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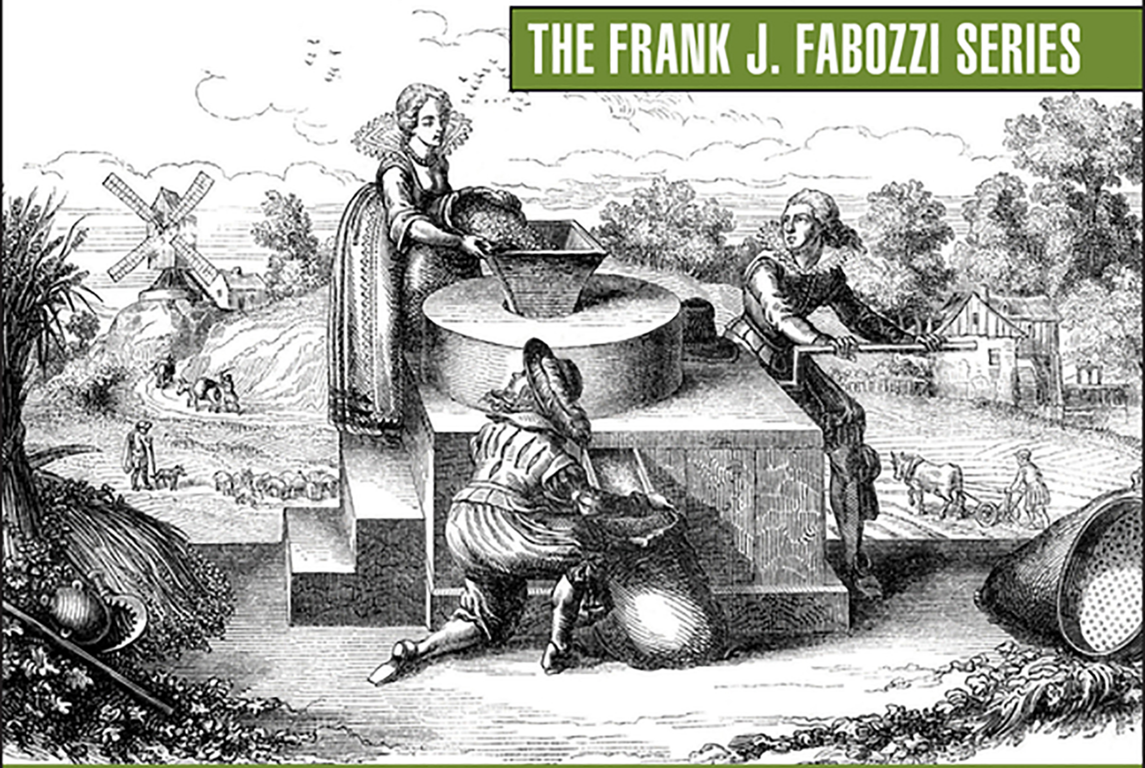

SYSTEMATIC INVESTING *in* CREDIT

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"To my wife Alina for her unwavering support and to my children Rachel, Joseph, Aryeh and David who inspire all my work."

—LD

"To my parents Lya and Ron to whom I can never repay for the sacrifices they made, my wife Melina who makes me a better human being each and every day and my pride and joy, my beloved children Shiraz, Shelly and Tamir"

—ABD

"To my wife, Anne-Louise, for her patience and support"

—AD

"To Ella"

—JH

"To my family and friends"

—SP

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Foreword

I first met Lev Dynkin and other members of the Barclays Quantitative Portfolio Strategy (QPS) Group at one of their esteemed annual investment councils. The experience brought back fond memories of the intimate conferences from my prior academic life in physics. The focus of the QPS council was not to sell or promote but rather to expand the knowledge of attendees and seek understanding of complex market phenomena. Evident throughout the day was the team's sincere desire to help investors achieve better outcomes.

For over 25 years, the QPS team has been at the forefront of research into methods to guide investors in making better decisions in their fixed income portfolios. This book is another milestone for this respected team. Here they compile their past and present research for the benefit of a broader investment community. The focus is not simply on innovation for its own sake. Rather it is to share and educate readers, thereby advancing the field and adding to the core knowledge of all market participants.

Why does this collection of insights deserve your attention? Because systematic approaches—and, more broadly, scientific approaches—are the future of credit investing. Scientific problem solving is the primary means of tackling data-rich complexity in virtually any field, investment related or not. In the field of investing, such approaches utilize the best of the human mind's natural ability to design processes and methodologies while avoiding the cognitive and behavioral biases inherent within traditional discretionary asset management.

Scientific approaches in fixed income credit are the exception rather than the rule and have lagged those in equity markets. This is because the successful implementation of a scientific investment approach generally requires four primary inputs: rich and relevant data availability, high breadth of investable instruments, sophisticated markets enabling long and short positioning, and a growing body of research, built on a foundation of prior knowledge, from which to find new and workable insights.

Credit markets in recent years have seen these four conditions met for the first time. This was not the case 20 years ago when today's homogeneous European credit market was born, nor when the first credit default swap was traded in the 1990s. Scientific credit investing stands today where scientific equity investing stood at the turn of the century: in an uncrowded space and on the threshold of considerable secular growth. This suggests significant and durable alpha generation possibilities for those investors capable of grasping the opportunity at hand.

It's not easy, however: Credit is complex, heterogeneous, and illiquid relative to equities. Scientific credit investing requires not only predictive insights but also the analysis and incorporation of bespoke liquidity, risk, and transaction cost considerations. Growing issuer breadth further demands high data capture. If success is achieved, the prize is enormous: the intellectual property of a scientific approach sits at an organizational level rather than in the minds of star traders. This lasting form of knowledge management can be built upon to create further iterative improvement—a powerful incentive.

Necessarily, this book covers only a small, yet important, part of the annals of current research in the field. A book could be written on each component of the investment process: selection of the traded universe, data management and application, creation and utilization of predictive insights, and the crucial step of portfolio construction—where insights must optimally and realistically meet risk management, trading costs, and liquidity considerations specific to credit. Each part of the process stands to benefit from a rigorous approach.

A collaborative spirit runs through the scientific investment community that is generally in contrast to the siloed mindset of traditional active management. This positive knowledge sharing is evident across a number of scientific firms and their practitioners, who publish insights and share best practices with investors. It is in this spirit that the QPS team has compiled the contents herein. I know nothing will make the QPS team happier than if readers benefit from, and build upon, QPS's research in the context of their own portfolios.

May this book inform and guide you on your own scientific journey, even as the QPS team tackles new frontiers of research.

Alex Khein
Chief Executive
BlueCove Limited

Preface

For over two decades, Barclays Research's Quantitative Portfolio Strategy (QPS) group has been recognized as a leading source of innovative insights into the fixed income markets. In the 1990s, the team was involved in the development of what was then known as the Lehman Brothers Global Family of Indices, providing an essential foundation for quantitative analysis of fixed income markets: high-quality data, available systematically. Today, the Bloomberg Barclays fixed income indices remain an integral part of the active and passive global portfolio management processes.

In its early years, the QPS team made use of fixed income data to create some of the first risk and return analytics for corporate bond portfolios, coded in C for Windows 1.0 and shipped to clients by mail every month on floppy disks. Client requests for data analysis beyond the scope of the software platform led to bespoke research projects and, ultimately, to the shift in the QPS team's focus toward a broad range of quantitative topics in portfolio management. Over the years, the group cemented its reputation among fixed income professionals, collecting many accolades along the way, including being repeatedly top ranked in *Institutional Investor* surveys in the United States and Europe.[1]

The QPS team has always paired a relentless focus on relevant, implementable findings in response to questions from practitioners with a sophisticated and rigorous approach. Many of the ideas behind the team's research projects come from interactions with a broad range of investors, through one-on-one meetings as well as various seminars and councils organized by Barclays. This has enabled the team to expand its research beyond its traditional fixed income focus. One important example is the group's development of cross-asset signals, where information from credit is applied to equities, and vice versa. While simple in concept, mapping bonds to equities requires a deep understanding of corporate bonds, which the team has developed over decades. Several of the approaches detailed in this book draw on these cross-asset insights.

The QPS group also remains closely connected with Barclays Research's fundamental analysts. This connectivity has helped the team incorporate fundamental data alongside prices and risk metrics in its products; several of these are discussed in detail in this volume. Going forward, the team remains committed to evolving its approach. Recently it has begun to partner with Barclays Research's data science team, with a view to incorporating modern data techniques and new, and at times larger, datasets into its analysis.

It is rare to find a group that has had such consistent success with its core mission over the years, yet remains so committed to innovation and creativity. Collaborating with the QPS team has been a great privilege.

—Jeff Meli, Head of Barclays Research

NOTE

1. The team ranked #1 in the Quantitative Analysis category in the *Institutional Investor* All-America Fixed Income Research Team Survey (2006–2008) and in 2017 and #2 in 2018. From 2009 to2016, this category was not included. The team ranked #1 in the Quantitative Analysis category in the All-Europe *Institutional Investor* Fixed Income Research Survey (2013–2015 and 2018).

Introduction

A systematic approach to investing in corporate bond portfolios is becoming more widely used by investors as a result of the increased availability of fixed income data, improved price transparency, and the influence of established quantitative insights from the equity markets. This book is focused on new research in this area covering a broad spectrum of algorithmic credit investing: exploiting inefficiencies of benchmark indices, investing based on factors constructed using a combination of fundamental and market data as well as extending quantitative equity methodologies and signals to credit.

The authors are long-term members of the Quantitative Portfolio Strategy (QPS) group, which has been a part of Barclays (and, previously, Lehman Brothers) Research for nearly three decades. The group has a unique focus on working with major institutional investors across the globe on all issues of portfolio management that are quantitative in nature. As a result of this focus, research results produced by the group are practical and implementable. The group's publications target portfolio managers and other investment practitioners as well as research analysts and academics. Past involvement by the QPS group in the creation and replication of Bloomberg Barclays Fixed Income Indices and its expertise in quantitative research in both equities and bonds further help it to produce innovative portfolio construction methodologies and timing signals.

This is the fourth book published by the QPS team. The group's prior books—*Quantitative Credit Portfolio Management* (Wiley, 2012) and *Quantitative Management of Bond Portfolios* (Princeton University Press, 2007)—were focused on QPS original risk measures, benchmark customization and replication, and other aspects of the investment process. The 2012 book was dedicated to credit investing while the 2007 book also included our research related to mortgage-backed securities and rates portfolio management. One of our risk measures for credit securities—Duration Times Spread (DTS)—was broadly adopted by institutional investors since its introduction in 2005 and is the sole subject of another QPS book, *A Decade of Duration Times Spread (DTS)* (Barclays, 2015). Given the broad use of DTS, we continue to monitor its validity in different market regimes and credit asset classes.

In this book, we focus on our original research into systematic strategies—fully rules-based algorithmic methodologies aimed at improving credit portfolio performance by generating alpha. Some of the strategies fall into "smart beta" category and take advantage of inefficiencies in conventional market-value-weighted benchmarks. Others harvest risk premia associated with risk factors, both traditional and new, and are formulated as scorecards—ranking methodologies for credit securities, issuers, and industry sectors by measures that are informative of future performance. Most of these scorecards are produced by Barclays Research on a periodic basis and are shared with clients.

All the materials included in the book reflect QPS research as it was originally published for Barclays clients*. We decided against going back and updating individual chapters to avoid any possibility of hindsight tainting the results.

Credit portfolio management was originally, and still mostly is, discretionary in nature. Managers form views on issuers, industry sectors, and credit spread curves based on fundamental bottom-up analysis and seek to implement those views using securities available in the market subject to liquidity constraints. However, there is a growing trend toward incorporating systematic (algorithmic) approaches into this process, either as additional filters of the eligible investment universe or as checks on the discretionary choices made by the fundamental manager or even—in some cases – as stand-alone strategies. This trend is helped by the increasing availability of bond-level index data and of large datasets that require a quantitative approach to be useful in the investment process as well as by the migration of rich, highly developed systematic equity methodologies into credit management.

Over the years, we have often heard investors question whether credit is an independent asset class or can be replaced in a portfolio by an appropriately weighted combination of Treasury bonds and equities. Part I addresses this fundamental question head-on with a thorough empirical analysis of the role of credit in a Treasury/equities portfolio. We analyze the underlying sources of the performance difference between a credit portfolio and a risk-matched and issuer-matched portfolio of equities and Treasuries. To ensure that the corporate bond portfolios and the Treasury/equity portfolios in this study are exposed to the same corporate entities, we rely on an issuer-level historical mapping between bond issuers and the associated equity tickers built by our team over time. This very detailed mapping process required that we correctly reflect all corporate events that can cause this mapping to change as well as address several technical challenges of the differences between the two markets. We rely on this mapping throughout this book for all studies and models that analyze corporate bonds using stock market data or fundamental issuer information.

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*Fixed income index data used in this book is sourced from Bloomberg Barclays Indices.

Credit investing is often an index-centric process subjecting managers to index rules and constraints. The continued popularity of low-fee passive management, coupled with the need for pension consultants to have a basis for comparison among different managers, ensures that it will remain this way going forward. In Part II we discuss ways of exploiting index inefficiencies to generate alpha. Empirical evidence of a particular methodology generating outperformance is never sufficient for us to call it "smart beta" or systematic alpha. We always insist on economic intuition explaining which market inefficiency allows for the outperformance and whether there is a reason to expect it to persist or to mean-revert. In this sense, index inefficiencies are among the most reliable sources of outperformance, as they stem from the rules of inclusion and elimination of securities built into the index definition. These rules, which are predefined and independent of market pricing, lead to strong demand for debt being added to the index increasing allocations to large borrowers and strong selling pressure on issuers being dropped from the index. These dynamics can often cause bonds to trade at levels that diverge from their financial fair value. We further look at the performance impact of other liquidation constraints based on rating downgrades in a credit portfolio beyond the traditional index constraints. We demonstrate their impact on portfolio performance and on the optimal allocation in a portfolio to different rating categories. This forced liquidation is one of the reasons long-horizon investors do not always significantly overweight credit during various crises and wait for the spreads to mean revert to generate alpha. The liquidation rule may trigger a realized loss before spreads recover.

In Part III we proceed with research on the performance implications of bond portfolio characteristics: both traditional ones, such as coupon level and maturity distribution, and those that came into focus more recently such as environmental, social, and governance (ESG) rankings. We show that low-coupon bonds offer a performance advantage over their high-coupon peers at the time of significant changes in Treasury yields due to better price protection provided by the recovery value. We also explain the causes of the outperformance of short-dated corporates over long-dated peers and attribute it to market factors. Our study of the impact of an ESG tilt on credit portfolio performance was first undertaken to see whether it leads to reduced returns. Like so many of our studies, it was prompted by a large US asset manager seeking to understand whether such tilt is justified in its pension mandate, given the return maximization objective. The concern was that high-ESG bonds might be overbought, which could lead to lower returns. We were surprised to find in a series of studies that, all else equal, an ESG tilt led to improved performance in both investment-grade and high-yield markets in both the United States and Europe. This finding held true using ESG rankings from different providers and over different time periods. We analyze the reasons for this outcome, both for the markets overall and for specific industry sectors.

The traditional approach to building a credit portfolio is based on allocations to industry sectors, credit ratings, spread duration buckets, and, of course, issuer selection based on fundamental bottom-up analysis. Most institutional investors measure these allocations in terms of contribution to Duration Times Spread (DTS)—a new measure of credit risk introduced by our group in 2005. These allocations may or may not reflect priced factors in credit markets: categories of risk that is compensated by corresponding return. Also, these allocations may contain biases, such as issue size or coupon level, which may affect performance. Finally, they can be correlated. In Part IV of this book we present two priced factors in credit markets that have risk premia associated with them—value and momentum—and analyze the role of issuer size as a factor. Again, we use our proprietary mapping between bonds and equity of a given issuer to access fundamental data and equity market information. We construct two value measures based on the combination of bond market data and fundamental data, one for monthly time horizon—excess spread to peers (ESP)—and the other for annual horizon—SPiDER (*SP*read per un*i*t of *D*ebt to *E*arnings *R*atio). ESP rankings are relative in nature and are meant to be used within a peer group. SPiDER scores are absolute and can be used across sectors as well as at the aggregate market level. Both are shown to be informative of future bond returns on their respective horizons. Our momentum factor for a given issuer, constructed based on the recent momentum of its equity rather than its bonds, equity momentum in credit (EMC), is shown to be highly informative of future bond returns on a monthly horizon. Diversified strategy portfolios based on both ESP and EMC are shown to deliver excellent performance. We find that performance of value portfolios is positively correlated with market returns, while momentum portfolios have negative market correlations. We explain the reasons for these results. We then introduce OneScore, which combines these two signals. Portfolios formed of bonds with strong positive scores for both value and momentum have outperformed those with strong negative scores in both dimensions in most market regimes with a significant information ratio, in both historical back-tests and since going live.

Quantitative investing in equities has been in place for decades and is well represented in hedge fund offerings as well as in exchange-traded funds and long-only funds. One reasons it has attracted significantly more attention than quantitative credit investing is the broad availability of equity market data based on definitive pricing from the exchanges. Much of the academic work on factor investing and systematic signals was done in equity space. Until recently, fixed income market data was produced mostly by index providers—investment banks that traded bonds over the counter and were in a position to price broad market segments. In the last few years, the task of producing fixed income indices and data moved to data vendors and pricing of bonds became increasingly transparent, making it possible to develop algorithmic credit strategies. However, quantitative bond analysts can learn a lot from the methodologies, signals, and techniques well established in systematic equity investing. Since both the equity and the credit of a given issuer are claims on the same underlying company, there is reason to expect that some equity models may also apply to credit. In Part V we give examples of using equity methodologies in credit markets to produce informative credit performance signals. In particular, we research whether the post-earnings-announcement-drift (PEAD) exists for corporate bonds and whether equity short interest is informative of the future performance of an issuer's credit securities.

We would like to thank our clients for stimulating questions and continuous dialogue that led to many results covered in this book, our colleagues who provided invaluable help with the analysis and preparation of the manuscript, and the senior management of Barclays for their continuous support and encouragement of our work. We hope that credit managers, research analysts, and academics in the field of systematic investing will find these chapters useful. As always, we welcome inquiries and challenges to our work.

PART

One

Investing in Credit vs. Investing in a Combination of Treasuries and Equities

CHAPTER 1

Can a Combination of Treasuries and Equities Replace Credit in a Portfolio?

INTRODUCTION

The corporate bond market is one of the largest markets in the world. According to the Security Industry and Financial Markets Association (SIFMA), \$1.38trn worth of new corporate bonds were issued in the United States alone in 2018, while total equity issuance that year was only \$0.22trn.[1] Since equity and bonds of the same issuer represent claims to the same underlying operating cash flows and are affected by the same set of firm fundamentals, their valuations are innately related, as formalized in Merton (1974).[2] The economic link between firms' corporate bonds and equity has led some investors to consider the possibility of replacing credit with a simple "barbell" combination of equities and Treasuries that will result in similar returns with the added benefit of higher liquidity. Studies examining this idea offered varying conclusions, partly because of the differences in approach and sample period. Asvanunt and Richardson (2017), for example, argued that corporate bonds carry a positive premium for bearing exposures to default risk using a long time series of corporate bond index returns since 1926 after properly adjusting for the bond exposures to Treasuries. In contrast, Norges Bank (2017) found that in an asset allocation framework, corporate bond indices did not offer any benefit to an equities/Treasuries portfolio in a more recent sample period from 1988 to 2017.

Given the central role played by credit in asset allocation, we conduct a comprehensive two-part study spanning almost three decades and leveraging our unique access to the Bloomberg Barclays Indices pricing and analytics data as well as a proprietary firm-level capital structure mapping developed by Barclays. Similar to most studies, we start with an asset-allocation-level analysis and examine the effect of including an allocation to a broad credit index (consisting of investment-grade [IG] and high-yield [HY] bonds) in various equities/Treasuries portfolios. Although very simple conceptually, great care should be taken in the implementation phase to control for the reallocation effect. This effect is caused by the possible difference between the equities/Treasuries mix in the portfolio and the one implied by the introduction of the allocation to credit. To demonstrate this issue, note that credit returns can be seen as a combination of equities, Treasuries plus some credit-specific returns. If the credit index equivalent mix of equities and Treasuries is different from that of the equities/Treasuries in the benchmark that the credit allocation is added to, the introduction of credit will effectively change the mix of equities and Treasuries in the original benchmark and thus affect performance. For example, in a portfolio with an initial large allocation to equities (relative to Treasuries), adding credit indirectly increases the weight of Treasuries. If Treasuries happened to rally on average during the sample period, adding an allocation to credit is likely to increase the risk-adjusted returns of the portfolio. Interpreting such a result as a confirmation of the benefit provided by credit may be incorrect if the improvement is due mostly to the increased weight of Treasuries in the portfolio rather than to the contribution of the credit-specific component of credit performance. The existence of the reallocation effect explains, at least in part, why different studies came up with opposing conclusions when using different time periods in the analysis.

We explicitly neutralize the reallocation effect in our analysis by finding the equivalent combination of equities and Treasuries that would best mimic the month-to-month return fluctuations of the credit index. The performance improvement from including the equivalent equities/Treasuries combination instead of the credit index captures the reallocation effect. We find that an allocation to credit improved the risk-adjusted performance of the benchmark regardless of the original mix of equities and Treasuries, controlling for the reallocation effect. For the period 1993 to 2019, for example, adding an allocation to a (market capitalization weighted) credit portfolio comprised of IG and HY indices increased the Sharpe ratio of a 60/40 equities/Treasuries portfolio from 0.71 to 0.86.

The latter result is not sufficient, however, to conclude that the barbell approach has no merit because our analysis has not taken into account a second element we term the “mismatch effect.” This effect emanates from the differences between commonly used bond and equity indices in terms of issuer composition and sector weights. A nonnegligible number of bond issuers do not have publicly traded equities, especially issuers with ratings below investment grade. Similarly, many small capitalization firms (especially