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Hedge Fund

**modelling
and analysis
using Excel
and VBA**

PAUL DARBYSHIRE
DAVID HAMPTON

Hedge Fund Modelling and Analysis Using Excel and VBA

Paul Darbyshire and David Hampton



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Mum and Dad
To whom I owe everything.
P.D. and D.H.

Preface

This book is a practical introduction to modelling and analysing hedge funds using the popular Excel spreadsheet tool and Visual Basic for Applications (VBA) programming language. The structure of the book is as follows. Chapters 1–3 cover the necessary foundations required in order to understand hedge funds and the alternative investment industry. With this fundamental knowledge in place, Chapters 4–7 cover the more quantitative and theoretical material needed to effectively analyse a series of hedge fund returns and extract the relevant information required in order to make critical investment decisions.

Throughout the book there are numerous snapshots of Excel spreadsheets and VBA source code. These are described as follows.

EXCEL SPREADSHEETS

The book assumes a working knowledge of Excel, with an ability to implement simple built-in functions, such as SUM(), AVERAGE() and STDEV(), and build dynamic spreadsheets. The following example schematic explains how to interpret an Excel spreadsheet snapshot within the book:

	A	B	C	D	E	F
1			Maximum	3.40	=fncMAXIMUM(B4:B75)	
2			Minimum	-2.17	=fncMINIMUM(B4:B75)	
3	Date	RoR (%)	Bins	Frequency	Frequency (%)	
4	Jan-05	0.62	-4.00	0	0	
5	Feb-05	-1.14	-3.75	0	=(D4/\$D\$37)*100	
6	Mar-05	-1.01	=C4+0.25	0	0	
7	Apr-05	1.89	-3.25	0	0	
8	May-05	1.24	-3.00			
9	Jun-05	-2.17	-2.75			
10	Jul-05	1.40	-2.50	0	0	
11	Aug-05	1.93	-0.50	2	3	
12	Sep-05	-0.90	-0.25	3	4	
13	Oct-05	0.85	0.00	6	8	
14	Nov-05	0.51	0.25	3	4	
15	Dec-05	0.83	0.50	4	6	
16	Jan-06	1.06	0.75	9	13	
17	Feb-06	1.00	1.00	6	8	
18	Mar-06	0.53	3.50	2	3	
19	Apr-06	3.40	3.75	0	0	
20	May-06	-0.28	4.00	0	0	
21	Jun-06	1.80				
22	Jul-06	1.74				
23	Aug-06	1.33				
24	Sep-06	-0.02				
25	Oct-06	2.51				
26	Nov-06					
27	Dec-06					
28	Jan-07					
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Sample Excel spreadsheet

EXCEL AND USER-DEFINED VBA FUNCTIONS

When a built-in Excel function is used in the book, a description of the use of the function is provided, where necessary, in the text or in a footnote. For example, if an Excel spreadsheet makes use of the NORMSINV() built-in Excel function, a brief description is given in a footnote.¹ All user-defined functions are implemented using the VBA programming language available free with all versions of Excel. There is no prior knowledge of VBA required, although a working grasp of the language would be advantageous. The book contains many user-defined

¹ The NORMSINV() function returns the inverse of the standard normal cumulative distribution, i.e. a distribution with a mean of zero and a standard deviation of one.

VBA functions (prefixed with the letters ‘fnc’) which are displayed in a source box, for example:

Source 4.3 User-defined VBA function to calculate the SKEWNESS of a returns array

```
'function to calculate the SKEWNESS of a
returns array
Function fncSKEWNESS(RoR As Range) As Double

    'count number in returns array
    n = RoR.Count

    'the mean of returns array
    avg = (fncMEAN(RoR) / 12) 'monthly
    'the standard deviation of returns array
    std = (fncSTDEV(RoR) / Sqr(12)) 'monthly

    'initialise sum to zero
    sum = 0

    For i = 1 To n
        sum = sum + ((RoR(i) - avg) / std) ^ 3
    Next

    fncSKEWNESS = (n / ((n - 1) * (n - 2))) * sum

End Function
```

Sample VBA user-defined function

HYPOTHETICAL HEDGE FUND DATA

Throughout the book there is constant reference to many hedge fund return series and factors. The 10 hedge funds and 15 factors used are all *hypothetical* and have been simulated by the authors as a unique data set for demonstration purposes only. The techniques and models used in the book can therefore be tested on the hypothetical data before being applied to real-life situations by the reader. The hypothetical data set is

nonetheless close to what would be expected in reality. The 10 funds are a mixture of several major hedge fund strategies, i.e. commodity trading advisor (CTA), long/short equity (LS), global macro (GM) and market neutral (MN) strategies as described in the table below:

Hedge Fund	Abbreviation
Commodity Trading Advisor	CTA1, CTA2, CTA3
Long Short Equity	LS1, LS2, LS3
Global Macro	GM1, GM2
Market Neutral	MN1, MN2

10 hypothetical hedge funds

The 15 factors are a mixture of both passive and active indices as described in the table below:

No.	Abbreviation
Beta factors	
1	Passive Global Stock Index PSDX
2	S&P 500 Equity Index S&P 500 Index
3	Passive Global Bond Index PBond DX
4	Passive Long Global Commodity Index PCom DX
5	Passive Long USD Index PUSD DX
6	Risk-Free Rate Rf
Industry reference alternative beta factors	
7	Commodity Trading Advisor Index CTA Index
8	Long Short Equity Index LS Index
Fama–French–Carhart factors	
9	Value minus Growth Val – Gr
10	Small Cap minus Large Cap SC – LC
11	Momentum Mom
Active alternative beta factors	
12	Active Global Stock Futures Index ASDX
13	Active Global Bond Futures Index ABDX
14	Active Global Commodity Futures Index ACDX
15	Active Global Foreign Exchange Futures Index AFDX

15 hypothetical factors

BOOK WEBSITE

The official website for the book is located at:

www.darbyshirehampton.com

The website provides free downloads to all of the hypothetical data, Excel spreadsheets, and VBA user-defined functions as well as many other useful resources.

The authors can be contacted on any matter relating to the book, or in a professional capacity, at the following email addresses:

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Contents

Preface	xi
1 The Hedge Fund Industry	1
1.1 What Are Hedge Funds?	1
1.2 The Structure of a Hedge Fund	4
1.2.1 Fund Administrators	5
1.2.2 Prime Brokers	5
1.2.3 Custodian, Auditors and Legal	6
1.3 The Global Hedge Fund Industry	7
1.3.1 North America	8
1.3.2 Europe	10
1.3.3 Asia	11
1.4 Specialist Investment Techniques	12
1.4.1 Short Selling	12
1.4.2 Leverage	14
1.4.3 Liquidity	15
1.5 New Developments for Hedge Funds	16
1.5.1 UCITS III Hedge Funds	16
1.5.2 The European Passport	19
1.5.3 Restrictions on Short Selling	20
2 Major Hedge Fund Strategies	23
2.1 Single- and Multi-Strategy Hedge Funds	23
2.2 Fund of Hedge Funds	25

2.3	Hedge Fund Strategies	27
2.3.1	Tactical Strategies	28
2.3.1.1	Global Macro	28
2.3.1.2	Managed Futures	31
2.3.1.3	Long/Short Equity	36
2.3.1.4	Pairs Trading	38
2.3.2	Event-Driven	42
2.3.2.1	Distressed Securities	42
2.3.2.2	Merger Arbitrage	46
2.3.3	Relative Value	49
2.3.3.1	Equity Market Neutral	49
2.3.3.2	Convertible Arbitrage	50
2.3.3.3	Fixed Income Arbitrage	54
2.3.3.3.1	Capital Structure Arbitrage	56
2.3.3.3.2	Swap-Spread Arbitrage	57
2.3.3.3.3	Yield Curve Arbitrage	58
3	Hedge Fund Data Sources	61
3.1	Hedge Fund Databases	61
3.2	Major Hedge Fund Indices	65
3.2.1	Non-investable and Investable Indices	66
3.2.2	Dow Jones Credit Suisse Hedge Fund Indexes	68
3.2.2.1	Liquid Alternative Betas	70
3.2.3	Hedge Fund Research	73
3.2.4	HedgeFund.net	77
3.2.5	FTSE Hedge	77
3.2.5.1	FTSE Hedge Momentum Index	78
3.2.6	Greenwich Alternative Investments	79
3.2.6.1	GAI Investable Indices	80
3.2.7	Morningstar Alternative Investment Center	83
3.2.7.1	MSCI Hedge Fund Classification	83
3.2.7.2	MSCI Investable Indices	85
3.2.8	EDHEC Risk and Asset Management Research Centre (www.edhec-risk.com)	86
3.3	Database and Index Biases	88
3.3.1	Survivorship Bias	89
3.3.2	Instant History Bias	90
3.4	Benchmarking	91
3.4.1	Tracking Error	92
	Appendix A: Weighting Schemes	95

4	Statistical Analysis	99
4.1	Basic Performance Plots	99
4.1.1	Value Added Monthly Index	99
4.1.2	Histograms	102
4.2	Probability Distributions	105
4.2.1	Populations and Samples	106
4.3	Probability Density Function	107
4.4	Cumulative Distribution Function	108
4.5	The Normal Distribution	109
4.5.1	Standard Normal Distribution	110
4.6	Visual Tests for Normality	111
4.6.1	Inspection	111
4.6.2	Normal Q-Q Plot	112
4.7	Moments of a Distribution	114
4.7.1	Mean and Standard Deviation	114
4.7.2	Skewness	117
4.7.3	Excess Kurtosis	119
4.7.4	Data Analysis Tool: Descriptive Statistics	120
4.8	Geometric Brownian Motion	122
4.8.1	Uniform Random Numbers	125
4.9	Covariance and Correlation	126
4.10	Regression Analysis	131
4.10.1	Ordinary Least Squares	131
4.10.1.1	Coefficient of Determination	133
4.10.1.2	Residual Plots	134
4.10.1.3	Jarque–Bera Normality Test	135
4.10.1.4	Data Analysis Tool: Regression	138
4.11	Portfolio Theory	142
4.11.1	Mean–Variance Analysis	142
4.11.2	Solver : Portfolio Optimisation	145
4.11.3	Efficient Portfolios	148
5	Risk-Adjusted Return Metrics	151
5.1	The Intuition behind Risk-Adjusted Returns	152
5.1.1	Risk-Adjusted Returns	154
5.2	Common Risk-Adjusted Performance Ratios	157
5.2.1	The Sharpe Ratio	160
5.2.2	The Modified Sharpe Ratio	162
5.2.3	The Sortino Ratio	163
5.2.4	The Drawdown Ratio	167

5.3	Common Performance Measures in the Presence of a Market Benchmark	170
5.3.1	The Information Ratio	172
5.3.2	The M -Squared Metric	173
5.3.3	The Treynor Ratio	174
5.3.4	Jensen's Alpha	178
5.4	The Omega Ratio	181
6	Asset Pricing Models	185
6.1	The Risk-Adjusted Two-Moment Capital Asset Pricing Model	185
6.1.1	Interpreting H	189
6.1.2	Static Alpha Analysis	191
6.1.3	Dynamic Rolling Alpha Analysis	193
6.2	Multi-factor Models	195
6.3	The Choice of Factors	196
6.3.1	A Multi-Factor Framework for a Risk-Adjusted Hedge Fund Alpha League Table	202
6.3.2	Alpha and Beta Separation	208
6.4	Dynamic Style Based Return Analysis	210
6.5	The Markowitz Risk-Adjusted Evaluation Method	214
7	Hedge Fund Market Risk Management	223
7.1	Value-at-Risk	223
7.2	Traditional Measures	226
7.2.1	Historical Simulation	226
7.2.2	Parametric Method	229
7.2.3	Monte Carlo Simulation	230
7.3	Modified VaR	233
7.4	Expected Shortfall	236
7.5	Extreme Value Theory	239
7.5.1	Block Maxima	240
7.5.2	Peaks over Threshold	241
	References	245
	Important Legal Information	249
	Index	251

The Hedge Fund Industry

The global credit crisis originated from a growing bubble in the US real estate market which eventually burst in 2008. This led to an overwhelming default of mortgages linked to subprime debt to which financial institutions reacted by tightening credit facilities, selling off bad debts at huge losses and pursuing fast foreclosures on delinquent mortgages. A liquidity crisis followed in the credit markets and banks became increasingly reluctant to lend to one another, causing risk premiums on debt to soar and credit to become ever scarcer and more costly. The global financial markets went into meltdown as a continuing spiral of worsening liquidity ensued. When the credit markets froze, hedge fund managers were unable to get their hands on enough capital to meet investor redemption requirements. Not until early 2009 did the industry start to experience a marked resurgence in activity, realising strong capital inflows and growing investor confidence.

This chapter introduces the concept of hedge funds and how they are structured and managed, as well as discussing the current state of the global hedge fund industry in light of the recent financial crisis. Several key investment techniques that are used in managing hedge fund strategies are also discussed. The chapter aims to build a basic working knowledge of hedge funds and, along with Chapters 2 and 3, to develop the fundamentals necessary in order to approach and understand the more quantitative and theoretical aspects of their modelling and analysis developed in later chapters.

1.1 WHAT ARE HEDGE FUNDS?

Whilst working for Fortune magazine in 1949, Alfred Winslow Jones began researching an article on various fashions in stock market forecasting and soon realised that it was possible to neutralise *market risk*¹ by buying undervalued securities and short selling (see Section 1.4.1)

¹ *Market risk* (or *systematic risk*) is the risk that the value of an investment will decrease due to the impact of various market factors, such as changes in interest and foreign currency rates.

overvalued ones. Such an investment scheme was the first to employ a *hedge* to eliminate the potential for losses by cancelling out adverse market moves, and the technique of *leverage*² to greatly improve profits. Jones generated an exceptional amount of wealth through his *hedge fund* during the 1950s and 1960s and continually outperformed traditional money managers. Jones refused to register the hedge fund with the Securities Act 1933, the Investment Advisers Act 1940, or the Investment Company Act 1940, his main argument being that the fund was a *private* entity and none of the laws associated with the three Acts applied to this type of investment. It was essential that such funds were treated separately from other regulated markets since the use of specialised investment techniques, such as short selling and leverage, were not permitted under these Acts, nor was the ability to charge performance fees to investors.

So that the funds maintained their private status, Jones would never publicly advertise or market the funds but only sought investors through word of mouth, keeping everything as secretive as possible. It was not until 1966, through the publication of a news article about Jones's exceptional profit-making ability, that Wall Street and *high net worth*³ individuals finally caught on, and within a couple of years there were over 200 active hedge funds in the market. However, many of these hedge funds began straying from the original *market neutral* strategy used by Jones and employed other apparently more volatile strategies. The losses investors associated with highly volatile investments discouraged them from investing in hedge funds. Moreover, the onset of the turbulent financial markets experienced in the 1970s practically wiped out the hedge fund industry altogether. Despite improving market conditions in the 1980s, only a handful of hedge funds remained active over this period. Indeed, the lack of hedge funds around in the market during this time changed the regulators' views on enforcing stricter regulation on the industry. Not until the 1990s did the hedge fund industry begin to rise to prominence again and attract renewed investor confidence.

Nowadays, hedge funds are still considered private investment schemes (or vehicles) with a collective pool of capital only open to a small range of institutional investors and wealthy individuals and

² *Leverage* is the use of a range of financial instruments or borrowed capital to increase the potential return of an investment (see Section 1.4.2).

³ A *high net worth* individual (or family) is generally assumed to have investable assets in excess of \$1 million, excluding any primary residence.

having minimal regulation. They can be as diverse as the manager in control of the capital wants to be in terms of the investment strategies and the range of financial instruments which they employ, including stocks, bonds, currencies, futures, options and physical commodities. It is difficult to define what constitutes a hedge fund, to the extent that it is now often thought in professional circles that a hedge fund is simply one that incorporates any *absolute return*⁴ strategy that invests in the financial markets and applies non-traditional investment techniques. Many consider hedge funds to be within the class of *alternative* investments, along with private equity and real estate finance, that seek a range of investment strategies employing a variety of sophisticated investment techniques beyond the longer established traditional ones, such as *mutual funds*.⁵

The majority of hedge funds are structured as limited partnerships, with the manager acting in the capacity of general partner and investors as limited partners. The general partners are responsible for the operation of the fund, relevant debts and any other financial obligations. Limited partners have nothing to do with the day-to-day running of the business and are only liable with respect to the amount of their investment. There is generally a minimum investment required by *accredited investors*⁶ of the order of \$250,000 to \$500,000, although many of the more established funds can require minimums of up to \$10 million. Managers will also usually have their own personal wealth invested in the fund, a circumstance intended to further increase their incentive to consistently generate above average returns for both the clients and themselves. In addition to the minimum investment required, hedge funds will also charge fees, the structure of which is related to both the management and performance of the fund. Such fees are not only used for administrative and ongoing operating costs but also to reward employees and managers for providing above average positive returns to investors. A typical fee basis is the so-called *2 and 20* structure which consists of a 2% annual fee (levied monthly or quarterly) based on the amount of *assets under management* (AuM) and a 20% performance-based fee, i.e.

⁴ *Absolute return* refers to the ability of an actively managed fund to generate positive returns regardless of market conditions.

⁵ *Mutual funds* are similar in structure to hedge funds but are subject to much stricter regulation and limited to very specific investments and strategies.

⁶ An *accredited investor* is one who has a net worth of at least \$1 million or has made \$200,000 each year for the past two years (\$300,000 if married) and has the capacity to make the same amount the following year.

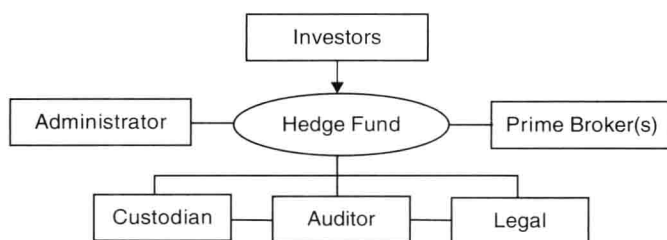


Figure 1.1 A schematic of the typical structure of a hedge fund

an incentive-oriented fee. The performance-based fee, also known as *carried interest*, is a percentage of the annual profits and only awarded to the manager when they have provided requisite returns to their clients. Some hedge funds also apply so-called *high water marks* to a particular amount of capital invested such that the manager can only receive performance fees, on that amount of money, when the value of the capital is more than the previous largest value. If the investment falls in value, the manager must bring the amount back to the previous largest amount before they can receive performance fees again. A *hurdle rate* can also be included in the fee structure, representing the minimum return on an investment a manager must achieve before performance fees are taken. The hurdle rate is usually tied to a market benchmark, such as LIBOR⁷ or the one-year T-bill rate plus a spread.

1.2 THE STRUCTURE OF A HEDGE FUND

In order for managers to be effective in the running of their business a number of internal and external parties covering a variety of operational roles are employed in the structure of a hedge fund, as shown in Figure 1.1. As the industry matures and investors are requiring greater transparency and confidence in the hedge funds in which they invest, the focus on the effectiveness of these parties is growing, as are their relevant expertise and professionalism. Hedge funds are also realising that their infrastructure must keep pace with the rapidly changing industry. Whereas in the past some funds paid little attention to their support and administrative activities, they are now aware that the

⁷ LIBOR is the *London Interbank Offered Rate*, a rate at which banks borrow from other banks in the London interbank market.