rue, then the excluded asset should be
ach is particularly useful for dealing with net
pplied to hedging decisions.
guide to portfolio selection. This method is
ility optimization. One of the main
is that options and other distribution-altering
ix. The key to this procedure is to separate
return forecast. As concluded by Grinold
ifficult than the mean-variance model.
is there is the presence of options or other

Young [1998] develops a minimax rule for
ig solution. In this method, framing the
ization problem also makes it feasible to
eger valued. This feature facilitates the use of
'his model can accommodate fixed transaction
turns are non-normally distributed, and when
on. The minimax portfolio maximizes the
olio subject to the restriction that the average
level and that the sum of the portfolio
ation budget. The minimax portfolio is given
am:

(2.6)

Subject to:

$$\sum_{j=1}^{N} w_j y_{jt} - M_p \geq 0 \quad t = 1,\ldots, T \qquad (2.7)$$

$$\sum_{j=1}^{N} w_j \bar{y}_j \geq G \qquad (2.8)$$

$$\sum_{j=1}^{N} w_j \leq W \qquad (2.9)$$

$$wj \geq 0 \; j = 1,\ldots,N \qquad (2.10)$$

Where y_{jt} = Return on one dollar invested in security j in time period t

$\bar{y}_j$ = Average Return on security j

w_j = Portfolio allocation to security j

M_p = Minimum return on the portfolio

The minimax rule uses minimum return as a measure of portfolio volatility. It considers the first order statistics of a portfolios return as a measure of its downside risk. Young found the minimax rule to be a good approximation to the mean-variance rule for normal data for a large dataset and the minimax rule a reasonable approximation to the utility maximizing rule for other combinations of utility function and joint probability distribution. The minimax rule uses the L_∞ norm as a measure of downside risk, thereby implying a strong risk aversion. The performances of the minimax and mean-variance approaches were compared. The findings suggest that the log-normality in the distribution of the portfolios might favor the minimax rule while mean-variance analysis is optimal for normal data. The author concludes that the minimax approach is best if an investor's utility function is more risk averse than is implied by the mean-variance

analysis, or if returns data are skewed, or if the portfolio optimization problem involves a large number of decision variables, including integer valued variables.

Cai, Teo, Yang, and Zhou [2000] expand upon Young's minimax rule by considering a model that model minimizes the expected absolute deviation of the future returns from their mean and providing an analytical solution instead of a linear programming solution. This model operates in a two-phase process. First the assets are selected based on their returns. In the second phase, the actual amounts allocated to the assets are determined based on risk. This allows for a double elimination process. The end result is an optimal investment strategy that should invest the assets in such a way that their risks are equal. This model does not use correlations among the stocks. The selection of the efficient portfolio is based on a ranking rule. The efficient frontier of this model is constructed analytically and allows for the trade-offs between risk and return to be examined. Table 2.1 summarizes the models covered by each author and the ones covered in this thesis.

Author	Behavioral Portfolio Theory	Mean-Variance Model	Scenario Based Model	Safety First Portfolio Theory	SP/A Theory	Value at Risk model	Minimax Model
Cai, Teo, Yang and Zhou (2000)							✔
Dowd (1999)						✔	
Fisher and Statman (1997)	✔	✔					
Grinold (1999)		✔	✔				
Johansson, Seiler, and Tjamberg (1999)						✔	
Schirripa and Tecotzky(2000)		✔					
Shefrin and Statman (2000)	✔			✔	✔		
Uysal, Trainer, Reiss (2001)		✔	✔				
Young (1998)		✔					✔
This thesis		✔					✔

Table 2.1 Portfolio Theories Covered in the Research