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originally, this class was captured using only one index, the Lehman Brothers Aggregate

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- Commodities

Table 3.1 describes the indices used for each of the above asset classes.

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mmodities were not included in this table so the
le for this study do not sum to one hundred. Generally,
only a few percentage points except for the aggressive
h.

d results that were on par with Merrill Lynch's
whether or not any benefit was derived from having
ce half of these were not considered in any of the
i is the practicality of the asset allocation at the
ighty-five percent of the investment is allocated to
le whereas eighty-five of the investment is allocated
essive growth profile. Furthermore, out of the five
lue is the only class that receives significant
ounter-intuitive from a diversification perspective.
s are added to this framework to obtain a more even
The constraints change based on the general
id bonds, and equity by the investment profiles
he additional constraints are:
invested in equity, that is 11 percent for capital
or income, 41 percent for growth and income, 56
percent for aggressive growth, a maximum of five
will be invested in international stocks.
total amount in equity, that is .5 percent for capital
or income, 2.1 percent for income and growth, 2.8

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percent for growth and 4.3 percent for aggressive growth, will be invested in each sector of domestic stocks.

- At least five percent of the total investment is in bonds, short and long-term asset classes combined.
- Less than 86 percent for capital preservation, 67 percent for income, 52 percent for growth and income, 35 percent for growth and 7 percent for aggressive growth, invested in cash and bonds.
- Small cap growth and value must be less than twenty-five percent of the total investment.
- Commodities and real estate must be less than fifteen percent of the total investment.

The sacrifice made by the efficient frontier due to constraints seems minimal. The Figure 4.2 shows the efficient frontiers for each model.

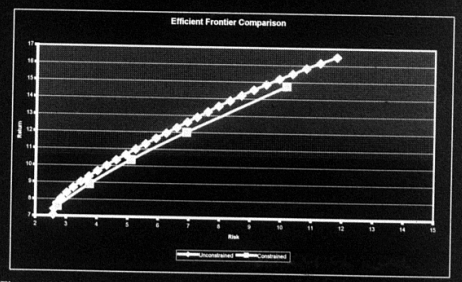


**Figure 4.2 Comparison of Efficient Frontiers**

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Table 4.6 summarizes the risk and return for each investor profile. The risk and return values listed under the constrained model correspond to the points illustrated in Figure 4.2. The values for the unconstrained model correspond to the mid-point of each group of six points on the unconstrained efficient frontier in Figure 4.2. This table shows the difference in risk and return relative to the unconstrained mean-variance model. The most important point this table illustrates is the greater percentage reduction in risk at the expense of a small loss in return. The two worst cases in return reduction occur in the income and growth profile and growth profile which both lose twelve percent in return but they do this with a sixteen and fifteen percent reduction in risk. The smallest changes in risk and return values occur at the extremes of the efficient frontier.

| | Constrained Mean-Variance Model | | Unconstrained Mean-Variance Model | | Difference in Risk and Return | |
|---|---|---|---|---|---|---|
| | Risk | Return | Risk | Return | Risk | Return |
| Capital Preservation | 2.71 | 7.57 | 2.65 | 7.56 | -0.02 | -0.002 |
| Income | 3.75 | 8.90 | 4.16 | 9.84 | 0.10 | 0.09 |
| Income and Growth | 5.10 | 10.35 | 6.07 | 11.79 | 0.16 | 0.12 |
| Growth | 6.91 | 12.01 | 8.12 | 13.71 | 0.15 | 0.12 |
| Aggressive Growth | 10.18 | 14.74 | 10.57 | 15.66 | 0.04 | 0.06 |

**Table 4.6 Risk-Return Comparisons for Mean-Variance Model**

The results of adding the constraints show that every index is invested in except the Merrill Lynch 15 Years and Up Bond Index. This has increased the utilization of asset classes from five in the unconstrained model to nine in the constrained model thereby producing a more diversified portfolio. Table 4.7 summarizes the asset investment for each investor profile.

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