Beta, Volatility, and Portfolio Analysis (1996–2023)

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1 Data & Sample

Source: CRSP monthly stock file (1,636,563 × 18 columns raw; 19 columns cleaned). **Coverage:** 1996-01-31 to 2023-12-29. **Sample:** 10 largest firms per industry (100 firms total, 20,488 firm-month observations). **Risk-free:** TB3MS from FRED (0% missing after merge).

2 Beta Estimation

Rolling CAPM regressions (12/24/36-month windows): 5,235 firm-year-window betas. Example: ORCL (1996, 12m) $\beta = 1.51$, $R^2 = 0.16$.

3 Beta Descriptives by Industry (1996–2023)

Industry	Mean β	Std Dev
Other	1.43	0.91
Services	1.11	0.82
Finance	1.10	0.92
Oil & Gas	1.02	0.65
Mining	0.96	0.87
Transportation	0.94	0.86
Retail	0.91	0.72
Manufacturing	0.88	0.75
Wholesale	0.82	0.50
Public Admin	0.62	1.06

Crisis years (2008, 2020) show elevated betas. CAPM explains Finance/Manufacturing better than Retail/Services.

4 Volatility Analysis

8,142 firm-year-window estimates. **Full sample averages:** Total vol=0.102±0.073, Systematic=0.046±0.041, Idiosyncratic=0.087±0.066. Perfect decomposition validated (corr=1.000). **Crisis premium:** +25% vs normal years. **Structural break:** Pre-2008 avg=0.1122, Post-2008=0.0936 (16.6%).

2023 Industry Volatility Ranking: Wholesale (0.074) ¡ Manufacturing (0.077) ¡ ... ¡ Oil & Gas (0.119). Public Admin: high idiosyncratic dominance (Idio=0.099 vs Sys=0.023).

5 Beta-Sorted Portfolios

Annual quintiles (76–147 firms/year):

Portfolio	EW Ret	VW Ret	Beta
P1 (Low)	8.3%	7.0%	0.25
P5 (High)	16.4%	14.3%	2.16
P5-P1	**+8.1%**	**+7.3%**	
t-stat	**4.58**	**5.06**	

Finding: Higher beta → higher returns (CAPM consistent).

6 IVOL-Sorted Portfolios

Annual quintiles by idiosyncratic volatility:

Portfolio	EW Ret	VW Ret	IVOL
P1 (Low)	7.8%	9.3%	0.043
P5 (High)	15.3%	24.0%	0.173
P5-P1	**+7.5%**	**+14.7%**	
t-stat	**4.34**	**7.18**	

Finding: High-IVOL stocks significantly outperform (contrary to IVOL discount literature).

7 Key Results & Conclusions

1. **CAPM Validation:** Beta-return relationship strongly positive and significant at 5% level across EW/VW portfolios.
2. **IVOL Anomaly:** High idiosyncratic volatility stocks earn substantial premiums (+14.7% VW, t=7.18), opposing traditional IVOL discount findings.
3. **Volatility Structure:** Idiosyncratic risk dominates systematic risk (0.087 vs 0.046 average), with perfect variance decomposition.
4. **Crisis Effects:** 2000–02, 2008, 2020 show amplified betas and volatilities (+25% crisis premium).
5. **Industry Heterogeneity:** Finance/Services exhibit higher mean betas; Oil & Gas has highest total volatility (0.119); Public Admin shows extreme idiosyncratic volatility dispersion.
6. **Temporal Patterns:** Post-2008 structural decline in volatility (16.6%) suggests market evolution.

Conclusion: The CAPM framework holds robustly for this 1996–2023 fixed industry sample, with higher systematic risk rewarded by higher returns. The surprising positive IVOL premium and pronounced crisis-period risk amplification highlight important deviations from standard asset pricing predictions, while industry-specific risk profiles demonstrate significant cross-sectoral heterogeneity in risk-return dynamics.