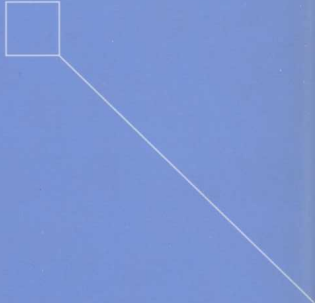
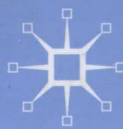


Evolutionary Finance



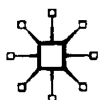
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EVOLUTIONARY FINANCE

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This book was written while I was a Research Associate at the Centre for Financial Research, Judge Institute of Management at Cambridge University. Without doubt, thanks must initially go to the support provided by this esteemed institution. That said, Oxford University too must claim its fair share of gratitude as the skeletal foundations of this book formed the basis of my Masters Thesis in Mathematical Finance at this equally impressive educational facility. My time at Oxford was particularly memorable thanks to the gifted (if not slightly unorthodox) lecturing by Paul Wilmott who proved to be a truly great educator, the erudite and thoroughly impressive Jeff Dewynne, the innovative and awe-inspiring Neil Johnson, and the wonderfully entertaining Sam Howison.

Still, as one will soon realize in perusing the following pages, my debt to academia is but a mere portion of the total bill of thanks this weighty tome owes to certain individuals. In particular, my time spent as a Chief Economist, Fixed Income & FX Strategist, Financial Engineer, and Global Asset Allocator based at first in the Antipodes, then to Wall Street, then to the City of London has provided me with a wonderful platform for some memorable exchanges as to how financial markets *really* work. To date, I have had the privilege of presenting my opinions in more than 18 countries in over 2000 various client meetings, conferences and seminars. This is not to mention the innumerable client conference calls, one-on-one exchanges and even “brainstorming” sessions with colleagues at, most recently, Merrill Lynch. To all these individuals – obviously too innumerable to mention here – I owe a sincere debt of thanks. It was through these interchanges that my views were molded and refined. Just as steel sharpens steel, I have been appreciative of the – at times near combative – forum in which these opinions were exchanged.

One particularly memorable experience for me was while I was in the position as a Desk Strategist to a team of proprietary traders and market-makers during the LTCM Crisis and (the associated) unwind of the Yen Carry trade. Watching markets gap down in a vain attempt to find a floor, experiencing first-hand the panic on the faces of traders, being physically shook by the sheer volume of noise erupting on the trading floor as individuals were – quite literally – screaming at each other (including at me, who was doing his own fair share of screaming back) was a truly exhilarating experience – both frightening and exciting at the same time. This was the blast furnace of capitalism in action. Unfortunately – somewhat ironically – given my academic background prior to this event, I was perplexed to find that there appeared to be no formal mechanism for describing precisely what was going on (much to the chagrin of my group of traders who were always looking for that informational edge). Sure, we all knew markets were governed by fear

and greed – Keynes taught us as much and back in those days these basic concepts were in the process of being significantly embellished by the Behavioral Finance and information asymmetry theorists. Still, as each gut-wrenching day came to an end and the traders would gradually fade away to the various bars across town, I would hit the textbooks in a vain attempt to understand the apparently incomprehensible. Why had asset prices appeared to over-react to one particular innocuous information release and ignore other apparently more sentient information, why had the informational “tipping point” suddenly morphed trader concern into outright panic, why had the informational “seeds of destruction” of an event such as the LTCM Crisis (and associated Asian and Russian Debt Crisis) been written in data, well known and discussed at length up to a full 12 months earlier, but somehow suddenly the benign became malignant? I was severely disappointed by what finance theory had to offer during those lonely hours with only the cleaners and the socially challenged night traders to keep me company. So started my seven-year quest. Along the way I have managed to find scattered throughout the academic literature various snippets of useful insights but unfortunately, up until now, there was no unifying theory as to how the various microcomponents of information interact to “build” asset prices. After being on the frontline of applied finance for more than 16 years and dodging – and indeed, manufacturing and firing my own – informational “bullets,” I decided to put pen to paper in an attempt to set the record straight – and I am thankful to Cambridge University for allowing me to pursue this ambition.

So what has been the response? Various drafts of various segments of this book have appeared on my company’s – Evolutionary Finance™ Ltd – website. Thankfully, I have found practitioners within markets warmly endorsing my views. Indeed, many put to me that I was “mad” to even attempt to start outlining such a comprehensive investment framework without at first attempting to claim some proprietorship over its content. This put me directly into the capable hands of Barker Brettell Patent Attorney’s in Cambridge to whom I owe an enormous debt of gratitude in assisting me with my patent application of the overall business method associated with my own “structured information” view on Evolutionary Finance. Kevin Upson at JellyBean Web at Cambridge did a wonderful job in designing my company’s website while Tony Donnelly from UBS assisted enormously in providing worthwhile tips for the establishment of the Evolutionary Finance™ Ltd’s absolute return strategy vehicles which have been designed specifically to leverage from the Evolutionary Finance principles espoused in this book. To all these individuals I am extremely thankful for allowing me to put this path breaking new finance theory into practice.

Dr Bartholomew Dowling
Cambridge, UK

Preface

This book is for all those who question assumption. Too often a Finance 101 lecture begins with the immortal words “let us assume markets are fully efficient” and that’s the end of the discussion when it comes to market structure. Unfortunately, what follows from then on may look impressive but like any house – no matter how imposing – built upon a weak foundation, the cracks soon appear. We go back to Finance 101 and question that initial assumption. In particular, our focus is on the way in which market “efficiency” – in the sense of how information is imparted into price – can be better understood. We build the information generation mechanism from the “ground-up” using bioinformatics as a guide. The analyst’s “idea” and the “gene” have a lot in common and we feel that some of the more exciting recent developments in the fields of genomics and bioinformatics have interesting implications for finance thinking – you just need to view the world through a different lens that’s all.

It is the construction of such a lens that constitutes a large part of this book. The preliminaries of what we label as the “traditionalist approach” toward finance versus an emerging challenge of various “new” views will be discussed in Chapters 2 and 3. However, we have purposefully set aside Chapters 4, 5 and 6 to outline the theoretical foundations of our unique perspective on *Evolutionary Finance*. Here the reader will be made progressively more aware of the strong similarities between biomathematics and financial mathematics – via the conduit of informational analysis. While an excursion into the formal theoretical underpinnings of this exciting new field of thought is a necessary evil for methodically detailing our case, we stress that the onus will remain very much on what is necessary for the *applied* rather than pure theory for theory’s sake.

Indeed, it is the pursuit of the applied aspects of our philosophy that form the foundations for Chapter 7 – which covers Evolutionary Finance principles in *practice*. As will be seen, virtually no aspect of applied finance will be left untouched – from asset selection, to strategy choices, to portfolio construction. In fact, as will be explained, we have now leveraged these applied principles to such an extent that we have developed our own proprietary Natural Selection™ software platform to assist us in making exceptional (risk adjusted) return decisions for asset and portfolio construction across an array of absolute return mandates within our firm – Evolutionary Finance™ Ltd. In short, Natural Selection™ provides a user-friendly interface for assessing an interesting array of Evolutionary Finance perspectives – from mapping the formation of the informational genome of an asset, to the developing of a step-by-step recommendation for the formation of an Evolutionary Stable

Strategy, to the construction of an optimal (time-variant weighted) evolutionary portfolio. These insights ultimately assist us to better manage drawdown risk while pursuing exceptional returns in our day-to-day running of funds and in the provision of research at Evolutionary Finance™ Ltd.

Finally, in Chapter 8 we will convey to the reader what we feel to be the overarching nature of our philosophy. Treating the evolution of information as the outcome of some biological-like molecular process is a powerful concept. Indeed, humans themselves can be perceived to be information generating “machines.” Just as we cannot avoid shedding skin, hair etc we also cannot avoid creating information for each other – whether this is by hopping on a bus, buying a particular brand of coffee or buying a particular stock. In this book we focus purely on the financial consequences of the information generation “by-product” of human action. We do this by constructing a framework to better understand the information generation and agglomeration process itself – which ultimately enables us to form far more effective financial decisions. Subsequently, our tact will be of particular interest to those investors looking for innovative interpretations of market dynamics – especially active fund managers and (like ourselves) members of the hedge fund community. Indeed, up until now a notable omission from the finance literature has been a comprehensive theory explaining how the various disparate categories of financial information – technical, fundamental, economic and political – somehow come together to form a cohesive whole that, in turn, drives asset prices. This glaring oversight has been to the chagrin of many market practitioners who feel the gap between finance theory and finance practice has become virtually insurmountable. We attempt to unite these two worlds once more by illustrating how various financial information “bytes” come together to form memes, which in turn form themes and thus drive overall market bullish/bearish sentiment. We believe that a better understanding of the formation of the contextual fabric of this “informational genome” helps us to form a superior view as to what dictates asset price movements on an intra-day, inter-day, weekly, monthly and even across year basis. Indeed, we argue that by explicitly modeling the biological-like molecular formation of information in such a way that perhaps therein resides our greatest contribution to the field of finance – both from a theoretical and applied perspective alike.

On a presentational note, one of the first things you may have noticed already in reading the preface to this book is that the entire text – with the obvious exception of the Acknowledgments – will be written in either the second or third person. The writer adopts this style in deference to the collective wisdom of innumerable interactions with like-minded people at different points across the globe regarding the issue at hand and by way of tribute to the army of scholars that have preceded us. Without doubt, it is upon the shoulders of these innumerable giants that the author presently stands. Whether this has enabled us to see further we leave that for you – the reader – to judge. We hope you enjoy the book.

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1

Introduction

It is the purpose of this book to introduce the field of bioinformatics to financial modeling. Why? Well, think of what you are doing. You are reading a book on the way information is imputed within financial markets. In the process you are absorbing information yourself. Whether you agree or disagree with what is about to be presented in the ensuing chapters you cannot help but be affected by it. The human mind displays a voracious appetite when it comes to seeking out and assimilating new information – even information that we don’t necessarily agree with. Financial markets are no different. They display an insatiable appetite for new thoughts and ideas. In short, financial markets are huge information consuming entities. What is the most obvious manifestation of their ruminations regarding this vast information flow? Asset prices. So we ask the obvious question – why then, up until now, has a comprehensive theory of the actual *building blocks* of information been noticeably lacking from the finance literature?

Generally, most standard Economics and Finance texts still have little to say about “information” in its own right. Indeed, quite often the study of the role of information within financial markets is treated more as a “means to an ends” rather than an ends in itself. What discussion there is, generally revolves around studies of the Efficient Markets Hypothesis (EMH) or the sterile cost/benefit analysis espoused under the “Information Economics” banner. Thankfully, all is not lost. The worm is finally starting to turn and surreptitiously for the past 20 years a quiet revolution has been underway within the hallowed halls of academia. The reigning orthodoxy of what we label as the “traditionalist” school (a viewpoint we will elaborate upon in the Chapter 2) has come under fire from a new breed of thinking. Full rationality is out, bounded rationality is in. Representative agent models are being replaced with heterogeneous systems. Stochastic has been overridden by deterministic. Analytical solutions are being supplanted by a more computationally orientated approach. Sounds complex? It is. But the good news is that hand-in-glove with the rise of these “new views” has been a belated

recognition of the centrality of information to asset price setting. Indeed, more and more studies are now being published under the collective subject headings of “incomplete markets,” “information asymmetries” and “artificial models of the marketplace.” This book aims to add to this emerging literature by developing a series of building blocks that assist investors by helping them to understand the actual texture and fabric of information itself. We do this by focusing on the analogous nature of *biological-like molecular replication* to the formation and transmission of ideas – in particular, those ideas expressed by analysts within the financial community.

So how best to introduce such a novel concept as biological-like molecular replication of analyst opinions within financial markets? Actually, it is quite easy. Think of it in these terms. The decoding of the human genome has been one of the principle mathematical achievements in recent history. The genome itself is a sequence of letters denoted C, A, G, T that runs over 600,000 A4 pages long – which in book form takes up 270 ft of shelving space. Encoding such information into binary form has allowed the development of sophisticated mathematical techniques to better understand this extremely long informational stream – particularly the detection of key sequences. So too can financial market information be encoded into a similar format so that we can better understand what is initially a dauntingly large information-set. The beauty of such an approach is that the encoding can take place irrespective of whether the original information is from a technical, fundamental, economic or political standpoint. In one fell swoop we thus have a unified theory of information inputs into investor decision-making. Indeed, just as it is possible to build a genomic sequence to describe each and every organism phenotype, we can just as easily build a “market information” genomic sequence to accompany each and every “asset price phenotype.”

As will be demonstrated in the ensuing pages, we believe market “themes” are made up of component “memes” which in turn are made up of informational “bytes.” This occurs in much the same fashion that DNA is made up of genes which in turn are made up of chemical bases (C, A, G, T). The mathematical building blocks of both approaches remain the same. Indeed the key objective within both approaches remains the same as well – the detection of those deterministic binary sequences that ultimately have a bearing upon phenotype. In the case of biology, it is the phenotype of an organism (its appearance). In the case of finance, it is the phenotype of an asset (its price). Consequently, it is the task of Chapters 2 and 3 of this book to initially lay the foundations for both traditionalist and “new” views of finance before moving on to Chapter 4 where we describe how the sequencing of byte, meme and theme informational building blocks actually determine asset price dynamics. In doing so, it is incumbent upon us to present a framework where an infinite stream of such information is generated willingly by the analyst community. We do this in Chapter 5 by developing a fully endogenized model of intertemporal information on

“consumption and production” within financial markets. The net outcome of our labors is a structure that not only describes the insatiable demand for new themes and ideas by investors (which is supplied by a veritable army of analysts – as identified by a “representative” individual – who each manufacture information bytes) but our framework also identifies how information comes together in an evolutionary/biological-like fashion to form larger sequences – memes, themes and even overall market sentiment. It is these informational sequences which then, in turn, determine asset prices in a meaningful way. Ultimately, this has implications for the distributional form of asset prices as well – a point which will be discussed at some length in Chapter 6.

Ergo, a large portion of what is to follow is primarily orientated toward building a revolutionary new theoretical framework for understanding the role of information within financial markets. Certainly we do not abide by the traditionalist finance philosophy that information (and therefore asset prices) should be treated as though it is the outcome of some random number generation process. Indeed, the contrast between our highly structured evolutionary/biological-like approach toward information and the “random number generator machine” model espoused under the traditionalist finance framework could not be more different (Figure 1.1).

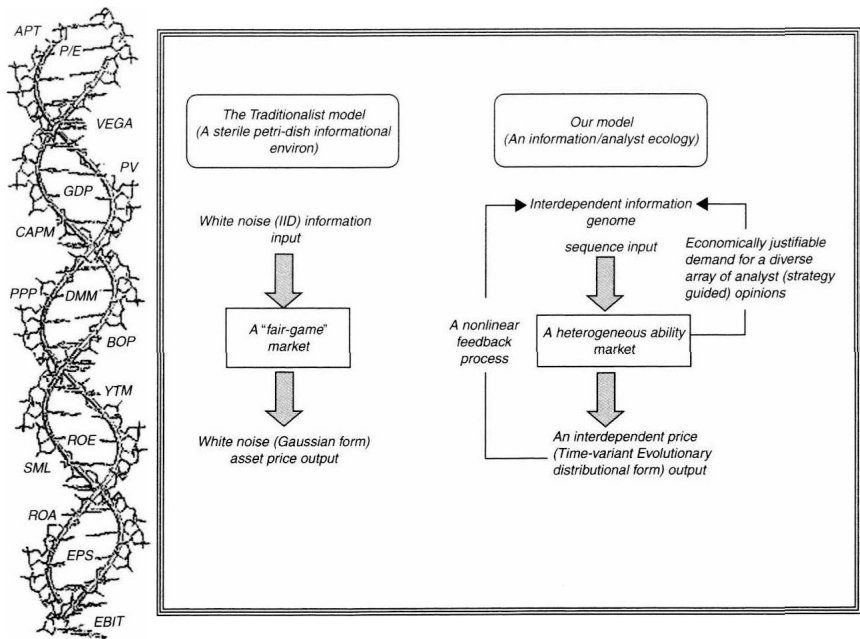


Figure 1.1 Their view versus our view on information within financial markets

So what to call our revolutionary evolutionary approach toward the treatment of information within financial markets? We label our style of analysis “Evolutionary Finance” in attempt to encapsulate the necessary elements of our cross-disciplinary “finance meets science” methodology.¹ The foundations of our Evolutionary Finance paradigm should be seen to be centered on the biological-like microfoundations of the way information is actually generated, interpreted and imparted within financial markets. It is this basic criterion that differentiates our Evolutionary Finance approach from models of a more traditionalist finance nature and even the “new” finance views that will be elaborated upon in greater detail in Chapter 3. Indeed, we would argue that the basic charter of Evolutionary Finance is to answer some fairly fundamental questions that as yet go unanswered within the finance sphere (or at least, are not explained by an all-encompassing model such as ours). How does information emerge and why do investors pay for it to emerge? How do the various components of what investors come to perceive to be “information” somehow bolt together to form memes, themes and overall market bullish/bearish sentiment? Are there any feedbacks to be considered in such a process? All are worthy questions for understanding the potentially complex nonlinear dynamics that can manifest between market information and asset prices. We argue that our own perspective on Evolutionary Finance develops a framework to better answer these fundamental questions and it is here that we feel that our greatest contribution resides.

But all this would come to naught had there not been an *applied* aspect to our work. When it comes to the earlier studies examining the link between information and asset prices, the typical approach has been to either undertake a piecemeal analysis via modeling specific interactions under various stylized frameworks, or alternately at the holistic level, treating information (and therefore asset price growth) as though it is the outcome of some stochastic random process. Our conjecture is to wholeheartedly rebut this claim. The reason why information in financial markets has up until now been treated as though it were the outcome of some random number generator is that the deterministic foundations of the production and

¹ We are not alone in coining the phrase “Evolutionary Finance.” Others, principally Professor Thorsten Hens from the University of Zurich, Professor Blake LeBaron from the University of Wisconsin-Madison and Professor Michael Dempster from the University of Cambridge have somewhat interchangeably used the term to describe the use of “evolutionary dynamics” (mutation and selection) in the study of the evolution of trading strategies and the evolution of financial innovations. If anything, our definition of Evolutionary Finance is even more broad-ranging than that of our forebears given our focus on the centrality of (biologically like determined) information to most financial market decision-making – and not just the formation of trading strategies in a manner highly sympathetic to the concept of Genetic Algorithms/Genetic Programming. That said, without doubt, our work benefits immensely from the insights of these pioneers in this exciting new field of finance.

consumption of information – along with the way such information necessarily bolts together – have been poorly understood. Needless to say, the applied aspects of our methodology vis-à-vis those that have come before this book could not be more markedly different.

In particular, we fully support the notion of active investing. Our foundation assumption is that we live in an informationally imperfect world where investors actively search for the “truth” about the informational determinants of a particular asset’s price. How is this search conducted? For starters, a considerable portion of time and effort (along with a great deal of money) is devoted to the production and gathering of information itself. Active investment institutions – whether they reside on the “buy-side” or “sell-side” – collectively employ tens of thousands of analysts, economists, strategists and market technicians whose primary goal is to garner that all important (initially private) information “edge” – an “edge” that they believe is not yet reflected in asset prices. Unfortunately, up until now, an all-encompassing theory as to how these various elements of information – technical, fundamental, economic and political – somehow bolt together to form a cohesive whole when percolating from private to public realms has been notable by its absence from the literature. It is this “informational building” process that drives asset prices – not some random number generator. Consequently, while most earlier theorists – especially those theorists of a traditionalist finance ilk – have tended to judge harshly alpha-seeking practitioners, our approach is the opposite – we actually condone active investing behavior wholeheartedly. By doing so we hope to bridge the veritable chasm that has arisen between a large portion of the theoretical and applied aspects of finance simply because of the harsh judgment allotted to active investing by these earlier (traditionalist based) theoretical studies. It is our intention to right this wrong primarily through a better understanding of the process of information building itself and importantly, how this interacts with asset prices.

One benefit of our approach is that we are thus able to form a better understanding of the mechanics underlying the strategies of both analysts and investors alike. Seeing yourself not as a solitary entity but rather as an active agent who generates and absorbs information (either consciously or unconsciously) as part of a cohesive whole is a powerful concept. Recognizing one’s role within this information “ecology” is therefore of crucial significance for *sustained* investment success.² Identifying how strategies *evolve* from one winning strategy to another as particular investment themes are being built, identifying the leading memes or even information bytes in this process so as to better forecast the emergence of winning strategies, or even recognizing the power of one’s actions should the market anoint you as a “dominant player” in the information hierarchy (i.e., as the likely initiation source of

² Farmer (1998) also refers to the “ecology” of financial markets.