Morgan Stanley

MORGAN STANLEY RESEARCH
NORTH AMERICA

Morgan Stanley & Co. Incorporated

Martin Leibowitz
Martin.Leibowitz@morganstanley.com
+1 (1)212 761 7597

Anthony Bova
Anthony.Bova@morganstanley.com
+1 (1)212 761 3781

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Portfolio Strategy

Minimum Target and Maximum Shortfall Risks

The allocation process can be viewed as a tradeoff between reaching for higher returns while accepting the potential risk of shortfalls. This Note focuses on the distinction between return targets that are higher than the risk-free rate and shortfall risk limits that fall below the risk-free rate. The relevant time horizons are also typically different, with shortfall risks being more imminent and near-term while expected returns evolve over time.

Using a shortfall analysis based upon a standard volatility model, the twin objectives of return targeting and risk control approximate the 0.6 beta levels seen in most US portfolios. On the one hand, setting limits for shortfall risk is tantamount to putting a cap on the fund's overall beta value. On the other hand, to achieve return targets above the risk-free rate, the fund must stretch to risk levels beyond some minimum beta value.

The beta sensitivity typically accounts for over 90% of a fund's total volatility. This beta value of 0.60 is strikingly common across US portfolios, including those that differ significantly in asset allocation, degree of diversification, investment objectives, funding requirements, prospective net flows, and sponsor strengths. Such commonality raises a question as to whether funds "back into" this 0.60 beta to avoid a "tripwire" risk that would be problematic for virtually any portfolio.

The development in this paper and the above findings are based on a shortfall analysis of a two-asset market model with standard volatility assumptions. It should be pointed out that the real world has recently given evidence that such shortfall models can be breached by spiking volatilities, return jumps, tightened correlations, and stress betas that can turn shortfalls into free-falls.

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Minimum Target and Maximum Shortfall Risks

Introduction

Investment objectives are often expressed in terms of various return levels: 1) expected return for a given allocation — possibly with some anticipated add-ons from active management, 2) a lower risk limit or minimum "shortfall" return that would hopefully not be penetrated, and 3) a higher "return target" set as a goal or standard for success.

This Note focuses on the distinction between return targets that are higher than the risk-free rate and shortfall risk limits that lie below the risk-free rate. Indeed, the allocation process can be viewed as a tradeoff between reaching for higher returns while accepting the potential risk of shortfalls.

One often hears that a fund must move towards a riskier stance in order to satisfy its return objectives. However, one rarely sees a formal analysis of the probability of reaching such a specified return target within a given time horizon.

The following results are based upon a simple equity-only allocation model where the expected return — and risk — is derived solely from beta sensitivity to an equity allocation. While such expected returns may be represented as annualized values, they should be "expected" to be achieved only over longer-term horizons. Our model is very basic, assuming no additional alpha benefits from diversification or active management. Consequently, this analysis should be viewed as an intentionally limited first-cut approximation. A symmetric normal probability distribution is used both for single year and for multi-year horizons (even though a lognormal or some other asymmetric distribution would probably be more appropriate). The multi-year analysis does not consider the potential impact of mean reversion or volatility drag.

The findings are highly dependent on the risk premium, which is here assumed, in the interest of being conservative, to be 4%. These choices were made to highlight the significant difference between the relatively high probability of satisfying a reasonable shortfall risk constraint, and the more modest probability of achieving a given return target that exceeds the risk-free rate.

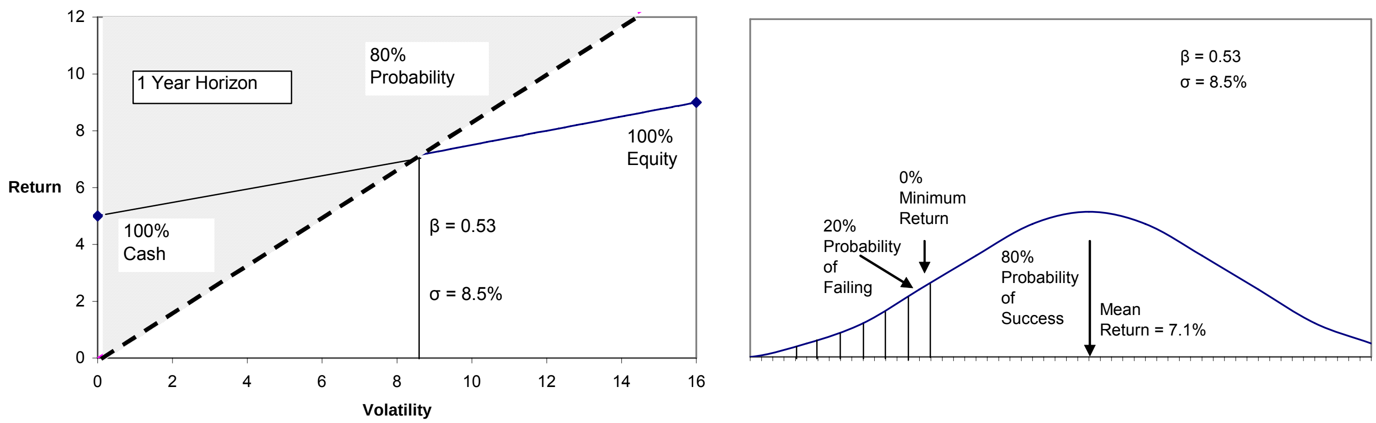
Maximum-Shortfall Risks

Shortfall risk refers to the probability of falling below some specified minimum return or minimum asset level. The shortfall concept is limited in the sense that it does not address the extent by which a given risk position may fall below the specified shortfall level. However, the shortfall concept does have the virtue of being easily visualized in return/risk space. With return/risk assumptions that are inherently uncertain, the simplicity of the shortfall approach can at least provide directionally valuable results that are highly intuitive.

The majority of exhibits in this report will follow the format of Exhibit 1. On the left side, the solid line represents the equity market line with a 5% risk-free return for cash, an equity risk premium of 4%, and an assumed equity volatility of 16%. In this space, the return/risk combinations that provide an 80% or greater probability of a positive return are depicted by the dotted "shortfall line" shown in Exhibit 1. This line emanates from the origin (the 0% shortfall limit) and ascends with a slope of 0.84 that corresponds to the 80% probability. (The analysis underlying this shortfall risk approach is presented in the Appendix.) All return/risk combinations above this shortfall line satisfy this shortfall constraint. The shortfall and the market lines intersect at a beta value of 0.53, which is the highest beta value on the equity/cash line that satisfies the shortfall constraint.

The right side of Exhibit 1 is a schematic representation of the outcomes for a portfolio with this beta of 0.53. The 0.53 beta corresponds to an expected one-year return of 7.1% and a volatility of 8.5% (=0.53*16%). The shortfall requirement implies that this combination provides an 80% probability of outcomes above the required shortfall level of 0%. All lower beta positions would more than satisfy this shortfall constraint, and all higher beta values would fail to do so.

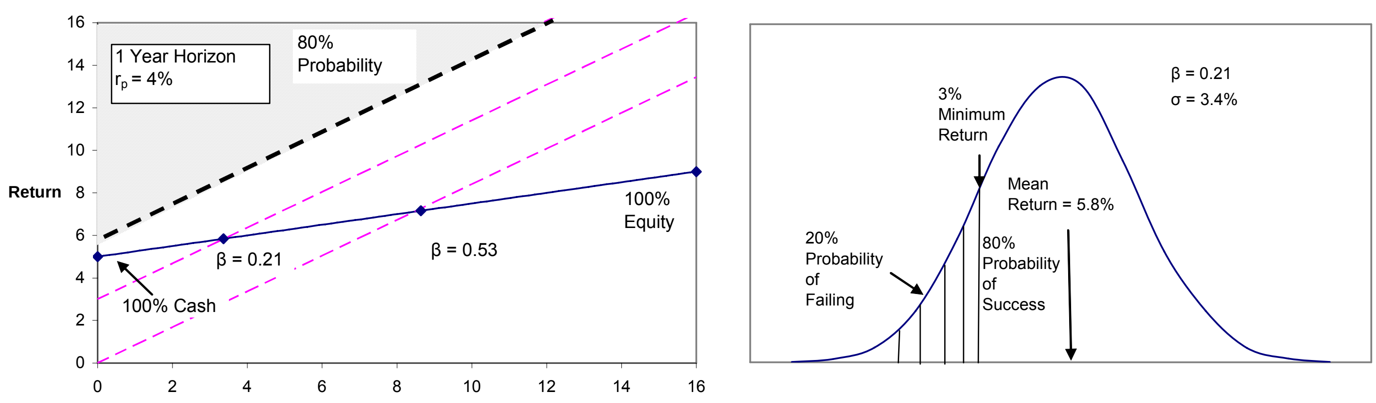
Exhibit 1
Shortfall Line for 80% Probability of Achieving 0% Return



Source: Morgan Stanley Research

Exhibit 2 repeats the equity market line from Exhibit 1 but adds two more 80% shortfall lines. The line that begins at 3% now intersects the market line at the much lower beta of 0.21. Thus, over the one-year horizon, only betas below 0.21 will provide the required 80% probability of exceeding the 3% shortfall level. The chart on the right side shows that with a beta of 0.21, 80% of the outcomes fall above 3%.

Exhibit 2
Shortfall Lines for 80% Probability of Achieving 3% and 6% Return



Source: Morgan Stanley Research

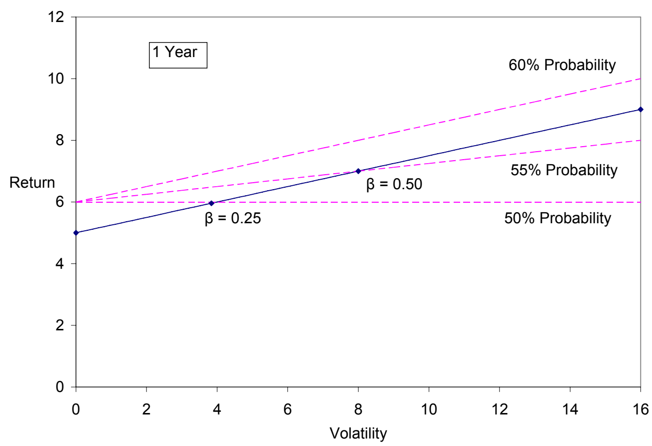
Minimum Target Risks

In the preceding examples, where the required minimum return lies below the risk-free rate, the shortfall constraint acts to limit the maximum acceptable beta risk. This shortfall application reflects its typical role in establishing maximum risk limits. Indeed, most forms of risk analysis are focused on establishing such outside risk limits. However, the shortfall approach can also be applied to determining the *minimum risk* needed to achieve some return target that lies *above* the risk-free rate. This minimum risk "constraint" is exemplified by the third 80% shortfall line in Exhibit 2 that is pinned at 6%, i.e., 1% over the 5% risk free-rate. It can be seen that the region above this line excludes the entire market line. In other words, there is no beta value that would provide an 80% chance of assuring a minimum 6% return.

In Exhibits 1 and 2, the slope of the shortfall lines was 0.84, corresponding to an 80% probability of achieving the minimum return. To force the slope of the shortfall line downward, the required probability must be dropped well below 80%. Exhibit 3 depicts three shortfall lines with lower probabilities The zero slope line corresponds to a 50% probability (Once again, it is the return/volatility combinations above the shortfall line that satisfy the constraint). This 50% shortfall probability line intersects the equity market line at a beta of 0.25. Thus, in contrast to the shortfall risk in Exhibit 1, this return target now calls for betas that are greater than the 0.25 point of intersection. Similarly, for the 55% probability line, the betas must exceed 0.50 to achieve the 6% target. Finally, the 60% line is just parallel to the equity market line itself, so no intersection exists and there is no beta that can achieve the 6% target with a 60% probability.

Exhibit 3

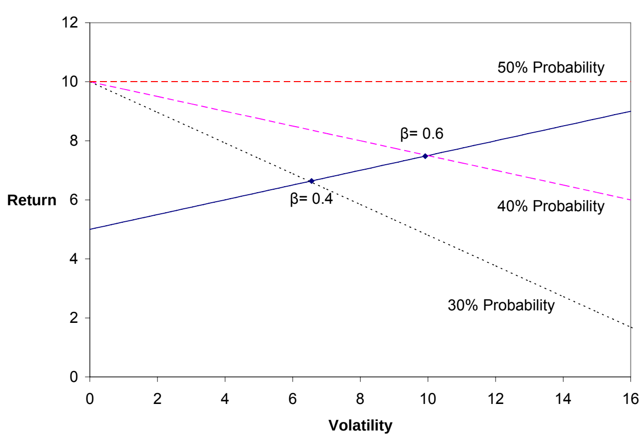
Shortfall Lines for 50%, 55% and 60% Probability of Achieving 6% Return Target



Source: Morgan Stanley Research

Exhibit 4

Shortfall Lines for 30%, 40% and 50% Probability of Achieving 10% Return Target



Source: Morgan Stanley Research

Lower-Probability "Stretch" Targets

This market model does offer the potential for significantly higher returns, but only with a reduced probability. This is illustrated in Exhibit 4 where the return target is now set at 10%. The shortfall lines are traced out for probabilities of 50%, 40% and 30%. The 50% line is horizontal and lies above the entire market line. Hence, there is no beta point on the market line (at least, no unleveraged beta value) that can provide a 50% or greater chance of reaching the 10% target return. The 30% and 40% lines are downward sloping, intersecting the market line at betas of 0.4 and 0.6, respectively. Thus, a 10% return target could be met with 30% probability as long as one accepts the risks associated with a beta of 0.4. Similarly, a 40% probability of 10% return would require a beta value of 0.60.

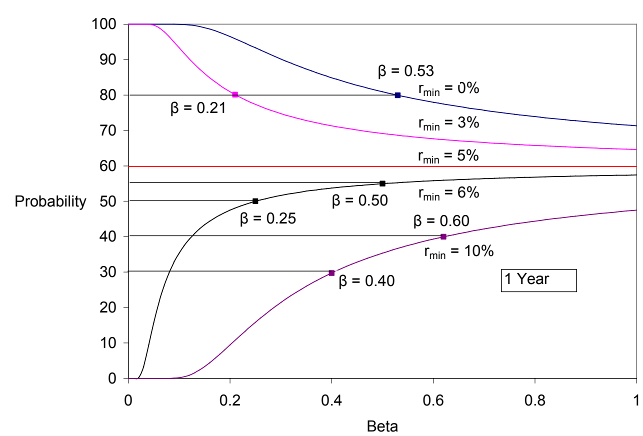
However, this 0.60 beta also entails a shortfall risk of having 22% of returns falling below 0%. Some investors might be attracted to this 10% "stretch" return even if it only carries a 40% probability and a 22% chance of incurring negative returns.

Probability vs. Beta Curves

Exhibit 5 now plots the probability of achieving specified minimum returns (r_{min}) across a range of beta values. Focusing first on the case of r_{min} = 0%, very low beta values are seen to provide an almost 100% probability of zero return or better. The probability naturally decreases as the betas increase.

Exhibit 5

Shortfall Probability vs. Beta for Various Return Minimums



Source: Morgan Stanley Research

As the threshold rises, the probability of achieving the minimum return decreases. For r_{min} = 3%, low betas again assure a virtual 100% chance of success, but the probability declines rapidly, reaching the 80% probability only for betas of 0.21 or lower. For a return minimum of 5% (equal to the cash rate), the probability remains constant at 60% even as the beta increases.

However, when the return target lies above the risk-free rate, there is a radical shift in these probability curves. An investment in the $\beta = 0$ risk-free rate has a 0% probability of meeting a 6% target. To have any chance of reaching 6%, the investor must accept some degree of risk. More specifically, as seen in Exhibit 3, one now needs betas of 0.25 to produce even a 50% probability of reaching the 6% target. A move to a 0.5 beta provides only a 55% probability. Indeed, there is no place on the market line — no matter how much beta risk is taken — that provides more than a 58% chance of achieving 6%.

Exhibit 5 summarizes these results plotting the shortfall probabilities against the associated beta values for various minimum returns above and below the risk-free rate. All return targets above the 5% risk-free rate have rising curves, implying that the probabilities increase with beta. In other words, some minimum beta risk is needed to assure reaching targets above the risk-free rate.

In contrast, for return minimums below the 5% rate, the curves are descending, implying that the probabilities decrease as beta increases. Thus, for each such shortfall level, there is some maximum beta value that allows the threshold criteria to be satisfied. For example, to achieve positive returns above 0% with 80% probability, the beta value must lie below a maximum of 0.53.

In Exhibit 5, the behavior at very low risk levels may seem curious at first. Minimum returns below 5% can be achieved with 100% probability by just investing at the risk-free rate itself. In contrast, such a risk-free investment would insure that return targets higher than 5% would have a 0% chance of being realized. This discontinuity is evident in how the curves in Exhibit 5 flip to suddenly fall below the horizontal 60% line when the minimum return rises above 5%.

A similar discontinuity exists along the equity market line itself. For investments in the 5% risk-free rate itself, i.e., $\beta = 0$, the probability of obtaining 5% is 100%. However, as soon as the investor steps off the solid footing of the risk-free rate and encounters the volatility present in any equity position, the probability of exceeding 5% drops to 60%. Moreover, this same 60% probability holds for any equity percentages. All $\beta > 0$ equity positions have the same balance of return and risk, so that any equity percentage — no matter how large or how small — has this same 60% probability of exceeding the 5% risk-free rate!

Multi-Year Horizons

The analysis thus far has focused on a one-year time horizon. However, shortfall probabilities and minimum returns can also be useful when looking at multi-year periods. Exhibit 6 plots our basic equity market line over 1, 3 and 5 year periods. As the time period increases, the annualized expected return will not change (ignoring compounding effects) while the annualized volatility will decrease approximately by the square root of the number of years. This lower volatility is also depicted schematically in Exhibit 6's tighter distribution for 3 years versus 1 year.

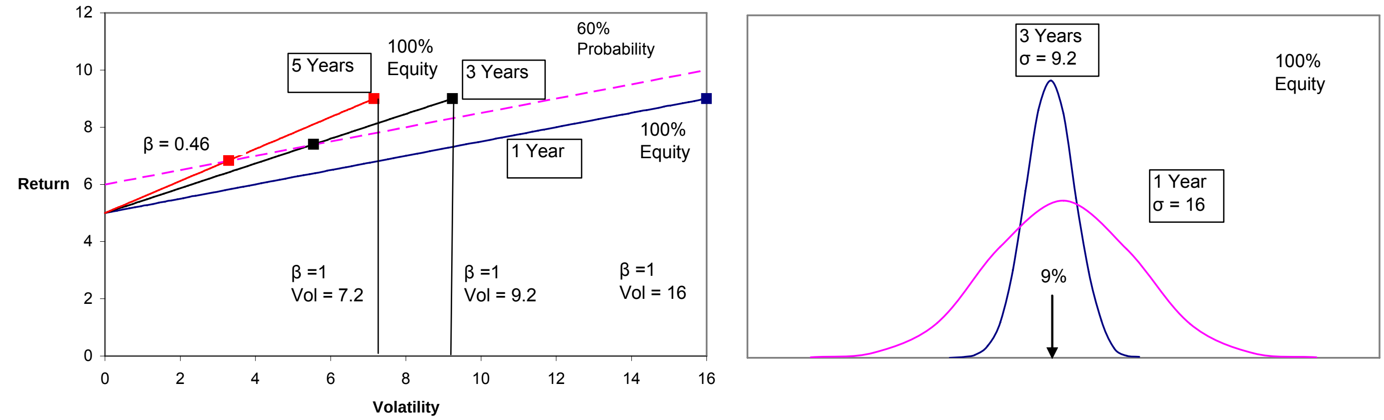
With lower annualized volatilities over the 3 and 5-year horizons, the equity market line rises in slope and contracts in length. This upward shift now allows the 60% shortfall line to intersect the market line. For example, at the 5-year horizon, beta values greater than 0.46 will satisfy the 6% criterion.

Beta Regimes

It is not unusual to have shorter horizons apply to risk constraints and longer horizons for return goals. For a one-year horizon, Exhibit 1 showed that a beta of 0.53 — or lower — was needed to assure an 80% probability of returns that do not fall below 0%, while Exhibit 5 illustrates that a 60% probability of making a 5-year return target of 6% requires a beta of 0.46. Exhibit 7 now illustrates how the imposition of both this risk constraint and the 6% return goal defines a viable beta range lying between 0.46 and 0.53. Outside of this range, either the risk constraint or the return goal would be violated.

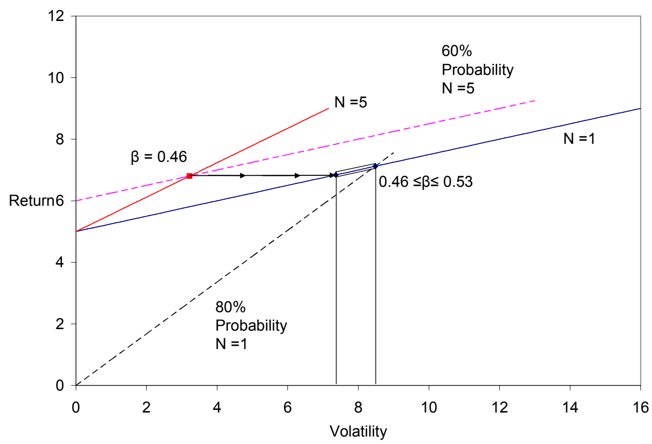
Although this example is strictly hypothetical, it is interesting to note that the typical beta value for US institutional portfolios actually does lie in the 0.55 to 0.65 range. Moreover, the total volatility of such funds is generally projected to be around 10%, with the beta factor accounting for over 90% of this volatility. Indeed, it is quite striking the extent to which all funds across a wide range of allocations cluster around this 0.60 beta value and 10% volatility [1,2]. One possible explanation might be that funds set their risk limits — either explicitly or implicitly — to assure a high probability of returns above some common shortfall limit. For the simplistic market line used in our example, a beta of 0.60 would result in a 9.6% volatility, and an expected return of 7.4%. It is interesting to note that this beta value would assure a 1-year return above 0% with a 78% probability and provide a 63% probability of matching or exceeding a 6% target over 5 years.

Exhibit 6
Multi-Year Horizons



Source: Morgan Stanley Research

Exhibit 7
A Beta Regime



Source: Morgan Stanley Research

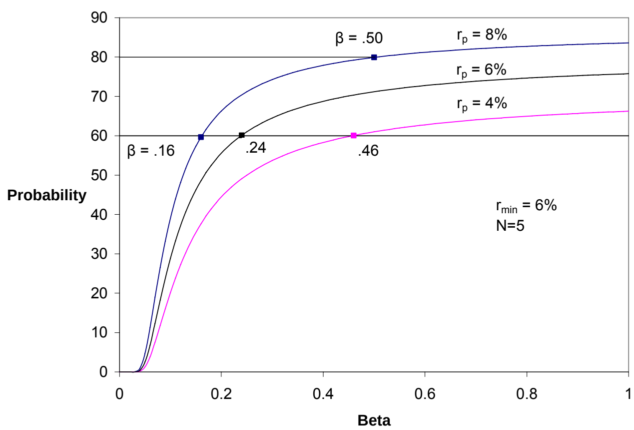
The Risk Premium Effect

In all the preceding examples, the risk premium for equities was fixed at 4%. However, at any given time, an investor's view of the market prospects may differ greatly from our simplistic market model. One can certainly envision compelling arguments for different assumptions regarding risk-free rates, risk premiums and volatility prospects. One may also revisit our exclusion of potential alpha add-ons from diversifying asset classes or active management. A more refined treatment might explore other probability distributions, including those with asymmetry, fatter tails, more sophisticated compounding procedures as well as the potential for mean reversion and/or volatility drag over multi-year periods.

The purpose of the examples in this paper was to illustrate that while betas must be limited for risk control, a certain minimum level of beta risk must be taken to reach a return target. And it can be sometimes quite surprising to see just how much risk is needed to have a reasonable probability of achieving even a modest target return.

At the same time, it should be recognized that variation in model assumptions could have a material impact on the probabilities and the corresponding beta limits. Exhibit 8 explores how different risk premiums would affect the 5-year probability curves for the 6% return target. The lower curve with a 4% risk premium leads to the same 0.46 minimum beta for a 60% probability of reaching an r_{min} = 6% as was seen in Exhibits 6 and 7. However, for the same 60% probability, but now with risk premiums of 6% and 8%, the minimum beta drops to the more easily accommodated levels of 0.24 and 0.16, respectively. For the 8% risk premium level, it can be seen that even an 80% success probability is obtainable, although at a relatively high minimum beta level of 0.50.

Exhibit 8
The Risk Premium Effect



Source: Morgan Stanley Research

Sharpe Ratio Probabilities

The slope of the equity market line is the risk premium divided by the equity volatility. This ratio is sometimes called a "Sharpe Ratio" [3]. However, in this basic equity market model, it can also be interpreted as the slope of a shortfall line that starts at the risk-free rate. Since any such slope corresponds to some shortfall probability, all risk assets on the market line can be viewed as providing the same probability of achieving the risk-free rate. For our example of a 4% risk premium and 16% volatility, the Sharpe Ratio is 0.25, which corresponds to a shortfall probability of 60%. Thus, as noted earlier in the discussion relating to Exhibit 6, all risky portfolios on the market line (those with β > 0), will have the same 60% probability of surpassing the 5% risk-free rate. (It should be noted that this shortfall probability depends only on the Sharpe Ratio, i.e., not on the specific level of the risk-free rate).

In Exhibit 9, the Sharpe Ratio and associated shortfall probabilities are shown for various risk premiums, assuming that the 16% volatility is kept constant. In contrast to the 60% probability for our basic example of a 4% risk premium over a 1-year period, one can see that a 6% premium over a 5-year period would lead to a much greater Sharpe Ratio of 0.375 and a significantly higher 80% probability.

Exhibit 9
Sharpe Ratio Probabilities

Risk	Sharpe	Shortfall Probabilities	
Premium	Ratio	1 Year	5 Year
0%	0	50%	50%
2%	0.125	55%	61%
4%	0.25	60%	71%
6%	0.375	65%	80%
8%	0.50	69%	87%

Source: Morgan Stanley Research

The Sharpe Ratio can be a useful guide to the probability level required to provide viable beta values for various return targets and shortfall limits. All shortfall lines that have the same probability as the Sharpe Ratio will be parallel to the market line. And any such parallel shortfall lines emanating from a risk point below the risk-free rate would never intersect the market line, implying that the entire market line (i.e., all beta values) would satisfy the shortfall constraint. For example, the 4% risk premium gives rise to a Sharpe Ratio of 0.25, corresponding to a 60% probability. Thus, for any minimum return below the risk-free rate, e.g., 0% or 3% or even 4%, all beta values on the market line would satisfy this 60% shortfall criterion. Only higher success probabilities, such as 80% or 90%, would lead to more sharply sloped shortfall lines that might intersect the market line and identify a maximum beta value.

In contrast, for return targets above the risk-free rate, the shortfall line would have to have a lower slope than the Sharpe Ratio to obtain an intersection. The viable beta values would then include those that were higher than the point of intersection. Thus, for such higher return targets, the target-reaching probability would always have to be lower than the Sharpe Ratio probability. In other words, for the basic example's 4% risk premium and the corresponding 0.25 Sharpe Ratio, one could never have a 1-year probability exceeding 60% for any return target greater than the risk-free rate. After 5 years, when the 0.25 Sharpe Ratio probability rises to 71%, the required probability would always have to be lower than 71%.

The basic message here is that there will always be some beta value that satisfies any given shortfall probability as long as the minimum return falls below the risk-free rate. In contrast, to even have a chance of finding beta values large enough for return targets above the risk-free rate, the required probability must always be less than the Sharpe Ratio probability.

Conclusions

The key message is that, even though both refer to minimum levels of return, return targets and shortfall risks can have very different probabilities of fulfillment. Risk limits that sound reasonable for the short-term horizon lead to the 0.55 to 0.65 beta values that most US institutions have actually adopted. This 0.55-0.65 beta level would appear to provide acceptable shortfall risks, at least within the framework of a basic equity model. However, it should be remembered that even the most comprehensive market models, are vulnerable to real world bouts of volatility and the associated "stress betas" that can have a devastating impact on any probability-based projections [4].

In contrast to the short-term character of risk limits and low-probability stretch targets, the benefit from expected returns and higher-probability return targets evolve only slowly over longer horizons. Indeed, in a basic market model, without any alpha add-ons, it is somewhat surprising just how much beta risk must be accepted to reach a specified return target with a reasonable probability.

References:

1) Leibowitz, Martin L. and Anthony Bova. "Allocation Betas." *Financial Analysts Journa*l, July/August 2005
2) Leibowitz, Martin L. and Anthony Bova. "Gathering Implicit Alphas in a Beta World." *Journal of Portfolio Management*, Spring 2007
3)Sharpe, William. "The Sharpe Ratio." *The Journal of Portfolio Management*, Fall 1994
4) Leibowitz, Martin L. and Anthony Bova. "Diversification Performance and Stress-Betas." *The Journal of Portfolio Management*, forthcoming Spring 2009

Appendix

The market model consists of a risk-free rate y and an equity risk premium r_e and volatility σ_e. In this simple model, the expected return R for portfolios with position β on the market line would provide an expected return R,

$$R = y + \beta r_e$$

and a volatility σ,

$$\sigma = \beta \sigma_e$$

For a given distribution of returns (assumed to be normal in this paper), the p^{th} percentile can be expressed as k_p units of standard deviation to the left of the mean. For a given beta value β, this would imply a p^{th} percentile return r,

$$\begin{aligned} r &= R - k_p \sigma \\ &= y + \beta r_e - k_p \beta \sigma_e \end{aligned}$$

For the condition

$$r > r_{min}$$

one would therefore need β values such that

$$r = y + \beta(r_e - k_p \sigma_e) > r_{min}$$

or

$$\beta(r_e - k_p \sigma_e) > r_{min} - y$$

or

$$\beta(SR_e - k_p) > \frac{(r_{min} - y)}{\sigma_e}$$

where SR_e is the Sharpe Ratio $\left(\frac{r_e}{\sigma_e}\right)$ for the equity market line.

Since $SR_e > 0$, we can write

$$\beta(1-\frac{k_p}{SR_e}) > \left[\frac{(r_{min}-y)}{\sigma_e}\right]\frac{1}{SR_e} = \frac{(r_{min}-y)}{r_e}$$

There are two different inequalities depending on whether $\left(\frac{k_p}{SR_e}\right)$ is greater or less than one.

For $k_p > SR_e$ i.e., the shortfall probability line k_p is steeper than the equity Sharpe Ratio, and

$$(1-\frac{k_p}{SR_e}) < 0$$

and both sides can be multiplied by (-1) to obtain

$$(-\beta)(1-\frac{k_p}{SR_e}) < -\left[\frac{(r_{min}-y)}{r_e}\right]$$

so that

$$\beta(\frac{k_p}{SR_e}-1) < \left[\frac{(y-r_{min})}{r_e}\right]$$

and

$$\beta < \frac{(y-r_{min})/r_e}{[k_p/SR_e - 1]} \qquad k_p > SR_e$$

On the other hand, if the shortfall probability line k_p is flatter than the market line, i.e., $k_p < SR_e$, then

$$(1-\frac{k_p}{SR_e}) > 0$$

and

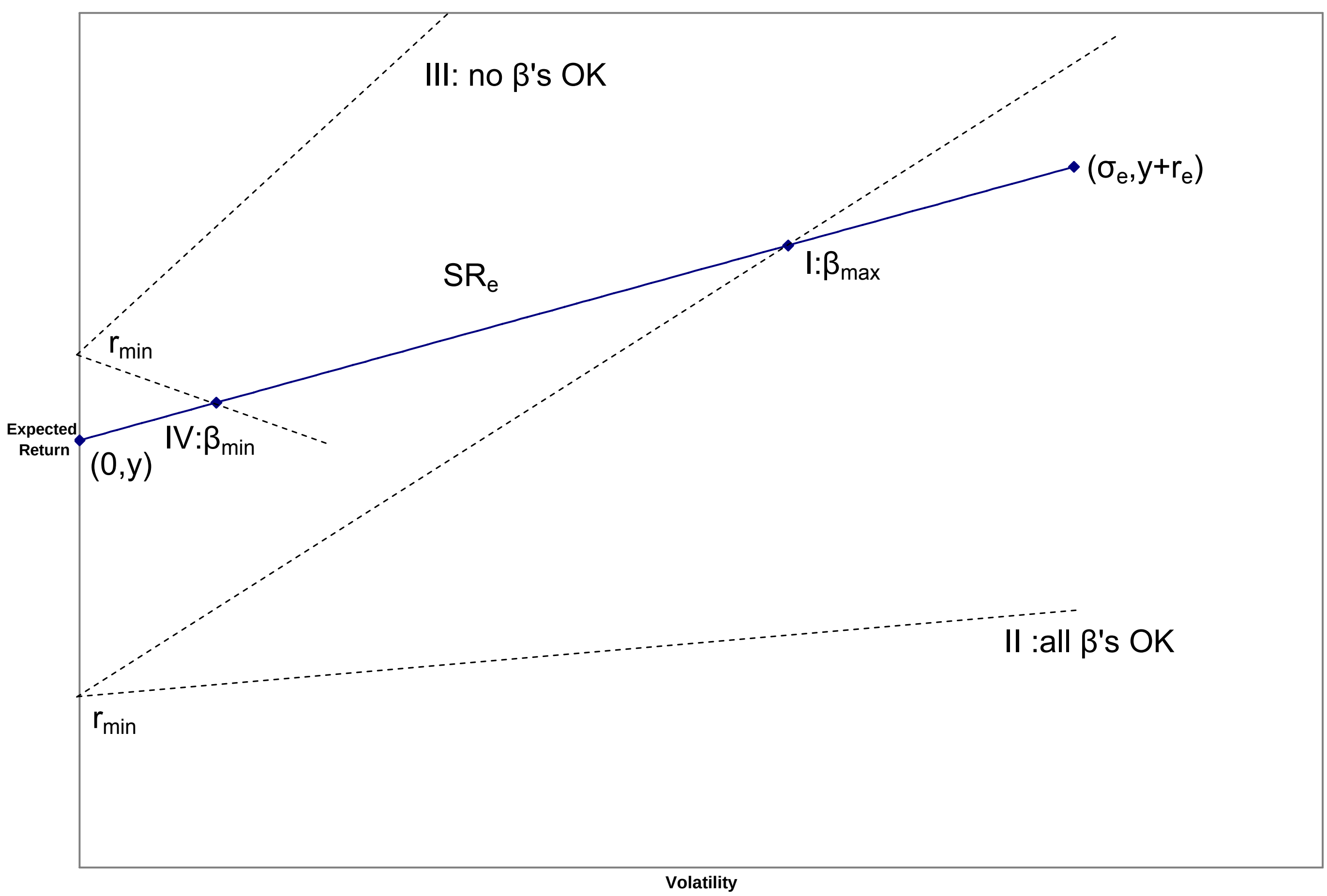
$$\beta > \frac{(r_{min}-y)/r_e}{[1-k_p/SR_e]} = \frac{(y-r_{min})/r_e}{[k_p/SR_e - 1]}$$

These two conditions can have different implications for feasible beta values depending on whether $y > r_{min}$ (the risk limit case) or $r_{min} > y$ (the return target case).

All in all, there are four possible results for the beta values that achieve r_{min} with the specified probability:

	Condition	Shortfall to Sharpe Ratio	Shortfall Line	Implied Beta Limit	Viable Beta Values
I	$y > r_{min}$ (risk limit)	$k_p/SR_e > 1$	Steeper	$\beta < [(y-r_{min})/r_e]/[(k_p/SR_e - 1)]$	Below a Maximum Beta
II	$y > r_{min}$ (risk limit)	$k_p/SR_e < 1$	Flatter	$\beta > 0 > [(y-r_{min})/r_e]/[(k_p/SR_e - 1)]$	All Betas OK
III	$y < r_{min}$ (return target)	$k_p/SR_e > 1$	Steeper	$\beta < [(y-r_{min})/r_e]/[(k_p/SR_e - 1)] < 0$	No Betas OK
IV	$y < r_{min}$ (return target)	$k_p/SR_e < 1$	Flatter	$\beta > [(y-r_{min})/r_e]/[(k_p/SR_e - 1)] > 0$	Above a Minimum Beta

The four conditions are schematically depicted



These distinct conditions provide an algebraic (and geometric) explanation of why return targets that are higher than the risk-free rate have fundamentally different model characteristics than risk limits that lie below the risk-free rate.

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	Coverage Universe		Investment Banking Clients (IBC)		
Stock Rating Category	Count	% of Total	Count	% of Total IBC	% of Rating Category
Overweight/Buy	**686**	**31%**	**211**	**37%**	**31%**
Equal-weight/Hold	**993**	**44%**	**249**	**43%**	**25%**
Not-Rated/Hold	**33**	**1%**	**8**	**1%**	**24%**
Underweight/Sell	**521**	**23%**	**107**	**19%**	**21%**
Total	**2,233**		**575**		

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.

Analyst Stock Ratings

Overweight (O). The stock's total return is expected to exceed the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Equal-weight (E). The stock's total return is expected to be in line with the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Not-Rated (NR). Currently the analyst does not have adequate conviction about the stock's total return relative to the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Underweight (U). The stock's total return is expected to be below the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Unless otherwise specified, the time frame for price targets included in Morgan Stanley Research is 12 to 18 months.

Analyst Industry Views

Attractive (A): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be attractive vs. the relevant broad market benchmark, as indicated below.

In-Line (I): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be in line with the relevant broad market benchmark, as indicated below.

Cautious (C): The analyst views the performance of his or her industry coverage universe over the next 12-18 months with caution vs. the relevant broad market benchmark, as indicated below.

Benchmarks for each region are as follows: North America - S&P 500; Latin America - relevant MSCI country index or MSCI Latin America Index; Europe - MSCI Europe; Japan - TOPIX; Asia - relevant MSCI country index.

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Other Important Disclosures

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The Americas
1585 Broadway
New York, NY 10036-8293
United States
Tel: +1 (1) 212 761 4000

Europe
20 Bank Street, Canary Wharf
London E14 4AD
United Kingdom
Tel: +44 (0) 20 7 425 8000

Japan
4-20-3 Ebisu, Shibuya-ku
Tokyo 150-6008
Japan
Tel: +81 (0) 3 5424 5000

Asia/Pacific
1 Austin Road West
Kowloon
Hong Kong
Tel: +852 2848 5200

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