Using Markowitz Portfolio Theory to Combine Technical Trading Rules in the Hong Kong Stock Market

WONG Chi Kin

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Philosophy

Principal Supervisor: Prof. LAM Kin

Hong Kong Baptist University

September 2002
ABSTRACT

The conventional portfolio theory (Markowitz’s portfolio selection approach) tries to maximize the portfolio return while holding risk constant by combining a basket of risky assets with optimal weightings. This study employs this idea and uses it to combine a basket of technical trading rules on a fixed risky asset. Two families of technical trading rules are considered in this thesis. They are the moving average trading rules and a modified version of technical trading rule based on the on balance volume. The portfolio formed is called the portfolio strategy. In this study, short-selling is not allowed. The position of the portfolio strategy is to switch between a riskfree asset and risky asset. The risky asset chosen in this study is either an individual stock which is a constituent stock of the HSI index, or it is the stock portfolio which makes up the Hang Seng Index.

In order to examine the profitability of the portfolio strategy, we test its performance on the Hang Seng Index basket as well as fifteen individual constituent stocks between 1988 and 1999. The real transaction cost is taken into consideration. The performance is measured by the method of William Sharpe (risk-adjusted return or Sharpe ratio). This study bypass the data snooping problem by dividing the data into 1) the portfolio formation period (in-sample period) and 2) the performance testing period (out-sample period). The portfolio formation period is either three years or six years. The testing period is one year. The optimal weighting of each year of the testing period is calculated from the successive three years or six years portfolio formation period before it. The performance is evaluated in the out-sample period.

From the out-sample test, the portfolio strategy with three-year formation period outperforms the naïve buy-and-hold strategy on the Hang Seng Index basket but not on most of the individual stocks in term of risk-adjusted return. On the other hand, the portfolio strategy with a six-year formation period beats the buy-and-hold strategy on Hang Seng Index basket as well as on most of the individual stocks. Although the outperformance is not significant under statistical test, the portfolio strategy is shown to be a useful strategy that warrants much more attention by technical analysts.
TABLE OF CONTENTS

DECLARATION................................................................................. i

ABSTRACT......................................................................................... ii

ACKNOWLEDGEMENTS................................................................. iii

TABLE OF CONTENTS..................................................................... iv

LIST OF TABLES.............................................................................. viii

LIST OF FIGURES........................................................................... x

CHAPTER 1 INTRODUCTION........................................................... 1

1.1 Efficient Market Hypothesis (EMH)......................................... 1

1.2 Test of the Efficient Market Hypothesis (EMH)...................... 2

1.2.1 Technical Analysis and the Weak Form Efficiency............... 3

1.2.2 Earlier Studies on Efficient Market Hypothesis................... 3

1.2.3 Underreaction, Overreaction of the Stock Prices.................. 4

1.2.4 Recent Studies on the Weak Form Market Efficiency.......... 4

1.3 Combining Technical Trading Rules........................................ 5

1.3.1 Computational Intelligence and Combination of Trading Signals.... 5

1.4 Objectives of this Thesis......................................................... 6

1.4.1 A Systematic Method in Combining Trading Signals............ 7

1.5 Structure of this Thesis........................................................... 8
CHAPTER 2 LITERATURE REVIEW ................................................. 9

2.1 PREVIOUS STUDIES ON EMH VIA TECHNICAL TRADING PERFORMANCE ....... 9
2.1.1 Literatures before 1990s ................................................. 9
2.1.2 Literatures after 1990s .................................................. 11

2.2 TECHNICAL TRADING RULES USED IN THIS STUDY .......................... 14
2.2.1 Moving Average (MA) .................................................... 15
2.2.2 On Balance Volume (OBV) ............................................. 17
   2.2.2.1 The Concept of On Balance Volume (OBV) ...................... 17
   2.2.2.2 Modification of OBV and Trading Signal ....................... 19

CHAPTER 3 COMBINING TRADING RULES USING

MARKOWITZ'S PORTFOLIO APPROACH ............................... 20

3.1 PORTFOLIO APPROACH ................................................................ 20
3.1.1 Foundation of Modern Portfolio Theory .................................. 20

3.2 MARKOWITZ'S PORTFOLIO THEORY ........................................... 21

3.3 COMBINING TECHNICAL TRADING RULES
   USING PORTFOLIO THEORY .................................................. 27
3.3.1 Combining Different Strategies on a Fixed Asset ....................... 27
3.3.2 No Short-Selling Constraint .............................................. 28
3.3.3 Comparison of the Conventional Portfolio Theory and the New Approach .... 30
3.3.4 Advantages of Combining Technical Trading Rules ................. 32
   3.3.4.1 Risk Reduction ....................................................... 32
   3.3.4.2 Cost Reduction ....................................................... 33
   3.3.4.3 Performance Measurement ...................................... 35
   3.3.4.3.1 Negative Sharpe Ratio ....................................... 36
CHAPTER 4 DATA AND METHODOLOGY................................. 37

4.1 DATA................................................................................. 37
  4.1.1 The Hong Kong Stock Market........................................ 38
  4.1.2 The Heng Seng Index...................................................... 38
  4.1.3 HSI Constituent Stocks in the Period 1988 - 1999.................. 39
  4.1.4 Sampling Methodology.................................................. 41
  4.1.5 Transaction Cost Data .................................................... 42

4.2 DATA SOURCE AND ADJUSTMENT METHODOLOGY.............. 43
  4.2.1 Data Source................................................................. 43
  4.2.2 Adjustment of Data...................................................... 43

4.3 METHODOLOGY ................................................................. 45
  4.3.1 Stage 1: Identify Two Families of Technical Trading Rules...... 46
  4.3.2 Stage 2: Identify the Optimal Trading Strategy in Each Group... 48
  4.3.3 Stage 3: Use Markowitz’s Theory to Compute the Optimal Portfolio... 55
  4.3.4 Stage 4: Statistical Test Using Out-Sample Data............... 56
  4.3.5 Cost Reduction Test..................................................... 57

CHAPTER 5 EMPIRICAL RESULTS.............................................. 59

5.1 PERFORMANCE OF PORTFOLIO STRATEGY WITH A THREE-YEAR FORMATION PERIOD... 62
  5.1.1 Using Hang Seng Index Basket as the Underlying Asset.......... 62
    5.1.1.1 Excess Return Comparison....................................... 62
    5.1.1.2 Risk Comparison..................................................... 63
    5.1.1.3 Sharpe Ratio Comparison........................................... 63

5.1.2 Individual Constituent Stocks as the Underlying Assets............ 64
  5.1.2.1 Excess Return Comparison........................................ 65
  5.1.2.2 Risk Comparison..................................................... 66
  5.1.2.3 Sharpe Ratio Comparison........................................... 66
5.2 Performance of the Portfolio Strategy with a Six-Year Formation Period... 71

5.2.1 Using Hang Seng Index Basket as the Underlying Asset.................................71
  5.2.1.1 Excess Return Comparison.................................................................71
  5.2.1.2 Risk Comparison.................................................................................72
  5.2.1.3 Sharpe Ratio Comparison.................................................................72

5.2.2 The Individual Constituent Stocks as the Underlying Assets......................74
  5.2.2.1 Excess Return Comparison.................................................................74
  5.2.2.2 Risk Comparison.................................................................................75
  5.2.2.3 Sharpe Ratio Comparison.................................................................75

5.2.3 Cost Reduction Effect.................................................................................79
  5.2.3.1 Portfolio Strategy with a Three-year Formation Period.......................79
  5.2.3.2 Portfolio Strategy with a Six-year Formation Period.........................79

CHAPTER 6 CONCLUSION......................................................................................80

6.1 Profitability of the Portfolio Strategy...............................................................80

6.2 Transaction Cost Reduction Induced by the Portfolio Strategy....................81

6.3 Suggestions for Further Research.................................................................82

APPENDIX...........................................................................................................83

REFERENCES......................................................................................................87

CURRICULUM VITAE..........................................................................................95