

Lower Risk Equity Investing

Investing with the Potential for Substantially Lower Volatility and Significantly Reduced Drawdowns

March 2011



Investment design & fund raising specialists



- A fundamental insight of Modern Portfolio Theory¹ is that the market capitalisation portfolio with non-diversifiable risk ***should*** generate the highest risk adjusted returns.
- However evidence suggests portfolios with low volatility and/or low beta² generate higher risk-adjusted returns over time – with substantially less volatility, significantly reduced drawdowns and the prospect of better absolute returns overall.
- Two investment strategies that address this anomaly are:
 - **Low Volatility (LV):** A portfolio of low volatility and/or low beta stocks
 - **Minimum Variance (MV):** The theoretical minimum variance portfolio
- Both exhibit persistence of risk-based pricing anomalies that appear independent of the Fama-French factors of market, value and size.
- Short term returns may differ substantially from those of traditional approaches and will necessarily have sizeable tracking errors to capitalisation-weighted market indices.
- These strategies will likely underperform the index in strong markets, so investors will need to be patient, well informed, and less concerned about relative performance.

Note 1: Markowitz, Harry. "Portfolio Selection." *Journal of Finance*, 7, 1952, pp. 77–91

Note 2: Beta is a measure of the volatility or risk of an asset to the broader market.

Low Volatility and Minimum Variance Explained

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- Low Volatility (LV) investing sorts all stocks by their volatility and/ or beta and then takes a subset of these stocks – comprising those with the lowest beta and/ or volatility.
- Minimum Variance (MV) investing relies on observations and/ or estimates of correlations of individual stocks as an input to an optimisation to identify the Minimum Variance Portfolio.

Why Low Volatility/Minimum Variance?

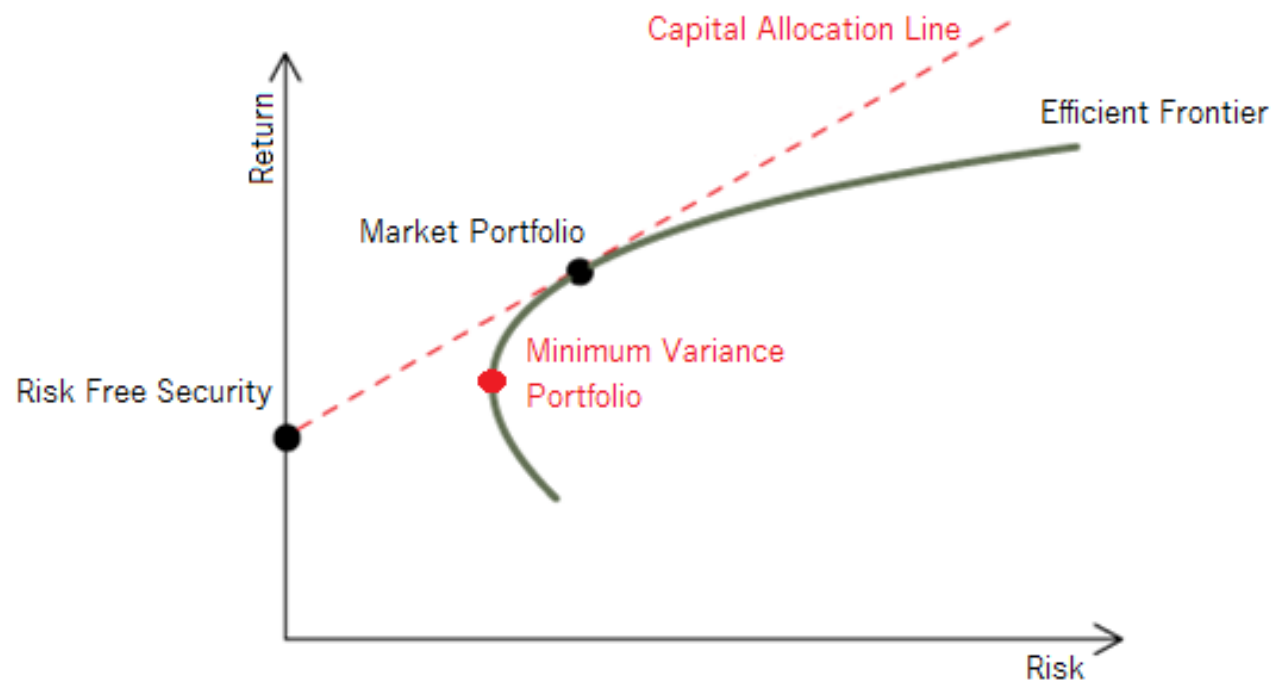
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- Both LV and MV strategies are responses to the sub-optimal nature of cap-weighted indices.
- Evidence suggests that both LV and MV generate superior risk-adjusted returns as well as superior absolute returns over time.
- Studies reveal that both LV and MV reduce volatility and draw-downs, with minimal net loss to long term returns.
- Several explanations have been proposed:
 - The market over estimates the growth prospects of companies
 - Low-risk portfolios have smaller drawdowns and can more quickly recover losses
 - As low risk portfolios differ substantially from market cap weighted indices they have less exposure to sharemarket “bubbles”
- Not all LV and MV methodologies are alike – different approaches can result in different levels of risk and return.

Traditional Portfolio Theory

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- The general acceptance of MPT led to the cap-weighted market portfolio, eg, S&P/ ASX 200 Accumulation Index, S&P500 Index, being the accepted “benchmark”.
- Above-benchmark returns can be captured through effectively exploiting investor biases implicit in the value, size and momentum effects.²



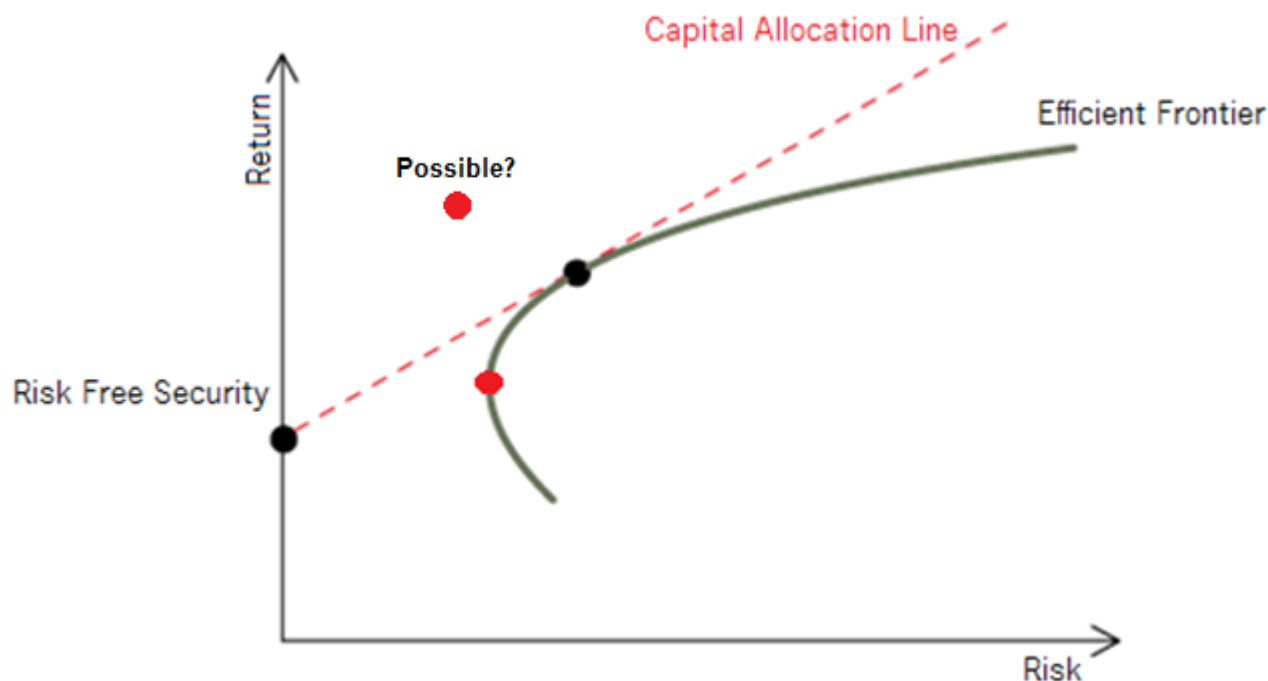
Note 1: Markowitz, Harry. “Portfolio Selection.” *Journal of Finance*, 7, 1952, pp. 77–91

Note 2: Fama, Eugene and Kenneth French. “The Cross-Section of Expected Stock Returns.” *Journal of Finance*, June 1992, pp. 427–465..

Discovery of Minimum Variance Investing

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- In 1967 Robert Haugen noted an abnormality – **lower risk portfolios** provided **superior** returns to the supposedly efficient market portfolio.
- This insight has had limited support – not least due to its large tracking error, which can be 6–12%.



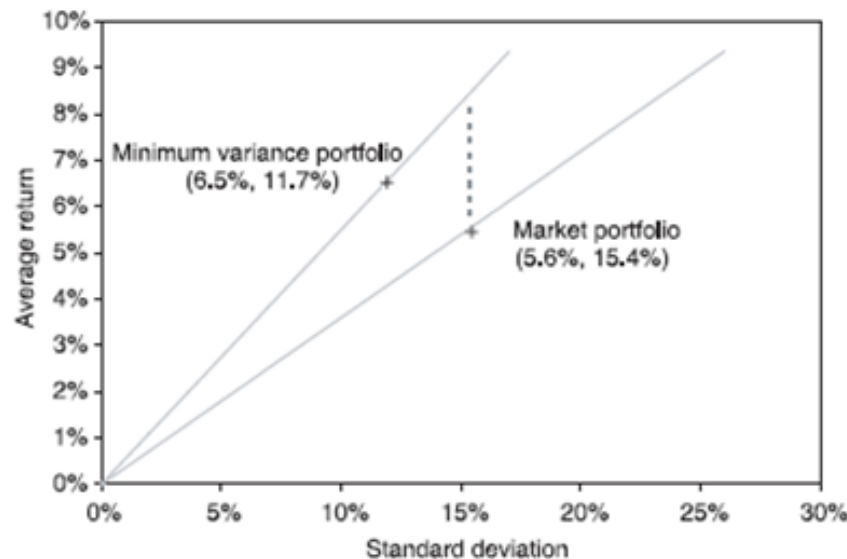
Note 1: Low Volatility Equity I

Minimum Variance Works

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- Clarke *et al* (2006)¹ found MV portfolios had ~75% of the risk of the market portfolio, with returns comparable to those of the market.
- Using data from 1968 to 2005 Clarke *et al* (2006)² found the excess return above T-Bills was 6.5% with a volatility of 11.7% whereas the market index had an average excess return of 5.6% with a volatility of 15.4%.

Empirical Results 1968 to 2005
(return in excess of T-bill)



Note 1: Clarke, Roger, Harindra de Silva, and Steven Thorley. "Minimum-Variance Portfolios in the U.S. Equity Market." *Journal of Portfolio Management*, Fall 2006, pp. 10–24

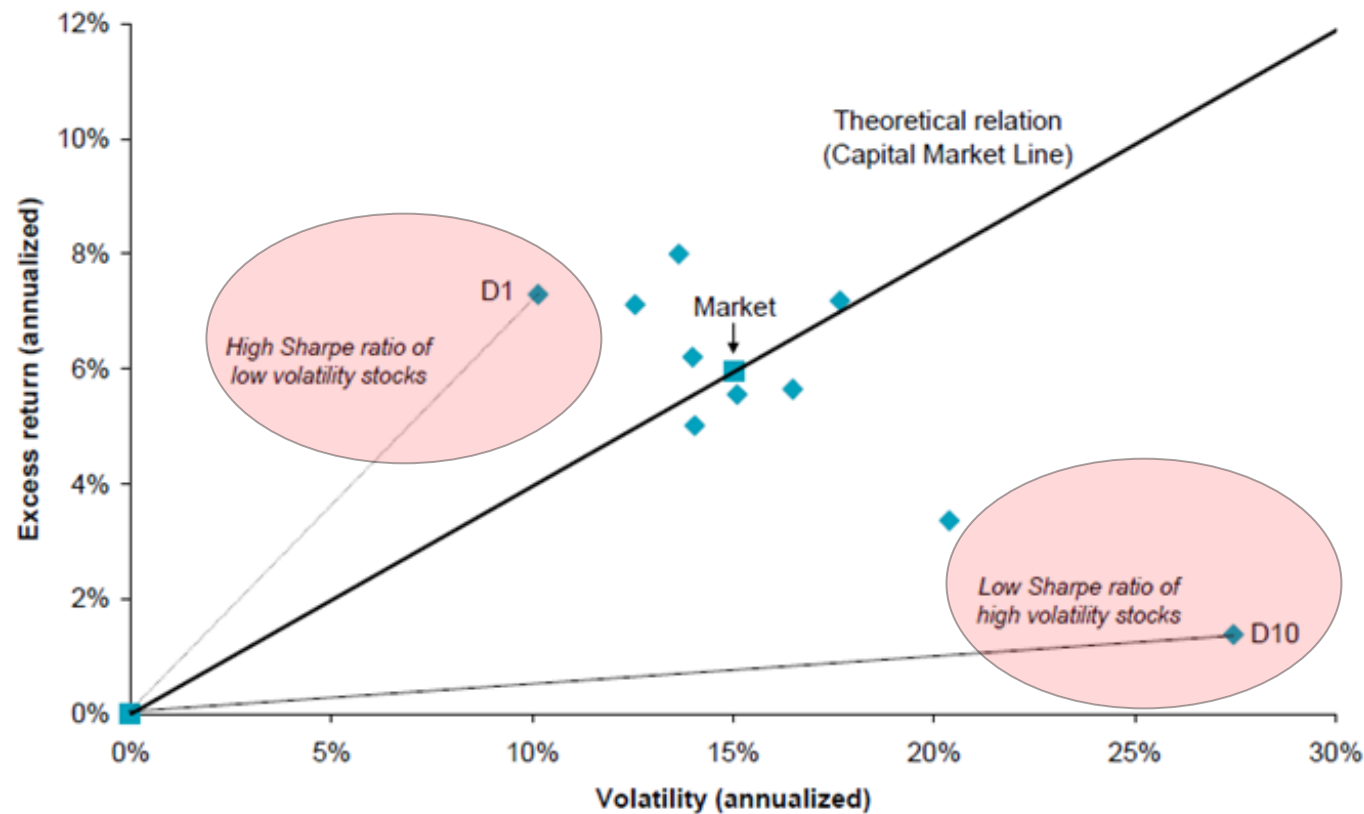
Note 2: 1,000 largest market capitalization U.S. Stocks from January 1968 through to December 2005 (456 months)

Low Volatility Stocks Have Superior Risk-Adjusted Returns

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- Blitz *et al* (2007)¹ found that low volatility stocks have superior risk-adjusted returns relative to the FTSE World Development Index.

Empirical versus theoretical relation between volatility and return



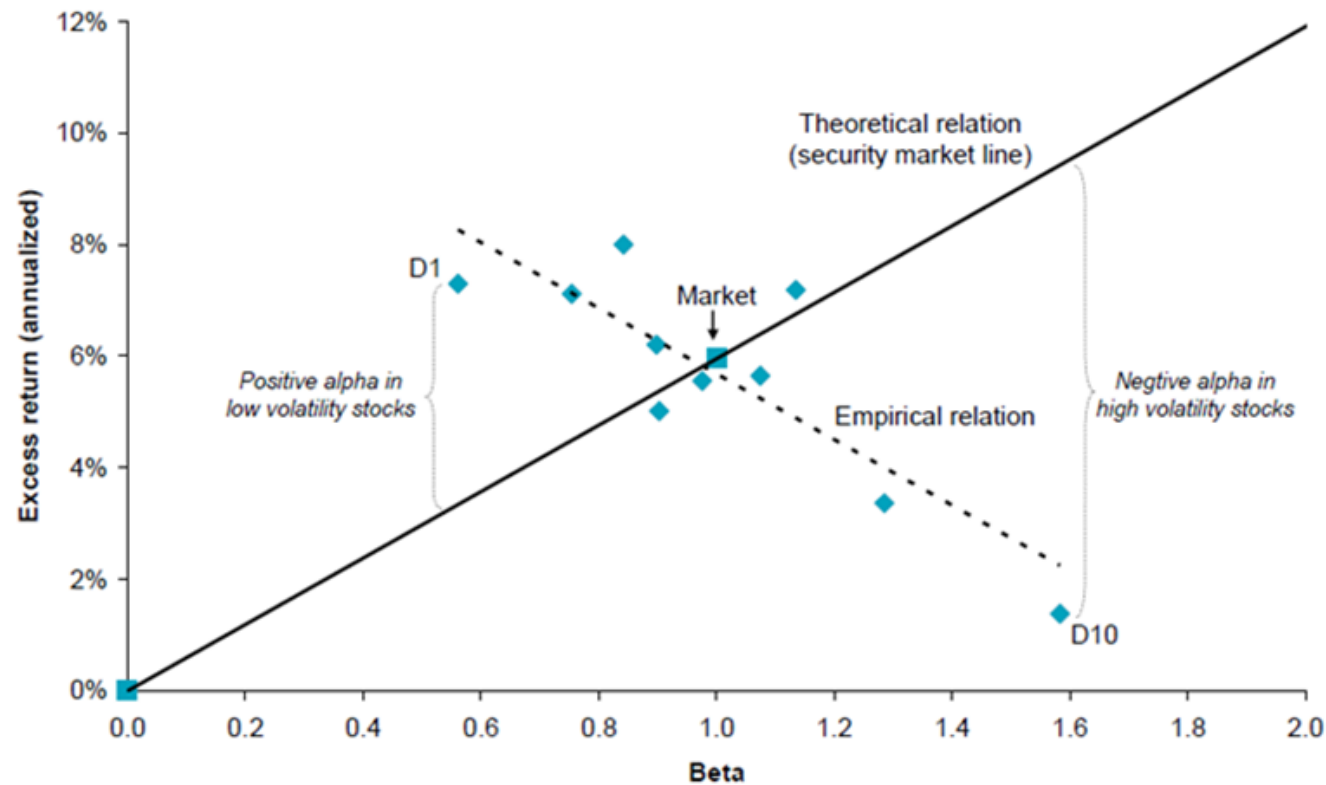
Note 1: Blitz, David C., and Pim van Vliet. "The Volatility Effect". *The Journal of Portfolio Management*, Fall 2007, pp. 102–113.

High Beta Does Not Increase Returns

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- Blitz *et al* (2007)¹ also found that low beta stocks had higher returns than predicted while the reverse held for high beta stocks.

Empirical versus theoretical relation between beta and return



Note 1: Blitz, David C., and Pim van Vliet. "The Volatility Effect". *The Journal of Portfolio Management*, Fall 2007, pp. 102–113.

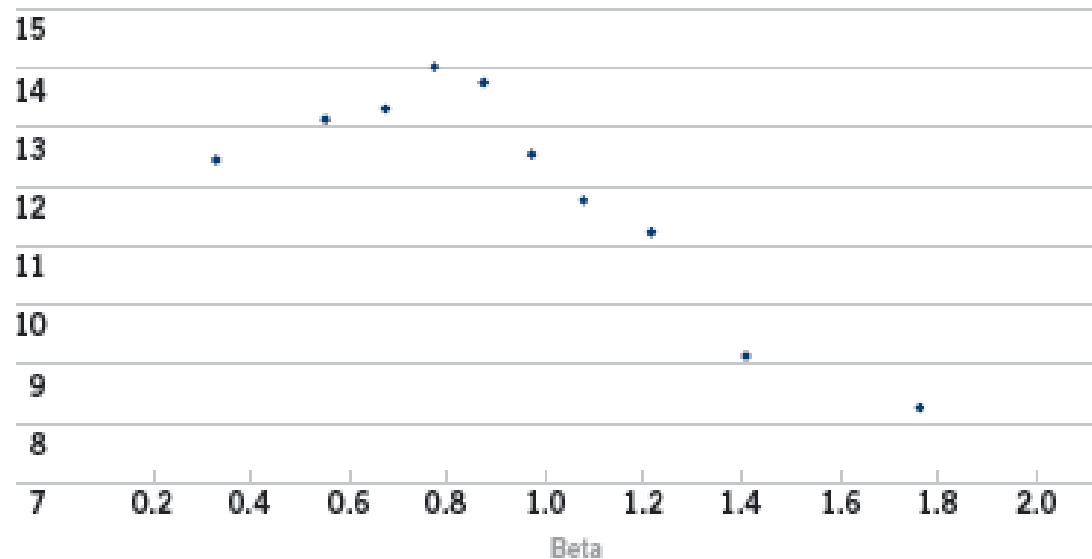
Excess Beta is Not Rewarded – But Lowest Beta Stocks Don't Necessarily Produce Highest Returns

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- State Street (2009)¹ noted that low beta stocks outperform high beta stocks, but ...
- Lowest beta stocks don't necessarily produce the highest returns, implying some added value to portfolio construction.

Exhibit 2: Average Annualized Monthly Return versus Beta For Equal Weighted Portfolios (Russell 3000 Universe) Dec 86–Oct 07

Average annualized monthly return (%)



Source: SSgA, Barra

Note 1: State Street – Managed Volatility: A New Approach to Equity Investing, 2009,. The Chart above plots the estimated historical betas by deciles. The deciles were broken into the lowest (1) and highest (10) beta estimates. One month forward returns were then calculated.

Minimum Variance Performance Varies Across Time Periods¹

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■ Poullaouec (2010)² found that:

- From June 1988 to June 2010 the MSCI MV Index¹ outperformed the MSCI World Index by +0.5% pa.
- However, a large component of the outperformance was concentrated in the June 2000 to June 2003 period.
- Strong underperformance occurred at the height of the tech bubble with superior performance in the extended downturn that followed.

Relative Performance by Sub-Periods

Period	Relative Performance of the MV Index versus the Capitalization Index	
Jun 88 — Jun 90	Outperformance	+3.3% pa
Jun 90 — Jun 98	Underperformance	-2.0% pa
Jun 98 — Jun 00	Strong underperformance	-10.4% pa
Jun 00 — Jun 03	Strong outperformance	+10.6% pa
Jun 03 — Jun 08	Flat	-0.4% pa
Jun 08 — Jun 10	Outperformance	+2.6%

Source: Ibbotson, MSCI Barra, SSgA, July 2008
Past performance is not a guarantee of future results.

Note 1: Further detail of MSCI MV Index is in Appendix 1.

Note 2: Things To Consider When Investing in Minimum-Variance Strategies, State Street Global Advisers, Thomas Poullaouec, 2010

The Volatility Effect is Only Partially Explained By Fama-French Factors

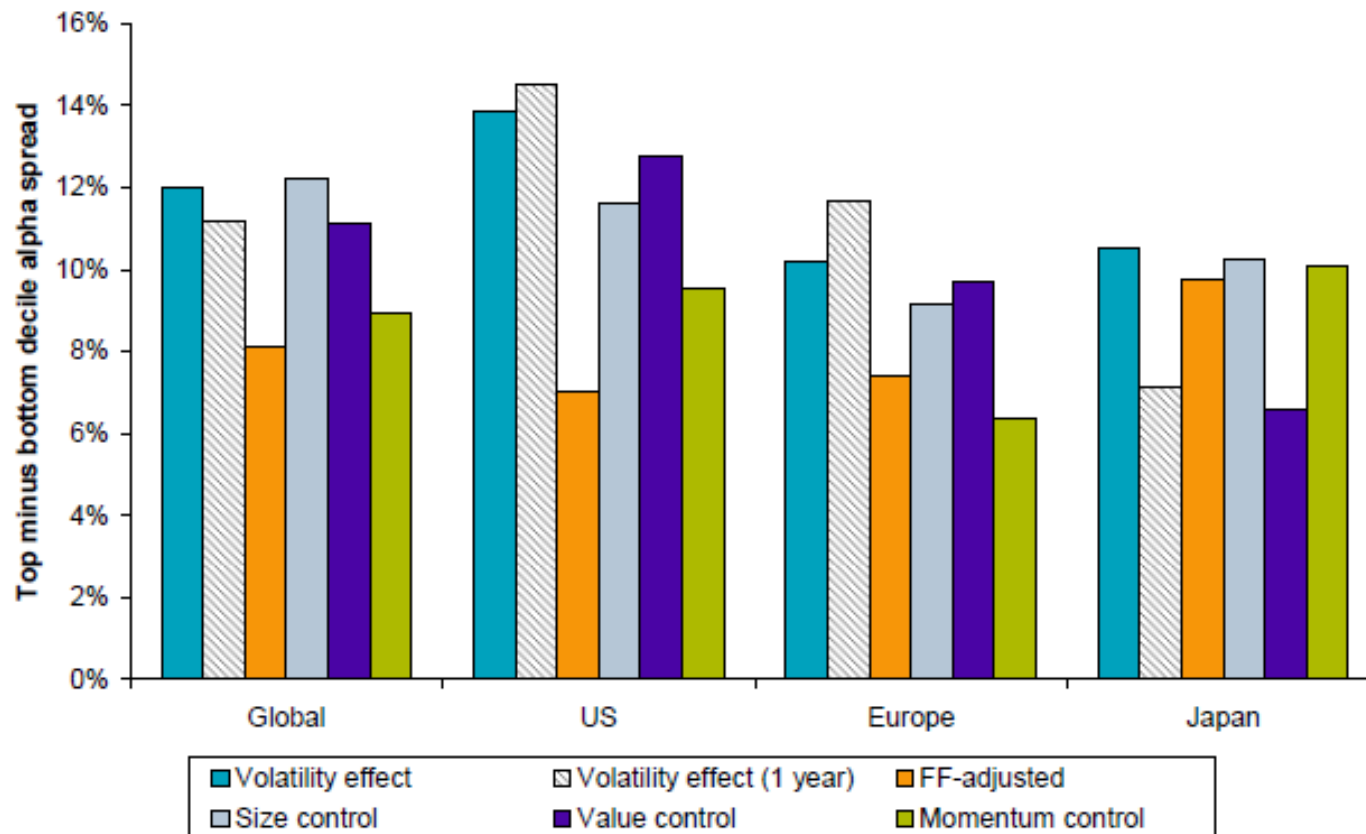
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- Consistent with other research Blitz *et al*¹ found that top deciles of size, value and momentum outperform relative to an equally weighted universe of stocks.
- However, the low volatility top decile portfolio delivered a higher Sharpe ratio than the top size, value and momentum portfolios.
- From an excess return perspective the volatility effect ranks second, with only the momentum effect being stronger in the sample.
- While partially explained by Fama-French factors, the volatility effect persists even when these factors are taken into account.

Note 1: Blitz, David C., and Pim van Vliet. "The Volatility Effect". *The Journal of Portfolio Management*, Fall 2007, pp. 102–113.

The Volatility Effect is Strong

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Note: Blitz, David C., and Pim van Vliet. "The Volatility Effect". *The Journal of Portfolio Management*, Fall 2007, pp. 102–113.

Should Investors Target the Anomaly Rather Than Minimum Variance?

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- According to Scherer (2010) the MV portfolio tends to invest in two identified anomalies – capturing the return inefficiency of low risk and low beta stocks¹.
- 83% of MV excess return compared to the index can be attributed to the Fama-French factors and the two anomalies of low volatility and low beta.
- In their own right the anomalies explain a sizeable 73% of the excess performance of the MV portfolio and nearly crowd out the Fama-French factors.
- Scherer argues that MV is an indirect method of accessing Fama-French and the two anomaly factors.
- Investors should decide the degree to which they invest in these two anomalies.

Note 1 : As demonstrated in Blitz, David C., and Pim van Vliet. “The Volatility Effect”. *The Journal of Portfolio Management*, Fall 2007, pp. 102–113.

The Volatility Effect Holds in the US, Europe and Japan

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- Blitz *et al* found that all ex-post Sharpe Ratios increased as volatility decreased in the US, Europe and Japan.

Regional results

Panel A: Main results US												
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D1-10	Univ
Excess return	6.9%	7.6%	8.1%	8.9%	8.3%	8.9%	9.6%	6.3%	7.0%	3.8%	3.1%	8.1%
Standard deviation	12.0%	13.7%	15.4%	15.9%	17.0%	16.7%	18.0%	20.7%	25.8%	36.5%	35.0%	17.1%
Sharpe ratio	0.58	0.56	0.53	0.56	0.49	0.53	0.53	0.30	0.27	0.10		0.47
(t-value)	0.5	0.7	0.6	0.9	0.2	1.0	0.9	-2.6	-2.1	-2.6		-
Beta	0.45	0.70	0.82	0.86	0.94	0.95	1.01	1.16	1.39	1.77	-1.32	1.00
Alpha	3.3%	1.9%	1.5%	1.9%	0.7%	1.1%	1.4%	-3.2%	-4.3%	-10.6%	13.8%	0.0%
(t-value)	1.6	1.3	1.1	1.4	0.5	1.3	1.3	-2.6	-1.9	-2.3	2.3	-
Panel B: Main results Europe												
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D1-10	Univ
Excess return	6.0%	6.9%	6.3%	6.8%	5.2%	4.7%	3.5%	2.4%	3.7%	-0.0%	6.0%	4.9%
Standard deviation	12.4%	14.2%	15.1%	16.9%	17.2%	17.8%	19.0%	20.2%	23.7%	28.7%	21.6%	17.5%
Sharpe ratio	0.49	0.49	0.42	0.40	0.31	0.27	0.19	0.12	0.16	-0.00		0.28
(t-value)	1.9	2.1	1.8	1.8	0.5	-0.2	-1.8	-2.7	-1.7	-2.7		-
Beta	0.64	0.74	0.82	0.93	0.94	0.98	1.06	1.12	1.29	1.49	-0.85	1.00
Alpha	2.9%	3.3%	2.4%	2.3%	0.7%	0.0%	-1.6%	-3.0%	-2.6%	-7.3%	10.2%	-0.0%
(t-value)	2.4	2.6	2.1	2.1	0.6	0.0	-1.8	-2.9	-1.5	-2.7	2.9	-
Panel C: Main results Japan												
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D1-10	Univ
Excess return	5.1%	5.1%	3.0%	4.6%	4.8%	4.2%	4.7%	3.5%	1.6%	-2.3%	7.5%	3.8%
Standard deviation	15.2%	18.0%	19.6%	20.1%	21.5%	22.3%	23.2%	25.3%	27.1%	33.0%	25.5%	21.5%
Sharpe ratio	0.34	0.28	0.15	0.23	0.22	0.19	0.20	0.14	0.06	-0.07		0.18
(t-value)	1.3	1.3	-0.3	0.9	0.9	0.3	0.6	-0.7	-1.7	-2.6		-
Beta	0.61	0.78	0.87	0.91	0.98	1.02	1.06	1.15	1.21	1.42	-0.81	1.00
Alpha	2.8%	2.1%	-0.3%	1.2%	1.1%	0.4%	0.7%	-0.8%	-2.9%	-7.7%	10.5%	-0.0%
(t-value)	1.6	1.5	-0.2	1.0	1.0	0.4	0.7	-0.7	-1.7	-2.8	2.5	-

Note 1: Blitz, David C., and Pim van Vliet. "The Volatility Effect". *The Journal of Portfolio Management*, Fall 2007, pp. 102–113.

Note 2: D1 represents the decile with the lowest volatility and D10 the highest, based on month end equally weighted portfolios ranked by the past 3 year volatility of weekly returns.

Why is the Volatility Effect Expected to Continue?

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- Inefficient pricing of securities such as the “lottery effect” of high volatility stocks, and a focus on tracking (relative) risk will conspire to extend the anomaly’s life.
- According to recent comments by Haugen, MV¹ and implicitly LV will continue as:
 - Market participants in general over-estimate the length of earnings trends.
 - Current relative advantages tend to dissipate more quickly than markets expect.
 - A success story is unlikely to be repeated, especially for growth stocks.
 - Growth stocks too eventually become overpriced and tend to have higher volatility.

Note 1: Minimum Variance investor explains why it can continue to outperform, February 2010, Citywire

What Role Can Low Volatility/Minimum Variance Investing Play?

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- In the aftermath of the GFC investors focused on protecting downside risks and reducing volatility.
- LV/MV is likely to appeal to:
 - Individual investors seeking diminished equity risk.
 - Liability-driven investment programmes (e.g., Defined benefit and insurance).
 - Superannuation and multi-manager funds with core or index allocations.
 - Pension funds in the US, Europe and Asia, seeking to lower portfolio volatility.
 - Investors who are re-focussing away from *relative* risk towards long-term net returns.

- Both LV and MV investing show significant overlap with Fama-French factors:
 - However the low volatility and low beta anomalies appear to persist. Why?
 - Is this an easier way to effectively “index” Fama-French?
- Should MV be preferred to LV?
 - What are the pro/cons of each?
 - Can the differences be timed or should investors just be patient?
- To what extent does this concept address market inefficiency?
 - Can LV/MV be used as an index, a core, a satellite or a separate low volatility equity allocation?
 - Does the concept make market benchmarks less relevant?
- Should LV/ MV be used to reallocate more capital to equities?

Expected Cost of Minimum Variance Implementation

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- According to Rogerscasey MV fees range from 15 bps (passive) to 70 bps (active), similar to those of other quant-driven strategies.
- MV implementation can include a range of approaches:
 - Passive: Define and implement a fixed “index” construction.
 - Managed Passive/ Enhanced Index: Define an index construction with some room to adjust for factors, such as a specific level of volatility.
 - Active: Implement MV as an independent overlay across other quant based strategies.

Note 1: Low Volatility Equity Portfolios, Arman Gevorgyan, Rogerscasey, October 2010

- Blitz, David C., and Pim van Vliet. “The Volatility Effect”. *The Journal of Portfolio Management*, Fall 2007, pp. 102–113.
- Clarke, Roger, Harindra de Silva, and Steven Thorley. “Minimum-Variance Portfolios in the U.S. Equity Market.” *Journal of Portfolio Management*, Fall 2006, pp. 10–24.
- Clarke, Roger, Harindra de Silva, and Steven Thorley. “Exploring the Risk Anomaly in the Equity Market,” *Economics and Portfolio Strategy*, December 2006
- Fama, Eugene and Kenneth French. “The CAPM: Theory and Evidence.” *Journal of Economic Perspectives*. Summer 2004, pp. 25–46.
- Fama, Eugene and Kenneth French. “The Cross-Section of Expected Stock Returns.” *Journal of Finance*, June 1992, pp. 427–465.
- Grossman, Blake and Peter Alpert, “Enhanced Indexing Techniques.” *Investment Guides for Plan Sponsors—Enhanced Index Strategies for the Multi-Manager Portfolio*, 1998, pp. 7–19.
- Haugen, Robert, and Nardin Baker. “The Efficient Market Inefficiency of Capitalization-Weighted Stock Portfolios.” *Journal of Portfolio Management*, Spring 2005, pp. 82–91.
- Markowitz, Harry. “Portfolio Selection.” *Journal of Finance*, 7, 1952, pp. 77–91.
- Sharpe, William. “Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk”. *Journal of Finance*, 19, 1964, pp. 425–442.
- Stattman, Dennis. “Book Values and Stock Returns.” *The Chicago MBA: A Journal of Selected Papers*, 4, 1980. pp. 25–45.

- The Cross-Section of Volatility and Expected Returns', Andrew Ang, Robert J. Hodrick, Yuhang Xing and Xiaoyan Zhang, Journal of Finance, Volatility LXI, No 1, February 2006
- R. Roll (1992), "A Mean/Variance Analysis of Tracking Error", Journal of Portfolio Management Summer 1992
- M. Vangelisti (1992), "Minimum Variance strategies: Do they work?": United States (1973 – 1991)
- J. Kleeberg (1995) "International Minimum-Variance strategies", Barra Newsletter Summer 1995: Germany, England, Japan, Canada (1978 – 1993)
- J. Bilson (1998), "Haugen Heroes, Risk and return in global equity markets": World (1981 – 1997)
- Thomas and Shapiro 2009 Managed Volatility: A New Approach to Equity Investing
- Low Volatility Equity Portfolios, Arman Gevorgyan, Rogerscasey, October 2010
- State Street – Managed Volatility: A New Approach to Equity Investing, 2009, Excess Beta is NOT Rewarded
- Low Volatility Equity Portfolios: A Free Lunch?, Harin de Silva, PhD, CFA, July 2010, Analytic Investors

APPENDIX:

Brookvine Analysis of the MSCI Minimum Volatility Index

Brookvine – MSCI Minimum Volatility Index Findings

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- The following slides show a comparison of the Gross All Countries MSCI MV (mid & large cap) and the Gross MSCI World Index (mid & large cap) both in USD from December 2001 through January 2011.
- MV excess return was 3.07% pa to the World Index returns.
- The MV portfolio had a superior and persistent 3 year Sharpe Ratio in all periods tested.
- Underperformance occurred during the recent rebound post GFC.
- Downside returns were muted, notably in 2008 when the MV portfolio dropped 25.1% versus the World Index losing 40.3%.

Note 1: MSCI Global Minimum Volatility Indices – http://www.msci.com/products/indices/strategy/minimum_volatility/

- MSCI Barra launched several Minimum Volatility Indices in April 2008.
- The Indices are the first benchmarks used by MSCI Barra to combine the firm's abilities in both index and risk modelling.
- Currently, MSCI Barra calculates six Minimum Volatility Indices in the following regions¹: All Country World, World, Europe, EAFE (Europe, Australia and the Far East), USA and Emerging Markets.
- The index is constructed with the following constraints:
 1. Maximum index constituent weight = Lower of 1.5% or 20 times weight in MSCI World Index²
 2. Minimum index constituent weight = 0.05%
 3. Sector and Country Weights +/- 5% of MSCI World Index
 4. Country weights capped at three times their weight in World Index
 5. USD denominated
 6. Maximum one-way index turnover = 10%

Note 1: MSCI Global Minimum Volatility Indices – http://www.msci.com/products/indices/strategy/minimum_volatility/

Note 2: The MSCI World Index is a equity index of over 1,500 global stocks. It is commonly used as the benchmark for global funds.

Snapshot – MSCI MV Index vs MSCI World Index

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Brookvine Performance Summary and Profit Attribution

January 2011

MSCI World Min Vol Index

MSCI World Index

Currency: USD

Risk Free Rate: ML 3-month T-bills²

Inception: December 2001

Performance versus MSCI World Index (% p.a.):	1 Year	2 Year	3 Year	5 Year	7 Year	Since Inception
MSCI World Min Vol Index	17.23%	20.51%	2.09%	5.51%	8.73%	8.53%
MSCI World Index	19.83%	28.32%	-0.99%	2.56%	5.75%	5.46%
Excess Return	-2.60%	-7.81%	3.08%	2.95%	2.98%	3.07%

MSCI World Min Vol Risk Statistics:	1 Year	2 Year	3 Year	5 Year	7 Year	Since Inception
MSCI World Min Vol Standard Deviation	11.41%	13.37%	16.08%	13.37%	12.09%	12.07%
MSCI World Index Standard Deviation	19.68%	20.24%	23.69%	19.33%	16.92%	16.82%
Tracking Error	9.71%	8.74%	9.16%	7.42%	6.52%	6.42%
Information Ratio	-0.27	-0.89	0.34	0.40	0.46	0.48

Sharpe Ratio	1 Year	2 Year	3 Year	5 Year	7 Year	Since Inception
MSCI World Min Vol Index	1.50	1.52	0.09	0.24	0.53	0.53
MSCI World Index	1.00	1.39	-0.07	0.01	0.20	0.20

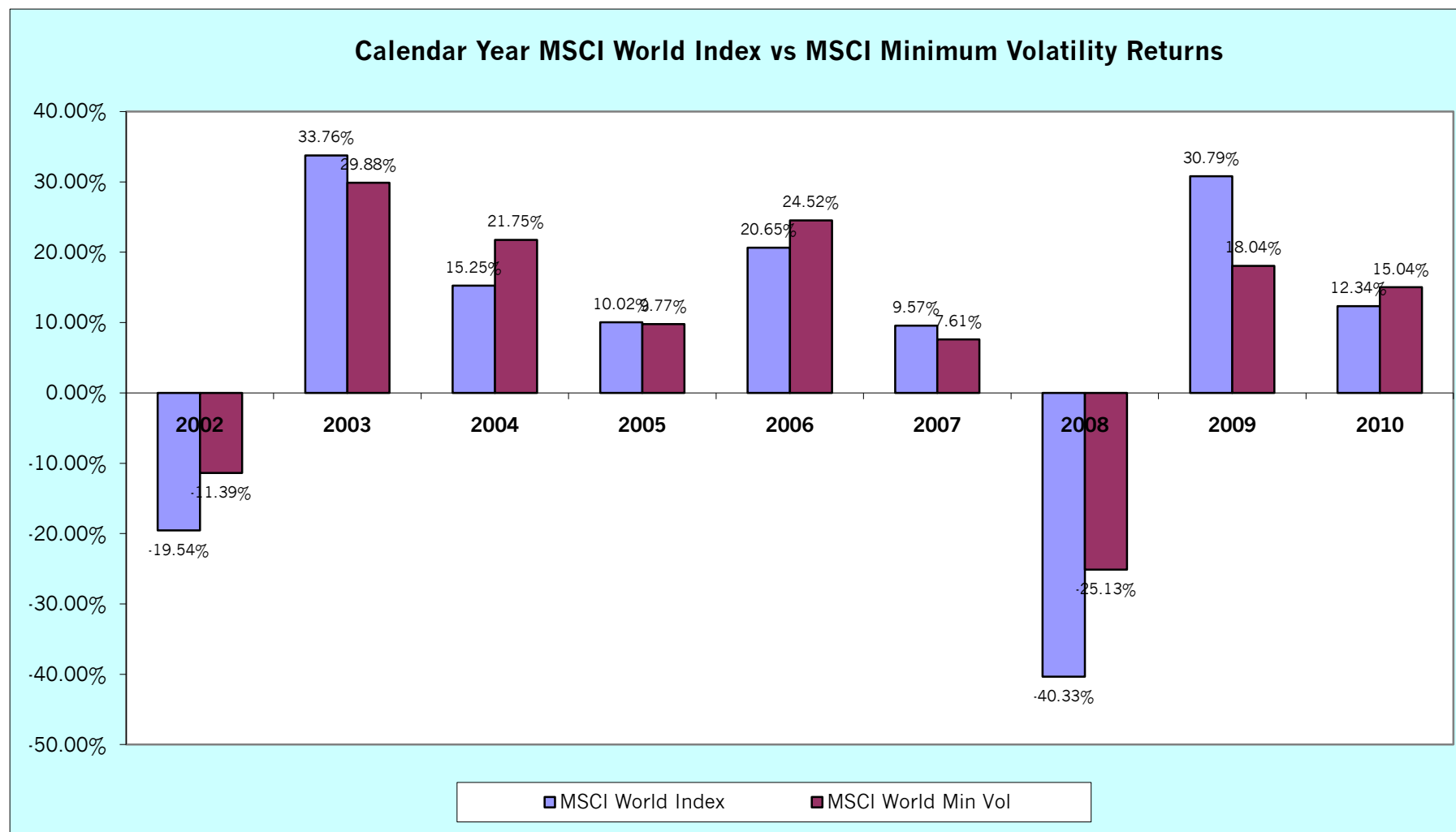
	1 Year	2 Year	3 Year	5 Year	7 Year	Since Inception
MSCI World Min Vol Monthly Average	1.38%	1.64%	0.28%	0.52%	0.76%	0.75%
MSCI World Index Monthly Average	1.67%	2.26%	0.15%	0.37%	0.76%	0.56%
MSCI World Min Vol Best Month	5.99%	6.73%	6.73%	6.73%	6.73%	6.73%
MSCI World Index Best Month	9.36%	11.32%	11.32%	11.32%	11.32%	11.32%
MSCI World Min Vol Worst Month	-5.56%	-8.91%	-14.33%	-14.33%	-14.33%	-14.33%
MSCI World Index Worst Month	-9.48%	-10.17%	-18.93%	-18.93%	-18.93%	-18.93%

Note 1: MSCI Global Minimum Volatility Indices – http://www.msci.com/products/indices/strategy/minimum_volatility/

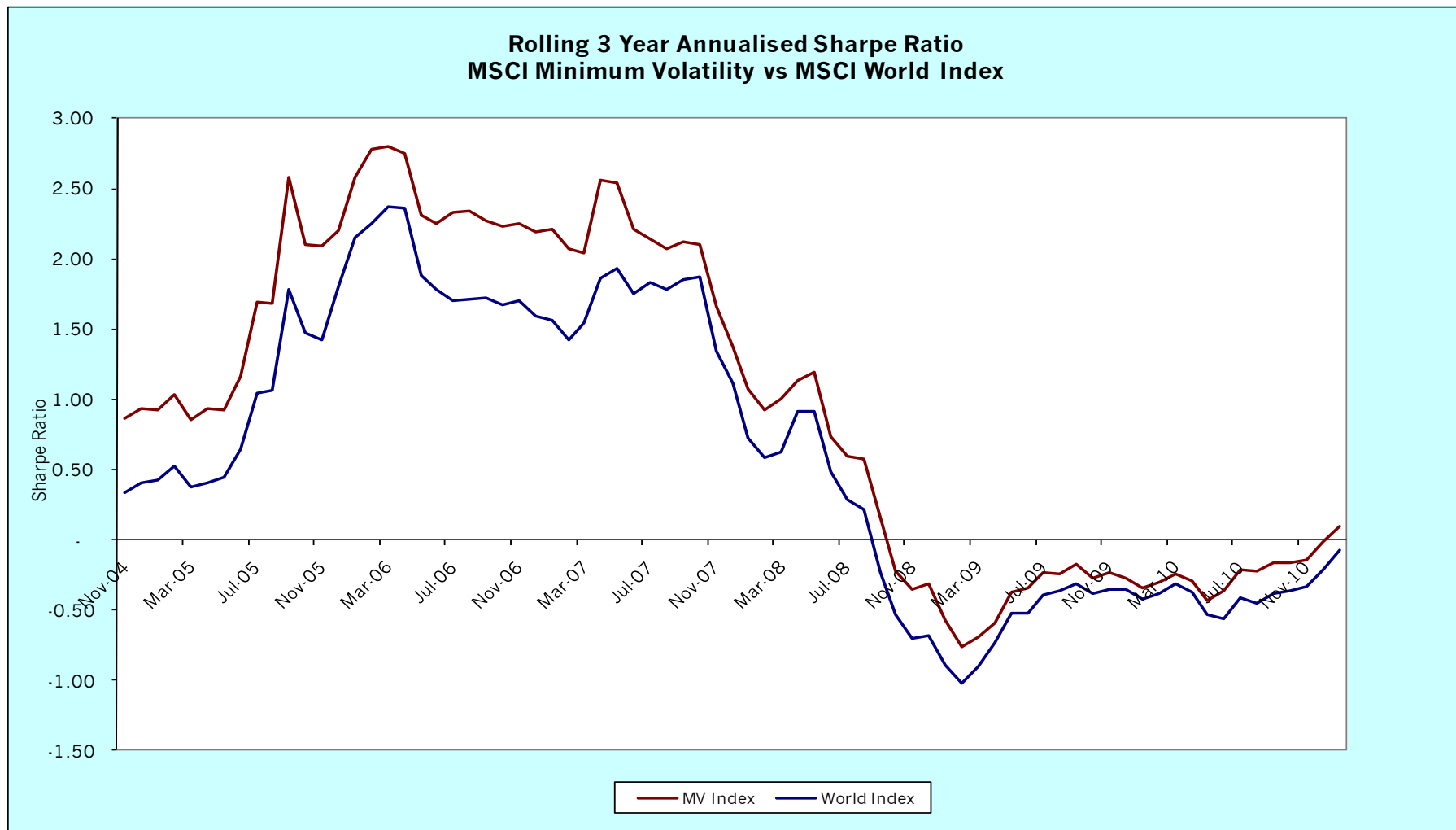
Note 2: The Merrill Lynch 3-Month Treasury Bill Index tracks the performance of the 3-month U.S. treasury market and is used as a proxy for the risk-free rate.

Calendar Year Returns

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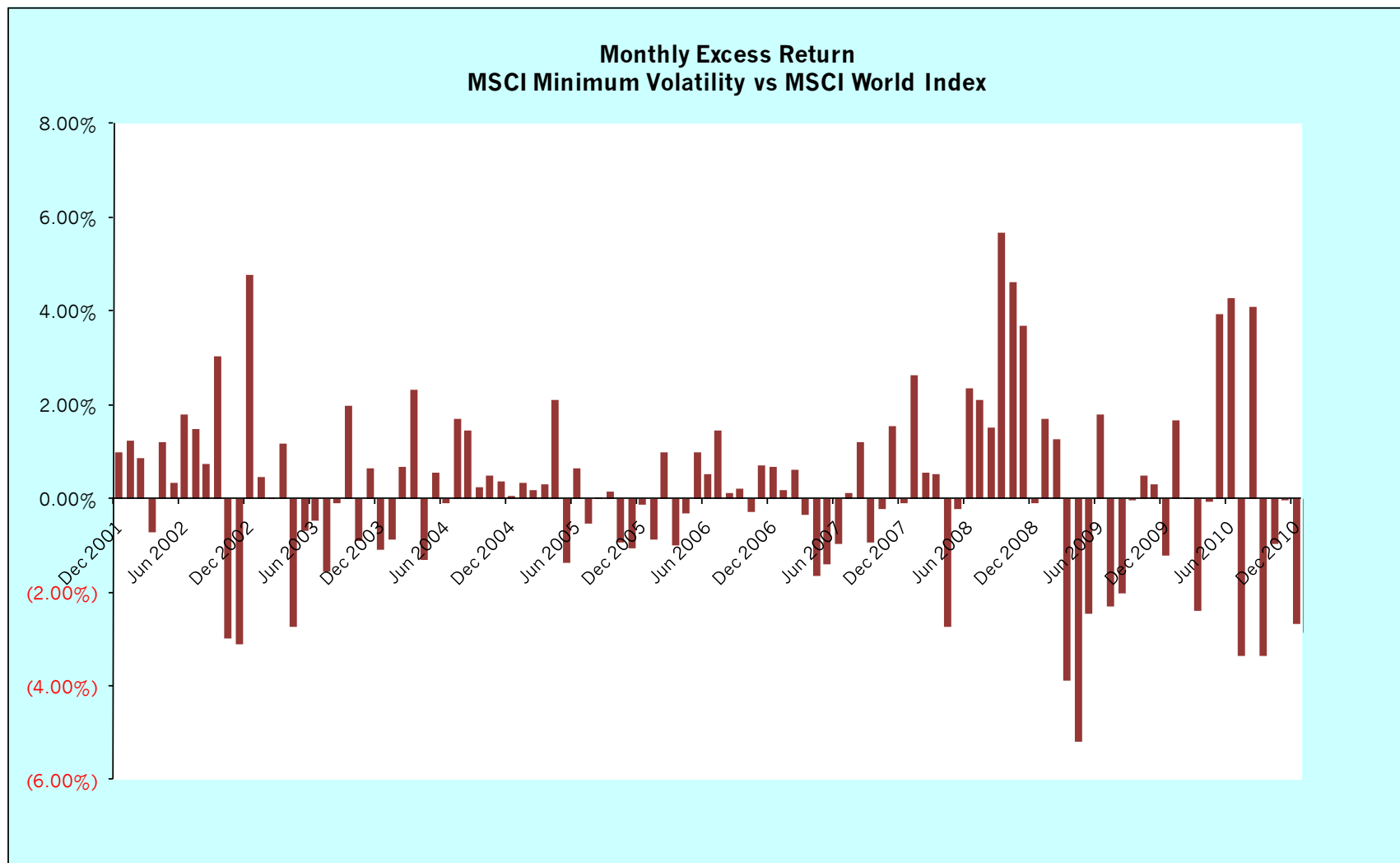
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Monthly Excess Returns

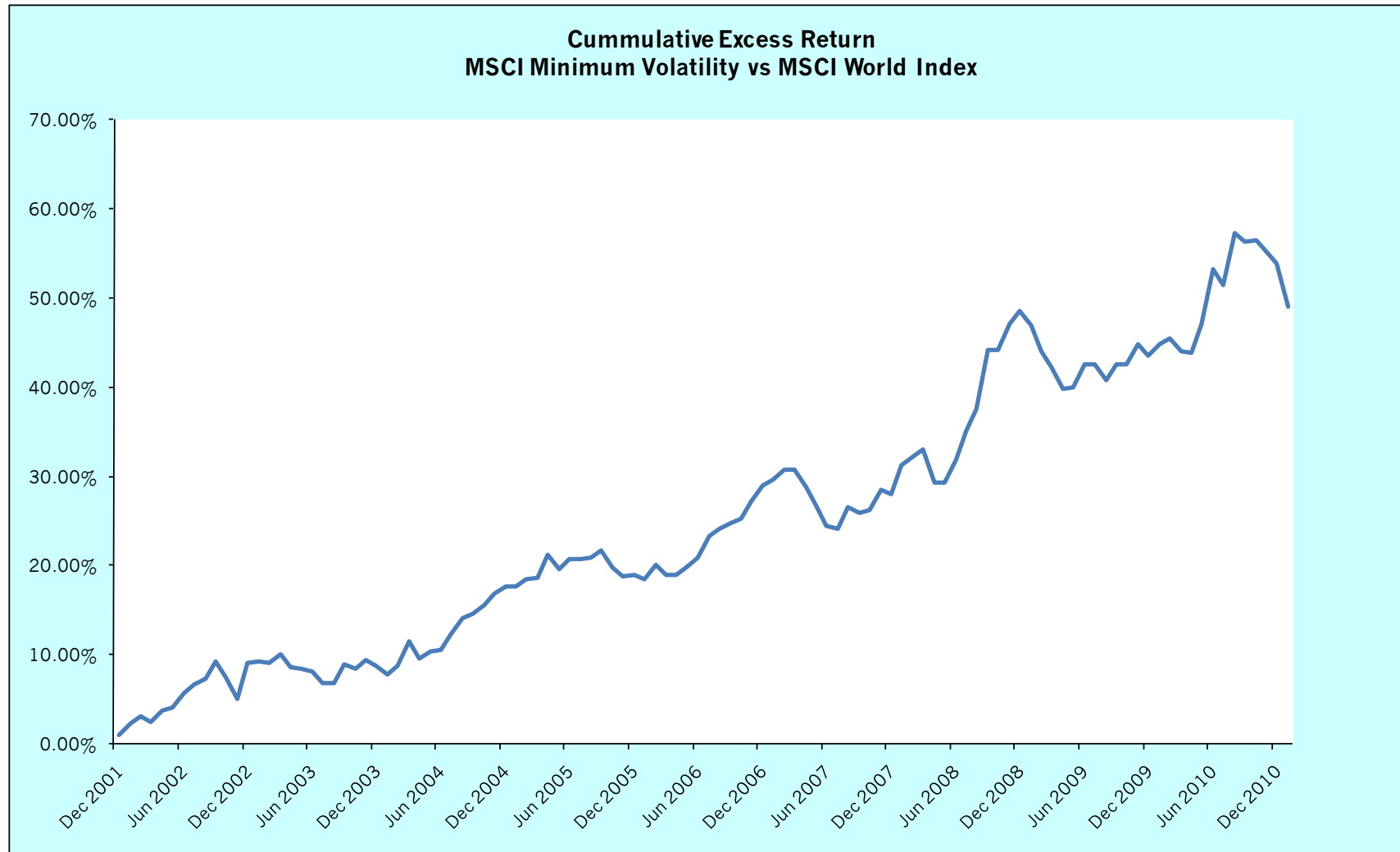
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Cumulative Excess Returns

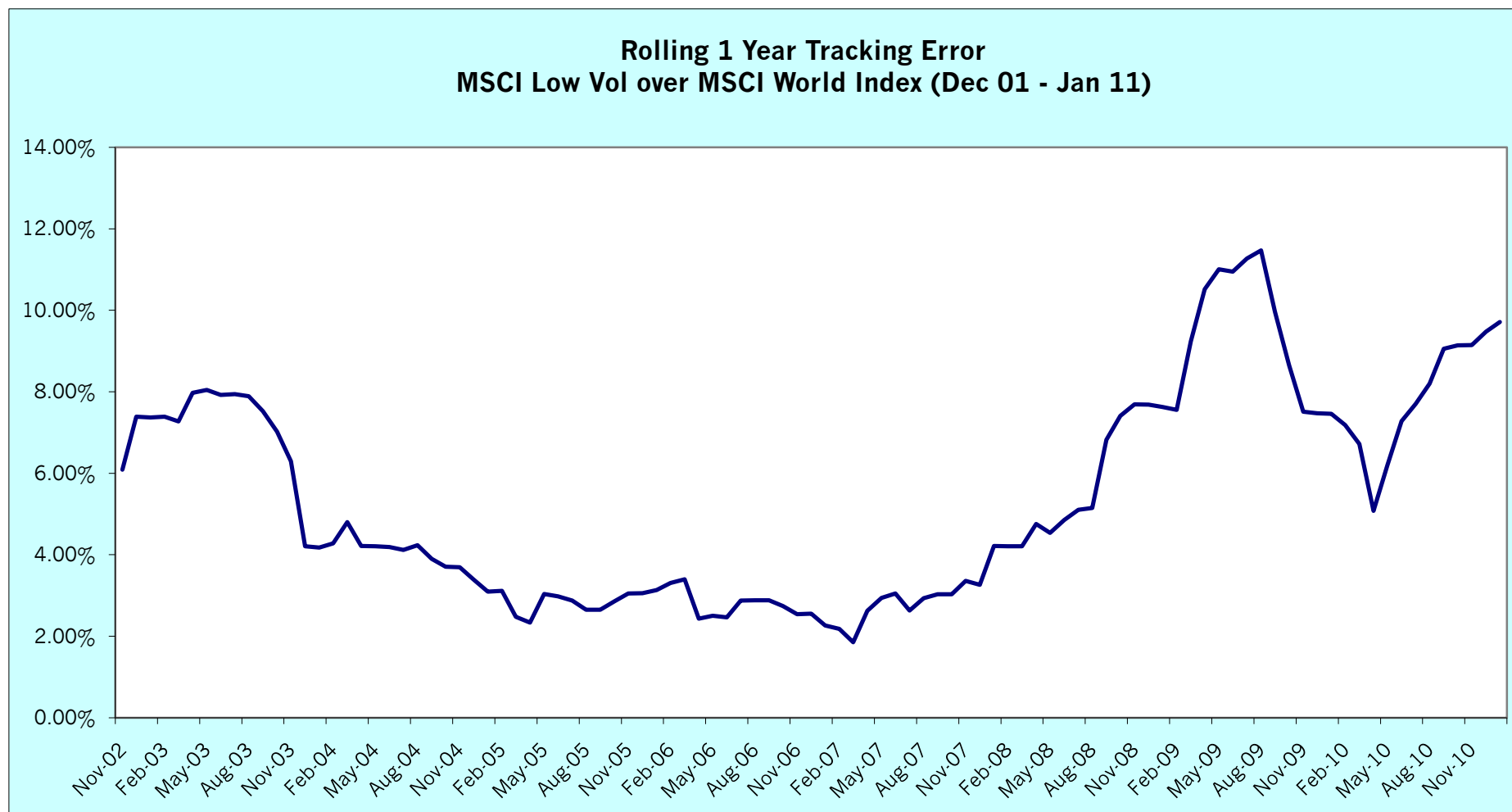
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Rolling 1 Year Tracking Error

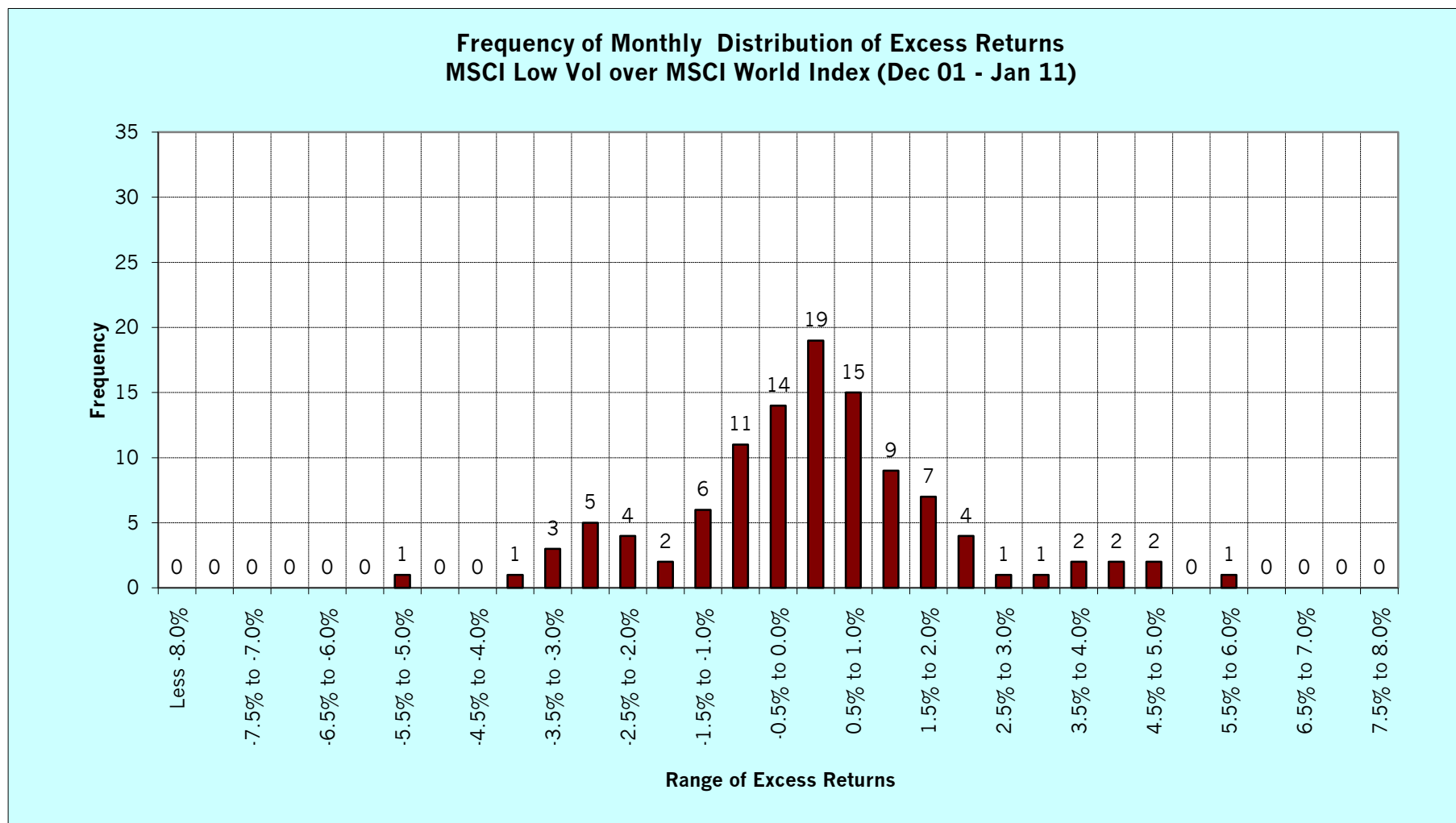
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Note 1: MSCI Global Minimum Volatility Indices – http://www.msci.com/products/indices/strategy/minimum_volatility/

Distribution of Excess Returns

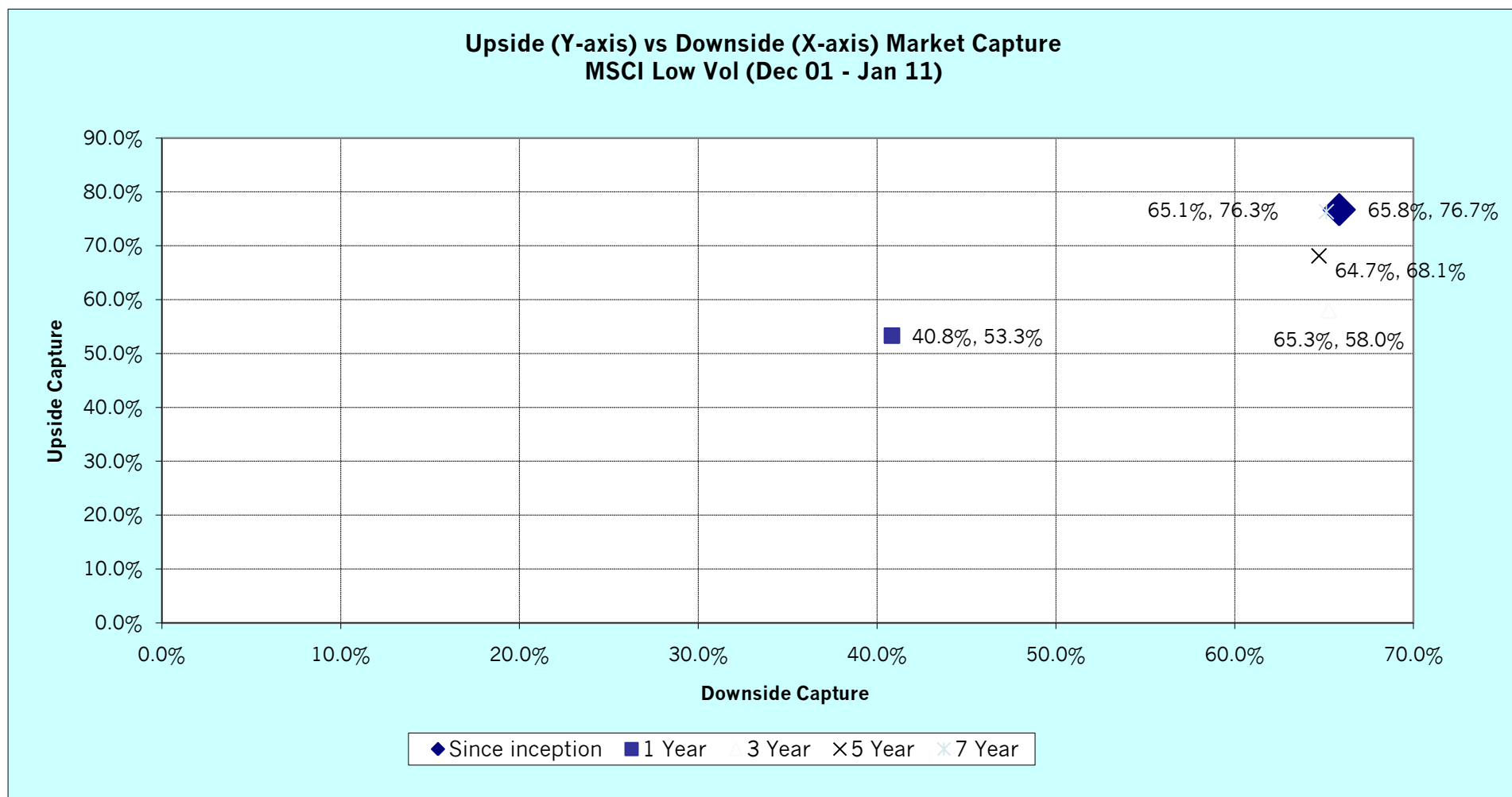
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Upside and Downside Market Capture

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Note 1: MSCI Global Minimum Volatility Indices – http://www.msci.com/products/indices/strategy/minimum_volatility/

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