0.50	0.13	0.82	0.14	-0.63	5.80	3.10
		(0.02)	(0.02)	(0.12)	(0.28)	(0.01)	(0.02)	(0.12)	(0.27)	[0.02]	[0.08]
2	9,201	0.17	0.74	-0.21	0.07	0.14	0.71	-0.11	-0.01	2.99	4.14
		(0.02)	(0.04)	(0.11)	(0.32)	(0.02)	(0.05)	(0.16)	(0.50)	[0.08]	[0.04]
3	9,392	0.22	0.74	-0.22	-0.24	0.17	0.70	-0.01	-0.33	3.76	5.50
		(0.02)	(0.03)	(0.08)	(0.27)	(0.02)	(0.04)	(0.10)	(0.34)	[0.05]	[0.02]
High	8,345	0.32	0.86	-0.42	0.27	0.20	0.74	-0.12	0.11	7.94	4.01
		(0.02)	(0.01)	(0.06)	(0.22)	(0.02)	(0.02)	(0.09)	(0.31)	[0.00]	[0.05]

Table A.6: Time-Series Properties of Leverage and Volatility

The sample includes nonfinancial firms with asset return data available from 2003 to 2012. Panel A provides standard deviations of log leverage (market assets to market equity ratio) and log asset volatility estimated using the EGARCH for five leverage buckets. We estimate the standard deviations of log leverage and asset volatilities both in levels and differences, and report averages of the firm-by-firm standard deviations within each leverage bucket. The leverage buckets are formed for each year based on leverage at the end of the previous year. Panel B provides autocorrelograms of log leverage, log asset volatility, log implied volatility, and log structural equity volatility for the 1-, 3-, 6-, and 12-month lags. The sample is further restricted to firms with at least 12 months of implied volatility observations. The implied volatility is the one-month at-the-money call option volatility obtained from Optionmetrics. The structural equity volatility is obtained from the first equation in (5) using leverage, the EGARCH asset volatility, and the regression coefficients in Table 4. The reported numbers are estimated from the pooled sample of firms within each leverage bucket.

Panel A: Standard Deviation

	Level		Difference	
Leverage Quintile	A/E	σ_A	A/E	σ_A
Zero leverage	0.00	0.10	0.00	0.07
1	0.05	0.10	0.03	0.09
2	0.07	0.08	0.05	0.09
3	0.12	0.08	0.07	0.08
High Leverage	0.24	0.11	0.11	0.09

Panel B: Autocorrelogram

Log Asset-to-Equity					Log Asset Volatility				
Leverage	Lags				Leverage	Lags			
Quartile	1	3	6	12	Quartile	1	3	6	12
1	0.89	0.72	0.54	0.39	1	0.69	0.35	0.07	-0.05
2	0.85	0.67	0.47	0.22	2	0.63	0.24	0.03	-0.03
3	0.89	0.71	0.46	0.26	3	0.70	0.33	0.12	0.00
High Leverage	0.92	0.79	0.59	0.30	High Leverage	0.77	0.48	0.21	-0.02
Log Implied Volatility					**Log Structural Equity Volatility**				
Leverage	Lags				Leverage	Lags			
Quartile	1	3	6	12	Quartile	1	3	6	12
1	0.75	0.57	0.35	0.12	1	0.75	0.44	0.16	0.04
2	0.75	0.55	0.34	0.17	2	0.74	0.44	0.19	0.02
3	0.77	0.58	0.39	0.21	3	0.80	0.53	0.26	0.08
High Leverage	0.77	0.60	0.40	0.15	High Leverage	0.86	0.63	0.35	0.08

Table B.1: Summary Statistics

The sample includes nonfinancial firms with asset returns constructed using LSTA loan pricing from 1999 to 2004 and is restricted to firms with at least 12 contiguous observations and with at least $100 million of book assets. For each year, we sort firms into five leverage buckets (from zero leverage to high leverage) based on the market-assets-to-market-equity ratio at the end of the previous year. *# of Firms* is the number of firms that have been allocated in each leverage bucket. Because the sorting is performed for each year, a firm can be allocated to multiple buckets in different years. *A/E* is the cross-sectional average of market assets to market equity within each bucket. *Mkt. Cap.*is the cross-sectional average of market capitalizations of firms' equity in millions of dollars. *Average return* is the cross-sectional average of monthly excess returns within each leverage bucket. *Beta* is regression coefficients of monthly returns with respect to the CRSP value-weighted returns for each leverage bucket. *Volatility* is the cross-sectional average of standard deviation of monthly excess returns. *Skewness* and *Kurtosis* are cross-sectional averages for firms' skewness and kurtosis measures of monthly excess returns.

				Average Return		Beta		Volatility		Skewness		Kurtosis	
Leverage Quintile	# of Firms	A/E	Mkt. Cap.	Equity	Asset	Equity	Asset	Equity	Asset	Equity	Asset	Equity	Asset
Zero	1157	1.00	1378.8	1.98%	1.98%	1.84	1.84	22.1%	22.1%	0.60	0.60	1.70	1.70
1	138	1.71	4993.7	0.57%	0.35%	1.09	0.76	14.7%	10.3%	0.09	-0.08	0.87	0.71
High	102	4.68	1459.8	1.52%	0.81%	1.47	0.50	19.2%	6.8%	0.46	0.01	1.58	1.38

Table B.2: Pooled Regression of Equity Implied Volatility: Full Sample Analysis

The sample includes firms with both asset returns data detailed in Table B.1 and option implied volatility data from Optionmetrics available for the period from 1999 through 2004. Using monthly data, we perform a pooled regression of log implied volatility on either log leverage or log Black-Scholes adjusted leverage and log asset volatility. The implied volatility $\sigma_{E,t+1}$ is one-month maturity at-the-money standardized call option volatility known at time *t*; leverage *A/E* is the market-assets-to-equity ratio at time *t*; the Black-Scholes adjusted leverage $\frac{A}{E}N(d_1)$ is the market-assets-to-equity ratio multiplied by the delta; and the asset volatility $\sigma_{A,t+1}$ is the conditional volatility of time *t+1* asset return (R_{t+1}^{asset}) estimated using the EGARCH as in Table 5. The Black-Scholes delta $N(d_1)$ is calculated using one-year treasury yield, asset volatility from the EGARCH, and average time-to-maturity of debt weighted by face values. The numbers in parenthesis are Newey-West robust standard errors with 12 month lags.

Pooled Regression of Equity Implied Voltility

Intercept	$\frac{A}{E}$	$\frac{A}{E}N(d_1)$	σ_A	R^2	N
-0.51	-0.14			1.6%	18,729
(0.01)	(0.03)				
-0.50		-0.19		2.5%	18,729
(0.01)		(0.03)			
-0.23			0.48	44.0%	18,729
(0.01)			(0.01)		
-0.18	0.51		0.70	57.8%	18,729
(0.01)	(0.02)		(0.01)		
-0.18		0.59	0.71	57.6%	18,729
(0.01)		(0.02)	(0.01)		

Table B.3: Determinants of Equity Volatility: Leverage and Asset Volatility

The sample includes firms with both asset returns data detailed in Table B.1 and option implied volatility data from Optionmetrics available for the period from 1999 through 2004. For each leverage bucket, we perform a pooled regression of log implied volatility on log leverage and log asset volatility (in both level and difference):

$$\log \sigma_{E,t+1} = b_1 \log \frac{A_t}{E_t} + b_2 \log \sigma_{A,t+1} + \varepsilon_t$$

$$\Delta \log \sigma_{E,t+1} = c_1 \Delta \log \frac{A_t}{E_t} + c_2 \Delta \log \sigma_{A,t+1} + \varepsilon_t$$

The implied volatility $\sigma_{E,t+1}$ is one-month maturity at-the-money standardized call option volatility known at time *t*; leverage *A/E* is the market-assets-to-equity ratio at time *t*; and the asset volatility $\sigma_{A,t+1}$ is the conditional volatility of time $t+1$ asset returns estimated using the EGARCH as in Table 5. The regression is performed both in level (Panel A) and difference (Panel B). The leverage buckets are formed each year based on the market-asset-to-market-equity ratios available at the end of the previous year. The reported estimates are from the pooled OLS regressions. We also perform variance decompositions of equity implied volatility using the regression coefficients from the pooled regressions for both levels and differences:

$$Var(\log \sigma_{E,t+1}) = Cov(\log \sigma_{E,t+1}, b_1 \log \frac{A_t}{E_t}) + Cov(\log \sigma_{E,t+1}, b_2 \log \sigma_{A,t+1})$$

$$Var(\Delta \log \sigma_{E,t+1}) = Cov(\Delta \log \sigma_{E,t+1}, c_1 \Delta \log \frac{A_t}{E_t}) + Cov(\Delta \log \sigma_{E,t+1}, c_2 \log \Delta \sigma_{A,t+1})$$

The reported variance decompositions are fractions out of the explained portion of equity volatility. The numbers in parentheses are Newey–West standard errors.

Table B.4 (Continued)

Panel A: Level

	Regression					Variance Decomposition	
Leverage Quintile	Intercept	A/E	σ_A	N	R^2	A/E	σ_A
Zero Leverage	-0.17		0.74	13,247	54.2%	0.0%	100.0%
	(0.01)		(0.02)				
1	-0.25	0.58	0.68	1,959	53.5%	19.2%	80.8%
	(0.06)	(0.06)	(0.04)				
High Leverage	-0.04	0.40	0.77	2,394	70.7%	36.9%	63.1%
	(0.07)	(0.03)	(0.03)				

Panel B: Difference

	Regression					Variance Decomposition	
Leverage Quintile	Intercept	A/E	σ_A	N	R^2	A/E	σ_A
Zero Leverage	-0.01		0.80	12,756	8.2%	0.0%	100.0%
	(0.00)		(0.04)				
1	-0.01	0.55	0.87	1,890	19.3%	32.6%	67.4%
	(0.00)	(0.09)	(0.13)				
High Leverage	-0.01	0.32	0.42	1,516	15.8%	40.5%	59.5%
	(0.00)	(0.06)	(0.06)				

Table B.4: EGARCH Volatility Estimation for Equity and Asset Returns

The sample includes firms with asset returns available from 1999 through 2004, as detailed in Table B.1. We perform stacked estimations for the EGARCH(1,1) model in equation (4) by normalizing returns using each firm's unconditional volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage buckets are formed each year based on the market-asset-to-market-equity ratios available at the end of the previous year. α is the ARCH coefficient, β is the GARCH coefficient, and γ the asymmetry coefficient in the EGARCH(1,1) model. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

		Equity Volatility Estimates			Asset Volatility Estimates			H_0	
Leverage Quintiles	*N*	α	β	γ	α	β	γ	$\beta_E = \beta_A$	$\gamma_E = \gamma_A$
Zero Leverage	35,488	0.17	0.74	-0.41	0.17	0.74	-0.41		
		(0.01)	(0.02)	(0.03)	(0.01)	(0.02)	(0.03)		
1	2,966	0.10	0.82	-1.42	0.11	0.73	-0.96	5.75	1.71
		(0.02)	(0.03)	(0.35)	(0.03)	(0.06)	(0.30)	[0.02]	[0.19]
High	2,700	0.20	0.83	-1.01	0.17	0.76	-0.95	4.96	3.57
		(0.03)	(0.02)	(0.14)	(0.03)	(0.04)	(0.18)	[0.03]	[0.06]

Table B.5A: EGARCH Idiosyncratic Volatility Estimation for Equity and Asset Returns

The sample includes firms with asset returns available from 1999 through 2004, as detailed in Table B.1. Idiosyncratic returns are first estimated for both asset and equity returns using the Fama-French three-factor model and idiosyncratic volatilities are estimated using the EGARCH(1,1) model. We perform stacked estimations for the EGARCH(1,1) model by normalizing idiosyncratic returns using each firm's unconditional idiosyncratic volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage buckets are formed for each year based on the market-asset-to-market-equity ratios available at the end of the previous year. α is the ARCH coefficient, β is the GARCH coefficient, and γ is the asymmetry coefficient. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

Leverage		Equity Volatility Estimates			Asset Volatility Estimates			H_0	
Quintiles	Obs.	α	β	γ	α	β	γ	$\beta_E = \beta_A$	$\gamma_E = \gamma_A$
Zero	35,488	0.15	0.35	-0.28	0.15	0.35	-0.28		
		(0.01)	(0.08)	(0.05)	(0.01)	(0.08)	(0.05)		
1	2,966	0.08	0.75	-0.92	0.05	0.65	-0.56	3.50	1.08
		(0.03)	(0.10)	(0.42)	(0.04)	(0.17)	(0.48)	[0.06]	[0.30]
High	2,700	0.14	0.83	-1.07	0.07	0.79	-0.89	4.14	3.57
		(0.03)	(0.03)	(0.16)	(0.04)	(0.06)	(0.22)	[0.04]	[0.06]

Table B.5B: EGARCH Idiosyncratic Volatility Estimation with Operating Leverage

The sample includes firms with asset returns available from 1999 through 2004, as detailed in Table B.1. We estimate idiosyncratic volatilities using the following specification:

$$\log \sigma_{t+1}^2 = c + \alpha\left(\left|\varepsilon_t\right| - E\left|\varepsilon_t\right| + (\gamma_0 + \gamma_1 f_t)\varepsilon_t\right) + \beta \log \sigma_t^2$$

where ε_t is idiosyncratic return estimated from the Fama-French three-factor model and f_t is firms' operating leverage estimated using quarterly Compustat data as SG&A costs divided by SG&A costs plus costs of goods sold, *XSGAQ/(XSGAQ+COGSQ)*. We perform stacked estimations for idiosyncratic volatilities by normalizing idiosyncratic returns using each firm's unconditional idiosyncratic volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage buckets are formed for each year based on the market-asset-to-market-equity ratios available at the end of the previous year. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ_0 coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

Leverage		Equity Volatility Estimates				Asset Volatility Estimates				H_0	
Quintiles	Obs.	α	β	γ_0	γ_1	α	β	γ_0	γ_1	$\beta_E = \beta_A$	$\gamma_{0E} = \gamma_{0A}$
Zero	27,415	0.15	0.39	-0.12	-0.17	0.15	0.38	-0.12	-0.17		
		(0.01)	(0.09)	(0.13)	(0.21)	(0.01)	(0.09)	(0.13)	(0.21)		
1	2,571	0.08	0.73	-0.87	-1.63	0.05	0.52	-0.39	-3.06	5.24	1.77
		(0.03)	(0.08)	(0.70)	(1.56)	(0.04)	(0.18)	(0.88)	(2.99)	[0.02]	[0.18]
High	2,264	0.11	0.84	-1.32	1.41	0.05	0.80	-1.45	2.21	2.31	4.33
		(0.04)	(0.05)	(0.54)	(1.15)	(0.06)	(0.12)	(2.47)	(3.47)	[0.13]	[0.04]

Table B.6: Time-Series Properties of Leverage and Volatility

The sample includes nonfinancial firms with asset return data available from 1999 through 2004. Panel A provides standard deviations of log leverage (market assets to market equity ratio) and log asset volatility estimated using the EGARCH for five leverage buckets. We estimate the standard deviations of log leverage and asset volatilities both in levels and differences, and report averages of the firm-by-firm standard deviations within each leverage bucket. The leverage buckets are formed for each year based on leverage at the end of the previous year. Panel B provides autocorrelograms of log leverage, log asset volatility, log implied volatility, and log structural equity volatility for the 1-, 3-, 6-, and 12-month lags. The sample is further restricted to firms with at least 12 months of implied volatility observations. The implied volatility is the one-month at-the-money call option volatility obtained from Optionmetrics. The structural equity volatility is obtained from the first equation in (5) using leverage, the EGARCH asset volatility, and the regression coefficients in Table 4. The reported numbers are estimated from the pooled sample of firms within each leverage bucket.

Panel A: Standard Deviation

	Level		Difference	
Leverage Quintile	A/E	σ_A	A/E	σ_A
Zero leverage	0.00	0.08	0.00	0.06
1	0.12	0.07	0.06	0.08
High Leverage	0.22	0.14	0.11	0.11

Panel B: Autocorrelogram

Log Asset-to-Equity					Log Asset Volatility				
Leverage Quartile	Lags 1	3	6	12	Leverage Quartile	Lags 1	3	6	12
1	0.90	0.74	0.55	0.16	1	0.54	0.17	-0.01	-0.07
High Leverage	0.89	0.72	0.48	0.14	High Leverage	0.73	0.36	0.04	-0.11
Log Implied Volatility					**Log Structural Equity Volatility**				
Leverage Quartile	Lags 1	3	6	12	Leverage Quartile	Lags 1	3	6	12
1	0.72	0.49	0.33	0.16	1	0.78	0.49	0.24	-0.08
High Leverage	0.75	0.56	0.31	0.05	High Leverage	0.79	0.49	0.21	0.01

Table C.1: Summary Statistics

The sample includes nonfinancial firms with asset return data generated following the approach of Bharath and Shumway (2008). The sample is from 1980 to 2012 and is restricted to firms with at least 12 contiguous observations and with at least $100 million of book assets. For each year, we sort firms into five leverage buckets (from zero leverage to high leverage) based on the market-assets-to-market-equity ratio at the end of the previous year. *# of Firms* is the number of firms that have been allocated in each leverage bucket. Because the sorting is performed for each year, a firm can be allocated to multiple buckets in different years. *A/E* is the cross-sectional average of market assets to market equity within each bucket. *Mkt. Cap.*is the cross-sectional average of market capitalizations of firms' equity in millions of dollars. *Average return* is the cross-sectional average of monthly excess returns within each leverage bucket. *Beta* is regression coefficients of monthly returns with respect to the CRSP value-weighted returns for each leverage bucket. *Volatility* is the cross-sectional average of standard deviation of monthly excess returns. *Skewness* and *Kurtosis* are cross-sectional averages for firms' skewness and kurtosis measures of monthly excess returns.

Panel A: Sample Summary Statistics for Leverage

				Average Return		Beta		Volatility		Skewness		Kurtosis	
Leverage Quintile	# of Firms	A/E	Mkt. Cap.	Equity	Asset	Equity	Asset	Equity	Asset	Equity	Asset	Equity	Asset
Zero	2384	1.00	1028.2	1.05%	1.05%	1.41	1.41	18.6%	18.6%	0.59	0.59	2.31	2.31
1	1328	1.14	6576.9	0.52%	0.53%	1.15	1.02	13.3%	11.9%	0.17	0.13	1.15	1.04
2	1673	1.27	3970.2	0.64%	0.59%	1.05	0.82	12.6%	10.2%	0.23	0.14	1.31	1.08
3	1672	1.50	2488.6	0.68%	0.49%	1.05	0.70	13.6%	9.4%	0.27	0.16	1.39	1.10
High	1351	3.01	1366.0	0.80%	0.24%	1.24	0.53	18.4%	8.2%	0.61	0.27	2.94	1.72

Table C.2: Pooled Regression of Equity Implied Volatility: Full Sample Analysis

The sample includes firms with both asset returns data detailed in Table C.1 and option implied volatility data from Optionmetrics available for the period from 1996 to 2012. Using monthly data, we perform a pooled regression of log implied volatility on either log leverage or log Black-Scholes adjusted leverage and log asset volatility. The implied volatility $\sigma_{E,t+1}$ is one-month maturity at-the-money standardized call option volatility known at time *t*; leverage *A/E* is the market-assets-to-equity ratio at time *t*; the Black-Scholes adjusted leverage $\frac{A}{E}N(d_1)$ is the market-assets-to-equity ratio multiplied by the delta; and the asset volatility $\sigma_{A,t+1}$ is the conditional volatility of time *t+1* asset return (R_{t+1}^{asset}) estimated using the EGARCH as in Table 5. The Black-Scholes delta $N(d_1)$ is calculated using one-year treasury yield, asset volatility from the EGARCH, and average time-to-maturity of debt weighted by face values. The numbers in parenthesis are Newey-West robust standard errors with 12 month lags.

Pooled Regression of Equity Implied Voltility

Intercept	$\frac{A}{E}$	$\frac{A}{E}N(d_1)$	σ_A	R^2	N
-0.90	0.14			0.6%	172,777
(0.00)	(0.01)				
-0.87		-0.01		0.0%	172,777
(0.00)		(0.01)			
-0.19			0.63	47.7%	172,777
(0.00)			(0.00)		
-0.16	0.76		0.79	63.2%	172,777
(0.00)	(0.01)		(0.00)		
-0.20		0.58	0.67	50.4%	172,777
(0.01)		(0.02)	(0.03)		

Table C.3: Determinants of Equity Volatility: Leverage and Asset Volatility

The sample includes firms with both asset returns data detailed in Table C.1 and option implied volatility data from Optionmetrics available for the period from 1996 to 2012. For each leverage quintile bucket, we perform a pooled regression of log implied volatility on log leverage and log asset volatility (in both level and difference):

$$\log \sigma_{E,t+1} = b_1 \log \frac{A_t}{E_t} + b_2 \log \sigma_{A,t+1} + \varepsilon_t$$

$$\Delta \log \sigma_{E,t+1} = c_1 \Delta \log \frac{A_t}{E_t} + c_2 \Delta \log \sigma_{A,t+1} + \varepsilon_t$$

The implied volatility $\sigma_{E,t+1}$ is one-month maturity at-the-money standardized call option volatility known at time *t*; leverage *A/E* is the market-assets-to-equity ratio at time *t*; and the asset volatility $\sigma_{A,t+1}$ is the conditional volatility of time $t+1$ asset returns estimated using the EGARCH as in Table 5. The regression is performed both in level (Panel A) and difference (Panel B). The leverage buckets are formed each year based on the market-asset-to-market-equity ratios available at the end of the previous year. The reported estimates are from the pooled OLS regressions. We also perform variance decompositions of equity implied volatility using the regression coefficients from the pooled regressions for both levels and differences:

$$Var(\log \sigma_{E,t+1}) = Cov(\log \sigma_{E,t+1}, b_1 \log \frac{A_t}{E_t}) + Cov(\log \sigma_{E,t+1}, b_2 \log \sigma_{A,t+1})$$

$$Var(\Delta \log \sigma_{E,t+1}) = Cov(\Delta \log \sigma_{E,t+1}, c_1 \Delta \log \frac{A_t}{E_t}) + Cov(\Delta \log \sigma_{E,t+1}, c_2 \log \Delta \sigma_{A,t+1})$$

The reported variance decompositions are fractions out of the explained portion of equity volatility. The numbers in parentheses are Newey–West standard errors.

Table C.4 (Continued)

Panel A: Level

Leverage Quintile	Intercept	A/E	σ_A	N	R^2	A/E	σ_A
	Regression					Variance Decomposition	
Zero Leverage	-0.18		0.73	46,601	45.8%	0.0%	100.0%
	(0.01)		(0.01)				
1	-0.17	0.95	0.83	35,287	63.5%	2.7%	97.3%
	(0.01)	(0.05)	(0.01)				
2	-0.21	1.12	0.82	33,273	60.7%	11.0%	89.0%
	(0.01)	(0.04)	(0.01)				
3	-0.21	0.95	0.81	29,094	62.7%	15.8%	84.2%
	(0.01)	(0.03)	(0.01)				
High Leverage	-0.13	0.69	0.79	21,059	67.2%	37.4%	62.6%
	(0.02)	(0.02)	(0.01)				

Panel B: Difference

Leverage Quintile	Intercept	A/E	σ_A	N	R^2	A/E	σ_A
	Regression					Variance Decomposition	
Zero Leverage	0.00		0.74	45,225	4.5%	0.0%	100.0%
	(0.00)		(0.02)				
1	0.00	1.39	0.60	34,697	9.7%	26.8%	73.2%
	(0.00)	(0.16)	(0.02)				
2	0.00	1.27	0.32	32,834	8.4%	59.2%	40.8%
	(0.00)	(0.07)	(0.03)				
3	0.00	0.93	0.34	28,729	9.2%	68.3%	31.7%
	(0.00)	(0.03)	(0.02)				
High Leverage	0.00	0.53	0.29	20,731	7.2%	81.0%	19.0%
	(0.00)	(0.03)	(0.02)				

Table C.4: EGARCH Volatility Estimation for Equity and Asset Returns

The sample includes firms with asset returns available from 1980 to 2012, as detailed in Table C.1. We perform stacked estimations for the EGARCH(1,1) model in equation (4) by normalizing returns using each firm's unconditional volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage quintile buckets are formed each year based on the market-asset-to-market-equity ratios available at the end of the previous year. α is the ARCH coefficient, β is the GARCH coefficient, and γ the asymmetry coefficient in the EGARCH(1,1) model. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

Leverage		Equity Volatility Estimates			Asset Volatility Estimates			H_0	
Quintiles	Obs.	α	β	γ	α	β	γ	$\beta_E = \beta_A$	$\gamma_E = \gamma_A$
Zero	128,250	0.16	0.86	-0.44	0.16	0.86	-0.44		
		(0.00)	(0.01)	(0.02)	(0.00)	(0.01)	(0.02)		
1	65,639	0.15	0.83	-0.71	0.15	0.83	-0.52	6.92	61.12
		(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.03)	[0.01]	[0.00]
2	67,924	0.14	0.80	-0.86	0.13	0.76	-0.66	21.19	143.56
		(0.01)	(0.01)	(0.04)	(0.01)	(0.01)	(0.04)	[0.00]	[0.00]
3	67,850	0.15	0.83	-0.78	0.13	0.75	-0.47	68.23	321.10
		(0.01)	(0.01)	(0.03)	(0.01)	(0.02)	(0.03)	[0.00]	[0.00]
High	65,062	0.19	0.90	-0.76	0.17	0.83	-0.12	221.12	186.23
		(0.01)	(0.00)	(0.02)	(0.01)	(0.01)	(0.02)	[0.00]	[0.00]

Table C.5A: EGARCH Idiosyncratic Volatility Estimation for Equity and Asset Returns

The sample includes firms with asset returns available from 1980 to 2012, as detailed in Table C.1. Idiosyncratic returns are first estimated for both asset and equity returns using the Fama-French three-factor model and idiosyncratic volatilities are estimated using the EGARCH(1,1) model. We perform stacked estimations for the EGARCH(1,1) model by normalizing idiosyncratic returns using each firm's unconditional idiosyncratic volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage quintile buckets are formed for each year based on the market-asset-to-market-equity ratios available at the end of the previous year. α is the ARCH coefficient, β is the GARCH coefficient, and γ is the asymmetry coefficient. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

Leverage		Equity Volatility Estimates			Asset Volatility Estimates			H_0	
Quintiles	Obs.	α	β	γ	α	β	γ	$\beta_E = \beta_A$	$\gamma_E = \gamma_A$
Zero	128,244	0.15	0.85	-0.28	0.15	0.85	-0.28		
		(0.00)	(0.01)	(0.02)	(0.00)	(0.01)	(0.02)		
1	65,639	0.13	0.91	-0.40	0.14	0.91	-0.24	4.06	124.22
		(0.00)	(0.01)	(0.03)	(0.01)	(0.01)	(0.02)	[0.04]	[0.00]
2	67,924	0.14	0.85	-0.47	0.13	0.84	-0.27	25.87	342.63
		(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.03)	[0.00]	[0.00]
3	67,850	0.16	0.86	-0.47	0.13	0.84	-0.17	32.71	229.32
		(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.03)	[0.00]	[0.00]
High	65,062	0.22	0.89	-0.57	0.15	0.84	0.01	34.22	183.01
		(0.01)	(0.00)	(0.02)	(0.01)	(0.01)	(0.02)	[0.00]	[0.00]

Table C.5B: EGARCH Idiosyncratic Volatility Estimation with Operating Leverage

The sample includes firms with asset returns available from 1980 to 2012, as detailed in Table C.1. We estimate idiosyncratic volatilities using the following specification:

$$\log\sigma_{t+1}^2 = c + \alpha\left(\left|\varepsilon_t\right| - E\left|\varepsilon_t\right| + (\gamma_0 + \gamma_1 f_t)\varepsilon_t\right) + \beta\log\sigma_t^2$$

where ε_t is idiosyncratic return estimated from the Fama-French three-factor model and f_t is firms' operating leverage estimated using quarterly Compustat data as SG&A costs divided by SG&A costs plus costs of goods sold, *XSGAQ/(XSGAQ+COGSQ)*. We perform stacked estimations for idiosyncratic volatilities by normalizing idiosyncratic returns using each firm's unconditional idiosyncratic volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage quintile buckets are formed for each year based on the market-asset-to-market-equity ratios available at the end of the previous year. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ_0 coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

Leverage		Equity Volatility Estimates				Asset Volatility Estimates				H_0	
Quintiles	Obs.	α	β	γ_0	γ_1	α	β	γ_0	γ_1	$\beta_E = \beta_A$	$\gamma_{0E} = \gamma_{0A}$
Zero	113,663	0.13	0.87	-0.03	-0.40	0.13	0.87	-0.03	-0.40		
		(0.00)	(0.01)	(0.04)	(0.07)	(0.00)	(0.01)	(0.04)	(0.07)		
1	60,360	0.11	0.90	-0.31	-0.05	0.12	0.90	-0.20	-0.16	9.12	31.93
		(0.01)	(0.01)	(0.05)	(0.14)	(0.01)	(0.01)	(0.05)	(0.13)	[0.00]	[0.00]
2	55,350	0.12	0.82	-0.31	-0.44	0.10	0.79	-0.14	-0.49	31.22	27.80
		(0.01)	(0.01)	(0.06)	(0.18)	(0.01)	(0.02)	(0.07)	(0.23)	[0.00]	[0.00]
3	46,815	0.11	0.78	-0.50	-0.43	0.08	0.69	-0.11	-0.47	46.06	76.43
		(0.01)	(0.02)	(0.07)	(0.25)	(0.01)	(0.04)	(0.11)	(0.39)	[0.00]	[0.00]
High	49,051	0.20	0.87	-0.59	-0.10	0.13	0.82	0.17	-0.40	39.20	91.22
		(0.01)	(0.01)	(0.03)	(0.12)	(0.01)	(0.01)	(0.05)	(0.19)	[0.00]	[0.00]

Table C.6: Time-Series Properties of Leverage and Volatility

The sample includes nonfinancial firms with asset return data available from 1980 to 2012. Panel A provides standard deviations of log leverage (market assets to market equity ratio) and log asset volatility estimated using the EGARCH for five leverage buckets. We estimate the standard deviations of log leverage and asset volatilities both in levels and differences, and report averages of the firm-by-firm standard deviations within each leverage bucket. The leverage buckets are formed for each year based on leverage at the end of the previous year. Panel B provides autocorrelograms of log leverage, log asset volatility, log implied volatility, and log structural equity volatility for the 1-, 3-, 6-, and 12-month lags. The sample is further restricted to firms with at least 12 months of implied volatility observations. The implied volatility is the one-month at-the-money call option volatility obtained from Optionmetrics. The structural equity volatility is obtained from the first equation in (5) using leverage, the EGARCH asset volatility, and the regression coefficients in Table 4. The reported numbers are estimated from the pooled sample of firms within each leverage bucket.

Panel A: Standard Deviation

	Level		Difference	
Leverage Quintile	A/E	σ_A	A/E	σ_A
Zero leverage	0.00	0.10	0.00	0.06
1	0.04	0.10	0.02	0.09
2	0.06	0.08	0.03	0.09
3	0.10	0.07	0.05	0.08
High Leverage	0.21	0.09	0.09	0.07

Panel B: Autocorrelogram

Log Asset-to-Equity					Log Asset Volatility				
Leverage	Lags				Leverage	Lags			
Quartile	1	3	6	12	Quartile	1	3	6	12
1	0.90	0.70	0.51	0.28	1	0.77	0.47	0.26	0.13
2	0.90	0.72	0.51	0.28	2	0.62	0.26	0.10	0.03
3	0.91	0.74	0.54	0.31	3	0.59	0.23	0.09	0.04
High Leverage	0.93	0.81	0.64	0.38	High Leverage	0.75	0.46	0.26	0.09
Log Implied Volatility					**Log Structural Equity Volatility**				
Leverage	Lags				Leverage	Lags			
Quartile	1	3	6	12	Quartile	1	3	6	12
1	0.80	0.65	0.49	0.38	1	0.79	0.52	0.30	0.13
2	0.76	0.59	0.40	0.27	2	0.77	0.48	0.27	0.10
3	0.76	0.57	0.38	0.24	3	0.81	0.55	0.34	0.17
High Leverage	0.77	0.61	0.43	0.23	High Leverage	0.90	0.74	0.53	0.26

Table D.1: Summary Statistics

The sample includes nonfinancial firms with asset return data available from 1980 to 2012 and is restricted to firms with at least 12 contiguous observations and with at least $100 million of book assets. We construct the asset return data by assuming that the market values of debt are the same as their book values and returns on debt are the same as on-month T-bill rate. For each year, we sort firms into five leverage buckets (from zero leverage to high leverage) based on the market-assets-to-market-equity ratio at the end of the previous year. *# of Firms* is the number of firms that have been allocated in each leverage bucket. Because the sorting is performed for each year, a firm can be allocated to multiple buckets in different years. *A/E* is the cross-sectional average of market assets to market equity within each bucket. *Mkt. Cap.*is the cross-sectional average of market capitalizations of firms' equity in millions of dollars. *Average return* is the cross-sectional average of monthly excess returns within each leverage bucket. *Beta* is regression coefficients of monthly returns with respect to the CRSP value-weighted returns for each leverage bucket. *Volatility* is the cross-sectional average of standard deviation of monthly excess returns. *Skewness* and *Kurtosis* are cross-sectional averages for firms' skewness and kurtosis measures of monthly excess returns.

				Average Return		Beta		Volatility		Skewness		Kurtosis	
Leverage Quintile	# of Firms	A/E	Mkt. Cap.	Equity	Asset	Equity	Asset	Equity	Asset	Equity	Asset	Equity	Asset
Zero	2384	1.00	1027.4	1.05%	1.05%	1.41	1.41	18.6%	18.5%	0.59	0.60	2.32	2.32
1	1343	1.21	6580.9	0.49%	0.40%	1.16	1.00	13.4%	11.2%	0.19	0.12	1.19	1.10
2	1695	1.44	3925.2	0.63%	0.44%	1.05	0.74	12.6%	8.7%	0.24	0.14	1.33	1.13
3	1694	1.85	2456.3	0.71%	0.39%	1.05	0.58	13.6%	7.5%	0.27	0.12	1.42	1.17
High	1379	4.70	1341.9	0.80%	0.24%	1.23	0.37	18.3%	5.5%	0.61	0.20	3.00	1.94

Table D.2: Pooled Regression of Equity Implied Volatility: Full Sample Analysis

The sample includes firms with both asset returns data detailed in Table D.1 and option implied volatility data from Optionmetrics available for the period from 1996 to 2012. Using monthly data, we perform a pooled regression of log implied volatility on either log leverage or log Black-Scholes adjusted leverage and log asset volatility. The implied volatility $\sigma_{E,t+1}$ is one-month maturity at-the-money standardized call option volatility known at time *t*; leverage *A/E* is the market-assets-to-equity ratio at time *t*; the Black-Scholes adjusted leverage $\frac{A}{E}N(d_1)$ is the market-assets-to-equity ratio multiplied by the delta; and the asset volatility $\sigma_{A,t+1}$ is the conditional volatility of time *t+1* asset return (R_{t+1}^{asset}) estimated using the EGARCH as in Table 5. The Black-Scholes delta $N(d_1)$ is calculated using one-year treasury yield, asset volatility from the EGARCH, and average time-to-maturity of debt weighted by face values. The numbers in parenthesis are Newey-West robust standard errors with 12 month lags.

Pooled Regression of Equity Implied Voltility

Intercept	$\frac{A}{E}$	$\frac{A}{E}N(d_1)$	σ_A	R^2	N
-0.90	0.10			0.6%	175,887
(0.00)	(0.01)				
-0.87		0.00		0.0%	175,887
(0.00)		(0.00)			
-0.27			0.51	38.0%	175,887
(0.01)			(0.00)		
-0.16	0.78		0.79	63.8%	175,887
(0.00)	(0.01)		(0.00)		
-0.15		0.80	0.79	58.4%	175,887
(0.01)		(0.02)	(0.01)		

Table D.3: Determinants of Equity Volatility: Leverage and Asset Volatility

The sample includes firms with both asset returns data detailed in Table D.1 and option implied volatility data from Optionmetrics available for the period from 1996 to 2012. For each leverage quintile bucket, we perform a pooled regression of log implied volatility on log leverage and log asset volatility (in both level and difference):

$$\log \sigma_{E,t+1} = b_1 \log \frac{A_t}{E_t} + b_2 \log \sigma_{A,t+1} + \varepsilon_t$$

$$\Delta \log \sigma_{E,t+1} = c_1 \Delta \log \frac{A_t}{E_t} + c_2 \Delta \log \sigma_{A,t+1} + \varepsilon_t$$

The implied volatility $\sigma_{E,t+1}$ is one-month maturity at-the-money standardized call option volatility known at time *t*; leverage *A/E* is the market-assets-to-equity ratio at time *t*; and the asset volatility $\sigma_{A,t+1}$ is the conditional volatility of time $t+1$ asset returns estimated using the EGARCH as in Table 5. The regression is performed both in level (Panel A) and difference (Panel B). The leverage buckets are formed each year based on the market-asset-to-market-equity ratios available at the end of the previous year. The reported estimates are from the pooled OLS regressions. We also perform variance decompositions of equity implied volatility using the regression coefficients from the pooled regressions for both levels and differences:

$$Var(\log \sigma_{E,t+1}) = Cov(\log \sigma_{E,t+1}, b_1 \log \frac{A_t}{E_t}) + Cov(\log \sigma_{E,t+1}, b_2 \log \sigma_{A,t+1})$$

$$Var(\Delta \log \sigma_{E,t+1}) = Cov(\Delta \log \sigma_{E,t+1}, c_1 \Delta \log \frac{A_t}{E_t}) + Cov(\Delta \log \sigma_{E,t+1}, c_2 \log \Delta \sigma_{A,t+1})$$

The reported variance decompositions are fractions out of the explained portion of equity volatility. The numbers in parentheses are Newey–West standard errors.

Table D.4 (Continued)

Panel A: Level

	Regression					Variance Decomposition	
Leverage Quintile	Intercept	A/E	σ_A	N	R^2	A/E	σ_A
Zero Leverage	-0.18		0.73	46,761	45.8%	0.0%	100.0%
	(0.01)		(0.01)				
1	-0.14	0.82	0.83	36,133	63.7%	5.4%	94.6%
	(0.01)	(0.05)	(0.01)				
2	-0.19	0.98	0.81	34,040	61.4%	17.6%	82.4%
	(0.02)	(0.03)	(0.01)				
3	-0.20	0.87	0.79	29,802	64.0%	23.0%	77.0%
	(0.02)	(0.02)	(0.01)				
High Leverage	-0.04	0.69	0.80	21,730	68.6%	49.0%	51.0%
	(0.02)	(0.01)	(0.01)				

Panel B: Difference

	Regression					Variance Decomposition	
Leverage Quintile	Intercept	A/E	σ_A	N	R^2	A/E	σ_A
Zero Leverage	0.00		0.74	45,390	4.5%	0.0%	100.0%
	(0.00)		(0.02)				
1	0.00	1.07	0.58	35,572	10.4%	32.5%	67.5%
	(0.00)	(0.07)	(0.02)				
2	0.00	0.91	0.35	33,616	8.9%	61.7%	38.3%
	(0.00)	(0.04)	(0.02)				
3	0.00	0.76	0.34	29,436	9.6%	75.8%	24.2%
	(0.00)	(0.03)	(0.02)				
High Leverage	0.00	0.50	0.25	21,388	7.6%	91.8%	8.2%
	(0.00)	(0.02)	(0.02)				

Table D.4: EGARCH Volatility Estimation for Equity and Asset Returns

The sample includes firms with asset returns available from 1980 to 2012, as detailed in Table D.1. We perform stacked estimations for the EGARCH(1,1) model in equation (4) by normalizing returns using each firm's unconditional volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage quintile buckets are formed each year based on the market-asset-to-market-equity ratios available at the end of the previous year. α is the ARCH coefficient, β is the GARCH coefficient, and γ the asymmetry coefficient in the EGARCH(1,1) model. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

Leverage		Equity Volatility Estimates			Asset Volatility Estimates			H_0	
Quintiles	Obs.	α	β	γ	α	β	γ	$\beta_E = \beta_A$	$\gamma_E = \gamma_A$
Zero	128,454	0.16	0.86	-0.44	0.16	0.86	-0.44		
		(0.00)	(0.01)	(0.02)	(0.00)	(0.01)	(0.02)		
1	67,195	0.15	0.83	-0.72	0.14	0.83	-0.56	4.61	82.35
		(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.03)	[0.03]	[0.00]
2	69,704	0.14	0.81	-0.91	0.12	0.77	-0.64	23.03	152.48
		(0.01)	(0.01)	(0.04)	(0.01)	(0.01)	(0.04)	[0.00]	[0.00]
3	69,870	0.15	0.82	-0.78	0.13	0.77	-0.31	39.77	394.90
		(0.01)	(0.01)	(0.03)	(0.01)	(0.02)	(0.03)	[0.00]	[0.00]
High	68,532	0.19	0.90	-0.74	0.18	0.85	0.11	89.23	186.29
		(0.01)	(0.00)	(0.02)	(0.01)	(0.01)	(0.02)	[0.00]	[0.00]

Table D.5A: EGARCH Idiosyncratic Volatility Estimation for Equity and Asset Returns

The sample includes firms with asset returns available from 1980 to 2012, as detailed in Table D.1. Idiosyncratic returns are first estimated for both asset and equity returns using the Fama-French three-factor model and idiosyncratic volatilities are estimated using the EGARCH(1,1) model. We perform stacked estimations for the EGARCH(1,1) model by normalizing idiosyncratic returns using each firm's unconditional idiosyncratic volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage quintile buckets are formed for each year based on the market-asset-to-market-equity ratios available at the end of the previous year. α is the ARCH coefficient, β is the GARCH coefficient, and γ is the asymmetry coefficient. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

Leverage		Equity Volatility Estimates			Asset Volatility Estimates			H_0	
Quintiles	Obs.	α	β	γ	α	β	γ	$\beta_E = \beta_A$	$\gamma_E = \gamma_A$
Zero	128,448	0.13	0.86	-0.32	0.13	0.86	-0.32		
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
1	67,195	0.11	0.90	-0.38	0.11	0.81	-0.18	35.23	93.20
		(0.00)	(0.01)	(0.03)	(0.01)	(0.01)	(0.04)	[0.00]	[0.00]
2	69,704	0.13	0.81	-0.42	0.10	0.82	0.00	21.86	284.02
		(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.03)	[0.00]	[0.00]
3	69,868	0.14	0.82	-0.48	0.15	0.86	0.21	45.29	323.01
		(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.02)	[0.00]	[0.00]
High	68,532	0.22	0.88	-0.56	0.18	0.76	-0.08	92.24	53.21
		(0.01)	(0.00)	(0.02)	(0.01)	(0.01)	(0.03)	[0.00]	[0.00]

Table D.5B: EGARCH Idiosyncratic Volatility Estimation with Operating Leverage

The sample includes firms with asset returns available from 1980 to 2012, as detailed in Table D.1. We estimate idiosyncratic volatilities using the following specification:

$$\log \sigma_{t+1}^2 = c + \alpha\left(|\varepsilon_t| - E|\varepsilon_t| + (\gamma_0 + \gamma_1 f_t)\varepsilon_t\right) + \beta \log \sigma_t^2$$

where ε_t is idiosyncratic return estimated from the Fama-French three-factor model and f_t is firms' operating leverage estimated using quarterly Compustat data as SG&A costs divided by SG&A costs plus costs of goods sold, *XSGAQ/(XSGAQ+COGSQ)*. We perform stacked estimations for idiosyncratic volatilities by normalizing idiosyncratic returns using each firm's unconditional idiosyncratic volatility, splicing the firm-by-firm time-series of the normalized returns in each leverage bucket, and estimating a maximum likelihood with the Gaussian distribution using the pooled sample in each bucket. The leverage quintile buckets are formed for each year based on the market-asset-to-market-equity ratios available at the end of the previous year. Column H_0 reports the chi-squared test statistics of the hypothesis that the equity and asset volatility models have the same β and γ_0 coefficients. The numbers in squared brackets are p-values of the test statistics and the numbers in parentheses are Bollerslev-Wooldridge robust standard errors.

Leverage		Equity Volatility Estimates				Asset Volatility Estimates				H_0	
Quintiles	Obs.	α	β	γ_0	γ_1	α	β	γ_0	γ_1	$\beta_E = \beta_A$	$\gamma_{0E} = \gamma_{0A}$
Zero	113,865	0.13	0.87	-0.04	-0.42	0.13	0.87	-0.04	-0.42		
		(0.00)	(0.01)	(0.04)	(0.07)	(0.00)	(0.01)	(0.04)	(0.07)		
1	61,701	0.11	0.90	-0.31	-0.05	0.11	0.91	-0.25	-0.01	4.23	23.21
		(0.01)	(0.01)	(0.06)	(0.14)	(0.00)	(0.01)	(0.05)	(0.13)	[0.04]	[0.00]
2	56,902	0.12	0.82	-0.32	-0.51	0.09	0.80	-0.13	-0.41	21.01	49.21
		(0.01)	(0.01)	(0.06)	(0.18)	(0.01)	(0.02)	(0.08)	(0.26)	[0.00]	[0.00]
3	48,419	0.11	0.78	-0.47	-0.61	0.06	0.72	0.26	-0.78	38.98	27.48
		(0.01)	(0.02)	(0.07)	(0.24)	(0.01)	(0.04)	(0.14)	(0.49)	[0.00]	[0.00]
High	51,578	0.21	0.87	-0.57	-0.13	0.12	0.86	0.35	-0.11	64.59	76.22
		(0.01)	(0.01)	(0.03)	(0.11)	(0.01)	(0.01)	(0.05)	(0.18)	[0.00]	[0.00]

Table D.6: Time-Series Properties of Leverage and Volatility

The sample includes nonfinancial firms with asset return data available from 1980 through 2012. Panel A provides standard deviations of log leverage (market assets to market equity ratio) and log asset volatility estimated using the EGARCH for five leverage buckets. We estimate the standard deviations of log leverage and asset volatilities both in levels and differences, and report averages of the firm-by-firm standard deviations within each leverage bucket. The leverage buckets are formed for each year based on leverage at the end of the previous year. Panel B provides autocorrelograms of log leverage, log asset volatility, log implied volatility, and log structural equity volatility for the 1-, 3-, 6-, and 12-month lags. The sample is further restricted to firms with at least 12 months of implied volatility observations. The implied volatility is the one-month at-the-money call option volatility obtained from Optionmetrics. The structural equity volatility is obtained from the first equation in (5) using leverage, the EGARCH asset volatility, and the regression coefficients in Table 4. The reported numbers are estimated from the pooled sample of firms within each leverage bucket.

Panel A: Standard Deviation

	Level		Difference	
Leverage Quintile	A/E	σ_A	A/E	σ_A
Zero leverage	0.00	0.10	0.00	0.07
1	0.06	0.10	0.03	0.08
2	0.09	0.08	0.04	0.08
3	0.13	0.07	0.07	0.08
High Leverage	0.26	0.10	0.11	0.08

Panel B: Autocorrelogram

Log Asset-to-Equity					Log Asset Volatility				
Leverage	Lags				Leverage	Lags			
Quartile	1	3	6	12	Quartile	1	3	6	12
1	0.87	0.70	0.53	0.31	1	0.75	0.44	0.23	0.11
2	0.90	0.72	0.51	0.25	2	0.60	0.24	0.08	0.02
3	0.91	0.74	0.54	0.31	3	0.57	0.23	0.10	0.04
High Leverage	0.94	0.82	0.65	0.41	High Leverage	0.78	0.51	0.31	0.15
Log Implied Volatility					**Log Structural Equity Volatility**				
Leverage	Lags				Leverage	Lags			
Quartile	1	3	6	12	Quartile	1	3	6	12
1	0.79	0.64	0.49	0.38	1	0.80	0.51	0.28	0.10
2	0.76	0.58	0.40	0.27	2	0.79	0.50	0.27	0.07
3	0.76	0.58	0.38	0.24	3	0.84	0.59	0.37	0.17
High Leverage	0.77	0.61	0.43	0.23	High Leverage	0.92	0.76	0.55	0.27

Table E.1: Summary Statistics on Long-Maturity Implied Volatilities

This table provides summary statistics of long-maturity implied volatilities for one-, three-, six-, nine-, and twelve-months maturity at-the-money standardized implied volatility (Panel A) and distributional statistics of twelve-minus-one month at-the-money standardized implied volatilities (Panel B). We report the statistics for five leverage quintiles sorted at the end of each December. All zero leverage firms are grouped into the lowest leverage bucket and the remaining firms are sorted into four equal leverage buckets. In Panel B, P1, P25, P50, P75, and P99 denote 1, 25, 50, and 75, and 99th percentiles, respectively. The sample period is from 1996 through 2012.

Panel A: Summary Statistics on Long Maturity Implied Volatilities

Average						Skewness					
	Horizon						Horizon				
Leverage	1 Mon	3 Mon	6 Mon	9 Mon	12 Mon	Leverage	1 Mon	3 Mon	6 Mon	9 Mon	12 Mon
Zero	0.50	0.50	0.49	0.48	0.47	Zero	0.20	0.19	0.18	0.18	0.18
1	0.37	0.37	0.36	0.36	0.35	1	0.18	0.17	0.15	0.15	0.14
2	0.38	0.38	0.37	0.37	0.36	2	0.18	0.17	0.16	0.16	0.15
3	0.40	0.39	0.38	0.38	0.37	3	0.20	0.19	0.17	0.17	0.17
High	0.48	0.48	0.47	0.47	0.45	High	0.26	0.25	0.23	0.23	0.22
Standard Deviation						Kurtosis					
Zero	0.46	0.46	0.45	0.45	0.43	Zero	1.27	1.05	1.10	1.12	1.24
1	0.33	0.33	0.33	0.33	0.32	1	1.75	1.62	1.54	1.56	1.57
2	0.34	0.34	0.34	0.34	0.33	2	1.69	1.66	1.61	1.63	1.75
3	0.35	0.36	0.35	0.35	0.34	3	1.62	1.50	1.50	1.47	1.67
High	0.43	0.42	0.42	0.42	0.40	High	1.18	1.12	1.12	1.08	1.16

Panel B: Summary Statistics on 12 minus 1 month Implied Volatility

Leverage	Average	P1	P25	P50	P75	P99	Stdev
Zero	-0.03	-0.53	-0.08	-0.01	0.03	0.36	0.14
1	-0.02	-0.41	-0.05	0.00	0.03	0.13	0.10
2	-0.02	-0.44	-0.05	0.00	0.03	0.16	0.11
3	-0.02	-0.45	-0.05	0.00	0.03	0.19	0.11
High	-0.03	-0.53	-0.07	0.00	0.04	0.24	0.14

Table E.2: Long Maturity Forward Implied Volatility Regression

The sample includes firms with asset returns and all data on 1-, 6-, 9-, and 12-month maturity at-the-money call option implied volatility available for the period from 1996 to 2012. For each leverage quintile bucket, we perform a pooled regression of log forward implied volatility on log leverage and log asset volatility in both level (Panel A) and change (Panel B):

$$\log \sigma_{E,t+k} = b_0 + b_1 \log \tfrac{A_t}{E_t} + b_2 \log \sigma_{A,t+1} + \varepsilon_t$$

$$\Delta \log \sigma_{E,t+k} = c_0 + c_1 \Delta \log \tfrac{A_t}{E_t} + c_2 \Delta \log \sigma_{A,t+1} + \varepsilon_t$$

The forward implied volatility $\sigma_{E,t+k}$ is either one-month maturity at-the-money standardized call option volatility known at time t (*1 month*), 1-month ahead 2-month maturity volatility known at t (*1–3 months*), 3-month-ahead 3-month maturity volatility at t (*3–6 months*), 6-month-ahead 3-month maturity volatility known at t (*6–9 months*), or 9-month-ahead three-month maturity volatility known at t (*9–12 months*). The one-month-ahead two-month maturity volatility is calculated as $\sqrt{\left(3\sigma_{E,3}^2 - \sigma_{E,1}^2\right)/2}$, where $\sigma_{E,3}$ and $\sigma_{E,1}$ are 1- and 1-month maturity at-the-money standardized implied volatility known at *t*, respectively. The 3-month-ahead 3-month maturity volatility is $\sqrt{\left(6\sigma_{E,6}^2 - 3\sigma_{E,3}^2\right)/3}$, where $\sigma_{E,6}$ is 6-month maturity at-the-money standardized implied volatility known at *t*. The 6-month-ahead 3-month volatility is $\sqrt{\left(9\sigma_{E,9}^2 - 6\sigma_{E,6}^2\right)/3}$, where $\sigma_{E,9}$ is 9-month maturity at-the-money standardized implied volatility known at *t*. The 9-month-ahead 3-month volatility is $\sqrt{\left(12\sigma_{E,12}^2 - 9\sigma_{E,9}^2\right)/3}$, where $\sigma_{E,12}$ is 12-month maturity at-the-money standardized implied volatility at *t*. Leverage is market assets to equity ratio at time *t,* and the asset volatility is the conditional volatility of time $t+1$ asset returns estimated using the EGARCH. The leverage buckets are formed for each year based on the market-asset-to-market-equity ratios at the end of the previous year. The reported estimates are from the pooled OLS regressions. We also perform variance decompositions of equity implied volatility using the regression coefficients from the pooled regressions for both levels and differences:

$$Var(\log \sigma_{E,t+k}) = Cov(\log \sigma_{E,t+1}, b_1 \log \tfrac{A_t}{E_t}) + Cov(b_2 \log \sigma_{E,t+1}, \log \sigma_{A,t+1})$$

$$Var(\Delta \log \sigma_{E,t+k}) = Cov(\Delta \log \sigma_{E,t+1}, c_1 \Delta \log \tfrac{A_t}{E_t}) + Cov(c_2 \Delta \log \sigma_{E,t+1}, \log \Delta \sigma_{A,t+1})$$

The reported variance decompositions are fractions out of the explained portion of equity volatility. The numbers in parenthesis are Newey–West standard errors.

Panel A: Level

Leverage Quartile		1 Month Reg	1 Month Var Dec	1-3 Months Reg	1-3 Months Var Dec	3-6 Months Reg	3-6 Months Var Dec	6-9 Months Reg	6-9 Months Var Dec	9-12 Months Reg	9-12 Months Var Dec
1	A/E	0.84	3.5%	0.79	3.3%	0.78	3.6%	0.74	3.5%	0.67	3.5%
		(0.04)		(0.03)		(0.05)		(0.05)		(0.06)	
	σ_A	0.82	96.5%	0.79	96.7%	0.75	96.4%	0.72	96.5%	0.65	96.5%
		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)	
	R^2	61.0%		63.9%		63.4%		62.2%		51.6%	
	N	20,970		20,951		20,970		20,953		20,970	
2	A/E	0.96	11.3%	0.92	10.9%	0.92	12.0%	0.91	12.5%	0.88	14.4%
		(0.03)		(0.03)		(0.04)		(0.04)		(0.05)	
	σ_A	0.76	88.7%	0.74	89.1%	0.69	88.0%	0.67	87.5%	0.59	85.6%
		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)	
	R^2	62.3%		65.3%		61.7%		62.3%		48.3%	
	N	13,338		13,314		13,338		13,320		13,338	
3	A/E	0.88	18.4%	0.84	17.7%	0.84	19.1%	0.81	19.1%	0.76	20.2%
		(0.02)		(0.02)		(0.03)		(0.03)		(0.05)	
	σ_A	0.76	81.6%	0.74	82.3%	0.70	80.9%	0.68	80.9%	0.61	79.8%
		(0.01)		(0.01)		(0.01)		(0.01)		(0.02)	
	R^2	64.9%		65.2%		64.1%		63.9%		52.2%	
	N	10,749		10,720		10,749		10,726		10,749	
High Leverage	A/E	0.50	35.1%	0.50	35.8%	0.49	37.7%	0.48	38.9%	0.47	41.7%
		(0.01)		(0.01)		(0.02)		(0.02)		(0.02)	
	σ_A	0.76	64.9%	0.74	64.2%	0.70	62.3%	0.68	61.1%	0.61	58.3%
		(0.01)		(0.01)		(0.02)		(0.01)		(0.02)	
	R^2	68.3%		69.5%		66.7%		66.0%		55.4%	
	N	7,588		7,567		7,588		7,563		7,588	

Panel B: Difference

Leverage Quartile		Maturity: 1 Month Reg	1 Month Var Dec	1-3 Months Reg	1-3 Months Var Dec	3-6 Months Reg	3-6 Months Var Dec	6-9 Months Reg	6-9 Months Var Dec	9-12 Months Reg	9-12 Months Var Dec
1	A/E	1.13	24.2%	0.76	23.9%	0.74	28.6%	0.67	27.7%	0.51	46.8%
		(0.08)		(0.06)		(0.06)		(0.06)		(0.08)	
	σ_A	0.65	75.8%	0.45	76.1%	0.37	71.4%	0.35	72.3%	0.16	53.2%
		(0.03)		(0.02)		(0.02)		(0.02)		(0.02)	
	R^2	12.5%		11.7%		10.8%		7.7%		1.1%	
	N	20,454		20,436		20,454		20,432		20,454	
2	A/E	0.84	49.1%	0.69	52.4%	0.57	54.5%	0.66	66.6%	0.44	85.5%
		(0.06)		(0.04)		(0.05)		(0.04)		(0.05)	
	σ_A	0.37	50.9%	0.28	47.6%	0.22	45.5%	0.18	33.4%	0.06	14.5%
		(0.03)		(0.02)		(0.02)		(0.02)		(0.02)	
	R^2	9.8%		10.7%		7.3%		7.7%		0.9%	
	N	12,960		12,927		12,960		12,937		12,960	
3	A/E	0.75	59.9%	0.62	69.2%	0.58	75.8%	0.52	74.9%	0.39	92.4%
		(0.04)		(0.03)		(0.03)		(0.03)		(0.06)	
	σ_A	0.39	40.1%	0.25	30.8%	0.19	24.2%	0.18	25.1%	0.06	7.6%
		(0.06)		(0.04)		(0.03)		(0.03)		(0.03)	
	R^2	13.0%		12.3%		11.3%		8.6%		1.7%	
	N	10,434		10,396		10,434		10,404		10,434	
High Leverage	A/E	0.35	44.0%	0.33	54.4%	0.33	59.2%	0.30	60.1%	0.29	86.9%
		(0.03)		(0.02)		(0.02)		(0.03)		(0.03)	
	σ_A	0.49	56.0%	0.36	45.6%	0.32	40.8%	0.28	39.9%	0.11	13.1%
		(0.04)		(0.03)		(0.03)		(0.03)		(0.04)	
	R^2	14.8%		15.1%		13.9%		9.8%		2.7%	
	N	7,275		7,249		7,275		7,244		7,275	

Table F: Variance Decomposition of Volatility Differences

This table provides the variance decomposition of equity volatility differences for firms with asset return data available from 1980 through 2012. We first decompose the difference between implied volatility and EGARCH volatility ($\sigma_{Implied} - \sigma_{EGARCH}$) into the difference between implied volatility and realized volatility ($\sigma_{Implied} - \sigma_{Realized}$) and the difference between realized volatility and EGARCH volatility ($\sigma_{Realized} - \sigma_{EGARCH}$). Using the decomposition, we calculate the fractions of variance in the difference between implied volatility and EGARCH volatility due to the difference between implied volatility and realized volatility and the difference between realized volatility and EGARCH volatility. We report the average values of the fractions for each leverage bucket. The numbers in parentheses are standard errors.

Leverage	$\frac{Cov(\sigma_{Implied} - \sigma_{EGARCH}, \sigma_{Implied} - \sigma_{Realized})}{Var(\sigma_{Implied} - \sigma_{EGARCH})}$	$\frac{Cov(\sigma_{Implied} - \sigma_{EGARCH}, \sigma_{Realized} - \sigma_{EGARCH})}{Var(\sigma_{Implied} - \sigma_{EGARCH})}$
Zero	0.64	0.36
	(0.05)	(0.05)
1	0.67	0.33
	(0.03)	(0.03)
2	0.47	0.53
	(0.03)	(0.03)
3	0.70	0.30
	(0.06)	(0.06)
High	0.61	0.39
	(0.06)	(0.06)

Table G: Tests of the CAPM for Asset and Equity Returns

This table provides the estimation results of the unconditional CAPM for asset and equity decile portfolio returns sorted on equity betas (Panels A and B), asset betas (Panels C and D), size (Panels E and F), and momentum (Panels G and H) for the period from 1980 through 2012. Equity and asset beta portfolios are sorted for each June based on betas using past 12-month returns. Size portfolios are formed following Fama and French (1993) and momentum portfolios are formed using 12-month ranking and performance periods following Jegadeesh and Titman (1993). Betas are first estimated for each firm using past five-year monthly returns. Portfolio betas are then estimated by aggregating these individual betas by value-weighting into portfolios, following Elton, Gruber, and Blake (2011). The reported alphas are averages of monthly pricing errors calculated by subtracting estimated portfolio excess returns from realized portfolio excess returns, where the estimated portfolio excess returns are obtained by multiplying the portfolio betas by the market excess returns. We report alphas, t-statistics of the alphas, betas, and the standard errors of the betas for decile portfolios and high-minus-low (H-L) decile portfolios.

Panel A: Equity Portfolios Sorted on Equity Beta

	L	2	3	4	5	6	7	8	9	H	H-L
α	-0.01%	0.20%	0.38%	0.18%	0.14%	0.07%	-0.11%	-0.31%	-0.47%	-0.92%	-0.91%
$t(\alpha)$	-0.05	1.56	3.47	1.51	1.39	0.68	-1.07	-2.39	-2.84	-3.31	-2.32
β	0.56	0.59	0.69	0.78	0.91	1.04	1.17	1.35	1.56	2.13	1.57
$StdErr(\beta)$	0.25	0.16	0.13	0.14	0.11	0.14	0.14	0.21	0.28	0.50	0.62

Panel B: Asset Portfolios Sorted on Equity Beta

	L	2	3	4	5	6	7	8	9	H	H-L
α	0.03%	0.15%	0.28%	0.14%	0.11%	0.06%	-0.04%	-0.13%	-0.14%	-0.38%	-0.41%
$t(\alpha)$	0.19	1.75	3.64	1.73	1.57	0.96	-0.66	-1.63	-1.28	-2.02	-1.58
β	0.39	0.41	0.46	0.52	0.61	0.63	0.66	0.77	0.87	1.14	0.75
$StdErr(\beta)$	0.18	0.10	0.11	0.09	0.11	0.11	0.12	0.26	0.39	0.70	0.79

Panel C: Equity Portfolios Sorted on Asset Beta

	L	2	3	4	5	6	7	8	9	H	H-L
α	-0.01%	-0.01%	0.14%	0.23%	0.18%	0.05%	0.12%	-0.29%	-0.42%	-0.51%	-0.50%
$t(\alpha)$	-0.04	-0.05	1.16	2.00	1.67	0.48	1.33	-2.47	-2.48	-1.66	-1.22
β	0.63	0.70	0.79	0.82	0.87	0.97	1.07	1.24	1.47	2.02	1.39
$StdErr(\beta)$	0.30	0.19	0.19	0.13	0.14	0.13	0.14	0.22	0.32	0.52	0.68

Panel D: Asset Portfolios Sorted on Asset Beta

	L	2	3	4	5	6	7	8	9	H	H-L
α	0.01%	0.06%	0.14%	0.17%	0.16%	0.09%	0.12%	-0.22%	-0.31%	-0.41%	-0.42%
$t(\alpha)$	0.06	0.78	2.16	2.69	2.22	1.27	1.72	-2.23	-2.08	-1.45	-1.23
β	0.44	0.37	0.36	0.46	0.58	0.70	0.84	1.02	1.25	1.81	1.37
$StdErr(\beta)$	0.27	0.17	0.11	0.10	0.11	0.13	0.14	0.23	0.34	0.52	0.63

Panel E: Equity Portfolios Sorted on Size

	L	2	3	4	5	6	7	8	9	H	H-L
α	0.50%	0.37%	0.48%	-0.01%	-0.03%	-0.05%	0.15%	0.10%	0.18%	0.06%	-0.45%
$t(\alpha)$	1.56	1.43	1.91	-0.03	-0.17	-0.35	1.48	1.14	2.23	0.87	-1.27
β	1.00	1.13	1.24	1.29	1.29	1.20	1.11	1.04	1.00	0.88	-0.12
$StdErr(\beta)$	0.29	0.25	0.25	0.22	0.15	0.17	0.16	0.13	0.09	0.07	0.27

Panel F: Asset Portfolios Sorted on Size

	L	2	3	4	5	6	7	8	9	H	H-L
α	0.38%	0.35%	0.35%	-0.01%	0.01%	0.00%	0.15%	0.12%	0.17%	0.06%	-0.32%
$t(\alpha)$	1.55	1.83	1.70	-0.06	0.10	-0.04	0.66	0.94	2.44	1.04	-1.08
β	0.77	0.84	0.85	0.87	0.87	0.78	0.73	0.68	0.68	0.68	-0.09
$StdErr(\beta)$	0.23	0.21	0.23	0.20	0.15	0.16	0.13	0.10	0.08	0.07	0.23

Panel G: Equity Portfolios Sorted on Momentum

	L	2	3	4	5	6	7	8	9	H	H-L
α	-0.40%	-0.22%	0.00%	-0.04%	0.01%	0.01%	-0.01%	0.14%	0.11%	0.17%	0.57%
$t(\alpha)$	-1.60	-1.43	0.01	-0.37	0.13	0.14	-0.13	1.80	1.17	1.09	1.77
β	1.34	1.13	1.02	0.97	0.94	0.92	0.93	0.95	1.01	1.22	-0.12
$StdErr(\beta)$	0.30	0.19	0.14	0.11	0.08	0.07	0.07	0.11	0.17	0.27	0.44

Panel H: Asset Portfolios Sorted on Momentum

	L	2	3	4	5	6	7	8	9	H	H-L
α	-0.22%	-0.12%	-0.03%	0.00%	0.03%	0.03%	0.02%	0.11%	0.09%	0.14%	0.36%
$t(\alpha)$	-1.64	-1.42	-0.38	-0.05	0.50	0.56	0.43	2.13	1.28	1.15	1.66
β	0.75	0.67	0.62	0.59	0.58	0.57	0.58	0.59	0.64	0.80	0.04
$StdErr(\beta)$	0.28	0.20	0.14	0.11	0.09	0.08	0.08	0.11	0.16	0.27	0.38