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The Endowment Model: Theory, Experience and More Experience

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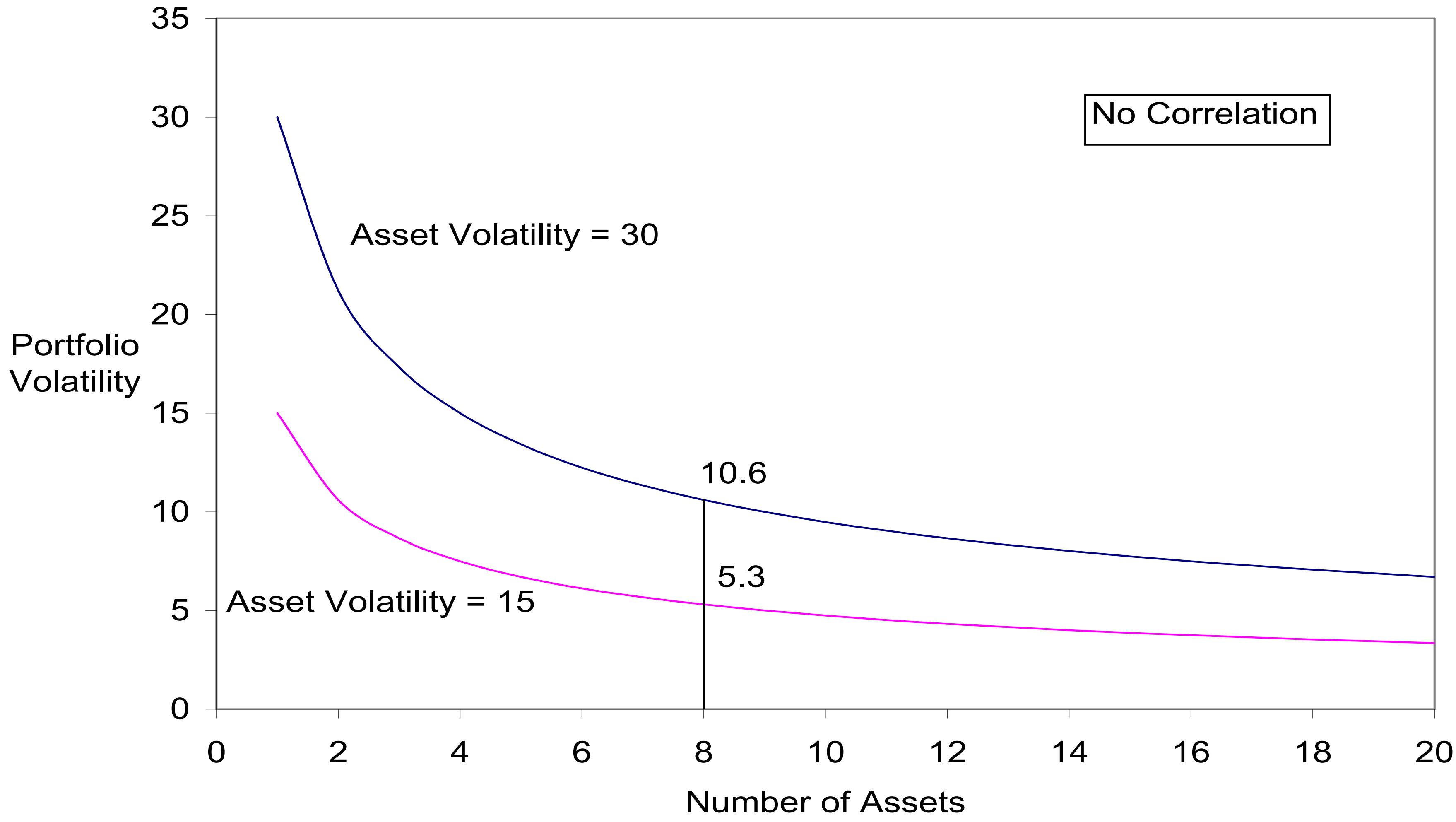
Q Conference
October 20, 2008

Classic Diversification

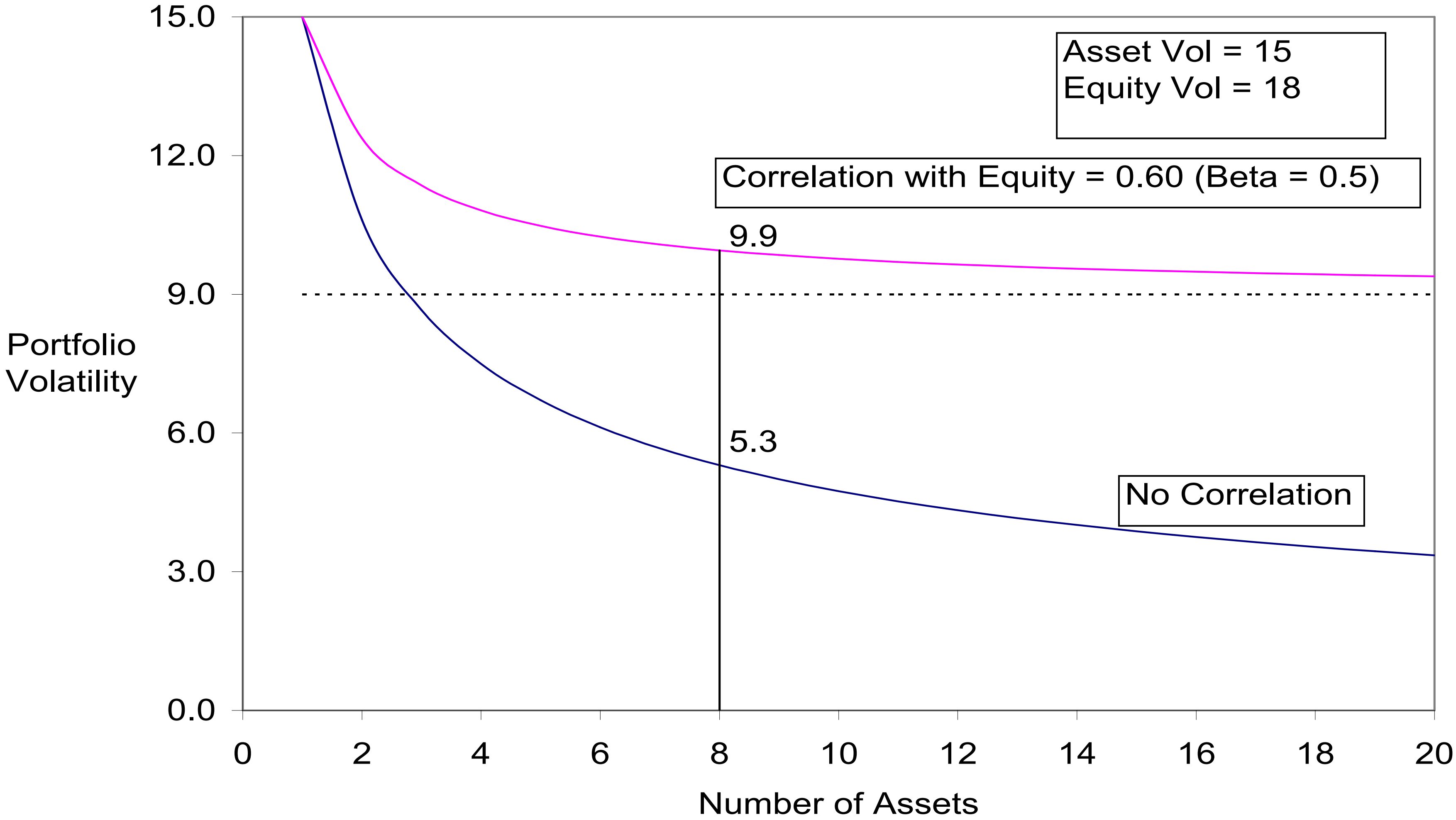
Source: Morgan Stanley Research

Textbook Diversification



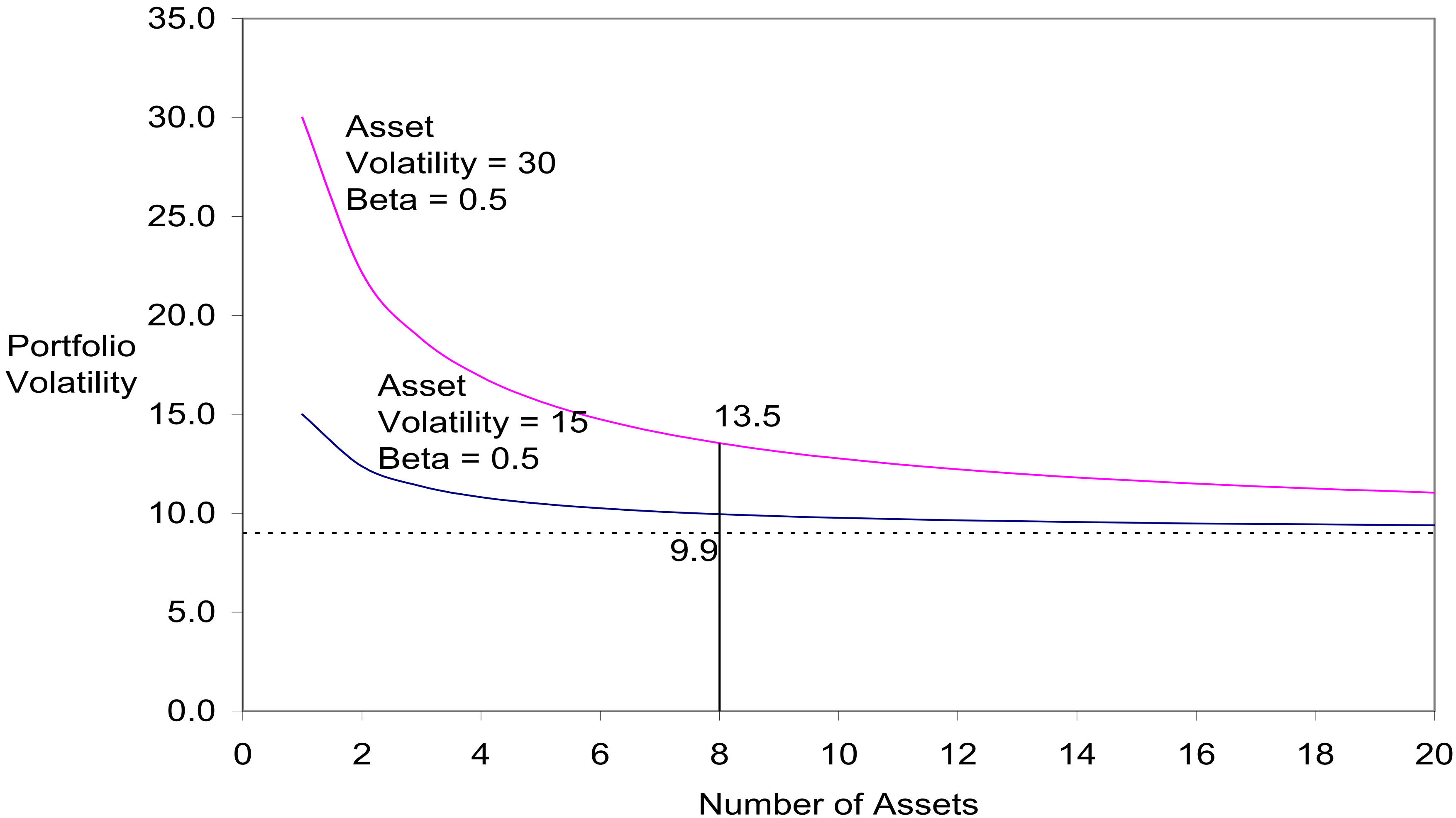
Source: Morgan Stanley Research

Diversification with Correlation Only Through Equity



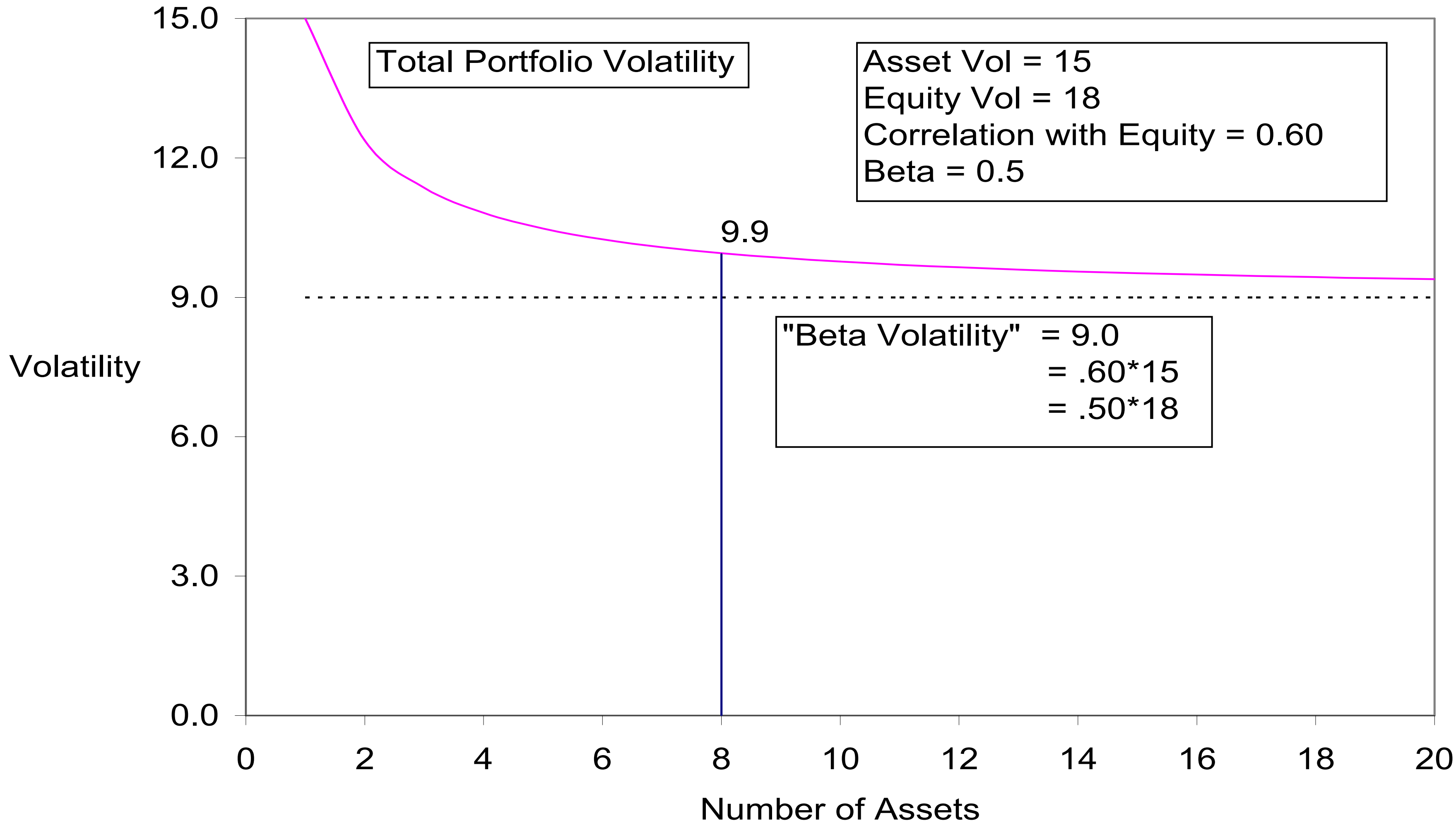
Source: Morgan Stanley Research

Convergence Much More Rapid With Lower Volatility



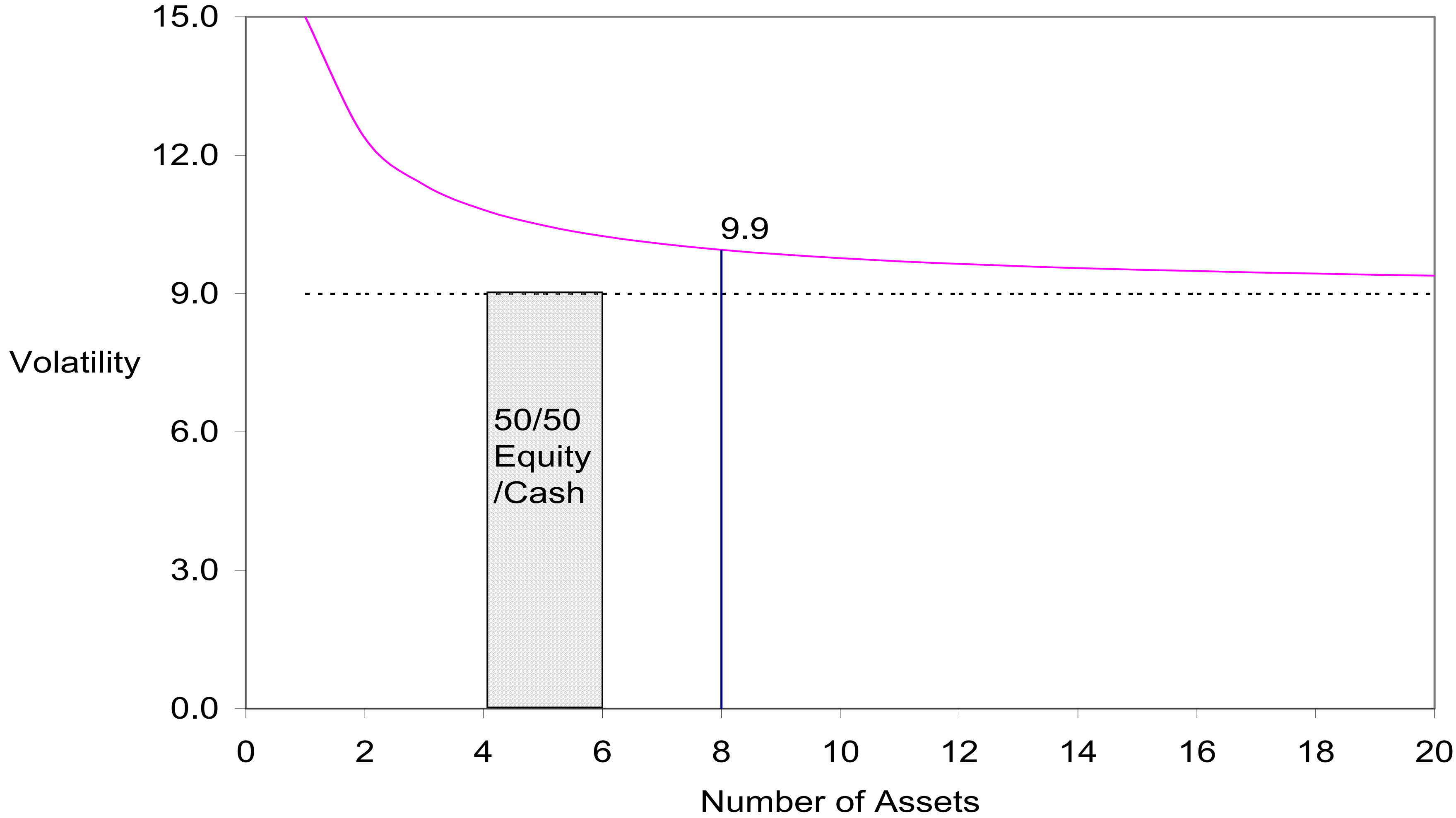
Source: Morgan Stanley Research

Correlated Diversification Converging on Beta Volatility



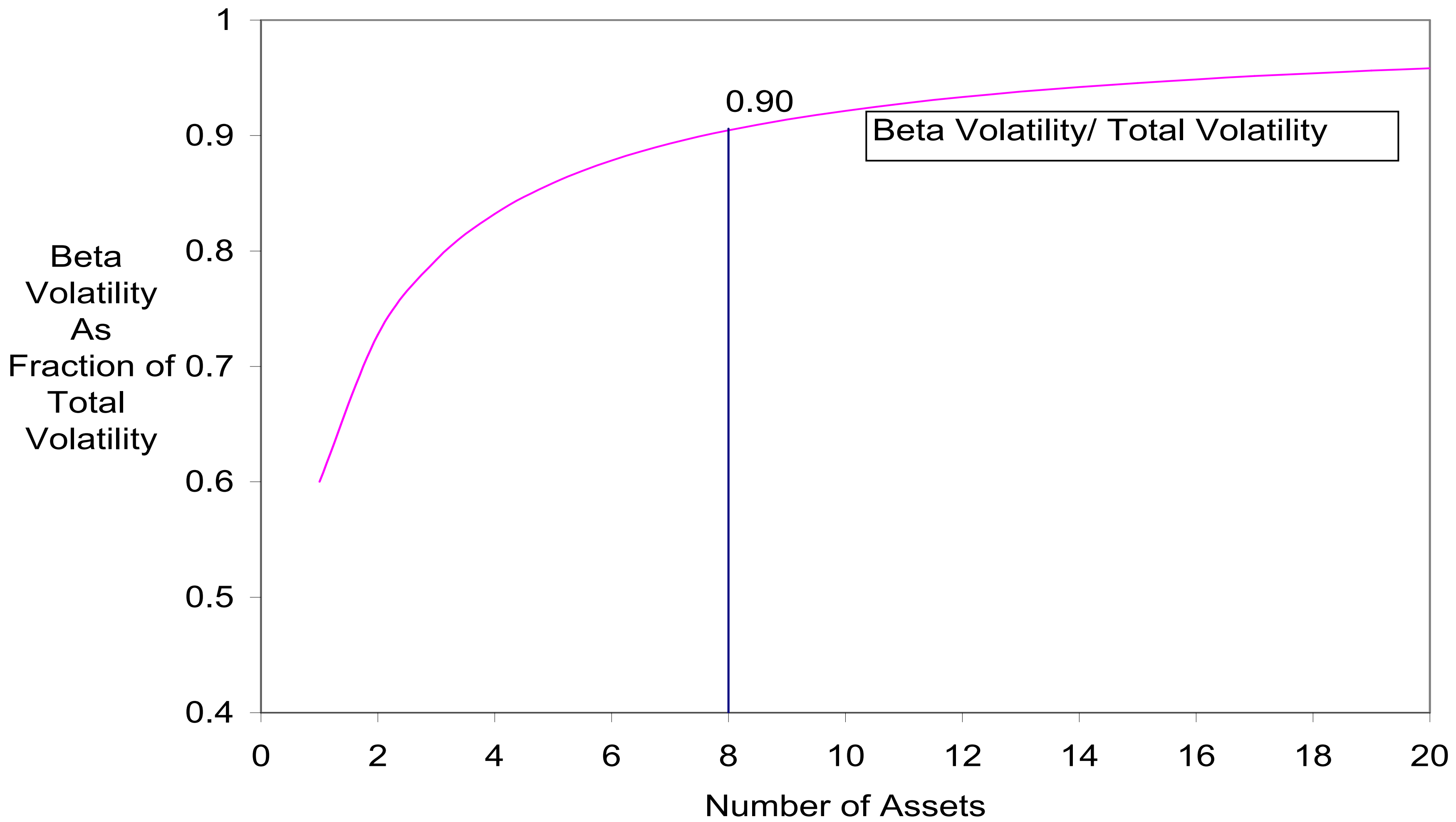
Source: Morgan Stanley Research

Alpha Diversification Converges on Beta-Equivalent Equity/Cash Portfolio



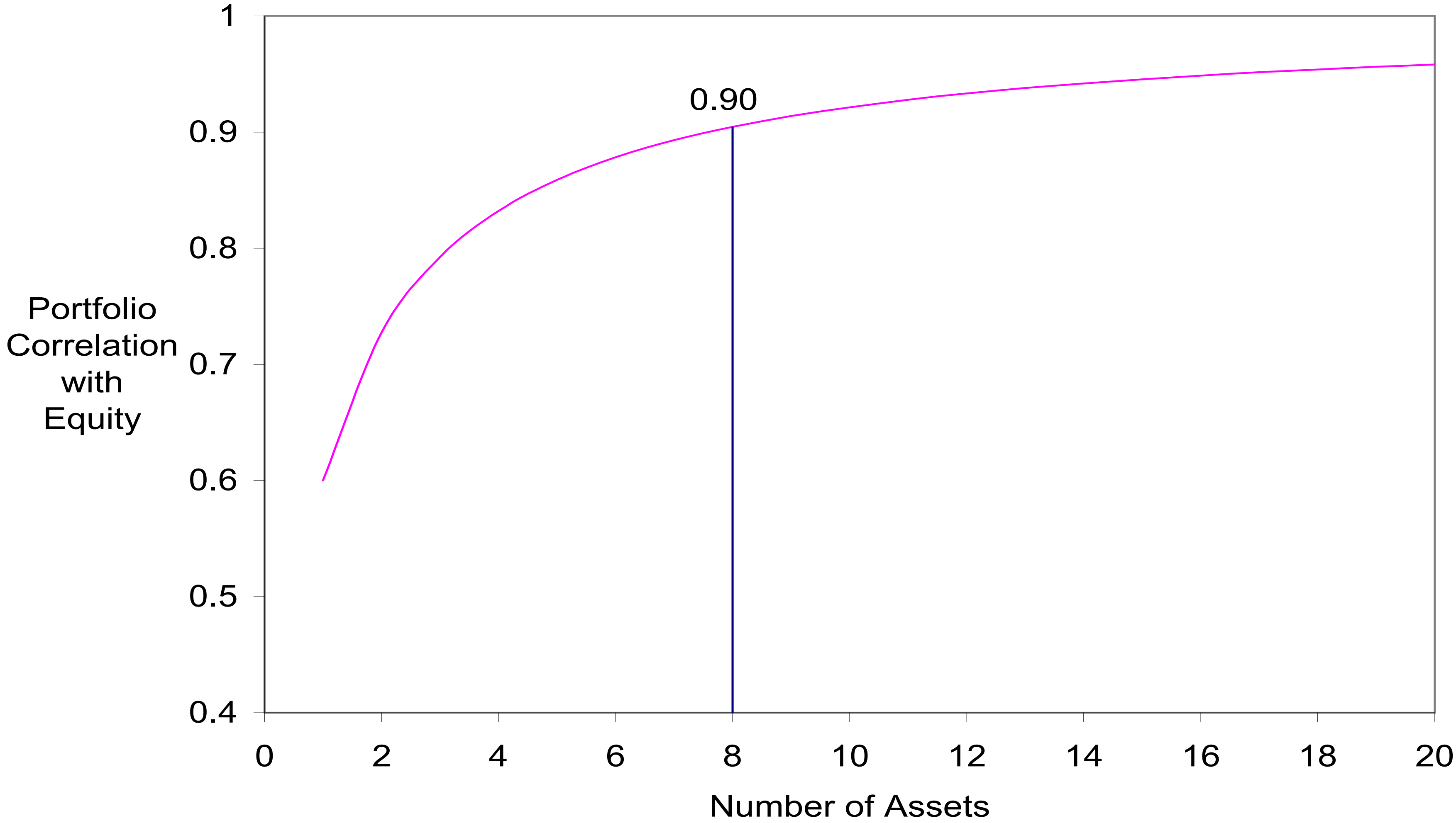
Source: Morgan Stanley Research

Portfolio's Beta Volatility Ratio Rapidly Moves Towards Unity



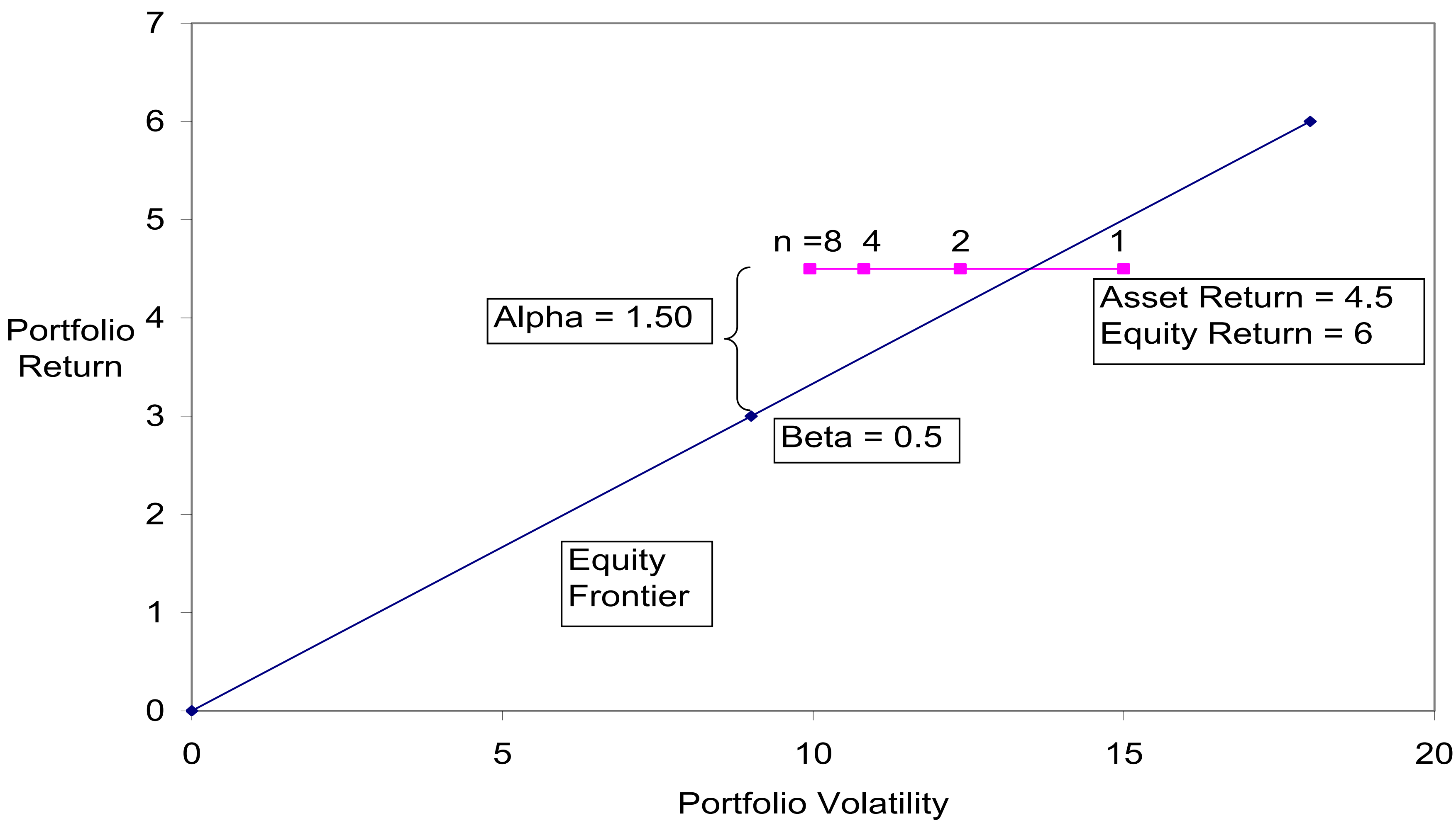
Source: Morgan Stanley Research

Portfolio Equity Correlation Rapidly Moves Towards Unity (Coincides with Beta Volatility/Total Volatility Ratio)



Source: Morgan Stanley Research

Partition of Portfolio Return



Source: Morgan Stanley Research

Theoretical Allocation Characteristics

Based on

A 2003 Return/Covariance Matrix

Leibowitz, Martin L.“The β-Plus Measure in Asset Allocation.” *Journal of Portfolio Management*, Spring 2004

Leibowitz, Martin L. and Anthony Bova. “Allocation Betas.’” *Financial Analysts Journal*, July/August 2005

Leibowitz, Martin L. and Anthony Bova. “Beta-Based Allocation: A Summary.” *Portfolio Analysis Note*, November 30, 2005

Leibowitz, Martin L. and Anthony Bova. “Gathering Implicit Alphas in a Beta World.” *Journal of Portfolio Management*, Spring 2007

Source: Morgan Stanley Research

A Simple Return Model

$$\tilde{r}_i = \beta_i \tilde{r}_e + \tilde{\alpha}_i$$

$$\beta_i = \rho_{ie}\left(\frac{\sigma_i}{\sigma_e}\right)$$

$$\tilde{r}_p = \left(\sum \omega_i \beta_i\right)\tilde{r}_e + \left(\sum \omega_i \tilde{\alpha}_i\right)$$

$$= \beta_p \tilde{r}_e + \tilde{\alpha}_p$$

Source: Morgan Stanley Research

An Even Simpler Risk Model

$$\sigma_p^2 = \left(\beta_p \sigma_e\right)^2 + \sum \left(\omega_i \sigma_{\alpha_i}\right)^2$$

$$\text{when } \rho_{ij} = \rho_{ie}\rho_{je} \qquad i \neq j$$

$$\frac{\beta_p \sigma_e}{\sigma_p} = \rho_{pe} \to 1 \quad \text{as} \sum \left(\omega_i \sigma_{\alpha_i}\right)^2 \to 0$$

Source: Morgan Stanley Research

Sample Portfolio Allocations

	Diversification →				
	B	B1	B2	C2	C
US Equity	60%	40%	30%	20%	20%
US Bonds	40%	30%	25%	10%	20%
International Equity		20%	20%	20%	15%
Emerging Mkt Equity				5%	5%
Real Estate		10%	10%	10%	10%
Absolute Return			10%	20%	10%
Private Equity			5%	10%	10%
Venture Capital				5%	10%
Total	100%	100%	100%	100%	100%

Source: Morgan Stanley Research

Theoretical Risk Projections

Diversification →

	B	B1	B2	C2	C	
Volatility (σ)	11.17%	→			10.45%	10.45%± .35%
Volatility/Equity Volatility	0.68	→			0.63	.65± .03
Correlation (ρ)	0.97	→			0.90	.94± .03
Beta to US Equity (β)	0.65	→			0.57	.61± .04
β-Based Volatility	10.73%	→			9.45%	10.07%± .67%
β-Based Volatility As % of Total Volatility	96.0%	→			90.4%	93.2%± 2.8%

Source: Morgan Stanley Research

Theoretical Implications

Typical Diversified Allocations and Traditional 60/40 Should Have

- Similar Volatilities in Any Given Period (at Level that Depends on Equity Volatility)
- Similar Volatility/Equity Ratios Across Time
- Similar High Equity Correlations (90%+) Across Time
- Similar Betas (0.60 ± 0.05) Across Time
- Similar Domination by Beta Volatility Across Time

But Even With These Similar Risk Characteristics, Greater Diversification Should Lead to Higher Alpha-Driven Returns

Source: Morgan Stanley Research

Theory Versus 2003-2007 Experience

Leibowitz, Martin L. and Anthony Bova. "The "Endowment Model": Theory and Experience, Morgan Stanley Note, August 20th, 2008

Source: Morgan Stanley Research

Last 5 Years: Similar Volatility/Equity Ratios Across Allocations

	Volatilities		Volatility/Equity	
	Theoretical	2003-2007	Theoretical	2003-2007
US Equity	16.50%	10.54%	1.00	1.00
B	11.17%	6.79%	0.68	0.64
B1	10.65%	7.21%	0.65	0.68
B2	10.19%	6.90%	0.62	0.65
C2	10.76%	7.49%	0.65	0.71
C	10.45%	6.61%	0.63	0.63

Source: Morgan Stanley Research

Last 5 Years: Similar Correlations and Betas Across Allocations

	Correlation		Beta	
	Theoretical	2003-2007	Theoretical	2003-2007
US Equity	1.00	1.00	1.00	1.00
B	0.97	0.94	0.65	0.61
B1	0.93	0.98	0.60	0.67
B2	0.93	0.98	0.57	0.64
C2	0.91	0.95	0.60	0.67
C	0.90	0.94	0.57	0.59

Source: Morgan Stanley Research

Last 5 Years: Return Patterns

	Total Return		Beta-Based Return		Alpha Return	
	Theoretical	2003-2007	Theoretical	2003-2007	Theoretical	2003-2007
US Equity	7.25%	9.42%	7.25%	9.42%	0.00%	0.00%
B	5.85%	6.24%	5.26%	5.66%	0.59%	0.58%
B1	6.03%	9.09%	4.96%	6.30%	1.07%	2.79%
B2	6.15%	9.99%	4.79%	5.98%	1.36%	4.01%
C2	6.98%	12.78%	4.93%	6.31%	2.05%	6.47%
C	7.08%	11.46%	4.79%	5.50%	2.29%	5.96%
	Should Depend on Realized Equity Return		Depends on Realized Equity Return But Similar Across Allocations		Higher than Projected But Improving with Diversification	

Source: Morgan Stanley Research

Comparing Past 5 Years With Theory

- Similar Risk Characteristics as Projected
- Total Volatility Depends on Equity Volatility
- Total Returns Depend on Equity Return
- Beta Returns Similar as Projected
- Alpha Returns Rise with Diversification as Projected
- But Alpha Returns Much Higher and Much More Consistent than Projected

Source: Morgan Stanley Research

Theory Versus 1993-2007 Experience

Leibowitz, Martin L. and Anthony Bova. "The "Endowment Model": Theory and More Experience, Morgan Stanley Note, October 10th, 2008

Source: Morgan Stanley Research

Diversified Portfolio Betas Lower in 1993-1997

	Theoretical	1993-1997	1998-2002	2003-2007
US Equity Real Return	7.25%	17.23%	-2.89%	9.42%
B	0.65	0.61	0.49	0.61
B1	0.60	0.56	0.54	0.67
B2	0.57	0.49	0.51	0.64
C2	0.60	0.43	0.62	0.67
C	0.57	0.46	0.59	0.59

Source: Morgan Stanley Research

Realized Alpha Returns

- Higher with Greater Diversification
- Surprisingly Stable
- Greater than Projections

	Theoretical	1993-1997	1998-2002	2003-2007
US Equity Real Return	7.25%	17.23%	-2.89%	9.42%
B	0.59%	0.86%	1.40%	0.58%
B1	1.07%	0.04%	1.52%	2.79%
B2	1.36%	1.78%	2.04%	4.01%
C2	2.05%	4.68%	3.88%	6.47%
C	2.29%	4.23%	5.53%	5.96%

Source: Morgan Stanley Research

Summary of Long-Term Results

Typical Diversification Does Not Materially Reduce

- Volatility
- Portfolio/Equity Volatility Ratio
- Correlation with US Equity
- Beta Sensitivity to US Equity
- Dominance of US Equity as Single Factor Risk

But Does Lead to

- Higher Returns
- Higher Alpha-Based Returns

Some Evidence that Strong Equity Markets

- Lower Correlation Based-Betas and Relative Returns of Diversified Portfolios

Some Evidence that Weak Equity Markets

- Increase Correlation-Based Betas and Also Reduce Relative Return of Diversified Portfolios

Source: Morgan Stanley Research

A "Semi-Diversified" Portfolio With Monthly Data

	B	D
US Equity	60%	30%
US Bonds	40%	25%
International Equity		25%
Emerging Market Equity		10%
REITS		10%

	US Equity Return	US Equity Volatility
Theoretical	7.25	16.50
1993-2007	7.59	15.08

	Theoretical		Monthly 1993-2007	
RISK	B	D	B	D
Volatility	11.17	11.83	8.48	9.54
Volatility/Equity	0.68	0.72	0.62	0.69
Correlation	0.97	0.91	0.98	0.91
Beta	0.65	0.65	0.61	0.63
RETURN				
Real Return	5.85	6.50	6.27	7.29
Real Beta Return	5.26	5.24	5.11	5.26
Real Alpha Return	0.59	1.26	1.16	2.03

Source: Morgan Stanley Research

Stress Betas, Stress Alphas, And … Stress

	B	D
US Equity	60%	30%
US Bonds	40%	25%
International Equity		25%
Emerging Market Equity		10%
REITS		10%

	US Equity	
	Return	Volatility
Theoretical	7.25	16.50
1993-2007	7.59	15.08
YTD 9/08	-15.35	16.75

	Theoretical		Monthly 1993-2007		Monthly YTD 9/08	
RISK	B	D	B	D	B	D
Volatility	11.17	11.83	8.48	9.54	10.32	13.96
Volatility/Equity	0.68	0.72	0.62	0.69	0.62	0.83
Correlation	0.97	0.91	0.98	0.91	0.99	0.95
Beta	0.65	0.65	0.61	0.63	0.61	0.79
RETURN						
Real Return	5.85	6.50	6.27	7.29	-11.69	-15.35
Real Beta Return	5.26	5.24	5.11	5.26	-10.86	-13.63
Real Alpha Return	0.59	1.26	1.16	2.03	-0.83	-1.72

Source: Morgan Stanley Research

Implications: Long-Term Benefits Versus Short-Term Risks

- Return Experience for Typical Diversification Looks Almost Too Good
- Short-Term Results from Typical Diversification Could Be (Should Be) More Erratic
- Short-Term Turbulence Can Hurt Diversified Portfolios More than Traditional 60/40 (Stress Betas and Stress Alphas)
- A Single Dominating Risk Factor May Incur Greater Vulnerability to Tail Events
- Short-Term “Lags” Under Strong Equity Markets Can Also Lower Diversified Portfolio’s Return Advantage
- Both Return and Risk Benefits from Diversification Should Be Viewed Within Long-Term Framework
- Raises Question of Short-Term Asset Momentum versus Intrinsic Sources of Long-Term Return

Source: Morgan Stanley Research

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Further Thoughts

- Realistically Assess Ability to Access and Monitor Desirable Subclasses/Managers/Vehicles
- Important to Review the Asset Class Limits that Really Determine Allocation (Not Optimization)
- Risk Tolerance Should Reflect Hard and Soft Liability Schedules and Backup Resources
- Asset Valuation and Entry Point Sensitivity Should Play Some Role
- Pro-Active Rebalancing and "Organizational Fortitude"

Source: Morgan Stanley Research

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	Coverage Universe		Investment Banking Clients (IBC)		
Stock Rating Category	Count	% of Total	Count	of Total IBC	% of Rating Catery
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Data include common stock and ADRs currently assigned ratings. An investor's decision to buy or sell a stock should depend on individual circumstances (such as the investor's existing holdings) and other considerations. Investment Banking Clients are companies from whom Morgan Stanley or an affiliate received investment banking compensation in the last 12 months.

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