USING PROC LP TO OPTIMIZE A COMMON STOCK PORTFOLIO

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For the new investor, it is often difficult to make prudent choices about the composition of a common stock portfolio. This is particularly true of those investors who brave it on their own without the research advice of a commercial stock broker. What issues should one consider, how much risk is involved, and how many shares of each stock should be purchased? These are only a few of the many questions that could be raised by the individual investor or practicing investment club for that matter.

Fortunately, one can find some immediate relief on the subject by consulting The National Association of Investment Clubs (NAIC), Value Line, The American Association of Individual Investors (AAII), or one of the other investment services that exist. NAIC, for example, offers some excellent criteria for buying and selling a stock based upon:

- Sales growth rate
- Earnings growth rate
- Price appreciation
- Zoning (buy, maybe, sell)
- Present yield
- Price earnings ratio

By comparison, Value Line offers a wealth of statistical information dealing with safety, beta, 1986-88 price projections, earnings per share, financial strength, earnings predictability, and a narrative on the individual stock itself. Despite these aids, the question still persists as to how to put together an optimal portfolio of 12 to 15 stocks from more than 1700 stocks that Value Line reports on. When the term optimal is used, it implies portfolios with a very high profit potential consistent with acceptable levels of risk, safety and yield.

Furthermore, the discussion implies that we are investing in stocks over a 5 year time horizon and not merely trading them on a week to week basis.

We can begin the search for optimality by fishing where the fish are. For a given safety level and investment dollar amount, it seems prudent to consult the Value Line Investment Survey (Summary and Index - Part 1). Here the investor should concentrate on the following stock selection screens:

- High 3- to 5-year appreciation potential
- Highest annual total returns (3- to 5-years)
- High growth stocks

These lists provide the investor with a summary of 300 stocks that could be analyzed by the NAIC method using a personal computer (4). Candidate stocks that meet acceptable investment criteria can then be optimized as a portfolio using a simple one stage stochastic programming formulation (5). The linear programming software necessary to generate an optimal portfolio can be found in SAS (6) or in Poole (7) for microcomputer applications. These results will present us with approximate solutions whereby sensitivity analysis can be performed to assess the impact of portfolio beta on expected profit levels. Perhaps a simple example at this point will help clarify the present discussion.

Suppose for the sake of argument you have $15,000 in cash that you are considering investing in the market for a five year time period. Being of a conservative nature, you decide to limit your search to stocks rated 2 in terms of safety in the Value Line Investment survey. Furthermore, you elect to scan the list entitled "High 3- to 5-year Appreciation Potential" for possible candidates. These stocks typically include Value Line narrative similar to "These shares are a solid three to five year vehicle for total returns." To keep the example simple, assume that your preliminary search turns up a list of seven stocks that all meet NAIC investment criteria. These data from the Value Line Ratings & Reports - Part 3 are as follows:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Price</th>
<th>1986-88 Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>ADX</td>
<td>$16</td>
<td>$60</td>
</tr>
<tr>
<td>AHS</td>
<td>34</td>
<td>115</td>
</tr>
<tr>
<td>BAX</td>
<td>17</td>
<td>55</td>
</tr>
<tr>
<td>GAM</td>
<td>17</td>
<td>60</td>
</tr>
<tr>
<td>PEO</td>
<td>29</td>
<td>115</td>
</tr>
<tr>
<td>SKB</td>
<td>53</td>
<td>165</td>
</tr>
<tr>
<td>TV</td>
<td>22</td>
<td>100</td>
</tr>
</tbody>
</table>

From Value Line, we observe that the above stocks fall into three distinct industries: (ADX, GAM, PEO, TV), (AHS, BAX) and (SKB). Furthermore, the 1986-88 high-low price estimates can be obtained:

- Directly from Value Line
- From the NAIC method
- From a simple linear regression of stock price on earnings per share.

Before we try to maximize expected profit potential, we apply the following weighted portfolio constraints:

- Beta equal to or less than 1.0
- Yield greater than or equal to 4.0%
- Total investment equal to or less than $15,000
- Earnings predictability equal to or greater than 88

Furthermore, we ultimately want to diversify our investment over all seven stocks or over all...
three industries. Using the method outlined by Wagner and the linear programming algorithm PROC LP produced the following approximate results:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Diversify Across Stocks</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADX</td>
<td>134</td>
<td>0</td>
</tr>
<tr>
<td>AHS</td>
<td>63</td>
<td>147</td>
</tr>
<tr>
<td>BAX</td>
<td>123</td>
<td>0</td>
</tr>
<tr>
<td>GAM</td>
<td>70</td>
<td>0</td>
</tr>
<tr>
<td>PEO</td>
<td>74</td>
<td>0</td>
</tr>
<tr>
<td>SKB</td>
<td>40</td>
<td>94</td>
</tr>
<tr>
<td>TY</td>
<td>97</td>
<td>227</td>
</tr>
</tbody>
</table>

Expected Profit: $31,081
Cash Position: $1,033

We leave it to the reader to confirm the fact that the portfolio weighted averages on beta, yield and earnings predictability are easily met. The above solutions are not obvious but are consistent with good investment judgement. The above procedure can easily be repeated for another roster of stocks and the search continued until total profit has been maximized. Obviously, other portfolio constraints on financial strength, growth rate, etc. can easily be introduced into the optimization model.

REFERENCES


4. Better Investing, an NAIC publication.


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