

**THE EXISTENCE OF THE VALUE PREMIUM ON THE
JOHANNESBURG STOCK EXCHANGE FROM 1972 TO 2001 AND
EXTRAPOLATION AS EXPLANATION**

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By
ANNA BEUKES
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Supervisor: Professor Alexander Pierre Faure

ABSTRACT

This study investigates the existence of the value premium in South Africa's equity market, and tests extrapolation as a possible explanation for it. The value premium refers to the widely reported superior performance of share price returns of value companies compared to growth companies.

The value premium represents an anomaly in mainstream rational finance theory, because it should not persist, unless it could be explained as the result of some composite form of risk. What is highly vexing is the fact that the value premium not only persists in most financial markets over a long period, but that the risk explanation cannot be upheld convincingly. This contributed to the rise of behavioral finance, an approach which introduces psychological factors to provide new explanations for financial phenomena.

The behavioral finance explanation for the value premium observation is extrapolation (the tendency to project recent experience too far into the future). This study applies propositions and methods from behavioral finance to investigate the South African equity market.

The existence of a value premium in South Africa was investigated by using twenty-nine years' worth of accounting and share price data. The study employed one- and two-dimensional tests for portfolio formation, and tracked share price returns for up to five years after portfolio formation. The results indicated that a statistically and economically significant value premium existed in South Africa for the period between 1972 and 2001.

Extrapolation as a potential explanation for the value premium observation was investigated by applying internationally used methods. Extrapolation was found to provide a robust explanation for the South African value premium.

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DEDICATION

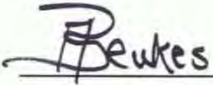
Dedicated to my children.

You are too young to understand the message of this thesis. Therefore I will summarize it for you in the words of Warren Buffet (a famous value investor):

“Stocks are a good thing to own over time. There are only two things you can do wrong: you can buy the wrong ones, and you can buy or sell them at the wrong time.” *Fortune Magazine*, April 20, 2008, page 62

DECLARATION

This Ph.D. thesis represents my own work and due acknowledgement is given in the references whenever information is derived from another source. No part of this thesis has been or is being concurrently submitted for another qualification at any other university.

Signed: 

Date: 20 July 2010

CONTENTS

ABSTRACT.....	ii
ACKNOWLEDGEMENTS.....	iii
DEDICATION.....	v
List of figures.....	xiii
List of tables.....	xiv
List of appendix tables.....	xv
List of acronyms	xvi
CHAPTER ONE	1
INTRODUCTION, PROBLEM STATEMENT AND AIMS	1
1.1 Introduction	1
1.2 Background to this study: the value versus growth debate	1
1.3 Contrasting views on the value premium anomaly and this study	4
1.4 Aims of the study.....	5
1.5 Acknowledgement of data source.....	6
1.6 Chapter summaries	7
Chapter 1: Introduction, problem statement and aims	7
Chapter 2: Rational finance theory	7
Chapter 3: Behavioral finance theory	8
Chapter 4: Research methods.....	8
Chapter 5: Research findings	9
Chapter 6: Comparison and interpretation of research findings	9
Chapter 7 Summary and conclusion	11
Chapter Two.....	12
RATIONAL FINANCE THEORY.....	12
2.1 The historical evolution of finance theory.....	13
2.2 Neo-classical economics and the basic assumptions of rational finance	17
2.3 Market participants: decision-making	19
2.3.1 Maximizing utility.....	19
2.3.2 Minimizing risk.....	20
2.3.3 Integrating maximizing utility and minimizing risk	21
2.3.4 Probability rule: decisions under uncertainty.....	22

2.4	Efficient financial markets: how they function	24
2.5	The efficient market hypothesis	25
2.5.1	Core of the hypothesis.....	25
2.5.2	Unease about the hypothesis	26
2.5.3	Main responses from supporters of the theory	27
2.6	Modern portfolio theory (MPT)	28
2.6.1	Description of MPT.....	29
2.6.2	The evolution of MPT	32
2.7	The capital asset pricing model (CAPM)	33
2.7.1	Description of CAPM.....	33
2.7.2	Problems with CAPM	36
2.8	Anomalies and CAPM.....	39
2.8.1	Some recognized anomalies in financial markets	40
2.8.2	Main responses from supporters of CAPM.....	44
2.9	Conclusion	51
CHAPTER 3		54
BEHAVIORAL FINANCE THEORY		54
3.1	Basic assumptions.....	55
3.1.1	Market participants.....	56
3.1.2	Utility maximizing	56
3.1.3	Approach towards risk	59
3.2	Inefficient markets: how they function.....	60
3.3	Different assumptions of rational and behavioral finance.....	63
3.4	Behavioral finance and the value premium	64
3.5	Information processing and extrapolation	66
3.5.1	Heuristics.....	68
3.5.2	Representativeness	69
3.5.3	Conservatism	69
3.5.4	Mean reversal	70
3.6	Over- and under-reaction.....	70
3.7	Overconfidence.....	72
3.8	Extrapolation schematically represented	74
3.9	The unsettled debate	77
3.9.1	Cherry-picking biases.....	77

3.9.2	Market practitioners and the value premium.....	78
3.9.3	The current status of this debate and where this study fits in	79
3.10	Overview of South African research on the value premium	80
3.10.1	Investigating the value premium on the JSE.....	81
3.10.1.1	Plaistowe and Knight	81
3.10.1.2	Maritz and Klerck.....	82
3.10.1.3	Graham and Uliana.....	83
3.10.1.4	Fraser and Page	84
3.10.1.5	Van Rensburg and Robertson.....	85
3.10.1.6	Auret and Sinclair.....	85
3.10.1.7	Rousseau and Van Rensburg.....	86
3.10.1.8	Mutooni and Muller	87
3.10.1.9	Basiewicz and Auret	88
3.10.2	Company and sample size effect on the JSE.....	88
3.10.3	Mean reversal	90
3.10.4	Earnings per share (EPS).....	91
3.10.5	Summary implications of empirical findings in South Africa	92
Chapter FOUR		94
RESEARCH METHODS		94
4.1	Methods	94
4.1.1	One-dimensional tests	94
4.1.2	Size-adjustment	95
4.1.3	Two-dimensional tests.....	95
4.1.4	Extrapolation	96
4.2	Portfolio formation	97
4.2.1	One-dimensional tests	97
4.2.2	Size-adjustment	98
4.2.3	Two-dimensional tests.....	99
4.2.4	Portfolio formation: Extrapolation	99
4.3	Returns.....	100
4.3.1	Annual returns	100
4.3.2	Holding returns.....	100
4.4	Statistical testing.....	101
4.5	Data.....	102

Chapter FIVE	103
RESEARCH FINDINGS	103
5.1 Findings for one-dimensional tests: annual returns.....	103
5.1.1 BV/MV: one to five year annual returns.....	103
5.1.2 Cash-flow-to-price (CF/P): one to five year annual returns	104
5.1.3 EPS: one to five year annual returns.....	105
5.1.4 Past sales growth (PSG): one to five year annual returns.....	106
5.2 Findings for one-dimensional tests: holding returns	107
5.2.1 BV/MV: 3-year holding return.....	108
5.2.2 BV/MV: 5-year holding return.....	109
5.2.3 CF/P: 3-year holding return.....	110
5.2.4 CF/P: 5-year holding return.....	111
5.2.5 EPS: 3-year holding return.....	112
5.2.6 EPS: 5-year holding return.....	113
5.2.7 PSG: 3 year holding return	114
5.2.8 PSG: 5-year holding return	115
5.3 Statistical significance of one-dimensional results.....	116
5.4 Findings for two-dimensional tests: annual returns.....	117
5.4.1 PSG and BV/MV: one to five years annual returns.....	117
5.4.2 PSG and CF/P: one to five years annual returns.....	118
5.5 Statistical significance of two-dimensional results.....	119
5.6 Findings on extrapolation	120
5.6.1 Sales growth before and after portfolio formation.....	120
5.6.2 Cash flow growth before and after portfolio formation.....	121
5.6.3 EPS growth before and after portfolio formation	122
5.6.4 Share price returns before and after portfolio formation	125
5.6.4.1 Share price return before portfolio formation.....	125
5.6.4.2 Share price returns after portfolio formation	128
CHAPTER SIX.....	131
COMPARISON AND INTERPRETATION OF RESEARCH FINDINGS	131
6.1 One dimensional tests.....	131
6.1.1 BV/MV and CF/P.....	131
6.1.2 EPS and PSG.....	137
6.1.3 Years four and five after portfolio formation.....	140

6.2	Two-dimensional tests	141
6.3	Comparing results with previous South African findings	143
6.3.1	Value premium	143
6.3.2	EPS	145
6.3.3	Mean reversal	147
6.4	International Comparisons.....	148
6.4.1	One-dimensional tests	148
6.4.2	Two-dimensional test comparisons.....	151
6.5	Extrapolation	153
6.6	Suggestions for further research	158
CHAPTER SEVEN		161
SUMMARY AND CONCLUSION		161
7.1	Main aims and outline of the study	161
7.2	Summary of literature reviewed	161
7.2.1	Rational finance and its predicament	162
7.2.2	Behavioral finance as response	163
7.3	Overview of research methods	164
7.4	Findings summarized and interpreted.....	167
7.4.1	Value premium.....	167
7.4.2	Testing for extrapolation	169
7.5	The continuing debate: going anywhere soon?	170
7.5.1	Main contentions	170
7.5.2	How far apart are they?	171
7.5.3	Possible agreements?.....	173
7.5.4	Deeper methodology matters	174
7.5.5	Where to now?	176
BIBLIOGRAPHY		177
APPENDIX 1.....		198
TABLES SUPPORTING ONE-DIMENSIONAL TESTS.....		198
A1	Methodology for constructing tables in appendix 1	198
A1.1	Portfolio formation.....	198
A1.2	Return tracking	200
APPENDIX 2.....		222
Repeating one-dimensional tests with alternative share price data		222

A.2.1	Portfolio formation with different share price data sets	222
A2.2	Return calculations with different share price data sets	223
A2.3	Share price return calculation with line 150	225
A2.4	Share price return calculation with MESP	231
A2.5.	Statistical significance between data sets	237
A2.6.	Conclusion	244
APPENDIX 3.....		245
Tables supporting the two-dimensional tests.....		245
A3.1	Expanding two-dimensional tests.....	245
A3.2	Construction of tables in appendix 3.....	246
A3.3	PSG and BV/MV as basis for portfolio formation.....	247
A3.4	Annual returns for PSG and CF/P portfolio	252
A3.5	Two-dimensional holding returns.....	257
A3.5.1	Three-year holding returns for PSG–BV/MV portfolio.....	257
A3.5.2	Five-year holding returns for PSG–BV/MV portfolio.....	259
A3.5.3	Three-year holding returns for PSG–CF/ portfolio.....	260
A3.5.4	Five-year holding returns for PSG–CF/P portfolio.....	261
APPENDIX 4:.....		262
EXTRAPOLATION METHODOLOGY		262
A4.1	Sales Growth.....	262
A4.1.1	Calculating sales growth before portfolio formation	262
A4.1.2	Calculating sales growth after portfolio formation	263
A4.2	Cash flow growth.....	263
A4.2.1	Calculating cash flow growth before portfolio formation.....	263
A4.2.2	Calculating cash flow growth after portfolio formation.....	264
A4.3	EPS growth.....	264
A4.3.1	Calculating EPS growth before portfolio formation	264
A4.3.2	Calculating EPS growth after portfolio formation	265
A4.4	Ratios	265
A4.5	Share price returns	266
A4.5.1	Before portfolio formation	266
A4.5.2	After portfolio formation.....	267

LIST OF FIGURES

Figure 1: Risk return trade-off	29
Figure 2: The Markowitz frontier	31
Figure 3: The security market line	35
Figure 4: Prospect theory value function	58
Figure 5: Becoming an over-valued growth company.....	75
Figure 6: Becoming an under-valued value company	76
Figure 7: BV/MV 1st year annual return (appendix 1, table 1).....	132
Figure 8: BV/MV 5-year holding return	134
Figure 9: CF/P average annual returns (table 2, chapter 5).....	131
Figure 10: CF/P 1st year annual returns (appendix 1, table 6).....	131
Figure 11: CF/P 2nd year annual returns (appendix 1, table).....	131
Figure 12: CF/P 3-year holding returns (table 7, chapter 5).....	131
Figure 13: CF/P 5 year holding returns (table 8, chapter 5).....	131
Figure 14: PSG-BV/MV 1-5 years annual returns (table 4).....	137
Figure 15: PSG-CF/P 1-5 years annual returns (table 15).....	137
Figure 16: Headline versus bottom-line EPS average returns	
Regular portfolios.....	140
Figure 17: Headline versus bottom-line EPS average returns	
Size-adjusted portfolios.....	141
Figure 18: Value-versus-growth before portfolio formation	
First year returns.....	151
Figure 19: Value-versus-growth before portfolio formation	
Second year returns.....	151
Figure 20: Value-versus-growth before portfolio formation	
Third year returns.....	151
Figure 21: Value-versus-growth before portfolio formation	
Fourth year returns.....	151
Figure 22: Value-versus-growth before portfolio formation	
Fifth year returns.....	151
Figure 23: Value-versus-growth after portfolio formation	
First year returns.....	152
Figure 24: Value versus growth after portfolio formation	
Second year returns.....	152
Figure 25: Value versus growth after portfolio formation	
Third year returns.....	152
Figure 26: Value-versus-growth after portfolio formation	
Fourth year returns.....	152
Figure 27: Value-versus-growth after portfolio formation	
Fifth year returns.....	152

LIST OF TABLES

Table 1: BV/MV annual returns	104
Table 2: CF/P annual returns	104
Table 3A: Headline EPS (including extraordinary items) annual returns	105
Table 3B: Bottom-line EPS (excluding extraordinary items) annual returns	101
Table 4: PSG annual returns	106
Table 5: BV/MV 3-year holding return	108
Table 6: BV/MV 5-year holding return	109
Table 7: CF/P 3-year holding return	110
Table 8: CF/P 5-year holding return	111
Table 9: EPS 3-year holding return	112
Table 10: EPS 5-year holding return	113
Table 11: PSG 3-year holding return	114
Table 12: PSG 5-year holding return	115
Table 13: Linear regressions accompanying one-dimensional tests	116
Table 14: PSG-BV/MV annual returns	117
Table 15: PSG-CF/P annual returns	118
Table 16: Linear regressions accompanying two-dimensional tests	119
Table 17: Sales growth: Value companies	120
Table 18: Sales growth: Growth companies	120
Table 19: Cash flow performance: Value companies	121
Table 20: Cash flow performance: Growth companies	121
Table 21: Cash flow/Price ratio	121
Table 22: EPS growth rate: Value companies	123
Table 23: EPS growth rate: Growth companies	123
Table 24: EPS/Price ratio	123
Table 25: EPS growth rate: Value companies	124
Table 26: EPS/Price ratio	124
Table 27: EPS growth rate: Growth companies	124
Table 28: Share price return in year five before portfolio formation	125
Table 29: Share price return in year four before portfolio formation	126
Table 30: Share price return in year three before portfolio formation	126
Table 31: Share price return in year two before portfolio formation	127
Table 32: Share price return in year one before portfolio formation	127
Table 33: Share price return one year after portfolio formation	128
Table 34: Share price return in the second year after portfolio formation	129
Table 35: Share price return in the third year after portfolio formation	129
Table 36: Share price return in the fourth year after portfolio formation	130
Table 37: Share price return in the fifth year after portfolio formation	130

Table 38: One-dimensional results: value versus growth spread – averaged over five years.....	144
Table 39: One dimensional test: performance of value and growth portfolios and spread.....	146
Table 40: One and two-dimensional test comparisons.....	147

LIST OF APPENDIX TABLES

Appendix 1 Table 1: BV/MV first year annual return.....	201
Appendix 1 Table 2: BV/MV second year annual return	203
Appendix 1 Table 3: BV/MV third year annual return	203
Appendix 1 Table 4: BV/MV fourth year annual return.....	205
Appendix 1 Table 5: BV/MV fifth year annual return	206
Appendix 1 Table 6: CF/P first year annual return.....	207
Appendix 1 Table 7: CF/P second year annual return	208
Appendix 1 Table 8: CF/P third year annual returns	209
Appendix 1 Table 9: CF/P fourth year annual return	210
Appendix 1 Table 10: CF/P fifth year annual return	211
Appendix 1 Table 11: EPS first year annual return	212
Appendix 1 Table 12: EPS second year annual return	213
Appendix 1 Table 13: EPS third year annual return	214
Appendix 1 Table 14: EPS fourth year annual return.....	215
Appendix 1 Table 15: EPS fifth year annual return.....	216
Appendix 1 Table 16: PSG first year's annual return.....	217
Appendix 1 Table 17: PSG second year annual return	218
Appendix 1 Table 18: PSG third year annual return.....	219
Appendix 1 Table 19: PSG fourth year annual return	220
Appendix 1 Table 20: PSG fifth year annual return	221
Appendix 2 Table 7: BV/MV annually adjusted return, data line 150.....	220
Appendix 2 Table 8: BV/MV first year annual return, data line 150.....	221
Appendix 2 Table 9: BV/MV second year annual return, data line 150.....	222
Appendix 2 Table 10: BV/MV third year annual return, data line 150.....	223
Appendix 2 Table 11: BV/MV fourth year annual return, data line 150.....	224
Appendix 2 Table 12: BV/MV fifth year annual return, data line 150.....	225
Appendix 2 Table 13: BV/MV annually adjusted return using MESP.....	226
Appendix 2 Table 14: BW/MV first year annual return using MESP	227
Appendix 2 Table 15: BV/MV second year annual return using MESP.....	228
Appendix 2 Table 16: BV/MV third year annual return using MESP.....	229
Appendix 2 Table 17: BV/MV fourth year annual return using MESP ...	230

Appendix 2 Table 18: BV/MV fifth year annual return using MESP... ..	231
Appendix 2 Table 19: ANOVA and Kruskal-Wallis test BV/MV first year	234
Appendix 2 Table 20: ANOVA and Kruskal-Wallis test of BV/MV second year	235
Appendix 2 Table 21: ANOVA and Kruskal-Wallis test of BV/MV third year	236
Appendix 2 Table 22: ANOVA and Kruskal-Wallis test of BV/MV fourth year	237
Appendix 2 Table 23: ANOVA and Kruskal-Wallis test of BV/MV fifth year	238
Appendix 3 Table 21: PSG and BV/MV first year annual return.....	242
Appendix 3 Table 22: PSG and BV/MV second year annual return.....	243
Appendix 3 Table 23: PSG and BV/MV third year annual return.....	244
Appendix 3 Table 24: PSG and BV/MV fourth year annual return.....	245
Appendix 3 Table 25: PSG and BV/MV fifth year annual return... ..	246
Appendix 3 Table 26: PSG and CF/P first year annual returns.....	247
Appendix 3 Table 27: PSG and CF/P second year annual returns.....	248
Appendix 3 Table 28: PSG and CF/P third year annual returns.....	249
Appendix 3 Table 29: PSG and CF/P fourth year annual returns.....	250
Appendix 3 Table 30: PSG and CF/P fifth year annual returns.....	251
Appendix 3 Table 31: PSG and BV/MV three year hold returns.....	252
Appendix 3 Table 32: PSG and BV/MV five year hold returns	254
Appendix 3 Table 33: PSG and CF/P three year hold returns.....	255
Appendix 3 Table 34: PSG and CF/P five year hold returns.....	256

LIST OF ACRONYMS

BV/MV.....	book value to market value
CF/P	cash flow-to-price ratio
E/P	earnings-to-price ratio
EPS.....	earnings per share
EPS/P.....	earnings per share/price
JSE	Johannesburg Stock Exchange
LSV.....	Lakonishok, Shleifer and Vishny (1994)
NYSE.....	New York Stock Exchange
PSG.....	past sales growth

CHAPTER ONE

INTRODUCTION, PROBLEM STATEMENT AND AIMS

1.1 Introduction

Based on accumulated empirical evidence, the academic community has generally come to agree that value investment strategies, on average, outperform growth investment strategies (Chan and Lakonishok, 2004:71). This has become known as the value premium. Despite strong evidence that value investment portfolios outperform growth investment portfolios over the medium to longer term, a significant number of investors continue to invest in growth portfolios. This suggests an anomaly in investor behavior and market efficiency: rational investors are supposed to maximize returns and efficient markets do not allow excess returns to persist.

This study undertakes to investigate this issue by analyzing the literature in the relevant academic field, and aims to contribute to the discussion by using South African data to put more recent findings in the literature to the test.

1.2 Background to this study: the value versus growth debate

The recent academic interest in value versus growth investment strategies was sparked by an influential article by Fama and French (1992). They evaluated the notion that United States stock prices might be related to the ratio of a firm's book value of common equity (BV), to its market value of equity (MV), and found a strong, consistent and unmistakable pattern. Companies with high book value relative to their market value of equity (BV/MV) were found to outperform the market. They also established that small-cap stocks tended to outperform large-cap stocks. Speculating about what the underlying economic explanation

for their findings might be, they concluded that “...whatever the underlying economic causes, our main result is straightforward. Two easily measured variables, namely size and BV/MV, provide a simple and powerful characterization of a cross-section of average stock returns for the 1963 – 1990 period” (Fama and French, 1992:429). Their conclusion unequivocally affirms the existence of what subsequently became known as the value premium anomaly.

Fama and French were by no means the first to suggest that it might be profitable to buy shares trading at low prices relative to fundamentals such as earnings, assets, dividends etc. This concept dates back to the 1930s when Graham and Dodd (1934), who became known as the fathers of value investing, first suggested almost sixty years previously that taking company fundamentals into consideration when buying shares, is a prerequisite for good returns. Fama and French were also not the only ones, or even the first, to test the notion that a relationship exists between a company's BV/MV and its share price. Rosenberg, Reid and Lanstein (1985) and Chopra, Lakonishok and Ritter (1992) tested this hypothesis before them in the USA, and found strong and positive correlations. Chan, Hamao and Lakonishok (1991) found similar results for Japan. However, Fama and French's work became instrumental in the development of style-specific benchmarks. Their BV/MV ratio became an important indicator of a portfolio's orientation toward either growth or value: value portfolios are companies with high BV/MV values, whereas growth portfolios comprise of companies with low BV/MV values.

Since 1992, the notion that the shares of value companies outperform the market was extensively tested around the world. Fama and French (1998a) tested it themselves with data from twelve major European countries, as well as from Australia and the Far East. The consistency of their findings is impressive. They found that between 1975 and 1995, in almost every country value stocks delivered a higher return than growth stocks. Even after refining their study by

incorporating other value measurements, such as earnings/price, cash flow/price and dividend/price, they found similar value premiums. This value premium phenomenon was also tested in emerging markets such as Indonesia, Singapore and Taiwan, by Naughton and Veeraraghavan (2005), where similar patterns were found.

The existence of a value premium was not just tested geographically, but in a number of other ways. Fama and French (1992) incorporated company size to determine whether value strategies also outperformed growth strategies in the case of large-cap stocks. This was undertaken to take account of a known (inverse) relationship that exists between a company's size and the return of its shares. As far back as 1981, Banz reached this important conclusion when he found that market equity, or ME — a stock's price multiplied by its shares outstanding — added to the explanation of a cross-section of average returns provided by market betas¹. Banz showed that average returns on small (low ME) stocks were higher than one would expect, based on their beta estimates alone, and average returns on large stocks (high ME) were lower than one would expect, based on beta estimates alone (Banz, 1981).

Against this background, Fama and French further tested investment strategies of value versus growth stocks for large- and small-cap stocks. They found that the portfolio of value stocks had an average return of 1.22 percentage points per month higher than the average return of a growth stock portfolio in the case of the smallest companies. Value stocks continued to earn higher returns in the category of the largest companies — albeit with a smaller margin (0.25 percentage points per month).

Ever since these findings were published, an academic debate has been growing about the implications of, and possible reasons for, what clearly constitutes an investment conundrum: viz. the seeming counter-factual actions of investment

¹ Beta is the most extensively used measure of systematic risk and will be discussed in detail in chapter 2.

strategists in the face of a growing body of evidence that value investment strategies outperform growth investment strategies. Tracing this debate will form the first part of this study.

1.3 Contrasting views on the value premium anomaly and this study

The agreement which exists in academic circles about the superiority of a value strategy has already led to numerous studies to refine the value strategy, by exploring the links between BV/MV and other return regularities. For instance, Asness (1997) and Daniel and Titman (1999) studied the interaction between the value effect and past returns (price momentum). Chan, Lakonishok, and Sougiannis (2001) incorporated intangible assets in the book value of equity, and found that doing so further improved the performance of the value approach. Piotroski (2000) used various financial statement items to identify successful value stocks more precisely. Ferson and Harvey (1999) used conditioning information to help predict the value premium. All these studies pursued the refinement of the value approach to allow an investor to reap even greater returns than can be obtained by using only BV/MV indicators (the basic value versus growth indicator).

Given the growing and convincing body of evidence attesting to the value premium, the question then becomes pointed: If this is the level of academic consensus, why does the value premium persist? What explains the value premium? What are the underlying theoretical reasons for its existence? Two broad categories of possible answers have come to dominate academic research:

- The first possibility is that a value strategy might be more risky. This explanation has mostly been investigated by the supporters of traditional finance theory because, according to them, a value premium can only persist to compensate value investors for carrying more risk. Given that this remains an influential approach, it justifies being explored in a separate chapter.

- The second, more recent, possible explanation is suggested by the supporters of behavioral finance theory. They put forward the notion that psychological motivations are the underlying reason for the value premium. This is the case when investors follow a naïve strategy in which they extrapolate past performance too far into the future. De Bondt and Thaler (1985) were the first to attribute the dominance of value strategies to the tendency of naïve investors to extrapolate past results too far into the future. Value stocks tend to have a past history of poor performance (relative to growth stocks) with respect to growth in earnings, cash flow and sales. Investors have a proclivity to overestimate the sustainability of the high returns on growth stocks, and project past growth too far into the future. That is to say, if a company has done well over the past year or two, investors expect that trend to continue, and are willing to pay more and more for those shares. The expectation of continued strong growth and good performance therefore entices investors to buy those shares even after they become expensive.

This study contributes to this debate by analyzing the risk explanation. It concludes that risk does not convince as a feasible explanation for the value premium anomaly. By using South African financial data, the study demonstrates empirically that extrapolation provides a more convincing reason for the existence of the value premium.

1.4 Aims of the study

In order to investigate and address the value premium conundrum, **the first aim** of this study is to establish whether a value premium exists in the South African stock market. Various researchers tested for a value premium in South Africa (see chapter 3 for a detailed discussion). Previous studies use small sample sizes that exclude the mining and the financial sectors from the analysis and to the best knowledge of the author, nobody in South Africa uses the method employed by Lakonishok, Shleifer and Vishny (1994) (henceforth LSV) which this

study used, and none of them tried to explain the reasons for the value premium observation. This thesis does a substantially more extensive investigation, by analyzing all the companies (including delisted ones) which were trading on the JSE² between 1972 and 2001³ for evidence that the value premium does indeed also exist in South Africa.

Once it has been established that the value premium exists, **the second aim** of this study is to contribute to the academic debate about the reason for its persistence, by testing extrapolation as an explanation with South African financial data.

It is possible to test the notion that individuals do not make predictions of the future based on sophisticated methods, but on past performance, because past performance and future expectations can be measured independently. Past performance is measured by past growth in sales, earnings and cash flow. Expectations about the future are reflected in the multiples of share prices to earnings and cash flow.

1.5 Acknowledgement of data source

The empirical work undertaken in this study required accounting and share price data for all JSE listed and delisted companies between 1977 and 2001. This information was made available by McGregor BFA of Johannesburg, South Africa in Microsoft Excel format.

² JSE Limited is the South African share/stock exchange. It started life as Johannesburg Stock Exchange (the origin of the acronym JSE); it later changed its name to Johannesburg Securities Exchange, and it later became incorporated as JSE Limited. We refer to it throughout this study simply as JSE.

³ The data time series used for this study stretches from 1972 to 2006. Since five years of post-portfolio information is necessary for the analysis, portfolio formation had to end in 2001.

1.6 Chapter summaries

Chapter 1: Introduction, problem statement and aims

This chapter provides an introduction to and explanation of the thesis topic. It introduces the background to the study by exploring the value versus growth debate, positions held in the debate as well as some references to research work done in the field. It explains why this is an important topic to study, and how the study fits into and enhances the academic debate.

Chapter 2: Rational finance theory

This chapter gives an overview of the evolution of rational finance theory over time. It discusses the assumptions that form the basis of all rational finance theory and elaborates on the main rational finance theories, including the modern portfolio theory (MPT) and the capital asset pricing model (CAPM). The chapter gives extensive coverage to the research done by supporters of this school of thought to explain the value premium.

Rational finance theory addresses the value premium explanation by focusing on forms of risk. The chapter concludes that risk is an insufficient explanation. The case will be made that irrespective of Friedman's argument about the irrelevance of assumptions, the assumptions underlying the rational finance theory approach decisively undermine its predictive power, and thus render it incapable of matching empirical evidence with theory. However, because the rational approach to finance had been so central and influential for forty years, its theoretical foundation and how it relates to the value premium issue both merit substantial attention.

The conclusion at the end of chapter 2 is that the traditional approach to finance disappointingly fails to explain the value premium phenomenon satisfactorily, in

contrast with the advances made in behavioral finance theory — one of the most active areas in asset pricing thinking during the 1990s.

Chapter 3: Behavioral finance theory

This chapter describes the assumptions and theoretical constructs that are the bases of behavioral finance. It includes substantial references to the research done by supporters of this school of thought, and continuously contrasts it with the rational finance theory approach. The chapter argues that behavioral finance assumptions and concomitant modeling — heuristics, framing, over- and under-reaction — form the foundation of naïve extrapolation, which provides a testable answer to the research question.

Chapter 4: Research methods

This chapter describes in detail the methods employed for the empirical part of the study, which consists of analyzing all the companies trading on the JSE between 1972 and 2001 to ascertain whether the value premium exists in South Africa, and if evidence can be found that extrapolation is the reason for the persistence of the value premium.

To test for the value premium, all the companies trading on the JSE were classified and sorted into five portfolios — from high value (portfolio 1) to high growth portfolios (portfolio 5), based on one-dimensional value classifications (such as BV/MV, cash flow-to-price ratio, earnings-to-price ratio and past sales growth), as well as two-dimensional classifications (such as sales growth and book-value or sales growth and cash flow). For each portfolio returns were recorded for up to five years after portfolio formation. Portfolios were also size-adjusted to see if the excess returns on value portfolios persist after controlling for size.

These extensive tests produced undisputable evidence that the value premium was present in South Africa over the past twenty-nine years. The next step was to look for evidence that extrapolation is an explanation for the persistence of the value premium in South Africa.

To test for extrapolation, four variables were tracked and analyzed for the high value portfolio (portfolio 1) and the high growth portfolio (portfolio 5), namely:

- a) Past growth performance for each portfolio in terms of growth in earnings, cash flow and sales growth in the five years **before** portfolio formation;
- b) Future⁴ growth performance in earnings, cash flow and sales growth for each portfolio in the five years **after** portfolio formation;
- c) Ratios of fundamentals such as earnings-to-price (E/P) and cash-flow-to-price (CF/P);
- d) The average share price returns for each portfolio in the five years before and after portfolio formation.

Chapter 5: Research findings

This chapter provides the results (in the form of tables) of implementing the methods described in chapter 4. In addition to the tables, the chapter also contains four appendices which provide more detail on how these tables containing the results were constructed.

Chapter 6: Comparison and interpretation of research findings

This chapter discusses and analyses the results presented in chapter 5. With a view to the two main tasks set for this study, observations are as follows:

⁴ Future growth refers to rates that were actually achieved between 1972 and 2001, but which, **at the time of portfolio formation**, were unknown to the investor and thus represented future growth rates. These can now be seen – with the benefit of hindsight or *ex post facto* – as the “actual” future growth rates that were achieved in the years after portfolio formation.

- (a) As far as investigating the existence of the value premium in South Africa is concerned, findings were highly consistent irrespective of which of the value measures (BV/MV, cash flow-to-price ratio, earnings-to-price ratio and past sales growth) were used. The latter of the two value measures were not as conclusively supportive of the finding as the first two, but did not contradict the finding either. The positive finding was also consistent for both one- and two-dimensional value classifications of stocks, with a combination of past sales growth and cash flow in the latter category the most clear-cut.
- (b) As far as investigating extrapolation as explanation for the value premium was concerned, findings were that growth portfolios have higher growth rates than value portfolios in all categories of sales, earnings and cash flow in the five years **before** portfolio formation. However, in the five years **after** portfolio formation the pattern reverses, with growth portfolios achieving lower growth rate in sales, earnings and cash flow than value portfolios. The extrapolation “false reasoning” phenomenon is evident in the ratios at which the two portfolios were trading when portfolios were formed. Growth companies were trading at lower⁵ ratios, indicating (unfounded) investor expectations that the strong performance of growth companies in the past would continue in the future. Therefore, they were willing to pay a higher price (per unit of value) for growth portfolios. The same extrapolation (erroneous) thought process is evident in the higher ratios of value companies. Investors observed the weaker performance of value companies in the five years before portfolio formation, and expected that pattern to continue in the future, which is why they were unwilling to pay a higher price per unit of value.

⁵ In ratios such as the P/E (with price as nominator and earnings as denominator) lower values are preferable. In line with influential research in the field, this study reverses the traditional formula with price as denominator and a value measures such as earnings or cash flow as nominator. Therefore, **lower ratio values indicate a higher price per unit of value and are therefore less desirable than high ratio values.**

Chapter 7 Summary and conclusion

This chapter concludes that the value premium did exist in South Africa over the past twenty-nine years. It also presents evidence that naïve extrapolations and faulty expectations in relation to investment decisions (as exposed by behavioral finance) provide an explanation for the value premium.

It ends with a reflection on the current debate between rational and behavioral finance, and concludes that these apparently dichotomous schools of thought actually have more in common than what meets the eye, and that there is scope for cross-fertilization and even convergence.

CHAPTER TWO

RATIONAL FINANCE THEORY

This chapter commences with a brief historical background to the advent of what is referred to in this study as rational finance theory⁶. It then analyzes the assumptions and constructs which form the basis of the theory. The reason for exploring the theoretical fundamentals of rational finance is to connect the deeper-lying issues in finance relating to markets with recent empirical evidence. It is this recent empirical evidence which has necessitated a re-examination of the basic assumptions underlying rational finance as part of the ongoing academic discussion.

The chapter traces how these assumptions translate into the most influential tenets of rational finance thinking as applied in the efficient market hypothesis, modern portfolio theory and capital asset pricing theory. It shows the core focus of rational finance theory is on the risk-return trade-off and its uses, and how that focus essentially explains the persistence of the value premium.

The aim of this chapter is thus twofold: (a) to demonstrate the inadequacy of the risk explanation for the persistence of the value premium, and (b) to provide the background to the rise of behavioral finance theory as an alternative approach.

The case will be made that empirical evidence does not support rational finance theory, mainly due to the problematical assumptions underlying it. Those assumptions will become evident by following the chronological development of this school of thought over time.

⁶ The mainstream body of finance theory is mostly called “modern finance theory” in the literature. In order to highlight its most salient characteristic as well as to contrast it with the main alternative theoretical stream, the name “rational” will be used in this study.

The conclusion is drawn that it is the inadequacy of the traditional approach to finance to explain the value premium, which ultimately gave rise to the advances in behavioral finance theory which we witness today.

2.1 The historical evolution of finance theory

Economists have long been aware of the basic economic function of credit markets, but were not keen on analyzing markets theoretically, because early ideas about financial markets were intuitive, mostly formulated by practitioners. During the early period economists did not regard financial markets as proper markets, but more analogous to casinos, in which asset prices were determined by speculative activity, i.e. the purchase of assets exclusively for later resale.

John Burr Williams (1938) was among the first to challenge the casino view in a rudimentary way. He argued that the price of financial assets reflected the intrinsic value of an asset, which can be measured by the discounted stream of future cash flow from the asset. Harry Markowitz (1952, 1959) realized that as Williams' notion relied on future expectations, an element of risk (i.e. uncertainty) had to be included in a meaningful manner. The fundamental idea in Markowitz's theory of optimal portfolio selection combines risk and return concepts, by asserting that asset selection happens in the context of trade-offs between return (discounted future cash flow) and risk (uncertainty of expected outcome). This constitutes the basis of what has subsequently become known as "modern portfolio theory" (MPT).

The next logical step was taken by James Tobin (1958) who added the notion of money to Markowitz's approach, leading to the "two-fund separation theorem". Tobin argued that agents would diversify their savings between a risk-free asset (money) and a single portfolio of risky assets (which would be the same for everyone). Different attitudes towards risk would then merely result in different combinations of money and that unique portfolio of risky assets.

Arguably the most important model to appear in the early 1960s, was the capital asset pricing model (CAPM) which solved the arduous mathematical calculation burden of Markowitz's MPT. Markowitz's model made it possible to benefit from portfolio diversification, by calculating the covariance of returns of every pair of assets in a portfolio against each other. The CAPM of William Sharpe (1963, 1964) and John Lintner (1965) solved this calculation burden by demonstrating that the same result is achieved by merely calculating the covariance of every asset return with respect to a general market return (beta). By reducing the volume of calculations previously required, portfolio selection became a much more feasible option for practitioners who embraced CAPM.

Addressing some of the recognized limits of CAPM, Stephen A. Ross (1976) came up with "arbitrage pricing theory" or APT. Even though Ross developed the APT, he noted that the basic reasoning behind arbitrage theory was not his unique concept, but was the underlying logic and methodology of all of rational finance theory. Arbitrage⁷ asserts that if the risk-return profiles of two assets are identical, the price of those two assets must also be the same, otherwise an arbitrage opportunity would arise, which would allow investors to earn excess profits by buying the under-priced asset and selling it at the higher price. Arbitrage assumes that investors seek to exploit any excess profit opportunities, and that prices adjust in response. When a security drifts away from its fundamental value, the actions of observant and sufficiently capitalized speculators will increase the demand for it. The greater demand will drive the price up, and thereby eliminate any excess profit opportunities. Arbitrage does not necessarily suggest that all investors are skilled and well-informed. However, it does assume that in well-developed, liquid capital markets, there are enough rational investors to ensure that a security's price equals its fundamental value, that prices reflect available information accurately, and that they thereby allow for

⁷ Introduced by Stephen Ross (1976), arbitrage pricing theory (APT) in finance sets out that the expected return of a financial asset can be modeled as a function of various macro-economic factors or theoretical market indices. The model-derived rate of return can then be used to price the asset correctly. The correct asset price should equal the expected end-of-period price discounted at the rate implied by model. If the price diverges, arbitrage should bring it back in line. The two pillars on which behavioral finance theory was built (see chapter 3) were limited arbitrage and investor psychology.

the efficient allocation of capital. This point is evident in the theory of option pricing advanced by Fisher Black and Myron Scholes (1973) and Robert Merton (1973), who use arbitrage in their reasoning. Arbitrage logic was also used by M. Harrison and David M. Kreps (1979) and Darrell J. Duffie and Chi-Fu Huang (1985), and further developed in theories of general equilibrium in asset markets by Roy Radner (1968, 1972) and Oliver D. Hart (1977).

The work discussed up to this point contributed to the formalization of financial economics as a recognized sub-discipline of economics during the 1960s (Jovanovich, 2008:214). The integration of financial economics into economic science was accomplished through a synthesis of the results from financial econometrics, MPT and economic equilibrium⁸. This synthesis also established links between empirical results in finance and core ideas of equilibrium in economics. These links paved the way for the creation of theoretical explanations for empirical results.

Empirical results which did not fit the bill, and created a stir among economists, came from investigations by Working, Cowles and Kendall, all of whom suggested that asset prices over time tended to follow a random pattern or “walk”. Holbrook Working (1934) and Alfred Cowles (1933) for American stock prices, and Maurice G. Kendall (1953) for British stock and commodity prices, found that no correlation existed between successive price changes on asset markets. If prices – as equilibrium economic theory states – are determined by the forces of supply and demand, then price changes should move steadily and without fail towards market clearing, instead of moving randomly. Serious efforts were initially made to show that the unusual findings flowed from a failure of traditional statistical methods in an attempt to explain what was actually happening. Time series methods were for instance applied by Clive Granger and

⁸ Jovanovich (2008:214) differentiates between financial economics – as a theoretical sub-discipline – and mathematical finance, which can be identified as mathematics applied to finance, and financial econometrics, which can in turn be described as econometrics applied to financial data.

Oskar Morgenstern (1963) to prove this, but their efforts produced results with the same randomness characteristics.

A breakthrough attempt to save mainstream economic reasoning started with Eugene Fama's doctoral dissertation at the University of Chicago (1964), which argued that, although the random walk hypothesis had to be accepted, this did not imply that the notion of market efficiency had to be rejected, with an accompanying rejection of the model of market equilibrium (i.e. the price setting mechanism) itself.⁹ He argued that the findings of Working, Cowles and Kendall did not disprove the normal working of markets, but that they in fact worked all too well. The basic notion was that if price changes were not random (and thus predictable), then any profit-hungry arbitrageur could easily make appropriate purchases and sales of assets to exploit this. On the other hand, if markets were working properly, then all public (and some private) information regarding an asset would be channeled immediately into its price. If price changes seemed random and thus could not be forecasted, Fama argued, it was a result of investors doing their jobs very well: all arbitrage opportunities had already been exploited to the maximum extent.

This brief historical overview shows that the genesis and evolution of finance theory — in the second half of 20th century in particular — flows directly from the application of standard (albeit sophisticated) neo-classical economic reasoning. Such reasoning is premised on the explicit notion of maximizing behavior by the individual rational decision-maker as the only explanation for economic actions. It is to the characteristics of such rational decision-making that the next section turns. This will be followed by an extensive discussion of the application of rational assumptions in the theoretical evolution of the EMH, MPT and CAPM.

⁹ The term "efficient", as it is used here, merely means that agents are making full use of the information available to them; it does not refer to other types of economic efficiency, e.g. production efficiency.

2.2 Neo-classical economics and the basic assumptions of rational finance

When building theoretical frameworks, academics have to make certain assumptions. When studying financial markets, assumptions are made about the motivations and preferences of market participants, and how these direct the functioning of financial markets.

The basic assumptions operative in finance theory can be summarized as follows:

- (1) Market participants are rational: they aim to maximize a positive function (utility) and minimize a negative function (cost or risk). Market participants are also well-informed, and able to process new data correctly and rapidly. They are ultimately concerned with personal consumption, which is always the focus when evaluating the pursuit of financial wealth or well-being.
- (2) Financial markets are efficient: all financial assets are perfect substitutes, and their traded prices reflect available information accurately and fully. A security's price equals its fundamental or intrinsic value, which is the discounted sum of expected future cash flow. Thus financial assets cannot be over- or under-valued, but are traded at their fair values.

These assumptions do require a clear definition of what rational behavior means. Mramor and Loncarski (2002) provided an explanation of what the rationality assumption postulates in financial decision models, namely:

Individuals behave in a completely rational way when they:

- a) undertake financial decisions that maximize their welfare;
- b) maximize welfare by maximizing the utility of consumption;
- c) maximize the utility of consumption by maximizing the present value of consumption;

- d) maximize consumption when the value of the investor's financial assets is at its maximum;
- e) maximize the value of financial assets when:
 - (i) expected returns are maximized,
 - (ii) expected returns occur in the nearest possible future,
 - (iii) the probability that expected returns materialize is maximized (or risk is at its minimum);
- f) manage risk by:
 - (i) accurately measuring risk,
 - (ii) being risk averse,
 - (iii) translating measured risk into added required return from an investment (or a risk premium), and
 - (iv) trading financial assets at prices that equate additional *expected* returns with additional *required* returns.

As background to a model of rational financial behavior, the first four postulates above (a – d) taken together can be summarized as: a person's welfare is maximized when consumption is at a maximum, which is achieved when the value of the person's financial assets is maximized. In a similar vein, the last two postulates above (e – f) taken together state: the value of financial assets depends solely on the interplay between their expected returns and risks.¹⁰

For the purpose of proceeding to a substantial discussion of MPT and CAPM in the latter part of this chapter, it is necessary further to explore some of the basic building blocks of rational finance theory as outlined above. What follows next is an investigation of the interplay between utility maximizing and risk minimizing by the individual investor. This is followed by a closer investigation of the model for the working of markets.

¹⁰ It is not the purpose of this study to critique the quality, nature and wider epistemological implications of neo-classical theoretical assumptions or models, or their application in finance theory. For the purpose at hand, they are explained and elaborated on as clearly and objectively as possible. Further discussion of what their influences are in the debate around the value premium will be provided below.

2.3 Market participants: decision-making

Assumptions about market participants are the foundation necessary to explain how financial/investment decisions are made within the boundaries of neo-classical economic thinking. Against the assumed context of rational decision-making, market participants maximize utility and minimize risk.

2.3.1 Maximizing utility

A long-standing maxim of micro-economic theory is that outcomes with a higher – rather than a lower – expected preferred result are always chosen. John von Neumann and Oskar Morgenstern (1944) interpreted and presented a sophisticated axiomatization of this line of theorizing. This became known as the expected utility hypothesis.¹¹ In this they specified the necessary and sufficient axioms that define a rational decision maker and under which the expected utility hypothesis holds, viz. completeness, transitivity, independence and continuity. Expected utility implies that, when faced with uncertain outcomes, choice will be based on expected outcome. The expected utility hypothesis further postulates that the decision preferences of people with regard to uncertain outcomes (such as in betting or gambling) can be described by a mathematical relation which takes into account the size of a payout, the probability of its occurrence, the risk aversion of the decision-maker, and the variable degree of utility of the same payout to people with different assets or personal preferences.

The idea of expected value is that, when faced with a number of actions, each of which could give rise to more than one possible outcome with different probabilities, the rational procedure is to identify all possible outcomes, determine their values (positive or negative) and the probabilities that will result from each course of action, and multiply the two to give an expected value. The

¹¹ The formalization of the modern theory of choice under uncertainty begins properly with Wald (1939). Interest coalesced, however, around the expected utility models described by Von Neumann and Morgenstern (1944) and Savage ([1956] 1972). Expected utility became such a dominant paradigm for choice under uncertainty that research into alternatives remained inactive until interest in behavioral economics took off in the 1970s. (Blume and Easley, 2008). Also see "Rationality," in *The New Palgrave Dictionary of Economics*, 2nd edition.)

action to be chosen should be the one that gives rise to the highest total expected value. In expected utility theorizing, the willingness or aversion to engage in risky behavior when making decisions, has to be taken into account as well. This means that risk-averse people may prefer a less risky option even though it has a lower expected value. Expected utility theory implies that rational individuals act as though they were maximizing expected utility, but it also allows the varying degrees of aversion to risk into the calculation of utility. Risk-neutral individuals have linear utility functions, risk-seeking individuals have convex utility functions and risk-averse individuals have concave utility functions.

Applying expected value and expected utility to decision-making requires knowledge of the probability of various outcomes. In practice, knowing the value of all such probabilities is highly unlikely because many decisions are made in the face of uncertainty – which cannot be calculated. As such, assumptions have to be made, making the expected value of decisions sensitive to the assumptions. The practical application of the expected utility idea in the field of financial theory is that in order to maximize utility, individuals are assumed to assign utility values to competing investment decisions, by comparing the size of the benefit with the probability of that benefit occurring.

2.3.2 Minimizing risk

The dictionary definition of the word “risk” is “loss, harm, destruction or an undesirable event”, which are all completely immeasurable. Risk is always related to probability, where probability reflects the continuum between absolute certainty and impossibility. Mindful of the distinction between risk and uncertainty (Knight, 1921), where the former can be approximated quantitatively while the latter cannot, rational finance theory views risk as the unexpected but estimable variability of returns. In order to approximate risk quantitatively in an objective a manner as possible, it is very often expressed as “volatility” – the standard deviation of the continuously compounded returns of a financial instrument. Volatility is commonly measured as the dispersion of outcomes around a mean –

the historic average return on an investment. That average return becomes the expected return on that particular investment. Standard deviation and variance are most often used to measure the dispersion of the expected return.¹² Securities with a higher standard deviation are more risky. By interpreting “risk” to mean volatility, all the power of algebra could be harnessed for financial modeling, which is useful for a scientific model.

An essential assumption underlying rational finance theory is that rational people avoid risk, meaning that they quantify the variance and standard deviation on an investment, and base their asset purchasing decision on that objective value. An individual might have subjective or emotional biases, but these biases are seen as not large enough to derail rational decision-making. What is more, the decision-making process involving risk is mostly not a multi-dimensional process with a combination of subjective (qualitative) aspects and objective (quantitative) components, but consists predominantly of objective components. This does not mean that the practitioners of rational finance theory had not attempted to quantify subjectivity as a component of risk. Subjectivity has been considered in the formulation of the theory on decision making in risky contexts. This can for instance be seen in the work of Savage (1954) on subjective expected utility. Savage argued that different people may make different decisions because they have different subjective expected values of utility or different beliefs about the probabilities of different outcomes. Experimental evidence by Ellsberg (1961) and others have shown, though, that most decision makers do not behave in a manner consistent with Savage's subjective expected utility calculations.

2.3.3 Integrating maximizing utility and minimizing risk

The two elements of maximizing utility and minimizing risk can be combined for rational decision-making. Such a decision-making rule can be expressed in a

¹² The variance (σ^2) is the average of the squares of all the deviations from their mean, and the standard deviation (σ) is the square root of the variance. In finance the standard deviation or variance provides an investor with a quantitative indicator for assessing and comparing the risk of alternative investments.

simple mathematical formula (e.g. as in Bodie et al. 2005:165), which combines the elements of expected return (the maximand), risk or volatility, as indicated by variance (the minimand), and willingness to take risk (represented by an index of the investor's risk aversion). Competing investment portfolios can thus be compared and ranked as to their net utility by applying the following formula:

$$U = E(r) - \frac{1}{2} A \sigma^2$$

where: U = utility value; E(r) = expected return; A = an index of an individual investor's aversion to taking risks, ranging in value from one to ten, with the factor $\frac{1}{2}$ a scaling convention with no economic significance; σ^2 = variance as indicator of risk.

Investments receive higher utility scores for higher expected returns, and lower scores for more risk or volatility, with all else remaining constant. More risk-averse investors (who have large A's) will "penalize" risky investments more severely than less risk-averse investors. When choosing among competing investment portfolios, investors can thus apply the rule rationally to select the portfolio that provides the highest utility level.¹³

2.3.4 Probability rule: decisions under uncertainty

In calculating expected return, decision-makers have to make judgments about the probability of uncertain future outcomes. Although rational decision-making theory assumes that market participants have consistent beliefs — meaning that they have enough accurate information available to forecast future events — they also have to use a statistical decision-making rule to do the probability calculation. A major statistical paradigm used to do that is the Bayesian paradigm.

¹³ Risk aversion obviously has a major impact on an investor's appropriate risk-return trade-off. In the formula, the utility provided by a risk-free portfolio is simply the rate of return on the portfolio, which provides a convenient benchmark for evaluating portfolios (Bodie, 2005:165).

Bayesian statistics treat probability distributions as a way of modifying expectations as new information becomes available, which is why it lends itself well to use within risk management. The key is that the Bayesian statistical model allows for the assessment of the probability of almost any chosen event. In Bayesian statistics, probability represents a degree of belief that a particular event will occur. Thus, the Bayesian approach provides a mathematical rule which explains how existing beliefs should be changed in the light of new evidence. The rule states that if A and B are events and $P[A]$ and $P[B]$ represent the probability of event A or B (both > 0), then

$$P(A/B) = \frac{P(B/A) P(A)}{P(B)}$$

where:

- $P(A)$ is the prior or marginal probability of A. It is “prior” in the sense that it does not take into account any information about B.
- $P(A/B)$ is the conditional or “posterior” probability of A, given B. It is called posterior because it is derived from or depends upon the specified value of B.
- $P(B/A)$ is the conditional probability of B given A.
- $P(B)$ is the prior or marginal probability of B, and acts as a normalizing constant.

Bayes’ theorem has also been used in the calculation of expected return to update expectation, though not necessarily so. Expected return ($\bar{R}_i$) is the sum of all possible outcomes on the investment of an asset (R_{ij}) multiplied by the probability (P_{ij}) of those outcomes occurring, or

$$\bar{R}_i = \sum_{j=1}^M R_{ij} P_{ij}$$

where $(1...M)$ represents the possible economic scenarios (recession, boom or normal economic conditions). The possible return on an asset (R_{ij}) is then based on the historic return of that asset in that particular economic climate. The

probability of a particular scenario (recession, boom or normal economic conditions) occurring is represented by P_{ij} .

2.4 Efficient financial markets: how they function

Assumptions about the motivation, preferences and decision-making behavioral patterns of market participants, taken together, translate into how financial markets function. This constitutes the second fundamental element of rational finance theory. The classical statement about efficient markets was provided by Fama in 1970, when he said that the primary role of the capital market is the allocation of ownership of capital, and that in order to achieve that, prices should be accurate signals for resource allocation. A market in which firms can make production-investment decisions, and investors can choose among securities that represent ownership of firms' activities under the assumption that security prices "fully reflect" all available information, is an efficient market. Three common forms to state the efficient-market hypothesis are weak-form, semi-strong-form and strong-form efficiency; each expressing a different degree of efficiency in terms of prices reflecting available information.

It is important to note that the hypothesis does not require each and every decision-maker to be rational. It allows that, when faced with new information, some investors may over-react and some may under-react. What is required though is that investors' reactions are random and follow a normal distribution pattern, so that the net effect on market prices cannot be reliably exploited to make an abnormal profit. Thus, any one person can be wrong about the market but the market as a whole is always right. The implication is that individual market participants could not beat the market through intelligent guessing. This can also be formulated as "the market knows best". What efficient markets therefore accomplish is a better assessment of what an asset is worth, better than any individual investor can. A further implication is that efficient markets do not allow investors to earn above-average returns without taking above-average risks (Malkiel, 2005:27).

2.5 The efficient market hypothesis

2.5.1 Core of the hypothesis

Against this background it can be stated that the logic of rational finance theory forms a basis for all subsequent theorizing, which was and remains of great importance.

The efficient market hypothesis (or EMH) states that price changes of individual securities are independent, i.e. do not influence each other. Most simply, the theory implies that stock price changes have no memory – the past history cannot be used to predict the future in any meaningful way. The unpredictability of prices on stock markets led to the well known expression that these price changes happen as a “random walk”¹⁴. The randomness and unpredictability are seen to come about because of the efficiency of markets. Fama described it as follows:

“... [I]n an efficient market at any point in time the actual price of a security will be a good estimate of its intrinsic value. In an uncertain world the intrinsic value of a security can never be determined exactly; however, the actions of the many competing participants should cause the actual price of a security to wander randomly about its intrinsic value. If the discrepancies between actual prices and intrinsic values are systematic rather than random in nature, then knowledge of this should help intelligent market participants to better predict the path by which actual prices will move towards intrinsic values. When the many intelligent traders attempt to take advantage of this knowledge, however, they will tend to neutralize such systematic behavior in price series. Although uncertainty concerning intrinsic values will remain, actual prices of securities will wander randomly about their intrinsic values.” (Fama 1965: 41)

In his original formalization of the random walk hypothesis, Samuelson (1965) argues that randomness in financial market price changes is achieved through the active participation of many investors seeking greater wealth. Unable to curtail their greed, an army of investors aggressively pounce on even the

¹⁴ The term “random walk” to describe what stock price patterns amount to, was popularized by Burton Malkiel's 1973 book, ‘A Random Walk Down Wall Street’. In their book “A non-random walk down Wall Street”, Andrew Lo and Craig MacKinlay (2002) argue that the idea is not all that new and was already conceived in the sixteenth century, but the first serious application of the hypothesis to financial markets can be traced to Paul Samuelson (1965).

smallest bit of information advantage at their disposal. In doing so they incorporate all information into market prices quickly, and thereby eliminate the profit opportunity that has given rise to their aggression. This is the essence of an arbitrage-driven financial market.

Although it is conceded by supporters of the random walk hypothesis that it does not provide an exact description of the behavior of stock market prices, they view the model as by and large acceptable in terms of its practical applications. This acceptability is predicated on the often demonstrated evidence that even the smartest investors cannot beat the markets consistently. Under the hypothesis, therefore, no investor should ever be able to beat the market, or do better than the average annual returns of all intelligent investors put together. There are, however, many examples of investors who do consistently beat the market; Warren Buffett arguably the best-known.

2.5.2 Unease about the hypothesis

Already by the late 1960s the elegant logic of the hypothesis was critically challenged by contradictory evidence from the real world of financial investment decisions. Evidence was accumulating that stock prices are not random by the strictest definition of that term, because some elements of predictability could be detected, particularly in long-term returns.

Empirical evidence had been mounting ever since, and currently consists of an enormous body of work. For instance, literature documenting the predictability of stock returns from past information includes:

- lagged returns: Fama and French (1998a), Poterba and Summers (1988),
- the dividend-to-price ratio: Campbell and Shiller (1988a), Fama and French (1988), Hodrick (1992),
- the earnings-to-price ratio: Campbell and Shiller (1988b),
- the book-to-market ratio: Lewellen (1999),

- the dividend payout ratio: Lamont (1988),
- the share of equity in new finance: Nelson (1999), Baker and Wurgler (2000),
- yield spreads between long-term and short-term interest rates and between low- and high-quality bond yields: Campbell (1987), Fama and French (1989), Keim and Stambaugh (1986),
- recent changes in short-term interest rates: Campbell (1987), Hodrick (1992),
- the level of consumption relative to income and wealth: Lettau and Ludvigson (1999a),
- stages of the business cycle and the predictability of counter-cyclical variation in stock returns: Fama and French (1989), Lettau and Ludvigson (1999b).

2.5.3 Main responses from supporters of the theory

The key response from the supporters of the EMH on the issue of whether publicly available information could be used successfully to predict stock prices, was to rephrase the question of whether the observed departures from randomness of returns were true profit opportunities, after transaction costs and risk adjustment. Paul Samuelson (1965), the first person to apply the random walk hypothesis in a meaningful manner to financial markets, did not account for risk at all. However, Malkiel's well-known book, *"Random walk down Wall Street"* (1973), was published well after Harry Markowitz (1952) introduced the idea that extra risk deserved to be compensated by extra return. And so, with the shift in focus from returns to cost and risk-adjusted returns, the efficient markets debate did not remain a matter of statistics, but became one of economics. This association with economics (and the unflinching defense of its central tenets) helps to explain why the EMH in finance remains influential, despite the steady drumbeat of empirical studies directed against it.

Grossman (1976) and Grossman and Stiglitz (1980) went further by arguing that perfectly efficient markets are an impossibility; for if markets were perfectly efficient, the return to gathering information would be nil, in which case there would be little reason to trade, and markets would eventually collapse. Boiled down to its essence, the argument is that if all information were already contained in prices and investors were fully rational, then not only could one not profit from using one's own information; indeed, there might not be any trade at all. Alternatively, the degree of market inefficiency determines the effort investors are willing to expend to gather and trade on information. Hence a non-degenerate market equilibrium will arise only when there are sufficient profit opportunities (i.e. inefficiencies) to compensate investors for the costs of trading and information-gathering. However, above-normal profits, wherever they are found, inevitably carry with them the seeds of their own decay. As long as arbitrage is not compromised — so the argument goes — what does it matter if share price returns are somewhat predictable?

Despite these rescue attempts, the theoretical conundrum was not finally settled. Although the EMH remains one of the more resilient empirical propositions in finance theory — in spite of Robert Shiller's critique (1981b) — it still lacks a sufficiently sound theoretical grounding.

2.6 Modern portfolio theory (MPT)

Merton Miller wrote that portfolio selection, as conceived and published by Harry Markowitz in 1952, could be considered the “big bang” of modern finance (Miller, 1999). In this ground-breaking work Markowitz systematically developed what became known as the risk and return trade-off in investment decision-making. For the first time, he mathematically derived a rule for the selection of portfolios of assets rather than individual stocks and bonds. Bernstein asserts that Markowitz's answers to the questions of ‘how much risk’ and ‘how to minimize risk while maximizing expected gains’ formed the foundation for all subsequent

theories on how financial markets work, how risk can be quantified, and how corporations should allocate capital (Bernstein, 1992:43).

2.6.1 Description of MPT

The premise of this work is that because risk is central to the whole process of investing, risky investments must offer higher return to compensate investors for bearing extra risk. The most original component of this theory is distinguishing between the riskiness of an individual stock and the riskiness of an entire portfolio. Graphically, it can be expressed as in the figure below.

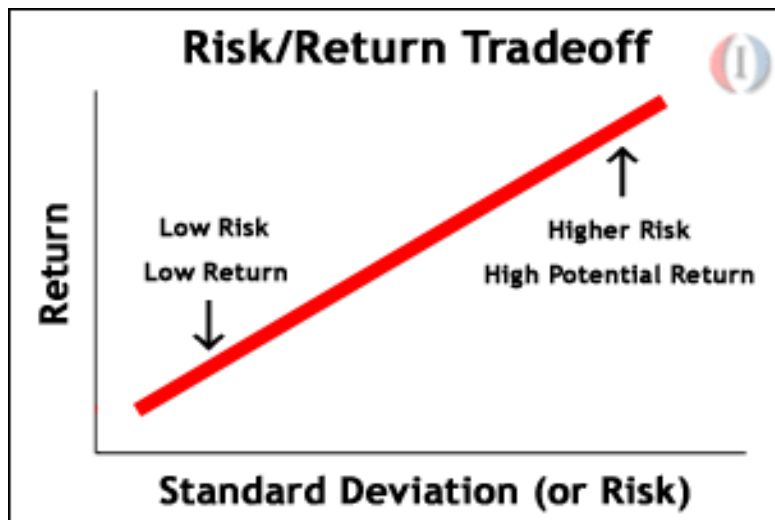


Figure 1: Risk return trade-off

<http://www.investopedia.com/university/risk/risk3.asp>

In Markowitz's theoretical analysis of how a portfolio could be formed rationally, an investor evaluates the degree of riskiness of each asset not just by its own risk level, but by the covariance of that asset's return to a portfolio of other investments. The theory subsequently explains why a combination of risky holdings may still comprise a low risk portfolio, as long as they do not change in an exactly parallel way – that is, so long as they have a low covariance. Through diversification, volatility in expected return (risk) can be minimized by including in the portfolio assets whose returns have no correlation with each other.

Covariance — and not mere numbers of securities held — determines the risk-reducing benefits of diversification.¹⁵ The absence of correlation¹⁶ lowers the volatility in expected returns and thereby lowers risk.

Furthermore, a diverse portfolio, consisting of more than one category of investments that are not perfectly correlated, lowers the risk and increases expected return.¹⁷

Markowitz proposed a paradigm for dealing with choices which involve many possible financial instruments. With MPT, investors had for the first time a method to build an optimal distribution of financial instruments within a portfolio that would achieve the best potential trade-off between risk and expected return: *mean-variance analysis* as it became known.¹⁸ It compared the expected (or mean) value of a portfolio at the end of the accounting period with its risk (standard deviation). What mean-variance analysis boils down to is to bring these two factors into systematic play in portfolio selection.

A portfolio's risk and return can be equal to more or less than the sum of its parts, depending on how the assets in the portfolio relate to each other. However, portfolios made up of assets with less than perfectly correlated assets always offer better risk-return opportunities than the individual component securities on their own.

Rational investors have a preference for more value rather than less value, but at the same time have an inclination for less risk rather than more risk. Yet, it is possible to gain more value by accepting more risk. This implies that there might

¹⁵ Seeing that the MPT is still highly influential, there are many current textbooks that address the MPT extensively. For a complete review see Elton, Gruber, Brown and Goetzmann (2007).

¹⁶ Correlation is measured through a regression analysis. The correlation coefficient is the square root of the regression coefficient of determination (R^2). For a perfect fit, R^2 square is one and the correlation coefficient is also one. The closer the correlation coefficient is to zero, the better it is for portfolio diversification purposes.

¹⁷ There are suggestions that the recent subprime mortgage crisis was brought about by exactly this technique. Subprime mortgages (high default risk investments) were grouped with good quality mortgages (low default risk investments) to form "structured investment vehicles" with low covariance (i.e. risk) but high returns.

¹⁸ Shortly after Markowitz's work appeared, the market created "index funds" – mutual funds that sought to hold all the shares in the market in their respective proportions. Such index funds or "passive" investment strategies are now followed by a large and increasing number of investors, particularly by U.S. pension funds.

be more than one optimal portfolio, depending on an individual investor's risk tolerance: some might aim for lower risk and lower return portfolios; others might be more aggressive by accepting riskier portfolios with an accompanied higher return. In combining assets in portfolios that provide the maximum expected return for different risk levels and the minimum risk for different levels of expected return, an investor reaches the efficient frontier. This can be graphically illustrated as below.



Figure 2: The Markowitz frontier

In the graph above, the line of expected return plotted against risk (standard deviation) is a straight line that connects all portfolios that can be formed using a combination of risky and riskless assets.

Every possible asset combination can be plotted in the risk-return sphere between the two axes shown in the graph, and all such possible portfolios define a zone in this space. The line along the upper edge of this region is known as the efficient frontier (sometimes also called the "Markowitz frontier"). Combinations along this line represent portfolios (excluding the risk-free alternative) for which there is the lowest risk for a given level of return. Conversely, for a given amount of risk, the portfolios lying on the efficient frontier represent the combination offering the best possible return. No added diversification can lower the portfolio's risk, and no additional return can be

gained without increasing the risk of the portfolio. The Markowitz “efficient frontier” is therefore the set of all portfolios that will give the highest expected return for each given level of risk, from which a preferable portfolio can be chosen.

In mean-variance theory, choices among alternatives are based on the effect of the outcome on levels of their wealth; other considerations such as wealth fluctuations or framing (i.e. presentation) of alternatives do not affect choice at all. The decision-making process is assumed to involve a rigorous analysis (calculating the absolute mean, variance, standard deviation and kurtosis of the data distribution) to determine the likelihood of success associated with the specific investment decision.

2.6.2 The evolution of MPT

A basic feature of MPT is that for the calculation of expected return and risk (volatility) historic data is used. In effect, it measures the probable distribution of *ex ante* or potential future returns, based on what had happened in the past. The problem with this is obvious: there is no guarantee that what took place in the past will repeat itself in the future.

What is more, the additional assumption is that returns are normally distributed in the form of a bell shaped graph. It thus employs the central tendency idea, which means that potential returns will fit a normal distribution and will center round the average return. The bigger the dispersion of returns around the average return (which is the expected value) the bigger the volatility (risk). Put another way, MPT is limited by measures of risk and return that may diverge quite substantially from the realities of investment markets.

It became increasingly clear that the standard deviation and the normal distribution presented a major practical limitation because they are symmetrical. Using standard deviation implies that better-than-expected returns are just as

risky as those returns that are worse than expected. Furthermore, using the normal distribution to model the pattern of investment returns, makes investment results with more upside than downside returns appear more risky than they really are, and vice-versa for returns with a predominance for downside returns. The result is that using traditional MPT techniques for measuring investment portfolio construction and evaluation frequently distorts investment reality.

In addition to the asymmetry issue noted above, one of the major challenges faced by MPT from its inception, was the monumental task of calculation it had necessitated: the covariance of every security with every other security had to be calculated to provide a mathematically clear result. The initial response to this problem was expressed in the work of W. F. Sharpe, a student of Markowitz. Sharpe eventually received the Economics Nobel Prize for the following simplifying solution: It was not necessary to compare each security with all others, since the same result could be achieved by calculating the covariance of an individual security and the market as a whole – a much simpler calculation.

Maybe the main achievement of the MPT was not that it became (and remains) influential, but that it provided a testable theory of asset demand, a method for the practical construction of portfolios, and that it led to the development of the capital asset pricing model.

2.7 The capital asset pricing model (CAPM)

2.7.1 Description of CAPM

As indicated above, the ground-breaking introduction of advanced statistical thinking to investment decision-making presented by Markowitz's portfolio selection approach, provided a sophisticated mechanism for compiling an investment portfolio. However, it always implied an onerous calculation burden – something that made its application difficult and not popular with actual financial decision-makers. Although logically astute, MPT evidently required further

development that would reduce the calculation load. Such development was provided, almost simultaneously, but through independent research, by Sharpe, Treynor and Lintner in the early 1960's. Their work subsequently became known as the highly influential Capital Asset Pricing Model (CAPM for short).

CAPM is a theoretical model for pricing individual security, and is used to determine what the appropriate rate of return for an asset to be added to a diversified portfolio is, given that particular asset's risk. Its core idea is that investors need to be compensated on the grounds of combining two considerations: (a) time value of money, and (b) market specific risk. The time value of money is represented by the first element in the formula below, representing a risk-free (R_f) rate of return. This constitutes a compensation to investors for placing money in any investment over a period of time. The second element in the formula below represents risk. The model is built on accounting for an asset's sensitivity to such risk which cannot be avoided through diversification (also known as systematic risk or market risk, and represented by the quantity beta, or β), as well as the expected return of the market and the expected return on a risk-free asset.

CAPM can be summarized in the following algebraic formula:

$$E(R_i) = R_f + \beta_i [E(R_m) - R_f], \text{ where}$$

$E(R_i)$ = the expected return on the capital asset;

R_f = the risk-free rate of interest (such as interest arising from government bonds);

β_i = the beta coefficient or the sensitivity of the asset returns to market;

$E(R_m)$ = the expected return of the market;

$[E(R_m) - R_f]$ = the risk premium (the difference between the expected market rate of return and the risk-free rate of return).

The CAPM formula essentially asserts that the expected return of a security (or a portfolio) should equal the rate on a risk-free security plus a risk premium. If this expected return does not meet or beat the required return, then the investment should not be undertaken. The security market line in the graph below plots the results of CAPM for all different risks (betas).

A graphical representation of CAPM can be given by constructing the security market line (or SML), the straight line in the graph below. For a single asset this shows its relation to expected return and non-diversifiable risk (or beta). It can be used to show how the market must price individual securities in relation to their category of risk.

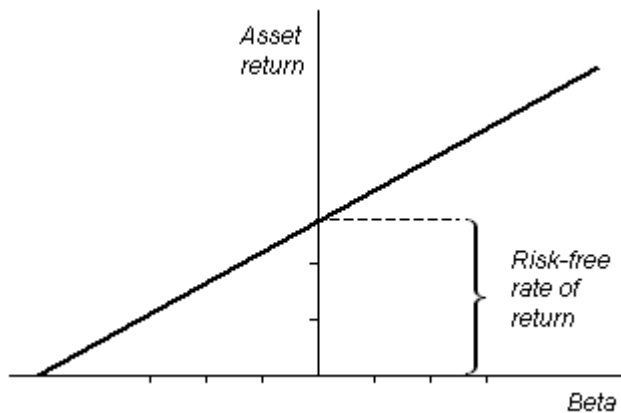


Figure 3: The security market line

SML enables the investor to calculate the reward-to-risk ratio for any security in relation to that of the overall market, and to make investment decisions on the basis of having appropriately priced asset choices.¹⁹

To calculate beta the following formula is applied:

¹⁹ When used in portfolio management, a single asset is plotted against the SML using its own beta and historical rate of return. If the plot of the asset falls above the SML it is considered to have a good rate of return relative to its risk (the asset is undervalued by the CAPM, and is worth acquiring), and vice versa: if it falls below, the asset is overvalued, and should be sold.

$$\beta_a = \frac{Cor(r_a, r_p)}{Var(r_a)}$$

where r_a = return on asset a

r_p = return on market portfolio p

$Cov(r_a, r_p)$ = covariance between returns of asset a and market portfolio return

The value of the market beta is always = 1, because the returns of all assets trading in the market are perfectly correlated to itself. If an asset has a value of beta > 1, it is more risky than the market. For instance, an asset with a beta = 2 is twice as risky as the market, and its return will decline by twice as much as the market during a correction; it will of course also generate twice the return of the market portfolio during upswings to compensate investors for bearing the greater risk.

Markowitz's MPT, and the later CAPM, are closely related, in that both build on the same assumptions of efficient, competitive markets and rational, well-informed, and risk-averting investors. Furthermore, both models make the following assumptions: that all investors aim to maximize economic utility; cannot influence prices; can do unlimited lending and borrow under the risk free rate of interest; trade without transaction or taxation costs; and all information is simultaneously available to all investors.

The main difference between MPT and CAPM is that mean-variance analysis (the essence of MPT) provides a theory of individual behavior regardless of whether the market as a whole is in equilibrium or not. While CAPM also builds on mean-variance analysis, it assumes that asset allocation takes place in a market in equilibrium.

2.7.2 Problems with CAPM

From an academic viewpoint, one of the predominant limitations of CAPM is that it is impossible to test the model's validity because the "market portfolio" cannot

be defined. This limitation was pointed out by various authors, including Fama, who admitted that in the efficient market approach the theory only has empirical content within the context of a specific model of market equilibrium, that is, within a model that specifies the nature of market equilibrium when prices fully reflect available information (1970:413)²⁰.

A pointed criticism of CAPM came from Roll (1977, 1978), who analyzed this problematic aspect of rational financial markets. Roll pointed out that applying a mean-variance analysis amounts to a tautology, because any mean-variance portfolio which has to satisfy the CAPM equation and the market portfolio (which is necessary to apply the formula) is unobservable, because it would be necessary to include every single possible available asset — including real estate, precious metals, stamp collections, jewelry, and anything with any value. The problem is that returns on all possible investments opportunities are unobservable.

Consequently, testing for market efficiency (which is what models such as CAPM aspire to achieve) always involves tests of models that are chosen to represent efficient markets — clearly not an objective testing procedure. For example, the beta technique of risk-adjusted performance requires the matching of portfolio return against some benchmark that “represents” the market return. Traditionally, market indices such as the S&P 500 are used for this purpose.

Despite this challenge to the inherent logic of CAPM, adherence to it was not substantially shaken on theoretical grounds. What was more troubling was the ever-increasing evidence that its predictions could not stand up to empirical scrutiny. Some of the most controversial results initially came from research by Basu (1977). By reporting that certain stocks (value stocks) outperformed the market even after accounting for risk, he presented his findings as a direct challenge to the foundation of CAPM, viz. the efficient market hypothesis itself.

²⁰ In a later publication Fama made the even stronger statement that “...market efficiency *per se* is not testable. It must be tested jointly with some model of equilibrium, an asset-pricing model” (Fama, 1991:1576).

Ball (1977) agreed that contradictions in terms of the efficiency of financial markets (anomalous findings about earnings versus stock prices) clearly required some revision. He did not regard the efficient market hypothesis itself in need of revision, but rather the model of risk and return which CAPM was based on. He suggested that it had to be acceded that beta was not the only risk that mattered. This response was followed later in the expansion of CAPM into a multi-factor model (see 4.2.2.3 below).

A further compelling challenge to CAPM was made in the early 1980s by Banz (1981), who suggested that “smallness” (i.e. company size) had to be added as a risk factor. This flowed from an analysis using fifty-three years’ worth of New York Stock Exchange data which showed that small-capitalization stocks consistently outperformed large ones – implying higher average returns than could be explained by CAPM. In defense of CAPM, Banz argued that investors had to be compensated for the estimation risk involved in buying small company stock, because less information was available about them.

Yet another important contribution to the burgeoning body of evidence viz-a-viz the reliability of predictions based on CAPM, came from Shiller (1981b). In a mixture of support for and rejection of rational financial markets, Shiller focused closely on volatility in various financial markets – interpreted as the continuous changing of people’s minds about uncertain future events. What this revealed, Shiller reported, were such substantial swings in security prices relative to the changes in underlying fundamentals, that he could find “no evidence of market behavior in accordance with the hypothesis of an efficient market.” (Bernstein, 2007:69).

Arguably the most telling finding with regard to how well CAPM stood up to empirical evidence, came from a remarkable landmark study by Fama and French (1992). In Fama’s earlier seminal contributions to CAPM, he had maintained that — according to the model — it was beta that determined how

well stocks would perform over time. It was a simple trade-off between risk and reward. In their 1992 study, however, Fama and French confronted head-on the accumulating evidence against the combination of efficient markets and CAPM. Examining market data from 1941 through to 1990, they found that beta (or more precisely, beta alone) could no longer suffice as an explanation for what was actually happening. They conceded: “We are forced to conclude that the SLB model [CAPM] does not describe the last fifty years of average stock returns.” (Fama and French, 1992:464)

While beta, in Fama and French’s view, remained important as a risk factor, the superior performance of certain stocks (especially value stocks) could simply not be explained in terms of risk. The findings of Fama and French (and others mentioned above) have since given rise to both increasingly sophisticated defenses of CAPM, and the growth of the current major alternative framework in finance, viz. behavioral finance. The defense of CAPM will be discussed below, and behavioral finance will form the topic of the next chapter.

2.8 Anomalies and CAPM

Collectively, the incongruence (or conflict) between CAPM – as well as its foundation, the efficient market hypothesis – and the variety of empirical findings about asset prices in actual financial markets, is described in the literature as anomalies. Anomalies can be defined as “a documented pattern of price behavior that is inconsistent with the predictions of traditional efficient markets, rational expectations asset pricing theory” (Brav and Heaton, 2002:575). Before focusing on the very persistent and consequential anomaly called the “value premium”, a brief discussion is provided of the larger collection of financial market anomalies.

2.8.1 Some recognized anomalies in financial markets

Logically speaking, anomalies can only be defined relative to what could be viewed as “normal returns” in a market. Fama (1970) had already noted this fact early on, by admitting that the idea of market efficiency was also implicitly tested whenever a hypothesis about expected asset returns in equilibrium were investigated. A finding that seems to indicate market inefficiency may therefore also serve as evidence that the underlying asset-pricing model is inadequate (Schwert, in Constantanides, 2003:940).

A useful overview and discussion of the most notable anomalies is provided in a paper by Malkiel (2003). He traced the following main categories:

(1) Short term momentum effects: Lo and MacKinlay (2000) found that serial correlations are not zero, and these findings led them to reject the random walk hypothesis. Jegadeesh and Titman (1993) showed that stocks which performed the best (worst) over a three to twelve month period tended to continue to perform well (poorly) over the subsequent three to twelve months. With most other anomalies, it seemed as if the higher returns disappeared or at least weakened once information of it became generally known. However, despite the popularity of the momentum strategy in the investment community and its visibility in the academic community, there is no evidence that the validity of short-term momentum effect is disappearing (Jegadeesh and Titman, 1993).

(2) Long term return reversals: A considerable body of evidence exists for negative serial correlations over longer holding periods (i.e. one to three years), meaning that winners (losers) over a one to three year period tend to be losers (winners) in the subsequent one to three year period (see. Fama and French, 1988b; Poterba and Summers, 1988).

(3) Seasonal and day-of-the-week patterns: The “January effect” indicates unusually high returns during the first two weeks of every year (Keim, 1983;

Haugen and Lakonishok, 1987). Higher returns are also recorded on Mondays (French, 1980) and around the turn of the month (Lakonishok and Schmidt, 1988), but these patterns are not dependable if various periods are compared with one another.

(4) Initial valuation parameters: This deals with the possibility that valuation ratios may have substantial predictive power.

- Predicting on the basis of dividend yields: Fama and French (1988) and Campbell and Shiller (1988a) found that as much as 40% of the variance of future returns for the US stock market as a whole could be predicted on this basis.
- Predicting on the basis of P/E multiples: Campbell and Shiller (1988b) also found that initial P/E ratios could explain a significant percentage of the variance of future stock price returns.

(5) Value stocks versus growth stocks: Value stocks are defined in various studies as those whose market price is relatively low in relation to earnings per share (Basu, 1977), cash flow per share (Lakonishok, Shleifer and Vishny, 1994), book value per share (Fama and French, 1992), and dividends per share (Blume, 1980; Rozeff, 1984). In comparison, growth stocks have been defined as having relatively high prices in relation to those same fundamental factors. Findings of this kind date back to Graham and Dodd (1934), who expounded on this in their classic early book on security analysis.

Bauman, Conover and Miller (1998:88) concluded that "...based on several different measures used to define value stocks and growth stocks in twenty-one international stock markets, with observations of more than 28,000 annual stock returns, value stocks generally outperformed growth stocks on a total-return and a risk-adjusted basis, in the ten-year period from 1986 to 1996". Chan and Lakonishok (2004:71) came to the same conclusion, but were more emphatic:

“...based on the accumulated weight of the evidence, the academic community has generally come to agree that value investment strategies, on average, outperform growth investment strategies”.

Of all the anomalies that had been identified, the value premium (superior returns on value compared to growth stocks) is the most notable, because no convincing explanation for it has so far been provided from within the traditional neo-classical framework (Cochrane, 1999). While some progress has been made to address the other anomalies in a way that keeps the assumptions and basic logic of the traditional finance framework intact, the answer to the question: “What explains the value premium?” is still to be provided (Fama and French, 2008).

Various explanations for the persistence of the value premium have been suggested by CAPM and rational finance supporters — essentially rebuttals of any idea that markets are not efficient.

The issue of anomalies (including the value premium) has been addressed from a somewhat unconventional angle in the work of Cooper, Gutierrez, and Marcum (2005). It frames the matter as the possibility of the predictability of stock returns, noting the well-known finding that such returns are predictable *ex post facto* but not *ex ante*. Cooper, Gutierrez, and Marcum (2005) apply three often-used criteria namely book-to-market, size, or momentum, for portfolio formation. For two of the three criteria, they find, the real-time portfolio does not outperform a passive index. For the other criterion, the real-time portfolio outperforms the index, albeit by a substantially lower margin than the full-period results. With a recursive out-of-sample method, applied to stock returns in the USA for the period 1974-1997, it thus finds that the market was difficult to beat.

These findings seem to indicate that the debate about whether anomalies, such as the value premium, could be exploited in investment strategies to predict returns is misplaced. The work suggests that the level of predictability (when

based on the effect of mispricing) is lower than previously believed (see e.g. the findings of Fama and French, 1992, Jagdeesh and Titman, 1993, Lakonishok, Shleifer and Vishny, 1994). It also argues that the performance of real-time investors seem consistent with these findings.

Cooper, Gutierrez, and Marcum (2005) further argue that poor out-of-sample predictability is consistent with the possibility that the effects of book-to-market, size and momentum may be quite spurious, so that their issue of their potential effects on stock returns may never be settled, except after data for a very long period (50 years or more) are available. They refer to the work of Lewellen and Shanker (2002) and Bossaerts and Hillion (2001) that argues that the Bayesian learning of economic agents can generate *ex post* predictable patterns that are *ex ante* rational and thus do not offer real-time trade opportunities.

A study that uses a modified version of the Cooper, Gutierrez, and Marcum (2005) research method was done by Bartens and Hassan (2010) on South African data. Focusing on the variables and investment strategies found to be most profitable in the South African stock market, they found the cross-section of individual common stocks listed on this market show the *ex-post facto* predictive power of market capitalization, price-to-earnings ratio, and one-year lagged returns (or momentum) have effects that are consistent with findings on US data. They remark that low-capitalization stocks outperform large-capitalization stocks; stocks with high earnings-to-price ratios (i.e. high earnings yield) outperform stocks with low earnings-to-price ratios; and the stocks which performed best over the previous twelve months (winners) outperform the worst performers (losers). In all cases, the out-performance is not explained by the CAPM as the equilibrium model for covariance risk. In the South African case, size and the earnings-to-price ratio (in contrast to size and book-to-market in US studies) subsume other candidate characteristics in explaining the cross-section of returns (Bartens and Hassan, 2010:182).

Comparing the findings of Cooper, Gutierrez, and Marcum (2005) with that of Bartens and Hassan (2010), it is clear that the South African long portfolio (based on the best performing rules for portfolio formation with in-sample data) outperform the market by an average of 65 basis points (bps) per month compared to 55 bps for a similar analysis of US markets. This excess performance is consistent throughout the in-sample period. The South African short portfolio (based on the worst performing rules for portfolio formation) underperforms by an average of 74 bps per month compared to 51 bps for US evidence.

Bartens and Hassan's findings for out-of-sample portfolios are however quite different. The passive index outperforms the active portfolio in most out-of-sample periods. The average out-of-sample monthly return of the long portfolio is found to be lower than that of the passive index by one to seven basis points. Bartens and Hassan come to a conclusion comparable to that of Cooper, Gutierrez, and Marcum (2005) for US data, viz. that that simulated real-time portfolios do not significantly outperform a passive index of South African stocks and even if predictability of returns are possible it does not seem to translate into profitability in real time investing. These findings can be seen as refuting the relevance of using anomalous stock return findings as a basis for more profitable investment strategies.

2.8.2 Main responses from supporters of CAPM

The general response from adherents to CAPM, and the underlying EMH, is that many of the well-known anomalies do not hold up in different sample periods. This led them to argue that anomalies are more apparent than real, and even if the anomalies existed in the sample period in which they were first identified, the activities of practitioners who implement strategies to take advantage of anomalous behavior, would cause the anomalies to disappear (Schwert, 2003), or to "self-destruct", as Malkiel (2003:22) put it. So, the logical conclusion is that one should be cautious not to overemphasize these anomalies.

More systematically, supporters of the CAPM argued that there are three potential explanations for the value anomaly:

- The most conservative interpretation is that the anomaly is nothing more than the result of “data snooping”;
- The possible presence of specific “distress factors”. Malkiel (2003) argued that some of the valuation measures may simply reflect better proxies for measuring the risk of individual stocks;
- Over-dependence on a single factor (beta) in standard CAPM. This led to expanding the CAPM model into a three-factor model. The three-factor model incorporates size and book-value-to-market-value (BV/MV) together with beta.

Each of the three explanations will now be examined in more detail.

2.8.2.1 Data snooping

This possibility was first raised by Kothari, Shanken and Sloan (1995) who suggested a selection bias in the construction of value portfolios because the same data basis (most often COMPUSTAT) was used for testing the same anomaly over the same period (1963 to 1990). If it could be proven that the value premium is nothing more than an over-mining of COMPUSTAT data sources, it would mean the rational finance theory framework would not be fundamentally challenged at all.

COMPUSTAT data suffer from at least four shortcomings:

1. The first problematic issue with the data is its survival bias. When a company stops trading, its records are removed from the COMPUSTAT databank. Kothari, Shanken and Sloan (1995) argued that the Fama and French (1992) portfolios were based on COMPUSTAT data, and only included companies that had survived — a feature that created bias in the sample because it included a pre-selected group only.

2. The second problem with COMPUSTAT data is a look-ahead bias, as identified by Banz and Breen (1986). This bias occurs where a study assumes that information was available to investors at a specific point in time when, in fact, that information was not publicly available at the time. For example, it is not always appropriate to assume that a firm's financial statements for the period closing December 31st are available to the public by the following March.
3. A third problem is "data snooping proper" (Lo and MacKinlay, 1990), which refers to new research that studies the return patterns of value companies with data in which certain patterns had already been documented. The "new" findings may be valid within the test set, but the results have no statistical significance in the wider population.
4. The fourth limitation of COMPUSTAT data is that it has been available only since 1963.

To test if the value premium can be explained through unmethodical research design, Davis (1994) formed BV/MV (value) portfolios from Moody's Industrial Manuals published between 1940 and 1962 — i.e. before the COMPUSTAT era, which started in 1963. Moody's Manuals are free from survival bias, as companies that stopped trading cannot be removed from the hard copy manuals. Davis (1994) tested data between 1950 and 1963 (as opposed to the 1963 to 1992 sample period that Fama and French used) and came up with a BV/MV effect similar in magnitude to that found by Fama and French. This finding was supported by Cohen and Polk (1995), who also constructed portfolios in a way that completely eliminated the COMPUSTAT selection bias and still proved the existence of the value premium.

The research of Chan, Jegadeesh and Lakonishok (1995) supported the findings of Davis (1994) and that of Cohen and Polk (1995), by showing that the selection biases are not large. They found that the primary reasons for delisting from the

COMPUSTAT database are unrelated to financial distress but rather due to mergers and non-standard accounting information, listed closed-end investment funds, and so forth. Their investigation revealed that only 3.1% of the company-year in the “Centre for Research into Security Prices” (CRSP) sample — the most respected source for security research — is omitted from the COMPUSTAT tapes because of financial distress.

All of the above puts methodological biases as explanation for the persistence of the value premium to bed, and leaves distress factors as potential explanation.

2.8.2.2 Distress factors

If the assumption of market efficiency is maintained, then the value premium is a measure of risk – an indicator of a higher discount rate that compensates investors for distress factors. In other words, the higher rate of return on value stock is an indicator of a higher discount rate used in discounted future cash flow. The value premium, it is therefore argued, is nothing more than a higher discount rate (a higher cost of capital) that investors expect on value companies to compensate them for extra risk. The higher return is compensation for higher systematic risk, and therefore the model which had made the evidence look anomalous had in fact been a misrepresentation.

The challenge to this argument is that the so-called “market discount rate” is unknown. In other words, if we had a universally accepted asset pricing model, it would have been straightforward to find this rate because “the general discount rate” would have been known. However, because “the market” cannot be defined (CAPM’s main limitation), it is impossible to know for sure what the basic discount rate is.

Various researchers set out to identify the possible distress factors that would explain the reason for a higher discount rate earned by value companies. The distress of an individual firm cannot be considered as a risk factor, because such

distress is unsystematic or is company-specific, and can be diversified away. Only aggregate events that average investors care about and that affect value companies, can result in a risk premium.

Heaton and Lucas (1997) suggested that vulnerability to recessions, business cycle downturns, or changes in credit conditions might be the vulnerability (i.e. distress factor) which value companies have in common. Heaton and Lucas argued that the typical stockholder is the proprietor of a small, privately held business. Such an investor's income is particularly sensitive to the kinds of financial events that cause shock-waves among small firms and distresses value firms. Therefore, the investor would demand a substantial premium to hold value stock, and would hold growth stock despite a low premium. This made it seem as if the market offers reward in the form of average return for holding risk related to recession and financial distress, in addition to the risk represented by overall market movements (beta). Even though this argument sounds logical and plausible, empirical evidence does not support it.

Xing and Zhang (2004) tested the notion that the fundamentals of value firms were more adversely affected by negative business shocks than the fundamentals of growth firms. They assumed that value firms carried more fixed cost, which causes a lack of flexibility in the capital structure of those firms. When demand for value firms' products falls during times of economic downturn, they need to divest unproductive fixed assets. This often means selling off assets at a loss, leading to equity values falling relative to book value. The empirical evidence available suggests some support for the argument that higher operational leverage (the degree to which a firm's operations rely on fixed cost) of value firms makes them more vulnerable to negative business shocks. However, for their empirical work, the authors used manufacturing companies only, which limits the validity and usefulness of their results.

Liew and Vassalou (1999) tried to link value firm returns to macro-economic events. Jagannathan and Wang (1996) and Reyfman (1997) used labor income as a factor to explain the value premium. Chen, Roll and Ross (1986) considered industrial production and inflation, and Cochrane (1999) incorporated investment growth as a possible explanation. These authors found that all the mentioned factors are theoretically easy to motivate, but none explains the value premium adequately.

In their dealing with the value premium anomaly, Fama and French (1992) stuck to risk as a possible explanation. After testing value companies for risk with the standard risk measures — namely beta — and finding no evidence that value companies are inherently more risky, they had to admit that: “our bottom-line results are [that] beta does not seem to help explain the cross-section of average stock return...” (1992:428). They suggested that small and value firms might be more vulnerable to distress risk factors such as poor prospects, and moved to a multi-factor CAPM model, where returns of “small minus big” stocks (SMB) and of “high book/market minus low book/market” stocks (HML) are considered in addition to beta. They argued that risk might be a multi-dimensional matter, with the ratio of book-value-to-market-value capturing one part of it, and size capturing another. But they had to admit that they did not know what the underlying economic causes were for their observations.

Daniel and Titman (1995) did an extensive empirical study in which they found no evidence of distress risk — as suggested by Fama and French. In addition, they found that beta had no explanation power for the value premium at all. Similar results were found in South Africa, where empirical work by Bowie and Bradfield (1998a and 1998b) and Van Rensburg and Robertson (2003a) testified to the limitations of the conventional approaches to risk measurement (beta) for explaining stock market returns in the South African context.

All of the above did not end the “distress factors as potential explanation” debate; in fact numerous researchers are still attempting to identify that *one* particular distress factor which will explain the value premium. The distress factors explanation did however pave the way for behavioral finance (i.e. imperfectly rational explanations) to be explored as the potential reason.

2.8.2.3 Multi-factor CAPM

In order to keep it alive, supporters of CAPM had to identify the factors that allow investments to earn returns not explained by the beta factor. It subsequently had to be admitted — as Fama and French (1992) did — that a single risk factor (namely beta) is not enough to describe the cross-section of expected returns. A model with more factors than beta had to be advanced as a more plausible treatment of the data than the single factor CAPM.

The expansion of the basic CAPM into a multi-factor model was the obvious thing to do. Fama and French (1992, 1993) incorporated size and book-to-market value as two additional risk factors into the standard CAPM to measure abnormal performance, as follows:

$$(R_{it}-R_{ft}) = \alpha_i + \beta_i (R_{mt}-R_{ft}) + s_iSMB_t + h_iHML_t + \varepsilon_{it}$$

In the formula above, SMB represents the difference between the returns to portfolios of small- and large-capitalization firms, with the BV/MV ratios for these stocks remaining constant; and HML represents the difference between the returns to portfolios of high and low BV/MV ratio firms, with the capitalization for these stocks staying constant. This formula suggests that the regression coefficients s_i and h_i represent exposures to size and value risk in much the same way that β_i measures the exposure to market risk.

Fama and French (1993) used their three-factor model to explore several of the anomalies identified in earlier literature, where the test of abnormal returns is based on whether $\alpha_i = 0$ in the formula above. They found that explanations of

abnormal returns from the three-factor model are not reliably different from zero for portfolios of stocks sorted by size, BV/MV ratios, dividend yield, or earnings-to-price ratios.

Even though the three-factor model is now widely accepted, it is still not clear if it provides a satisfactory explanation for the value premium. Also lurking in the background is the more fundamental question of whether all the findings and studies mentioned come down to the following question: Is existing empirical evidence convincing enough to overturn the cherished view that markets are efficient, or could the traditional viewpoint on market efficiency be saved by “tinkering” with models built on it?

2.9 Conclusion

In their study, Lakonishok, Shleifer and Vishny (1994) warned against the “metaphysical” approach to risk, in which higher average returns on an investment strategy, such as value investing, are taken necessarily to reflect some source of risk. Testing the role of risk by employing traditional measures such as beta and volatility, they came to the conclusion that risk does not explain the difference in return between value and growth investment strategies.

The response from the supporters of the rational finance approach to the mounting contrary evidence remains essentially simple: they argue that arbitrage is still functioning, and whenever above normal profits are found, investors will incorporate that knowledge in an arbitrage-driven market, so that any excess profit opportunity will disappear quickly. The suggestion is that the anomalies may simply have been overlooked by a large fraction of improperly informed market participants who helped sustain the appearance of anomaly for a while, but – so the argument continues – once large numbers of investors have included value stocks in their portfolio, the value premium will disappear. Above-normal profits, wherever they are found, inevitably carry with them the seeds of their own decay. This is essentially the rational finance defense put forward by

Schwert (2003). He provides evidence that many trading strategies which generated abnormal returns in earlier periods (such as the January effect) were unprofitable in the past decade.

Against the arguments and data presented in this chapter, the conclusion cannot be avoided that substantial and practically consequential anomalies have come to the fore and persist in financial markets – anomalies that cannot be explained within the framework of the conventional and dominant paradigm of rational finance theory. The most telling of these anomalies, with high relevance for investment decision-making, is the value premium.

A further conclusion about the value premium is that the cornerstone of rational finance theory's explanation for different returns on different kinds of investment choice — viz. the level and kind of risk involved – does not provide a sufficient explanation of the value premium anomaly.

The question arises whether the impasse in which rational finance theory and its practical application find itself, can be disposed of by invoking the classic instrumentalist position regarding economic methodology provided by Milton Friedman (1953). For Friedman, an instrumentalist, hypotheses are chosen because they are successful in yielding useful predictions. In other words, hypotheses and theories are viewed as instruments for successful predictions. Concentrating on successful predictions obviates any further consideration of either the realism of theoretical assumptions or the "truthfulness" of theories.

According to Friedman, false assumptions might be applied as a convincing explanation of an observed phenomenon. He argues that as long as the observed phenomenon can be considered a logical conclusion from the argument containing the false assumption, the use of that assumption is acceptable. In particular, if we are trying to explain the effect of the assumed behavior of individuals, so long as the effect is observed and it would be the

effect if they were to behave as we assume, then we can use our assumption even when the assumption is false.

The crux of the usefulness for Friedman's position lies with successful application (or testing) of a theory in predicting outcomes. His position allows a theory so long as it is sufficient for the successful predictions at issue.

Applying Friedman's instrumentalist logic to defend the conundrums in rational finance theory could therefore mean that criticism of the realism of its assumptions, or the completeness of the theoretical construct, is irrelevant. The issue is whether rational finance can predict outcomes such as the value premium in financial markets. Given the demonstrated (though contested) inability of mainstream thinking to predict this major anomaly within its framework, it must be concluded that rational finance theory does not convincingly, or fully, meet the instrumentalist criterion for a useful theory. This result forces attention to return again to the assumptions of finance theory, in order to find models that are not in persistent and intrinsic conflict with empirical findings. The rise of behavioral finance is currently the obvious outcome of this need for a re-examination. Even a supporter of the core underlying ideas of efficient markets such as Malkiel (2003:4) had to acknowledge that: "By the start of the twenty-first century, the intellectual dominance of the efficient market hypothesis had become far less universal. Many financial economists and statisticians began to believe that stock prices are at least partially predictable. A new breed of economist emphasized psychological and behavioral elements of stock-price determination, and came to believe that future stock prices are somewhat predictable on the basis of past stock price patterns as well as certain "fundamental" valuation metrics. Moreover, many of these economists were even making the far more controversial claim that these predictable patterns enable investors to earn excess risk-adjusted rates of return". It is to these considerations that attention is turned in the next chapter.

CHAPTER 3

BEHAVIORAL FINANCE THEORY

Behavioral finance is the academic discipline which examines how psychological factors affect financial decisions. Since non-rational factors form the basis for human desires, goals and motivations, behavioral finance is based on the premise that these factors are also the reason for a variety of errors in decision-making. Errors typically stem from illusions in perception, overconfidence, free reign to emotions and an over-reliance on rules of thumb. Such errors and the biases that underlie them also influence the financial landscape and all actors who participate in it, because people are imperfect processors of information. This is the essential premise and gist of behavioral finance.

Shefrin (2002), a noted advocate of behavioral finance, states that the way to understand financial decisions is to look beyond the explanation that market psychology is about greed and fear. He asserts that the primary emotions that determine risk-taking are *hope* and fear. The emotion of hope brings a whole new gamut of non-rational and incalculable factors into consideration, which cannot be sufficiently explained by greed. An equally important discovery is that although it is human to make mistakes, financial practitioners (even sophisticated ones) make the same mistakes repeatedly (Shefrin, 2002:3). The way in which applications of these insights (a) lead to a different view of financial decision-making compared to that offered by rational finance, and (b) offer an alternative explanation for a conundrum like the value premium, are themes explored in this chapter.

The chapter commences with a précis of the assumptions on which behavioral finance is based. It continues with an explanation of how these assumptions give rise to financial decision-making based on imperfect data processing. The

outcome of such decisions is then demonstrated as a misplaced reaction to historic occurrences, the latter which is protracted into the future as extrapolation. Extrapolation is proposed as the most plausible explanation for the value premium, and forms the theoretical hypothesis which is empirically tested with South African data in later chapters. The last part of this chapter provides an overview of South African research findings, which deal with the value premium and extrapolation on the JSE.

3.1 Basic assumptions

In their endeavors to construct frameworks which enable them to study financial markets, behavioral finance theorists – like rational finance theorists – have to make assumptions about the judgments, preferences and decisions of market participants. Most of the fundamental principles employed by behavioral finance had been imported from other social sciences, because most of the work to understand less-than-perfectly-rational human behavior had been done by practitioners of social sciences other than economics. Scholars applying psychological insights (in combination with economic theory) – such as Kahneman and Tversky (1973), Benartzi and Thaler (1995), Rabin (1998) and Odean (1998a) – produced substantial evidence that people do not base their preferences purely on the information they have to hand about expected utility (as argued by Von Neumann and Morgenstern), nor do they form judgments by applying Bayesian statistical reasoning to work out their chances of success. Instead, humans systematically behave in a manner contrary to both of these precepts. Shleifer called behavioral finance “a study of human fallibility in competitive markets” (2000: 24). It is this human fallibility, and the tendency to base decisions on non-rational motivations, which underlie the basic point of departure used in this study.

3.1.1 Market participants

Behavioral finance shifts the focus from the mechanical working of efficient markets to human decision-making. The following most salient assumptions are made about the characteristics of market participants. Participants are:

1. imperfectly rational;
2. not reliant on statistical procedures to make investment decisions, but instead rely on crude heuristics, i.e. simple and general rules;
3. greatly influenced in decision-making by the way problems are framed, i.e. worded and presented; and
4. overconfident of their ability to judge.

Statman (1999) further summarizes the essential difference between rational and behavioral finance by stating that in rational finance people (participants) are always rational, care about utilitarian considerations (as opposed to value ones), never make cognitive errors, have perfect self-control, are always risk averse, and never regret a decision. In stark contrast, in behavioral finance people are regarded as normal, and they do not obey any of these patterns.

3.1.2 Utility maximizing

Behavioral finance supporters do not deny the role which the “maximize benefit and minimize cost” maxim plays in the financial decision-making process, but they differ from the rational finance interpretation about how gains and losses are perceived when outcomes are uncertain.

Rational finance assumes that individuals undertake financial decisions to maximize their consumption (and the utility derived from it). Such a position assumes that investment decisions are made strictly with an eye on final outcomes, as financial success is the basis on which increased consumption

rests. In contrast, behavioral finance assumes that individuals undertake financial decisions in order to maximize consumption, as well as for financial well-being – and the latter is seen as valuable in its own right. These broader dimensions of value connected to financial decisions have implications for utility maximizing decisions. Rational finance theory holds that the only factor which people take into account when choosing investments, is the utility (or satisfaction) which the consumption of their wealth is anticipated to bring. Behavioral finance proposes that investors are as concerned about *changes* in the level of their financial wealth as they are about consumption. Consequently, they take both consumption utility and changes in financial well-being into consideration.

Rational finance relies on Von Neumann and Morgenstern's (1944) expected utility theory to explain utility maximization. Expected utility theory assumes that investors give the same weight to gains and losses. In the presence of uncertain outcomes, rational decision-makers choose between two investments based on the higher expected utility, which is calculated by deducting the negative value of the loss from the positive value of the gain, taking into consideration the probability of each outcome coming to fruition. The higher expected utility investment is the preferred one, because rational individuals maximize expected utility and minimize loss.

The behavioral finance counterpart to expected utility theory is prospect theory, the brainchild of Kahneman and Tversky (1979). In prospect theory, gains and losses are considered very differently, because value is assigned to gains and losses, not only to final outcomes. Probabilities are also replaced by decision weights. This means that people tend to think of possible outcomes relative to a reference point – usually the status quo or, in the case of stock purchases, the purchasing price. Instead of a utility calculation (as in rational finance) Kahneman and Tversky suggested that decision-makers construct a value function. This is the difference between a possible outcome (x) and a reference

point (ω), expressed as $(x - \omega)$. Decision-makers choose between two investments by ranking them according to their value $(x - \omega)$; where the reference point ω is as important as the final outcome x .

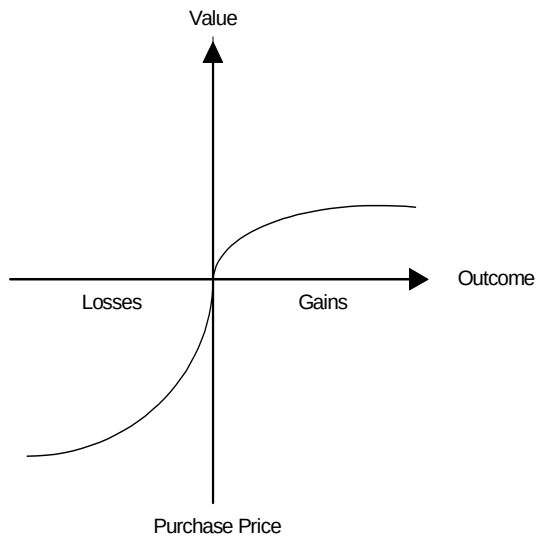


Figure 4: Prospect theory value function

Graphically, the prospect theory's value function is concave for gains after passing through the reference point, and convex with a steeper curve for losses. This change of slope at the origin is due to the tendency of investors to be more sensitive to possible reductions in levels of well-being (points on the loss side of the graph) than to increases in well-being (points on the gains side of the graph). Empirical estimates of loss aversion converge around the number

2, which means that the disutility of giving something up is twice as great as the utility of acquiring it (Tversky and Kahneman, 1991; Kahneman, Knetsch and Thaler, 1990).

Prospect theory, like expected utility theory, focuses on the way people choose among alternative investments, but it comes to a different conclusion about *what* they will choose. To test this, Shefrin and Statman (1985) applied the concepts of "aversion to loss" and "purchase price as reference point", and found that it explains the tendency to sell winning stocks too soon and hang on to losing stocks for too long.

In summary, while expected utility in rational finance is linear in its probabilities, value in behavioral finance is not. Secondly, where utility is dependent on final wealth, value is defined in terms of gains and losses to financial well-being (Shiller, 2003). This difference in perception is borne out in possible

explanations for the value premium – a matter that will be elaborated on later in this chapter.

3.1.3 Approach towards risk

Garland (2002) observed that when individuals focus on risk, it has both an objective and subjective component. Objective risk – the only kind rational finance considers – refers to risk which can be confirmed scientifically by applying statistical analyses to the best obtainable knowledge and data. Subjective risk – the more important component of risk according to behavioral finance – refers to perceived risk that is rooted in subjective factors such as recent personal experience. Frankfurter, McGoun and Allen (2004) called this the difference between rational and actual decision-making.

Kahneman and Tversky (1979) found that people do not treat risk objectively (i.e. by its scientifically calculated probabilities) but that they instead place a disproportionate amount of weight on small probabilities. This may lead people to be risk-seekers if the potential outcome is hugely profitable (e.g. by buying lottery tickets) and risk-averse when facing substantial losses. The way in which weight is assigned is therefore not in accordance with Bayesian thinking, but instead it gives zero weight to extremely low probabilities, and 100% weight to extremely high probabilities. This means that people behave as if they regard extremely improbable events as impossible, and extremely probable events as certain. Prospect theory is not clear on what constitutes an extremely low probability or an extremely high probability, because this assessment is determined by individuals' subjective impressions. However, differences in approach to risk have profound implications for portfolio construction. Kahneman and Tversky found that people do not choose well-diversified portfolios. In particular, people ignore covariance among security returns and choose portfolios that lie below the efficient frontier.

3.2 Inefficient markets: how they function

The rational finance approach argues that it does not matter if some investors are irrational in decision-making or have behavioral biases when processing information, because it is not systematic. In an efficient market, sophisticated (i.e. rational) investors can and will take advantage of any mispricing which develops because of such eccentricities. An efficient market will not allow any arbitrage opportunities to exist for long.

The theory of efficient financial markets can be formally expressed as:

$$P_t = E_t P_t^*, \text{ where}$$

P_t = price of a share (or portfolio) at time t

E_t = public information (i.e. news) available at time t

P_t^* = present value of forecasted future dividends accruing

In efficient markets, the price of an asset is the present value of its optimal and mathematically forecasted future cash flow. Different forms of the efficient market model differ in the choice of the discount rate to calculate the present value, but the equation asserts that any surprising movements in the stock market must have at their origin some new information about the fundamental value P_t^* .

It has now been established that evidence counters this postulation. Arbitrage opportunities keep cropping up, and are exploited. For example, between 1994 and 1997 the well-known New York firm Long Term Capital Management (LTCM), claimed that it successfully made huge leveraged bets which exploited mispricing – mispricing which, if rational finance's efficient market theory were valid, were not supposed to have occurred other than for very brief periods (Shefrin, 2002: 34).

In the preface to the second volume of *Advances in Behavioral Finance*, Richard Thaler wrote:

“I think that many economists began to take behavioral approaches to finance more seriously on October 19, 1987, when stock prices fell over 20 percent on a day without any important news (other than the crash itself). If that is the case, then the rise and fall of the Internet bubble has surely solidified the view that rational models have trouble explaining all that we see in financial markets. It is quite hard to claim that NASDAQ was rationally priced at both 5000 and 1300 within a couple of years.” (Thaler, 2005)

Behavioral finance argues that in a world populated by noise traders²¹, there is no certainty that rational traders dominate the market, or that noise traders will become extinct, even in the long run. In fact, under very plausible conditions, noise traders can outperform rational arbitrageurs, as demonstrated by the work of DeLong et al. (1990 and 1991), Shleifer and Vishny (1997), Kyle and Wang (1997) and Hirshleifer and Luo (2001). These researchers demonstrated that market agents with incorrect beliefs may drive agents with correct²² beliefs out of the market. This evidence leads the behavioral finance school to believe that financial markets are not efficient enough to eliminate arbitrage opportunities, because erroneous reasoning is systematic and can prevail.

In an extensive survey of behavioral finance, Barberis and Thaler (2003) review the approach which argues that some empirical findings in financial markets can more plausibly be understood by an alternative approach to rational finance. This kind of theorizing builds models in which some agents are not fully rational. The main building blocks for this alternative view are (a) a focus on the limits to arbitrage and (b) psychological phenomena operating in financial activity. The first argues that it can be difficult for rational traders to undo the effects of less rational ones. The second argues that there are significant deviations from full

²¹ Noise traders are investors whose buying and selling decisions are irrational and erratic. The term “noise” was coined by Fisher Black in 1986 when he defined noise as “a large number of small events which is more powerful than a small number of large events”.

²² “Correct” in this context refers to objective, statistically correct probability distributions of returns, conditional on what is known at the time. Noise trading, on the other hand, is based on incorrect probability assessments.

rationality in financial transactions that cause significant and persistent deviations from what rationality presupposes. This irrationality arises from how people form beliefs about markets and what the preferences are for making decisions, given their beliefs (Barberis and Thaler, 2003:1055-1056).

By arguing for limits to arbitrage as a process by which asset prices will rapidly and consistently be brought in line with their fundamental values, behavioral finance moves away from the Efficient Market Hypothesis that provides the theoretical basis for rational finance (Barberis and Thaler, 2003:1056). In an efficient market no investment strategy can earn excess risk-adjusted average returns or average returns that are greater than that warranted by their inherent risk. Behavioral finance argues that some features of asset prices should more credibly be seen as deviations from fundamental values. These deviations are caused by less than fully rational trading decisions. The persistence of such less than fully rational decisions is attributed to the view that the correction of mispricing of assets carries both fundamental and noise trader risk and is accompanied by quite substantial implementation costs (see Barberis and Thaler, 2003:1058-1065, who also offer empirical evidence of significant and persistent mispricing in financial markets).

The investigation of the psychological factors that lie behind the persistence of irrational behavior has led behavioral finance to the following elements of the way in which traders form beliefs, evident in financial markets (Barberis and Thaler, 2003:1065-1069): overconfidence; optimism and wishful thinking; representativeness; conservatism; belief perseverance; anchoring; availability bias. The first four of these are expanded on in section 3.5.1 below.

On how beliefs play a role in how investors evaluate risky decisions, behavioral finance theorists have found that people systematically violate the implications of expected utility that builds on the work of Von Neumann and Morgenstern. Looking at experimental evidence from the psychology of decision-making,

behavioral finance has found that prospect theory, as originally laid out by Kahneman and Tversky (1979), offers the most promising grounds for understanding the role of preferences in financial decisions. This theory is further examined in section 3.1.2 below.

In their wide-ranging overview, Barberis and Thaler (2003:1114) admit that behavioral finance is still “...much closer to the beginning of a research agenda than to the end”. They admit to narrowness in the models offered by behavioral finance, mentioning that models often capture only one of investors’ beliefs, their preferences, or the limits to arbitrage, but not all three. Such broader incorporation is envisaged as some of the main work to be attended to in future. They also admit to the existence of competing models in behavioral finance for some of the empirical facts – seen as a weakness of the approach by some, especially by adherents of rational finance.

3.3 Different assumptions of rational and behavioral finance

The assumptions that indicate the fundamental differences²³ between rational and behavioral finance can be contrasted as follows. Rational finance assumes that:

- (1) investors are rational,
- (2) markets are efficient;
- (3) investors design their portfolios according to the rules of mean-variance portfolio theory;
- (4) expected returns are a function of risk and risk alone; and
- (5) when making financial decisions, investors are oriented to the future. This is done by performing statistically sophisticated calculations of what future

²³ Statman (2005) provided the basic elements of this summary.

cash flows are likely to be, followed by discounting these to bring them to present values for cost comparison.²⁴

Behavioral finance, on the other hand, assumes that:

- (1) investors are normal, not rational;
- (2) markets are not efficient, even if they are difficult to beat;
- (3) investors design portfolios according to rules of behavioral portfolio thinking (i.e. subjective impressions), not mean-variance portfolio theory;
- (4) expected returns follow a path in which risk is not measured by beta, and returns are determined by more than risk; and
- (5) when making financial decisions, investors are essentially oriented towards the past. This is done by looking at a reference point such as returns generated by an asset in the past, and basing expectations for future returns on that.

The behavioral finance assumptions above are fundamental insights required for understanding information processing in financial markets. This gives rise to a plausible explanation for the value premium anomaly.

3.4 Behavioral finance and the value premium

Ever since the work of Graham and Dodd in the 1930s, scholars and investment professionals have known that stocks with low prices relative to value measures such as earnings, dividends or book value, outperform the market. Despite this relatively long history of superior returns on value investments, the explanation for it was usually not accompanied by defensible statistical work, and hence

²⁴ A more formal statement of the rational finance position is given by Barberis and Thaler (2003:1053), who noted that rationality means two things: "First, when they receive new information, agents update their beliefs correctly, in the manner described by Bayes' law. Second, given their beliefs, agents make choices that are normatively acceptable, in the sense that they are consistent with Savage's notion of Subjective Expected Utility (SEU)". [In GM Constantinides, M Harris and R Stulz (eds.). (2003). *Handbook of the Economics of Finance*. Amsterdam: Elsevier Science.]

never appeared scientifically persuasive. With the rise of behavioral finance, value strategies have attracted increasing academic attention, with the interest focused on what lies behind the success of value investing.

The behavioral finance explanation for the superior performance of value investment strategies is that such strategies are successful because they are *contrarian* to naïve²⁵ strategies. These naïve strategies are the result of improper (non-rational) information processing, which in turn leads to over-reaction or under-reaction to price signals. Contrarian investors bet against such naïve investors by investing disproportionately in stocks that are under-priced, and under-investing in stocks that are overpriced. The outcome regularly outperforms the market (De Bond and Thaler, 1985; Haugen, 1995).

The contrarian investment strategy has been tested extensively²⁶. In addition to the innovative and influential study of Lakonishok, Shleifer and Vishny (1994), similar findings have been recorded in Japan by Chan, Homao and Lakonishok (1991), in the UK by Gregory, Harris, and Michou (2001), in the Netherlands by Doeswijk (1997), in New Zealand by Chin, Prevost, and Gottesman (2002), in France and Germany by Mun, Vasconcellos and Kish (1999), in Germany by Schiereck, De Bondt and Weber (1999), in a broader European context by Brouwer, Van Der Put and Veld (1997), and in Australia by Lee, Chan, Faff, and Kalev (2003). The findings show that value investment strategies consistently outperform the market. These findings are compared with results from the South African market in chapter 6 of this study.

²⁵ Various terms have been used to describe this phenomenon. Shiller (1984) calls it popular models; while Black (1986) calls it noise trading.

²⁶ There are more ways than one to test the profitability of contrarian investment, but all methods use mean-reversal (explained later in this chapter) in one way or another. De Bondt and Thaler (1985) followed a zero-net-investment strategy – short selling assets that have performed well and using the proceeds to buy assets that have performed poorly. This way of testing was also followed by Richards (1995, 1997) to test it in sixteen OECD countries, finding partial mean-reversal across national stock markets. Balvers, Wu, and Gilliland (2000) studied national equity indexes for eleven countries for the period 1949 to 1997, using the same technique as De Bondt and Thaler, and found strong evidence of mean-reversal.

The rational finance explanation, namely that value strategies are more risky, had also been tested extensively, but no convincing evidence to date could be found to support this position (as discussed in chapter 2).

That leads to interesting and pertinent questions, such as: Why don't all investors follow a value strategy? If it had been established that value investments generate higher returns without being more risky, why do some investors continue to invest in growth stocks? What is more, the number of investors who choose growth investment strategies is substantial enough that the contrarian investment strategy remains profitable, and that the value premium persists. What could explain these less than optimal investment choices? The rudimentary behavioral finance explanation is that it is improper information processing (due to psychological factors) which leads to extrapolation.

3.5 Information processing and extrapolation

Real-life, actual decision-making is often not a simple task – in contrast with the formal decision-making presumed in theoretical models. This distinction is particularly true of financial decisions that take place in complex and rapidly changing financial markets.

Despite the rational finance claim that decisions are made rationally by using Bayes' law (i.e. by weighing information correctly) and by basing them on a knowledge of the actual statistical distribution that variables are drawn from, a wealth of evidence now exists to show that investors try to reduce complexities by forming expectations on impetuous grounds, and by resorting to simple judging operations (Tversky and Kahneman, 1974; Rabin, 1998; Kahneman, 2003a). This means that not all information is included, or that it is included incorrectly in the decision-making process. Simplifications are often useful and even effective for a while, but they invariably result in systematic cognitive illusions, errors and biases. A variety of errors have been identified, including errors of judgment and reasoning, which involves putting excessive weight on the

recent past, and equating well-run companies with good investment opportunities, regardless of their stock price.

The essential error in information processing involves excessively tying expectations about the future to past trends, or betting on current trends to continue (Shefrin, 2002:183). These are called expectational errors, and are schematically represented in the next section. In their landmark study, Lakonishok, Shleifer and Vishny (LSV, 1994:1575) found evidence that a systematic pattern of expectational errors is the explanation for the superior performance of value stocks compared to growth stocks (called “glamour” stocks by the authors). LSV suggested that the basic expectational error is to assume that growth (or glamour) stocks – those which had performed well in the past – will continue to perform well in the future. Similarly, value stocks – those that had performed poorly in the past – were expected to continue to perform poorly. The buying behavior of investors, based on these expectations, thus caused growth stocks to be over-priced and value stocks under-priced. This flawed intuitive forecasting is the behavioral finance explanation for extrapolation as the underlying reason for the existence and durability of the value premium. LSV summarize it as follows: “The essence of extrapolation is that investors are excessively optimistic about glamour stocks and excessively pessimistic about value stocks because they tie their expectations of future growth to past growth.” (Lakonishok, Shleifer and Vishny, 1994: 1559)

If investors make mistakes like these, the evidence must be detectable in the data. An explicit test for extrapolation is to look at future growth rates, and compare them to past growth rates. In order to prove that extrapolation is the explanation for the success of the contrarian investment strategy, and by extension the value premium, it must be shown that growth companies performed well in the past, and that investors expected this strong growth to continue in the future. Similarly, it must be shown that value companies performed badly in past and are expected to continue to perform poorly in the

future. It is possible to test this notion, because past performance and future expectations are two distinct and separate entities which can be evidenced. Past performance is measured by past growth in sales, earnings and cash flow. Expectations about the future are reflected by the multiples of stock price to earnings and cash flow.

Behavioral finance explains decision-making errors by relaxing the assumption regarding the use of Bayes' law. The behavioral counterparts to Bayes' law regarding information processing are known as heuristics, conservatism, representativeness and mean reversal (collectively referred to as biases or psychological biases). Attention now turns to each of these biases and their place in the information processing chain. Given the complexity of financial decisions, information processing normally occurs as successive steps, which can be called a processing chain.

3.5.1 Heuristics

Heuristics describe how individuals typically respond to new information: by giving too much weight to recent information and too little to prior data. In predicting uncertain future events, investors tend to take a brief data history into account, and ask themselves what broader picture this represents. Not enough attention is paid to the possibility that recent history is generated by chance rather than by the "model" they are constructing.

Heuristics have significant implications for asset pricing. CAPM theory suggests that asset pricing is based on the value of an asset's systematic risk as measured by beta. Heuristics imply that people use a "rule of thumb" to assess asset pricing. Rational finance supporters would argue that unsystematic biases would average to zero across all investors, but behavioral finance postulates that heuristics and the other accompanied biases are systematic, and that they move prices away from fundamental values.

Heuristics is the first element in the information processing chain that leads to extrapolation. Extrapolation means that recent observations are predicted to repeat themselves too far into the future. Heuristics explain how this happens, namely by investors giving too much weight to recent information and too little to prior data.

3.5.2 Representativeness

Representativeness, the second element in the information processing chain, is also called “the law of small numbers”, where people expect small samples to reflect the properties of a big population. Representativeness occurs because investors do not understand the data-generating process or the actual distribution of variables; which is why they tend to infer expected outcomes too quickly on the basis of too few data points.

For example, if a company announces good earnings for a couple of quarters in a row, investors believe that all subsequent announcements will be good (based on the small sample) so they **over-react** by buying up these shares, thereby increasing the demand and the price.

3.5.3 Conservatism

Conservatism, the third element in the information processing chain, is the tendency to update expectations too slowly by being too tardy at incorporating new information. For example, if the example mentioned above under representativeness is carried through, when a company announces good earnings for a couple of quarters in a row, and the share price subsequently increases, investors do not update expectations about future returns by taking into account the new (higher) stock price information. Instead, they **under-react** to the higher price information and persist in buying these (increasingly exuberantly) expensive stocks.

3.5.4 Mean reversal

Mean reversal (also referred to as mean reversion) is the last element in the information processing chain, and refers to the fact that people do not give enough consideration to what psychologists call the base rate or class average. Kahneman and Tversky (1982: 419) explain this as follows:

“One of the basic principles of statistical prediction, which is also one of the least intuitive, is that the extremeness of predictions must be moderated by considerations of predictability. Predictions are allowed to match impressions only in the case of perfect predictability. In intermediate situations, which are the most common, the prediction should be regressive, that is, should fall between the class average and the value that best represents one’s impression of the case at hand. The lower the predictability the closer the prediction should be to the class average.”

The implication of this faulty reasoning is that instead of expecting mean-reversal when making predictions about earnings or growth, investors expect the “trend” to continue. They then project the current pattern into the future and expect it to continue.

Mean reversal is an extensively studied phenomenon, and the findings are that prices and returns eventually move back to a mean or average, which can be the historical average of prices, or returns, or another relevant average such as the growth of the economy or the average return of an industry.

Taken together, the four errors of reasoning, namely heuristics, conservatism, representativeness and mean reversal, lead to over- and under-reaction to market signals.

3.6 Over- and under-reaction

Under-reaction means that due to improper information processing, investors tend not to react to price signals appropriately, but either under-react or over-react. For example, an investor hears news about a particular company. In the

formula below, the news he hears in period t is represented as z_t . This news can be either good or bad, that is $z_t = G$ or $z_t = B$. If the news about the company is good ($z_t = G$), the average return on the company's stock in the period $(t+1)$ following such an announcement is *higher* than the average return. In other words, the stock price **under-reacts** to good news initially, because the information is incorporated too slowly. This mistake is subsequently corrected in the following period. In formal terms the formula is represented as:

$$E(r_{t+1}|z_t = G) > E(r_{t+1}|z_t = B)$$

Over-reaction occurs when the average return following (not one, but a series of) good news announcements is *lower* than the average return following a series of bad news announcements. Using the same notation as before, this can be formally stated as:

$$E(r_{t+1}|z_t = G, z_{t-1} = G, \dots, z_{t-j} = G) < E(r_{t+1}|z_t = B, z_{t-1} = B, \dots, z_{t-j} = B)$$

J in the equation refers to the number of good news announcements. The idea is simply that after a series of positive news announcements, an investor becomes overly optimistic that future news announcements will always be good. He then over-reacts, sending the stock price to unduly high levels. Subsequent news announcements are likely to contradict the optimism, leading to lower returns that flow from the new higher price levels.

The evidence suggests that stocks with a consistent record of good news, and hence extremely high past returns, are over-valued. Investors can earn abnormal profits by betting against this over-reaction to patterns of good news. The opposite is true for stocks with a consistent record of bad news, which tend to be undervalued. This had been confirmed by De Bondt and Thaler (1985), Bernard (1993), Barberis, Shleifer and Vishny (1998), and Liu, Strong, and Xu

(2001), who found that investors regularly over-react and under-react to market information.

De Bondt and Thaler (1985) tested the over- and under-reaction and mean-reversal phenomena in financial markets, using monthly return data from 1926 to 1982 for companies trading on the NYSE. They constructed two portfolios, each consisting of thirty-five companies, one with extreme winners and the other with extreme losers over the five years before portfolio formation. Share price returns were then followed over the five years after portfolio formation (the test period). The research found that both winners and losers show significant mean reversal, with winners turning to losers and losers turning to winners. The five-year price reversals for losers were more pronounced than for winners (about +30 percent versus -10 percent excess returns). A strategy that bought losing portfolios long and sold winning portfolios short over a three to five year period, earned average annual returns ranging between five to eight percent above the market return.

Fama and French (1986) used New York Stock Exchange index data for the period 1926 – 1985, and regressed the stock market index return over some time period (t), on returns over the prior period ($t-1$) of equal length. If prices fluctuated in a random walk, the slope in the regression should be zero. If prices were mean-reverting, the slope should be negative. The results revealed considerable mean reversal. The slopes of the regression lines were generally negative for time spans ranging from eighteen months to five years. Slopes were found to be more negative for portfolios of smaller firms than for larger firm portfolios, but R^2 varying between twenty-five and forty percent, meaning that between twenty-five and forty percent of the three to five year return were predictable, based on mean-reversal.

3.7 Overconfidence

Overconfidence is one of the most persuasively documented behavioral biases in this regard (Daniel and Titman, 1999). De Bondt and Thaler (1985) state that the

finding that people are overconfident is perhaps the most robust finding in the psychology of judgment, because it had been observed in almost every profession, including clinical psychologists (Oskamp, 1965), physicians and nurses (Christensen-Szalanski and Bushyhead, 1981; Baumann, Deber and Thompson, 1991), investment bankers (Staël von Holstein, 1972), engineers (Kidd, 1970), entrepreneurs (Cooper, Woo and Dunkelberg, 1988), lawyers (Wagenaar and Keren, 1986), and managers (Russo and Schoemaker, 1992).

Overconfidence takes on many forms. People tend to overestimate their own positive contribution to past positive outcomes, recalling information related to their success, while reframing failures. Fischhoff (1982) found that people wrongly remember their own predictions by exaggerating in hindsight what they knew in foresight. When people expect a certain outcome and the outcome occurs, they often over-estimate the degree to which they were instrumental in bringing it about (Miller and Ross, 1975).

It is obvious that levels of confidence will have direct impacts on decision-making and data processing. When investors value a stock, they must combine information from various sources: new information with existing information, and information they collect on their own with information provided by others, such as company managers and accountants. Rational finance assumes that investors combine these different sources of information using Bayes' law, weighing each piece of information objectively, and assigning appropriate probabilities to each. In contrast, Daniel, Hirshleifer and Subrahmanyam (1998) found that people place too much weight on information they have collected themselves, being overconfident about the accuracy of it, while putting too little weight on information provided by accountants or company managers.

Despite overconfidence being a characteristic of people and not markets, it greatly affects markets, prices and asset allocation. Dow and Gorton (1997), as well as Statman, Thorley and Vorkink (2006), showed that trading volumes

increase when price-takers, insiders or market-makers are overconfident. Research findings (Kahneman and Tversky, 1973; Grether 1980; Daniel and Titman, 1999) also show that overconfidence causes people systematically to underweigh abstract, statistical and other highly relevant information, and overweigh salient or extreme information (which stands out and grabs attention), as well as anecdotal information. The evidence in this regard has been substantiated extensively and over a long period (Kahneman and Tversky, 1973; Bar-Hillel, 1980; Hamill, Wilson and Nisbett, 1980; Nisbett and Ross, 1980; Bar-Hillel and Fischhoff, 1981; Taylor and Thompson, 1982; Tversky and Kahneman, 1982).

Not only do people give more consideration to extreme, salient or anecdotal information, but they also do not pay enough attention to the validity of such information (Griffin and Tversky, 1992). Fiske and Taylor (1991) found that investors often behave as though information is to be trusted regardless of the source, and that they make equally strong or confident inferences regardless of the information's predictive value. Whether the information is accurate and fully reliable on the one hand, or out-of-date, inaccurate and based on hearsay on the other, may ultimately matter little.

The significance of overconfidence for this study is that it represents a strong and substantially documented underpinning for the four phenomena which constitute the information processing chain, namely heuristics (the tendency to give too much weight to recent information and too little to prior data), representativeness (the rule of small numbers), conservatism (the tendency to incorporate new information too slowly), and mean reversal (the improper information processing biases that lead to extrapolation).

3.8 Extrapolation schematically represented

The flowchart below illustrates the process of extrapolation that results from erroneously processing information.

How a company becomes an over-valued growth company

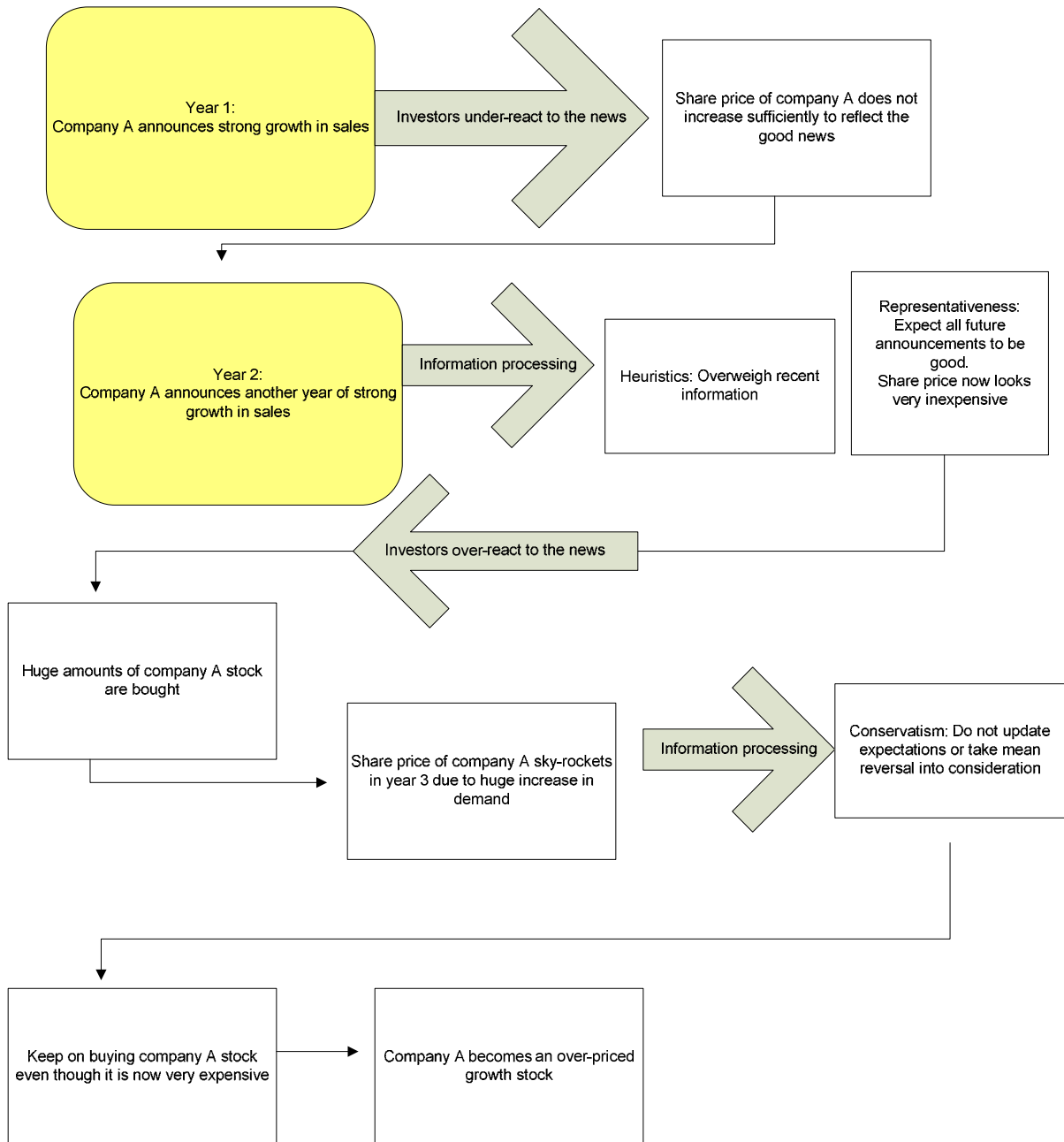


Figure 5: Becoming an over-valued growth company

How a company becomes an under-valued value company

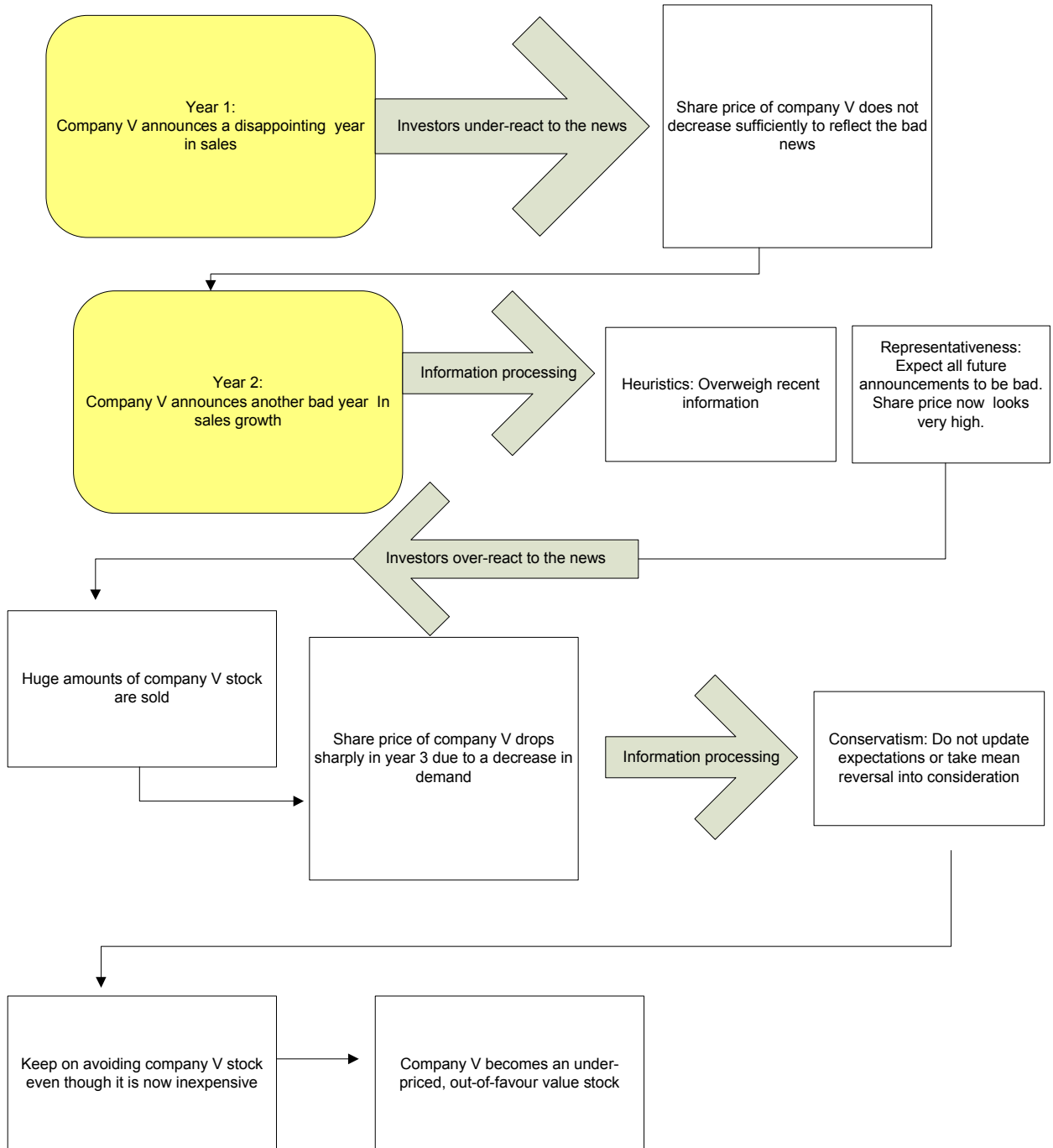


Figure 6: Becoming an under-valued value company

3.9 The unsettled debate

3.9.1 Cherry-picking biases

Supporters of rational finance, including Fama (1998b) and Rubinstein (2001), have expressed concern that behavioral finance researchers arbitrarily pick and choose from a list of psychological biases in order to “behavioralize” market anomalies. Depending on the anomaly, so they argue, at least one bias inevitably fits the facts.

An example is the momentum²⁷ anomaly as identified by Jegadeesh and Titman (1993). What to attribute this momentum effect to – under-reaction or delayed over-reaction – is not clear yet, and ultimately depends on which biases researchers employ. Daniel, Hirshleifer and Subrahmanyam (1998) investigated overconfidence as the bias for momentum reversal. Barberis, Shleifer and Vishny (1998) in turn investigated conservatism and representativeness as the relevant bias to generate initial under-reaction and subsequent over-reaction as a way of explaining the momentum observation.

Since these models employ different behavioral and decision-making biases, they differ as to whether serial correlation (the statistical method to test for momentum effect) is caused by under-reaction or by delayed over-reaction. If serial correlation is caused by under-reaction, then we can expect to see positive abnormal returns during the holding period to be followed by normal returns in a subsequent period. However, if abnormal returns are caused by delayed over-reaction, then we can expect that abnormal momentum returns in the holding period will be followed by negative returns, since the delayed over-reaction must subsequently be reversed (Jegadeesh and Titman, 1993). This debate is currently alive and well in the behavioral finance field, and appears to be a fertile

²⁷ Momentum refers to the observation that even though there is a tendency in the long run (three to five years) towards mean reversal (as identified by De Bondt and Thaler in 1985); there is a tendency for stock returns to continue moving in the same direction in the short run (six to twelve months). Jegadeesh and Titman (1993) documented this first, and it had been tested extensively since then.

ground for research. It also provides supporters of rational finance with abundant ammunition to accuse behavioral finance supporters of arbitrarily cherry-picking psychological biases in order to “behavioralize” market anomalies.

De Bondt and Thaler (2002) share this concern about arbitrarily picking psychological biases, but do point out that, if carefully defined, psychological biases are not as slippery a concept as rationality. In principle, the data can always falsify the hypothesis at hand.

Despite the pitfalls of arbitrarily picking biases for explanatory purposes, it is noteworthy that as far as the value premium is concerned, there is no debate or disagreement among behavioral finance supporters about which psychological biases contribute to the superiority of value strategies. Over- and under-reaction, as identified by De Bondt and Thaler (1985); Bernard (1993); Barberis, Shleifer and Vishny (1998), and Liu, Strong and Xu (2001), are the actions that follow from heuristics, representativeness and conservatism as decision-making biases.

3.9.2 Market practitioners and the value premium

The debate about whether value companies are more risky (the traditional approach) or mispriced (the behavioral finance approach) has reached practitioners in a haphazard manner. Practitioners of finance, such as investment bankers, fund managers and analysts, are the market participants whose opinions and impressions move the market.

Bloomfield and Michaely (2002) collected data from market practitioners such as sell-side analysts, investment bankers and traders, on their views and beliefs. The study was a controlled experiment rather than a survey because Bloomfield and Michaely manipulated the variables of interest (beta, BV/MV and firm size), and examined how those manipulations led to differences in beliefs among investment professionals. They found that practitioners view high BV/MV as an indicator of mispricing, but generally did not expect mispricing to correct itself

within one year. They also found no evidence that practitioners viewed BV/MV as an indicator of risk which, within the CAPM model, would explain higher returns. However, practitioners expected high beta firms to earn significantly higher returns than low beta firms – a belief that is no longer borne out by empirical evidence.

Analysts also divulged to Bloomfield and Michaely that the BV/MV ratio is the most important factor in assessing wrong evaluation, and that beta is the most important in assessing risk. Bloomfield and Michaely concluded that market participants have been more influenced by earlier literature, which puts a heavy emphasis on the central role of beta in asset pricing, than by later literature, which questions beta's role. Practitioners have also been more swayed by the behavioral finance literature, which argues that the BV/MV ratio is an indicator of mispricing (or value measure), than by rational finance theory, which argues that the BV/MV ratio is an indicator of risk factors.

3.9.3 The current status of this debate and where this study fits in

In 1986, when Fama and French presented their test results for New York Stock Exchange index data, in which they found strong evidence of mean-reversal (as discussed in section 3.6), they did not concede that the behavioral finance explanation is correct. In fact, they came to the following conclusion:

“[T]he tendency toward reversal ... may reflect time-varying expected returns generated by rational investor behavior and the dynamics of common macro-economic driving variables. On the other hand, reversals generated by a stationary component of prices may reflect market-wide waves of over-reaction of the kind assumed in the models of an inefficient market. Whether predictability reflects market inefficiency or time-varying expected returns generated by rational investor behavior, is and will remain an open issue.” (1986: 23)

This “open issue”, as Fama and French called it here, begs the question: Does erroneous thinking (such as heuristics, representativeness and conservatism) and extrapolation which results from it, explain the value premium, or does risk

provide the explanation? For the risk argument to be convincing, the still poorly understood risk measure which Fama and French (1986) called “time varying”, will have to be demonstrated to be real. In order for extrapolation to be accepted as a viable explanation, the drumbeat of empirical evidence will have to become so resounding that it will be impossible to ignore – which is what this study aims to contribute to.

3.10 Overview of South African research on the value premium

Four of the most striking features of South African research literature on the topic of this study are: (a) all studies use monthly share price data for the empirical part of the analysis; (b) sample sizes are mostly small (though very recent studies improved on this limitation); (c) almost all studies exclude smaller, highly illiquid companies which are not on the main board; and (d) with one recent exception, they all exclude mining companies.

Given the dominance of mining – gold mining specifically – on the JSE and the substantial proportion of total market capitalization it accounts for, it must follow that excluding it from studies to determine the characteristics of the JSE, will limit results. The reason stated by most South African researchers for this omission is that gold mining companies have non-standard accounting and tax environments, and that they are vulnerable to fluctuations in the gold price (Gilbertson and Goldberg, 1981). For these reasons, all South-African studies have hitherto only used industrial companies for their analysis.

The foregoing approaches to selecting data are in sharp contrast with this study, which includes mining companies – including gold mines – in the analysis. This was made possible by using McGregor’s standardized manual. This study used only annual share price²⁸ data and had the benefit of more than 8,000 data

²⁸ Appendix 2 provides a detailed description and analysis of how the researcher decided which share price data set to use for the empirical part of this study.

points, which provide a broad sample for this analysis.²⁹

The larger sample size and inclusion of companies from the mining sector ensures that the results of this study are more representative of the South African economy and therefore more relevant.

3.10.1 Investigating the value premium on the JSE

Graham and Uliana (2001) refer to the value-versus-growth phenomenon in South Africa as a neglected area of study. However, neglected cannot be interpreted as ignored. In fact, various researchers have used a variety of methods to look into it. Yet, considering that the value-versus-growth discussion re-entered the academic debate eighteen years ago with the publication of Fama and French's now famous 1992 article³⁰, the topic was never studied in South Africa with the same vigor with which it was analyzed in the rest of the world. This is surprising, given how profitable the value investment strategies proved to be in the rest of the world, and one would have expected this to be a more active research area in South Africa too.

The most influential studies which did appear on the topic will be discussed next. Attention will be given to the findings as well as the methods used to test for the value premium, since both of these will be compared and commented on in the light of the investigations carried out for this study.

3.10.1.1 Plaistowe and Knight

The first study on the value premium was done in 1986 by Plaistowe and Knight (1986). They used thirty-five shares as data and found evidence of the BV/MV effect on the JSE over the 1973 to 1980 period. A variant of the Fama, Fisher,

²⁹ The number of companies in the sample varied from 138 in 1972 to 374 in 2001. The researcher had access to twenty-nine years of accounting and share price data. Portfolios were formed in every one of those years, which gave over 8,000 data points for the analysis.

³⁰ The cross-section of expected stock returns., *The Journal of Finance*, 47 (2), June 1992.

Jensen and Roll (1969) methodology³¹ was used, comparing the performance of the growth³² portfolio to the value³³ portfolio over the annual period, following the release of earning reports. They found that value firms significantly outperformed growth firms over the time period under review.

3.10.1.2 Maritz and Klerck

The first comprehensive study in South Africa was undertaken by Maritz and Klerck (1997), who used the Graham investment criteria for a study on the industrial index of the JSE between 1977 and 1994. Graham (Graham and Dodd 1934), the father of value investing, considered investment return on stock portfolios to be the reward for the intellectual effort which an investor brings to bear, in addition to risk. Graham suggested a number of selection criteria to increase returns on investment, including: picking companies with low P/E ratios, low dividend yields compared to bond yields, and low debt levels. Maritz and Klerck used listed firms which made up the industrial index between 1977 and 1994, and formed portfolios based on the Graham method. Firms were screened in order to determine which companies met the criteria. All stocks were included in three equally-weighted portfolios. The first portfolio included stock that met criterion one (i.e. low P/E ratios), the second included stocks that met criteria one and two (i.e. low P/E ratios, and low dividend yields compared to bond yields), and the third consisted of stock that met all three criteria (i.e. low P/E ratios, low dividend yields compared to bond yields, and low debt levels). The stocks which were included were “purchased” on the last day of March of each year, and share prices were tracked monthly. The return on these portfolios was then compared with the return of the index.

Maritz and Klerck found that their value portfolio (the portfolio that met all three criteria) had a significantly higher share price return than the market index.

³¹ Their study ranked shares on their relative BV/MV. All share trading at a premium (i.e. a higher share price per share than the book value per share) were placed into a winner portfolio; while all shares trading at a discount (i.e. a lower price per share than the book value per share) were placed in a loser portfolio.

³² This they called premium portfolios because of the reason stated in the previous footnote (31).

³³ This they called discount portfolios because of the reason stated in footnote 31.

However, the standard deviation on that portfolio was also higher, indicating higher risk. Maritz and Klerck adjusted the data for risk, and found that even after risk-adjustment, the returns for the value portfolio were still positive and significant. This provided evidence of superior returns to the value investment strategy.

3.10.1.3 Graham and Uliana

Graham and Uliana (2001) used data for fifty-three industrial companies over a 120-month period between 1987 and 1996. Two portfolios were formed for each year: one for the top 50% of companies with high P/BV (growth companies) and the other for the bottom 50% of companies with low P/BV (value companies). Monthly returns were calculated over a three year, five year and ten year period, using both equally weighted³⁴ and capitalization weighted portfolios³⁵. The authors then computed the value-versus-growth spread by subtracting the average excess return on the growth portfolio from the value portfolio. They did not take size differences between companies into consideration, but made provision for risk differences between the two portfolios' return and the Treasury bill rate (as proxy for the risk-free rate). The intent of their study was to produce results that could be compared to the international study done by Capaul, Rowley and Sharpe (1993).

The study used the mean monthly excess (i.e. above the Treasury-bill rate) return on each of the growth and value portfolios for each of the years between 1987 and 1996, and computed the annual value-versus-growth spread by subtracting the cumulative average return on the value portfolio from the growth portfolio. They did this for both the equally weighted and capitalization weighted

³⁴ Equally weighted portfolios mean that each company has an equal weight in the portfolio. Portfolio returns are calculated as the returns of each company in the portfolio added up, and divided by the number of stocks in each portfolio (without first weighing ownership portions). Equally weighted portfolios are most regularly used as the preferred way of doing portfolio formation in studies of this nature.

³⁵ Capitalization weighted portfolios refer to the ownership portion in each firm, which is arrived at by dividing \$1 by the market capitalization of each firm. To calculate the return on each stock, the returns to the firm is multiplied by the portion of the firm held in the portfolio. The returns of each company are then added up across all stocks held in each portfolio, and divided by the number of stocks in each portfolio. This is used to calculate the average return on the portfolio.

portfolios.

Graham and Uliana's study found no outright evidence for the value-versus-growth phenomenon, because in the period which their study covered, they identified two distinct periods: one in which the growth portfolios showed a superior performance (1988 to 1992), and one in which the opposite happened (1992 to 1996).

This study also used the Sharpe ratio to determine risk-adjusted returns, and found that value portfolios were **not** more risky than growth portfolios. In fact, value portfolios had a higher risk-adjusted return than growth companies.

The finding of “no outright evidence for the value-versus-growth phenomenon” was supported by Robins, Sandler and Durand (1999), who found no evidence of a value premium in South Africa. Their study was small, excluded mining, non-main board and financial shares, included an average of only ninety-seven companies per year in the sample, and in some cases had as few as eighteen companies per year in the sample.

3.10.1.4 Fraser and Page

Fraser and Page (2000) tested for the value and momentum strategies independently, by constructing equally weighted portfolios, using all industrial shares trading on the JSE between 1973 and 1997. The number of companies available for portfolio formation ranged from 273 in the earlier years, to a maximum of 454 in later years. They used monthly holding periods over twenty-eight day intervals, and sorted companies based on sector-relative³⁶ dividend yields (Dividend/Price, or D/P) and sector-relative calculations of $\log(BV/MV)$ ³⁷ in order to test for the value strategy. Once sorted, companies were grouped into five portfolios, and monthly returns were tracked. Fraser and Page found strong

³⁶ Sector-relative variables are defined as the difference between a company's D/P or $\log(BV/MV)$, and the D/P or $\log(BV/MV)$ for the relevant sector for each month.

³⁷ $\log(BV/MV)$ = natural log values of BV/MV. This is used to ease the statistical analysis section of a study.

evidence in support of the value premium for value measures applied by them, the sector-related dividend yield, as well as sector-related BV/MV. The value portfolios outperformed the growth portfolios by 0.6% per month, or approximately 8% per annum. The value and momentum variables were found not to be related to one another (or uncorrelated).

3.10.1.5 Van Rensburg and Robertson

Van Rensburg and Robertson (2003a) set out to identify the attributes which have the ability to explain average monthly returns independent of beta, the CAPM risk measure. This was done with ten years' worth of data from the JSE (July 1990 to June 2000) with a sample size varying between 206 and 542. They regressed the share price returns of a company on each of twenty-four different variables/attributes of that company, to test which of these attributes has prediction power in terms of expected return. The twenty-four attributes (also called style characteristics) could be grouped into three categories viz. measures of value (such as price-to-earnings, price to net asset value, cash flow to price, dividend yield and price to profit); measures of future earnings (company size, debt to equity, quick ratio); and measures of irrationality and neglect (such as price momentum and trading volumes). The study found that six factors (five of which were value measures) had statistically significant prediction power. These were: price-to-net-assets value (NAV), dividend yield, price-to-earnings, size, cash-flow-to-price, and price to profit.

3.10.1.6 Auret and Sinclair

Auret and Sinclair (2006) incorporated book-to-market (BTM)³⁸ as a variable in the analytical approach used by Van Rensburg and Robertson (2003a) to see if BTM in the South African context had the kind of explanatory power found in the multi-factor CAPM model of Fama and French (1992). They used the five most significant variables reported by Van Rensburg and Robertson (2003a), and

³⁸ What these researchers call BTM is the same concept as BV/MV used throughout this study.

added BTM. The finding was that the BTM variable did have power to explain variations in stock returns and was statistically significant (t-stat = 2.968), however not as significant as cash flow to price (t-stat = 3.894).

In contrast to the findings of Van Rensburg and Robertson (2003b), which established that the size effect is important for predicting share price returns, Auret and Sinclair found a less significant size effect when BV/MV is incorporated.

3.10.1.7 Rousseau and Van Rensburg

In 2004, Rousseau and Van Rensburg published findings to establish whether value investing should best be regarded as a long-term approach. Although they did not directly investigate the existence of the value premium, their methods and findings are nevertheless relevant to the scope and contents of this study, and thus merit discussion. Using a simulation methodology with monthly JSE data for the period between January 1982 and August 1998, they examined the payoffs which low P/E securities fetched in the course of various intervals.

Their calculations gave them a distribution of the active returns of the portfolio formation over the specific interval selected. The research identified six cut-off criteria, comprised of top and bottom portfolios for three time periods. These were applied to five intervals – six, twelve, eighteen, twenty-four and thirty months respectively – from the initially selected date. This provided the distribution pattern of active returns of thirty permutations of portfolio formation rules and intervals.

Rousseau and Van Rensburg found that the bottom P/E portfolios (comparable to value portfolios in this thesis) consistently outperform the top portfolios (comparable to growth portfolios in this thesis) over all time periods, and that this superior performance becomes noticeably higher for intervals longer than twelve

months. The latter finding confirms their hypothesis, namely that holding on to value stocks for a longer period represents the better investment strategy.

3.10.1.8 Mutooni and Muller

Mutooni and Muller (2007) tried to determine if the value premium occurs independently of the company size effect. They ranked shares listed in the industrial sector of the JSE based on market cap and price-to-book (P/B). For their sample, they used all shares listed and trading in the industrial sector of the JSE for the twenty years between 1986 and 2006, thus excluding mining, bank and small company shares. Companies whose market value cumulatively made up the bottom 10% of the total market capitalization, constituted the small cap portfolio. The next 10% of total capitalization constituted the mid cap portfolio, while companies of the top 80% constituted the large cap portfolio.

Within each of the categories above, the authors formed two portfolios: the top 50% of companies with higher P/B ratios were designated as the growth portfolio and the bottom 50% with lower P/B ratios as the value portfolio. Returns from value and growth companies were compared and, in order to ensure that size did not influence the outcome, results were presented separately for small value and small growth stocks, and for large value and large growth stocks. Small cap value companies generally outperformed small cap growth companies. The trend was reversed twice: once between 1992 and 1994, when growth portfolios only just outperformed value portfolios; and again between 1998 and 2002, when small growth companies outperformed small value companies.

Large cap value companies performed better than large cap growth companies between 1986 and 1991, when a shift from value to growth occurred. Growth companies performed better until December 1992, when value companies returned to favor and performed better until 1994. Between 1994 and 1997 growth companies performed best, but between 1997 and 2001 value companies again took the lead. Despite the fluctuations, their overall conclusion was that

over the twenty years of their study, value stock outperformed growth stock across the size spectrum.

3.10.1.9 Basiewicz and Auret

In a recently published test for the value premium in South Africa, Basiewicz and Auret (2009) used a large sample of original data to test for the value premium on the JSE. They further investigated if the value premium would survive adjustments for trading costs and thin trading.

Their research established that book-to-market-value (BV/MV) delivered the strongest basis for predicting returns, and earnings to price (EPS) the weakest. Basiewicz and Auret found the value premium to be lower than what earlier research in South Africa had established³⁹. It would be interesting to compare their findings with this thesis, but Basiewicz and Auret's results are presented in monthly format only. This makes it difficult to compare with this thesis, where findings are presented in annual format.

Despite differences in how information was processed and presented, the findings of this research by Basiewicz and Auret confirm the results produced by this thesis, namely that irrespective of the value measure used, the value premium undoubtedly persists. Their findings also show that the premium persists after allowing for trading costs. This suggests that the premium cannot be explained by a market imperfection such as trading costs.

3.10.2 Company and sample size effect on the JSE

Since Banz's (1981) influential study in which he found that firms with large market capitalization had lower risk-adjusted returns than small market capitalization firms, the "small cap effect", as it became known, had been tested with JSE data numerous times.

³⁹ These results were published after research investigations for this thesis had been in progress for two years.

The first significant study in this regard was done by De Villiers, Lowing, Petit and Affleck-Graves (1986). They tested results for small and large cap portfolios over a five year period between 1973 and 1982, and found no conclusive evidence of a size effect on the JSE. Instead, they found that firms with smaller market capitalization significantly under-performed in comparison to larger firms. The researchers concluded that there seemed to be a large-firm effect on the JSE. This study was followed up by one from Bradfield, Barr and Affleck-Graves (1988) which confirmed this finding.

Page and Palmer (1991) delivered the next influential paper on this matter. They also used ten years' of worth of data between 1978 and 1988. For each firm in the data sample a market value and E/P⁴⁰ ratio were calculated for each year. They used the within-group method of portfolio construction popularized by researchers Jaffe, Keim and Westerfield (1989:137). No evidence was found of the "small cap effect", but their findings contradicted the results of De Villiers et al. (1986) in that large companies did not perform better either – company size just did not seem to matter. Subsequently Page (1996) extended the analysis by including five-factor models of asset pricing. He found that the E/P effect persisted over and across different benchmarks, but again found no evidence of a size effect.

All studies on the existence of the company size effect in South Africa until 2002 (and there were at least four major studies done) found no such effect. However, in 2003 Van Rensburg and Robertson (2003b) found that of the twenty-four attributes used to explain stock returns, size (t-stat = -2.112) and price-to-earnings (t-stat = -2.481) were the two variables with more explanatory power than any other. Furthermore, they found that one of the primary reasons for the non-identification of a size effect in the earlier South African research was the

⁴⁰ Some research defines this variable as earnings-to-price (E/P) while others define it as price-to-earnings (P/E). This does not change the fundamental thrust of their analysis. It merely reverses the relative positioning of winners and losers on the basis of this ratio.

small sample sizes used in the work. (2003(b): 8)

The implication of the above is that size does matter: both in terms of company size and sample size. Company size, which for the longest time was considered irrelevant on the JSE, showed its relevance in other respects such as mean reversal. In order to address these issues, this thesis used a large sample size and also size-adjusted all results.

3.10.3 Mean reversal

Page and Way (1992) did the first study on this phenomenon and found evidence of mean reversal, which they referred to as over-reaction, because of the behavioral bias that underlies it. Using the De Bondt and Thaler (1985) method (as described in paragraph 3.6), they examined returns for 204 shares between 1974 and 1989. For monthly returns, they found that past “loser” portfolios on average outperformed past “winners” by almost 15% over the three year period of the study. They only included companies that were still trading at the end of their study period, and the argument that their study suffered from survivor bias led Cubbins, Eiden, Firer and Gilbert (2006) to repeat the study, but they corrected this perceived research design weakness.

Cubbins et al. (2006) continued to follow the De Bondt and Thaler methodology closely by constructing winner/loser portfolios. They used month-end share prices from all shares on the All Share Index (ALSI) between October 1983 and December 2005. Their sample included 1,320 shares still trading and 841 delisted ones by the end of the period under study. The two portfolios they constructed consisted of the top thirty-five and bottom thirty-five shares as rated by their P/E ratio at portfolio formation time. Shares were weighted equally, and portfolio returns were tracked in the five years after portfolio formation, and then compared to the ALSI performance. The results were that, on average, high P/E portfolios under-performed compared to ALSI, while low P/E portfolios outperformed it. In fact, they found that over the sixty month period under

review, the loser portfolios outperformed the winner portfolios by 11% per year.

By their own acknowledgement, the Cubbins et al. study (2006) was not adjusted for risk or size, which is what Bailey and Gilbert (2007) did a year later. They took the effect of liquidity on mean reversal into consideration, and found that liquidity does play a large role in explaining why abnormal returns persist in the bottom end (low P/E) of the market. For large investors (portfolios size > R100 million) these shares are simply too small (that is illiquid) to invest in. When they eliminated illiquid companies from the analysis, the abnormal returns due to mean reversal almost disappeared. The authors suggested that a possible explanation for this observation is that there may be a correlation between liquidity and company size (i.e. market capitalization).⁴¹

This observation eliminated any remaining doubt over the importance of size-adjustment, and rendered it absolutely necessary to adjust results for company size in this study.

3.10.4 Earnings per share (EPS)

EPS and its power to predict or explain returns on the JSE had never been disputed. In fact, it is probably the most robust finding on the JSE. Page and Palmer (1991) were the first to find strong evidence of an E/P effect. They concluded that the E/P effect existed on the JSE for the period 1978 to 1988, and found that investors could have earned 6.5% more per year by holding high rather than low E/P securities.

Subsequently Page (1996) extended the analysis, and examined whether the size and E/P effects persisted in multi-factor models. He found that the E/P effect indeed persists over and across different benchmarks. Page's study found a strong E/P ratio over a one-year as well as over a five-year holding period. As

⁴¹ In a later study Basiewicz and Auret (2009) found an unexpectedly low correlation between company size and trading volume (liquidity). Their explanation for this is that it is likely that the relationship between size and liquidity is non-linear.

referred to previously, Van Rensburg and Robertson (2003b) found that the optimal combination of variables for explaining average stock return were company size and price-to-earnings.

All these South African studies found strong evidence of EPS as predictor of return, but never made the distinction between EPS ratios that include headline and EPS ratios that exclude bottom-line extraordinary items. This thesis found different results for portfolios based on headline and bottom-line EPS. Although both ways of doing portfolio formation prove to be profitable, confirm the existence of the value premium, and compare favorably with international comparisons, this distinction does however raise the question whether limited data availability on bottom-line EPS (only available since 1992) may influence results in the same way in which limited sample size influenced results for the small cap effect. Page and Palmer (1991) suggest that EPS research designs could be sensitive to biases (1991: 65).

Both headline and bottom-line EPS values were used to test for extrapolation in this thesis, and the findings point in the same direction. This strengthens the robustness of the hypothesis that extrapolation is the most likely explanation for the value premium observation.

3.10.5 Summary implications of empirical findings in South Africa

Despite the different methods used to test for the value premium in South Africa, most of them confirmed its existence, with the exception of Robins et al. (1999) and Graham and Uliana (2001), who found no outright supporting evidence. The fact that the value premium had not been established unanimously in all studies is the implicit reason for investigating whether the research methods used and the size and inclusiveness of data sets may be the reason for the lack of unanimity about the value premium in South Africa.

None of the previous studies which tested for the value premium in South Africa

used the methods employed in this thesis (as described in chapter 4). In this regard, this thesis attempts to perform a substantially more thorough investigation of the value premium in South Africa's financial market. Firstly, it uses a much larger number of companies, and also includes all sectors on the JSE. Secondly, the timeframe for the analysis (1972 to 2001) is meaningfully longer than that used in any of the preceding studies. None of the previous studies had the benefit of twenty-nine years' worth of share price and accounting data. Thirdly, due consideration is given in the various analyses to the possible impact of company size, as well as to extraordinary items.

South African studies so far have also not attempted to provide any underlying explanation for the existence of the value premium. In order to contribute to the important effect which this phenomenon may have on investment strategies, if properly taken into account, this thesis attempts thoroughly to test one of the basic implications of behavioral finance for this purpose. The relevance of such an attempt is underscored by a recent award-winning study in the USA by Ooi, Webb and Zhou (2007). This research on the performance and pricing of real estate investment trust stocks found that a "contrarian" investment strategy would pay handsomely in this market. This strategy is contrary to the received opinion which suggests that there is little scope for earning abnormal returns – both in domestic US and international publicly traded real estate markets. The researchers explicitly identified the existence of the value premium in this market in the USA, and then continued to explore extrapolation as the most convincing explanation for it. They came to essentially the same findings as those presented in this thesis.

CHAPTER FOUR

RESEARCH METHODS

Chapter 4 describes the empirical methods used to test for the existence of the value premium in South Africa by using one- and two-dimensional tests. Once it is established that the value premium does indeed exist, it also sets out to examine extrapolation as a possible explanation for the existence of the value premium.

4.1 Methods

4.1.1 One-dimensional tests

One dimensional tests use one measure of value⁴² at a time. All companies which had the necessary information available, and which were trading on the Johannesburg Stock Exchange (JSE) between 1972 and 2001, were classified and listed, based on one-dimensional value classifications such as book-value-to-market-value (BV/MV), cash flow-to-price ratio (CF/P), earnings-to-price ratio (EPS) and past sales growth (PSG). After classification, all companies were grouped into five portfolios (quintiles)⁴³. Portfolios were adjusted annually, resulting in twenty-nine years of portfolio formations between 1972 and 2001.⁴⁴

For each company, in each portfolio, share price return was calculated annually for up to five years after portfolio formation. After this calculation, the average for all companies in each portfolio was recorded as the portfolio return for that year.

⁴² "Value" in this context is defined as book value to price or cash flow to price or EPS to price or past sales growth.

⁴³ Using USA data, Lakonishok, Shleifer and Vishny (1994) used ten (i.e. decile) portfolios. So did Gregory, Harris and Michou (2001) with data from the London Stock Exchange. Doeswijk (1997) used five (i.e. quintile) portfolios for his study of Dutch data because only 303 stocks traded on the Amsterdam Stock Exchange, too few to justify more portfolios. There were 542 stocks listed on the JSE in 2001, which was considered too few to justify more than quintile portfolios.

⁴⁴ Data availability varies, depending on which value classification was used for portfolio formation. For BV/MV, EPS and sales growth, data availability dates back to 1972. For cash flow however, data availability only dates back to 1987, resulting in fourteen years of portfolio formation.

The portfolio return is the arithmetic average of equally weighted shares that form each portfolio. The five portfolio returns were then compared to ascertain which of them had the highest returns. If it could be demonstrated that those with the highest value constituted the value portfolio, this would be a positive test for the value premium. In other words: it would be correct to conclude that the value premium was present if the value portfolio (portfolio 1), on average, outperformed the growth portfolio (portfolio 5).

4.1.2 Size-adjustment

The inverse relationship between a company's size and return on its shares is well known and dates back to 1981, when Banz found that the average return on small cap stocks was higher than expected, based on their beta estimates alone. The question is whether the value premium is a new observation or just another incarnation of the small cap premium phenomenon. To take account of this, results of both one-dimensional and two-dimensional tests (see below in 4.1.3) were size-adjusted. The "size-adjusted returns" reported at the bottom of each table is the difference between an average return on the original portfolio and an average return on the size-adjusted benchmark portfolio.

In order to draw a decisive conclusion that the value premium is indeed a new observation, test results should confirm that the value portfolio (portfolio 1) continues to outperform the growth portfolio (portfolio 5) even after size-adjustment.

4.1.3 Two-dimensional tests

The third element of this study used two-dimensional tests to check if the value premium persists when portfolio formation is based on two variables instead of one. After establishing that it does indeed persist, the study then set out to determine whether the value premium is more pronounced if a portfolio is formed

in this way. The two-dimensional value classifications used for portfolio formation were PSG and BV/MV and (independently) PSG and CF/P.

In order to confirm that the value premium persists when two variables are used for portfolio formation, companies that have both poor past performance (as measured by past PSG) and poor expected future performance (as measured by ratios such as BV/MV or CF/P) should perform better in terms of share price return. In other words, in order to substantiate the existence of the value premium, the value portfolio (portfolio A1) should outperform the growth portfolio (portfolio C3) consistently.

To ascertain whether the value premium is more pronounced if portfolio formation is undertaken in this way, the results of the one- and two-dimensional tests have to be compared. If the spread between the extreme value and growth portfolios in the two-dimensional case exceeds the spread in the one-dimensional case, it can be concluded that the value premium is more pronounced, and vice versa.

4.1.4 Extrapolation

In order to test for extrapolation as a possible explanation for the value premium, the following variables were tracked for the extreme value and extreme growth portfolios:

- Past performance (i.e. in the five years *before* portfolio formation) of growth in sales, earnings and cash flow.
- Future performance (i.e. in the five years *after* portfolio formation) of growth in sales, earnings and cash flow.
- Ratios such as E/P (earnings/market value of equity) and C/P (cash flow/market value of equity) at portfolio formation. These ratios give an indication of investors' expectations of what will happen in the future.

- Share price returns for the two portfolios in the five years *before* portfolio formation as well as in the five years *after* portfolio formation.

To calculate annual growth⁴⁵ for each portfolio, the compounded growth values for each company in the portfolio were added up and divided by the number of companies in that portfolio. The result is the portfolio's average growth rate for that year.

In order to establish whether extrapolation is a satisfactory explanation for the value premium, results must show that value companies have grown (more) slowly in the five years before portfolio and have traded at higher ratios. This reflects investors' expectations that slow past growth trends will continue in future. For growth companies, on the other hand, results must show the opposite trend.

4.2 Portfolio formation

4.2.1 One-dimensional tests

Portfolio formation was based on the following ratios, each describing a value measure:

- BV/MV ratio to differentiate between value and growth companies: Book value of equity/market value.⁴⁶
- CF/P ratio: Cash-flow-from operations/market value.
- EPS/P: Earnings per share/market value.
- PSG: Arithmetic average growth in sales in the three years before portfolio formation.

⁴⁵ In each case "growth" refers to compounded annual growth. See appendix 4 for a detailed description of the calculation method.

⁴⁶ Market value always refers to number of shares outstanding multiplied by share price.

Companies were sorted from the highest to the lowest — based on the value of the ratio — after which five equally-sized portfolios were formed, with portfolio 1 constituting the high value companies, and portfolio 5 constituting the growth companies.

If a stock was delisted during a particular year, it was retained in the portfolio for the remainder of that year. At the end of that year the portfolio was rebalanced and equal weights were reassigned to companies that remained in the portfolio for the remainder of the five years for which returns were tracked.

In line with Lakonishok, Shleifer and Vishny (1994 — henceforth referred to as LSV) only stocks with positive cash flow and earning-to-price ratios were included.

Including only companies with positive cash flow and earning-to-price ratios is a limitation of this method, because it might create the impression that this analysis is only valid for companies doing relatively well (i.e. with positive cash flow and earnings). The reason for excluding companies with negative earnings and cash flow is because the test for extrapolation, as potential explanation for the value premium, requires calculation of growth in earnings and cash flow and negative values are too hard to interpret. The size of the potential bias in our sample was not large. In the 29 years under study a total of less than 600 companies had to be excluded because of this limitation.

4.2.2 Size-adjustment

Returns were size-adjusted by following the method specified by LSV (1994). The market capitalization⁴⁷ was determined for all companies at portfolio formation date.⁴⁸ Based on market capitalization values, all companies were

⁴⁷ Market capitalization is the number of shares outstanding at portfolio formation multiplied by share price.

⁴⁸ This study treats “portfolio formation date” differently from most international studies. Doeswijk (1997) used June; LSV (1994) used April, Gregory, Harris and Michou (2001) used July as portfolio formation month. The reason given by these researchers for their choice of portfolio formation month is to allow enough time, after year-end results are reported, for the market to process that information. The data available for this study provided information (accounting and share

sorted into five “size-based” portfolios (small to large). A size benchmark portfolio was constructed, by replacing each company’s stock price return in the original portfolios (based on a value measure such as BV/MV) by average return of the size-based portfolios of which that company forms part. The difference between the average return on the original portfolio and the average return on the size based portfolio is the size-adjusted return.

4.2.3 Two-dimensional tests

Stocks were sorted into three portfolios, based on past performance and proxied by PSG: the bottom 30% of companies with the lowest PSG formed one portfolio, the middle 40% of companies formed the second portfolio, and the top 30% of companies with the highest PSG formed the third portfolio.

Within each of these three PSG portfolios, stocks were re-sorted into three portfolios, based on expected future performance, and proxied by BV/MV. This resulted in nine portfolios. As with the one-way classification, for each of the nine two-way portfolios annual returns were computed in each of the subsequent five year periods. The same procedure was used to carry out the second two-dimensional test, based on a two-way classification of PSG and CF/P.

In the two-dimensional tests, value portfolios consisted of portfolios with the lowest PSG portfolio and lowest expected performance (measured by highest BV/MV or CF/P portfolios). The growth portfolios consisted of the highest PSG and highest expected performance (measured as lowest BV/MV or CF/P portfolios).

4.2.4 Portfolio formation: Extrapolation

To test for extrapolation, BV/MV was used for portfolio formation. Five years of pre-portfolio formation data was necessary to test for extrapolation, which is why

prices) at each company’s financial year-end, and that was used for portfolio formation, even if each company’s financial year-end did not fall in the same month.

portfolio formation started in 1977 even though the data available dates back 1972. Three portfolios (top 30%, middle 40% and bottom 30%) were formed annually, with the top 30% making up the value portfolio and the bottom 30% the growth portfolio. For each of these two extreme portfolios the variables described in paragraph 4.1.4 were tracked and analyzed.

4.3 Returns

Share price returns are presented as annual returns, as well as holding returns, which means that the same portfolios are held for three or five years after formation.

4.3.1 Annual returns

Annual returns are recorded yearly after portfolio formation. Results are year-on-year returns, and share price returns are calculated as follows:

- First year (year_1) after portfolio formation: $(\text{Share price in year}_1 - \text{share price at portfolio formation}) / \text{Share price at portfolio formation}$
- Second year (year_2) after portfolio formation: $(\text{Share price in year}_2 - \text{share price in year}_1) / \text{share price in year}_1$
- Third year (year_3) after portfolio formation: $(\text{Share price in year}_3 - \text{share price in year}_2) / \text{share price in year}_2$
- Fourth year (year_4) after portfolio formation: $(\text{Share price in year}_4 - \text{share price in year}_3) / \text{share price in year}_3$
- Fifth year (year_5) after portfolio formation: $(\text{Share price in year}_5 - \text{share price in year}_4) / \text{share price in year}_4$

4.3.2 Holding returns

Holding returns refer to share price returns three and five years respectively

after portfolio formation, representing a buy-and-hold investment strategy, where investors hold the same portfolios for three or five years. Portfolio formation still takes place annually (in the same way as for annually adjusted return), but each portfolio is carried for three or five years, as opposed to one year. These share price returns are calculated as follows:

- Three years after portfolio formation: $(\text{Share price in year}_3 - \text{share price at portfolio formation}) / \text{share price at portfolio formation}$
- Five years after portfolio formation: $(\text{Share price in year}_5 - \text{share price at portfolio formation}) / \text{share price at portfolio formation}$

Share price refers to the “weighted average price per share for the financial year”, which is the monetary value of all shares traded during a specific year, divided by the number of shares traded during that year. This share price value was chosen on the basis of data availability and data reliability. See appendix 2 for a description of the methodology applied to decide which share price value to choose among the various available share price values.

4.4 Statistical testing

Results from the one- and two-dimensional tests were assessed for statistical significance. A regression analysis indicates whether there is a significant relationship between the share price return and each value measure (BV/MV or CF/P or EPS or PSG). Each company's share price return (dependent variable) was regressed against its value ratio (independent variable). The statistical results indicate which value measure is a meaningful variable on which to base portfolio formation for capturing the value premium.

A cross-section regression analysis was not done as part of the study, because the purpose was not to establish a style-based model for expected share price returns. It was therefore seen as unnecessary to decompose the correlation between the different value measures. In addition, recent and substantial South

African studies found little correlation between the different value-growth indicators (Basiewicz and Auret, 2009: 23).

4.5 Data

The data for this study was made available by McGregor BFA from Johannesburg, South Africa. McGregor is an eminent provider of stock market and accounting data to companies and researchers. McGregor has standardized financial statements dating back to 1972, and has included information for all companies representing every single industry trading on the JSE since then. The data also encompasses information of companies which have delisted from the exchange, thereby preventing this study's findings from suffering from survival bias (as discussed in section 2.8.2.1). Data items used to conduct this study were selected from McGregor's standardized manual, which explains the meaning of each data item, as well as how it was standardized from each company's financial statements. The selected data items were made available by McGregor in Microsoft Excel spreadsheet format.

Most other South African studies include only companies from a specific industry – such as industrial shares – in their analyses. This study had the benefit of analyzing data from *all* industries, including industrial, financial and mining companies. Also, the data stretched over a twenty-nine year period, which gives this analysis and its findings substance.

CHAPTER FIVE

RESEARCH FINDINGS

Chapter 5 presents the empirical findings which resulted from performing the empirical tests described in chapter 4. The results provided in chapter 5 are essentially summaries of extensive calculations performed on the data. These calculations are described in appendices 1 to 4. Sections 5.1 to 5.5 deal with the range of findings, based on various procedures applied to test for the existence of the value premium in the South Africa context. Section 5.6 deals with findings of tests which explored extrapolation as a plausible explanation for the value premium.

5.1 Findings for one-dimensional tests: annual returns

Tables 1 to 4 show results when portfolios were based on book-value-to-market-value (BV/MV in table 1), cash-flow-to-price (CF/P in table 2), earnings-per-share (EPS in tables 3A and 3B) and past sales growth (PSG in table 4), respectively. Results reflect the average returns of the quintile portfolios over the entire period for which data is available.⁴⁹

5.1.1 BV/MV: one to five year annual returns

Table 1 shows that the first-quintile BV/MV stocks (value stocks) had an average annual return of 30%⁵⁰, whereas the fifth-quintile BV/MV stocks (growth stocks) showed an average annual return of only 18%. After size-adjusting the returns, the first-quintile portfolios continued to outperform the fifth-quintile portfolios by 9% per annum (28% average return for portfolio 1 as opposed to 19% average return for portfolio 5).

⁴⁹ Tables 1 to 4 were put together by first calculating the share price return for each company in each portfolio annually, followed by adding up all individual company returns and dividing the sum by the number of companies in that portfolio. This then gives the portfolio return for that year. These annual portfolio returns were then added up and divided by the number of portfolios (29) to show the average share price return of each quintile portfolio in each year. For a more detailed description on how tables 1 to 4 were compiled refer to appendix 1.

⁵⁰ Results in all tables are presented to the second decimal. In the text, references to results are given as rounded values with no decimals included, except where the numbers are smaller than 1 (one) or where ratios are discussed (e.g. textual references to tables 21 and 26).

⁵¹Table 1: BV/MV annual returns

	Value	Values in %				Growth
Years	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1yr	39.20	17.57	11.10	11.80	13.33	
2yr	29.06	16.99	12.21	15.27	21.91	
3yr	27.29	19.40	17.94	16.87	17.28	
4yr	29.39	23.07	20.59	17.75	19.95	
5yr	25.42	25.30	24.84	16.98	18.65	
Average	30.07	20.46	17.34	15.73	18.23	
Size-adjusted returns	28.26	21.04	18.58	16.52	19.20	

5.1.2 Cash-flow-to-price (CF/P): one to five year annual returns

Table 2 repeats the calculations underlying the construction of table 1, but used CF/P instead of BV/MV for portfolio formation.

Table 2: CF/P annual returns

	Value	Values in %				Growth
Years	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1yr	42.71	19.40	7.30	3.01	1.61	
2yr	31.65	19.05	10.64	6.13	5.24	
3yr	23.33	16.46	18.94	9.26	6.05	
4yr	27.27	19.86	17.69	19.37	15.54	
5yr	23.48	18.80	12.74	19.58	23.24	
Average	29.69	18.72	13.46	11.47	10.34	
Size-adjusted returns	4.49	1.06	- 0.92	- 2.16	- 5.04	

There is a 20% difference between the 30% average return generated by portfolio 1 and the 10% generated by portfolio 5. After adjusting for size, first-quintile portfolios continued to outperform the fifth-quintile portfolios by 9% per annum (4% average return for portfolio 1 as opposed to -5% average returns for portfolio 5).⁵²

⁵¹ Results from table 1 and 2 have been accepted for publication in *The Journal of Finance and Accountancy*: "Limited arbitrage: the South African evidence"

⁵² It is an interesting coincidence that in both tables 1 and 2, the size-adjusted returns difference between portfolios 1 and 5 is between 9% and 10% per annum.

5.1.3 EPS: one to five year annual returns

Tables 3A and 3B repeat the calculations used to compile tables 1 and 2, but use EPS for portfolio formation. The value premium is less pronounced when EPS is used for portfolio formation. When headline EPS (which includes “extraordinary items”) was used (table 3A), the value portfolio (portfolio 1) outperformed the growth portfolio (portfolio 5), but with a much smaller margin. After adjusting for size, the value premium disappeared altogether.

Table 3A: Headline EPS (including extraordinary items) annual returns

	Value	Values in %				Growth
Years	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1	33.97	18.96	16.65	12.95		13.26
2	36.34	28.60	32.11	25.04		34.11
3	23.41	17.72	19.14	16.76		21.38
4	22.11	21.95	23.55	20.51		26.00
5	20.88	26.50	22.39	18.74		22.57
Average	27.34	22.75	22.77	18.80		23.46
Size-adjusted returns	- 1.19	- 1.29	2.59	- 0.35		3.55

In table 3A the first quintile (value) portfolio generated an average annual return of 27%, compared to the 23% generated by the fifth quintile (growth) portfolio. After adjusting for size, portfolio 5 (growth) produced 4% average annual return compared to -1% return generated by portfolio 1 (value).

When bottom-line earnings (which exclude extraordinary items) were used (table 3B) the value premium held strongly, with 16% generated by portfolio 1 and 4% by portfolio 5. After adjusting for size, portfolio 1 generated 15% average return compared to 7% generated by portfolio 5, for a difference of 8% per annum.

Table 3B
Bottom-line EPS (excluding extraordinary items) annual returns

	Value	Values in %				Growth
Years	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1	24.09	7.35	0.19	0.70		- 7.70
2	6.86	0.58	- 2.24	- 5.47		- 8.91
3	7.98	1.86	-0.87	2.17		- 1.55
4	20.33	11.30	8.40	10.44		18.04
5	21.35	24.53	16.02	13.13		21.03
Average	16.12	9.12	4.29	4.19		4.17
Size-adjusted Average	14.53	9.48	5.12	4.89		6.55

5.1.4 Past sales growth (PSG): one to five year annual returns

Table 4 repeats the calculations underlying the construction of tables 1, 2 and 3, but with PSG as basis for portfolio formation.

Table 4: PSG annual returns

	Value	Values in %				Growth
Years	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1	27.77	18.70	17.11	15.29		20.68
2	21.43	21.79	20.11	18.52		17.55
3	21.40	22.05	22.28	21.66		20.59
4	21.44	22.36	23.63	20.48		23.35
5	19.36	20.30	22.59	21.95		25.85
Average	22.28	21.04	21.14	19.58		21.60
Size-adjusted returns	1.67	3.49	3.92	1.95		3.67

The difference in returns generated by portfolios 1 and 5 is almost negligible. On average, over five post-formation years, first quintile (value) portfolios generated an annual return of 22.28%, compared to the 21.60% generated by fifth quintile (growth)

portfolios. This represents a difference of less than 1%. After adjusting for size, the value premium disappeared completely, with growth portfolios (portfolio 5) outperforming value portfolios (portfolio 1) by 2% per annum (4% as opposed to 2%). When the extreme growth portfolio (portfolio 5) outperforms the extreme value portfolio (portfolio 1), it is called pattern reversal.

5.2 Findings for one-dimensional tests: holding returns

In tables 5 and 6, BV/MV is used for portfolio formation, and portfolios are carried for three and five years respectively. In tables 7 and 8 CF/P is used for portfolio formation, and portfolios are carried for three and five years respectively.

5.2.1 BV/MV: 3-year holding return

Table 5: BV/MV 3-year holding return

	Value	Values in %				Growth
<i>Portfolio formed in...</i>	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1972	13.25	- 2.62	- 14.86	13.92	35.18	
1973	95.29	- 21.75	- 29.13	- 25.65	6.47	
1974	122.71	- 4.72	- 35.11	- 19.83	- 31.02	
1975	26.97	8.67	- 14.75	9.29	- 3.57	
1976	58.57	22.56	30.81	50.76	41.96	
1977	200.40	132.55	128.06	179.76	117.57	
1978	295.39	275.76	173.75	212.15	133.41	
1979	201.38	204.12	110.06	109.63	69.38	
1980	117.26	90.81	57.60	63.64	6.71	
1981	147.89	58.02	26.91	53.34	16.61	
1982	116.05	59.99	0.4488	34.54	54.22	
1983	92.57	47.64	43.74	77.48	8.350	
1984	122.16	64.94	90.40	87.49	114.96	
1985	186.17	90.99	107.11	129.67	133.02	
1986	196.29	61.32	57.40	56.89	95.04	
1987	25.30	38.60	36.23	24.11	- 10.25	
1988	49.30	48.01	13.41	18.60	- 24.13	
1989	48.15	67.05	41.73	80.71	18.05	
1990	28.81	17.34	52.73	47.92	38.28	
1991	141.69	37.54	108.83	96.72	72.00	
1992	211.76	130.19	151.81	48.24	160.85	
1993	347.53	282.05	225.66	87.60	96.92	
1994	269.21	222.56	127.57	7.863	50.45	
1995	193.40	100.99	60.29	71.48	91.04	
1996	51.94	36.09	16.05	17.37	44.53	
1997	0.13	- 24.60	41.11	- 4.50	16.59	
1998	52.73	- 29.49	- 4.43	- 6.21	- 9.36	
1999	83.63	74.66	- 7.98	-24.05	- 13.99	
2000	112.56	26.86	9.61	0.75	8.37	
2001	201.20	77.28	76.78	40.40	97.54	
Average	126.99	73.11	57.54	53.69	50.34	
Size-adjusted returns	26.59	-5.08	-0.0793	-0.0560	- 11.60	

Portfolios based on BV/MV

Findings:

Average return: Portfolio 1 (value) outperforms portfolio 5 (growth) by 77% over 3 years (127% return on portfolio 1 versus 50% on portfolio 5).

Size-adjusted returns: Portfolio 1 continues to outperform portfolio 5 by 39% over 3 years (27% returns on portfolio 1 versus -12% on portfolio 5).

Statistical significance:

t-stat = 3.7701*

p-value = 0.000*

*Statistically significant at 0.05 level of significance.

5.2.2 BV/MV: 5-year holding return

Table 6⁵³: BV/MV 5-year holding return

	Value	Values in %				Growth
<i>Portfolio formed in...</i>	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1972	22.04	- 14.18	- 16 70	0.25	50.88	
1973	9.643	- 20.61	- 25 09	- 27 49	7.33	
1974	227.71	33.32	- 9 40	8 60	4.75	
1975	170.70	125.83	99 59	116 39	123.13	
1976	259.20	188.66	216 61	161 23	179.98	
1977	358.62	283.19	246.83	230 89	67.68	
1978	442.40	349.91	243.59	234 27	164.89	
1979	582.56	356.02	218.62	179 36	165.80	
1980	249.06	157.54	110.37	102 48	27.23	
1981	251.16	107.74	43.77	105 66	61.47	
1982	341.63	214.97	163.31	167 74	188.75	
1983	134.63	297.85	157.84	144 63	137.09	
1984	149.20	98.61	85.65	124 19	109.41	
1985	198.38	124.65	162.60	114 76	253.94	
1986	150.75	80.70	116.72	117 26	139.65	
1987	34.40	99.32	80.83	88 39	11.75	
1988	61.90	74.52	31.77	81 55	2.56	
1989	100.42	212.34	80.28	145 83	59.49	
1990	166.48	178.93	189.27	96 85	146.90	
1991	436.09	213.77	270.53	193 39	187.88	
1992	679.96	263.70	275.92	129 23	289.72	
1993	501.89	401.97	205.33	154 51	176.71	
1994	255.43	197.91	80.86	90 57	99.92	
1995	16.18	59.80	25.75	44 51	125.34	
1996	31.49	0.66	14.61	15 09	75.68	
1997	88.21	15.27	9.10	19 46	34.39	
1998	149.72	- 4.08	56.74	- 5.64	.075	
1999	240.77	145.18	38.28	7 54	11.62	
2000	429.79	137.07	73.48	17 79	76.98	
2001	n/a	n/a	n/a	n/a	n/a	
<i>Average</i>	235.42	151.05	111.97	98.60	102.82	
<i>Size-adjusted</i>	43 97	- 4.19	- 21.67	- 14.09	- 13.15	

Portfolios based
on BV/MV

Findings:

Average return:

Portfolio 1
(value)
outperforms
portfolio 5
(growth) by
132% over 5
years (235%
over 5 years for
portfolio 1 versus
103% for
portfolio 5).

Size-adjusted
returns: Portfolio
1 continues to
outperform
portfolio 5 by
57% over 5
years (44% on
portfolio 1 versus
-13% on portfolio
5).

Statistical significance:

t-stat = 2.6187*
p-value = 0.008*

*Statistically significant at
0.05 level of significance.

⁵³ No portfolios are available for 2001, because five years' worth of post-portfolio formation data was necessary for the calculation of the table and data availability in 2006 was too thin.

5.2.3 CF/P: 3-year holding return

Table 7: CF/P 3-year holding return

	High Value	Values in %				Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1987	63.83	28.44	42.96	38.20	- 6.05	
1988	50.44	55.58	43.61	- 18.36	- 13.46	
1989	37.73	57.15	57.94	58.10	25.30	
1990	32.83	32.33	49.08	35.81	1.10	
1991	125.46	82.42	107.34	46.80	36.94	
1992	263.95	124.83	100.64	88.09	71.36	
1993	553.41	277.41	140.42	77.87	50.22	
1994	358.84	204.46	95.52	63.32	44.71	
1995	223.12	82.19	63.11	76.70	56.51	
1996	112.48	3.63	- 11.61	2.56	48.31	
1997	6.03	31.52	- 9.42	3.21	0.34	
1998	- 8.34	- 2.59	- 17.47	14.48	- 17.75	
1999	81.48	76.11	5.96	- 33.98	4.32	
2000	151.24	31.93	- 4.74	- 20.39	- 8.92	
Average	146.61	77.53	47.38	30.89	20.92	
Size-adjusted returns	32.27	0.61	- 6.66	- 14.16	- 25.02	

Data availability for CF/P only dates back to 1987, not to 1972 as is the case with BV/MV, EPS and PSG. Despite the limited data availability, the value premium holds strongly.

Portfolio based on CF/P

Findings:

Average return: Portfolio 1 (value) outperforms portfolio 5 (growth) by 126% over 3 years (147% return on portfolio 1 compared to 21% on portfolio 5).

Size-adjusted returns: Portfolio 1 continues to outperform portfolio 5 by 57% over 3 years (32% return on portfolio 1 compared to -25% on portfolio 5).

Statistical significance:

t-stat = 6.0863*

p-value = 0.000*

*Statistically significant at 0.05 level of significance.

5.2.4 CF/P: 5-year holding return

Table 8: CF/P 5-year holding return

	High Value	Values in %				Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1987	118.48	56.39	81.85	102.50		14.32
1988	30.16	84.48	70.97	31.07		11.47
1989	124.00	136.44	154.85	97.25		85.33
1990	267.19	122.96	119.60	97.63		68.85
1991	458.96	242.95	188.40	123.74		80.33
1992	786.84	219.28	222.22	245.17		142.21
1993	690.31	415.94	234.37	228.50		75.49
1994	287.59	265.80	117.36	0.34		31.51
1995	38.18	65.25	14.36	77.68		103.37
1996	36.72	- 2.79	0.64	- 9.57		83.99
1997	87.28	- 3.10	29.79	22.81		11.37
1998	72.93	55.68	4.60	51.06		-20.50
1999	228.41	178.28	80.08	- 14.07		- 2.73
2000	429.82	144.75	75.89	41.35		- 17.41
Average	261.21	141.59	99.64	78.25		47.69
Size-adjusted returns	54.11	- 3.17	- 4.62	- 15.59		- 50.63

Portfolios based on CF/P

Findings:

Average returns:

Portfolio 1 (value) outperforms portfolio 5 (growth) by 213% over 5 years (261% over 5 years for portfolio 1 versus 48% for portfolio 5).

Size-adjusted returns:

Portfolio 1 continues to outperform portfolio 5 by 105% over 5 years (54% on portfolio 1 compared to -51% on portfolio 5).

Statistical significance:

t-stat = 6.4764*

p-value=0.000*

*Statistically significant at 0.05 level of significance.

5.2.5 EPS: 3-year holding return

Table 9: EPS 3-year holding return

	Value	Values in %			Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5
1975	- 12.06	11.81	8.77	9.49	5.58
1976	19.07	54.47	41.20	35.96	55.42
1977	126.20	189.67	140.31	126.45	178.58
1978	243.86	204.08	226.84	211.15	202.72
1979	163.60	112.71	136.73	142.58	102.46
1980	104.01	51.13	55.89	92.57	41.42
1981	107.66	42.38	45.71	69.57	53.45
1982	85.78	50.44	44.81	52.73	56.02
1983	91.62	36.95	98.91	38.97	91.20
1984	104.88	104.88	93.93	76.21	111.10
1985	81.32	171.31	143.95	110.00	91.18
1986	118.27	51.81	83.93	58.56	156.94
1987	31.48	14.34	42.17	23.97	24.04
1988	51.02	- 8.95	25.93	41.92	1.23
1989	51.04	21.11	50.23	62.99	79.27
1990	33.96	34.45	41.43	47.01	33.93
1991	111.62	88.96	67.91	45.57	78.27
1992	228.81	106.28	80.60	79.18	50.83
1993	303.63	163.49	247.30	62.82	68.72
1994	305.13	218.02	107.47	68.48	39.63
1995	122.48	155.09	73.78	44.07	28.28
1996	100.04	4.20	42.51	24.01	- 9.00
1997	- 7.50	- 23.63	42.88	7.48	12.10
1998	- 19.31	- 12.12	- 32.06	- 7.88	15.78
1999	90.44	24.74	- 10.10	- 9.30	32.98
2000	117.58	52.40	18.96	- 10.43	- 7.07
2001	267.23	66.67	91.69	35.67	25.03
Average	111.92	73.58	74.51	57.03	60.00
Size-adjusted returns	14.82	- 5.60	15.31	- 3.69	- 2.70

Portfolios based on headline EPS (that includes extra-ordinary items).

Findings:

Average returns:
Portfolio 1 (value) outperforms portfolio 5 (growth) by 52% over 3 years (112% for portfolio 1 compared to 60% return for portfolio 5).

Size-adjusted returns:
Portfolio 1 continues to outperform portfolio 5 by 18% over 3 years (15% for portfolio 1 versus -3% for portfolio 5).

Statistical significance:
t-stat = 4.511*
p-value = 0.0004*

*Statistically significant at 0.05 level of significance.

5.2.6 EPS: 5-year holding return

Table 10: EPS 5-year holding return

Value	Values in %					Growth
<i>Portfolio formed in...</i>	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1975	90.26	142.42	122.29	125.53	148.26	
1976	149.31	184.63	246.36	193.25	232.01	
1977	242.98	247.39	237.74	155.09	288.01	
1978	261.43	250.09	283.83	293.47	261.83	
1979	427.55	212.59	256.53	331.56	198.03	
1980	245.53	73.18	86.53	175.81	69.97	
1981	175.02	112.91	89.37	106.37	115.16	
1982	168.23	235.56	217.42	185.52	235.62	
1983	135.27	144.20	316.34	98.22	178.86	
1984	113.32	113.32	63.97	127.79	141.28	
1985	76.29	215.42	117.96	196.91	159.90	
1986	85.61	56.68	176.86	116.55	197.81	
1987	54.08	31.78	129.01	76.38	59.40	
1988	63.53	- 8.85	39.30	95.25	59.53	
1989	97.76	99.00	150.45	102.82	160.37	
1990	196.74	150.85	182.18	144.25	79.28	
1991	386.18	283.22	150.34	208.02	110.56	
1992	632.97	294.26	238.40	219.47	110.14	
1993	486.50	295.07	345.69	150.57	140.68	
1994	267.82	290.83	78.21	30.78	41.33	
1995	46.60	26.35	108.59	41.39	27.05	
1996	11.81	19.90	34.87	7.97	65.05	
1997	69.95	- 14.46	15.94	- 9.76	68.14	
1998	44.69	37.65	- 7.38	16.39	18.78	
1999	155.18	95.92	19.49	13.83	9.014	
2000	242.80	273.31	72.04	72.65	26.06	
2001	n/a	n/a	n/a	n/a	n/a	
Average	189.52	148.59	145.09	126.00	126.28	
Size adj.	- 1.05	- 7.10	31.27	7.51	1.41	

Findings:

In table10 EPS (headline EPS that includes extra-ordinary items) is used as basis for portfolio formation and **portfolios are carried for 5 years before returns are recorded**, portfolio 1 outperforms portfolio 5 by 63.24% over 5 years.

This value premium holds (before size-adjustment) even though in 12 out of 27 years the growth portfolio (5) outperforms the value portfolio (1).

5.2.7 PSG: 3 year holding return

Table 11: PSG 3-year holding return

	High Value	Values in %				Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1975	12.25	1.40	3.55	1.20	12.12	
1976	37.32	23.46	54.79	30.92	35.79	
1977	161.07	154.49	126.20	127.87	156.62	
1978	241.07	172.54	253.02	211.44	218.55	
1979	138.01	168.15	157.51	165.03	74.70	
1980	78.56	58.86	63.29	102.76	40.90	
1981	75.11	62.63	111.54	32.88	40.60	
1982	83.58	37.71	34.30	36.90	78.56	
1983	78.01	68.79	95.31	70.68	42.00	
1984	163.34	96.50	125.40	67.72	39.73	
1985	114.53	100.34	99.78	116.98	159.55	
1986	99.32	54.86	108.04	49.38	109.95	
1987	25.10	18.03	29.99	20.30	48.42	
1988	17.32	21.88	13.02	43.10	39.91	
1989	30.59	69.72	65.65	66.13	52.73	
1990	40.90	29.87	79.72	62.10	38.23	
1991	73.98	110.56	71.41	76.45	139.88	
1992	143.27	211.03	92.37	92.49	149.03	
1993	243.89	228.50	153.55	315.15	166.18	
1994	246.31	152.45	127.86	83.46	126.90	
1995	180.58	92.62	38.62	56.81	93.75	
1996	68.61	- 7.53	21.33	- 2.27	26.70	
1997	2.47	11.50	- 25.15	- 17.57	12.80	
1998	3.29	101.62	- 16.00	- 2.63	15.05	
1999	80.24	84.68	37.15	51.51	- 11.03	
2000	120.69	66.13	43.53	46.28	- 6.82	
2001	60.70	64.33	112.07	73.55	191.04	
Average	97.04	83.52	76.96	73.28	77.48	
Size-adjusted returns	- 11.18	- 9.10	- 10.11	- 7.40	- 15.22	

Portfolios
based on
PSG

Findings:

Average return:

Portfolio 1 outperforms portfolio 5 by 19% over 3 years (97% on portfolio 1 versus 77% on portfolio 5).

Size-adjusted returns:

All size-adjusted returns are negative, but portfolio 1 has a smaller negative return (-11%) compared to portfolio 5 (-15%).

Statistical significance:

t- stat = 1.9257*
p-value = 0.054*

*Statistically significant at 0.05 level

5.2.8 PSG: 5-year holding return

Table 12⁵⁴: PSG 5-year holding return

	High Value	Values in %				Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1975	141.62	108.38	122.82	116.26	129.72	
1976	216.95	153.14	249.79	179.32	170.90	
1977	253.38	236.94	262.94	217.82	204.71	
1978	379.21	223.71	372.85	262.07	199.79	
1979	454.07	314.69	326.00	307.11	125.73	
1980	149.17	99.71	133.56	228.46	64.40	
1981	131.76	116.36	180.29	114.10	66.64	
1982	261.91	209.67	177.45	145.76	201.57	
1983	135.64	151.93	247.62	175.85	138.62	
1984	170.43	101.16	113.29	101.53	86.35	
1985	145.01	188.47	154.53	90.13	179.84	
1986	87.05	75.95	104.32	90.70	125.45	
1987	37.38	58.53	52.01	73.66	78.24	
1988	16.88	74.44	51.34	59.80	36.82	
1989	72.78	114.59	102.67	122.97	126.95	
1990	142.85	130.54	204.91	181.73	169.19	
1991	203.67	241.94	210.69	202.08	382.29	
1992	427.57	581.87	152.76	265.39	266.80	
1993	344.69	348.95	265.75	499.51	279.76	
1994	255.80	122.16	95.18	22.21	197.19	
1995	32.50	65.34	12.99	- 1.07	77.02	
1996	38.98	33.91	-1.57	- 13.35	60.14	
1997	35.87	73.57	- 5.27	- 25.92	112.77	
1998	27.97	172.27	38.90	48.82	39.35	
1999	95.91	192.37	181.74	90.70	33.51	
2000	157.23	132.05	150.42	285.46	73.41	
2001	n/a	n/a	n/a	n/a	n/a	
Average	169.86	166.26	152.23	147.74	139.51	
Size-adjusted Returns	- 34.04	- 4.37	- 11.08	-0.2235	-0.4363	

Portfolios
based on PSG

Findings:

Average returns:

Portfolio 1 outperforms portfolio 5 by 30% over 5 years (170% on portfolio 1 versus 140% on portfolio 5).

Size-adjusted returns:

All size-adjusted returns are negative and portfolio 1 has a more negative return (-34%) than portfolio 5 (-0.43%).

Statistical significance:

t-stat = 1.448**

p-value = 0.1476**

**Statistically not significant at 0.05 level of significance.

⁵⁴Portfolios start in 1975 (not 1972) because three years' or pre-formation data is required,

5.3 Statistical significance of one-dimensional results

Table 13: Linear regressions for all portfolios and all years accompanying one-dimensional tests

Sample sizes between 6,000 and 8,000		BV/MV	CF/P	EPS	PSG
1 year return	t-stats	2.1183 [*]	7.0834 [*]	7.256 [*]	- 2.7148 [*]
	p- value	0.0341 [*]	0.000 [*]	0.000 [*]	0.0067 [*]
2 year return	t-stats	3.8591 [*]	3.4262 [*]	2.8055 [*]	3.3868 [*]
	p- value	0.0001 [*]	0.0006	0.000 [*]	0.0007 [*]
3 year return	t-stats	6.5991 [*]	2.4538 [*]	2.3503 [*]	1.5231 ^{**}
	p- value	0.000 [*]	.0000 [*]	0.0187 [*]	0.1278 ^{**}
4 year return	t-stats	3.7316 [*]	8.0833 [*]	-0.798 ^{**}	1.2285 ^{**}
	p- value	0.0002 [*]	0.0000 [*]	0.4251 ^{**}	0.2193 ^{**}
5 year return	t-stats	3.8996 [*]	1.9081 [*]	1.724 ^{**}	-1.2767 ^{**}
	p- value	9E-05 [*]	0.0564 [*]	0.0847 ^{**}	0.2017 ^{**}
3 year holding return	t-stats	3.7701 [*]	6.0863 [*]	4.511 [*]	-1.9257 [*]
	p- value	0.0001 [*]	0.000 [*]	0.000 [*]	0.054 [*]
5 year holding return	t-stats	2.6187 [*]	6.4764 [*]	1.9666 [*]	1.448 ^{**}
	p- value	0.0088 [*]	0.000 [*]	0.0492 [*]	0.1476 ^{**}

* Statistically significant at 0.05 level where critical t = 1.2816. All tstat > t critical.

** Statistically not significant at 0.05 level.

Linear regression proved that all one-dimensional tests are statistically significant at the 5% level of significance, with the following exceptions:

- 4 and 5 year annual returns when portfolio formation is based on EPS or PSG.
- 5 year holding returns when portfolio formation is based on PSG.

The significance of this table will be discussed in chapter 6.

5.4 Findings for two-dimensional tests: annual returns

Table 14 and 15 represent two-dimensional ways of carrying out portfolio formation.

- In table 14, stocks are first sorted on the basis of PSG, and then further sorted based on BV/MV.
- In table 15, stocks are also first sorted by PSG and then further sorted by CF/P.

In both tables 14 and 15, portfolio A represents the bottom 30% of companies with the lowest PSG; portfolio B represents the middle 40% of PSG, and portfolio C represents the top 30% of companies with the highest PSG. Within each one of these three portfolios (A, B and C), companies were further sorted into groups 1, 2 and 3, based on the value of BV/MV (table 14) and CF/P (table 15); where group 1 represented the high value companies (with high BV/MV or CF/P) and 3 represented the growth companies (with low BV/MV or CF/P). Portfolio A1 is therefore the portfolio with the lowest PSG and the highest BV/MV (or CF/P in the case of table 15), while portfolio C3 is the portfolio with the highest PSG and the lowest BV/MV (or lowest CF/P in the case of table 15).

5.4.1 PSG and BV/MV: one to five years annual returns

Table 14: PSG-BV/MV annual returns

	Value	Values in %							Growth
Years	A1	A2	A3	B1	B2	B3	C1	C2	C3
1yr	26.6	13.9	13.5	20.2	13.0	9.6	19.9	10.1	10.2
2yr	15.2	9.9	13.8	18.1	12.8	10.9	14.9	12.5	10.1
3yr	17.9	14.2	8.8	18.8	13.7	9.4	19.7	14.3	8.3
4yr	18.4	20.3	11.3	20.1	17.3	11.3	18.5	13.4	10.0
5yr	16.5	13.1	11.2	20.3	15.5	12.2	17.8	18.1	8.4
Average	18.9	14.3	11.7	19.5	14.5	10.7	18.2	13.7	9.4
Size-adjusted average	3.6	- 0.2	- 1.6	3.4	0.2	- 2.5	3.0	0.3	- 2.2

Table 14 shows the extreme value portfolio (A1) generated an average annual return of 19% before size-adjustment, while the extreme growth portfolio (C3) generated an average annual return of 9%, for a difference of 10% annually. The size-adjusted difference in return between portfolio A1 and C3 is 6% annually (4% generated by A1, compared to -2% generated by C3).

In table 15 the extreme value portfolio (A1) generated an average annual return of 22%, while the extreme growth portfolio (C3) generated an average annual return of 3%, for a difference of 19% annually.

5.4.2 PSG and CF/P: one to five years annual returns

Table 15: PSG-CF/P annual returns

	Value		Values in %					Growth	
Years	A1	A2	A3	B1	B2	B3	C1	C2	C3
1yr	35.4	9.8	9.1	24.3	11.5	- 0.3	30.0	12.5	- 2.1
2yr	24.2	13.7	12.4	23.0	11.8	3.4	16.5	15.5	- 2.4
3yr	21.5	14.0	11.6	14.4	13.2	11.3	20.6	12.0	0.1
4yr	18.7	16.5	17.6	24.5	14.6	8.9	33.1	11.1	6.9
5yr	11.1	13.8	13.6	19.0	18.4	14.2	35.0	17.9	10.8
Average	22.2	13.6	12.9	21.0	13.9	7.5	27.0	13.8	2.7
Size-adjusted average	2.3	- 1.8	-0.4	2.8	0.7	- 3.5	7.6	0.9	- 7.9

The two-dimensional tests were also done with holding returns, in which returns are recorded three and five years respectively after portfolio formation.⁵⁵

To test if the results in tables 14 and 15 were statistically significant, a regression analysis was performed. The results are summarized in table 16.

⁵⁵ See appendix 3, specifically appendix tables 31 to 34, for the three and five year holding results for the two-dimensional tests.

5.5 Statistical significance of two-dimensional results

Table 16: Linear regressions accompanying two-dimensional tests for all portfolios and all years

Sample size between 3000 and 6000		Past sales growth and cash flow		Sales growth and BV/MV	
		Sales growth (PSG)	Cash flow (CF/P)	Sales growth	BV/MV
1 year return	t-stats	-0.8132**	4.0515*	-3.5752*	0.5813**
	p- value	0.41612**	0.000*	0.00035*	0.561**
2 nd year return	t-stats	-0.3486**	2.1449*	-0.5974**	0.7668**
	p- value	0.7273**	0.032*	0.5502**	0.4432**
3 year return	t-stats	-0.2726**	2.7248*	2.7772*	1.6795**
	p- value	0.7851**	0.0065*	0.0005*	0.0931**
4 th year return	t-stats	0.4311**	2.355*	3.0747*	1.282**
	p- value	0.6663**	0.0185*	0.00212*	0.1999**
5 th year return	t-stats	1.2092**	1.2999**	3.2177*	0.2908**
	p- value	0.2266**	0.1937**	0.0013*	0.7711**

In a multiple linear regression, CF/P proved to be the statistically significant variable when portfolio formation is based on PSG and CF/P. CF/P is statistically significant variable every year except in the fifth year.

When portfolio formation is based on PSG and BV/MV, PSG is the statistically significant variable. PSG is statistically significant variable every year.

Implications of this table will be discussed in chapter 6.

* Statistically significant at 0.05 level where critical t = 1.2816. All t stats > critical t; and p value < $\alpha = 0.10$

** Statistically not significant at 0.05 level.

All tables up to here tested for the existence of the value premium in South Africa over the past twenty-nine years. It proved convincingly that the value premium existed in the South Africa's stock market. Further analysis of the results follows in chapter 6. The next section (5.6) tests extrapolation as an explanation for the value premium.

5.6⁵⁶ Findings on extrapolation

5.6.1 Sales growth before and after portfolio formation

Table 17: Sales growth:

Value companies

Years	Future Years 1 to 5	Past Years -5 to 0
1977	25.14	17.30
1978	25.26	21.22
1979	30.12	19.70
1980	21.79	16.88
1981	15.76	15.94
1982	14.87	22.49
1983	20.48	29.26
1984	20.36	23.10
1985	22.47	21.26
1986	23.66	17.42
1987	16.71	14.51
1988	11.31	19.36
1989	8.23	21.66
1990	8.22	26.53
1991	10.43	23.05
1992	18.20	14.32
1993	17.05	9.34
1994	16.75	6.04
1995	10.12	5.91
1996	7.88	5.57
1997	15.24	10.20
1998	12.31	13.15
1999	12.40	14.26
2000	18.01	12.04
2001	23.86	10.92
Average	17.07	16.46

Table 18: Sales growth:

Growth companies

Years	Future Years 1 to 5	Past Years -5 to 0
1977	23.32	26.25
1978	19.08	22.63
1979	27.88	17.71
1980	22.86	20.60
1981	18.99	15.10
1982	18.54	22.17
1983	18.77	19.74
1984	23.66	30.55
1985	21.86	18.53
1986	23.95	14.86
1987	25.99	16.30
1988	20.30	18.41
1989	17.12	18.24
1990	18.31	22.45
1991	15.84	25.44
1992	19.13	25.34
1993	20.45	18.70
1994	26.19	18.47
1995	25.20	19.67
1996	20.72	20.69
1997	20.46	20.33
1998	15.16	22.56
1999	8.00	19.92
2000	6.30	21.34
2001	15.13	29.15
Average	19.73	21.01

Findings:

Value companies (table 17) have sales growth of 16% before portfolio formation and 17% afterwards.

Growth companies (table 18) have sales growth of 21% before portfolio formation and 20% afterwards.

For a detailed description of how portfolios were formed and returns calculated, refer to appendix 4.

⁵⁶ Extrapolation results have been accepted for presentation at the 18th Annual Conference of the American Society for Business and Behavioral Science to be held in Las Vegas during February 24 to 27, 2011: “The value premium: more evidence on extrapolation”.

5.6.2 Cash flow growth before and after portfolio formation

Table 19⁵⁷:

**Cash flow
performance:**

Value companies

Years	Future	Past
1992	32.33	22.62
1993	29.35	19.04
1994	39.27	19.37
1995	30.69	14.17
1996	36.93	13.25
1997	28.36	19.90
1998	30.81	26.38
1999	25.54	20.35
2000	21.69	25.87
2001	23.24	30.10
Average	29.82	21.10

Table 20:

**Cash flow
performance:**

Growth companies

Years	Future	Past
1992	18.54	28.46
1993	26.27	26.89
1994	25.37	21.23
1995	39.76	22.64
1996	34.50	28.54
1997	35.75	26.05
1998	29.44	31.47
1999	24.16	46.76
2000	23.57	33.56
2001	22.92	55.07
Average	28.03	32.07

Table 21:

Cash flow/Price ratio⁵⁸

Years	Value	Growth
1992	0.0075	0.0025
1993	0.0089	0.0015
1994	0.0050	0.0015
1995	0.0038	0.0013
1996	0.0039	0.0033
1997	0.0035	0.0019
1998	0.0060	-0.0002
1999	0.0073	0.0015
2000	0.0068	0.0014
2001	0.0101	0.0014
Average	0.0063	0.0016

Findings:

Value companies (table 19) have an average cash flow growth of 21% in the five years before portfolio formation, and 30% in the five years after portfolio formation.

Growth companies (table 20) show cash flow growth of 32% before portfolio formation, and slow down to 28% afterwards.

The ratios at portfolio formation time (table 21) show growth companies trading at a lower multiple (0.0016) than value companies (0.0063).

⁵⁷ For all the tables on this page the heading "Future" refers to years 1 to 5 after portfolio formation, while the heading "Past" always refers to years -5 to 0 (i.e. the five years before portfolio formation).

⁵⁸ In ratios such as P/E (with price as nominator and earnings as denominator) lower values are preferable. In line with influential research such as LSV (1994), this study reverses the traditional formula, and uses price as denominator, and a value measure (such as earnings or cash flow) as nominator. For example, in table 21 the ratio is: cash flow/(shares outstanding x share price). Therefore, **lower ratio values indicate a higher price per unit of value and are therefore less desirable than high ratio values.**

5.6.3 EPS growth before and after portfolio formation

Tables 22 to 24 show results for extrapolation testing when using **EPS growth** for value and growth companies respectively. The EPS tests were done with both headline earnings (including extraordinary items) and bottom-line EPS (excluding extraordinary items), because one-dimensional tests show that headline earnings and bottom-line earnings generate different results.

Findings:

Value companies (table 22) show EPS growth of 21% in the five years before portfolio formation, and 26% growth in the years afterwards.

Growth companies (table 23) show EPS growth of 22% before portfolio formation, and 20% in the years afterwards.

Ratio calculations (table 24) show a lower ratio (and therefore a higher price per unit of EPS) for growth companies (1.061) than for value companies (4.7475).

5.6.3.1 Headline EPS growth (including extra-ordinary items)

Table 22⁵⁹:

EPS growth rate
Value companies

Years	Future	Past
1978	44.21	n/a
1979	24.36	20.15
1980	28.04	17.35
1981	16.68	21.58
1982	15.23	30.19
1983	21.75	19.84
1984	23.38	15.91
1985	23.38	18.20
1986	26.21	13.00
1987	20.65	17.98
1988	18.01	18.50
1989	17.99	21.11
1990	19.31	28.78
1991	32.89	20.71
1992	30.07	25.32
1993	23.02	17.91
1994	22.09	17.52
1995	19.01	50.13
1996	21.60	18.72
1997	16.06	20.43
1998	38.61	19.49
1999	24.55	16.54
2000	36.84	13.93
2001	52.48	26.21
Average	26.00	21.28

Table 23:

EPS growth rate
Growth companies

Years	Future	Past
1978	15.94	16.08
1979	13.90	12.01
1980	15.49	20.64
1981	10.46	21.05
1982	15.99	26.38
1983	19.56	21.69
1984	22.24	17.47
1985	23.72	24.72
1986	24.02	17.46
1987	22.61	22.76
1988	18.42	50.75
1989	16.35	23.25
1990	16.35	22.80
1991	14.43	21.85
1992	21.08	19.91
1993	20.08	18.01
1994	19.46	19.14
1995	17.26	5.42
1996	21.68	18.90
1997	21.89	26.03
1998	28.71	45.27
1999	19.88	25.80
2000	19.06	21.93
2001	29.85	30.95
Average	19.63	22.28

Table 24:

EPS/Price ratio

Years	Value	Growth
1978	9.508	4.916
1979	1.082	2.719
1980	1.143	2.052
1981	1.330	2.857
1982	1.335	8.933
1983	9.330	1.256
1984	5.275	8.970
1985	4.999	1.109
1986	5.835	1.263
1987	4.340	5.280
1988	2.323	5.470
1989	2.499	6.799
1990	1.381	6.121
1991	2.858	7.845
1992	5.402	4.641
1993	1.423	5.372
1994	9.250	1.688
1995	9.370	3.529
1996	6.023	2.280
1997	8.814	3.434
1998	6.482	-6.664
1999	8.295	1.278
2000	1.069	1.219
2001	9.466	6.729
Average	4.747	1.061

⁵⁹ For all the tables on this page the heading "Future" always refers to years 1 to 5 after portfolio formation, while the heading "Past" always refers to years -5 to 0 (i.e. the five years before portfolio formation).

5.6.3.2 Bottom-line EPS growth (excluding extra-ordinary items)⁶⁰

Table 25⁶¹:

EPS growth rate

Value companies

<i>Years</i>	<i>Future</i>	<i>Past</i>
1997	23.89	13.63
1998	23.63	31.33
1999	68.38	19.74
2000	17.38	42.89
2001	21.96	32.62
Average	31.05	28.04

Table 27:

EPS growth rate

Growth companies

<i>Years</i>	<i>Future</i>	<i>Past</i>
1997	26.98	38.67
1998	24.26	44.87
1999	27.63	6.53
2000	22.45	20.75
2001	23.71	28.29
Average	25.00	27.82

Table 26:

EPS/Price ratio

<i>Years</i>	<i>Value</i>	<i>Growth</i>
1992	0.116	0.425
1993	0.126	0.503
1994	0.089	0.196
1995	0.060	0.337
1996	0.060	0.226
1997	0.084	-1.563
1998	0.144	-0.683
1999	0.076	-0.242
2000	0.113	-0.375
2001	0.081	0.109
Average	0.095	-0.107

Findings:

Value companies (table 25) show EPS growth of 28% in the five years before portfolio formation and 31% in the years afterwards.

Growth companies (table 27) show EPS growth of 28% before portfolio formation, and 25% in the years afterwards.

Ratios (table 26) show a higher price per unit of EPS at the time of portfolio formation for growth companies (-0.107) than for value companies (0.095).

⁶⁰ Bottom-line EPS data only date back to the mid-1990s, unlike headline EPS that was used in tables 22, 23 and 24 which date back to the early 1970s.

⁶¹ For all the tables on this page the heading "Future" always refers to years 1 to 5 after portfolio formation, while the heading "Past" always refers to years -5 to 0 (i.e. the five years before portfolio formation).

5.6.4 Share price returns before and after portfolio formation

5.6.4.1 Share price return before portfolio formation

The following five tables (tables 28, 29, 30, 31 and 32) show successively what happened to share price returns in each of the 5 years **before** portfolio formation.

Table 28: Share price return in year five before portfolio formation

	Value	Growth
Portfolio formed in...	Portfolio 1	Portfolio 5
1977	- 20.41	3.70
1978	0.217	11.89
1979	36.61	45.59
1980	60.42	78.87
1981	34.72	19.00
1982	8.49	2.99
1983	15.07	28.87
1984	29.52	33.72
1985	- 11.34	7.55
1986	24.45	45.27
1987	49.13	70.89
1988	5.44	16.42
1989	- 3.73	1.89
1990	6.06	12.23
1991	- 9.79	6.04
1992	- 5.41	36.35
1993	- 15.93	50.03
1994	51.26	57.39
1995	55.25	29.02
1996	32.44	32.66
1997	0.34	41.89
1998	- 17.73	39.72
1999	- 33.10	6.61
2000	- 9.78	2.31
2001	- 8.76	9.93
Average	10.94	27.64

In the fifth year before portfolio formation (table 28), the growth portfolio generated an average annual return of 28%, while the value portfolio generated 11%.

A full interpretation follows in chapter 6. See appendix 4 for a detailed description of how these returns were calculated.

Table 29:**Share price return in year four before portfolio formation**

	Value	Growth
Portfolio formed in...	Portfolio 1	Portfolio 5
1977	-0.48	6.34
1978	- 21.71	- 2.10
1979	0.13	10.58
1980	36.07	44.67
1981	63.28	80.96
1982	33.69	19.03
1983	8.40	4.17
1984	9.77	24.86
1985	32.46	28.75
1986	- 12.32	4.90
1987	18.10	49.01
1988	56.06	105.61
1989	8.12	13.52
1990	- 5.88	0.62
1991	- 1.86	21.09
1992	- 12.10	5.11
1993	27.94	26.88
1994	- 17.18	40.41
1995	41.78	46.47
1996	48.64	46.51
1997	31.42	40.87
1998	- 2.41	49.98
1999	- 10.13	21.56
2000	- 29.15	10.77
2001	- 9.11	2.07
Average	11.74	28.11

Table 30:**Share price return in year three before portfolio formation**

	Value	Growth
Portfolio formed in...	Portfolio 1	Portfolio 5
1977	- 25.01	72.28
1978	1.51	7.63
1979	- 17.23	- 3.08
1980	3.30	12.52
1981	34.68	46.08
1982	62.14	76.49
1983	35.63	15.72
1984	0.08	4.14
1985	10.37	31.94
1986	33.54	25.33
1987	- 15.30	10.36
1988	23.34	43.93
1989	53.89	51.08
1990	8.57	15.47
1991	- 7.91	5.48
1992	-0.83	16.85
1993	- 14.53	7.12
1994	36.15	28.09
1995	- 12.76	18.01
1996	48.53	45.31
1997	51.65	47.39
1998	26.01	41.86
1999	8.26	28.49
2000	- 11.48	34.95
2001	- 28.57	7.45
Average	12.19	27.64

In the fourth year before portfolio formation (table 29), growth portfolios generated an average annual share price return of 28%, while value portfolios generated 12%.

In the third year before portfolio formation (table 30) growth portfolios generated a return of 28%, while value portfolios generated 12%.

Table 31:**Share price return in year two before portfolio formation**

	Value	Growth
Portfolio formed in...	<i>Portfolio 1</i>	<i>Portfolio 5</i>
1977	- 8.85	84.97
1978	- 25.16	57.84
1979	5.07	7.60
1980	- 13.71	2.44
1981	3.81	9.30
1982	34.15	44.63
1983	68.43	69.96
1984	37.65	22.46
1985	12.49	- 5.81
1986	9.76	29.11
1987	27.82	35.92
1988	- 11.09	2.75
1989	18.98	46.40
1990	54.31	69.07
1991	9.85	7.20
1992	- 5.87	5.23
1993	- 249.54	14.37
1994	- 8.63	5.80
1995	39.35	35.26
1996	- 3.11	40.16
1997	51.58	55.46
1998	51.64	52.19
1999	35.73	34.78
2000	8.14	26.80
2001	33.23	24.54
Average	16.93	31.14

Table 32:**Share price return in year one before portfolio formation**

	Value	Growth
Portfolio formed in...	<i>Portfolio 1</i>	<i>Portfolio 5</i>
1977	26.77	28.62
1978	- 8.87	68.23
1979	- 2.43	62.95
1980	8.05	5.09
1981	- 16.23	- 1.67
1982	6.37	7.42
1983	32.42	43.02
1984	69.95	73.33
1985	42.03	15.54
1986	8.89	- 6.28
1987	10.89	22.53
1988	31.68	31.87
1989	- 8.33	4.44
1990	17.78	45.90
1991	56.49	90.14
1992	6.52	- 1.31
1993	- 5.60	1.69
1994	6.35	12.15
1995	- 7.02	9.30
1996	36.15	29.35
1997	- 2.07	22.16
1998	54.72	54.41
1999	52.32	60.79
2000	25.74	28.61
2001	16.15	26.58
Average	17.48	29.40

In the second year before portfolio formation (table 31) growth portfolios generated an average annual return of 31%, while value portfolios generated 17%.

During the first year before portfolio formation (table 32) growth portfolios generated an average annual return of 29%, while value portfolios generated 17%.

5.6.4.2 Share price returns after portfolio formation

The following five tables (tables 33, 34, 35, 36 and 37) show successively what happens to share price returns of the value and growth companies in each of the 5 years **after** portfolio formation.

Table 33:

Share price return one year after portfolio formation

	Value	Growth
Portfolio formed in...	Portfolio 1	Portfolio 5
1977	14.48	3.33
1978	44.19	37.51
1979	76.43	74.33
1980	56.44	10.43
1981	14.81	- 3.92
1982	22.30	15.87
1983	44.22	25.19
1984	- 7.68	-0.33
1985	34.14	31.21
1986	115.89	49.15
1987	28.27	- 10.71
1988	16.00	- 18.66
1989	19.194	10.72
1990	6.90	- 5.77
1991	46.55	19.71
1992	21.61	16.42
1993	75.00	35.70
1994	93.47	14.82
1995	64.60	16.79
1996	32.77	9.57
1997	33.88	7.36
1998	- 14.043	- 10.30
1999	7.79	- 14.01
2000	23.50	- 18.21
2001	25.40	5.89
Average	35.85	12.09

Unlike in the five years before portfolio formation (when the growth portfolios generated higher share price returns than the value portfolios), in the years after portfolio formation value portfolios outperformed growth portfolios consistently.

In table 33, value companies generated an average annual return of 36% in the first year after portfolio formation, compared to the 12% generated by growth companies.

Table 34:

Share price return in the second year after portfolio formation

	Value	Growth
Portfolio formed in...	Portfolio 1	Portfolio 5
1977	46.52	41.09
1978	78.12	76.91
1979	58.97	12.15
1980	14.42	- 2.72
1981	19.78	22.77
1982	40.05	26.86
1983	- 9.30	2.98
1984	33.14	31.01
1985	71.86	51.50
1986	13.07	13.97
1987	16.34	- 8.29
1988	19.71	9.68
1989	8.74	- 1.30
1990	6.38	53.70
1991	2.12	18.77
1992	61.78	46.84
1993	83.01	28.38
1994	37.47	33.98
1995	36.32	10.64
1996	32.09	13.59
1997	24.09	- 5.76
1998	0.54	- 10.46
1999	21.06	- 24.53
2000	27.54	13.33
2001	36.33	9.01
Average	29.11	18.57

Table 35:

Share price return in the third year after portfolio formation

	Value	Growth
Portfolio formed in...	Portfolio 1	Portfolio 5
1977	72.16	68.91
1978	51.13	12.82
1979	13.56	- 1.68
1980	20.80	25.17
1981	42.71	22.34
1982	- 8.38	0.64
1983	24.60	25.79
1984	76.62	42.62
1985	7.61	14.53
1986	5.81	5.63
1987	12.14	16.95
1988	6.92	- 3.13
1989	10.77	18.64
1990	- 2.43	39.62
1991	62.12	46.62
1992	66.16	24.82
1993	40.87	38.22
1994	26.27	13.51
1995	26.04	13.94
1996	- 20.65	- 14.56
1997	- 5.16	- 2.58
1998	25.48	- 9.12
1999	28.40	1.69
2000	35.29	9.59
2001	83.92	39.31
Average	28.11	18.01

In the second year after portfolio formation (table 34) value companies generated an average annual share price return of 29%, compared to the 19% return of growth companies. In the third year after portfolio formation (table 35) value companies generated a 28% return, compared to the 18% for value companies.

Table 2:**Share price return in the fourth year after portfolio formation**

	Value	Growth
Portfolio formed in...	<i>Portfolio 1</i>	<i>Portfolio 5</i>
1977	47.73	10.04
1978	12.54	- 7.12
1979	17.88	21.51
1980	42.70	18.93
1981	- 4.74	2.00
1982	32.26	30.07
1983	76.26	36.73
1984	10.95	4.85
1985	13.48	5.42
1986	13.21	17.50
1987	3.27	- 2.41
1988	7.80	18.27
1989	10.75	21.86
1990	62.79	53.37
1991	66.82	36.33
1992	49.11	33.82
1993	28.21	18.63
1994	15.07	15.93
1995	- 19.76	- 12.44
1996	-9.55	19.75
1997	25.96	3.22
1998	28.81	20.17
1999	33.11	14.84
2000	114.95	33.10
2001	68.86	29.81
Average	29.94	17.77

Table 37:**Share price return in the fifth year after portfolio formation**

	Value	Growth
Portfolio formed in...	<i>Portfolio 1</i>	<i>Portfolio 5</i>
1977	4.83	- 6.60
1978	16.92	23.41
1979	44.72	18.43
1980	- 4.33	3.82
1981	30.26	30.51
1982	75.54	51.56
1983	16.19	-0.44
1984	13.10	6.29
1985	7.51	21.72
1986	-0.23	- 6.24
1987	10.97	10.13
1988	2.55	35.16
1989	66.97	22.39
1990	62.24	31.32
1991	47.85	12.31
1992	38.47	11.92
1993	15.71	13.98
1994	- 25.16	- 12.68
1995	- 4.04	12.23
1996	24.19	2.28
1997	33.11	26.47
1998	25.94	16.31
1999	48.07	31.26
2000	54.43	36.80
Average	25.24	16.35

In the fourth year after portfolio formation (table 36) value companies generated an average annual return of 30%, compared to the 18% return of growth companies.

In the fifth year after portfolio formation (table 37) value companies generated 25% return, compared to the 16% return of growth companies.

CHAPTER SIX

COMPARISON AND INTERPRETATION OF RESEARCH FINDINGS

This chapter analyses, interprets and discusses the results from the empirical tests which were presented in chapter 5. It systematically puts all the results from the one- and two-dimensional tests under the spotlight, and compares them with other South African as well as international studies. It ends with a discussion on how these results clearly demonstrate why extrapolation is the most satisfactory explanation for the South Africa findings. Finally, it concludes by offering some potential topics for future research in the field of financial economics.

6.1 One dimensional tests

6.1.1 BV/MV and CF/P

Basing portfolio formation on both book-value-to-market-value (BV/MV) and cash-flow-to-price (CF/P), proved to be excellent and consistently reliable ways to establish whether the value premium exists. For both of those these methods, portfolio 1 (value portfolios) consistently outperformed portfolio 5 (growth portfolios), regardless of the length of time the portfolios were carried (one to five years), or whether returns were recorded annually (year-on-year) or for holding purposes (on a buy-and-hold basis). Even after size-adjustment, value portfolios still outperformed growth portfolios by an impressive margin.

6.1.1.1 Book-value-to-market-value (BV/MV)

When BV/MV is used for portfolio formation and returns are recorded annually (table 1, chapter 5) the average annual return difference between the value portfolio (portfolio 1) and the growth portfolio (portfolio 5) is 12% per year before size-adjustment, and 9%

per year after adjusting results for size.

From analyzing the BV/MV test results, it becomes clear that the years during which the value portfolio did not outperform the growth portfolio always coincided with exceptional and/or unusual political or economic events which occurred either in South Africa or internationally.

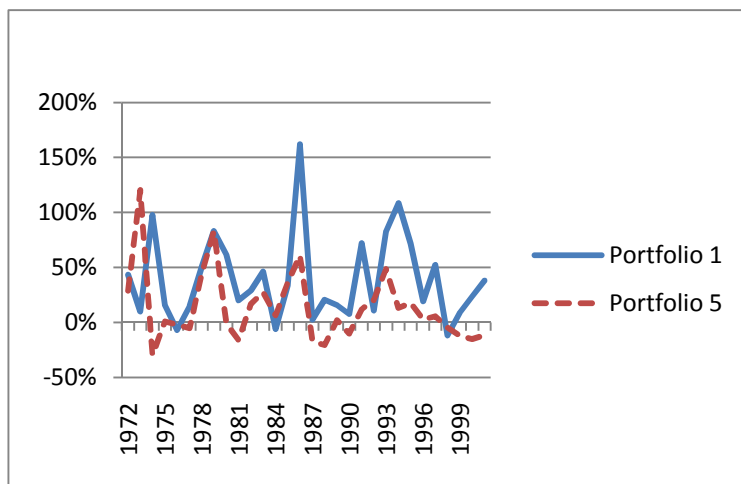


Figure 7: BV/MV 1st year annual return (appendix 1, table 1)

A detailed analysis of table 1 (appendix 1) reveals that in the twenty-nine years under study, there were only six years during which the value portfolio did not perform relatively better in the **first year** after portfolio formation. These were 1972 and 1973 (the

time of the first OPEC oil price hike), 1984 and 1985 (years of

intensified international sanctions against South Africa accompanied by internal unrest), and 1992 and 1998 (both years of great political uncertainty before initially Mr. Mandela and subsequently Mr. Mbeki became president of South Africa). Figure 7 demonstrates that the best year for the value portfolio was 1986 – the year after two consecutive years (1984 and 1985) of better growth portfolio performance. In that year the value portfolio generated a 162% return. If 1986 was the best year for value investing in South Africa over a one-year term, 1998 (the year after the East Asian crisis, which was also the year Mr. Mbeki became president) was the worst. In addition, there are only two years during which all five portfolios (1 to 5) generated negative returns: 1976 (during the Soweto unrest), and 1998 (the year after the East Asian crisis). Negative returns for all portfolios could only be interpreted as negative expectations about the investment climate in general, and cannot be viewed as reasonable grounds for negating the value premium altogether.

In the **second year** after portfolio formation (appendix 1, table 2), portfolio 1 (value portfolio) generated an average annual return of 29.06%, with a 16.99% return for portfolio 2, 12.21% for portfolio 3, 15.27% for portfolio 4, and 21.91% for portfolio 5 (growth). A closer look at appendix 1, table 2 reveals that there were only eight years during which the value portfolio did not outperform the growth portfolio in the second year after portfolio formation. These eight years were roughly the same as those relevant to the first year after portfolio formation, when OPEC oil price hikes struck in 1972 and 1975, as did the tightening of international sanctions against South Africa in 1984 and 1985. However, the effect of political uncertainty showed up more markedly in the two-year analysis. In each of 1990 (when Mr. Mandela was released from jail), 1991 (the year negotiations led to the demise of apartheid), 1994 (the first democratic election), and 1997 (the year before Mr. Mandela stepped down as first president), growth stocks outperformed value stocks.

This pattern continued for annual returns in table 1 for years 3, 4, and 5 after portfolio formation (appendix 1, tables 3, 4 and 5). There were always a couple of years during which the value portfolio did not outperform the growth portfolio. For the fourth year after portfolio formation, there were fourteen instances during which this happened, but even then the value portfolio still generated an average annual return of 29%, compared to the 19% generated by the growth portfolio over that time period.

Interestingly, the worst performing portfolio on average in table 1 of chapter 5 is not portfolio 5 (the high growth portfolio) but portfolio 4 (the second-highest growth portfolio). The reason for this is not clear and requires further investigation.

When portfolios are based on BV/MV and not adjusted annually but held for three and five years respectively (tables 5 and 6), the value portfolios noticeably outperformed the growth portfolios. In fact, there were only two years (1972 and 1990) in the twenty-nine years under examination during which the value portfolio did not outperform the growth portfolio over a three year investment span.

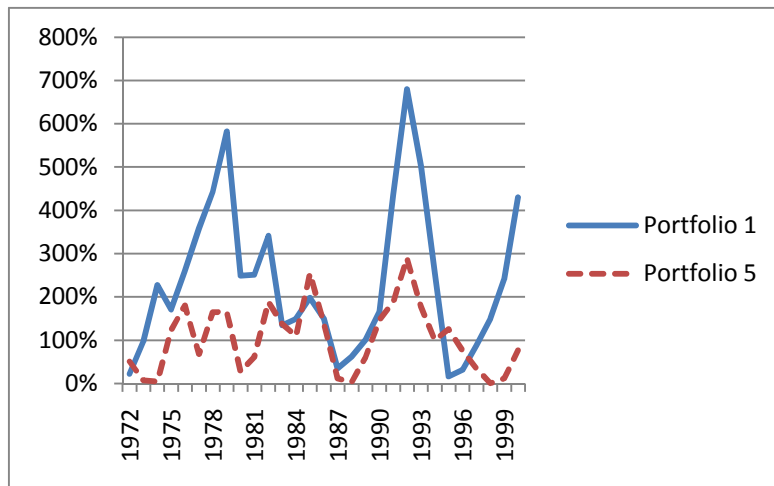


Figure 8: BV/MV 5-year holding return

Over a five year period (see figure 8), value investing proved to be a highly profitable investment strategy. If investors used BV/MV as the basis for portfolio formation, and held on to it for five years, there would have been only five years out of twenty-nine (namely 1972, 1983, 1985, 1995 and 1996) during which

the value portfolio would not have outperformed the growth portfolio. This finding is of particular interest when compared with the findings of other South African researchers, particularly Graham and Uliana (2001), as discussed in section 6.3.1 below.

6.1.1.2 Cash-flow-to-price (CF/P)

In table 2 of chapter 5, where portfolio formation is based on CF/P and returns are recorded annually, the average difference between the annual returns of the value and growth portfolios is 19% per year before size-adjustment, and 10%⁶² per year after results had been adjusted for size.

From table 2 it is evident that there are even fewer years during which the value portfolio (portfolio 1) did not outperform the growth portfolio (portfolio 5) when portfolio formation is based on CF/P. Also, as before, these instances coincided with exceptional and/or unusual political or economic events. Table 6 of appendix 1 reveals that for the fourteen years of data availability there was only one year during which the value portfolio did not outperform the growth portfolio in the **first year** after portfolio formation, namely 1998 – the year after the East Asian crisis. That was also the only

⁶² It is an interesting coincidence that the size-adjusted return difference between portfolios 1 and 5 for both BV/MV and CF/P is between 9% and 10% per year. This is higher than the 8% difference for bottom-line EPS (table 3B, chapter 5) and substantially higher than the -2% difference for PSG (table 4, chapter 5).

year during which all five portfolios generated negative returns. This was clearly an uncertain time for stock market investment activity in general.

In the **second year** after portfolio formation (table 7, appendix 1), the value portfolio generated an average annual return of 32% with returns of 19% for portfolio 2, 11% for portfolio 3, 6% for portfolio 4, and 5% for portfolio 5 (growth) – all before size-adjustment. The table also shows that there were only two years during which the value portfolio did not outperform the growth portfolio in the second year after portfolio formation, namely 1990 (the year Mr. Mandela was released from jail) and 1997 (the year before he stepped down as first president, and when the East Asian crisis hit).

This pattern continued for years 3, 4, and 5 after portfolio formation (appendix 1, tables 8, 9 and 10). There were always one or two years during which the value portfolio did not outperform the growth portfolio. Once again, these exceptions were always tied to wider political uncertainties.

When CF/P portfolios are carried for three years (table 7 in chapter 5), there is not a single year for the fourteen years of data between 1987 and 2000 during which the growth portfolio outperformed the value portfolio. Table 8 of chapter 5 shows that when CF/P portfolios are held for five years, there were only two years (1995 and 1996) out of fourteen during which the value portfolio did not perform superlatively.

The most interesting finding when CF/P is used for portfolio formation, is the unwavering (i.e. consistently uni-directional) decline in returns from portfolio 1 to portfolio 5. This pattern reveals an unmistakably linear regression between cash flow (as independent variable) and share price return (as dependent variable). Companies with high CF/P values had high share price returns, companies with average CF/P values had average share price returns, and companies with low CF/P values had low share price returns. The unswerving downward curve of returns is evident from the average results in the first and second year after portfolio formation, when returns are

adjusted annually, as well as on a three and five year holding period basis. This was found to be the case for regular as well as size-adjusted portfolios (fig. 9-13 below).

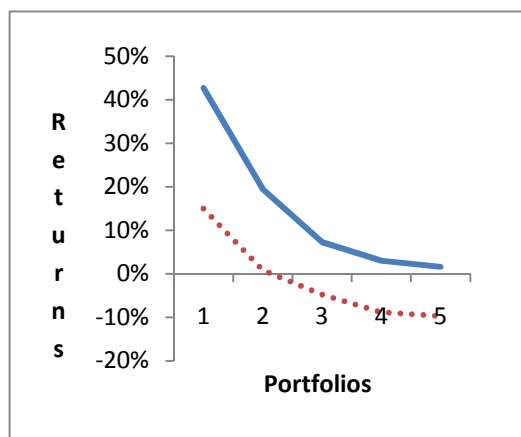


Figure 9: CF/P average annual returns (table 2, chapter 5)

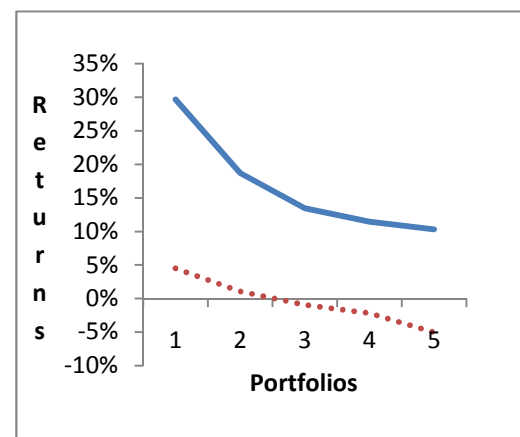


Figure 10: CF/P 1st year annual returns (appendix 1, table 6)

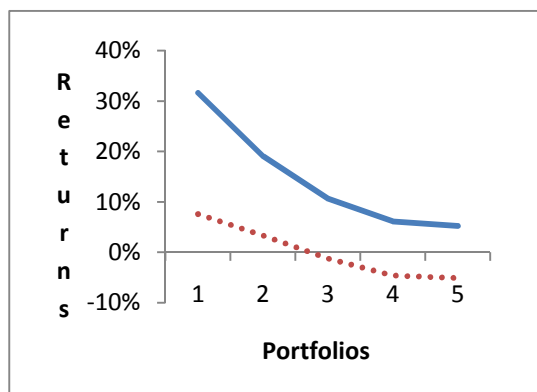


Figure 11: CF/P 2nd year annual returns (appendix 1, table 7)

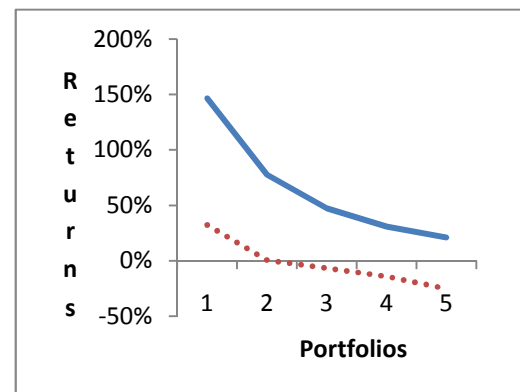


Figure 12: CF/P 3-year holding returns (table 7, chapter 5)

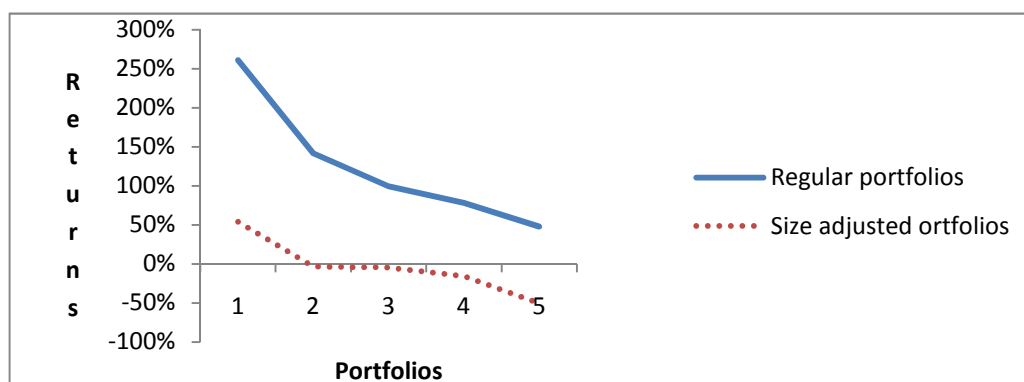


Figure 13: CF/P 5 year holding returns (table 8, chapter 5)

This finding explains why other South African research – such as that by Auret and Sinclair (2006) – found cash flow to be such a powerful and statistically significant variable in explaining share price return (see paragraph 3.10.1.6). CF/P proved to be a reliable and robust value measure, and a profitable basis for portfolio formation in South Africa.

The only time during which this undeviatingly downward pattern of returns did not hold, was in the third, fourth and fifth year after portfolio formation for annually adjusted returns. This observation is discussed in more detail in section 6.1.3.

In summary, it can be concluded that based on one-dimensional tests, a value premium exists in South Africa when BV/MV and CF/P are used as the basis for portfolio formation.

6.1.2 EPS and PSG

Earnings-per-share (EPS) and past-sales-growth (PSG) were revealed as less convincing footings on which to base portfolio formation for the purpose of this study.⁶³

6.1.2.1 Earnings-per-share (EPS)

EPS results varied, depending on whether EPS included (headline) or excluded (bottom-line) extraordinary items were used for portfolio formation. For headline EPS (table 3A, chapter 5) the value premium was present, but weak, with a difference of only 4%⁶⁴ between returns for the value portfolio and that of the growth portfolio. After size-adjusting, the value premium disappeared altogether. Bottom-line EPS (table 3B, chapter 5) captured the value premium more decisively, with a difference of 12% return per year before size-adjusting, and 8% per year after size-adjusting the data.

⁶³ See the section on “statistical significance of one-dimensional tests” (section 5.3) for a brief overview of the statistical significance of each of the four methods of portfolio formation.

⁶⁴ Note that even though a 3.88% annual return difference between portfolio 1 and 5 does not seem impressive (rounded up in the main text to 4% for the sake of consistency), it compares favorably with international results (see table 37), specifically the results from the UK. It is also almost identical to the 3.3% earning yield premium found by Van Rensburg and Robertson (2003b).

LSV (1994) and most international studies since then used bottom-line EPS to carry out their tests. However, it only became mandatory for companies to declare bottom-line EPS in South Africa in 1992. Therefore, limited data availability for bottom-line EPS forced this researcher to use both headline data – for which twenty-nine years' worth of data is available – and bottom-line EPS – for which only nine years' worth of data is available – to test for extrapolation with EPS (see section 6.5).

Tables 11, 12, 13, 14 and 15 in appendix 1 show the detailed results for using EPS as the basis for portfolio formation. A similar picture emerges when BV/MV and CF/P are used for portfolio formation, namely that there are always a couple of years during which the growth portfolio outperformed the value portfolio (six years in the case of table 11, and thirteen years in the case of tables 12 and 13) and these years always coincided with political or economic uncertainty. However, on average, value portfolios undeniably performed superlatively overall.

6.1.2.1 Past-sales-growth (PSG)

Doing portfolio formation based on PSG was demonstrated as the least successful way of capturing the value premium. A difference of only 0.68% was generated between the average return of the value and growth portfolios. After size-adjusting, the value premium disappeared altogether.

Because the results for PSG were so disappointing and abstruse, various alternative methods were applied to determine whether a clearer indication of the value premium could not be found if PSG were to be defined differently. In addition to using the arithmetic average to calculate PSG, the geometric average was also used. In another set of tests, the figure used for “average sales growth” was based on five years of pre-portfolio formation growth, as opposed to the standard three years. However, neither of these alternative methods turned out to be any more successful as a means of capturing the value premium. PSG as the basis for portfolio formation had never been used in the South African context before, and it was included in this study in order to make international comparisons (see section 6.4).

The reason for the value premium disappearing after size-adjusting PSG portfolios is most likely due to the inverse relationship between PSG and company size. Value companies are most often larger, more mature companies whose growth had leveled off. Their growth rate is in fact usually comparable to the national GDP growth rate. Growth companies, on the other hand, are those with high sales growth, which means that they are almost always smaller companies in the early stages of development.

An interesting finding is that when both headline EPS (table 3A in chapter 5) and PSG (table 4 in chapter 5) are used for portfolio formation, pattern reversal occurs in years 4 and 5 after portfolio formation. Pattern reversal in this study refers to a situation in which the average returns generated by growth portfolios are higher than the average returns generated by value portfolios. In the case of table 3A, the growth portfolio generated a 26% return in the fourth year after portfolio formation, compared to only 22% for the value portfolio. In the fifth year after portfolio formation, the same observation is made: portfolio 5 (growth) generated a 23% average return compared to the 21% generated by portfolio 1 (value). It is also true in the case of table 4 (PSG), where the growth portfolio generated a 23% return in the fourth year after portfolio formation, while the value portfolio only delivered 21%. In the fifth year after portfolio formation, returns were 26% for the growth portfolio versus 19% for the value portfolio.

This observation could lead to the incorrect conclusion that the value premium disappears in the longer term when portfolio formation is based on headline EPS or PSG. Such a conclusion would be false, since the data showed that when portfolios are retained for three and five years, the value portfolio once again outperformed the growth portfolio for formations based on both headline EPS (see tables 9 and 10) and PSG (see tables 11 and 12).⁶⁵ This finding is also borne out by Rousseau and Van Rensburg (2004).

Table 11 of chapter 5 (PSG, 3 year holding) shows that the value portfolio outperformed the growth portfolio on average by 20% over a three-year period, even though pattern

reversal occurred in ten out of twenty-seven years (1985 to 1989, 1991, 1992, 1997, 1998 and 2001). In table 12 of chapter 5 (PSG, five year holding) pattern reversal took place in twelve out of twenty-six years (1983, 1985 to 1991, and 1995 to 1998).⁶⁶ Despite these reversals, the value premium remains economically significant over a five year holding period, with a 30% difference over five years between portfolios 1 and 5.

The reason why pattern reversal manifests itself so frequently when PSG is used as basis for portfolio formation, might have to do with investor nervousness about investing in low sales growth (value) companies for a three to five year fixed period during spells of political or economic uncertainty. Examples include the mid-eighties when a tightening of international sanctions against South Africa were implemented, or in the early nineties when rapid political change was taking place in the country. It may also have something to do with money managers' tendency to focus on a shorter time frame, as they are typically rewarded on the basis of the short-term success of their investment strategies.

6.1.3 Years four and five after portfolio formation

Years four and five after portfolio formation are conspicuous in that they denote the periods when CF/P portfolios stop showing consistently declining return patterns, and headline EPS and PSG portfolios' returns become statistically insignificant (table 13, chapter 5). This is a somewhat puzzling observation, and the reason is not detectable in the context and scope of this study. Although further research would have to be carried out, a possible explanation may be that mean reversal starts to set in. However, despite this observation that there is a reversal of the trend in years four and five after portfolio formation, *average returns* over a five year period are nevertheless higher for the value than for the growth portfolio. This undeniably indicates the persistent presence of the value premium.

⁶⁵ For further observations on this pattern reversal, refer to appendix 1 tables 14 and 15 (for EPS) as well as appendix tables 19 and 20 (for PSG).

⁶⁶ Note that in both tables 11 and 12 all size-adjusted returns are negative.

6.2 Two-dimensional tests

To ascertain whether the value premium is as pronounced for two-dimensional as for one-dimensional tests, the difference in returns between the extreme value portfolio (portfolio A1) and extreme growth portfolio (portfolio C3) in tables 14 and 15 had to be compared, in order to ascertain whether it is larger than the difference between the value and growth portfolios in tables 1 and 2 (chapter 5) respectively.

Results for one dimensional (BV/MV in table 1) and two-dimensional (table 14)⁶⁷ tests show that the two-dimensional value portfolio (A1) did not generate a higher level of return than the one-dimensional value portfolio. The value portfolio in table 1 generated an average annual return (before size-adjustment) of 30%, which is higher than the 19% generated by value portfolio A1 in table 14. In addition, the difference between the return of the value portfolio and the growth portfolio in table 1 was 12%, which is more substantial than the 10% difference reported in table 14.

Almost the exact same is true when comparing the results of the second two-dimensional test (table 15) with the one dimensional test (CF/P in table 2). The two-dimensional value portfolio (A1) did not generate a higher level of return than the one-dimensional portfolio. Before size-adjustment, the value portfolio in table 2 (one-dimensional) generated an average annual return of 30%, which is higher than the 22% generated by value portfolio A1 in table 15 (two-dimensional). The difference between the return of the value portfolio and the growth portfolio in table 2 was 19%, which is marginally less than the 20% difference in table 15.

In both tables 14 and 15 the pattern of average share price returns for different portfolios before size-adjustment is the same as that found by LSV (1994). This is illustrated in figure 14 and 15 below.

⁶⁷ All tables in section 6.2 refer to chapter 5

- A1 high return, A2 medium return and A3 low return.
- B1 high return, B2 medium return and B3 low return.
- C1 high return, C2 medium return and C3 the lowest return.

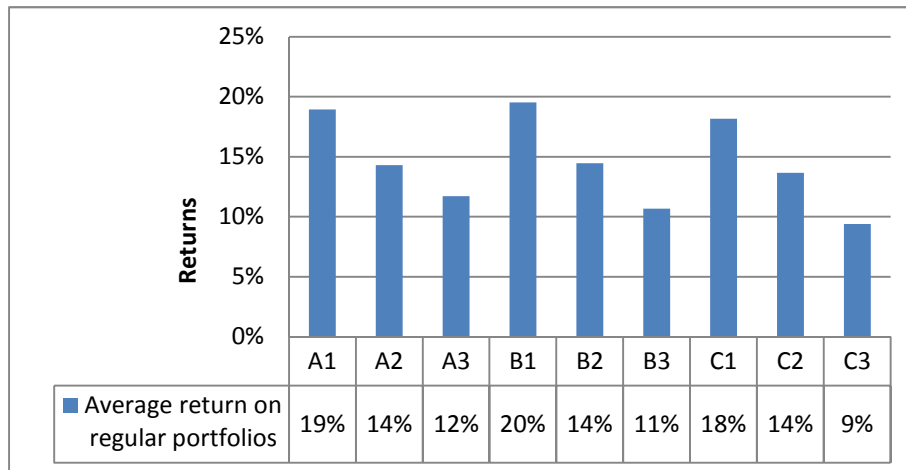


Figure 14: PSG-BV/MV 1-5 years annual returns (table 14)

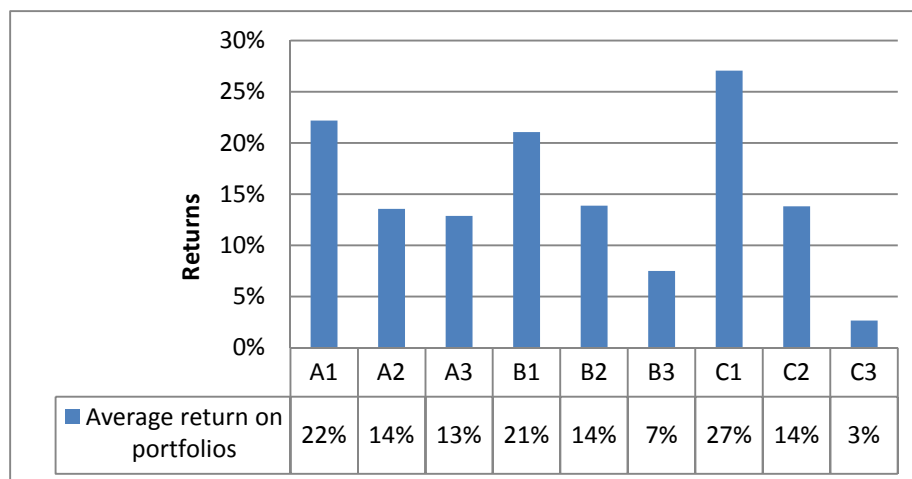


Figure 15: PSG-CF/P 1-5 years annual returns (table 15)

This pattern of returns is not surprising, because portfolio 1 in each case (A, B, and C) represents high value companies (based on either BV/MV or CF/P). What is noteworthy though is that in table 15, portfolio C1 outperformed portfolio A1 (the extreme value portfolio). Group C represents the top sales growth companies, and portfolio C1 includes the highest PSG companies which also have high cash flow.

Tables 14 and 15 show that the value premium persists in South Africa if portfolio formation is based on two value measures. This is evident from the fact that the value portfolio (portfolio A1) consistently outperformed the growth portfolio (portfolio C3).

Based on two-dimensional tests, it can be concluded that a value premium exists in South Africa. This is the case for both ways of portfolio formation (PSG–BV/MV and PSG–CF/P), with the latter being the most profitable. Nonetheless, the value premium was not more pronounced when portfolio formation was based on two value measures instead of one.

6.3 Comparing results with previous South African findings

6.3.1 Value premium

The study of Graham and Uliana (2001) deserves particular consideration in this regard, because theirs was the only study of a reasonable size which did not find any outright evidence of a value premium on the JSE.

Comparing Graham and Uliana's results with the findings of this thesis is not straightforward. This is because they only formed two portfolios (extreme value and extreme growth), used cumulative excess returns (returns in excess of a risk free rate), used monthly returns for both equally weighted and capitalization weighted portfolios, and only applied BV/MV for portfolio formation.

Despite these differences, there are some noteworthy similarities. For instance, when comparing Graham and Uliana's table 5, where they present five year holding returns (which they called "not reformed annually"), with the five year holding returns for portfolios based on BV/MV of this thesis (table 6, chapter 5), it is evident that the portfolios which Graham and Uliana formed in 1987 generated a 28% return difference between the value and growth portfolio. This result is close to the 23% difference (for the same comparison) found by this research.

However, the second half of their study period, namely 1993 to 1997⁶⁸, did not deliver findings similar to this study. This is not wholly surprising, since this thesis found that for the twenty-nine years under review, there were only two of the five years during which value portfolios did not outperform growth portfolios over a five year holding period, namely 1993 and 1997. Both fall in the second half of Graham and Uliana's study period.

Graham and Uliana observed two distinct periods: one during which annually adjusted growth portfolios performed best (1988 to 1992), and the other during which value portfolios performed best (1993 to 1996). As indicated in section 6.1, the late 1980s and early 1990s were politically, socially and economically uncertain times in South Africa – giving rise to a much less pronounced value premium. One can argue that Graham and Uliana's study period (1988 to 1996) contained more years of pattern reversal (in terms of growth portfolios outperforming value portfolios) than any other decade, which is why they did not find outright evidence of the value premium over this turbulent period.

Maritz and Klerck (1997) found that the only period during which their value portfolio did not beat the market index was between 1985 and 1989. This is similar to the findings of this thesis, namely that the last half of the 1980s (1985 to 1989) was not a good time for value investment based on EPS.⁶⁹ From appendix 1 (tables 11 to 15) it is evident that between 1985 and 1989, the growth portfolio outperformed the value portfolio, depending on how long the portfolios were held for: for one out of the five years (appendix 1, table 11), for two and three out of the five years (appendix 1, tables 12 and 13), and for four and five out of the five years (appendix 1, tables 14 and 15).

The focus and approach of Mutooni and Muller's study (2007) is very different from this thesis. They attempted to "time the market", used industrial companies only (excluding mines and banks), and only used BV/MV as the basis for portfolio formation. Despite

⁶⁸ Graham and Uliana did not conduct portfolio formation annually (as is the case in this study), but instead formed portfolios for two consecutive periods: from 1987 to 1992, and again from 1993 to 1997.

these differences, this thesis confirms Mutooni and Muller's finding that the value premium persists after adjusting results for company size for both one- and two-dimensional portfolios. The only instances where the value premium disappeared were after size-adjusting, when headline EPS (table 3A in chapter 5) and PSG (table 4 in chapter 5) were used for portfolio formation.

6.3.2 EPS

EPS as a value measure had been tested extensively in South Africa, and probably produced the most robust findings about the JSE. The novel and interesting contribution which this thesis makes, is to demonstrate that the results are different depending on whether headline or bottom-line EPS is used (see figures 16 and 17 below).

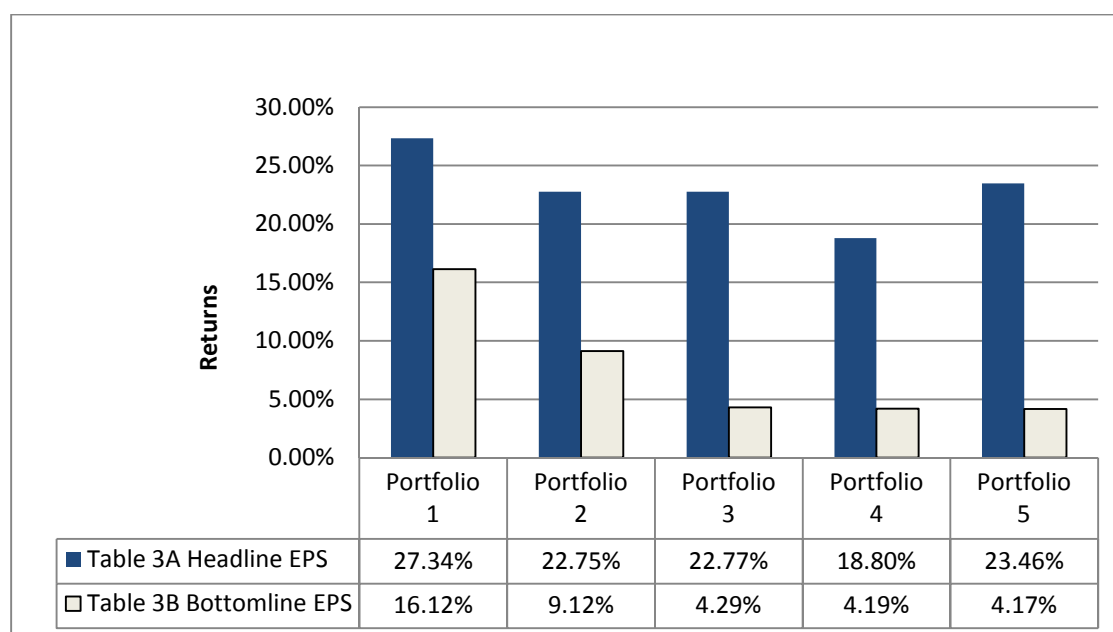


Figure 16: Headline versus bottom-line EPS average returns - regular portfolios

⁶⁹ EPS is the only one of the three criteria used by Maritz and Klerck for portfolio formation which is comparable to the method used in this thesis.

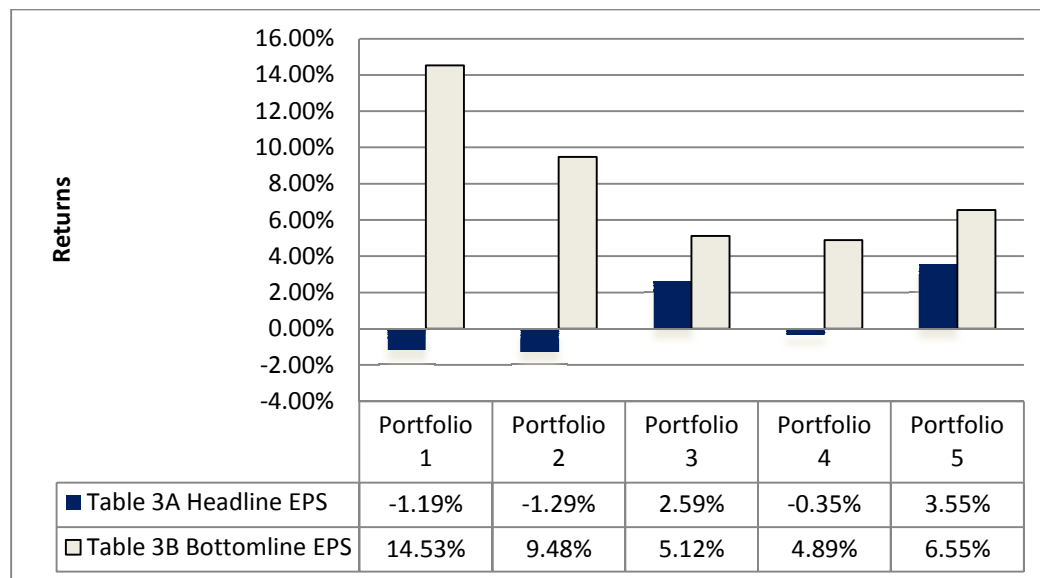


Figure 17: Headline versus bottom-line EPS average returns – size-adjusted portfolios

The two figures above show that the inclusion of extra-ordinary items impacts small companies more dramatically than large companies, and that it happens in a more haphazard manner. This is in line with previous findings on EPS for the JSE; in fact, this study shows EPS to be even more pronounced, depending on the inclusion or exclusion of extraordinary items.

The weaker EPS – headline EPS which includes extra-ordinary items – still produced a value premium of 4% (or 3.88% before rounding) before size-adjusting, which is comparable to findings in the UK and almost identical to the 3.3% annual earning yield premium found by Van Rensburg and Robertson (2003b). This study also confirms Basiewicz and Auret's finding (2009) that headline EPS is a weaker predictor of share price return than either BV/MV or CF/P.

Fraser and Page (2000) found their value portfolios outperformed their growth portfolios by 0.6% per month, or approximately 8% per year. This thesis found that the size-adjusted difference between the value and the growth portfolio is between 9% and 10% per annum when portfolios are based on BV/MV and CF/P (tables 1 and 2 in chapter 5), and 8% per annum when portfolios are based on bottom-line EPS (table 3B chapter 5).

Many other South African studies on EPS – such as De Villiers, Lowing, Petit and Affleck-Graves (1986) as well as Page and Palmer (1991) – pre-dates 1992, which means that the only data available to them was headline EPS. However, all South African research found strong evidence that EPS has predictive power for future share price returns. The observation made in this thesis is that bottom-line EPS provides a more profitable basis for portfolio formation than headline line EPS, but not more so than BV/MV or CF/P.

6.3.3 Mean reversal

Mean reversal in South Africa has been shown to be very profitable, generating excess returns of 15% per annum. (Page and Way, 1992) or 11.5% per annum (Cubbins et al., 2006). The difference between the two findings is probably due to the longer time period of the Cubbins et al. study – twenty-two years, as opposed to fifteen years in the case of Page and Way – and also because the Cubbins et al. study removed the effect of survivor bias.

The reason for the persistence of excess returns based on mean reversal was addressed by Bailey and Gilbert (2007). They found that liquidity has an impact on mean reversal. Once the effect of liquidity is removed, the excess profits which an investor might earn by heeding mean reversal, disappears almost completely. The authors explored various possible explanations for this observation, one being that the most liquid shares on the JSE are large resource companies, which are more exposed to shocks in the form of volatile commodity prices. This volatility may make these shares more prone to investor over-reaction and thus generate a higher return. This explanation could be part of the reason why the South African value premium is larger than that found by international studies which used the same methodology.

6.4 International Comparisons

6.4.1 One-dimensional tests

Tables 38 and 39 present international findings of the one-dimensional tests, and compare them to the South African results produced in this study.⁷⁰ Table 38 shows the difference between the average annual returns generated in the five years after portfolio formation by the extreme value portfolio and the extreme growth portfolio. The difference is called the “spread”, and is equivalent to the size of the value premium.

The number of portfolios used in these studies differs, depending on the size of the financial market studied. The USA and UK studies used ten portfolios each, and consequently the difference between the extreme value and extreme growth portfolios in these cases is the difference between portfolios 1 and 10. South Africa has a smaller stock market and therefore only justified the compilation of five portfolios. Therefore, the differences presented in table 38 are between portfolios 1 and 10 for data from the USA and the UK⁷¹, and between portfolios 1 and 5 for South African and European data. All differences in this table are averages for portfolios before size-adjustment.⁷²

⁷⁰The comparisons are with studies which also used the LSV methodology employed in this study, as described in chapter 4. In the comparative tables data is presented with two decimal points, but in the main text numbers are rounded with no decimal points. This is consistent with the rest of the thesis.

⁷¹There are unavoidable complications in table 38, because the European portfolio includes the UK, which is also represented in a separate column. This is deemed justifiable as it reflects London's status as an important single market in its own right. It is also worth noting that there are more international studies available than what has been included here for comparative purposes. For example, similar stock market data is available for the Netherlands and New Zealand. The reason why these findings are not included is because they only used a three year annually adjusted return time frame, while the international studies presented here all used a five year period.

⁷²The South African EPS results presented in table 38 are bottom-line EPS from table 3B in chapter 5, since EPS results that exclude extra-ordinary items are more consistent with other studies.

Table 38⁷³: One-dimensional results: value versus growth spread – averaged over five years

Value measure	USA	UK	European	South Africa
BV/MV	10.5	8.95	10.00	11.84
CF/P	11.00	3.92	20.8	19.35
EPS	7.6	3.98	5.01	11.95
PSG	6.8	2.16	n/a	0.68

The USA study presented here for comparative purposes is the landmark research conducted by Lakonishok, Shleifer and Vishny (1994), which is referred to throughout this study as LSV. The UK study is by Gregory, Harris and Michou (2001), and the European study was conducted by Brouwer, Van der Put and Veld (1997). The latter contains data from France, Germany, the Netherlands and the UK.

Scrutinizing the South African results, the main observation is that of the four ways of doing portfolio formation, PSG produced a spread which is completely dissimilar to the other three ways of portfolio formation. PSG produced a return difference of less than 1% between the value and growth portfolios, while all other value measures (BV/MV, CF/P and EPS) produced double digit figures.

Comparing other South African with international results shows that the BV/MV portfolio formation basis in South Africa produced average returns that are close to the averages recorded in the USA and Europe. In the UK, BV/MV was the most profitable way of carrying out portfolio formation (compared to CF/P, EPS and PSG), and it is the only market where the difference between value and growth portfolios based on BV/MV was less than 10%.

⁷³ All values in this table are percentages (%) and refer to average annual return over five post-formation years. "Spread" refers to the difference between the performance of the top value portfolio and the bottom growth portfolio, which is portfolio 1 and portfolio 5 in this study, with South African data. Returns in the table are not size-adjusted.

CF/P as basis for portfolio formation produced the highest return difference (19%) in South Africa, which is close to the 20% spread produced by European CF/P portfolios. It was also the most profitable one-dimensional way to form portfolios in the USA and Europe. CF/P portfolios were substantially less profitable in the UK.

With EPS as basis for portfolio formation, South African data produced a higher average annual return difference than that observed in any other region under review. It is nevertheless important to note that the high value of 12% is the spread of bottom-line EPS (table 3B, chapter 5). With headline EPS (which includes extraordinary items in table 3A, chapter 5) the spread shrinks to 4%, which is almost identical to the UK value. Of the studies under review, the South African bottom-line EPS was the only one which produced a double digit spread. This may be an indication of what can be called a “Third World” premium, which reflects the greater exposure to exchange rate fluctuations which smaller markets have to contend with. The higher value premium in emerging markets had been documented by various authors, most convincingly by Rouwenhorst (1999).

Table 39 extends the one-dimensional comparison, by not only looking at the difference between results generated by the extreme value and growth portfolios, but by also tracing the actual returns generated by each of the two extreme portfolios.

Table 39⁷⁴: One dimensional test: performance of extreme value and growth portfolios and spread

Portfolio based on	USA			UK			South Africa		
	Extreme value portfolio	Extreme growth portfolio	Spread	Extreme value portfolio	Extreme growth portfolio	Spread	Extreme value portfolio	Extreme growth portfolio	Spread
BV/MV	19.8	9.3	10.5	27.42	18.47	8.95	30.07	18.23	11.84
CF/P	20.1	9.1	11.00	24.49	20.57	3.92	29.69	10.34	19.35
EPS	19.0	11.4	7.6	24.62	20.64	3.98	27.34	23.46	3.88
PSG	19.5	12.7	6.8	21.05	18.89	2.16	22.28	21.60	0.68

The most telling observation from table 39 is that, although the PSG way of doing portfolio formation in South Africa is not particularly impressive in terms of spread, the top PSG value portfolio in South Africa generated a higher return (22%) than any of the other top international PSG value portfolios. In fact, the rest of South Africa's top value portfolios, whether based on BV/MV, CF/P or EPS, generated a higher return than their international counterparts. This could again be an indication of the possible effect of a "Third World" premium.

6.4.2 Two-dimensional test comparisons

Comparisons with main international markets become even more revealing when the two-dimensional basis for portfolio formation is brought under the spotlight, as table 40 shows.

⁷⁴ All values in this table are percentages (%), and refer to the average annual return over five post-formation years. "Spread" refers to the difference between the performance of the top value portfolio and the bottom growth portfolio, which is portfolio 1 and portfolio 5 in the case of the South African study. Brouwer et al. (1997) also used five portfolios for portfolio formation in their European study, but unfortunately did not include two-dimensional ways of portfolio formation. Therefore, their results could not be included in the two-dimensional table for comparative purposes.

Table 40⁷⁵: One and two-dimensional test comparisons

Portfolio based on	USA			UK			South Africa		
	Extreme value portfolio	Extreme growth portfolio	Spread	Extreme value portfolio	Bottom growth portfolio	Spread	Extreme value portfolio	Extreme growth portfolio	Spread
BV/MV	19.8	9.3	10.5	27.42	18.47	8.95	30.07	18.23	11.84
CF/P	20.1	9.1	11.00	24.49	20.57	3.92	29.69	10.34	19.35
EPS	190	11.4	7.6	24.62	20.64	3.98	27.34	23.46	3.88
PSG	19.5	12.7	6.8	21.05	18.89	2.16	22.28	21.60	0.68
PSG-BV/MV	21.12	13.0	8.12	25.00	13.19	12.53	18.9	9.4	9.5
PSG- CF/P	22.1	11.4	10.70	24.14	13.31	9.56	22.2	2.7	19.5

In addition to comparing the results from the three countries, table 40 makes it possible to ascertain whether it is more profitable to base portfolio formation on two- as opposed to one-dimensional criteria. For the former to be the case, the spread between the value and growth portfolio in the two-dimensional case must exceed the spread in the one-dimensional case. Alternatively, returns generated by the extreme value portfolio under two-dimensional portfolio formation must be higher than returns generated by the same portfolio under one-dimensional tests.

It is clear that sorting portfolios in the USA, UK and South Africa on the basis of PSG-BV/MV (the first of the two-dimensional tests) does produce a larger spread than when portfolios are based on PSG alone, but the spread is not larger than when portfolios are based on BV/MV alone, at least not in South Africa and the USA. In the UK, the spread difference is much more pronounced. The 13% spread for the UK's PSG-BV/MV portfolios is not only larger for portfolios based on PSG, but also larger than the 9% spread for portfolios based on BV/MV alone. This is an observation which may merit

⁷⁵ Results were presented at the 2010 International Business & Economics Research Conference at Caesar's Palace, Las Vegas; October 11-13, 2010. The presentation: "value investing: international comparisons" was also taken into conference proceedings.

further in-depth comparative study, considering that many multi-faceted and market-specific factors may be at play.

The yield generated by the extreme value portfolio under the PSG–BV/MV (two-dimensional portfolio formation) in the USA is 21%, which is more than when portfolios are based on BV/MV or on PSG alone (the one-dimensional ways). The yield generated by the extreme value portfolio under PSG–BV/MV in the UK is also more (25%) than the yield generated by the extreme value portfolio based on PSG alone. Both large developed countries' results in this regard are in contrast with the South African results, where the yield of the top PSG–BV/MV portfolio is less than either of the top portfolios when the one-dimensional BV/MV or PSG bases are used.

When the second of the two-dimensional portfolio formation methods is used (PSG–CF/P), it again leads to a larger spread in returns in the USA and the UK than when portfolios are based on one-dimensional PSG alone, although the difference is not large. The South African figures show almost identical values for the two approaches. Despite definite differences between South Africa and the other two large economic markets, it is noteworthy that it is the similarities between them which are by far the most pronounced. This is an unexpected finding, given that there are huge differences between small and large financial markets.

6.5 Extrapolation

In order to prove that one of the main tenets of the behavioral finance position holds true in the South African context, namely that extrapolation is a convincing explanation for the value premium, the data would first have to show that value companies grew relatively slowly in the five years before portfolio formation. Also, the results would need to show higher ratios, such as EPS/P and CF/P (which indicate a less expensive price per unit of value). This would substantiate the assumption that investors expected slow past growth trends to continue into the future, and were consequently unwilling to pay high prices for value stock. Growth companies have to show the opposite: they need to show relatively faster growth in the five years before portfolio formation, and trading at lower multiples (which indicates a higher price per unit of value). This, in turn, indicates

that investors extrapolate faster past growth rates into the future, and make them willing to pay a premium for growth companies. After portfolio formation the growth trends of value and growth companies reverse: value companies growth relatively faster than growth companies – giving rise to the value premium.⁷⁶

This description of investors' behavior is exactly what was found when South African data was scrutinized. Value companies consistently grew more slowly in terms of sales (table 17, chapter 5)⁷⁷, cash flow (table 19) and EPS (tables 22 and 25) in the five years before portfolio formation, and faster afterwards. At the time of portfolio formation, value companies were also trading at higher multiples both in terms of CF/P (table 21) and EPS/P (tables 24 and 27).

Growth companies, on the other hand, consistently grew faster in the five years before portfolio formation in terms of sales (table 18), cash flow (table 20) and EPS (tables 23 and 26), and had lower multiples at the time of portfolio formation, both in terms of CF/P (table 21) and EPS/P (tables 24 and 27).

These results clearly indicate that investors expected past stock price trends (of whatever sort) to continue into the future. For example, table 21 (CF/P) shows that investors expected the strong performance of growth companies to continue, because they were willing to pay a premium for them. This is indicated by the low multiple (0.0016 on average) at which these shares were trading, while value companies were trading at much higher multiples (0.0063 on average).

The same results were generated when EPS was investigated. Data show that regardless of whether headline earnings (tables 22, 23 and 24) or bottom-line earnings (tables 25, 26 and 27) were used, the outcome was the same, namely:

- Past growth in EPS is slower for value companies and faster for growth companies.

⁷⁶ Price is the denominator in the ratios calculation used in this study, and EPS is the nominator. Consequently, a lower ratio indicates a higher price per unit of EPS, and serves as an indicator of higher expectations for future growth and return.

- Future growth rates reverse the pattern, with value companies growing faster and growth companies more slowly.
- The EPS/P ratios at portfolio formation show that investors expected past trends to continue into the future, because growth companies traded at more expensive prices per unit of value.

For example, in table 22 value companies show EPS growth of 21% in the five years before portfolio formation and 26% growth in the years afterwards. The ratio table (table 24) shows that at the time of portfolio formation, investors expected past trends to continue into the future, which is why they were willing to pay a higher price per unit of EPS for growth companies (1.061) than for value companies (4.747).

It is therefore possible to conclude that empirical tests confirm that South African investors' investment decisions are informed by expectations about future stock prices, which they arrive at by extrapolating market observations of the recent past into the future.

This conclusion is reinforced when it is seen in conjunction with actual future share prices (i.e. share prices which at the time of portfolio formation were unknown to investors). The data indicate that mean reversal occurred in the five years after portfolio formation. Value companies, which generated a lower share price return in the period before portfolio formation, generated a higher return afterwards. Growth companies showed the opposite trend: they generated a higher share price return in the period before portfolio formation and a lower return afterwards.

This information about share price return before and after portfolio formation is recorded in tables 28 to 37, and is also depicted in the graphs below. The pattern is unmistakable – growth portfolios generated a higher return in the five years **before** portfolio formation, while value portfolios generated a higher return in the five years **after** portfolio formation.

⁷⁷ All tables referred to in this section are those provided in chapter 5.

The following five graphs (figures 18 to 22) clearly demonstrate that growth portfolios consistently outperformed value portfolios in terms of share price return in the five years *before* portfolio formation.

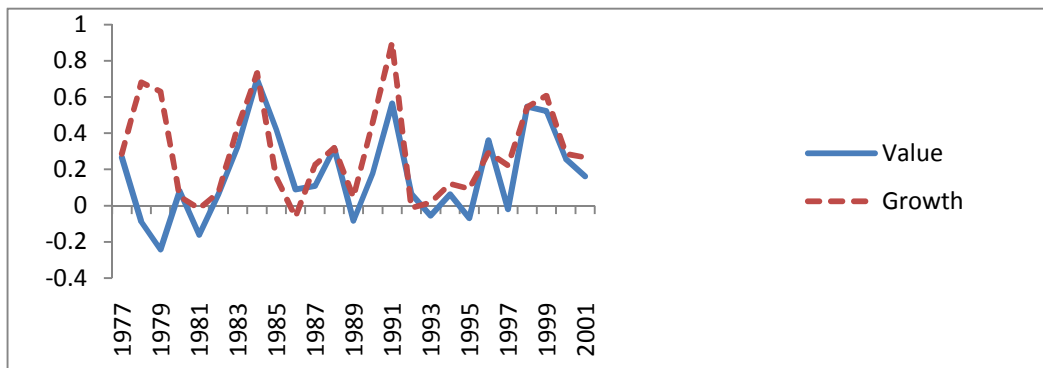


Figure 18: Value-versus-growth before portfolio formation. First year returns

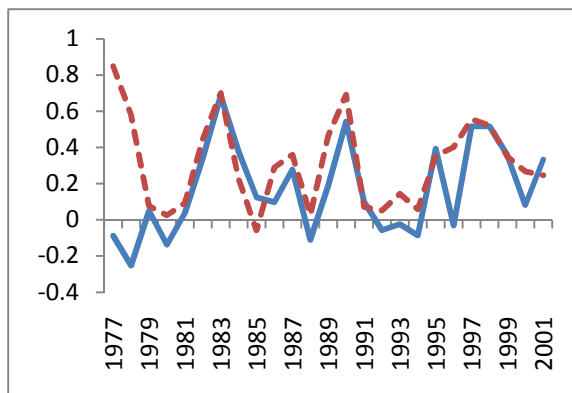


Figure 19: Value-versus-growth before portfolio formation. Second year returns

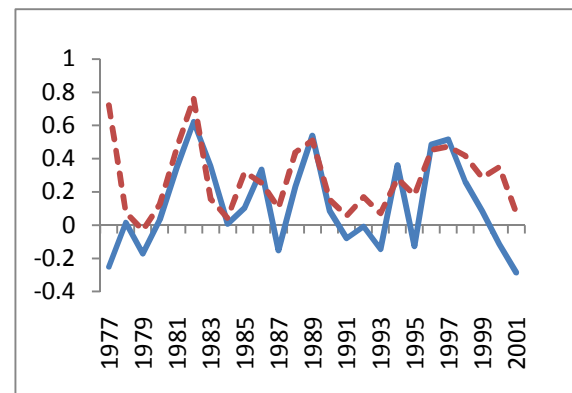


Figure 20: Value-versus-growth before portfolio formation. Third year returns:

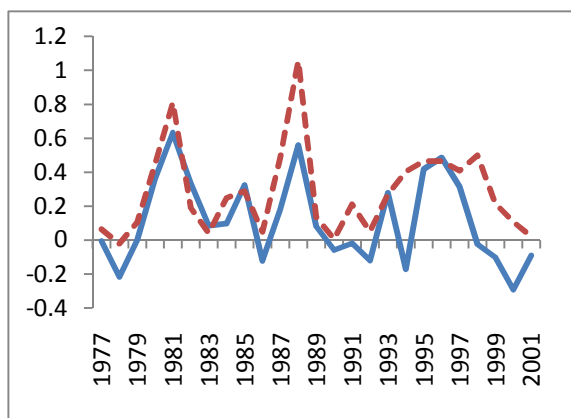


Figure 21: Value-versus-growth before portfolio formation. Fourth year returns

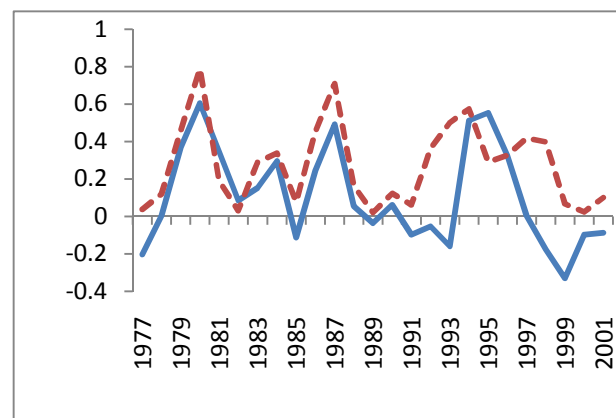


Figure 22: Value-versus-growth before portfolio formation. Fifth year returns

The following five graphs (figures 23 to 27) graphically depict the findings of tables 33 to 37 regarding share price returns in the five years directly after portfolio formation. They show that in the five years *after* portfolio formation, value portfolios outperformed growth portfolios in terms of share price return.

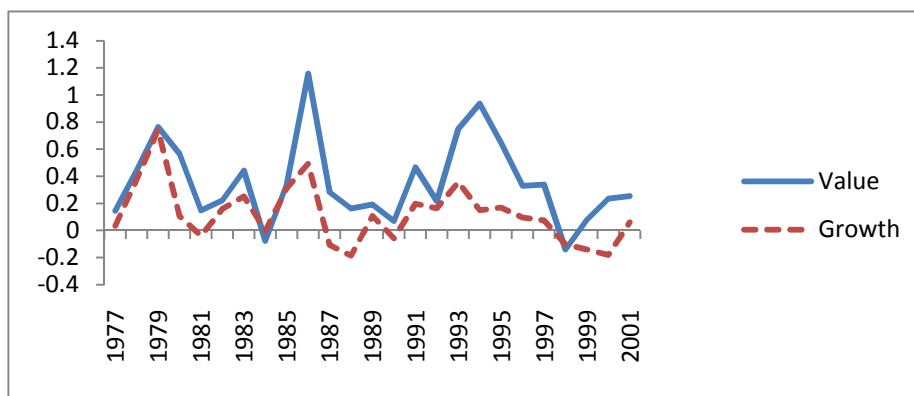


Figure 23: Value-versus-growth after portfolio formation. First year returns

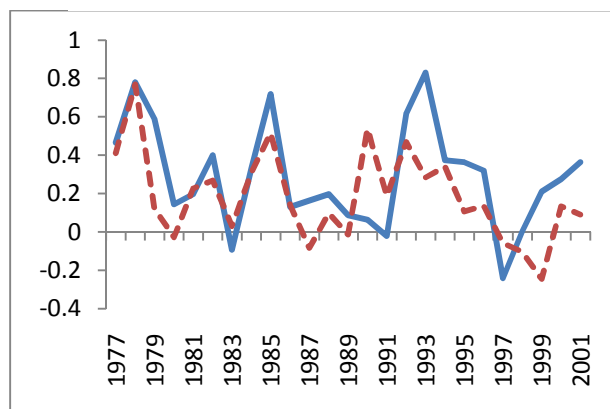


Figure 24: Value versus growth after portfolio formation. Second year returns

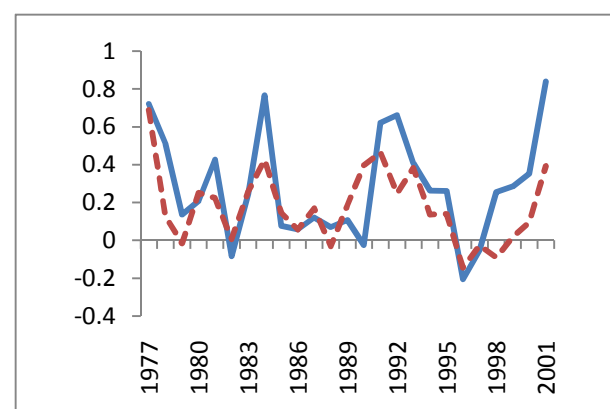


Figure 25: Value versus growth after portfolio formation. Third year returns

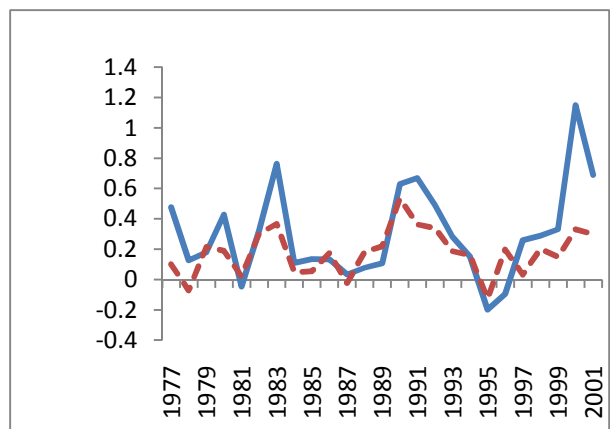


Figure 26: Value-versus-growth after portfolio formation. Fourth year returns

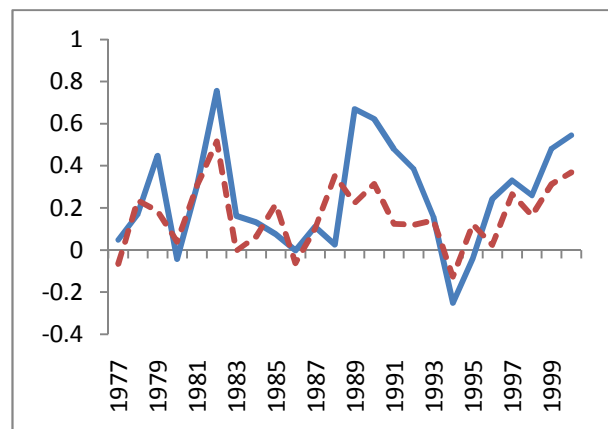


Figure 27: Value-versus-growth after portfolio formation. Fifth year returns

6.6 Suggestions for further research

This study investigated and subsequently demonstrated extrapolation as a more plausible explanation for the value premium than risk. This is entirely consistent with existing international evidence (discussed in chapter 2), which convincingly demonstrates that value portfolios are *not* more risky than growth portfolios. Two of the more comprehensive South African studies (Graham and Uliana, 2001; Fraser and Page, 2000) also corroborated the international results, by demonstrating that value companies in South Africa are no more risky than growth companies. In addition, Van Rensburg and Robertson (2003b) and Bowie and Bradfield (1998b) highlighted the limitations of the conventional approach to risk measurement (i.e. beta) in relation to the JSE. Van Rensburg and Robertson did extensive testing by sorting quintile portfolios into both a one-dimensional (based on size) and two-dimensional (based on size and EPS attributes) manner, and tested beta's power to make accurate predictions. They came to the conclusion that "...if anything, beta is inversely related to returns!" (2003b:9).

And yet, earlier studies, such as Maritz and Klerck (1997), found that value portfolios for the JSE had not only a higher share price return but also a higher standard deviation, i.e. higher risk. Fraser and Page (2000) also made the interesting observation that an inverse U-shaped relationship existed between risk and value, i.e. a portfolio's risk level initially increased with higher value, then declined or remained level between quintiles three and five (the highest value portfolio). This means that the difference in risk level between the extreme value and extreme growth portfolios was almost negligible – definitely not enough to justify the observed 8% annual difference. These findings merit thorough further research.

More recent studies on the value phenomenon in South Africa, such as Mutooni and Muller (2007) as well as Auret and Sinclair (2006), did not address risk as the potential explanation for the value premium. However, Auret and Sinclair (2006:31) did refer to BV/MV as "a proxy of certain elements of risk of a firm".

Hopefully, the findings from this study will contribute to current research activities in South Africa, and will stimulate future research into market inefficiencies such as asymmetrical information or thin trading volumes as potential explanations for the value premium. In a small market like the JSE, it is possible that widespread excess returns persist, because something (such as thin trading volumes, asymmetric information, or limiting prescriptions for large institutional investors) might prevent market participants from taking advantage of arbitrage opportunities.

Another potential reason for the persistence of the value premium considered by behavioral finance supporters is the career considerations of money managers. LSV (1994) argued that the three to five years necessary for a value strategy to pay off might simply be too long and too risky for money managers from a career perspective, especially if the value strategy underperforms on the market during that time. This is very likely the situation in South Africa as well. Scher and Muller (2005) note that it is increasingly necessary for unit trust funds to achieve and maintain good performance in order to attract and retain investors. They analyzed the performance of unit trusts that follow different investment styles (value, growth, large cap and small cap), and found that “value funds exhibited negative performance persistence that extended for at least two years” (Scher and Muller, 2005:12).⁷⁸ Conducting detailed surveys could for instance help to shed light on the possible role of such considerations in money managers’ actual decision-making.

It will also be valuable to do industry comparisons similar to those done by Fraser and Page (2000), who tested the value strategy based on sector-relative Dividend/Price and sector-relative BV/MV. They did not do sector specific comparisons, because they only used industrial company data. Comparisons between various sectors to establish whether some sectors are more “value premium prone” than others, might enhance the potential for international comparison of the South African financial market, as well as

⁷⁸ It is important to note that most funds which are referred to as “value funds” do not necessarily follow an approach for portfolio formation which is in accordance with the method followed in this study. In other words, even though they call themselves value funds, they might not meet the strict academic definition. In this study value portfolios for South African data outperformed growth portfolios even for a one-year holding period.

contribute to more profitable investment strategies. It might prove to be the case that large resource companies, which are such a sizeable part of the JSE, are more exposed to shocks in the form of volatile commodity prices, and are therefore more prone to investor over-reaction. This could also help to explain the underlying reasons for the relatively high value premium in South Africa.

Ultimately, the aspiration is that this study will contribute to the academic debate on the existence of the value premium in South Africa, and provoke further innovative research in the field of behavioral finance, and financial economics in general.

CHAPTER SEVEN

SUMMARY AND CONCLUSION

7.1 Main aims and outline of the study

This study was motivated by the ongoing and intensifying debate in financial economics between the dominant rational finance approach, and the rising breakaway approach called behavioral finance. The debate for some time now has been about the persistence and implications of a widely recognized empirical phenomenon, called the value premium anomaly. It is called an anomaly because it defies explanation by the mainstream rational finance school. Although this phenomenon had been intensively studied internationally, it has not received the same amount of attention in South African financial market research activities.

The main aims of this study were twofold: (1) to examine if the value premium also exists in South Africa, and if found, how compelling its dimensions are; and (2) to examine extrapolation as a potential explanation for it. Robust findings confirming the existence of the value premium would indicate similar anomalous behavior in the South African financial market as in international markets, both by investors (who do not maximize returns) and the market itself (allowing arbitrage opportunities to persist). The findings from this study contribute to the wider academic debate, in which supporters of the rational and behavioral finance schools explain the value premium differently. Rational finance theory explains the value premium by focusing on risk, while behavioral finance focuses on extrapolation, based on over- and under-reaction.

7.2 Summary of literature reviewed

Underlying this study is a review of the essence of both contending schools of thought. This provides the foundation for the empirical part of the thesis, both with regard to the central question which it attempts to address, and the methods which are used to do so.

7.2.1 Rational finance and its predicament

The overview of rational finance provided in chapter 2 dealt with this approach's main characteristics and their evolution over time. It also identified the growing problems which rational finance has been forced to face up to. It shows that rational finance is an application of mainstream microeconomic choice theory, which is applied to financial markets. Therefore, its main components are the idea of rational choice in markets and the efficiency of markets, which the efficient market hypothesis (or EMH) lay down as the bedrock of rational finance. Resting on this hypothesis, rational finance evolved from modern portfolio theory (or MPT) – first developed by Markowitz – to successive versions of the capital asset pricing model (or CAPM) – developed by a number of theoreticians including Lintner, Treynor, Sharpe and Fama. The essential idea is that rational investors base financial decisions on trade-offs between return and risk, which are built on the application of sophisticated financial decision-making models. Such behavior would cause financial markets rapidly to eliminate all short-term possibilities for arbitrage.

Assumptions about what rational behavior entails (including the ideas of expected utility, measuring risk as volatility, and using Bayesian probability estimates), and how this means that markets are always right, underlie this line of argument. It is these assumptions which sanitize away all but the single-minded pursuit of financial gain, which were first critically addressed and fundamentally challenged by alternative theoretical thinking. Behaviorists insist that more comprehensive (less rational and less exclusively economic) behavioral pressures are strongly influential in financial markets – a core idea of behavioral finance.

Chapter 2 also traces the empirical reasons for the ever increasing wave of challenges and objections to rational finance. This refers to the continued recurrence of anomalies which are out of line with what rational finance stipulates. The most significant one is that value stocks internationally have on average, and for decades now, performed better than growth stocks. Yet, a large number of investors do not respond rationally, by exploiting arbitrage, to grab the opportunity for higher returns. Instead, with notable

exceptions (such as Warren Buffet), enough persist with something other than a contrarian (i.e. value based) strategy – allowing the value premium to remain. This is a basic incongruity that has been crying out for an explanation.

The response from supporters of rational finance (especially Eugene Fama) to anomalies is discussed. It has essentially been to stick with the risk explanation, but then to expand it to include more than beta, and also to expand CAPM into a multi-factor model. The chapter concludes with arguments as to why the risk explanation, in whatever form, does not suffice to explain the value premium. No empirical evidence exists to suggest that value investment is consistently any more risky than growth investment.

7.2.2 Behavioral finance as response

Chapter 3 investigates the increasingly influential approach of behavioral finance as the main response to the conundrums which have come to trouble rational finance. At its core lie alternatives to the two main theoretical constituents of rational finance: (1) behavioral finance relinquishes the notion that single-minded financial rationality steers investment decisions, and (2) it allows for markets to be less than, or not consistently, efficient. Investors are seen as unable to avoid non-rational factors and goals when they make investment decisions. In the theoretical sense, the incorporation of psychological factors into decisions is one of the hallmarks of this framework, which builds on the initial work of thinkers like Kahneman, Tversky, Thaler and Shiller.

Contrary to rational finance, behavioral finance assumes that investors are normal, rather than consistently and exclusively rational; that markets are not efficient, even if they are difficult to beat; that portfolio formation does not follow mean-variance; and that investors are more oriented towards the past than the future in decision-making. Theoretically this is expressed in prospect theory as the behavioral counterpart to expected utility. It argues that gains and losses are treated quite differently by investors, causing them to be more sensitive to possible reductions in well-being than to

increases. In addition, when considering risk, behavioral thinkers allow for subjective (e.g. rooted in recent personal experience) as well as objective risk.

Chapter 3 discusses extrapolation as a potential explanation for the value premium. It charts how investors try to reduce complexity in real life decision-making by resorting to simple judgments – leading to cognitive illusions, biases and simple errors of reasoning. The most egregious error is to tie expectations about the future to past trends, or betting on current trends to persist. A ground-breaking contribution in this regard came from Lakonishok, Shleifer and Vishny (LSV) in 1994. They found that a systematic pattern of errors relating to future expectations explains the superior performance of value compared to growth stocks. Flawed intuitive forecasting and its underlying biases of heuristics, representativeness, conservatism and mean reversal are behavioral finance's explanation for the value premium. The approach of Lakonishok, Shleifer and Vishny, both regarding methodology and explanatory suggestions, is applied in an adapted form to the South African data tested in this study.

In conclusion, chapter 3 reviews previous South African research which investigated the value premium, company and sample size effect, the occurrence of mean reversal, and the role of EPS as predictor of success.

With singular exceptions, research done in South Africa prior to this thesis had used monthly rather than annual data, employed small sample sizes, and excluded major sectors like mining. This provided a strong impetus for embarking on this study, because a more substantive investigation of such a major issue as the existence of the value premium in the South African financial market appeared overdue. It is also the first time that a study which employs the LSV methodology was undertaken with South African data, and is for the longest review period (twenty-nine years) so far.

7.3 Overview of research methods

As indicated, this study used an adapted form of the methods used by Lakonishok, Shleifer and Vishny (1994). This is explained in detail in chapter 4. These methods

were applied to stocks for all sectors listed on the JSE between 1971 and 2001, with data provided by McGregor BFA.

The **first step** was to investigate and establish if the value premium was present in South Africa, and if it persisted over the twenty nine year period. Both one and two-dimensional tests were employed to test for the value premium.

One dimensional tests use one measure of value at a time, namely book-value-to-market-value (BV/MV), cash-flow-to-price (CF/P), earnings per share (EPS), or past sales growth (PSG). Companies on the JSE were classified and listed for every year between 1972 and 2001, based on each of these four value measures. After being classified, companies were grouped into five portfolios (quintiles), ranging from high value companies to high growth companies. For each of these portfolios, share price returns were calculated for up to five years after portfolio formation.

Two-dimensional tests are based on portfolio formation which uses two value measures, namely PSG and BV/MV and (independently) PSG and CF/P. In the same way as the one-dimensional tests, companies were grouped into portfolios, ranging from high value to high growth, and returns were calculated for five years after portfolio formation.

All results for both one and two-dimensional tests were size-adjusted to allow for the company size effect, which recent studies in South Africa showed to be an important factor in explaining share price returns (Van Rensburg and Robertson 2003b), as well as a factor which can influence results drastically, as in the case of mean reversal (Bailey and Gilbert 2007).

In order to prevent this study from suffering from the acknowledged research design fault of survival bias, delisted companies were included in the sample. This heeds the findings of Gilbert and Strugnell (2008) who showed survival bias to be a significant issue on the JSE.

In addition, an extensive statistical analysis was done to determine if statistically significant differences in results would be generated when different ways of composing share price data sets were used for portfolio formation and return calculation. The finding was that results were not statistically different to any significant degree.

The **second step** was to test for extrapolation as a possible explanation for the value premium. To do this, four variables were tracked and analyzed for the high value portfolio (portfolio 1) and high growth portfolio (portfolio 5). These were:

- (a) past growth performance for each portfolio in terms of earnings growth, cash flow and sales growth, i.e. for the five years **before** portfolio formation;
- (b) future growth performance for each portfolio in terms of earnings growth, cash flow and sales growth, i.e. for the five years **after** portfolio formation;
- (c) ratios of fundamentals such as earnings-to-price (E/P), cash-flow-to-price (CF/P) and book-value-to-price (BV/MV) at the time of portfolio formation
- (d) the average share price returns for each portfolio in the five years before and after portfolio formation.

The test for extrapolation as an explanation for the value premium entails determining whether data in the portfolios for high value companies grew relatively slowly in the five years before portfolio formation, and had higher ratios such as EPS/P and CF/P. This would indicate that investors expected slow past growth trends to continue into the future (extrapolation), and were consequently unwilling to pay high prices for value stock. For the extrapolation test to be affirmed, growth companies had to show the opposite, namely that portfolios grew relatively faster in the five years before portfolio formation, and were trading at lower multiples (which indicate a higher price per unit of value). This would indicate that investors' expectations are leading them to extrapolate faster past growth rates into the future, and that it makes them willing to pay a premium for growth companies.

7.4 Findings summarized and interpreted

Chapters 5 and 6 present and interpret the empirical findings made in the course of this study. Empirical findings are presented in chapter 5 as well as in extensive appendices. They are then further analyzed and discussed in chapter 6.

7.4.1 Value premium

This study established without reservation that the value premium was present in South Africa over the twenty-nine year period between 1972 and 2001, irrespective of which of the value measures (BV/MV, CF/P, EPS or PSG) were used. The latter two value measures were not as conclusively supportive of the finding as the first two, but did not contradict the finding either. The positive finding was also consistent for two-dimensional value classifications of stocks, with a combination of PSG and CF/P the most profitable.

The years during which the value premium was not evident without some degree of ambiguity, always coincided with exceptional economic and/or political circumstances. This was the case in 1973 and 1974 (the time of adapting to the first dramatic OPEC oil price hike), 1984 and 1985 (years of intensified international sanctions against South Africa, accompanied by high internal unrest), 1986 (state of emergency), 1990 (Mr. Mandela released from prison and the ANC unbanned), 1994 (first democratic election in South Africa), 1992 and 1998 (both years of great political uncertainty, first about a new constitutional order, and later about the succession of Mr. Mandela by Mr. Mbeki as president of South Africa), and 1997 (year of the East Asian crisis).

7.4.1.1 One-dimensional tests

The results of performing one-dimensional tests on the basis of BV/MV portfolio formation generated an average annual return difference of 12% per year between the value portfolio and the growth portfolio before size adjustment, and 9% per year after results were adjusted for size.

Where portfolio formation was based on CF/P, the average return difference between the value portfolio and the growth portfolio was 19 % per year before size-adjustment, and 10% per year after size-adjustment.

For portfolio formation based on EPS, results differ depending on whether headline EPS (which includes extraordinary items) or bottom-line EPS (which excludes extraordinary items) was used for portfolio formation. For headline EPS, return differences between value and growth portfolios were 4% per year before size-adjustment. After size-adjustment, the value premium disappeared altogether. Bottom-line EPS captured the value premium better with a difference of 12% before size-adjustment, and 8% thereafter.

PSG was the least successful way of doing portfolio formation for capturing the value premium, with a difference of only 0.68% between the average return generated by value and growth portfolios. After size-adjustment, the value premium disappears altogether with these portfolios too. Although the PSG is a disappointment in terms of the difference in return between the value and growth portfolios, the top PSG value portfolio in South Africa generated a higher return than any of the other top international PSG value portfolios.

7.4.1.2 Two-dimensional tests

The two-dimensional test results confirmed those which one-dimensional tests produced. They show that the difference between returns of the value portfolio and the growth portfolio is 20% per year when portfolio was based on PSG-CF/P, and 10% per year when portfolios were based on PSG-BV/MV. In both cases (PSG-CF/P and PSG-BV/MV), the value premium also persisted after size-adjusting results.

Furthermore, results show that sorting portfolios by PSG–CF/P (the second of the two-dimensional tests) did produce a slightly larger value premium than when portfolios are based on PSG alone. In the case the PSG–BV/MV (the first two-dimensional test) the value premium was not higher than when portfolios are based on one-dimensional test

of BV/MV or PSG alone.

7.4.1.3 International comparisons

When comparing results of South African data presented in this study with similar studies done abroad, it was found that the value premium is higher in South Africa than in the USA, the UK and Western Europe. This is the case for both one- and two-dimensional tests. One potential explanation for this is the far more developed nature and much larger size of markets abroad. Another is the much greater dependence on the resource sector in South Africa (mining in particular). Resource companies are more vulnerable to fluctuations in resource prices, which make them more prone to extensive under- or over-reaction by investors. This contributes to a markedly more pronounced value premium.

7.4.2 Testing for extrapolation

The second main investigative purpose of this study was also achieved. **Results show unambiguously that extrapolation serves as a convincing explanation for the persistence of the value premium in South Africa.**

Growth portfolios were found to have higher growth rates than value portfolios in all relevant categories, viz. sales, earnings and cash flow, in the five years **before** portfolio formation. However, in the five years **after** portfolio formation, the pattern clearly reverses with growth portfolios achieving lower growth rates in sales, earnings and cash flow than value portfolios. Mean reversal thus occurred for the entire twenty-nine year period under study. These results clearly indicate that South African investors expected past stock price trends (of whatever sort) to continue into the future.

The reasoning and decision-making errors underlying extrapolation are further borne out by the ratios at which the two portfolios were trading at the time for their formation. Growth companies were trading at lower and value companies at higher ratios⁷⁹.

It was thus found that empirical test results show that investors in South Africa form expectations about future stock price changes based on their observations of recent market performance. It is those expectations which lead them consistently to extrapolate market observations of the recent past into the future.

7.5 The continuing debate: going anywhere soon?

Although the findings of this study have been quite clear and are pointing firmly in one direction – namely that extrapolation is the explanation for the persistence of the value premium in South Africa as it is in international markets – it is not denied that the “myth of the rational market” will not easily be relinquished. The work done here did not set out to present findings and arguments contending that a persuasive contribution would be made to settle such a major issue once and for all. Its purpose was a much more modest one, namely to contribute to the empirical analysis of the relevant facts bearing on this debate in a specific context, and to investigate whether one widely held explanation, namely extrapolation, could be borne out by the analysis.

However, the clarity and unambiguous nature of the findings do give rise to further thought about their meaning for the debate. It is thus appropriate finally to position the work of this study in a broader perspective.

7.5.1 Main contentions

It has become clear that the main bone of contention between rational and behavioral finance is the central importance which is given to the assumptions regarding rationality in financial markets and the resulting efficiency (or not) of such markets. That

⁷⁹ In ratios such as the P/E (with price as nominator and earnings as denominator) lower values are preferable. In line with influential research in the field, this study reverses the traditional formula with price as denominator and a value measure such as earnings or cash flow as nominator. Therefore, lower ratio values indicate a higher price per unit of value, and are therefore less desirable than high ratio values.

incontrovertible evidence of anomalies exists, and that there are conundrums that challenge the rational finance framework, is not denied by any reputable research any more, irrespective of orientation. The vexing question is whether it is necessary from a scientific point of view to change paradigms to explain these anomalies. Should rationality in financial markets and the dependence on efficient market working now be replaced by another, more realistic model of financial markets and investor behavior? To address this decisive question, it is necessary to focus one last time on the basic theoretical difference between the contending approaches to finance, and on questions about the methodological grounds for retaining or relinquishing either of these theories.

7.5.2 How far apart are they?

The first point to address is how far the two contending approaches actually lie apart. At first glance the differences seem unbridgeable. Put in simplified (and overdrawn) terms, the rational finance world is populated by *Homo economicus*, a creature that makes perfectly rational decisions, applies unlimited processing power to available information, and holds preferences consistent with expected utility. But anyone with any experience of reality and a measure of honest self-knowledge knows that the world is populated by the error-prone and emotional *Homo sapiens*, a creature who does not have many – if any – of the above characteristics. The main difference between the two types of creature (the central character in each of the theories) thus lies in how “rationally” each of them is prone to act. This brings the underlying economic theorising into the picture, specifically microeconomics, which is as much a theory of rational choice as it is a theory which explains and predicts economic outcomes.

Since the early twentieth century, economic theory stripped the idea of economic rationality of its earlier hedonistic clothing. Rather than supposing that choices can be ranked in terms of the extent to which they promote an agent’s happiness or well-being, mainstream economists narrowed the focus to the ranking itself, disregarding the basis of the ranking. All that was supposed was that agents are able consistently to rank the alternatives they face – famously formalized by Samuelson (1947). Economists thus isolated it from other social sciences’ inquiries by sanitizing the content of the motives or

preferences with which it is concerned. What they chose to focus on were phenomena deriving from the single-minded and rational pursuit of wealth and more consumption. Mainstream economic thinking thus avoided analytic complexity by stepping away from the intentionality of beliefs and desires. By assumption, people believe and expect the “indisputable” facts which lie before them.

But in reality, choice depends on how things look from the inside perspective – i.e. from inside the real, subjective *Homo sapiens*. In the stock market, for instance, the true value of stocks depends on future profits, which are of course uncertain. But even if stock prices are clearly in excess of their true value, what matters in the short run is what real people believe about them. No matter how overpriced shares may be, real people will consider them good investments if they believe that somebody would be willing to pay even more for them tomorrow or next month. This is the basic reasoning behind extrapolation as explored in this thesis.

The arguments persist between the contending schools about the significance and persistence of this subjectivity. Fama (1998), in a pointed defense of rational finance, dismisses the relevance of empirical evidence of such non-rational behavior. He argues that over- and under-reaction are randomly split in terms of frequency and importance, and thus on balance will be in line with how an efficient market deals with real variations. Every market experiences chance results after all. In addition, Fama ascribes findings about long-term anomalies to the use of different research methodologies, which make such anomalies become marginal, or disappear altogether, when exposed to alternative models or statistical approaches. The matter of methodology will be returned to below in more detail.

In a cautious response to the above, Shiller (one of the main protagonists of behavioral finance) admits that although imports from other disciplines have added profoundly to theory’s ability to shed new light on persistent anomalies in finance, such underlying behavioral traits from psychology and other sciences “...are unstable and the hypothesized behavioral phenomena may disappear when the situation becomes better

structured and people have had a lot of opportunity to learn about it” (2001:1308). He furthermore contends that incorporating behavioral phenomena into finance does not entail that “anything can happen” in financial markets. Financial markets, according to Shiller, are in fact “...impressively efficient in certain respects” (2001:1333). His final, careful conclusion is that the rational finance frameworks, if appropriately used, can be a starting point from which other theories can evolve.

7.5.3 Possible agreements?

The point is that no serious researcher of any persuasion would discard markets as inherently inefficient, but relaxing particular (even fundamental) assumptions is seen by behavioral researchers as opening the way to explain actual deviations from market efficiency. This may eventually lead to a convincing and coherent alternative theoretical framework, which may even be a mere overhaul of the currently dominating one.

It is significant that behavioral theory does not simplistically contend that there is a basic psychological principle which always makes people tend to over-react or under-react. Research on financial anomalies does not reveal such a principle either. As for the rationality assumption, the mere fact that anomalies sometimes disappear or switch signs with time is no evidence that markets are fully rational. That is also what one would expect to happen in highly irrational markets. It would seem decidedly peculiar to argue that irrational markets should display regular and lasting patterns.

It is true that the bulk of work in the field of behavioral finance consists of empirical studies which demonstrate that markets behave in ways that are inconsistent with rational finance – such as studying the value premium – and showing that such deviations are consistent with one or more of the individual behavioral tendencies proposed by psychological research. The steadily growing mass of evidence coming from such studies is convincing ever more finance researchers that behavioral perspectives can at least improve predictions. This thesis falls into this category. But the issue of approaching a Kuhnian paradigm shift in financial thinking remains far from decided.

7.5.4 Deeper methodology matters

Fama's 1998b discussion of rational versus behavioral finance steered the discussion into the deeper waters of the methodology employed in Economics research. Unsurprisingly, since he can be regarded as a member of the influential Chicago School, Fama confronts critics of the efficient market approach with the well-known requirements for a tenable theory, namely that it should be simple, unified and refutable (Fama, 1998b:284). His point is that one cannot discard a reasonably successful theory ("successful" in the classical sense as defined by Milton Friedman, 1953) unless it can predict better than existing theory without being too complex, and is refutable on the basis of empirical evidence.

Model builders in the behavioral approach have indeed made some progress toward simplicity and refutability (testability) by demonstrating that behavioral forces can be built into traditional models such as in the work of Barberis, Shleifer and Vishny (1998), Hong and Stein (1999) and Barberis and Huang (2008). Whether model-builders will ever be able adequately to address the demand for simplicity and refutability is doubtful. Individual behavior is inherently too complex and the deviations from *Homo economicus* are so numerous, that defenders of rational finance will always be able to point to the resultant profusion of alternative models as sufficient indication that behavioral finance is not simple or refutable.

However, the methodological aspect of the debate remains a source of discomfort for both sides. How "successful" is any one of the contending theories on this score? Behavioral finance has not come forward with a single, explicit alternative to *Homo economicus*, and as long as this continues, it cannot meet the requirement of refutability, or testability. It is thus quite some distance away from producing a more complete and standardized alternative theory of financial markets. On the other hand, the instrumentalist positivism (following Friedman, 1953) that provides the basis for a defense of rational finance, also leaves it seriously vulnerable. As argued before, instrumentalism views science as a method of inquiry to identify recurring associations among observable variables, but argues that the variables themselves, or the theories

that describe the relationships among them, need not be realistic. The realism of assumptions is irrelevant. Prediction on the basis of them is what counts, assuming that economic variables function as *if* all decisions are made by *Homo economicus*. On this basis, rational finance defenders imply that behavioralists are arguing their case on the basis of realism rather than predictive power. Furthermore, behavioral finance is deemed as scientifically unsound because its supporters present a theory that can be adapted *ex post* to accommodate almost any observation.

And yet, when the criterion of predictability is applied to rational finance theory, the evidence is increasingly disturbing. As this study indicates, together with a continually growing body of similar findings elsewhere in the world, rational finance simply cannot reliably predict a substantial and practically relevant body of observations. This means that the rational finance approach also fails its own criterion for being scientific.

There is yet another, earlier, issue in rational finance theorizing – one that even more fundamentally militates against the precepts of instrumentalist positivism. This concerns the classic matter of the relevance of assumptions, as mentioned above. In a consistent application of Friedman's arguments, no social science is required to hold on to (or defend) any assumption as if it had to be "true". Any assumption is acceptable, as long as it contributes to good prediction. It is perplexing then that rational finance theorists persist in defending the rationality assumption so strongly against the alternative of non-rational, emotion-driven motives for investor behavior. To a degree this also goes for doggedly defending the idea of the efficiency of markets. By refusing to admit a freer choice of assumptions, and by being unable to predict important observations on how financial markets actually work, rational finance finds itself in a position from which it can hardly convincingly accuse behavioral finance of being insufficiently "scientific", according to the tenets of instrumentalist methodology. Alas, rational finance too cannot claim the high ground on predictive power and testability.

7.5.5 Where to now?

Does all of the above mean that Thaler is right when he speculates as follows in his musings on *The End of Behavioral Finance*?:

“Behavioral finance is no longer as controversial a subject as it once was. As financial economists become accustomed to thinking about the role of human behavior in driving stock prices, people will look back at the articles published in the past 15 years and wonder what the fuss was about. I predict that in the not-too distant future, the term “behavioral finance” will be correctly viewed as a redundant phrase. What other kind of finance is there? In their enlightenment, economists will routinely incorporate as much “behavior” into their models as they observe in the real world. After all, to do otherwise would be irrational” (1999:17).

This is probably a much too optimistic opinion. But the debate between the currently contending positions about vexing research findings and their possible explanations has opened possibilities for a more sound and useful contribution by financial economics to improving financial investment. A larger degree of humility and openness to cross-fertilization between contending positions seem appropriate now.

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APPENDIX 1

TABLES SUPPORTING ONE-DIMENSIONAL TESTS

The data presented in the tables in appendix 1 form the basis for the first four tables (tables 1 to 4) in chapter 5. The average returns recorded at the bottom of appendix tables 1 to 5 serve as input into table 1 in chapter 5⁸⁰. For instance, the averages at the bottom of appendix table 1 appear in table 1 (chapter 5) as the first line, where it is called “1yr”. The average returns recorded at the bottom of appendix table 2 appears as the second line in table 1 (chapter 5) where it is called “2yr”, and so forth.

Tables 1 to 4 in the main text (chapter 5) were constructed by using the result of the following appendix tables:

Tables	Appendix tables behind each table
Table 1 BV/MV annual returns	Appendix tables: 1, 2, 3, 4 and 5
Table 2 CF/P annual returns	Appendix tables: 6, 7, 8, 9 and 10
Table 3A Headline EPS annual returns	Appendix tables 11, 12, 13, 14 and 15
Table 4 PSG annual returns	Appendix tables 16, 17, 18, 19 and 20

All values in appendix tables are numerical (up to four decimal places).

A1 Methodology for constructing tables in appendix 1

A1.1 Portfolio formation

Companies trading on the JSE between 1972 and 2001 were sorted in annual order based on the value of a particular value measure such as:

⁸⁰ It is the “average” in each table that appears in the tables in chapter 5, **not** the size adjusted average.

A1.1.1BV/MV = Ordinary shareholder's interest each year/market value (appendix tables 1 to 5).

McGregor data line input formula: [line 6/(line 102 x line 149)]

McGregor's standardized manual defines line 6 as "**ordinary shareholders' interest**" and describes it as: "This item consists of the ordinary share capital paid, plus the distributable and non-distributable reserves, less the cost of control of subsidiaries and intangible assets. It represents the equity of the ordinary shareholders of the Company in the total assets of the Group, with the exclusion of the cost of control and the intangible assets."

McGregor's standardized manual defines line 102 as "**number of ordinary shares**" and describes it as: "This represents the number of shares in issue at year-end and is the total of lines 201, 202, 203 and 204. This number of shares in issue therefore represents the total of all kinds of shares that may be in issue by the Company, with the exception of preference shares."

McGregor's standardized manual defines line 149 as "**average price per share sold**" and describes it as: "The average price per share for the total of the financial year or period of the Company, is calculated by dividing the total monetary value of the shares traded during this year or period, by the number of shares traded during this year or period."

A.1.1.2 Cash-flow-from operations/market value (appendix tables 6 to 10)

McGregor data input formula: [line 703/(line 102 x line 149)]

McGregor's standardized manual defines line 703 as "**cash as operations**" and describes it as: "This represents the total of lines 701 and 702. It is automatically generated." Line 701 is defined as "**operating profit/loss**", and is described as: "This line consists of the operating profit as per the published cash flow statements. Line 702 is defined as "**depreciation and other non-cash items**", which is defined

as: “All non-cash items are disclosed on this line. (Both negative and positive amounts). Examples are, inter alia, depreciation, amortisation, impairment or other losses relating to fixed assets, investments, loans, inventories or any other assets.”

A.1.1.3 Earnings per share/market value (appendix tables 11 to 15).

McGregor data input formula: $[\text{line } 144 / (\text{line } 102 \times \text{line } 149)]$

McGregor's standardized manual defines line 144 as “**(headline) earnings per share**” and describes it as: “This represents the ‘headline earnings per share’ or the ‘adjusted headline earnings per share’ if that is the only ‘headline earnings disclosed in the published financial statements’.” Line 144 is also disclosed on line 306 in McGregor standardized manual.

A.1.1.4 Past sales growth (appendix tables 16 to 20)

McGregor data input formula: $[(\text{line } 51 \text{ in all 3-years before portfolio formation})/3]$

McGregor's standardized manual defines line 51 as “**turnover**” and describes it as: “This figure represents the total turnover as reflected in the published financial statements of the Company or Group. It may sometimes be reflected as ‘Revenue’ and in the case of life insurance companies the amount used is ‘Gross recurring premiums’. Banking companies do not disclose any form of turnover due to the nature of their business.”

After sorting companies according to one of the above-mentioned criteria, five equally sized portfolios (quintiles) were formed annually from high value (portfolio 1) to low value or growth (portfolio 5).

A1.2 Return tracking

After calculating the return per company, the returns are added up and divided by the number of companies in the portfolio to get the portfolio return, which are the values reported in the table.

Appendix 1 Table 1:
BV/MV first year annual return

	High Value	Values in decimals				Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1972	0.4347	0.3544	0.2698	0.2478	0.2875	
1973	0.0972	-0.1251	-0.1301	-0.0238	1.2036	
1974	0.9763	-0.1589	-0.2370	-0.1302	-0.2976	
1975	0.1578	0.0668	-0.0240	0.0520	0.0095	
1976	-0.0716	-0.1795	-0.1242	-0.0084	-0.0202	
1977	0.1440	0.0936	0.0882	0.1625	-0.0540	
1978	0.5034	0.3545	0.3412	0.3251	0.4349	
1979	0.8332	0.6709	0.4804	0.6202	0.8296	
1980	0.6166	0.4476	0.3757	0.2997	-0.0096	
1981	0.2009	0.0329	0.0559	0.0486	-0.1590	
1982	0.2903	0.1966	0.1734	0.1429	0.1675	
1983	0.4624	0.3241	0.2180	0.2213	0.2723	
1984	-0.0609	-0.1213	-0.0371	-0.0430	0.0643	
1985	0.3364	0.3437	0.2956	0.2672	0.3628	
1986	1.6211	0.3284	0.3423	0.3891	0.6078	
1987	0.0250	0.0198	0.0457	-0.0838	-0.1696	
1988	0.2069	0.1202	-0.0113	-0.0897	-0.2062	
1989	0.1577	0.1725	0.0505	0.1626	0.0186	
1990	0.0745	0.0297	0.0681	-0.0044	-0.1012	
1991	0.7226	0.0668	0.1706	0.3029	0.1199	
1992	0.1065	0.2248	0.0818	0.0634	0.2031	
1993	0.8247	0.5681	0.2907	0.2326	0.4850	
1994	1.0859	0.6156	0.2706	0.3017	0.1303	
1995	0.7149	0.4294	0.1827	0.2072	0.1775	
1996	0.1907	0.4551	0.2301	0.2329	0.0253	
1997	0.5248	0.0231	0.1095	0.0700	0.0539	
1998	-0.1211	-0.2275	-0.1433	-0.2231	-0.0483	
1999	0.0894	0.0271	-0.0750	-0.1639	-0.1215	
2000	0.2348	0.0242	-0.1540	-0.1864	-0.1517	
2001	0.3803	0.0923	0.1265	0.1455	-0.1169	
Average	0.3920	0.1757	0.1110	0.1180	0.1333	
Size adjusted	0.1621	-0.0352	-0.0579	-0.0347	-0.0724	

If book-value-to-market-value ("BV/MV") is used as basis for portfolio formation, returns recorded in appendix table 1 show return **one year after portfolio formation**.

Data line input formula:
(line 149 year₁ – line 149 year₀) / line 149 year₀.

For example: for a portfolio formed in 1973 the first year's return is calculated as: (line 149 for 1974 – line 149 for 1973)/line 149 for 1973.

After calculating the share price return for each company, the average for all companies in each portfolio is recorded in the table as portfolio return for that year.

In a regression analysis, BV/MV as basis for portfolio formation was found to be a statistically significant "predictor" of share price return on a one year annually adjusted return basis: t-stat = 2.11183, and p-value = 0.0341.

The averages recorded at the bottom of appendix table 1 represent the average return generated by each of the quintile portfolios in the first year after portfolio formation. In other words, if an investor bought a high value portfolio in 1982 and sold it one year later in 1983, it would have generated a 29% rate of return. However, if that same investor bought a growth portfolio in 1982 and sold it one year later, it would only have generated a 16% return. Similarly, a value portfolio bought in 1991 would have generated 72% return by 1992 as opposed to the 12% return generated by a growth portfolio over that same period.

In the twenty-nine years for which data is available, there are only five years (1973, 1976, 1985, 1992 and 1998) in which the extreme value portfolio (portfolio 1) did not outperform the extreme growth portfolio (portfolio 5) in the first year after portfolio formation.

Appendix 1 Table 2:
BV/MV second year annual return

	High Value				Growth
<i>Portfolio formed in...</i>	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>
1972	0.0140	-0.0377	-0.1538	0.0545	1.2703
1973	0.3718	-0.1727	-0.2199	0.0449	0.1448
1974	0.1610	0.1010	0.0170	0.0215	-0.0503
1975	-0.0981	-0.1162	-0.1711	-0.0519	0.0023
1976	0.2099	0.0501	0.1235	0.0677	0.0054
1977	0.4915	0.3979	0.2985	0.3534	0.3998
1978	0.7984	0.6884	0.4580	0.8716	0.6149
1979	0.4924	0.5806	0.3877	0.2610	0.0410
1980	0.1382	0.1029	-0.0285	0.0995	-0.1136
1981	0.2484	0.1539	0.0640	0.2268	0.2168
1982	0.5179	0.3968	0.2301	0.2451	0.2598
1983	-0.0452	-0.1487	-0.1469	0.0220	0.0740
1984	0.3197	0.2735	0.3087	0.3288	0.3284
1985	0.8523	0.3855	0.5574	0.3530	0.6255
1986	0.1654	0.0717	0.0819	0.1733	0.1179
1987	0.2072	0.1771	0.1359	0.1507	0.1169
1988	0.1999	0.1378	0.1008	0.1632	0.0285
1989	0.1001	0.0644	-0.0868	0.0777	-0.0692
1990	0.0557	0.0661	0.2771	0.2468	0.7524
1991	0.0096	-0.0727	0.3462	0.1285	0.2570
1992	0.7716	0.4058	0.4680	0.2421	0.6109
1993	0.9017	0.6022	0.4392	0.2790	0.2500
1994	0.3478	0.4553	0.2383	0.2019	0.4574
1995	0.4007	0.0983	0.2014	0.1978	0.1150
1996	0.3903	0.1186	-0.0576	0.0388	0.2015
1997	-0.2082	-0.1779	-0.2274	-0.1413	0.0123
1998	0.0522	-0.0309	-0.0038	0.0916	-0.1440
1999	0.1108	0.2441	-0.0393	-0.2477	-0.1822
2000	0.3140	0.1139	0.0533	0.0709	0.1308
2001	0.4264	0.1679	0.0126	0.0105	0.0992
Average	0.2906	0.1699	0.1221	0.1527	0.2191
Size adjusted	0.0317	-0.0481	-0.0497	0.0125	0.0198

Appendix table 2 shows **annual share price return in the second year after portfolio formation.**

Data line input formula: (line 149 year₂ – line 149 year₁) / line 149 year₁.

For example: for a portfolio formed in 1973, annual return in the second year is calculated as: (line 149 for 1975 – line 149 for 1974)/line 149 for 1974.

In a regression analysis, BV/MV as basis for portfolio formation was found to be statistically significant: t-stat = 3.8591, and p-value = 0.0001.

Appendix Appendix 1 Table 2.1 Table 3

Appendix 1 Table 3: BV/MV third year annual return

	High Value				Growth
<i>Portfolio formed in...</i>	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>
1972	-0.2038	-0.2663	0.0750	0.4442	0.2367
1973	0.1768	0.0620	0.0071	-0.0156	0.0240
1974	-0.1043	-0.0634	-0.1992	-0.0911	-0.0429
1975	0.1444	0.1253	0.0223	0.1160	-0.0030
1976	0.3916	0.4337	0.3395	0.3703	0.4138
1977	0.7976	0.6122	0.6289	0.7674	0.6315
1978	0.4889	0.6363	0.3484	0.2504	0.0423
1979	0.0992	0.1499	0.0273	0.0787	-0.1058
1980	0.1908	0.2086	0.1408	0.1961	0.2279
1981	0.5123	0.2904	0.1779	0.2639	0.1626
1982	-0.0449	-0.0716	-0.0331	-0.0612	0.0318
1983	0.2684	0.2643	0.3411	0.3547	0.3069
1984	0.8759	0.4755	0.4003	0.5354	0.4632
1985	0.1594	0.0799	0.0478	0.2440	0.0909
1986	0.0559	0.1916	0.1611	0.0318	0.0137
1987	0.0392	0.1247	0.1100	0.1999	-0.0214
1988	0.0499	0.1032	-0.0191	0.0330	-0.0779
1989	0.1035	0.1267	0.8053	0.2650	0.1506
1990	-0.0255	-0.0388	0.0892	0.2619	0.3700
1991	0.6917	0.3700	0.4141	0.3165	0.6142
1992	0.7435	0.6821	0.3627	0.2324	0.2985
1993	0.3458	0.4330	0.2482	0.1772	0.4669
1994	0.3418	0.1293	0.2153	0.1193	0.1371
1995	0.0582	0.2628	0.0602	0.0157	0.2297
1996	-0.1358	-0.2426	-0.1293	-0.1653	-0.0882
1997	-0.0137	-0.0611	0.2689	0.0617	-0.0417
1998	0.3710	0.0592	-0.0179	-0.1155	-0.0537
1999	0.3417	0.1878	0.0604	-0.0439	0.0984
2000	0.4416	0.1247	0.0463	0.0250	0.1271
2001	1.0266	0.4294	0.3823	0.1940	0.4792
Average	0.2729	0.1940	0.1794	0.1687	0.1728
Size adjusted	0.0321	0.0146	0.0056	-0.0138	0.0012

Appendix table 3 shows annual **share price return in the third year after portfolio formation.**

Data line input formula: (line 149 year₃ – line 149 year₂) / line 149 year₂.

For example: for a portfolio formed in 1973, annual return in the third year is calculated as: (line 149 for 1976 – line 149 for 1975)/line 149 for 1975.

In a regression analysis, BV/MV as basis for portfolio formation was found to be statistically significant: t-stat = 6.5991, and p-value = 0.

Appendix 1 Table 4:
BV/MV fourth year annual return

	High Value					Growth
<i>Portfolio formed in...</i>	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1972	0.1664	0.0381	0.0318	-0.0197		0.0545
1973	-0.1393	-0.1063	-0.0821	-0.1341	0.0478	
1974	0.1200	0.0954	0.0592	0.1026		0.0447
1975	0.4454	0.3657	0.4111	0.3105		0.4426
1976	0.6769	0.6854	0.6522	0.5985	0.8753	
1977	0.5705	0.4001	0.4996	0.2715		-0.0151
1978	0.0823	0.1432	0.0559	-0.0260		-0.0853
1979	0.2404	0.0980	0.1922	0.1905	0.2442	
1980	0.4316	0.3647	0.2973	0.2640		0.0906
1981	-0.0438	-0.0675	-0.1186	0.0173	0.0269	
1982	0.2894	0.3590	0.2935	0.3257		0.2732
1983	0.8397	0.6794	0.5263	0.4261		0.3612
1984	0.0702	0.1511	0.1383	-0.0106	0.1149	
1985	0.0709	0.1198	0.0826	0.0834		0.0218
1986	0.0594	0.1230	0.2427	0.1451	0.2160	
1987	-0.0176	0.0973	0.1880	0.1532	0.1078	
1988	0.0239	0.1455	0.1347	0.8530	0.2582	
1989	-0.0402	0.3518	-0.0224	0.2861	0.1881	
1990	0.6136	0.6545	0.3885	0.1094	0.7661	
1991	0.6702	0.5618	0.5018	0.2078		0.3306
1992	0.3733	0.5302	0.2531	0.1918	0.3913	
1993	0.3424	0.1210	0.2186	0.1584		0.1144
1994	0.0554	0.0027	0.2408	0.0589	0.2020	
1995	-0.1993	-0.1531	-0.1420	-0.2155	-0.0972	
1996	-0.0387	-0.0747	0.0852	0.1458	0.1581	
1997	0.3598	0.0649	0.0235	-0.0992		-0.0091
1998	0.3328	0.1216	0.2014	0.0433		-0.0201
1999	0.4064	0.0783	0.0843	0.0609		0.1913
2000	1.4460	0.3286	0.1817	0.0752		0.3937
2001	0.6076	0.6426	0.5570	0.7502		0.2965
Average	0.2939	0.2307	0.2059	0.1775	0.1995	
Size adjusted	0.0214	-0.0022	-0.0007	-0.0085	-0.0219	

Appendix table 4 shows **annual share price return in the fourth year after portfolio formation.**

Data line input formula: (line 149 year₄ – line 149 year₃) / line 149 year₃.

For example: for a portfolio formed in 1973, the fourth year's annual return is calculated as: (line 149 for 1977 – line 149 for 1976)/line 149 for 1976.

In a regression analysis, BV/MV as basis for portfolio formation was found to be statistically significant: t-stat = 3.7216, and p-value = 0.0002

Appendix 1 Table 5: BV/MV fifth year annual return

	High Value				Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5
1972	-0.0706	-0.1971	-0.0583	-0.1357	0.0641
1973	0.0704	0.0838	0.1356	0.0830	0.0366
1974	0.4171	0.3671	0.3491	0.3217	0.4571
1975	0.6710	0.6748	0.8002	0.5534	0.7979
1976	0.5102	0.3971	0.5544	0.2319	0.0555
1977	0.0235	0.1784	0.0865	-0.0595	-0.0830
1978	0.2180	0.0578	0.2393	0.1936	0.2512
1979	0.5769	0.2654	0.3152	0.1488	0.2090
1980	-0.0258	-0.1163	-0.1047	-0.0020	0.0474
1981	0.2717	0.3073	0.2736	0.3135	0.3633
1982	0.7250	0.5530	0.3886	0.5509	0.4522
1983	-0.0063	0.4013	0.2962	0.0389	-0.0394
1984	0.1157	0.2033	-0.0244	0.1453	0.0181
1985	0.0880	0.0988	0.1426	0.0880	0.3339
1986	-0.0354	0.0781	0.1558	0.1430	-0.0767
1987	0.1706	0.4247	0.0600	0.1976	0.1052
1988	-0.0545	0.0874	0.1388	0.4291	0.2120
1989	0.6078	0.6246	0.4360	0.2563	0.2741
1990	0.6248	0.5468	0.5245	0.2891	0.3148
1991	0.4546	0.4947	0.5947	0.1269	0.1161
1992	0.4552	0.1713	0.1448	0.1303	0.1176
1993	0.1204	0.0323	0.2725	0.0309	0.1516
1994	-0.2185	-0.0752	-0.2085	-0.1620	-0.1065
1995	-0.0611	0.0046	0.0016	-0.0026	0.1876
1996	0.3310	0.0422	-0.0079	-0.0636	0.0727
1997	0.2172	0.3278	0.0907	0.3090	0.1417
1998	0.2978	0.1735	0.1484	0.1459	0.2103
1999	0.2886	0.5401	1.0486	0.2323	0.2975
2000	0.5881	0.5895	0.4106	0.3907	0.4274
2001	n/a	n/a	n/a	n/a	n/a
Average	0.2542	0.2530	0.2484	0.1698	0.1865
Size Adjusted Returns	-0.0120	0.0233	0.0305	-0.0307	-0.0247

Appendix table 5 shows **annual share price return in the fifth year after portfolio formation.**

Data line input formula: (line 149 year₅ – line 149 year₄) / line 149 year₄.

For example: for a portfolio formed in 1973, fifth year's annual return is calculated as: (line 149 for 1978 – line 149 for 1977)/line 149 for 1977.

In a regression analysis, BV/MV as basis for portfolio formation was found to be statistically significant: t-stat = 3.8996, and p-value = 0

The previous five appendix tables (appendix tables 1 to 5) were used to construct table 1 in chapter 5. The following 5 appendix tables (appendix tables 6 to 10) provided the data which was used to produce table 2 in chapter 5. In these tables cash-flow-to-market-value (CF/P) is used as the basis for portfolio formation.

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Appendix 1 Table 6:
CF/P first year annual return

	High Value					Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1987	0.4126	0.1295	0.0465	0.0709	0.0419	
1988	0.2763	0.1907	-0.0017	-0.1783	-0.2182	
1989	0.2537	0.0945	0.1797	0.1131	0.0792	
1990	0.1402	0.0693	0.0821	-0.0100	-0.1110	
1991	0.2395	0.1909	0.1595	0.1291	0.0627	
1992	0.2975	0.2428	0.0107	0.0158	0.0796	
1993	1.0611	0.5808	0.3669	0.2487	0.0565	
1994	1.1488	0.6300	0.2988	0.2369	0.1164	
1995	0.6309	0.3403	0.2133	0.1674	0.0945	
1996	0.6723	0.2166	0.0594	0.0283	0.2777	
1997	0.6002	0.0890	0.1185	0.1106	0.0535	
1998	-0.1091	-0.2525	-0.2866	-0.1063	-0.0953	
1999	0.0973	0.1569	-0.0271	-0.1170	-0.1309	
2000	0.2578	0.0377	-0.1976	-0.2883	-0.0811	
Average	0.4271	0.1940	0.0730	0.0301	0.0161	
Size adjusted returns	0.1497	0.0077	-0.0480	-0.0887	-0.0975	

Data availability for cash flow only dates back to 1987, unlike BV/MV information in appendix tables 1 to 5, which is available from 1972 onwards. This explains why appendix tables 6 to 10 only show portfolio formation starting in 1987.

If cash- flow-to-market value (CF/P) is used as basis for portfolio formation, returns recorded in appendix table 6 reflect **share price returns one year after portfolio formation**.

Data line input formula:
(line 149 year₁ – line 149 at portfolio formation)/line 149 at portfolio formation.

For example: for portfolios formed in 1987, the first year annually adjusted return is calculated as: (line 149 for 1988 – line 149 for 1987)/line 149 for 1987.

After calculating the share price return for each company, the average for all companies in each portfolio is recorded in the table as portfolio returns for that year.

In a regression analysis, cash flow as basis for portfolio formation was found to be a statistically significant and extremely strong “predictor” of share price return in the first year after portfolio formation: t-stat = 7.0834, and p-value = 0.

Appendix 1 Table 7:
CF/P second year annual return

<i>Portfolio formed in...</i>	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>
1987	0.1282	0.1314	0.1547	-0.0667	-0.0578
1988	0.1882	0.1779	0.1758	0.0741	0.0828
1989	-0.0206	0.1206	0.0288	0.0353	-0.0315
1990	0.0935	0.1144	0.1889	0.1390	0.0982
1991	0.1450	0.0518	0.1885	0.1424	0.0893
1992	0.7700	0.6138	0.3898	0.2388	0.1677
1993	1.1402	0.5085	0.3890	0.2223	0.2912
1994	0.4668	0.7772	0.1561	0.2661	0.0827
1995	0.6960	0.0505	0.0430	0.1375	0.1106
1996	0.5730	0.0001	0.0449	0.0898	0.0413
1997	-0.1211	-0.2575	-0.2746	-0.1060	-0.0705
1998	0.0336	0.0608	0.1339	-0.0737	0.0107
1999	0.0649	0.1939	-0.1515	-0.3036	-0.0091
2000	0.2731	0.1238	0.0226	0.0626	-0.0726
Average	0.3165	0.1905	0.1064	0.0613	0.0524
Size Adjusted Returns	0.0761	0.0334	-0.0121	-0.0458	-0.0512

Returns recorded in appendix table 7 are: **the annual share price return in the second year after portfolio formation.**

Data line input formula: (line 149 year₂ – line 149 year₁) / line 149 year₁.

For example: for a portfolio formed in 1987, the second year's annual return is calculated as: (line 149 for 1989 – line 149 for 1988)/line 149 for 1988.

In a regression analysis, cash flow as basis for portfolio formation was found to be statistically significant: t-stat = 3.4262, and p-value = 0.0006.

Appendix 1 Table 8:
CF/P third year annual returns

	High Value	-				Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1987	0.1358	0.0444	0.1633	0.3204	0.0162	
1988	0.0046	0.0723	0.1157	-0.0512	-0.0582	
1989	-0.0131	0.1524	0.0756	0.3104	0.1409	
1990	0.0085	0.0464	0.0471	0.1988	-0.0172	
1991	0.5485	0.3917	0.5717	0.2672	0.3365	
1992	0.7517	0.3747	0.4223	0.5250	0.3074	
1993	0.3916	0.5459	0.5452	0.1526	0.1020	
1994	0.5460	0.0931	0.0961	-0.0168	0.1011	
1995	0.0372	0.2265	0.4253	0.0207	0.0021	
1996	-0.1578	-0.2512	-0.0524	-0.2472	-0.0989	
1997	0.0170	0.1801	0.1497	-0.0744	-0.0716	
1998	0.0583	0.1822	-0.0696	-0.0660	-0.1176	
1999	0.4489	0.1727	0.0312	-0.0614	0.1807	
2000	0.4894	0.0732	0.1312	0.0188	0.0235	
Average	0.2333	0.1646	0.1894	0.0926	0.0605	
Size adjusted returns	-0.0110	-0.0096	0.0476	-0.0269	-0.0621	

Appendix table 8 shows **annual share price return in the third year after portfolio formation.**

Data line input formula: (line 149 year₃ – line 149 year₂) / line 149 year₂.

For example: for a portfolio formed in 1987, the third year's annual return is calculated as: (line 149 for 1990 – line 149 for 1989)/line 149 for 1989.

In a regression analysis, cash flow as basis for portfolio formation was found to be statistically significant in the third year's after portfolio formation: t-stat = 2.4538, and p-value = 0.

Appendix 1 Table 9:
CF/P fourth year annual return

	High Value					Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1987	0.0463	0.1023	0.0756	0.1497		-0.1028
1988	-0.0349	0.1176	0.1413	1.0273		0.3276
1989	0.0423	0.0302	0.1863	0.0974		0.2404
1990	0.7645	0.4523	0.3358	0.3892		0.3710
1991	0.6374	0.4408	0.2529	0.4148		0.5800
1992	0.9173	0.3142	0.1726	0.1953		0.0932
1993	0.1942	0.1104	0.3364	0.2325		0.1646
1994	0.2291	0.0839	0.5812	-0.1014		-0.0007
1995	-0.1993	-0.0334	-0.2154	-0.1629		-0.1261
1996	-0.0964	0.1948	0.1075	-0.0114		0.0435
1997	0.0592	-0.0584	0.0724	0.0692		-0.0498
1998	0.2895	0.4267	0.0944	-0.0244		0.3815
1999	0.4840	0.1681	0.1222	0.0765		0.0247
2000	0.4849	0.4305	0.2135	0.3599		0.2289
Average	0.2727	0.1986	0.1769	0.1937		0.1554
Size adjusted returns	-0.0105	-0.0085	0.0061	0.0265		-0.0153

Appendix table 9 shows annual share price return in year the fourth year after portfolio formation.

Data line input formula:
 (line 149 year₄ – line 149 year₃) / line 149 year₃.

For example: for a portfolio formed in 1987, the fourth year's annual return is calculated as: (line 149 for 1991 – line 149 for 1990)/line 149 for 1990.

In a regression analysis, cash flow as basis for portfolio formation was found to be statistically significant for the fourth year's annual return: t-stat = 8.0833, and p-value = 0.

Appendix 1 Table 10:
CF/P fifth year annual return

	High Value					Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1987	0.1192	0.1099	0.0409	0.3082	0.0886	
1988	-0.1083	-0.0220	-0.0477	0.3102	0.6279	
1989	-0.1083	-0.0220	-0.0477	0.3102	0.6279	
1990	0.7119	0.6440	0.2904	0.2987	0.3800	
1991	0.4723	0.3651	0.2843	0.2989	0.3105	
1992	0.4209	0.2083	0.1278	0.0938	0.0995	
1993	0.3404	0.2020	0.0921	-0.0071	0.0371	
1994	-0.1464	-0.1576	-0.1713	-0.1614	-0.1515	
1995	-0.0764	-0.0108	0.0529	0.0893	0.0724	
1996	0.0394	0.0155	0.0278	0.0276	0.0309	
1997	0.2948	0.2880	0.1887	0.2188	0.1851	
1998	0.2735	0.2571	0.1500	0.2351	0.1951	
1999	0.3149	0.3427	0.3289	0.2956	0.2944	
2000	0.7400	0.4121	0.4659	0.4228	0.4555	
Average	0.2348	0.1880	0.1274	0.1958	0.2324	
Size adjusted returns	0.0202	0.0298	-0.0396	0.0267	-0.0260	

Appendix table 10 shows the **annual share price return in the fifth year after portfolio**

Data line input formula: (line 149 year₅ – line 149 year₄) / line 149 year₄.

For example: for a portfolio formed in 1987, the fifth year's annual return is calculated as: (line 149 for 1992 – line 149 for 1991)/line 149 for 1991.

In a regression analysis, cash flow as basis for portfolio formation was found to be a statistically significant “predictor” of share price return for the fifth year's annual adjusted return basis: t-stat = 1.9081, and p-value = 0.0564

Appendix tables 6 to 10 were based on cash flow as the basis of portfolio formation. The following five appendix tables (11 to 15) are based on earnings-per-share (EPS) as basis for portfolio formation. Unlike cash flow, data availability for EPS for BV/MV again dates back to 1972. Appendix tables 11 to 15 provided the data input used for table 3A in chapter 5.

Appendix 1 Table 11:
EPS first year annual return

	High Value				Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5
1975	0.0112	0.0739	0.0541	0.0793	0.0302
1976	-0.1356	-0.0022	-0.1261	-0.0980	-0.0452
1977	0.1282	0.1066	0.0957	0.0629	0.1114
1978	0.4879	0.3563	0.4368	0.3645	0.3288
1979	0.6873	0.5898	0.6368	0.6109	0.8465
1980	0.6720	0.3270	0.2919	0.3409	0.1184
1981	0.0963	-0.0167	0.0508	0.0505	0.0705
1982	0.2179	0.1937	0.1200	0.1809	0.2668
1983	0.4259	0.2523	0.3357	0.2796	0.2029
1984	-0.0332	-0.0332	-0.1123	-0.0285	0.0030
1985	0.4394	0.3491	0.3457	0.3729	0.2871
1986	0.7190	0.5728	0.5741	0.4306	1.1531
1987	0.2579	0.1537	0.0429	-0.0042	-0.0910
1988	0.2032	-0.0003	0.0124	-0.0605	-0.0916
1989	0.2461	0.1124	0.0918	0.0837	0.1506
1990	0.1408	0.0139	0.0402	0.0655	-0.0106
1991	0.2399	0.2270	0.1987	0.1526	0.1860
1992	0.2472	0.2030	-0.0612	0.1724	0.0059
1993	0.7032	0.4933	0.4743	0.1595	0.1735
1994	1.1080	0.5482	0.4357	0.1839	0.1621
1995	0.5994	0.4263	0.1942	0.1715	0.0735
1996	0.6838	0.2464	0.1738	0.1093	0.0530
1997	0.4174	0.1716	0.2141	0.1435	-0.0694
1998	-0.1248	-0.2592	-0.2235	-0.0489	-0.1346
1999	0.1792	-0.0430	-0.0578	-0.0699	-0.0555
2000	0.1677	-0.0027	0.0424	-0.1833	-0.1441
2001	0.3874	0.0587	0.2156	-0.0258	-0.0013
Average	0.3397	0.1896	0.1665	0.1295	0.1326
Size adjusted returns	0.0794	-0.0225	0.0388	-0.0228	-0.0223

For portfolios based on earnings-per-share (EPS), returns recorded in appendix table 11 reflect **share price return one year after portfolio formation.**

Data line input formula: (line 149 year₁ – line 149 at portfolio formation)/line 149 at portfolio formation.

For example: for a portfolio formed in 1975, first year's annual return is calculated as: (line 149 for 1976 – line 149 for 1975)/line 149 for 1975.

After calculating the share price return for each company, the average for all companies in each portfolio is recorded in the table as portfolio returns for that year.

In a regression analysis, EPS was found to be a statistically significant predictor of share price return one year after portfolio formation: t-stat = 7.256, and p-value = 0.

Appendix 1 Table 12:
EPS second year annual return

	High Value				Growth
Portfolio formed in...	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5
1975	-0.1128	-0.0613	-0.1156	-0.0855	-0.0646
1976	1.4931	1.8463	2.4636	1.9325	2.3201
1977	2.4298	2.4739	2.3774	1.5509	2.8801
1978	0.4676	0.6201	0.6769	0.6478	0.9812
1979	0.6226	0.2923	0.3140	0.3763	0.1633
1980	0.0598	0.0432	-0.0042	0.1015	0.0479
1981	0.1804	0.1037	0.1189	0.2279	0.2497
1982	0.4435	0.2727	0.2581	0.3093	0.2405
1983	-0.0151	-0.1295	-0.0071	-0.1581	0.0967
1984	0.3471	0.3471	0.2480	0.3077	0.3052
1985	0.2595	0.7610	0.4478	0.4617	0.4861
1986	0.1583	0.0136	0.0459	0.0941	0.2617
1987	-0.0280	-0.0037	0.1777	-0.0121	0.1163
1988	0.1685	-0.0193	0.1671	0.1784	0.1567
1989	0.0543	-0.0914	0.0218	0.1249	-0.0108
1990	0.0806	0.0808	0.2359	0.1758	0.1454
1991	0.1184	0.0530	0.0313	0.0118	0.3423
1992	0.6414	0.2723	0.3399	0.2784	0.2827
1993	0.6576	0.2899	0.6074	0.2148	0.1747
1994	0.4805	0.2439	0.1512	0.2609	0.1269
1995	0.3270	0.4216	0.1154	0.0814	0.0561
1996	0.4798	-0.0324	0.1219	0.1275	-0.0669
1997	-0.1700	-0.3210	-0.1876	-0.0523	-0.1239
1998	0.0193	0.0063	-0.0227	-0.1173	0.0441
1999	0.1063	-0.0242	-0.1921	-0.1768	0.0573
2000	0.1821	0.0721	0.1327	-0.0687	-0.0130
2001	0.3595	0.1912	0.1468	-0.0321	-0.0473
Average	0.3634	0.2860	0.3211	0.2504	0.3411
Size Adjusted Returns	0.0118	-0.0278	0.0325	0.0040	0.0210

For portfolios based on EPS, returns recorded in appendix table 12 are the **annual share price return in the second year after portfolio formation.**

Data line input formula: (line 149 year₂ – line 149 year₁) / line 149 year₁.

For example: for a portfolio formed in 1975, the 2nd year's annual return is calculated as: (line 149 for 1977 – line 149 for 1976)/line 149 for 1976.

In a regression analysis, EPS was found to be statistically significant: t-stat = 2.8055, and p-value = 0.

Appendix 1 Table 13: EPS third year annual return

	High Value					Growth
Portfolio formed in...	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1975	0.0100	0.0834	0.1063	0.1157	0.0899	
1976	0.3822	0.3904	0.4104	0.3552	0.4190	
1977	0.4225	0.7616	0.6293	0.6075	0.9598	
1978	0.5771	0.3392	0.2853	0.3960	0.1832	
1979	0.0205	0.0299	0.0649	0.0740	-0.0114	
1980	0.1731	0.1121	0.2186	0.2614	0.1897	
1981	0.4478	0.2702	0.2386	0.3037	0.1897	
1982	-0.0595	-0.0890	-0.0304	-0.0492	0.0401	
1983	0.2322	0.2975	0.3748	0.2459	0.3944	
1984	0.6229	0.6229	0.5863	0.3745	0.5398	
1985	0.0345	0.0899	0.1774	0.0434	0.0788	
1986	0.0891	-0.0060	0.1276	0.0881	0.1387	
1987	0.0767	0.0389	0.2278	0.2716	0.1703	
1988	0.0650	-0.0634	0.0083	0.1719	-0.0372	
1989	0.0921	-0.0171	0.1626	0.1919	0.8979	
1990	0.0359	0.0702	-0.0343	0.0638	0.1149	
1991	0.4529	0.3318	0.3502	0.2707	0.3999	
1992	0.6836	0.3937	0.4559	0.1944	0.3035	
1993	0.3904	0.2348	0.3333	0.1285	0.2063	
1994	0.1899	0.5013	0.1000	0.0485	0.0341	
1995	0.0275	0.0125	0.0522	0.1195	-0.0068	
1996	-0.2226	-0.2592	-0.0628	-0.1105	-0.1106	
1997	0.0663	-0.0395	0.0186	0.0032	0.1901	
1998	-0.0942	0.0942	-0.1158	0.0215	0.0972	
1999	0.2720	0.0790	0.0240	0.0736	0.1371	
2000	0.4457	0.2395	0.0233	0.0109	-0.0731	
2001	0.8867	0.2666	0.4355	0.2495	0.2379	
Average	0.2341	0.1772	0.1914	0.1676	0.2138	
Size Adjusted Returns	-0.0118	-0.0206	0.0220	0.0011	0.0495	

Appendix table 13 shows the **annual share price return in the third year after portfolio formation.**

Data line input formula: (line 149 year₃ – line 149 year₂) / line 149 year₂.

For example: for a portfolio formed in 1975, the 3rd year's annual return is calculated as: (line 149 for 1978 – line 149 for 1977)/line 149 for 1977.

In a regression analysis, EPS as basis for portfolio formation was found to be statistically significant: t-stat = 2.3503, and p-value = 0.0187.

Appendix 1 Table 14:
EPS fourth year annual return

	High Value					Growth
Portfolio formed in...	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1975	0.3073	0.4417	0.3295	0.4292	0.4318	
1976	0.6175	0.6887	0.9279	0.6177	0.5984	
1977	0.5358	0.1973	0.3938	0.1931	0.3963	
1978	0.0277	0.0010	0.0738	0.0878	-0.1016	
1979	0.1720	0.1115	0.2323	0.2326	0.2164	
1980	0.4574	0.2825	0.2020	0.3522	0.1795	
1981	0.0104	-0.1024	-0.0763	-0.0985	0.0702	
1982	0.1699	0.4018	0.3907	0.2390	0.4175	
1983	0.4541	0.7171	0.4999	0.5959	0.5604	
1984	0.0803	0.0803	0.1358	0.1124	0.0018	
1985	0.0395	-0.0109	0.0111	0.1601	0.1380	
1986	0.0605	0.0964	0.3328	0.1151	0.2530	
1987	0.0545	-0.0388	0.1936	0.1280	-0.0098	
1988	0.0584	0.0310	0.1594	0.2358	0.8858	
1989	-0.0254	0.1353	0.0608	0.1603	0.3520	
1990	0.4549	0.4119	0.4545	0.4669	0.5259	
1991	0.6955	0.4090	0.3733	0.4688	0.1646	
1992	0.3499	0.3951	0.3380	0.1939	0.1027	
1993	0.1922	0.1682	0.0826	0.0971	0.3893	
1994	0.1268	0.5077	0.0544	0.0839	-0.0410	
1995	-0.2296	-0.1444	-0.2022	-0.0720	-0.1409	
1996	-0.1224	0.0907	0.0184	0.0624	0.2116	
1997	0.0696	-0.0588	-0.0345	0.0240	0.1698	
1998	0.3342	0.1702	-0.0443	0.0111	0.2668	
1999	0.1754	0.2808	0.1362	-0.0701	0.0701	
2000	0.3161	0.3006	0.8735	0.2708	0.4460	
2001	0.5877	0.3641	0.4416	0.4391	0.4660	
Average	0.2211	0.2195	0.2355	0.2051	0.2600	
Size Adjusted Returns	-0.0711	-0.0428	0.0191	0.0113	0.0837	

Appendix table 14 shows the annual **share price return in the fourth year after portfolio formation.**

Data line input formula: (line 149 year₄ – line 149 year₃) / line 149 year₃.

For example: for a portfolio formed in 1975, the fourth year's annually adjusted return is calculated as: (line 149 for 1979 – line 149 for 1978)/line 149 for 1978.

In a regression analysis, EPS as basis for portfolio formation was found **not** to be a statistically significant “predictor” of share price return for the fourth year's annual return: t-stat = -0.798, and p-value =0.4251.

In fifteen out of the twenty-seven years for which data is available the pattern reverses, and

growth portfolio (5) outperforms value portfolio (1).

Appendix 1 Table 15: EPS fifth year annual return

	High Value				Growth
Portfolio formed in...	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5
1975	0.7751	0.6191	0.8791	0.5721	0.6426
1976	0.2634	0.1681	0.3992	0.4797	0.4149
1977	0.0367	-0.0089	0.0570	-0.0329	0.0072
1978	0.0788	0.1545	0.2125	0.1798	0.2574
1979	0.4598	0.2782	0.1973	0.3211	0.2160
1980	-0.0256	-0.1283	-0.0655	-0.0433	0.0601
1981	0.1546	0.4268	0.2992	0.2533	0.3806
1982	0.4680	0.7515	0.6027	0.4428	0.5483
1983	0.0920	0.1390	0.2807	0.1994	-0.0290
1984	0.0100	0.0100	0.0257	0.1491	0.1774
1985	0.0307	0.3023	0.0492	0.2037	0.1910
1986	-0.0109	0.0698	0.0213	0.1976	0.0059
1987	0.0599	0.0816	0.2797	0.1829	0.1153
1988	-0.0737	-0.0485	0.0238	0.2414	0.3181
1989	0.3446	0.6276	0.6884	0.2530	0.2629
1990	0.5165	0.5323	0.5985	0.3172	0.1856
1991	0.4304	0.5096	0.0808	0.6045	0.0789
1992	0.2058	0.5498	0.1703	-0.0337	0.1052
1993	0.1965	0.5411	0.1280	-0.0291	-0.0401
1994	-0.2286	-0.1155	-0.1475	-0.2735	-0.0841
1995	-0.0377	-0.0841	-0.0050	0.1071	0.1939
1996	0.0356	0.3009	0.0282	0.0042	0.1638
1997	0.3988	0.2246	0.0572	-0.0689	0.4605
1998	0.4143	0.1239	0.2854	0.1198	0.0734
1999	0.2196	0.2257	0.3222	0.2037	0.7534
2000	0.6148	0.6380	0.3520	0.3220	0.4094
2001	n/a	n/a	n/a	n/a	n/a
Average	0.2088	0.2650	0.2239	0.1874	0.2257
Size adjusted returns	-0.0680	0.0492	0.0174	-0.0109	0.0455

Appendix table 15 shows the **annual share price return in the fifth year after portfolio formation.**

Data line input formula: (line 149 year₅ – line 149 year₄) / line 149 year₄.

For example: for a portfolio formed in 1975, the 5 yr annual adjusted return is calculated as: (line 149 for 1980 – line 149 for 1979)/line 149 for 1979.

Returns were found to be **not** statistically significant: t-stat = -0.798, and p-value = 0.4251.

The following five appendix tables (appendix tables 16 to 20) formed the basis for table 4, which is presented in chapter 5.

Appendix 1 Table 16: PSG first year's annual return

	High Value					Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1975	0.0542	0.0168	-0.0271	0.1749	0.0417	
1976	0.0903	-0.1029	-0.1572	-0.1578	-0.1118	
1977	-0.0273	0.0695	0.1572	0.1025	0.1097	
1978	0.3708	0.3334	0.3355	0.3754	0.4537	
1979	0.9762	0.8336	0.6044	0.5385	0.4971	
1980	0.2837	0.3718	0.4014	0.3616	0.3962	
1981	0.0837	0.0457	0.1081	0.0213	-0.0697	
1982	0.3388	0.0961	0.0834	0.1051	0.2573	
1983	0.1561	0.2509	0.4334	0.2876	0.3164	
1984	0.0845	0.0483	-0.1477	-0.0844	-0.0879	
1985	0.3022	0.3592	0.4117	0.2244	0.2276	
1986	0.6243	0.3869	0.7343	0.4872	0.6720	
1987	-0.0138	0.0147	0.0540	0.0891	0.2987	
1988	0.1894	0.0894	-0.0577	0.0616	0.0824	
1989	0.0234	0.2048	0.0970	0.1002	0.3410	
1990	0.0615	-0.0166	0.1146	0.1309	0.0073	
1991	0.2788	0.1176	0.1128	0.2027	0.8291	
1992	0.2800	0.1031	0.1573	-0.0605	0.2843	
1993	0.8861	0.4178	0.4004	0.4097	0.4417	
1994	0.7027	0.4238	0.3676	0.3637	0.4125	
1995	0.7097	0.3772	0.1923	0.1384	0.2790	
1996	0.5595	0.1246	0.0953	0.1125	0.0954	
1997	0.1948	0.2611	-0.0435	0.1701	0.0860	
1998	-0.1168	-0.0887	-0.2031	-0.2819	-0.0254	
1999	-0.0516	0.1454	0.0961	0.1825	-0.0561	
2000	0.4372	0.0657	-0.0877	-0.0212	-0.1752	
2001	0.0186	0.1003	0.3875	0.0937	-0.0201	
Average	0.2777	0.1870	0.1711	0.1529	0.2068	
Size Adjusted	0.0108	-0.0282	-0.0272	-0.0307	-0.0204	

For portfolios based on **past sales growth (PSG)**, returns recorded in appendix table 16 are: **the annual share price return in the first year after portfolio formation.**

Data line input formula: (line 149 year₁ – line 149 at portfolio formation) / line 149 at portfolio formation.

For example: for a portfolio formed in 1975, the first year's annually adjusted return is calculated as: (line 149 for 1976 – line 149 for 1975)/line 149 for 1975.

In a regression analysis, PSG as basis for portfolio formation was found to be statistically significant: t-stat = 2.7148, and p-value = 0.0067.

Appendix 1 Table 17:
PSG second year annual return

	High Value					Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1975	0.0655	-0.0697	-0.1651	-0.1630	-0.0812	
1976	-0.0633	0.0706	0.1894	0.1366	0.0830	
1977	0.3101	0.3935	0.3515	0.3452	0.4262	
1978	0.8900	0.7375	0.7374	0.5222	0.5949	
1979	0.3141	0.2937	0.4214	0.5766	0.2623	
1980	0.0754	-0.0346	0.0796	0.1308	-0.0604	
1981	0.2098	0.1845	0.2142	0.1280	0.1417	
1982	0.2991	0.2305	0.2437	0.3376	0.3454	
1983	0.0734	-0.0247	-0.0919	-0.0490	-0.1151	
1984	0.4104	0.3293	0.3407	0.2748	0.1971	
1985	0.5985	0.6714	0.5001	0.7049	0.4876	
1986	-0.0135	-0.0208	0.1731	0.1236	0.1877	
1987	0.1909	0.0712	-0.0304	0.0437	0.1537	
1988	0.0406	0.1137	0.0704	0.1944	0.2584	
1989	-0.0203	0.0537	0.0630	0.1465	0.0513	
1990	0.1820	0.1053	0.1845	0.1265	0.1431	
1991	0.0426	0.2956	0.1244	0.0750	0.2130	
1992	0.3277	0.7596	0.3217	0.3624	0.4737	
1993	0.3647	0.7212	0.3791	0.4001	0.3994	
1994	0.3603	0.2420	0.5742	0.2205	0.3256	
1995	0.4461	0.3235	0.0492	-0.0065	0.1854	
1996	0.0959	0.0055	0.3967	0.0500	0.0771	
1997	-0.1221	-0.1730	-0.2662	-0.1664	-0.0031	
1998	-0.0572	0.1552	0.0644	0.1034	-0.0216	
1999	0.3756	0.1145	-0.0114	0.0729	-0.1597	
2000	0.1630	0.2386	0.2259	0.1871	-0.0556	
2001	0.2269	0.0942	0.2901	0.1216	0.2291	
Average	0.2143	0.2179	0.2011	0.1852	0.1755	
Size adjusted returns	-0.0245	-0.0188	-0.0091	-0.0146	-0.0358	

For portfolios based on **PSG**, returns recorded in appendix table 17 are the annual share price return in the **second year after portfolio formation**.

Data line input formula: $(\text{line 149 year}_2 - \text{line 149 year}_1) / \text{line 149 year}_1$.

For example: for a portfolio formed in 1975, the second year's annual adjusted return is calculated as: $(\text{line 149 for 1977} - \text{line 149 for 1976}) / \text{line 149 for 1976}$.

In a regression analysis, PSG as basis for portfolio formation was found to be statistically significant: $t\text{-stat} = 3.3868$, and $p\text{-value} = 0.0007$.

Appendix 1 Table 18:
PSG third year annual return

	High Value					Growth
<i>Portfolio formed in...</i>	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1975	-0.0154	0.0281	0.2079	0.0239	0.1449	
1976	0.3012	0.2803	0.5413	0.3768	0.3534	
1977	1.0568	0.6424	0.5721	0.5530	0.6377	
1978	0.2993	0.2219	0.4939	0.4207	0.4182	
1979	-0.0488	0.0721	0.1105	0.1149	-0.0974	
1980	0.2480	0.2458	0.0641	0.2828	0.1033	
1981	0.3009	0.2977	0.5013	0.1030	0.2665	
1982	0.0682	-0.0362	-0.0571	-0.1137	-0.0872	
1983	0.3454	0.3519	0.2562	0.3651	0.2260	
1984	0.6219	0.4164	0.8937	0.6791	0.2645	
1985	-0.0651	-0.0548	-0.0297	0.1357	0.3183	
1986	0.2026	0.1220	0.0219	-0.0938	0.1697	
1987	0.0595	0.0699	0.2212	0.0470	0.0981	
1988	-0.0525	0.0532	0.0476	0.0750	0.0659	
1989	0.1129	0.2535	0.1985	0.1561	0.0661	
1990	0.0736	0.0463	0.2189	0.2200	0.3968	
1991	0.3455	0.4959	0.4960	0.4337	0.4389	
1992	0.3129	0.4548	0.3664	0.5567	0.5625	
1993	0.2682	0.3526	0.2291	0.3475	0.6335	
1994	0.5181	0.2887	0.0593	0.0194	0.1345	
1995	0.1344	0.0011	-0.0305	0.3653	0.1505	
1996	-0.0826	-0.1919	-0.2730	-0.2330	0.0548	
1997	-0.0146	0.1230	0.0483	0.0612	0.0232	
1998	0.0749	0.5549	0.0083	0.0544	-0.1028	
1999	0.1123	0.3652	0.1870	0.2339	-0.0630	
2000	0.1884	0.1115	0.3041	0.3337	-0.0133	
2001	0.4129	0.3881	0.3580	0.3288	0.3957	
Average	0.2140	0.2205	0.2228	0.2166	0.2059	
Size Adjusted Returns	-0.0476	-0.0172	-0.0033	-0.0119	-0.0555	

Appendix table 18 shows **the annual share price return in the third year after portfolio formation.**

Data line input formula: (line 149 year₃ – line 149 year₂) / line 149 year₂.

For example: for a portfolio formed in 1975, the third year's annually adjusted return is calculated as: (line 149 for 1978 – line 149 for 1977)/line 149 for 1977.

In a regression analysis, PSG as basis for portfolio formation was found **not** to be a statistically significant “predictor” of share price return in the third year after portfolio formation: t-stat = 1.5231 and p-value = 0.1278.

Appendix 1 Table 19:
PSG fourth year annual return

	High Value					Growth
<i>Portfolio formed in...</i>	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1975	0.3470	0.2894	0.4329	0.4085	0.3960	
1976	1.0422	0.5472	0.6231	0.6088	0.6596	
1977	0.3053	0.2403	0.5123	0.5061	0.3022	
1978	0.0704	0.0514	0.0175	0.1081	-0.0737	
1979	0.2952	0.2343	0.1365	0.1150	0.1364	
1980	0.2971	0.2849	0.3948	0.3414	0.1983	
1981	0.0145	-0.0478	-0.0502	-0.0307	-0.0777	
1982	0.3320	0.3567	0.3302	0.3312	0.2036	
1983	0.3728	0.9265	0.5193	0.4897	0.5732	
1984	-0.1009	-0.0926	-0.0539	0.1936	0.3208	
1985	0.0862	0.2035	0.1854	-0.1296	0.0534	
1986	0.1606	0.0460	0.0865	0.0884	0.1595	
1987	-0.0429	0.0241	0.0345	0.1587	0.0048	
1988	0.0744	0.1724	0.1879	0.1395	0.0992	
1989	0.0859	0.0305	-0.0623	-0.0516	0.3964	
1990	0.1982	0.5787	0.5339	0.4555	0.3331	
1991	0.2938	0.2886	0.4823	0.4473	0.6431	
1992	0.2458	0.3700	0.1334	0.3517	0.6654	
1993	0.3514	0.2674	0.1429	0.3002	0.0471	
1994	0.1361	-0.0266	0.4495	-0.0225	0.1701	
1995	-0.1003	-0.1460	-0.2085	-0.2236	-0.0035	
1996	-0.0611	0.1086	0.1021	0.0706	-0.0031	
1997	0.0723	0.1172	0.0363	-0.0503	0.3039	
1998	0.1258	0.3954	0.2212	0.1185	0.0393	
1999	0.1636	0.2284	0.3488	0.0383	0.1553	
2000	0.4666	0.2115	0.3116	0.4659	0.2183	
2001	0.5572	0.3774	0.5314	0.3008	0.3828	
Average	0.2144	0.2236	0.2363	0.2048	0.2335	
Size adjusted returns	-0.0461	-0.0152	0.0441	-0.0103	0.0109	

Appendix table 19 shows the **annual share price return in the fourth year after portfolio formation.**

Data line input formula: (line 149 year₄ – line 149 year₃) / line 149 year₃.

For example: for a portfolio formed in 1975, the fourth year's annually adjusted return is calculated as: (line 149 for 1979 – line 149 for 1978)/line 149 for 1978.

In a regression analysis, PSG as basis for portfolio formation was found **not** to be a statistically significant “predictor” of share price return for the fourth year after portfolio formation: t-stat = 1.2285, and p-value = 0.2193.

Appendix 1 Table 20: PSG fifth year annual return

	High Value					Growth
<i>Portfolio formed in...</i>	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1975	1.0137	0.6759	0.6643	0.5609		0.5389
1976	0.3052	0.3386	0.4860	0.4222		0.2474
1977	0.0531	0.1003	0.0713	0.0164		-0.0603
1978	0.2462	0.1925	0.2728	0.1880		0.0478
1979	0.3691	0.2675	0.3418	0.4061		0.1434
1980	-0.0223	-0.0401	-0.1002	-0.0320		-0.0064
1981	0.4196	0.2702	0.2247	0.3751		0.2795
1982	0.4692	0.5791	0.5845	0.5540		0.6752
1983	-0.0567	-0.0679	0.1638	0.2114		0.2370
1984	0.2533	0.1797	0.1003	-0.0447		0.0524
1985	0.1065	0.0873	0.1063	0.0858		0.1511
1986	-0.0271	0.0494	0.0000	0.1935		-0.0264
1987	0.0462	0.0276	0.1976	0.1349		0.1499
1988	-0.0814	0.0206	-0.0938	0.0855		0.0511
1989	0.3889	0.1808	0.3805	0.5740		0.4528
1990	0.2390	0.4099	0.2549	0.3721		0.5612
1991	0.1831	0.2835	0.1669	0.2058		0.9169
1992	0.3918	0.2821	0.0065	0.0529		0.3765
1993	0.0872	-0.0760	0.4464	0.0329		0.2188
1994	-0.0678	0.0756	0.0945	0.0887		0.0275
1995	0.0253	0.1636	-0.0623	0.0595		0.3350
1996	0.0253	0.1636	-0.0623	0.0595		0.3350
1997	-0.0147	0.2628	0.2176	0.1702		0.2673
1998	0.2046	0.2220	0.3667	0.0606		-0.0048
1999	0.1310	0.2420	0.6438	0.3939		0.2964
2000	0.3467	0.3862	0.4010	0.4802		0.4571
2001	n/a	n/a	n/a	n/a		n/a
Average	0.1936	0.2030	0.2259	0.2195		0.2585
Size adjusted returns	-0.0761	0.0385	-0.0068	-0.0187		0.0573

Appendix table 20 shows the annual share price returns in the **fifth year after portfolio formation**.

Data line input formula: (line 149 year₅ – line 149 year₄) / line 149 year₄.

For example: for a portfolio formed in 1975, the fifth year's annually adjusted return is calculated as: (line 149 for 1980 – line 149 for 1979)/line 149 for 1979.

In a regression analysis, PSG as basis for portfolio formation was found **not** to be statistically significant: t-stat = 1.2767, and p-value = 0.2017.

There are no portfolios in 2001, because data availability does not date back far enough to allow a five year analysis after 2001.

APPENDIX 2

REPEATING ONE-DIMENSIONAL TESTS WITH ALTERNATIVE SHARE PRICE DATA

McGregor BFA's data base has three different share price data sets, namely:

- The “weighted average price per share for the **financial year**” (line 149). This is the monetary value of all shares traded during a specific year, divided by the number of shares traded during that year.
- The “weighted average price per share during the last **month** of the company's financial year end” (line 150). This “year-end” price per share is calculated by dividing the total monetary value of shares traded during the last month of the company's financial year by the number of shares traded during that month.
- Month end share price (MESP) which is the share price on a specific trading day.

Having these three kinds of share price data sets available, raises the question of whether using one set of data as opposed to another will influence results, and if so, which data set is appropriate to use. The three share price data sets differ in the following ways:

- The first two are weighted averages, while the third is the closing price on a specific day.
- Line 149 is a weighted **yearly** price, while line 150 is a weighted **monthly** price.
- The time span of data available: data for line 149 covers 29 years (1972 until 2001); data for line 150 covers 26 years (1975 until 2001) and data for MESP covers 15 years (1987 until 2001).

In order to determine whether the results will differ significantly depending on which share price data set is used, the BV/MV one-dimensional test was repeated for each of the three share price data sets to produce comparisons. These were then analyzed for statistically significant differences by using the Kruskal–Wallis and one-way ANOVA tests.

A.2.1 Portfolio formation with different share price data sets

In order to test for differences by employing the Kruskal-Wallis and ANOVA methodologies, comparable portfolios were constructed with the three data sets.

BV/MV (the portfolio formation method used in this appendix) is defined as:

Shareholders' equity / (shares outstanding in portfolio formation year x share price).

This formula consists of three variables, namely:

- (1) Shareholder's equity: line 6 in McGregor's database;
- (2) Shares outstanding: line 102 in McGregor's database; and
- (3) Share price: lines 149, 150, and MESP.

To prepare three different but comparable portfolios, the first two variables were kept constant, and the third (share price) was based on each of the three data sets respectively.

This results in the following three formulas for portfolio formation:

- a) With line 149 share price data: line 6/(line 102 x **line 149**);
- b) With line 150 share price data: line 6/(line 102 x **line 150**); and
- c) With MESP share price data: Line 6/(line 102 x **closing share price on portfolio formation day**).

When conducting portfolio formation with the third type of share price, namely MESP, four days per year were chosen as a baseline for "portfolio formation day". All companies were divided into four groups depending on which quarter their financial year ends occurred. Companies with year-ends in the first quarter constitutes group A, the second quarter group B, and so on. Three months were then added to the last day of the quarter to allow enough time for financial information to reach the financial market. For group A the portfolio formation date was set as June 30; for group B it was September 30; for group C December 30 (or as close to the last trading day of the year as possible) and for group D it was March 31 of the following year.

A2.2 Return calculations with different share price data sets

In the same way as described in appendix 1, returns denote annual returns but computed successively for periods of increasing length (one, two, three, four and five years) after portfolio formation. The returns are thus calculated as follows:

Return in year x : $(\text{Share price in year } x - \text{share price in year}_{x-1})/\text{share price at year}_{x-1}$.

This formula was applied to the various share price sets as follows:

- a) $(\text{line 149 for year}_x - \text{line 149 for year}_{x-1}) / \text{line 149 for year}_{x-1}$.
- b) $(\text{line 150 for year}_x - \text{line 150 for year}_{x-1}) / \text{line 150 for year}_{x-1}$.
- c) $(\text{MESP in year}_x - \text{MESP}_{x-1}) / \text{MESP in year}_{x-1}$

After calculating the return for each company, the average return for all companies in a portfolio is recorded as portfolio return for that year. The results are presented in different parts of the study (main text and in this appendix) as follows:

Test with ...	Summary tables	Appendix tables forming the underlying basis of summary tables
Line 149	Table 1 in chapter 5 of main text	Appendix 1 Tables 1, 2, 3, 4 and 5
Line 150	Table 7 in appendix 2	Appendix 2 Tables 8, 9, 10, 11 and 12
MESP	Table 13 in appendix 2	Appendix 2 Tables 14, 15, 16, 17 and 18

All values in appendix tables are numerical (up to four decimal places).

As the table above indicates, the results presented in appendix 1, and summarized in table 1 of chapter 5, use the value represented in line 149 as the relevant share price for portfolio formation and share price return calculation. The next step is to repeat that process using line 150 and MESP respectively.

A2.3 Share price return calculation with line 150

Table 7
BV/MV annually adjusted return averages
between 1972 and 2001
using data from line 150

	High Value					Growth
Years	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1 yr	0.625	0.238	0.080	0.110		0.390
2 yr	0.313	0.277	0.225	0.189		0.279
3 yr	0.391	0.318	0.228	0.237		0.375
4 yr	0.382	0.331	0.267	0.244		0.600
5 yr	0.403	0.458	0.269	0.329		0.278
Average	0.423	0.324	0.214	0.222		0.385

Table 7 is comparable to table 1 in chapter 5, with the only difference that “weighted average share price in the **last month** of the financial year end” (line 150) was used in table 7.

Table 7 is a summary table based on the following steps: The elements in row 1 (i.e. returns in the first year after portfolio formation) are transferred from the last row in table 8 (the average for the first year after portfolio formation for all years between 1972 and 2001). Similarly, the elements in row 2 (i.e. returns in the second year after portfolio formation) are transferred from the last row in table 9. The rest of table 7 is similarly constructed from the last lines in tables 10 to 12.

Table 8
BV/MV first year annual return
using data from line 150

	High Value					Growth
Portfolio formed in...	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1975	-0.007	0.002	-0.103	-0.094	0.136	
1976	-0.066	-0.098	-0.203	0.065	0.013	
1977	0.414	0.251	0.248	0.185	0.122	
1978	0.599	0.505	0.353	0.439	0.680	
1979	1.092	0.787	0.603	0.661	0.655	
1980	0.337	0.288	0.032	0.180	-0.065	
1981	0.083	0.002	-0.054	0.004	-0.054	
1982	0.644	0.576	0.562	0.272	0.394	
1983	0.140	0.142	0.102	0.041	0.185	
1984	-0.047	-0.009	0.049	0.003	0.088	
1985	0.596	0.338	0.502	0.313	0.455	
1986	1.206	0.550	0.282	0.538	0.506	
1987	0.089	-0.048	-0.110	-0.170	-0.304	
1988	0.440	0.191	0.217	0.201	0.088	
1989	0.078	0.015	0.175	-0.013	-0.056	
1990	0.179	0.161	0.161	0.190	0.299	
1991	0.007	0.073	0.218	0.154	0.125	
1992	0.161	0.038	0.458	0.168	0.189	
1993	1.807	0.727	0.508	0.602	0.621	
1994	0.714	0.816	0.253	0.062	0.229	
1995	0.864	0.578	0.230	0.253	0.444	
1996	6.821	-0.184	-2.279	-1.529	5.129	
1997	0.178	0.028	0.055	0.092	0.167	
1998	-0.137	-0.118	-0.041	-0.156	0.012	
1999	0.229	-0.014	-0.104	0.106	-0.126	
2000	-0.010	-0.002	0.043	0.079	0.400	
2001	0.477	0.854	0.014	0.326	0.226	
Average	0.625	0.239	0.080	0.110	0.391	

This table was constructed in the same way as table 1 in appendix 1, except that instead of using line 149 as denominator, line 150 was used.

For example: for a portfolio formed in 1975 the 1st year's return is calculated as: (line 150 for 1976 – line 150 for 1975)/line 150 for 1975.

After calculating the share price return for each company, the average for all companies in each portfolio is recorded in the table as the portfolio return for that year.

Table 9
BV/MV second year annual return using data from
line 150

	Value				Growth
Portfolio formed in...	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5
1975	-0.055	-0.174	-0.079	-0.039	0.021
1976	0.411	0.280	0.197	0.232	0.118
1977	0.555	0.479	0.343	0.498	0.709
1978	0.967	0.944	0.526	0.877	0.453
1979	0.309	0.314	0.087	0.097	-0.068
1980	0.135	-0.047	-0.053	0.010	-0.043
1981	0.705	0.517	0.376	0.484	0.404
1982	0.080	0.231	0.044	0.186	0.058
1983	-0.056	-0.087	0.047	0.077	0.089
1984	0.564	0.450	0.356	0.442	0.400
1985	0.830	0.857	0.455	0.283	0.729
1986	-0.021	-0.121	-0.048	-0.014	-0.147
1987	0.302	0.256	0.396	0.168	0.276
1988	0.029	0.128	-0.024	0.066	-0.056
1989	0.184	0.132	0.287	0.287	0.117
1990	-0.060	0.019	0.152	0.307	0.032
1991	0.131	0.171	0.394	0.177	0.212
1992	1.089	1.185	0.651	0.313	0.972
1993	0.604	0.860	0.377	0.008	0.225
1994	0.372	0.389	0.437	0.265	0.687
1995	0.256	0.107	0.153	0.072	0.532
1996	0.318	0.032	-0.087	-0.022	0.073
1997	-0.029	-0.131	-0.080	0.035	-0.049
1998	-0.003	-0.029	0.553	-0.083	0.115
1999	0.319	0.495	0.129	-0.189	-0.136
2000	0.040	0.076	0.175	0.576	1.632
2001	0.493	0.164	0.334	-0.004	0.192
Average	0.314	0.278	0.226	0.189	0.280

Returns recorded in this table are share price returns in the **second year after portfolio formation**.

For example: for a portfolio formed in 1975 the second year's return is calculated as: (line 150 for 1977 – line 150 for 1976)/line 150 for 1976.

Table 10
BV/MV third year annual return
using data from line 150

	Value					Growth
Portfolio formed in...	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1975	0.382	0.279	0.142	0.262		0.124
1976	0.468	0.464	0.427	0.453		0.738
1977	1.042	0.892	0.714	0.704		0.412
1978	0.216	0.373	0.162	0.060		-0.007
1979	0.136	-0.051	-0.094	0.049		-0.040
1980	0.527	0.733	0.410	0.473		0.337
1981	0.195	0.121	0.140	0.045		0.070
1982	-0.062	0.012	-0.060	0.046		0.200
1983	0.438	0.505	0.442	0.394		0.399
1984	0.851	0.738	0.358	0.580		0.507
1985	-0.049	-0.209	-0.089	0.131		-0.182
1986	0.297	0.261	0.372	0.325		0.406
1987	0.033	0.060	-0.004	0.129		0.032
1988	0.178	0.191	0.178	0.387		0.090
1989	0.013	-0.003	0.145	0.285		0.035
1990	0.131	0.412	0.140	0.159		0.281
1991	1.196	0.740	0.756	0.462		0.946
1992	0.888	0.562	0.274	0.248		0.031
1993	0.500	0.417	0.408	0.297		0.721
1994	0.261	0.104	0.037	0.152		0.520
1995	0.059	0.246	-0.070	-0.094		0.101
1996	-0.023	-0.165	0.061	-0.023		-0.033
1997	0.018	0.117	0.375	0.071		-0.001
1998	0.423	0.255	0.027	-0.006		0.203
1999	0.568	0.872	0.087	0.081		0.298
2000	-0.022	0.201	0.094	0.480		0.613
2001	1.895	0.472	0.742	0.264		3.343
Average	0.391	0.318	0.229	0.238		0.376

Returns recorded in this table are share price returns in the **third year after portfolio formation**.

For example: for a portfolio formed in 1975, the third year's annual return is calculated as: (line 150 for 1978 – line 150 for 1977)/line 150 for 1977.

Table 11
BV/MV fourth year annual return
using data from line 150

	High Value					Growth
Portfolio formed in...	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1975	0.449	0.480	0.473	0.495	0.695	
1976	0.715	0.887	1.037	0.566	0.589	
1977	0.279	0.324	0.200	-0.020	-0.007	
1978	0.162	-0.090	-0.080	-0.060	-0.016	
1979	0.808	0.367	0.673	0.310	0.356	
1980	0.238	0.091	0.068	0.136	0.030	
1981	-0.039	-0.047	-0.016	0.002	0.190	
1982	0.531	0.369	0.425	0.512	0.332	
1983	0.865	0.827	0.656	0.458	0.402	
1984	-0.067	-0.080	0.004	-0.058	-0.167	
1985	0.278	0.257	0.277	0.253	0.480	
1986	-0.097	0.223	0.100	0.059	-0.037	
1987	0.177	0.184	0.387	0.287	0.017	
1988	-0.080	0.134	0.036	0.290	0.032	
1989	-0.009	0.605	0.073	0.286	0.176	
1990	1.327	0.834	0.666	0.487	0.955	
1991	0.976	0.399	0.373	0.134	0.194	
1992	0.630	0.516	0.354	0.241	0.663	
1993	0.242	0.088	0.148	0.058	0.565	
1994	0.181	0.151	-0.040	-0.057	0.014	
1995	-0.023	-0.210	-0.038	0.018	0.196	
1996	-0.006	0.090	0.011	0.451	0.363	
1997	0.751	0.239	0.238	-0.081	0.127	
1998	0.469	0.209	0.177	0.592	0.181	
1999	0.265	0.357	0.116	0.219	0.316	
2000	0.346	0.336	0.463	0.437	9.163	
2001	0.947	1.419	0.438	0.576	0.407	
Average	0.382	0.332	0.267	0.244	0.601	

Returns recorded in this table are **share price returns in the fourth year after portfolio formation.**

For example: for the portfolio formed in 1975, the fourth year's annually adjusted return is given by the formula:
 (line 150 for 1979 – line 150 for 1978)/line 150 for 1978.

Table 12
BV/MV fifth year annual return
using data from line 150

	High Value					Growth
Portfolio formed in...	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1975	0.757	0.784	0.866	0.811		0.560
1976	0.279	0.292	0.149	0.043		-0.011
1977	-0.007	0.060	-0.072	-0.089		0.017
1978	0.645	0.495	0.505	0.475		0.319
1979	0.295	0.107	0.077	-0.023		0.125
1980	-0.002	-0.038	-0.099	0.083		0.173
1981	0.368	0.623	0.321	0.480		0.359
1982	0.951	0.603	0.572	0.479		0.387
1983	-0.102	-0.008	-0.059	0.026		-0.193
1984	0.312	0.282	0.345	0.124		0.369
1985	-0.038	0.134	0.244	-0.106		-0.003
1986	0.130	0.241	0.324	0.358		-0.001
1987	0.010	0.050	0.100	0.052		0.131
1988	-0.017	0.350	0.090	0.342		0.386
1989	1.466	0.724	0.807	0.407		0.616
1990	0.453	1.080	0.233	0.223		0.194
1991	0.483	0.894	0.620	0.213		0.205
1992	0.253	0.048	0.138	0.126		0.556
1993	0.210	-0.118	0.154	-0.003		-0.003
1994	-0.127	-0.083	-0.004	-0.034		0.213
1995	-0.111	0.091	0.011	0.455		0.205
1996	0.579	0.456	0.154	0.151		0.005
1997	0.562	0.245	0.128	0.464		0.253
1998	0.276	0.744	0.007	0.166		0.138
1999	2.304	3.155	0.670	2.296		0.592
2000	0.455	0.386	0.658	0.623		1.091
2001	0.508	0.770	0.340	0.768		0.826
Average	0.403	0.458	0.270	0.330		0.278

Returns recorded in this table are **share price returns for the fifth year after portfolio formation.**

For example: for the portfolio formed in 1975, the fifth year's annual adjusted return is given by the formula: (line 150 for 1980 – line 150 for 1979)/line 150 for 1979.

A2.4 Share price return calculation with MESP

Tables 13 – 18 repeat the process followed in section A2.3 above, but use month end share prices (MESP) as the relevant share price value for portfolio formation and return calculation.

Table 13

BV/MV annually adjusted return averages between 1987 and 2001 using MESP

	High Value					Growth
Years	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1 yr	0.412	0.243	0.090	0.084	0.046	
2 yr	0.358	0.221	0.148	0.110	0.116	
3 yr	0.343	0.218	0.196	0.134	0.202	
4 yr	0.377	0.269	0.282	0.520	0.245	
5 yr	0.324	0.319	0.325	0.216	0.773	
Average	0.363	0.254	0.208	0.213	0.276	

Table 13 constitutes a summary of results, which was formed by following the following steps: the elements in row 1 (i.e. returns in the first year after portfolio formation) are transferred from the last row in table 14 (the average for the first year after portfolio formation for all years between 1972 and 2001). Similarly, the elements in row 2 (i.e. returns in the second year after portfolio formation) are transferred from the last row in table 15 (the average for the second year after portfolio formation for all years between 1972 and 2001). The rest of table 13 is similarly constructed from the last lines in tables 16 to 18.

Table 14
BW/MV first year annual return using MESP

	High Value				Growth
Portfolio formed in...	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>
1987	0.139	-0.075	-0.015	0.107	-0.145
1988	0.425	0.271	0.213	0.188	0.033
1989	0.160	0.049	0.006	-0.088	-0.044
1990	0.513	0.283	0.105	0.192	0.049
1991	0.182	0.034	0.021	0.160	-0.055
1992	0.264	0.353	0.304	0.150	0.551
1993	1.123	1.593	0.660	0.483	0.530
1994	0.546	0.448	0.224	0.113	0.134
1995	1.109	0.383	0.298	0.363	0.235
1996	0.730	0.208	0.109	0.111	0.172
1997	-0.126	-0.140	-0.235	-0.086	0.032
1998	0.105	0.126	-0.045	-0.082	-0.137
1999	0.070	-0.102	-0.161	-0.121	-0.273
2000	0.586	0.162	-0.112	-0.229	-0.643
2001	0.360	0.061	-0.015	0.009	0.255
Average	0.412	0.244	0.090	0.085	0.046

This table was constructed in a similar way to table 1 in appendix 1 and table 8 above, except that instead of using line 149 or line 150 as denominator, month end share price (MESP) was used.

Limited data availability meant that an analysis for only fifteen years (1987 – 2001) was possible. Portfolio formation for each company in 1987 was performed by calculating the ordinary shareholder interest in 1987/(number of shares outstanding in 1987 x share price for 1987).

Table 15

BV/MV second year annual return using MESP

	High Value					Growth
Portfolio formed in...	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	
1987	0.438	0.335	0.339	0.179	0.058	
1988	0.201	0.091	-0.040	-0.071	-0.107	
1989	0.563	0.262	0.151	0.183	0.030	
1990	0.132	-0.026	0.062	0.128	-0.019	
1991	0.295	0.223	0.280	0.278	0.487	
1992	0.966	0.851	0.671	0.483	0.741	
1993	0.412	0.561	0.218	0.064	0.217	
1994	1.092	0.476	0.233	0.350	0.254	
1995	0.313	0.106	0.153	0.044	0.027	
1996	-0.122	-0.147	-0.274	-0.032	0.020	
1997	0.083	-0.037	0.123	-0.021	0.017	
1998	0.117	0.172	-0.079	-0.164	-0.152	
1999	0.137	0.141	-0.039	-0.092	-0.241	
2000	0.335	0.067	0.029	0.146	0.079	
2001	0.416	0.254	0.402	0.181	0.338	
Average	0.359	0.222	0.149	0.110	0.117	

Returns recorded in this table are **share price returns for each company in the second year after portfolio formation.**

For example: for the portfolio formed in 1987, the second year's annual return is given by the formula:
 (MESP for 1989 – MESP for 1988)/MESP for 1988.

Table 16**BV/MV third year annual return using MESP**

	High Value					Growth
Portfolio formed in...	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1987	0.176	0.065	0.107	-0.025	-0.173	
1988	0.505	0.242	0.181	0.192	0.016	
1989	0.168	0.040	-0.035	0.219	-0.076	
1990	0.313	0.229	0.238	0.307	1.185	
1991	1.039	0.869	0.447	0.638	0.855	
1992	0.335	0.423	0.315	0.126	0.102	
1993	1.024	0.296	0.348	0.374	0.242	
1994	0.304	0.171	-0.007	0.064	0.082	
1995	-0.029	-0.167	-0.224	-0.020	0.269	
1996	0.056	-0.028	0.143	-0.007	0.046	
1997	0.011	0.053	0.219	-0.118	0.016	
1998	0.223	0.212	0.064	-0.110	-0.107	
1999	0.097	0.232	0.370	-0.040	0.091	
2000	0.535	0.201	0.291	0.158	0.328	
2001	0.395	0.440	0.483	0.263	0.158	
Average	0.343	0.218	0.196	0.135	0.202	

Returns recorded in this table are the **share price returns for each company in the third year after portfolio formation.**

For example: for the portfolio formed in 1987, the third year's annual return is given by the formula:

(MESP for 1990 – MESP for 1989)/MESP for 1989.

Table 17

BV/MV fourth year annual return using MESP

	High Value					Growth
Portfolio formed in...	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1987	0.599	0.245	0.140	0.347	0.003	
1988	0.106	-0.036	0.034	0.128	-0.037	
1989	0.268	0.376	0.892	0.289	0.328	
1990	0.674	0.966	0.774	0.551	0.789	
1991	0.293	0.446	0.413	0.050	0.090	
1992	1.080	0.389	0.339	0.318	0.227	
1993	0.261	0.070	0.085	0.004	0.620	
1994	0.283	-0.144	-0.206	-0.089	-0.044	
1995	-0.022	0.018	0.107	0.045	0.076	
1996	0.048	-0.037	0.011	0.147	0.165	
1997	0.156	0.216	0.103	0.012	-0.092	
1998	0.163	0.180	0.227	0.144	-0.013	
1999	0.374	0.461	0.174	0.223	0.359	
2000	0.262	0.387	0.307	0.315	0.228	
2001	1.123	0.500	0.836	5.331	0.980	
Average	0.378	0.269	0.282	0.521	0.245	

Returns recorded in this table are the **share price returns for each company in the fourth year after portfolio formation.**

For example: for the portfolio formed in 1987, the fourth year's annual return is given by the formula:
 (MESP for 1991 – MESP for 1990)/MESP for 1990.

Table 18**BV/MV fifth year annual return using MESP**

	High Value					Growth
Portfolio formed in...	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>	
1987	0.152	0.022	0.058	0.077	0.069	
1988	0.248	0.255	0.514	0.382	0.623	
1989	0.598	0.890	0.788	0.613	1.332	
1990	0.384	0.326	0.324	0.238	0.134	
1991	1.028	0.580	0.393	0.235	0.267	
1992	0.190	0.186	0.060	0.148	0.074	
1993	-0.191	0.164	-0.111	-0.066	-0.041	
1994	-0.029	-0.067	0.176	0.068	0.147	
1995	-0.006	0.038	0.039	-0.110	0.313	
1996	0.191	0.025	0.111	0.030	-0.024	
1997	0.119	0.143	0.392	0.035	0.047	
1998	0.347	0.211	0.413	0.205	0.252	
1999	0.335	0.395	0.366	0.358	0.178	
2000	0.613	0.400	1.140	0.815	7.761	
2001	0.884	1.223	0.222	0.222	0.472	
Average	0.324	0.319	0.326	0.217	0.774	

Returns recorded in this table are the **share price returns for each company in the fifth year after portfolio formation.**

For example: for the portfolio formed in 1987, the fifth year's annual return is given by the formula:
 (MESP for 1992 – MESP for 1991)/MESP for 1991.

A2.5. Statistical significance between data sets

A way to determine whether significant differences exist between outcomes for the three different share price data sets is to apply formal statistical tests. The two tests widely used are the one-way analysis of variance (ANOVA) and the Kruskal-Wallis tests. The Kruskal-Wallis test is a less stringent version of one-way ANOVA, since it does not require normally distributed data, whereas ANOVA does. In this study both tests were performed on the annual returns generated each year for each portfolio. The results indicate that both tests provide evidence which points in the same direction (i.e. confirmation and acceptance of the null hypothesis).

Results for these tests are presented in the following way:

H_0 : There are **no significant differences** between the results found when using different share price data (line 149, 150 and MESP)

H_1 : There are **significant differences** between results from different share price data

The two hypotheses (H_0 and H_1 respectively) are accepted if the tests produce the following results:

	ANOVA	Kruskal – Wallis
Accept H_0	$P > 0.10$ $F < F_{\text{critical}}$	$P > 0.05$
Accept H_1	$P < 0.05$ $F > F_{\text{critical}}$	$P < 0.05$

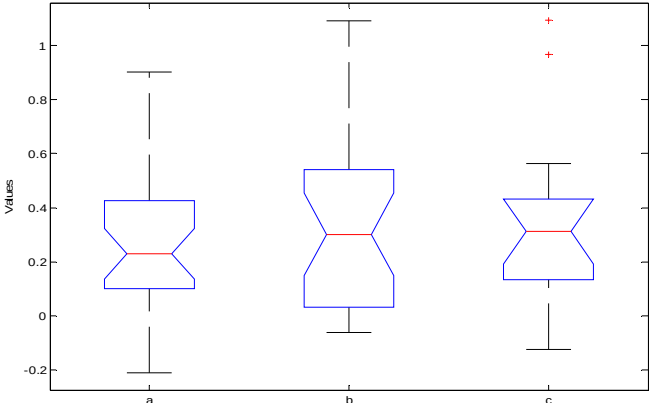
Testing was done by comparing BV/MV annual return for **each portfolio** for all three share price data sets in each of the five years after portfolio formation. The tests were performed by comparing the following sets of data:

- The returns generated by the first portfolio (portfolio 1) in the **first year** after portfolio formation in appendix table 1 were compared with the returns generated by portfolio 1 in the first year after portfolio formation in tables 8 and 14.
- The returns generated by the first portfolio (portfolio 1) in the **second year** after portfolio formation in appendix table 2 were compared with results generated in the second year after portfolio formation by portfolio 1 in tables 9 and 15.
- The **first portfolio's** returns in years three, four and five after portfolio formation were compared in a similar way.
- This process was also repeated for portfolios 2, 3, 4 and 5.

Table 19: ANOVA and Kruskal-Wallis test of BV/MV first year annual returns; portfolio 1 from appendix table 1 and tables 8 and 14

Portfolio formed in...	Portfolio 1, line 149	Portfolio 1, line 150	Portfolio 1, MESP																									
1972	0.43	-0.00		ANOVA: Single																								
1973	0.09			Factor:																								
1974	0.97			SUMMARY																								
1975	0.15																											
1976	-0.07																											
1977	0.14																											
1978	0.50																											
1979	0.83																											
1980	0.61																											
1981	0.20																											
1982	0.29																											
1983	0.46																											
1984	-0.06																											
1985	0.33																											
1986	1.62																											
1987	0.02	0.089	0.139	Kruskal – Wallis <table><tr><th>Source</th><th>SS</th><th>df</th><th>MS</th><th>Chi-sq</th><th>Prob>Chi-sq</th></tr><tr><td>Groups</td><td>81.8</td><td>2</td><td>40.902</td><td>0.19</td><td>0.9108</td></tr><tr><td>Error</td><td>31016.2</td><td>69</td><td>449.51</td><td></td><td></td></tr><tr><td>Total</td><td>31098</td><td>71</td><td></td><td></td><td></td></tr></table>	Source	SS	df	MS	Chi-sq	Prob>Chi-sq	Groups	81.8	2	40.902	0.19	0.9108	Error	31016.2	69	449.51			Total	31098	71			
Source	SS	df	MS		Chi-sq	Prob>Chi-sq																						
Groups	81.8	2	40.902		0.19	0.9108																						
Error	31016.2	69	449.51																									
Total	31098	71																										
1988	0.20	0.440	0.425																									
1989	0.25	0.078	0.160																									
1990	0.07	0.179	0.513																									
1991	0.72	0.007	0.182																									
1992	0.10	0.161	0.264																									
1993	0.82	1.807	1.123																									
1994	1.08	0.714	0.546																									
1995	0.71	0.864	1.109																									
1996	0.19	6.821	0.730																									
1997	0.52	0.178	-0.126																									
1998	-0.12	-0.13	0.105																									
1999	0.08	0.22	0.070																									
2000	0.23	-0.01	0.586																									
2001	0.38	0.47	0.360																									

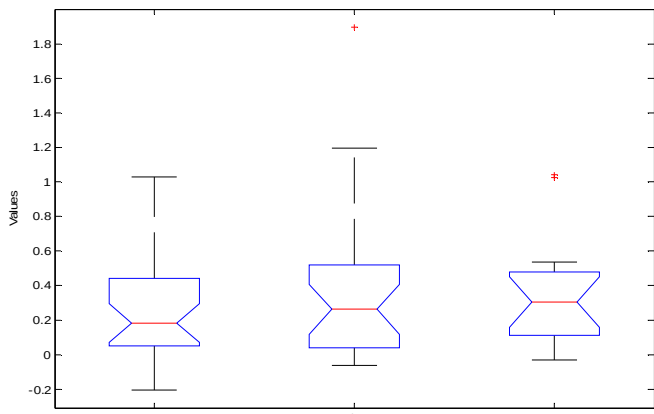
Table 20: ANOVA and Kruskal-Wallis test of BV/MV second year annual returns; portfolio 1 from appendix table 2 and tables 9 and 15

Portfolio formed in...	Portfolio 1 line 149	Portfolio 1 line 150	Portfolio 1 MESP																															
1972	0.014			ANOVA: Single Factor																														
1973	0.372																																	
1974	0.161																																	
1975	-0.098	-0.055		SUMMARY																														
1976	0.210	0.411		Groups	Count	Sum	Average	Variance																										
1977	0.491	0.555		Column 1	30	8.717315	0.290577	0.078983																										
1978	0.798	0.967		Column 2	27	8.470093	0.313707	0.105196																										
1979	0.492	0.309		Column 3	15	5.37765	0.35851	0.104138																										
1980	0.138	0.135		ANOVA																														
1981	0.248	0.705																																
1982	0.518	0.080																																
1983	-0.045	-0.056																																
1984	0.320	0.564		Source of Variation	SS	df	MS	F	P-value	F crit																								
1985	0.852	0.830		Between Groups	0.046153	2	0.023076	0.245587	0.782926	3.129644																								
1986	0.165	-0.021		Within Groups	6.483515	69	0.093964																											
1987	0.207	0.302	0.438	Total	6.529667	71																												
1988	0.200	0.029	0.201	Kruskal - Wallis <table><tr><td>Source</td><td>SS</td><td>df</td><td>MS</td><td>Chi-sq</td><td>Prob>Chi-sq</td></tr><tr><td>Groups</td><td>206.6</td><td>2</td><td>103.317</td><td>0.47</td><td>0.7899</td></tr><tr><td>Error</td><td>30891.4</td><td>69</td><td>447.701</td><td></td><td></td></tr><tr><td>Total</td><td>31098</td><td>71</td><td></td><td></td><td></td></tr></table> 							Source	SS	df	MS	Chi-sq	Prob>Chi-sq	Groups	206.6	2	103.317	0.47	0.7899	Error	30891.4	69	447.701			Total	31098	71			
Source	SS	df	MS								Chi-sq	Prob>Chi-sq																						
Groups	206.6	2	103.317								0.47	0.7899																						
Error	30891.4	69	447.701																															
Total	31098	71																																
1989	0.100	0.184	0.563																															
1990	0.056	-0.060	0.132																															
1991	0.010	0.131	0.295																															
1992	0.772	1.089	0.966																															
1993	0.902	0.604	0.412																															
1994	0.348	0.372	1.092																															
1995	0.401	0.256	0.313																															
1996	0.390	0.318	-0.122																															
1997	-0.208	-0.029	0.083																															
1998	0.052	-0.003	0.117																															
1999	0.111	0.319	0.137																															
2000	0.314	0.040	0.335																															
2001	0.426	0.493	0.416																															

Conclusion: Accept H₀

Conclusion: Accept H_0

Table 21: ANOVA and Kruskal-Wallis test of BV/MV third year annual returns; portfolios 1 from appendix table 3 and tables 10 and 16

Portfolio formed in...	Portfolio 1 line 149	Portfolio 1 line 150	Portfolio 1 line MESP																																							
1972	-0.204			ANOVA: Single Factor																																						
1973	0.177																																									
1974	-0.104																																									
1975	0.144	0.382		SUMMARY																																						
1976	0.392	0.468		Groups	Count	Sum	Average	Variance																																		
1977	0.798	1.042		Column 1	30	8.188	0.273	0.099																																		
1978	0.489	0.216		Column 2	27	10.558	0.391	0.208																																		
1979	0.099	0.136		Column 3	15	5.151	0.343	0.106																																		
1980	0.191	0.527		ANOVA																																						
1981	0.512	0.195																																								
1982	-0.045	-0.062																																								
1983	0.268	0.438		Source of Variation	SS	df	MS	F	P-value	F crit																																
1984	0.876	0.851		Between Groups	0.201	2.000	0.100	0.709	0.495	3.130																																
1985	0.159	-0.049		Within Groups	9.763	69.000	0.141																																			
1986	0.056	0.297		Total	9.964	71.000	Kruskal - Wallis <table><tr><td>Source</td><td>SS</td><td>df</td><td>MS</td><td>Chi-sq</td><td>Prob>Chi-sq</td></tr><tr><td colspan="6">-----</td></tr><tr><td>Groups</td><td>365.8</td><td>2</td><td>182.902</td><td>0.84</td><td>0.6586</td></tr><tr><td>Error</td><td>30732.2</td><td>69</td><td>445.394</td><td></td><td></td></tr><tr><td>Total</td><td>31098</td><td>71</td><td></td><td></td><td></td></tr></table> 				Source	SS	df	MS	Chi-sq	Prob>Chi-sq	-----						Groups	365.8	2	182.902	0.84	0.6586	Error	30732.2	69	445.394			Total	31098	71					
Source	SS	df	MS	Chi-sq	Prob>Chi-sq																																					

Groups	365.8	2	182.902	0.84	0.6586																																					
Error	30732.2	69	445.394																																							
Total	31098	71																																								
1987	0.039	0.033	0.176																																							
1988	0.050	0.178	0.505																																							
1989	0.103	0.013	0.168																																							
1990	-0.025	0.131	0.313																																							
1991	0.692	1.196	1.039																																							
1992	0.744	0.888	0.335																																							
1993	0.346	0.500	1.024																																							
1994	0.342	0.261	0.304																																							
1995	0.058	0.059	-0.029																																							
1996	-0.136	-0.023	0.056																																							
1997	-0.014	0.018	0.011																																							
1998	0.371	0.423	0.223																																							
1999	0.342	0.568	0.097																																							
2000	0.442	-0.022	0.535																																							
2001	1.027	1.895	0.395																																							

Conclusion: Accept H₀

Conclusion: Accept H_0

Table 22: ANOVA and Kruskal-Wallis test of BV/MV fourth year annual returns; portfolios 1 from appendix table 4 and tables 11 and 17

Portfolio formed in...	Portfolio 1 line 149	Portfolio 1 line 150	Portfolio 1 line MESP							
1972	0.166			ANOVA: Single Factor						
1973	-0.139									
1974	0.120			SUMMARY						
1975	0.445		0.449	Groups	Count	Sum	Average	Variance		
1976	0.677		0.715	Column 1	30	8.816	0.294	0.121		
1977	0.570		0.279	Column 2	27	10.315	0.382	0.147		
1978	0.082		0.162	Column 3	15	5.668	0.378	0.120		
1979	0.240		0.808							
1980	0.432		0.238							
1981	-0.044		-0.039	ANOVA						
1982	0.289		0.531	Source of						
1983				Variation	SS	df	MS	F	P-value	F crit
1984				Between Groups	0.1317	2	0.066	0.505	0.606	3.130
1985				Within Groups	8.9987	69	0.130			
1986				Total	9.1304	71				
1987				-0.018	0.177	0.599				
1988	0.024	-0.080	0.106							
1989	-0.040	-0.009	0.268							
1990	0.614	1.327	0.674							
1991	0.670	0.976	0.293							
1992	0.373	0.630	1.080							
1993	0.342	0.242	0.261							
1994	0.055	0.181	0.283							
1995	-0.199	-0.023	-0.022							
1996	-0.039	-0.006	0.048							
1997	0.360	0.751	0.156							
1998	0.333	0.469	0.163							
1999	0.406	0.265	0.374							
2000	1.446	0.346	0.262							
2001	0.608	0.947	1.123							

Kruskal - Wallis						
Source	SS	df	MS	Chi-sq	Prob>Chi-sq	

Groups	370.7	2	185.346	0.85	0.655	
Error	30727.3	69	445.323			
Total	31098	71				

Conclusion: Accept H_0

Table 23: ANOVA and Kruskal-Wallis test of BV/MV fifth year annual returns; portfolios 1 from appendix table 5 and tables 12 and 18

Portfolio formed in...	Portfolio 1 line 149	Portfolio 1 line 150	Portfolio 1 line MESP
1972	-0.071		
1973	0.070		
1974	0.417		
1975	0.671		
1976	0.510		
1977	0.024		
1978	0.218		
1979	0.577		
1980	-0.026		
1981	0.272		
1982	0.725		
1983	-0.006		
1984	0.116		
1985	0.088		
1986	-0.035		
1987	0.171	0.010	0.152
1988	-0.054	-0.017	0.248
1989	0.608	1.466	0.598
1990	0.625	0.453	0.384
1991	0.455	0.483	1.028
1992	0.455	0.253	0.190
1993	0.120	0.210	-0.191
1994	-0.218	-0.127	-0.029
1995	-0.061	-0.111	-0.006
1996	0.331	0.579	0.191
1997	0.217	0.562	0.119
1998	0.298	0.276	0.347
1999	0.289	2.304	0.335
2000	0.588	0.455	0.613
2001	n/a	0.508	0.884

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	29	7.371207	0.25418	0.070372
Column 2	26	10.38431	0.399396	0.285633
Column 3	14	3.978582	0.284184	0.096002

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.305761	2	0.15288	0.974014	0.382925	3.135918
Within Groups	10.3593	66	0.156959			
Total	10.66506	68				

Kruskal - Wallis

Source	SS	df	MS	Chi-sq	Prob>Chi-sq
Groups	275.05	2	137.524	0.65	0.7241
Error	29544.95	68	434.485		
Total	29820	70			

Conclusion: Accept H₀

Conclusion: Accept H_0

A2.6. Conclusion

The statistical tests show that there are no significant differences between the three share price data sets. Since it was possible to rule out any statistical significance in relation to the three share price data sets, it became evident that the only possibly relevant differences had to be down to other considerations. Therefore, the share price data sets considered for the remaining tests were for factors such as data availability (line 149 has more years of data than the other two and was therefore accepted) and data reliability (line 150 have suspicious “outliers” and was therefore rejected).

All the remaining tests were done using line 149 for portfolio formation and share price calculation returns.

APPENDIX 3

TABLES SUPPORTING THE TWO-DIMENSIONAL TESTS

After determining (in appendix 2) that there is not a significant difference in results when different share price sets (line 149, 150 or MESP) are used, all calculations in appendix 3 **use line 149** as share price for portfolio formation and return calculations.

A3.1 Expanding two-dimensional tests

- Tables 21 to 30 serve as the underlying data which forms the basis for the two-dimensional test tables 14 and 15 in chapter 5.
- Tables 31 to 34 show the results for the two-dimensional tests when portfolios were held for three years and five years respectively before share price returns are recorded.

Summary: Tables 14 and 15 in chapter 5 were constructed as follows:

Two-dimensional tables in chapter 5	Appendix Tables underlying each table
Table 14: PSG-BV/MV annual returns	Appendix 3 Tables: 21, 22, 23, 24 and 25
Table 15: PSG-CF/P annual returns	Appendix 3 Tables: 26, 27, 28, 29 and 30

All values in appendix tables are numerical (up to four decimal places).

Explanation: The averages at the bottom of tables 21 to 25 provide the statistics transferred to table 14 in chapter 5⁸¹. For instance, the average at the bottom of appendix table 21 is transferred to table 14 as “1yr” - the first line in table 14. Similarly, the average returns recorded at the bottom of table 22 is transferred to table 14 as “2yr” - the second line in table 14, and so forth.

⁸¹ It is the “average value” in each table that feeds into table 14, and **not** the “size adjusted average”.

A3.2 Construction of tables in appendix 3

For portfolio formation, all companies were ranked annually based on past sales growth (PSG) in the three years before portfolio formation. McGregor data is processed by using the following formula:

$$(\text{Sum of line 52 in 3 years before portfolio formation}) / 3$$

The decision to use three years' worth of pre-portfolio formation sales growth data was based on other international studies, which reflect market research in countries such as New Zealand (Chin, 2002) and Holland (Doeswijk, 1997).

After ranking companies according to this criterion, 3 portfolio groups were formed:

- top 30% with highest sales growth (growth companies), called group A
- middle 40% with average sales growth, called group B
- bottom 30% with the lowest sales growth (value companies), called group C

Within each of these three groups, companies were further sorted into three equally sized portfolio sub-groups based on:

- BV/MV (for tables 21 to 25) using McGregor data in the formula:
[line 6 / (line 102 x line 149)]
- CF/P (for tables 26 to 30) using McGregor data in the formula:
[line 703 / (line 102 x line 149)]

This grouping and sub-grouping produced nine portfolios, called A1-A3, B1-B3, and C1-C3. A1 to C3 thus denote the nine columns presented in tables 21 to 30. Value portfolios (A1) have the lowest PSG and the poorest expected performance (measured by the highest BV/MV or CF/P) portfolios. Growth portfolios (C3) have the highest PSG and the most optimistic expected performance (measured by the lowest BV/MV or CF/P) portfolios.

A3.3 PSG and BV/MV as basis for portfolio formation

The following five tables (21 – 25) use PSG and BV/MV as basis for portfolio formation and underlie table 14 in chapter 5.

Table 21

PSG and BV/MV first year annual return

	Value								Growth
Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1975	0.227	0.044	-0.083	0.086	0.004	0.210	0.048	0.027	0.043
1976	-0.006	-0.204	-0.175	-0.188	-0.137	-0.117	-0.082	-0.152	-0.098
1977	0.088	-0.015	0.021	0.110	0.148	0.182	0.267	0.193	0.062
1978	0.488	0.444	0.288	0.408	0.356	0.304	0.510	0.357	0.281
1979	0.857	0.605	1.050	0.657	0.451	0.480	0.591	0.491	0.381
1980	0.700	0.474	0.184	0.373	0.326	0.455	0.673	0.222	0.048
1981	-0.090	-0.000	0.099	0.014	0.177	-0.006	0.087	0.013	-0.185
1982	0.148	0.147	-0.009	0.140	0.179	0.015	0.179	0.039	0.136
1983	0.615	0.333	0.011	0.369	0.295	0.250	0.414	0.298	0.312
1984	-0.105	-0.038	0.230	-0.104	-0.190	-0.164	0.045	-0.143	-0.074
1985	0.468	0.145	0.580	0.346	0.324	0.344	0.118	0.225	0.381
1986	0.829	0.418	0.281	0.998	0.343	0.322	0.704	0.291	0.377
1987	0.198	0.014	0.082	0.286	0.205	-0.311	0.231	0.028	-0.110
1988	-0.009	0.199	0.006	-0.030	0.146	-0.178	0.310	0.040	0.027
1989	0.227	0.028	-0.142	0.082	0.025	0.164	0.053	0.319	0.245
1990	0.044	-0.087	-0.059	-0.012	0.072	0.189	0.051	0.005	0.072
1991	-0.038	0.039	0.046	-0.000	0.128	0.295	-0.144	0.204	0.337
1992	0.048	0.000	0.099	-0.228	0.129	0.034	0.030	-0.164	-0.014
1993	0.798	0.514	0.325	0.444	0.316	0.136	0.481	0.096	-0.088
1994	0.734	0.527	0.144	0.692	0.238	0.143	0.478	0.127	0.156
1995	0.332	0.449	0.181	0.240	0.251	0.017	0.225	0.128	0.030
1996	0.140	0.034	0.106	0.263	0.125	-0.111	0.106	0.393	-0.123
1997	0.049	0.052	0.223	-0.128	-0.119	-0.103	-0.015	0.015	0.073
1998	-0.167	-0.338	-0.025	-0.130	-0.315	-0.266	-0.196	-0.208	-0.114
1999	0.215	-0.059	-0.115	0.109	0.007	0.180	0.095	0.018	0.441
2000	0.244	0.007	0.233	0.095	-0.134	-0.021	0.046	-0.124	0.144
2001	0.143	0.026	0.071	0.560	0.149	0.157	0.051	-0.021	0.002
Average	0.266	0.139	0.135	0.202	0.129	0.096	0.198	0.100	0.101
Size Adjusted Average	0.057	-0.035	-0.029	0.049	-0.010	-0.046	0.051	-0.023	-0.020

Table 21 shows **share price returns one year after portfolio formation.**

Data line input formula: (line 149 year₁ – line 149 year₀) / line 149 year₀.

Averages reported at the bottom of this table were transferred to the first line in table 14 (where it is called “1yr”).

A regression analysis for the above, using PSG and BV/MV as basis for portfolio formation, indicates that the first year's annual share price return showed statistically significant differences between the nine portfolios, with t-stat = -3.575, and p-value = 0.000035.

Table 22

PSG and BV/MV second year annual return

Portfolio formed in...	Value								Growth
	A1	A2	A3	B1	B2	B3	C1	C2	C3
1975	0.080	-0.198	-0.276	-0.143	-0.202	-0.108	-0.053	-0.119	0.045
1976	0.059	-0.048	0.234	0.262	0.140	0.081	0.116	0.164	-0.026
1977	0.434	0.311	0.275	0.537	0.313	0.289	0.373	0.433	0.358
1978	0.472	0.536	0.908	0.686	0.560	0.542	0.362	0.457	0.273
1979	0.566	0.529	-0.058	0.527	0.368	0.284	0.406	0.268	0.115
1980	0.077	-0.107	-0.121	0.197	0.101	0.101	-0.079	0.066	-0.199
1981	-0.033	0.005	0.120	0.168	0.069	0.196	0.274	0.079	0.119
1982	0.378	0.139	0.124	0.395	0.216	0.202	0.491	0.084	0.323
1983	-0.045	0.016	0.059	-0.159	-0.174	-0.062	-0.191	-0.050	0.064
1984	0.198	0.391	0.463	0.254	0.230	0.231	0.125	0.448	0.258
1985	0.127	0.368	0.408	0.627	0.573	0.412	0.832	0.465	0.187
1986	0.021	0.005	-0.076	-0.097	0.089	0.027	0.154	-0.003	0.033
1987	0.191	-0.032	0.026	-0.056	0.184	-0.136	0.094	0.064	0.115
1988	0.122	-0.100	-0.014	0.039	0.191	0.179	0.170	-0.043	0.119
1989	0.040	-0.141	-0.006	-0.026	0.102	0.112	0.115	0.070	0.189
1990	-0.053	0.117	0.082	-0.038	0.118	0.455	-0.098	0.359	0.189
1991	-0.145	-0.092	0.003	-0.128	0.105	0.016	-0.242	-0.009	0.058
1992	0.748	0.781	0.340	0.578	0.297	0.054	0.278	0.401	-0.015
1993	0.394	0.186	0.150	0.627	0.228	0.054	0.416	0.260	0.144
1994	0.145	0.083	0.121	0.258	0.132	-0.010	0.215	0.072	0.142
1995	-0.070	-0.017	0.235	-0.049	0.008	-0.048	-0.001	0.137	-0.090
1996	0.069	0.007	-0.036	-0.073	-0.111	-0.098	0.084	0.059	0.483
1997	-0.107	-0.206	-0.098	-0.238	-0.302	-0.166	-0.379	-0.165	-0.011
1998	0.098	-0.116	0.088	0.068	0.033	0.177	0.052	-0.025	-0.085
1999	0.043	-0.079	0.125	-0.022	0.090	-0.033	0.115	-0.162	-0.088
2000	0.192	0.159	0.277	0.338	0.051	0.114	0.218	0.032	0.071
2001	0.102	0.184	0.361	0.365	0.045	0.071	0.180	0.026	-0.041
Average	0.152	0.099	0.137	0.181	0.128	0.108	0.149	0.124	0.101
Size Adjusted Average	0.028	-0.009	0.048	0.043	0.001	-0.007	0.018	0.002	0.010

Table 22 shows annual returns in the second year after portfolio formation.

Data line input formula:
(line 149 year₂ – line 149 year₁) / line 149 year₁.

For example for portfolios formed in 1975, second year annual returns are calculated as: (line 149 for 1977 – line 149 for 1976) / (line 149 for 1976).

A regression analysis for the above did **not** indicate statistically significant differences, with t-stat = -0.5974, and p-value = 0.550. However, the returns are economically significant as the top value portfolio (A1) generated 5% p.a. more growth than bottom growth portfolio (C3).

Table 23

PSG and BV/MV third year annual return

	High Value								Growth
Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1975	0.190	0.083	0.284	0.188	-0.023	-0.005	0.246	0.124	0.234
1976	0.369	0.411	0.322	0.474	0.485	0.191	0.241	0.475	0.377
1977	0.979	0.637	0.633	0.493	0.327	0.492	0.671	0.592	0.299
1978	0.361	0.217	-0.065	0.517	0.321	0.293	0.663	0.298	0.222
1979	-0.105	0.049	-0.242	0.188	0.082	0.063	-0.004	0.036	-0.055
1980	0.191	0.087	-0.028	0.202	0.198	0.093	0.091	0.157	0.180
1981	0.309	0.181	0.171	0.403	0.236	0.293	0.296	0.322	0.243
1982	-0.150	-0.168	-0.177	-0.153	-0.075	-0.146	-0.141	-0.268	0.051
1983	0.233	0.722	0.375	0.076	0.359	0.356	0.142	0.226	0.271
1984	0.642	0.415	0.475	1.063	0.533	0.511	0.244	0.295	0.281
1985	-0.241	0.014	-0.299	-0.144	0.099	-0.064	0.274	0.101	0.041
1986	0.036	0.141	0.140	-0.118	-0.069	0.025	0.360	0.019	0.041
1987	-0.026	0.150	-0.229	0.069	0.092	0.228	0.210	0.073	0.081
1988	-0.041	0.160	-0.022	-0.076	-0.000	0.095	-0.107	0.118	-0.094
1989	0.036	0.049	0.004	0.050	0.197	0.257	-0.094	0.257	0.214
1990	-0.080	0.001	0.215	-0.111	-0.007	0.021	-0.248	-0.084	0.084
1991	0.527	0.243	0.233	0.546	0.293	0.072	0.400	0.327	-0.091
1992	0.415	0.342	-0.001	0.611	0.250	0.055	0.793	0.389	0.173
1993	0.033	0.068	-0.057	0.179	0.056	0.053	0.076	0.215	0.137
1994	-0.110	-0.139	0.087	-0.083	-0.081	-0.029	0.050	-0.036	0.009
1995	-0.047	-0.208	0.009	-0.076	-0.208	-0.061	-0.173	0.083	-0.092
1996	-0.047	-0.296	-0.140	-0.234	-0.274	-0.237	-0.277	-0.220	-0.293
1997	-0.212	-0.057	0.115	-0.028	0.133	0.059	0.035	0.209	-0.024
1998	-0.034	0.120	0.151	0.232	0.043	-0.142	0.219	-0.128	-0.230
1999	0.324	0.097	0.317	0.356	0.129	0.030	0.200	0.036	-0.003
2000	0.259	0.158	0.141	0.270	0.157	-0.075	0.773	-0.020	0.019
2001	1.050	0.313	-0.037	0.183	0.434	0.102	0.373	0.245	0.158
Average	0.172	0.141	0.088	0.188	0.136	0.093	0.196	0.142	0.082
Size Adjusted Average	0.049	0.013	-0.025	0.039	0.009	-0.016	0.047	0.034	-0.040

Table 23 shows **annual returns in the third year after portfolio formation.**

Data line input formula: (line 149 year₃ – line 149 year₂) / line 149 year₂.

For example for a portfolio formed in 1975, third year's annual return is calculated as: (line 149 for 1978 – line 149 for 1977) / line 149 for 1977.

A regression analysis for the above indicates statistically significant differences in the third year after portfolio formation, with t-stat = 2.777 and p-value = 0.0005

Table 24
PSG and BV/MV fourth year annual return

	Value								Growth
Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1975	0.473	0.415	0.199	0.494	0.488	0.153	0.296	0.393	0.473
1976	0.284	0.690	0.571	0.529	0.522	0.495	0.646	0.553	0.360
1977	0.469	0.661	0.265	0.392	0.323	0.283	0.116	0.615	0.196
1978	0.073	-0.023	-0.113	0.275	0.048	0.043	-0.144	-0.027	-0.026
1979	0.249	0.083	0.124	0.093	0.100	0.210	0.159	0.229	0.059
1980	0.377	0.205	0.166	0.378	0.347	0.355	0.069	0.175	0.122
1981	-0.245	-0.108	-0.027	-0.026	-0.192	-0.099	-0.164	-0.108	-0.030
1982	0.249	0.218	-0.040	0.255	0.335	0.334	0.172	0.219	0.313
1983	1.065	0.720	0.552	0.320	0.535	0.124	0.788	0.299	0.284
1984	0.002	-0.344	-0.182	-0.079	0.040	0.076	0.196	0.300	-0.012
1985	0.266	0.153	-0.080	-0.042	0.290	0.215	-0.128	-0.133	-0.126
1986	-0.101	0.113	0.214	0.246	0.067	0.046	0.074	-0.069	0.261
1987	-0.149	0.193	-0.157	-0.161	0.192	-0.014	-0.046	0.117	0.097
1988	-0.201	0.322	0.191	0.014	0.117	0.199	0.049	0.066	0.142
1989	-0.046	-0.134	0.257	-0.136	-0.048	0.012	-0.080	-0.164	-0.006
1990	0.417	0.244	0.391	0.481	0.299	0.040	0.567	-0.009	0.065
1991	0.443	0.185	0.021	0.819	0.319	0.104	0.636	0.589	0.368
1992	-0.003	0.244	-0.007	0.174	-0.038	0.022	0.186	0.220	0.019
1993	-0.202	-0.049	0.147	-0.012	0.061	-0.056	-0.249	-0.049	0.028
1994	-0.144	-0.125	-0.113	-0.108	-0.053	0.267	-0.240	-0.121	0.117
1995	-0.234	-0.328	-0.026	-0.138	-0.217	-0.226	-0.002	-0.340	-0.317
1996	-0.299	-0.068	0.236	0.003	0.192	0.112	-0.032	0.115	0.054
1997	-0.160	0.188	-0.044	0.118	-0.090	-0.081	0.153	-0.074	-0.096
1998	0.500	0.220	0.193	0.388	0.141	-0.089	0.269	0.198	-0.037
1999	0.701	0.121	0.101	0.318	0.007	0.086	0.796	0.137	-0.045
2000	0.297	1.116	-0.010	0.271	0.345	0.073	0.378	0.188	0.163
2001	0.884	0.557	0.214	0.555	0.537	0.345	0.523	0.293	0.265
Average	0.183	0.202	0.112	0.201	0.173	0.112	0.184	0.133	0.099
Size Adjusted Average	0.0178	0.0266	-0.037	0.016	0.019	-0.027	0.030	-0.013	-0.030

Table 24 shows annual returns in the fourth year after portfolio formation.

Data line input formula: (line 149 year₄ – line 149 year₃) / line 149 year₃.

For example for a portfolio formed in 1975, fourth year's annually adjusted return is calculated as: (line 149 for 1979 – line 149 for 1978) / line 149 for 1978.

A regression analysis for the above indicates statistically significant differences in the fourth year after portfolio formation, with t-stat = -3.0747 and p-value = 0.00212.

Table 25
PSG and BV/MV fifth year annual return

	Value								Growth
Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1975	0.444	0.591	0.678	0.676	0.877	0.337	0.633	0.832	0.361
1976	0.710	0.466	0.180	0.593	0.278	0.406	0.388	0.223	0.151
1977	0.221	0.097	0.103	-0.042	0.042	0.080	-0.069	0.010	-0.031
1978	0.151	-0.022	0.193	0.223	0.110	0.354	-0.007	0.231	0.053
1979	0.456	0.346	0.111	0.630	0.217	0.229	0.318	0.216	0.162
1980	-0.177	-0.105	0.028	-0.064	-0.195	-0.090	-0.116	-0.095	0.060
1981	0.350	0.233	0.282	0.219	0.243	0.285	0.110	0.234	0.418
1982	0.765	0.472	0.171	0.629	0.601	0.312	0.642	0.688	0.243
1983	-0.241	-0.425	-0.086	0.294	0.285	-0.001	0.022	0.283	-0.118
1984	0.371	0.051	0.239	0.124	0.060	-0.168	0.032	0.180	-0.129
1985	0.101	0.282	-0.109	0.075	0.062	0.087	0.136	0.005	0.179
1986	0.012	0.051	0.015	-0.066	0.060	0.060	0.001	0.124	0.140
1987	-0.039	0.027	-0.138	0.147	0.117	0.089	0.188	0.190	0.062
1988	-0.155	-0.000	-0.022	-0.272	-0.058	0.257	-0.126	-0.068	0.291
1989	0.232	0.329	0.810	0.434	0.435	0.112	0.587	0.291	0.047
1990	0.617	0.227	0.061	0.538	0.264	0.123	0.746	0.747	0.083
1991	0.178	0.240	-0.037	0.321	-0.017	0.032	0.286	0.352	0.060
1992	-0.165	-0.037	0.074	-0.166	-0.099	-0.039	-0.114	-0.001	0.007
1993	-0.182	-0.037	-0.165	0.009	-0.089	-0.063	-0.342	-0.155	0.115
1994	-0.275	-0.346	0.068	-0.188	-0.207	-0.200	-0.268	-0.271	-0.276
1995	-0.298	-0.079	0.087	0.078	0.133	0.211	-0.046	0.090	0.145
1996	-0.253	0.177	-0.016	-0.073	-0.036	-0.098	0.307	0.032	-0.160
1997	-0.097	0.320	-0.015	0.333	0.154	0.220	0.391	0.060	-0.022
1998	0.578	0.228	0.106	0.097	0.262	0.021	0.188	-0.040	-0.027
1999	0.222	0.329	0.069	0.378	0.170	0.119	0.355	0.161	0.121
2000	0.757	-0.011	0.220	0.341	0.356	0.486	0.377	0.379	0.248
2001	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average	0.164	0.131	0.112	0.202	0.155	0.121	0.177	0.180	0.084
Size Adjusted Average	0.032	-0.004	-0.039	0.021	-0.009	-0.026	0.003	0.015	-0.028

A regression analysis for the above indicates statistically significant differences, with t-stat = 3.2177 and p-value = 0.0013.

Table 25 shows annual returns in the fifth year after portfolio formation.

Data line input formula: (line 149 year₅ – line 149 year₄) / line 149 year₄.

For example for a portfolio formed in 1975, fifth year's annually adjusted return is calculated as: (line 149 for 1980 – line 149 for 1979)/line 149 for 1979.

A3.4 Annual returns for PSG and CF/P portfolio

The following five tables (tables 26 to 30) use **PSG and CF/P** as basis for portfolio formation, and underlie table 15 in chapter 5⁸². The averages at the bottom of tables 26 to 30 provide the statistics transferred to table 15 in chapter 5. For instance, the averages at the bottom of table 26 are transferred to table 15 as “1yr” – the first line in table 15. Similarly, the average returns recorded at the bottom of table 27 are transferred to table 15 as “2yr” – the second line in table 15, and so forth.

Table 26

PSG and CF/P first year annual returns

Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1987	0.048	-0.036	0.061	0.389	0.120	-0.022	0.362	0.287	0.024
1988	0.343	0.033	0.116	0.133	0.142	-0.263	0.250	0.208	-0.142
1989	0.182	-0.045	0.004	0.088	0.122	0.082	0.569	0.198	0.198
1990	0.189	0.091	-0.192	0.070	0.030	0.075	0.145	0.225	-0.038
1991	0.389	0.121	0.120	0.082	0.181	0.147	-0.106	0.342	-0.014
1992	0.277	-0.072	0.0509	0.180	0.040	0.040	0.528	0.116	0.003
1993	0.821	0.563	0.229	0.700	0.439	0.152	0.636	0.334	-0.001
1994	0.753	0.353	0.178	0.665	0.312	0.251	0.431	0.385	0.158
1995	0.650	0.213	0.121	0.308	0.175	0.061	0.378	0.209	-0.020
1996	0.713	0.222	0.262	0.454	0.040	-0.094	0.447	-0.020	-0.009
1997	0.249	0.331	-0.099	-0.112	0.005	-0.135	0.800	0.0713	0.108
1998	-0.072	-0.211	-0.097	-0.192	-0.241	-0.294	-0.064	-0.288	-0.076
1999	0.138	-0.051	0.101	0.122	0.223	0.096	0.186	-0.021	-0.068
2000	0.345	-0.032	0.455	0.145	-0.043	-0.16	-0.153	-0.165	-0.295
2001	0.281	-0.010	0.0492	0.604	0.167	0.023	0.084	-0.007	-0.143
Average	0.354	0.098	0.090	0.242	0.114	-0.002	0.299	0.125	-0.021
Size Adjusted Average	0.131	-0.070	-0.048	0.104	0.0005	-0.095	0.117	-0.0009	-0.115

Table 26 shows return for the first year after portfolio formation

Data line input formula: (line 149 year₁ – line 149_{pf}) / line 149_{pf}.

pf above stands for “at portfolio formation”

Data availability for cash flow only dates back to 1987, which explains why tables 26 to 30 only have portfolio formation starting in 1987.

⁸² It is the “average value” in each table that feeds into table 15, and not the “size adjusted average”.

A regression analysis for the above, using SG and CP as basis for portfolio formation, show that the first year's annual share price returns showed statistically significant differences between the nine portfolios, with t-stat = 4.051 and p-value = 0.

Table 27
PSG and CF/P second year annual returns

Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1987	0.022	0.136	0.149	-0.015	0.105	-0.045	0.075	0.444	0.016
1988	0.116	-0.055	0.076	0.071	0.240	0.066	0.540	0.169	0.107
1989	0.067	0.010	-0.058	0.075	0.033	0.092	-0.088	0.143	0.152
1990	0.233	0.132	0.097	0.001	0.179	0.233	-0.028	0.237	0.006
1991	0.308	0.170	-0.018	-0.042	0.246	0.003	0.272	0.065	-0.026
1992	0.766	0.382	0.233	0.584	0.341	0.176	0.580	0.325	0.195
1993	0.507	0.408	0.392	0.614	0.201	0.171	0.482	0.290	0.125
1994	0.414	0.265	0.220	0.940	0.195	0.138	0.125	0.346	0.089
1995	0.345	0.091	0.150	-0.044	0.014	-0.099	0.173	-0.003	-0.022
1996	0.204	0.0131	0.015	0.702	-0.097	-0.135	0.163	0.047	-0.031
1997	-0.091	-0.207	-0.071	-0.178	-0.292	-0.250	-0.234	0.065	-0.159
1998	-0.046	0.072	-0.061	0.197	0.199	0.064	0.058	0.050	-0.010
1999	0.263	0.183	0.619	-0.017	-0.041	0.008	0.018	-0.068	-0.35
2000	0.447	0.084	-0.013	0.260	0.205	0.106	0.019	0.043	-0.165
2001	0.066	0.370	0.124	0.301	0.233	-0.018	0.323	0.170	-0.290
Average	0.241	0.137	0.123	0.230	0.117	0.034	0.165	0.155	-0.024
Size Adjusted Average	0.043	-0.022	-0.009	0.064	-0.001	-0.061	0.030	0.055	-0.077

A regression analysis for the above indicates statistically significant differences in the second year after portfolio formation, with t-stat = 2.144 and p-value = 0.032.

Table 27 shows the annual share price return in the second year after portfolio formation

Data line input formula:
(line 149 year₂ – line 149 year₁) / line 149 year₁.

Table 28
PSG and CF/P third year annual returns

Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1987	0.002	0.096	0.087	0.069	0.237	0.167	0.133	0.060	0.130
1988	-0.034	0.047	-0.129	-0.024	0.152	-0.021	0.185	0.097	-0.041
1989	0.228	0.162	0.157	0.139	0.112	0.294	-0.127	0.036	0.294
1990	0.110	0.171	0.012	-0.013	-0.074	0.367	0.096	-0.069	-0.039
1991	0.595	0.284	0.473	0.499	0.579	0.270	0.464	0.374	0.104
1992	0.518	0.292	0.334	0.628	0.241	0.233	0.660	0.472	0.315
1993	0.126	0.366	0.233	0.274	0.168	0.024	0.233	0.325	0.118
1994	0.973	0.214	0.179	-0.119	0.085	-0.040	-0.015	0.046	0.058
1995	0.221	-0.153	-0.067	-0.097	-0.096	-0.065	0.201	-0.121	-0.082
1996	-0.157	-0.137	-0.187	-0.217	-0.288	-0.247	-0.197	-0.001	-0.245
1997	-0.196	-0.108	0.127	0.047	0.188	0.079	0.157	0.131	0.000
1998	-0.000	0.300	0.034	0.121	0.003	0.125	-0.018	-0.026	-0.286
1999	0.492	0.160	0.258	0.420	0.206	0.036	0.211	0.117	-0.145
2000	0.122	0.138	0.079	0.285	0.133	0.298	0.700	0.087	-0.22
2001	0.216	0.268	0.148	0.153	0.333	0.169	0.399	0.276	0.068
Average	0.214	0.140	0.116	0.144	0.132	0.112	0.205	0.120	0.001
Size Adjusted Average	0.009	-0.008	-0.001	-0.023	0.012	0.008	0.033	0.029	-0.060

Table 27 shows the annual share price return in the third year after portfolio formation

Data line input formula:
(line 149 year₃ – line 149 year₂) / line 149 year₂.

A regression analysis for the above indicates statistically significant differences in the second year after portfolio formation, with t-stat = 2.7248 and p-value = 0.0065.

Table 29
PSG and CF/P fourth year annual returns

Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1987	-0.040	0.006	-0.078	0.032	0.091	0.079	0.021	0.110	0.052
1988	-0.002	0.149	0.205	0.123	0.253	0.059	0.000	0.221	0.086
1989	0.013	0.213	-0.098	-0.156	-0.006	0.022	0.323	-0.081	0.023
1990	0.492	0.439	0.238	0.830	0.399	0.247	0.560	0.199	0.137
1991	0.231	0.213	0.267	0.669	0.211	0.372	0.541	0.475	0.711
1992	0.156	0.208	0.203	0.304	0.142	0.091	1.449	0.372	0.149
1993	0.288	0.347	0.370	-0.081	0.043	0.014	-0.120	-0.069	-0.006
1994	0.504	-0.057	-0.099	0.031	0.198	-0.096	-0.049	0.113	0.166
1995	-0.271	-0.015	-0.025	-0.141	-0.258	-0.196	-0.029	-0.054	-0.260
1996	-0.299	-0.087	0.034	0.061	0.244	0.048	0.033	-0.051	0.025
1997	-0.182	-0.069	0.367	0.103	0.030	-0.040	0.349	-0.046	-0.117
1998	0.128	0.490	0.376	0.344	0.226	-0.000	0.504	-0.037	-0.125
1999	0.205	0.205	0.306	0.606	0.120	-0.013	0.292	0.069	-0.212
2000	0.989	0.210	0.138	0.244	0.198	0.367	0.605	0.158	0.152
2001	0.588	0.214	0.438	0.706	0.292	0.377	0.476	0.291	0.253
Average	0.186	0.164	0.176	0.245	0.145	0.088	0.330	0.111	0.069
Size Adjusted Average	-0.040	0.005	0.024	0.046	-0.010	-0.034	0.123	-0.039	-0.063

Table 29 shows the annual share price return in the fourth year after portfolio formation

Data line input formula:
(line 149 year₄ – line 149 year₃) / line 149 year₃.

A regression analysis for the above indicates statistically significant differences in the fourth year after portfolio formation, with t-stat = 2.355 and p-value = 0.0185.

Table 30
PSG and CF/P fifth year annual returns

Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1987	0.012	0.036	0.162	0.168	0.112	0.068	0.174	0.120	0.112
1988	0.025	0.059	-0.122	-0.130	-0.119	0.164	-0.054	-0.101	0.321
1989	0.538	0.231	0.330	0.296	0.495	0.174	0.885	0.836	0.078
1990	0.337	0.430	0.054	0.656	0.392	0.155	0.547	0.523	0.499
1991	0.206	0.172	0.148	0.289	0.065	-0.024	1.792	0.359	0.204
1992	0.072	0.286	0.258	0.103	-0.082	0.058	-0.312	0.165	0.059
1993	-0.053	-0.104	0.217	-0.022	0.090	0.597	0.084	-0.246	0.074
1994	-0.290	-0.240	0.006	-0.191	-0.209	-0.137	-0.258	-0.023	-0.242
1995	-0.155	-0.060	0.069	0.037	0.289	0.124	-0.069	0.020	0.217
1996	-0.203	0.029	0.258	-0.103	0.140	-0.032	0.440	-0.105	-0.148
1997	0.268	0.292	0.062	0.376	0.275	0.061	0.504	0.165	-0.041
1998	0.361	0.235	0.061	0.494	0.086	0.129	0.081	-0.016	-0.054
1999	0.169	0.226	0.071	0.345	0.796	0.145	0.473	0.111	0.204
2000	0.269	0.333	0.331	0.338	0.242	0.499	0.615	0.691	0.232
2001	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average	0.111	0.137	0.136	0.189	0.183	0.141	0.350	0.178	0.108
Size Adjusted Average	-0.029	0.006	0.015	-0.053	0.037	0.009	0.077	-0.000	-0.076

Table 30 shows the **annual share price return in the fifth year after portfolio formation**

Data line input formula:
(line 149 year₅ – line 149 year₄) / line 149 year₄.

A regression analysis for the above shows **no** statistically significant differences between the nine portfolios on a five year annually adjusted return basis, with t-stat = 1.299 and p-value = 0.0564.

A3.5 Two-dimensional holding returns

A3.5.1 Three-year holding returns for PSG–BV/MV portfolio

Table 31

PSG and BV/MV three year hold returns

	Value								Growth
Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1975	0.750	-0.096	-0.113	0.159	-0.183	0.032	0.223	0.048	0.365
1976	0.500	0.096	0.227	0.502	0.447	0.177	0.255	0.470	0.361
1977	2.056	1.165	1.116	1.499	0.998	1.268	1.754	1.710	1.020
1978	1.848	1.654	1.265	2.652	1.825	1.666	2.363	1.787	1.031
1979	1.359	1.512	0.443	1.922	1.155	1.007	1.181	0.858	0.464
1980	1.172	0.255	0.043	0.951	0.720	0.731	0.646	0.486	0.010
1981	0.153	0.158	0.347	0.654	0.556	0.515	0.970	0.448	0.062
1982	0.368	0.041	-0.093	0.396	0.357	0.077	0.623	-0.151	0.525
1983	0.944	1.365	0.631	0.224	0.411	0.487	0.262	0.512	0.728
1984	0.718	1.246	1.685	1.250	0.582	0.625	0.409	0.536	0.484
1985	0.305	0.635	0.469	0.638	1.072	0.774	1.262	0.903	0.657
1986	0.961	0.681	0.369	0.504	0.389	0.322	1.163	0.259	0.530
1987	0.360	0.117	-0.144	0.341	0.500	-0.200	0.430	0.169	0.121
1988	-0.029	0.228	-0.072	-0.001	0.419	-0.007	0.222	0.097	0.259
1989	0.338	0.164	0.014	0.253	0.569	0.829	-0.015	0.678	0.804
1990	0.103	0.262	0.298	-0.102	0.360	0.741	-0.269	-0.019	0.355
1991	0.234	0.185	0.196	0.216	0.557	0.333	-0.188	0.523	0.169
1992	1.250	1.089	0.325	0.876	0.747	0.115	1.119	0.522	0.316
1993	1.457	1.054	0.384	1.520	0.783	0.325	1.060	0.590	0.046
1994	0.931	0.516	0.305	0.971	0.436	0.124	0.597	0.342	0.057
1995	0.025	0.174	0.308	0.167	0.036	-0.003	0.112	0.546	-0.205
1996	0.205	-0.184	-0.066	-0.061	-0.178	-0.452	-0.267	0.241	0.051
1997	-0.374	-0.219	0.291	-0.344	-0.323	-0.293	-0.485	-0.011	0.129
1998	-0.060	-0.371	1.088	0.400	-0.254	-0.185	-0.033	0.038	-0.362
1999	0.380	0.055	0.358	0.444	0.381	0.254	0.770	0.179	0.135
2000	1.614	0.372	1.162	0.771	0.023	0.099	0.842	-0.087	0.430
2001	1.533	0.531	0.196	1.352	0.679	0.440	0.517	0.334	-0.017
Average	0.707	0.470	0.409	0.672	0.484	0.363	0.575	0.445	0.316
Size Adjusted Average	0.1797	-0.042	-0.052	0.152	-0.002	-0.091	0.074	0.030	-0.096

Table 31 shows returns after shares were held for a period of three years after portfolio formation. In the table the value portfolio (A1) outperforms the growth portfolio (C3) by a margin of 39.18% over three years (70.78% minus 31.60%). When size-adjusted return is considered, the difference between A1 and C3 is 25.75% over a three year holding period.

Table 32 shows returns after shares were held for five years after portfolio formation. In the table the value portfolio (A1) outperforms the growth portfolio (C3) by a margin of 57% over three years (110% minus 53%). When size-adjusted return is considered, the difference between A1 and C3 is 49% over a five year holding period.

A3.5.2 Five-year holding returns for PSG–BV/MV portfolio

Table 32

PSG and BV/MV five year hold returns

	Value								Growth
Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1975	2.485	0.718	0.731	1.658	1.025	0.629	1.336	1.642	1.740
1976	2.290	1.753	1.047	2.565	1.959	1.237	1.569	1.881	1.249
1977	4.235	3.085	2.257	2.161	1.596	2.066	1.849	3.054	1.180
1978	2.486	1.539	1.231	4.213	2.231	2.451	1.685	2.073	0.956
1979	3.166	2.464	0.724	4.511	1.625	1.870	2.526	1.698	0.664
1980	1.640	0.590	0.566	1.650	0.910	1.254	0.461	0.618	0.211
1981	0.240	0.368	0.561	0.977	0.498	0.757	0.861	0.771	0.625
1982	1.915	0.784	0.076	1.071	1.756	0.622	1.646	0.544	1.536
1983	1.183	0.993	1.073	0.951	1.675	0.674	1.141	1.495	1.106
1984	0.783	0.358	1.523	0.997	0.452	0.222	0.790	1.261	0.344
1985	0.777	1.476	0.011	0.843	1.646	1.307	1.276	0.659	0.656
1986	0.821	0.605	0.965	0.737	0.265	0.450	1.364	0.229	1.081
1987	0.134	0.515	-0.421	0.054	0.865	-0.102	0.657	0.422	0.348
1988	-0.306	0.849	0.405	-0.254	0.791	0.377	-0.066	0.102	0.262
1989	0.341	0.208	1.075	0.529	0.905	0.785	0.348	0.497	0.624
1990	0.619	0.759	0.631	0.694	0.619	0.906	0.938	0.643	0.513
1991	0.656	1.104	0.081	1.436	0.758	0.560	0.737	1.906	0.300
1992	0.913	0.977	0.342	0.861	0.456	0.253	0.997	0.699	0.107
1993	0.580	0.942	0.456	1.434	0.329	0.091	0.089	0.628	0.010
1994	0.388	-0.237	0.164	0.427	0.167	-0.128	-0.163	-0.153	-0.098
1995	-0.510	-0.123	0.533	-0.206	-0.076	-0.149	-0.226	-0.249	-0.327
1996	-0.381	-0.174	0.429	-0.449	-0.038	-0.336	0.122	0.238	-0.276
1997	-0.386	0.450	0.615	-0.183	-0.271	-0.039	-0.063	0.012	-0.212
1998	1.185	-0.083	1.643	1.479	0.096	-0.070	0.425	0.458	-0.488
1999	1.617	0.592	0.563	1.402	0.744	0.638	1.693	0.450	0.849
2000	1.815	1.284	1.113	1.708	0.793	0.809	2.706	0.991	0.734
2001	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average	1.103	0.838	0.707	1.202	0.837	0.659	0.950	0.868	0.526
Size Adjusted Average	0.3130	-0.051	-0.181	0.255	-0.017	-0.156	0.107	0.050	-0.180

A3.5.3 Three-year holding returns for PSG–CF/ portfolio

Table 33

PSG and CF/P three year hold returns

Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1987	0.1565	0.1611	0.3371	0.4057	0.4958	0.1732	0.4587	0.8242	0.1994
1988	0.4548	-0.0247	0.1367	0.2805	0.7142	-0.3015	0.9437	0.6630	-0.1240
1989	0.7141	0.1521	0.3324	0.6332	0.5223	0.6774	0.4666	0.4421	0.7678
1990	0.7374	0.2796	-0.0191	0.2491	0.2684	0.6811	0.2259	0.6368	-0.0163
1991	1.9444	0.7568	0.5697	0.5513	1.0319	0.2819	0.6954	1.0304	0.0325
1992	2.0149	0.5501	0.8412	1.5531	0.6664	0.4934	1.7838	0.9733	0.2952
1993	2.1751	1.9244	1.0996	2.2568	1.1153	0.5355	1.9858	1.4626	0.1166
1994	2.1518	1.3720	0.9138	1.0480	1.0050	0.4635	0.9704	1.0312	0.4004
1995	1.2973	0.1395	0.1997	0.2416	0.0494	-0.0319	0.8043	0.2882	-0.0476
1996	0.9752	-0.0045	0.2048	0.8517	-0.2414	-0.3955	0.5055	-0.1124	-0.0018
1997	-0.1672	-0.0539	0.0490	-0.2899	-0.1288	-0.2710	0.2204	0.2661	0.0002
1998	-0.0683	0.3574	0.0426	0.1239	-0.0773	0.1278	-0.1182	-0.1939	-0.2311
1999	0.8289	0.4869	1.0042	0.6208	0.5434	0.272	0.7758	0.0999	-0.445
2000	1.3129	0.2798	0.7081	0.8581	0.3858	0.2187	0.3285	-0.005	-0.515
2001	0.8077	0.3615	0.4528	1.2485	0.8387	0.2441	0.8632	0.5088	-0.2967
Average	1.0224	0.4492	0.4582	0.7088	0.4793	0.2113	0.7273	0.5276	0.0090
Size Adjusted Average	0.2475	-0.1599	-0.0658	0.1287	0.0434	-0.1547	0.1642	0.1263	-0.2789

Returns in table 33 are comparable to that presented in table 1 of chapter 4 (main text) as the extreme value portfolio (A1) outperforms the extreme growth portfolio (C3), with a margin of 101% (102% minus 1%) if shares are held for three years since the portfolio was formed.

A3.5.4 Five-year holding returns for PSG–CF/P portfolio

Table 34

PSG and CF/P five year hold returns

Portfolio formed in...	A1	A2	A3	B1	B2	B3	C1	C2	C3
1987	0.5487	0.2244	1.1162	0.8334	0.8408	0.4994	0.9423	1.1920	0.5366
1988	0.8635	0.1163	0.2829	0.4221	1.1108	-0.0576	0.8954	0.7027	-0.0877
1989	1.5343	0.7106	0.3035	0.7895	0.8645	1.2448	2.0677	0.9591	0.5461
1990	2.3555	1.9057	0.2541	2.1897	0.4826	1.0468	1.8073	1.9572	0.3843
1991	2.7488	2.2460	1.3376	1.8016	1.9018	0.4775	2.3844	2.8355	0.6448
1992	2.7053	1.6783	2.2902	2.8167	1.0573	0.9731	1.1899	2.1914	0.6755
1993	2.5412	2.5812	1.5957	1.8352	1.3989	1.1199	1.8023	0.6165	0.1494
1994	1.9412	0.9347	0.3960	0.7680	0.9332	0.0393	0.7485	0.9141	0.0442
1995	0.3232	0.2741	0.4178	-0.1464	0.0214	-0.1221	0.5158	-0.3922	-0.0908
1996	-0.1679	0.2621	0.4714	0.0098	-0.0124	-0.2868	1.0487	-0.3967	-0.1137
1997	0.1281	0.4678	0.8275	-0.0356	0.0993	-0.0653	2.0694	0.5372	-0.3398
1998	0.5290	0.7783	0.1448	0.9877	0.2342	0.6387	0.4766	-0.1508	-0.4596
1999	1.888	0.9863	0.9666	2.0962	1.9419	0.636	1.4419	0.2584	-0.352
2000	2.7091	0.434	0.5307	1.5153	1.0656	1.0175	2.3562	0.8363	0.0139
2001	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average	1.4749	0.9714	0.7811	1.1345	0.8529	0.5115	1.4104	0.8615	0.1108
Size Adjusted Average	0.2385	-0.0560	-0.1422	0.0474	0.0893	-0.1312	0.3328	0.1850	-0.4985

Table 32 shows returns for shares which were held for five years after the portfolio was formed. The extreme value portfolio (A1) outperformed the extreme growth portfolio (C3) by 137% over this holding period.

APPENDIX 4:

EXTRAPOLATION METHODOLOGY

The purpose of this appendix is to describe the methods used to test for extrapolation. The three variables traced below – sales growth, cash flow and earnings per share – represent the values that investors' expectations are most likely based on.

The following method was used for portfolio formation and for tracking returns for extrapolation:

After calculating the BV/MV ratio for each company in each year of data availability, three portfolios were formed for each year: the top 30% of companies with the highest BV/MV ratio (extreme value portfolio), the middle 40%, and the bottom 30% (extreme growth) with the lowest BV/MV ratios.

A4.1 Sales Growth

For each company in the two extreme portfolios, compounded annual **sales growth** (see tables 17 and 18 in chapter 5) were calculated for the five years before portfolio formation (years -5 years to 0), as well as in the five years after portfolio formation (years 1 to 5). Geometric average growth rates were used.

A4.1.1 Calculating sales growth before portfolio formation

Compounded annual sales growth in years -5 to 0 was calculated as:

$$(\text{sales in year}_0 / \text{sales in year}_{-5})^{0.2} - 1.$$

Example: $(\text{sales in 2001} / \text{sales in 1996})^{0.2} - 1.$

McGregor BFA data input lines: $(\text{line 51 for 2001} / \text{line 51 for 1996})^{0.2} - 1$

A4.1.2 Calculating sales growth after portfolio formation

Compounded annual sales growth in years 1 to 5 was calculated as:

$$(\text{sales in year}_5 / \text{sales in year}_1)^{0.2} - 1.$$

Example: $(\text{sales in year 2006} / \text{sales in year 2001})^{0.2} - 1.$

McGregor BFA data input lines: $(\text{line 51 for 2006} / \text{line 51 for 2001})^{0.2} - 1$

Portfolio sales growth (as used in tables 17 and 18 in chapter 5) is the arithmetic averages for all companies in the portfolio. This is the growth value of each company in the portfolio added up and divided by the number of companies in the portfolio, to give the portfolio's sales growth rate for that year.

A4.2 Cash flow growth

For each company in these two extreme portfolios, compounded annual **cash flow growth/performance** (see tables 19 and 20 in chapter 5) was calculated for the five years before portfolio formation (years -5 years to 0), as well as for the five years after portfolio formation (years 1 to 5).

A4.2.1 Calculating cash flow growth before portfolio formation

Compounded annual cash flow in years -5 to 0 was calculated as:

$$(\text{cash flow in year 0} / \text{cash flow in year -5})^{0.2} - 1$$

Example: $(\text{cash flow in 2001} / \text{cash flow in 1996})^{0.2} - 1$

McGregor BFA data input lines: $(\text{line 703 for 2001} / \text{line 703 for 1996})^{0.2} - 1$

A4.2.2 Calculating cash flow growth after portfolio formation

Compounded annual cash flow growth in years 1 to 5 was calculated as:

$$(\text{cash flow in year 5} / \text{cash flow in year 1})^{0.2} - 1$$

Example: $(\text{cash flow in year 2006} / \text{cash flow in year 2001})^{0.2} - 1$.

McGregor BFA data input lines: $(\text{line 703 for 2006} / \text{line 703 for 2001})^{0.2} - 1$

The compounded cash flow growth values for each company in the portfolio was added up and divided by the number of companies in the portfolio, to give the portfolio's cash flow growth rate for the year. The average value at the bottom of table 19 and 20 is the average portfolio sales growth rates over the entire period of data availability (calculated as the sum of each year's portfolio return divided by 10).

A4.3 EPS growth

For each company in the two extreme portfolios, compounded annual **EPS growth/performance** was calculated (see tables 22 to 27 in chapter 5) for the 5 years before portfolio formation (years -5 years to 0), as well as for the five years after portfolio formation (years 1 to 5). The EPS tests were done with headline earnings (including extraordinary items) and bottom-line EPS (excluding extraordinary items).

A4.3.1 Calculating EPS growth before portfolio formation

EPS growth in years -5 to 0 was calculated as:

$$(\text{EPS in year 0} / \text{EPS in year -5})^{0.2} - 1$$

Example: $(\text{EPS in 2001} / \text{EPS in 1996})^{0.2} - 1$

McGregor BFA data input lines:

- For EPS **including** extra-ordinary items: $(\text{line 144 for 2001} / \text{line 144 for 1996})^{0.2} - 1$
- For EPS **excluding** extra-ordinary items: $(\text{line 305 for 2001} / \text{line 305 for 1996})^{0.2} - 1$

A4.3.2 Calculating EPS growth after portfolio formation

EPS growth in years 1 to 5 was calculated as:

$$(\text{EPS in year 5} / \text{EPS in year 1})^{0.2} - 1$$

Example: $(\text{EPS in year 2006} / \text{EPS in year 2001})^{0.2} - 1$

McGregor BFA data input lines:

- For EPS **including** extra-ordinary items: $(\text{line 144 for 2006} / \text{line 144 for 2001})^{0.2} - 1$
- For EPS **excluding** extra-ordinary items: $(\text{line 305 for 2006} / \text{line 305 for 2001})^{0.2} - 1$

In McGregor's standardized manual line 305 is defined as "**Earnings per share (EPS): Bottom-line**", and it is described as: "This represents the 'attributable earnings per share' for the period under review for the Company/Group as per the published financial statements. The Company/Group uses the net weighted average number of ordinary shares in issue at period-end (line 206 in the general information section) in this calculation."

The EPS growth values for each company in a portfolio was added up and divided by the number of companies in the portfolio, to give the portfolio's EPS growth rate for that year. The averages at the bottom of tables 22 to 27 is the average portfolio EPS growth rate over the entire period of data availability (calculated as the sum of each year's portfolio EPS growth rate divided by the number of years of data availability).

A4.4 Ratios

For each company in the two extreme portfolios three ratios were calculated at portfolio formation time, namely:

- Cash-flow-from operations/market value (table 21)
McGregor data input formula: $[\text{Line 703} / (\text{line 102} \times \text{line 149})]$
- Headline Earnings per share/market value (table 24)
McGregor data input formula: $[\text{Line 144} / (\text{line 102} \times \text{line 149})]$

- Bottom-line EPS/market value (table 27)
McGregor data input formula: [Line 305/(line 102 x line 149)]

A4.5 Share price returns

For each company in these two extreme portfolios, share price returns were calculated in the five years before portfolio formation as well as in the five years after portfolio formation.

A4.5.1 Before portfolio formation

Returns recorded in tables 28 to 32 of chapter 5 were generated in the fifth to first year before portfolio formation.

The formula used for calculating returns was:

(Share prices in any given year before portfolio formation – share prices in preceding year) / Share prices in preceding year.

Returns recorded in table 28 (chapter 5) were generated in the fifth year before portfolio formation, which means that returns were calculated as: (Share prices in year ₄ before portfolio formation – Share prices in year ₅ before portfolio formation) / Share prices in year ₅ before portfolio formation. For example: for portfolios formed in 1977 return is calculated as: (Share price ₁₉₇₃ – share price ₁₉₇₂) / Share price ₁₉₇₂.

Returns recorded in table 29 (chapter 5) were generated in the fourth year before portfolio formation, which means that for a portfolio formed in 1977, return is calculated as: (Share price ₁₉₇₄ – share price ₁₉₇₃) / Share price ₁₉₇₃.

Returns recorded in table 30 (chapter 5) were generated in the third year before portfolio formation, which means that for portfolios formed in 1977, return is calculated as: (Share price ₁₉₇₅ – Share price ₁₉₇₄) / Share price ₁₉₇₄.

Returns recorded in table 31 (chapter 5) were generated in the second year before portfolio formation, which means that for portfolios formed in 1977, return is calculated as: $(\text{Share price}_{1976} - \text{share price}_{1975}) / \text{Share price}_{1975}$.

Returns recorded in table 32 (chapter 5) were generated in the first year before portfolio formation, which means that for a portfolio formed in 1977, return is calculated as: $(\text{Share price}_{1977} - \text{Share price}_{1976}) / \text{Share price}_{1976}$.

A4.5.2 After portfolio formation

Returns recorded in tables 33 to 37 of chapter 5 were generated from data captured during the first to fifth year after portfolio formation respectively.

The formula used for calculating returns was:

$(\text{Share prices in any given year after portfolio formation} - \text{share prices in preceding year}) / \text{Share prices in preceding year}$.

Returns recorded in table 33 (chapter 5) were generated in the first year after portfolio formation, which is $(\text{Share price}_{\text{in year one after portfolio formation}} - \text{Share price}_{\text{at portfolio formation}}) / \text{Share price}_{\text{at portfolio formation}}$. This means that for a portfolio formed in 1977, return is calculated as: $(\text{Share price}_{1978} - \text{Share price}_{1977}) / \text{Share price}_{1977}$.

Returns recorded in table 34 (chapter 5) were generated in the second year after portfolio formation, which means that for a portfolio formed in 1977, return is recorded as: $(\text{Share price}_{1979} - \text{share price}_{1978}) / \text{Share price}_{1978}$.

Returns recorded in table 35 (chapter 5) were generated in the third year after portfolio formation, which means that for a portfolio formed in 1977, return is recorded as: $(\text{Share price}_{1980} - \text{share price}_{1979}) / \text{Share price}_{1979}$.

Returns recorded in table 36 (chapter 5) were generated in the fourth year after portfolio formation, which means that for a portfolio formed in 1977, return is generated as: $(\text{Share price}_{1981} - \text{share price}_{1980}) / \text{Share price}_{1980}$.

Returns recorded in table 37 (chapter 5) were generated in the fifth year after portfolio formation, which means that for a portfolio formed in 1977, return is generated as: $(\text{Share price}_{1982} - \text{share price}_{1981}) / \text{Share price}_{1981}$.