

The Optimally Risky Portfolio

The table to the right summarizes the expected return and risk performance of each of our sixteen categories over the next three to five years.

We can combine investments into some or all of these categories in an infinite number of possible portfolios, each with its own projected risk and return characteristics. Of all possible portfolios, however, we are only interested in those which are the most efficient, which yield the highest expected return for a given level of risk or the lowest expected risk for a given return level. Figure ORP.1 shows the expected return and risk from sets of efficient portfolios constructed in several different ways.

If we could be certain that the future would work just as we expect, we could be happy with a portfolio made up of just one or several asset categories – whichever yielded the best return for a given level of risk. The dark blue line in figure ORP.1 shows the results for such a set of portfolios. Depending on whether one wants a high return/risk portfolio or a low return/risk portfolio, the most efficient ones along the dark blue line require only three, four, five, or six asset categories to construct. Thus, if a portfolio with an expected standard deviation of 25% is acceptable, the most efficient combination of assets is a combination of venture capital (36.6%), emerging-market equities (34.7%), UK equities (28.3%), and high yield bonds (0.4%), which will provide a 14.9% return – if our expectations are correct.

The problem, of course, is that our expectations are almost certainly not going to be correct, so in constructing our optimal portfolio we hedge our bets by requiring a broader diversification of assets than is necessary under the case of no uncertainty about the future. The other lines in figure ORP.1 show sets of efficient portfolios constructed under various constraints requiring more diversified allocations. The red line shows the results for the most efficient portfolios with a minimum of 10% in U.S. equities,

INVESTMENT PERFORMANCE EXPECTATIONS

Asset Class	Expected Return (Total Return) Per Year	Expected Risk (Standard Deviation of Annual Returns)
U.S. large-cap ctocks	8.9%	20.0%
U.S. small-cap stocks	11.1%	28.0%
UK stocks	13.3%	24.0%
Euro area stocks	12.5%	27.0%
Japan stocks	13.0%	32.0%
Emerging-market stocks	15.0%	34.0%
Venture capital	16.0%	36.0%
Real estate	7.5%	17.0%
Intermediate-term Treasuries	5.0%	6.0%
Long-term Treasuries	5.1%	10.0%
TIPS (inflation-indexed)	5.0%	6.0%
Long-term corporate bonds	5.9%	9.0%
High-yield bonds	8.8%	12.0%
Mortgage-backed bonds	6.1%	5.0%
Foreign investment-grade bonds	4.5%	13.0%
Emerging-market sovereign debt	7.5%	20.0%
Treasury-bills	4.8%	
Inflation	2.5%	

Source: Advisor calculations

EFFICIENT FRONTIERS UNDER ALTERNATIVE ALLOCATION CONSTRAINTS

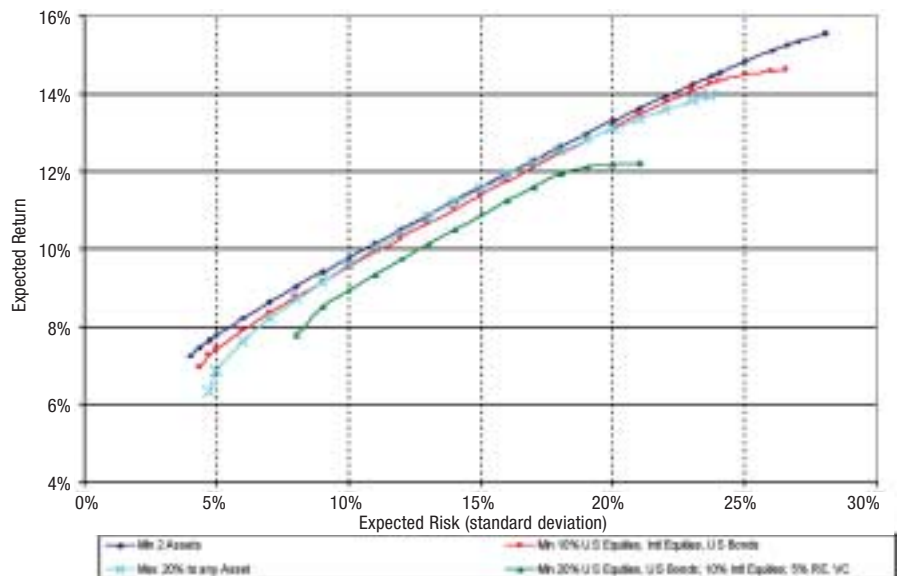


Figure ORP.1: Efficient Frontiers under Alternative Allocation Constraints
Source: Advisor calculations



Managers and fiduciaries desiring to limit their risk will have to accept returns of less than 10%.

international equities, and U.S. bonds. An optimization program figures out which allocations to the individual categories within the broad category give the best return for a given level of risk. The light blue line shows results for the most efficient portfolios where diversification is forced not by minimum requirements but by limiting the amount that can go into any one asset category. Allocations to at least five asset categories are required, but most points along the efficient frontier utilize at least seven categories, some as many as ten. The green line, finally, shows the results for the most efficient portfolios with the broadest diversification. Minimums in these cases are set to force some allocations to thirteen of our sixteen asset categories. Figure ORP.1 shows that as we require broader diversification, we give up some potential return for a given level of risk – but only if the future turns out just as we expected.

Figure ORP.1 also shows that achieving portfolio returns in excess of 10% with a broadly diversified portfolio will require assuming portfolio risk of a 13% average standard deviation or greater. If returns are normally distributed, that means we have a greater than one in five chance of experiencing negative returns in any year on such a portfolio. Since returns are not normally distributed, the chance of loss may be higher. Endowment managers and fiduciaries desiring to limit their risk will have to accept expected returns of less than 10%.

What do the efficient portfolios look like? Figures ORP.2 and ORP.3 show how the asset allocations vary from the high return/risk end of the efficient frontier line to the low return/risk end for portfolios with a minimum of five asset categories and for portfolios with a broader diversification requirement. The graphs in these figures may require some study for they contain a great deal of information. A vertical slice through the graph at any point shows the asset allocation for a portfolio with the return and risk characteristics as labeled on the x axis, return numbers on top, and risk numbers (in the form of expected standard deviation) on the bottom in parentheses. The minimum risk portfolio is on the left and the maximum return portfolio is on the right – points in between correspond to points along the efficient frontier. Readers should note that the graphs do not show continuous calculations, but the discrete results of allocations measured at every whole percentage of standard deviation between the minimum risk and maximum return portfolios.

Figure ORP.2 corresponds to those portfolios along the light blue line in figure ORP.1. Note that these portfolios include venture capital as an asset category.

ASSET ALLOCATION VS. EXPECTED RETURN/RISK FOR PORTFOLIOS WITH 20% MAX TO ANY ASSET

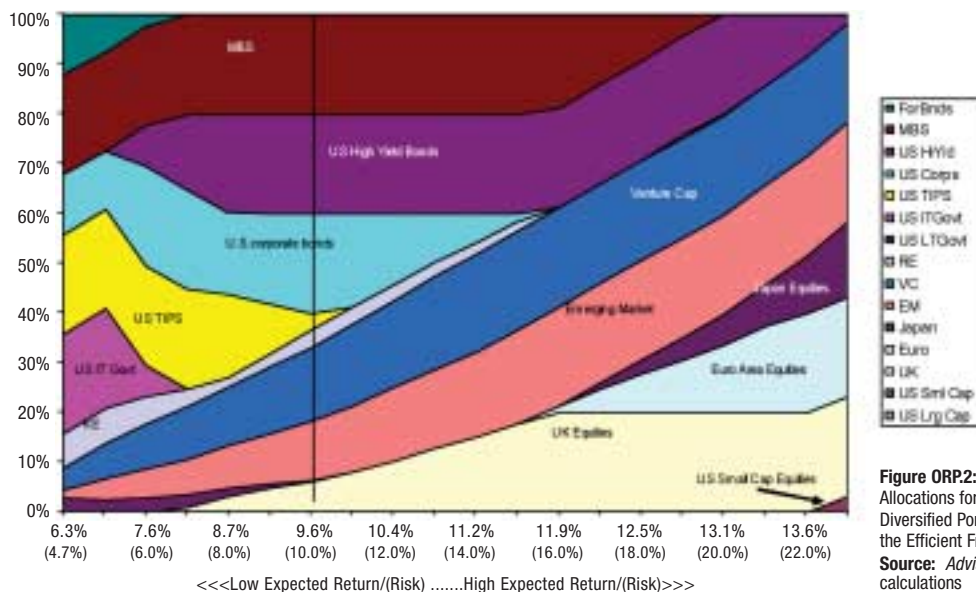


Figure ORP.2: Asset Allocations for Narrowly Diversified Portfolios along the Efficient Frontier
Source: Advisor calculations

No minimum allocations to any asset category are required in the allocations shown in figure ORP.2. Not surprisingly, the allocations on the high return/risk end of the efficient frontier are dominated by those asset categories with the highest expected returns: venture capital and international equities, with a small allocation to U.S. small-cap equities. Note that U.S. large-cap equities are not included in the allocation at any point along the efficient frontier. On the low risk/return end of the efficient frontier, the allocations are dominated by mortgage-backed securities, U.S. TIPS, intermediate-term U.S. government bonds, and corporate bonds. The portfolio also includes allocations to the individually high-risk categories: venture capital, emerging-market equities, and Japan equities. Eliminating these high-risk allocations from the low-risk portfolio has the effect of increasing the risk of this portfolio!

At a 10% standard deviation (see the vertical line on figure ORP.2), the most efficient portfolio comprises mortgage-backed securities (20%), U.S. high-yield bonds (20%), U.S. corporate bonds (20%), venture capital (15.1%), emerging-market equities (11.8%), UK equities (6.0%), real estate (3.4%), U.S. inflation-protected bonds (3.4%), and Japan equities (0.3%). The expected return from this portfolio is 9.6%, the maximum return available from any allocation with a 10% standard deviation and no more than 20% of the total portfolio allocated to any single asset.

Figure ORP.3 shows the allocations for broadly diversified portfolios along the efficient frontier (those along the green line in figure ORP.1).

Eliminating high-risk allocations from the low-risk portfolio has the effect of increasing portfolio risk!

ASSET ALLOCATION VS. EXPECTED RETURN/RISK FOR BROADLY DIVERSIFIED PORTFOLIOS

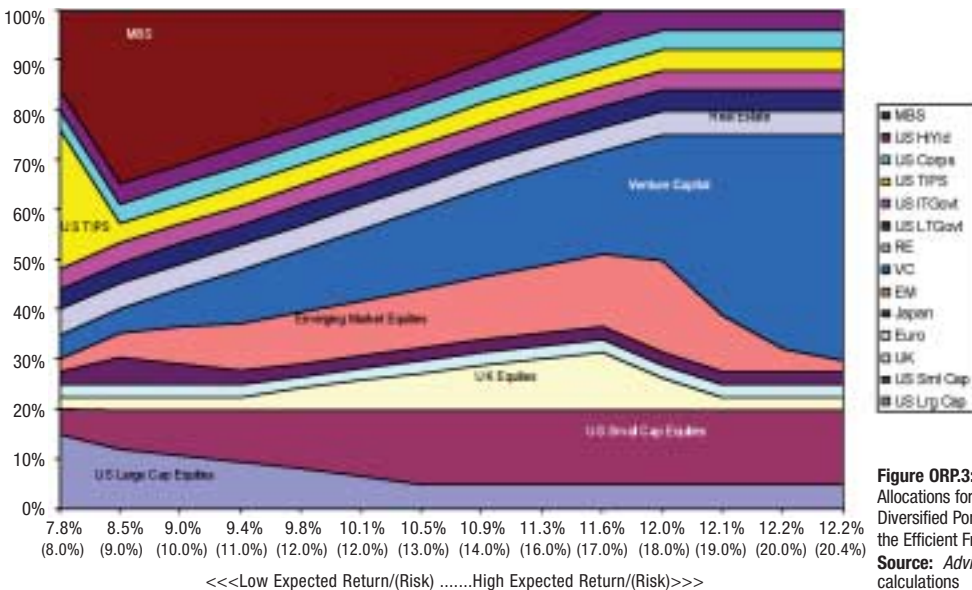


Figure ORP.3: Asset Allocations for Broadly Diversified Portfolios along the Efficient Frontier
Source: Advisor calculations

Individual asset allocations in figure ORP.3 are not limited, except to the extent that minimum allocations have to be available for thirteen of the sixteen categories. The maximum return portfolio, therefore, allocates the minimum required to all categories except venture capital, which receives a 45.0% allocation, the maximum available after all other minimum requirements have been met. This portfolio has an expected return of 12.2% with an expected standard deviation of 20.4%, the highest return possible for any combination of assets meeting the minimum allocation requirements. The moral here is that given our expected returns, the maximum return a broadly diversified portfolio can achieve is only 12% with the specified constraints: 20% to U.S. equities, 2.5% to each international equity category, 5% to venture capital and real estate, 20% to U.S. bonds (4% to each category), no minimum to MBS, foreign investment-grade bonds, or emerging-market sovereign debt.

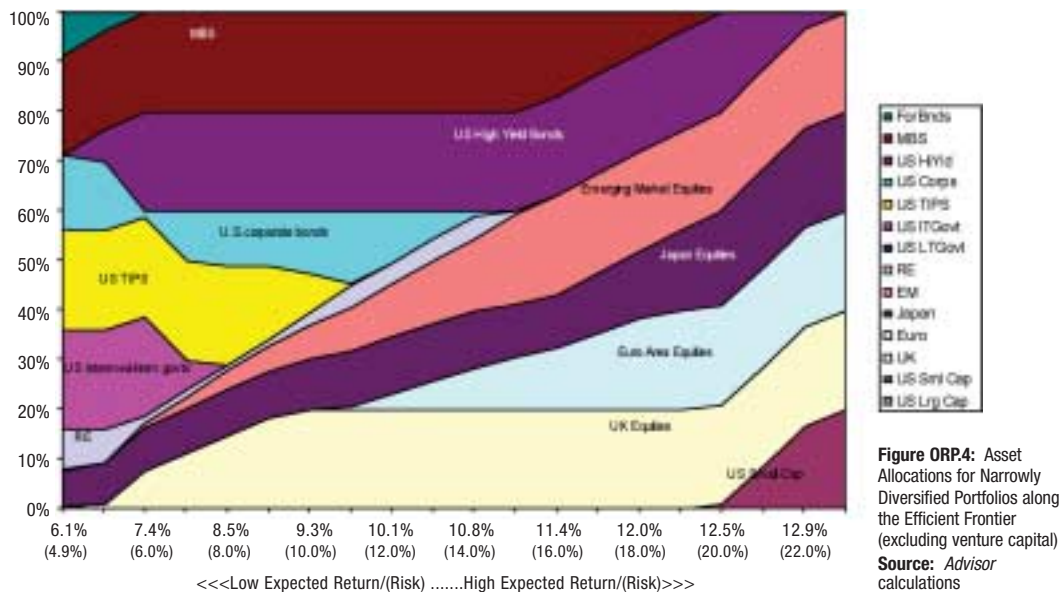


The minimum risk portfolio utilizes fourteen of the sixteen categories and assigns the minimum allocation to twelve of the fourteen categories. Only TIPS and mortgage-backed securities receive larger than minimum allocations. The expected return from the minimum risk portfolio is 7.8% with an 8.0% standard deviation.

Not all endowments and foundations have the ability to invest in venture capital, which plays a large role in the allocations in figures ORP.3 and ORP.4. Figures ORP.4 and ORP.5 show the efficient frontier allocations without venture capital.

We are only interested in those portfolios that are the most efficient, that yield the highest return for a given level of risk or the lowest risk for a given return level.

ASSET ALLOCATION VS. EXPECTED RETURN/RISK FOR PORTFOLIOS WITH 20% MAX TO ANY ASSET (NO VENTURE CAPITAL)



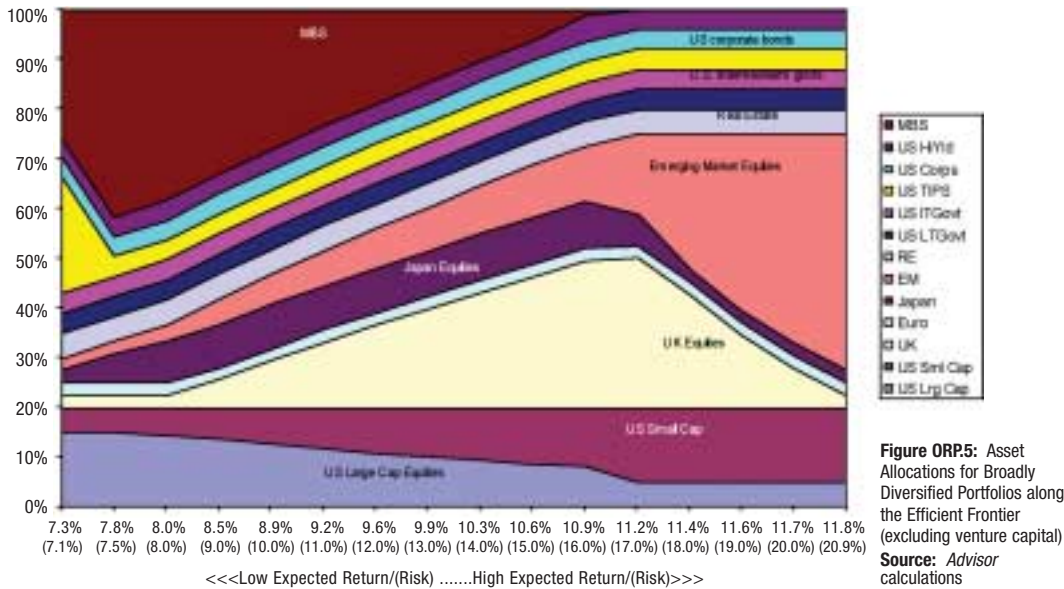
In the absence of venture capital, the maximum return portfolios in figure ORP.4 are dominated by allocations to international equities, with the maximum 20% allocations to each of emerging-market stocks, euro area stocks, UK stocks, and Japan stocks – matched with a 20% allocation to U.S. small-cap stocks. This portfolio has an expected return of 13.0% or 1.0% less than the return on the maximum return portfolio with venture capital. The minimum risk portfolio comprises allocations to nine categories (two of which, U.S. large-cap stocks and emerging-market stocks, barely appear in figure ORP.4 because of their small size) and has an expected return of 6.1% with a standard deviation of 4.9%, compared to 6.3% and 4.7%, respectively, for the minimum risk portfolio including venture capital.

At a 10% standard deviation, the most efficient portfolio excluding venture capital comprises mortgage-backed securities (20%), U.S. high-yield bonds (20%), UK equities (20%), U.S. corporate bonds (12.6%), Japan equities (10.3%), U.S. inflation-protected bonds (7.8%), emerging-market equities (6.7%), and real estate (2.6%). The expected return from this portfolio is 9.3%, the maximum return available from any allocation with a 10% standard deviation and 0.3% less than the return on the comparable portfolio including venture capital.

Figure ORP.5 shows the efficient frontier allocations for broadly diversified portfolios excluding venture capital. As in figure ORP.4, allocations to international equities – particularly to the U.K., Japan, and emerging markets – have taken the place of venture capital in the more broadly diversified portfolio allocations. The maximum return portfolio has an expected return of 11.8% with a standard deviation of 20.9%, compared to a 12.2% return with a standard deviation of 20.4% for the portfolio including venture capital. The minimum return portfolio in ORP.5 has an expected return of 7.3% with a standard deviation of 7.1%, compared to a 7.8% return with a standard

deviation of 8.0% for the portfolio including venture capital. We conclude, therefore, that endowments and foundations without access to venture capital can do nearly as well as those with access to venture capital provided they are prepared to allocate a significant portion of their investments to international equities. We should keep in mind, however, that our expected return from venture capital is lower than what many would expect from this asset class.

ASSET ALLOCATION VS. EXPECTED RETURN/RISK FOR BROADLY DIVERSIFIED PORTFOLIOS (NO VENTURE CAPITAL)



We pointed out earlier that allocations to large-cap U.S. equities were not included in any of the efficient frontier allocations in figure ORP.2. With the exception of a small 0.5% allocation in the minimum risk portfolio in figure ORP.4, large-cap U.S. equities are not included in the efficient frontier allocations here, either. Other asset categories also play little or no role in the allocations. Emerging-market sovereign debt is not included in any allocation, and foreign investment-grade bonds appear in only the minimum risk cases of the narrowly diversified portfolios. Long-term U.S. government bonds receive no allocations in the narrowly diversified portfolios and appear in the broadly diversified portfolio only because of a minimum required allocation. These asset categories are not efficient contributors to the overall return and risk of a portfolio, based on their expected returns, risks, and correlations with other categories.

Should we, then, exclude these asset categories from our allocations? In particular, should we exclude large-cap U.S. stocks – the category of blue chip stocks – from our portfolios? What if they perform better than our outlook projects? Is it wise to include a minimum allocation to blue chips in our broadly diversified portfolio?

U.S. large-cap stocks have to have an expected return of 10.0% or more in order to be efficient contributors to overall portfolio return/risk. With an expected return of 10.0%, portfolios along the efficient frontier contain small allocations (less than 7.5%) to large-cap U.S. stocks for portfolios with standard deviations between 9.0% and 22.0%. Figure ORP.6 shows efficient frontier allocations for narrowly diversified portfolios (not including venture capital) keeping all expectations the same except increasing the expected return on U.S. large-cap equities from 8.9% to 10.5%. With these revised expectations, U.S. large-cap stocks are now an efficient contributor to most of the efficient frontier portfolios, reaching a maximum allocation of 18.9% in the portfolio with an 18.0% standard deviation. The allocation to the optimum portfolio with a standard deviation of 10.0% is 5.8% of the total portfolio.





ASSET ALLOCATION VS. EXPECTED RETURN/RISK FOR PORTFOLIOS WITH 20% MAX TO ANY ASSET

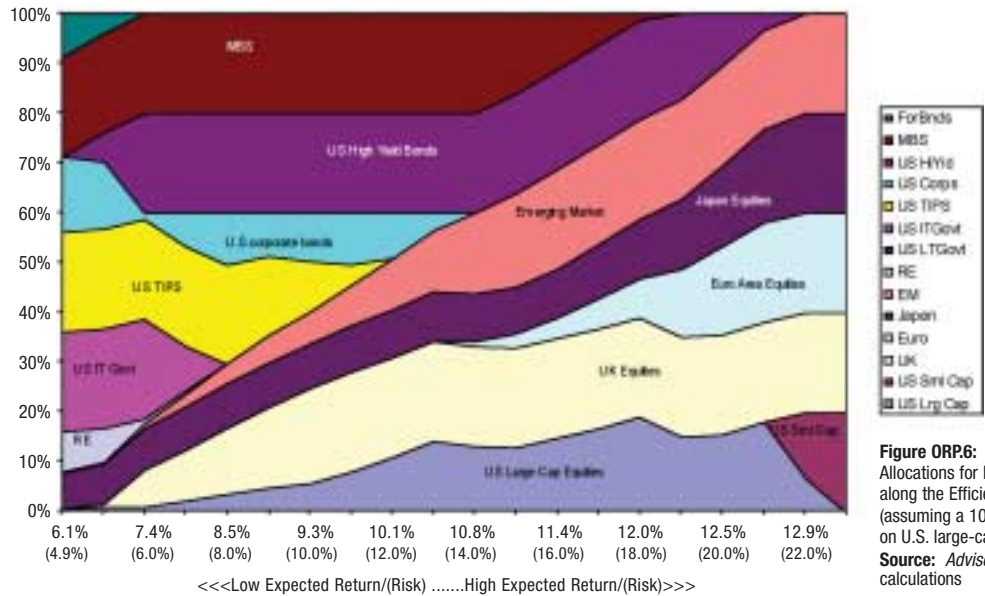


Figure ORP.6: Asset Allocations for Portfolios along the Efficient Frontier (assuming a 10.5% return on U.S. large-cap stocks)
Source: Advisor calculations

If we think that U.S. large-cap stocks may exceed our expected returns of 8.9%, we would be well advised to include some allocation to them in our portfolio. And unless we are comfortable with a portfolio risk well in excess of our expected returns, the minimum allocations specified in our broadly diversified portfolios in figures ORP.3 and ORP.5 should be sufficient to hedge our bets regarding U.S. large-cap equities.

In the final analysis, what is the optimally risky portfolio? That depends on several issues: the expected return on short-term Treasury bills (the riskless asset), your institution's risk tolerance, and the policies and practices governing the management of your endowment assets.

We expect the return on short-term Treasury bills to average 4.8% over the next three to five years. If we add the riskless asset to our mix of other assets, we get an efficient frontier as pictured in ORP.7. This is for a broadly diversified portfolio without venture capital.

EFFICIENT FRONTIER WITH RISK-FREE ASSET FOR BROADLY DIVERSIFIED PORTFOLIOS (WITHOUT VENTURE CAPITAL)

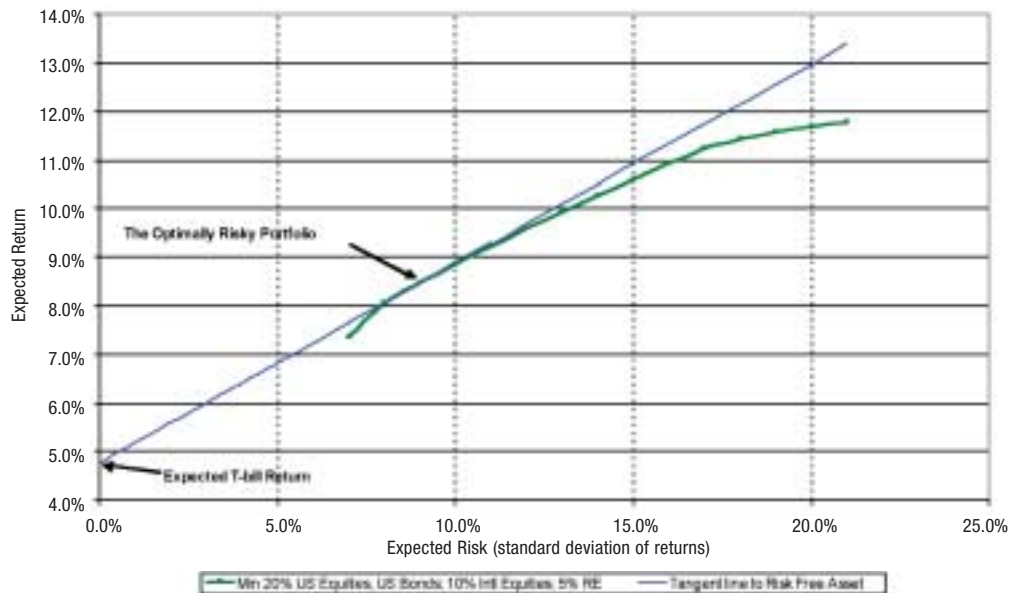


Figure ORP.7: The Efficient Frontier with the Risk-free Asset for Broadly Diversified Portfolios without venture capital
Source: Advisor calculations

Although it is impossible to construct a portfolio from our sixteen asset categories with a standard deviation of less than 7.1%, by adding Treasury bills to the mix, we can construct a portfolio with standard deviations down to 0.0%. We do this by adding Treasury bills to a portfolio that otherwise has the mix of assets as the optimally risky portfolio – which is just that portfolio where the line to the riskless asset touches or is tangent to the efficient frontier (see the point indicated by the arrow on figure ORP.7). In our case, the optimally risky portfolio is the one on the efficient frontier with a standard deviation of approximately 9%. From Figure ORP.5 we see that this portfolio has the asset allocation in the table on the right. The table also shows the allocation for the optimally risky portfolio including venture capital.

As we reduce the portion of the portfolio invested in the optimally risk portfolio and increase the portion invested in Treasury bills, we travel down the blue line in figure ORP.7 from the optimally risky portfolio towards the 100% Treasury bill portfolio yielding 4.8% with no risk.

What if we are willing to assume more risk? We have two options. We can assume more risk by adjusting our asset allocation consistent with those portfolios along the efficient frontier line. Or, if we are permitted, we can borrow and invest more than 100% in the optimally risky portfolio. The second strategy can enable us to earn rates of return above the efficient frontier line. Since many endowment investment policies restrict borrowing, and since the subject requires more elaboration than space permits here, we will pass over it with just this mention, leaving further discussion to future issues.

THE OPTIMALLY RISKY PORTFOLIO - ASSET ALLOCATIONS

	w/o venture capital	with venture capital
U.S. large-cap stocks	13.6%	11.0%
U.S. small-cap stocks	6.4%	9.0%
UK stocks	5.6%	2.5%
Euro area atocks	2.5%	2.5%
Japan stocks	8.7%	4.2%
Emerging-market stocks	5.2%	7.4%
Venture capital	n/a	7.7%
Real estate	5.0%	5.0%
Intermediate-term Treasuries	4.0%	4.0%
Long-term Treasuries	4.0%	4.0%
TIPS (inflation-indexed)	4.0%	4.0%
Long-term corporate bonds	4.0%	4.0%
High-yield bonds	4.0%	4.0%
Mortgage-backed bonds	33.0%	30.7%
Expected return	8.5%	8.9%
Expected risk	9.0%	10.0%



Endowments and foundations without access to venture capital can do nearly as well provided they are prepared to make significant allocations to international equities.

Diversification beyond traditional domestic stock and bond funds is necessary to achieve optimal return/risk performance.



Conclusions

ENDOWMENT MANAGERS and fiduciaries should draw at least three conclusions from the information and analysis presented in this issue.

First, diversification beyond traditional domestic stock and bond funds is necessary to achieve optimal return/risk performance. Even if you disagree with the outlooks for individual assets presented here, domestic stocks and bonds are not sufficient for the best portfolio performance. If you don't look any further than these categories, you will not be serving your organization's mission as it deserves.

Consider the traditional 65/35 asset allocation. Endowment and foundation assets that are allocated according to the traditional formula of 65% in domestic equities and 35% in domestic bonds are likely to produce poor returns on both an absolute and a risk-adjusted basis. According to our outlook, the expected return for the traditional allocation is 8.3% with a 14.3% standard deviation! Figure C.1 shows how far this return/risk point is from the efficient frontiers for both narrowly and broadly diversified portfolios constructed according to the rules as described in the section on the optimally risky portfolio but excluding venture capital. The traditional allocation provides too little return for the risk and too much risk for the return. (For the traditional allocation we allocate 40% to large-cap stocks, 25% to small-cap stocks, 20% to corporate bonds, 10% to intermediate-term government bonds, and 5% to long-term government bonds).

The second conclusion is that average portfolio returns are likely to be less than 10% per year over the next three to five years, and are unlikely to exceed 12% per year even with the assumption of substantial risk. Institutions and organizations whose spending policies are much in excess of 4% per year, therefore, may see limited growth in their endowed assets without additional contributions.

Third, prudent asset allocation requires knowing your risk tolerance. Although one can argue that all permanent endowments should have similar risk tolerances because they are perpetual, the fact is that permanently endowed institutions face different financial and mission challenges, and these different challenges affect their risk tolerances. But how do you measure your risk tolerance? How do you decide where you should be situated on the efficient frontier? Not by the individual opinions of members of your finance or investment committee! Institutional risk tolerances should be determined in a systematic fashion that takes into account the near- and long-term resources and needs of the institution. It should be a process that yields a quantitative measure not just a vague sense of what is and is not acceptable. We take up this topic in the next issue.

EFFICIENT FRONTIERS COMPARED TO TRADITIONAL 65/35 ALLOCATION

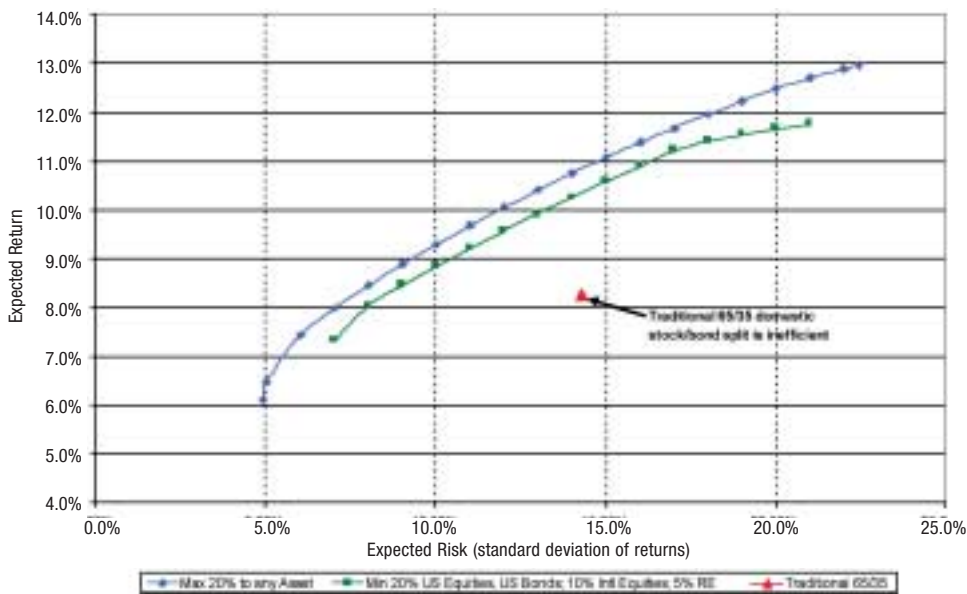


Figure C.1: Comparison of Expected Return/Risk for Traditional 65/35 Asset Allocation to Efficient Frontiers for Narrowly and Broadly Diversified Portfolios

Source: Advisor calculations