

CHAPTER 1

INTRODUCTION

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QUANTITATIVE portfolio management has advanced to a highly specialized discipline. Computing power and software improvements have driven this development: we can now solve large scale quadratic programs with mixed integer constraints in reasonable times that would not have been thinkable when Harry Markowitz began the modern era of quantitative portfolio management in 1952. But computing power and software would not have been sufficient without the major advances in financial economics and econometrics that have shaped academia and the financial industry over the last 60 years. While the idea of a general theory of finance is still only a distant hope, asset managers now have tools in the financial engineering kit that address specific problems in their industry. The present Handbook consists of seven sections that explore major themes in current theoretical and practical use. These themes span all aspects of a modern quantitative investment organization.

Both qualitative and quantitative investment organizations spend enormous resources on human capital and data intensive research so as to build superior portfolios. Quantitative managers often deploy this costly information using *Portfolio Optimization* methods. Thus Part I of the Handbook consists of three chapters on this subject. Reha Tütüncü (Goldman Sachs) provides in “Recent Advances in Portfolio Optimization” a comprehensive review of the field to help readers navigate this deep area. Bruce I. Jacobs, Kenneth N. Levy, and David Starer (all of Jacobs Levy Equity Management) extend Markowitz’s 1956 critical line algorithm to the construction of enhanced active equity (that is, long/short) portfolios. Debates over quantitative versus qualitative methods for portfolio construction, and the efficacy of various quantitative measures, have raged for decades and no doubt will go on for decades more. Sebastian Ceria (Axioma) refers to “religious” camps in these debates in his chapter “To Optimize or Not to Optimize: Is that the Question?”. His provocative piece argues that there is no alternative to the use of “MVO” (mean-variance optimization) methods.

Further aspects of the *Portfolio Construction Processes* used by quantitative asset management organizations are investigated in the next section of the Handbook. Mark Kritzman (Windham Capital Management), Simon Myrgren (State Street), and

Sébastien Page (PIMCO) use dynamic programming in “Adding the Time Dimension: Optimal Rebalancing” to assess when in the management process it is best to rebalance portfolios. Colm O’Cinneide (QS Investors) provides in “Bayesian Methods in Investing” an overview and a tutorial of the extensive field of Bayesian methods, in which prior views about parameters of future outcome distributions are carefully updated to take into account new information. A different approach to the decision-theoretic problem faced by portfolio engineers is put forward by Michael Wolf and Dan Wunderli (both of the University of Zurich). In “Fund-of-Funds Construction by Statistical Multiple Testing Methods” they offer a framework to avoid data mining and to incorporate only significant risk premia. Nils Tuchschnid, Eric Wallerstein (both of the University of Applied Sciences, Geneva), and Sassan Zuker (Bank Julius Baer & Co. Ltd) survey in their “Hedge Fund Clones” chapter the current processes used by institutions seeking to construct portfolios with properties similar to hedge funds, using purely quantitative and deterministic methods.

The behavioral and organizational aspects of asset management organization are explored in Part III of the Handbook. The chapter by Jules H. van Binsbergen (Stanford University and NBER), Michael Brandt (Duke University and NBER), and Ralph S. J. Koijen (University of Chicago and NBER), “Decentralized Decision Making in Investment Management” argues that the inherent decentralization in asset management decision processes is welfare distracting and needs to be modified. This has direct implications for popular methods such as core/satellite and portable alpha approaches. Bernhard Scherer (EDHEC) and Xiaodong Xu (Deutsche Asset Management) argue in “Performance Based Fees, Incentives and Dynamic Tracking Error Choice” that fee structures that incent managers to diverge from the best interests of their clients are an issue only for badly written single period contracts. With the right contract specification, Scherer and Xu argue, excessive risk taking can largely be mitigated.

The Handbook then considers the issue of *Parameter Estimation* – crucial for quantitative methods – in the next three chapters. Heiko Bailer (Clariden Leu- Credit Suisse Group), Tatiana Mariavina, and R. Douglas Martin (both of the University of Washington) describe in “Robust Betas in Asset Management” how instabilities in exposure measures can be tackled. Daniel Giamouridis (Athens University of Economics and Business) and George Skiadopolous (University of Piraeus) offer in “The Informational Content of Financial Options for Quantitative Asset Management: A Review” tools for the financial engineer to estimate and accommodate non-normal distributions. Campbell R. Harvey (Duke University), John Liechty (Pennsylvania State University), and Merrill Liechty (Drexel University) conduct a parameter estimation experiment in “Parameter Uncertainty in Asset Allocation.” This chapter revisits a test pitting a Monte-Carlo-based resampling approach advocated by Richard Michaud versus a Bayesian approach. While the resampled approach was found to be superior by Markowitz and Usmen in 2003, Harvey, Liechty, and Liechty obtain different results when a more realistic Bayesian procedure is used.

The next section addresses risk and *Risk Management*. Dan diBartolomeo (Northfield Information Services) surveys the major approaches to estimating equity risk in “Equity

Factor Models: Estimation and Extensions.” diBartolomeo also shows how equity factor models can be extended to cover some fixed income credit risk. Kenneth Winston (Western Asset Management) takes up the fixed income risk theme, surveying the size and scope of the global fixed income market and describing two key risks in this market: interest rate risk and credit risk. In the next chapter, Winston and Thomas Hewett (Morgan Stanley Investment Management) consider “Risk Management for Long-Short Portfolios.” Winston and Hewett point out that long-short portfolios have outcome distributions very different from long-only portfolios, and (after characterizing these distributions) argue that stop losses are not the optimal risk management technique for such portfolios.

Purely theoretical approaches to markets often fail in practice if they do not take into account *Market Structure and Trading*, the subject of the next section of the Handbook. A whole sub-industry (high frequency trading) is based on the knowledge of market microstructure and transaction costs. Equally, investment capacity problems can be seen as applications of transaction cost economics. Petter Kolm and Lee Maclin (both of New York University) describe in “Algorithmic Trading, Optimal Execution, and Dynamic Portfolios” the current status of algorithmic trading and in managing and benchmarking trading processes. Yossi Brandes, Ian Donowitz, and Vitaly Serbin (all of Investment Technology Group) expand on this in “Transaction Costs and Equity Portfolio Capacity Analysis” by including the capacity dimension. This dimension is not only important for computing the decay of advantageous information, but also for the distribution function of an asset management firm, addressing the question of pricing limited capacity.

In the final section of the Handbook, three chapters attack the unique problems of the field of *Investment Solutions*. Investment solutions address the construction of the entire portfolio held by an owner of capital. Many other methods address only the construction of portfolios representing a specific part on the entire owner’s capital. Michael Peskin (Hudson Pilot) applies corporate finance principles to corporate pension plans in “Pension Funds and Corporate Enterprise Risk Management.” Peskin identifies dynamic asset allocation policies for these plans as a function of funding level and sponsor health, creating an intersection between corporate finance and investment theory. Roy Hoevenaars (APG Asset Management) derives asset allocation methods for sector-wide pension funds in “Pricing Embedded Options in Value-Based Asset Liability Management.” Such sector-wide funds are typical in Canada and in some European jurisdictions. While pension funds (also known as retirement funds and superannuation schemes) represent one of the largest concentrated pools of capital in the world, sovereign wealth funds are growing fast as another pool of highly concentrated capital. Such funds convert some of the wealth of a nation, which is often in the form of a non-renewable natural resource such as oil, into financial holdings that will provide for future generations as the stock of the natural resource dwindles. Francis Breedon (Queen Mary College, University of London) and Robert Kosowski (Imperial College London) provide a normative framework for sovereign wealth funds in “Asset Liability Management for Sovereign Wealth Funds.”

We hope that readers of the *Handbook of Quantitative Asset Management* will use this Introduction both as a tour guide and as selected reading advice. As the variety of subjects, authors, and authors' backgrounds suggests, quantitative asset management is a field undergoing vigorous investigation and development. While no one book could cover all parts of this robust field, the Handbook explores some of the most important aspects of the theory and practice of quantitative asset management.

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