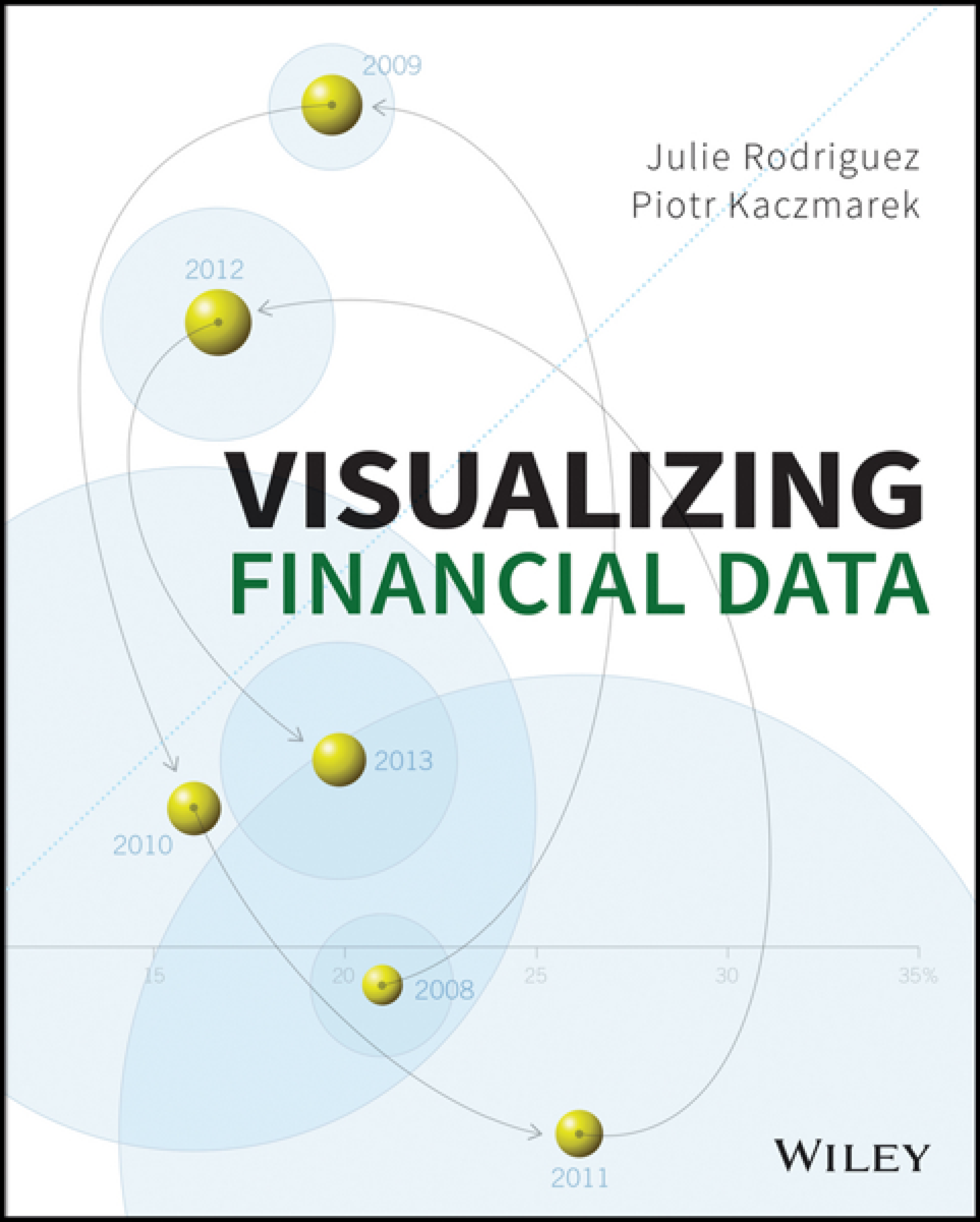

Julie Rodriguez
Piotr Kaczmarek

VISUALIZING FINANCIAL DATA

WILEY

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This book is dedicated to you, the reader,
for your interest in and pursuit of bringing data to life.

—The authors

About the Authors

Julie Rodriguez is a user experience designer, researcher, and speaker on creating meaningful experiences that change the way we solve problems. As an information architect, Julie analyzes data use and needs, tests alternative solutions, and refines new solutions that deliver business value.

During her 15 years of work experience in the financial services domain she has designed for front, middle, and back office roles, restructured business processes, and solidified new business ventures with application launches. More recent ventures include designing the future state vision for institutional wealth services and defining the user experience for a new brokerage solution.

Julie holds a bachelor's degree industrial design from Carnegie Mellon University and a master's degree in digital media, Extension Studies, from Harvard University.

Piotr Kaczmarek is an information designer in the financial industry and he conceives visual tools for navigating through data collections of varied complexity. In his work, he merges roles of an information architect studying user needs and providing conceptual frameworks, and a visual designer dealing with effective delivery of the final solutions.

Though he was educated as an architect and industrial designer, Piotr's interest shifted toward visual communications, and now he has more than 20 years' experience in information design and digital media. Although financial data has been his focus these last few years, his general area of expertise is in visual explanations. Piotr's creations in this field include data visualizations for analytical software, as well as 3-D animations showing the inner workings of complex mechanisms.

Piotr studied architecture at Warsaw University of Technology and holds a master's degree in industrial design from the Academy of Fine Arts in Warsaw, Poland.

About the Technical Editors

Bob Bannon is semi-retired and living in Southern California. Most recently Mr. Bannon was the chief risk officer for Genworth Financial Wealth Management. Prior to that position, Mr. Bannon was the chief investment officer for the Wealth Management Division of Bank of the West. In previous roles Mr. Bannon served in various investment and analytical positions for Analytic Investors, IDEAglobal, and Security Pacific National Bank. Mr. Bannon earned his bachelor's degree in economics from Villanova University in 1980 and his master's degree in economics from UCLA in 1983. He holds both the Chartered Financial Analyst (CFA) designation from the CFA Institute as well as the Financial Risk Manager (FRM) designation from the Global Association of Risk Professionals.

Brandon Farr is a senior quantitative analyst at Copper Rock Capital Partners, where he is responsible for quantitative analysis, risk management, and portfolio management reporting for all the firm's investment strategies. Prior to joining Copper Rock, Brandon worked at State Street Global Advisors where he was a vice president and investment risk analyst. He also worked as an investment risk analyst at Putnam Investments for 6 years in which he collaborated directly with the investment teams on risk and performance attribution reporting for global equity portfolios. Brandon received his master's degree in mathematical finance from Boston University. He has more than 10 years of quantitative and portfolio risk management experience.

Richard Perez leads the investment effort of Aquitaine, 40 North's third-party manager platform focused on alternative investments. Prior to joining 40 North, Mr. Perez was a senior analyst on the External Manager Selection team at Soros Fund Management. Prior to Soros, Mr. Perez was a vice president in the Hedge Fund Strategies Group at Goldman Sachs, where he headed Research for Tactical Trading Strategies. Mr. Perez earned his MBA degree from the Wharton School of the University of Pennsylvania and graduated with honors from Harvard University with a bachelor's degree in applied mathematics with a focus in Economics.

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There are a number of others who have closely reviewed a few chapters in the book: For those, we thank Jacque Murphy, Catherine Musinsky, Matt Hull, and Michael Ledeoux, who provided spot-on feedback. Their words are embedded in the chapters they reviewed.

We also thank those that we interviewed to shape the book contents to begin with. We cannot thank each by name because we promised anonymity, but we can thank each by role. The perspective of portfolio managers, investment analysts, and controllers has proven invaluable as we discussed typical data displays, current challenges, and our visualization solutions. We could not have written this book without their perspectives as practitioners in the field.

We have immense gratitude for our families for giving us the time to write the book. Their patience and support through the months has been touching. Natalia Rodriguez's interest in knowing how close we were to finishing made our constant response of "almost done" increasingly comical. Surprise breakfasts, snacks, sandwiches, and encouraging notes from Isabela Rodriguez helped to keep our spirits and energy up. Alejandro (Julie's husband) has been her life support providing a balance of quiet time to work and fun distractions when she needed to take a break.

Contents

PART 4: NEXT STEPS

Foreword

As the volume and complexity of the world's data increases, so too does our requirement to find meaning and insight in the information we amass. For businesses, simply collecting and storing data is of little use. The real power lies in unlocking more informed decision-making that can drive substantial user impact, revenue growth, and process innovation.

Much of the traditional business effort around data has been focused on how best to aggregate and organize an enterprise's unstructured information into data sets for analysis. This has proven to be a massive exercise in both scale and futility. As data sets continue to grow from the proliferation of new information sources, they are simultaneously stretching and testing the boundaries of our legacy modes of analysis and making it challenging for financial services professionals to uncover relevant business insights.

Data visualization seeks to remove this complexity by presenting information in consumable, graphical ways. Good visual communications do much more than simply replace words and numbers with imagery—they reveal data patterns, themes, and changes at a quick glance to help individuals make informed decisions effectively and efficiently. In time, it is likely that machine learning and artificial intelligence will further intervene to unlock even greater insights from our visual communications.

In this book, two of Sapient Global Markets' creative directors known for running highly successful engagements with our largest clients, Julie Rodriguez and Piotr Kaczmarek, explore the power inherent in improving the visualization of financial data.

They share original solutions to push the visualization of financial data to the next level, unlocking new meaning and supporting more robust, informed decision making. These ideas are accelerators you can use to start your process to display and interact with data. I encourage you to review their work and leverage their designs to make your displays more insightful.

Chip Register
CEO, Sapient Consulting

Introduction

Financial data presentations are often riddled with incomplete, misleading, excessive, or raw data, compromising their ability to tell a full story and leading to inaccurate conclusions. As an industry, we need to improve our ability to see major issues, discover hidden details, make connections, and compare top investment ideas. Given ever increasing amounts of data, we need to work ever more diligently to ensure our decisions are based on a clear understanding of the data. This requires that we first undertake a close examination of the data, then explore data visualization solutions, making incremental refinements and continual critical assessments along the way. The chapters in this book provide a variety of data visualizations designed to improve your understanding of data and your ability to convey that understanding to your audience.

Our Approach

This book provides visualization methods that will help you navigate today's cluttered landscape of financial markets. It starts with a review of current, commonly used methods for communicating financial data and then offers methods to refine or enhance them, or create new types of visualizations that are easy to use, elegant, and that facilitate better decision-making. Many break with today's common practices for communicating data, but improve efficiency and clarity.

Core chapters (Chapters 3–10) examine current typical approaches to communicating data and contrast those against our revised visualization methods. These chapters

provide industry examples organized by common portfolio management activities and by typical financial statements for pension funds, mutual funds, and hedge funds. We analyze existing, representative data sets, and keeping in mind their intended purpose, we propose alternative visualizations to improve their clarity and drive home the most important information they contain.

As information designers, we combine analytics and cognitive aesthetics to create data visualizations. We start by interviewing practitioners in the field to understand their goals; next we evaluate and interrogate the data itself for the various questions it might answer. Finally we craft design concepts that will reveal these answers most effectively. Our work is constantly evolving as we invent better ways to communicate data. The visualizations we present inform, inspire, and aspire to light the way to intelligent decision-making.

Intended Audience

This book is designed for those who work within financial services, especially within investment management firms such as foundations, endowments, estate and wealth management companies, pensions, hedge funds, mutual funds, registered investment advisories, 401k plan sponsors, third-party providers, banks, or at brokerages, in addition to those responsible for disclosing the financial status of a for-profit or non-profit firm.

Investment managers who actively manage investments, research analysts, and associates who provide insights and information to those that make investment decisions will find this a valuable resource when it comes to transforming data into active management decisions. Marketing analysts who provide sales and presentation materials and accounting and financial analysts will find visualization solutions to showcase their data.

Systems analysts, business analysts, and user experience designers who design, implement, and support systems for investment management firms can find security, portfolio, trade, performance, and risk management solutions they can adapt to their own uses. Some firms have business intelligence analysts tasked

with creating specific reports to reflect departmental or firmwide conditions. These BI analysts may find they can reuse or repurpose many of the data visualizations in these pages.

Chapter Structure

This book has four parts and twelve chapters. Part 1 introduces the many uses of data visualizations and explains their many levels of importance. Part 2 provides data visualization solutions for active investing decisions across different phases of managing a portfolio. Part 3 provides ideas for how best to present data for accounting, marketing, sales, and communications needs. Finally, Part 4 enumerates key principles and provides some next steps for implementing visualizations.

Firms need to monitor, report, and identify needs on the basis of financial data. To monitor status, to answer the question, *How are we doing?* they need to consult a myriad of accounting, performance, risk, market, and transactional data. Reporting requires regulatory compliance. Various regulatory demands push standards and create rules for greater transparency. Well-documented audit trails allow firms to track accountability and answer the question, *Are we compliant?* Good decisions require clear understanding of status and strategies. Dots must connect in order to know *What should we do differently?* or *How should we adjust in order to succeed? M*ore than 250 charts and graphs in this book help furnish such questions with the tools to find clear and actionable solutions. From start to finish, we identify needs and design visualizations that reflect those needs. What follows is a short synopsis of what to expect from each chapter.

Part 1: Information Gains Through Data Visualizations

In his book *Exploratory Data Analysis* (Pearson, 1977), renowned mathematician John Tukey wrote, "The greatest value of a picture is when it forces us to notice what we never expected to see." In that book he encouraged translating text and numbers into visual methods like charts to explore data sets with the

goal of reaching a more complete understanding of the data. The chapters in Part 1 introduce the uses of data visualizations and the value they provide.

Chapter 1: Paving a Path Toward Visual Communications

Today, we are challenged by both the size and complexity of data. Advancements in technology enable us to access, store, and share more data than ever, but have also created higher standards for onscreen displays. We expect screen presentations to be increasingly immediate, simple, and telling, not to mention aesthetically pleasing. This chapter aims to answer, *How should we best represent the data?*

Chapter 2: Benefits of Using Visual Methods

Why do we use charts and graphs? What are their benefits? How should we take advantage of these methods? If you know what something is good for, then you'll know how to apply it. Part of the puzzle is to allow the connection between data and charts and maximize the utility of both. This chapter reviews the various benefits of data visualizations to make better use of the chart and graphing ideas that follow.

Part 2: Transforming Data for Active Investment Decisions

Part 2 focuses on the art of investment management as it applies to the management of separate client accounts, either individual or institutional. Investment Managers tend to make all the investment decisions for a client's separate portfolio across multiple asset classes. You can find individuals in these roles at foundations, endowments, family offices, wealth management companies, registered investment advisories, or at brokerages. Because the investment approach, style, and process will vary from firm to firm or even individual to individual, we do not focus on process. Rather we showcase visualization techniques based on common investment activities used in the industry. The investment activities within Part 2 are organized by the major investment management phases. Each chapter provides visualizations for each phase of

the Investment Process: Security Assessment, Portfolio Construction, Trading, and Performance Measurement.

At every phase of the Investment Process, members of the Investment Management firm are seeking to "add value" for the client. This term can have many different meanings. The client might define adding value as outperforming a benchmark, outperforming other peer Investment Management firms in the industry, or simply striving to achieve positive investment results most of the time (outperforming "zero" or a benchmark of cash, as it is often called).

The most important goal of the Investment Process is to gain value over some alternative. The most important function of our visualizations, therefore, is to help the Investment Management staff either find ways to add value to the Investment Process or to communicate to clients their level of success in that pursuit.

Chapter 3: Security Assessment

Each investment option has its own set of characteristics to watch and track: This may include the short-term growth of a stock, or the stability of a bond to pay coupons, the longer-term returns of a mutual fund, or the diversification of an ETF. Despite, or because of, these variations, each investment option presents data points that make it harder to review. Data inconsistency presents a difficult comparison problem: *How do we normalize this data? How do we ensure we are not missing out on the relative characteristics for each vehicle?* In this chapter we introduce how to review a mix of stocks, bonds, mutual funds, and ETFs, and how to present a rich view of each while keeping them within a consistent framework.

Chapter 4: Portfolio Construction

During the Portfolio Construction phase of an Investment, investment professionals confer to create a portfolio best suited to the client by looking at data views designed for evaluation and reaction to change. This key chapter covers asset allocation, sector analysis, and risk management and monitoring. It provides visualizations that can be tailored to unique decision-making rationales.

Chapter 5: Trading

In this chapter, we rethink how to use the data in tickers, quotes, and watchlists to provide you with better up-to-the-minute information on the current state of a security or index. This chapter explains how to create, use, and reuse a visual system to reduce the time required to learn new, additional visual markers. We provide visualizations to not only increase awareness of the data but also to improve the elegance and efficiency of the display.

Chapter 6: Performance Measurement

Market fluctuations impart volatility to the values of the instruments held in a portfolio. Tracking and analyzing the overall performance of the portfolio—in absolute terms and also relative to the fluctuations of the broader markets—is an important part of the Investment Process. Lessons can be learned by members of the investment firm from a thorough analysis of market and portfolio performance, and through a feedback loop, those lessons can be used for improvement. This chapter discusses performance at the market, firm, and portfolio level and reviews both risk and return attribution.

Part 3: Showcasing Data for Effective Communications

Effective visual communications can improve your sales, marketing, and client presentations to help you connect more clearly with your audience. Part 3 walks through key chart designs for non-profit and for-profit organizations' annual reports to showcase demographic, tributary, and funding ratio data for a pension fund. New visual techniques demonstrate how to display fund factsheet data and how to analyze the top 100 hedge funds.

Chapter 7: Financial Statements

Financial accounting is a large topic encompassing many different types of financial statements. This chapter reviews a few standard financial statements required of all public firms and which analysts are required to compile, review, and report, such as the Statement of Cash Flows, Statement of Financial Activity, and Operating Budget. These statements report fundamental data points that

are not typically visualized. We suggest visualizations that observe standard accounting practices while making the data more transparent with supporting details.

Chapter 8: Pension Funds

This chapter focuses on one of the largest pension funds in the world and reviews how its annual report documents its status. We hone in on three main areas, including 1) demographics of plan members and their profiles, 2) contributions versus benefits, and 3) fund position as revealed by the funding ratio. This chapter transforms table data, then combines them into both individual and consolidated charts.

Chapter 9: Mutual Funds

Following fund profile, allocations, performance, and fees are key aspects of reviewing and marketing a mutual fund. In this chapter, we design some commonly displayed charts that represent these key components and incorporate the charts into a revised fund factsheet. The chapter ends with a few concise methods for comparing a list of mutual funds.

Chapter 10: Hedge Funds

This chapter uses pattern recognition and interactive displays to present temporal data of the top 100 performing hedge funds. We examine two important sets of hedge fund data: individual funds and overall industry analyses. We compare both hedge fund strategies and the funds within a strategy to analyze a firm's growth in AUM.

Part 4: Next Steps

To continue with the visualization ideas presented in this book, you need a way to implement and weave visualizations into your day-to-day analyses and communications. The chapters in this section provide some design principles to keep in mind, as well as a framework to help you decide your next steps.

Chapter 11: Data Visualization Principles

Chapter 11 raises key questions about the visualizations presented in the book. *How can visualizations be introduced to create a concise understanding of data? How do we ensure that those visualizations are shown within a relative perspective to provide greater context? How do we reveal underlying issues and remove the risk of masking critical information? Or, vice versa, how can we pull ourselves away from the details to see and understand the big picture?* We discovered three overarching principles that apply to all of our visualization methods. This chapter provides a detailed definition about each guiding principle and illustrates each one's practical applications.

Chapter 12: Implementing the Visuals

The technologies used to create data visualizations constantly evolve, as do recommendations for their implementation. This chapter suggests a framework for deciding how to design appropriate visualizations, and closes the book with a list of criteria for next steps in visualizations. We provide a set of criteria for refining and narrowing your choices based on your immediate needs.

How To Read This Book

There is an intentional flow to this book in which Part 1 introduces the need and value for data visualizations, Parts 2 and 3 show current data visualization examples, and Part 4 provides lessons learned and next steps to implement. Although core chapters (Chapters 3–10) within Parts 2 and 3 can be read in any order, we do recommend that you read Parts 2 and 3 before Part 4, and that you read each chapter in a linear fashion.

Reading the book in sequential order will provide an easier learning experience when it comes to understanding references from prior chapters. In particular, Chapter 11, "Data Visualization Principles," refers to visualizations from core Chapters 3–10 to show how a design principle is applied in practice. Reading the core chapters first prepares you to better understand the principles and points

within Chapter 11. Chapter 12, "Implementing the Visuals," similarly references visualization examples from prior chapters but does not require you to be as familiar with them.

Disclosures

Disclosure 1: Selected Examples Are Based on Variety

There are countless data sets and their visualizations we could have selected as examples on which to base our work. Ultimately, we narrowed down the candidates to ones that provide variation and frequent use, and that typically result in efficiency, transparency, or usability issues that could use some alternative solutions. We wanted to represent various aspects of financial services, from the active investment phases of security assessment, portfolio construction, trading, and performance measurements, to marketing and communications, to compliance and reporting requirements.

Our choice of a starting example does not reflect any endorsement or opinion about the investment process. The industry has debated many investment processes, has standardized some, and has made others proprietary. Our starting example simply represents our search for the most familiar and representative data sets of the industry.

Disclosure 2: Visualization Solutions Are Not Firm-Specific

Creating proprietary software solutions often means customizing each solution for specific firm or client needs. In fact, most of what we do in our line of work is firm/client-specific and tailored. This book is not. The scenarios explored are commonly seen and our solutions are therefore neither proprietary nor based upon individual firm or client opinions or directions. Instead, we suggest unique solutions based on our explorations of the data sets, interviews with financial managers, and critiques from our technical editors.

Disclosure 3: Visualization Solutions Are Reusable

Consider our data visualizations as flexible and reusable. Although we have organized the chapters by investment management phases and subjects, you may find that many of the visualizations they contain can be applied to other situations. Visuals can be mixed, matched, and reused to solve problems you encounter in your own work. As you read through the book, view our examples as design patterns that can be customized to fit your own needs.

Disclosure 4: Data Reflects a Representative Sample Set

Unless otherwise noted, the source data sets are not specific to a firm or organization. Each firm's data set will vary in the size of the individual value amounts and ranges, number of values in each list, and detail data types. The data visualizations are based largely upon representative sample data, with a focus on transforming similar data ranges into visual communications. Your redesign of data visualizations may likely need to adjust to accommodate your data.

Disclosure 5: All Visualizations Can Be Designed for Interactions

Although some of the visualizations are based on printed publications or static reports, all the ideas can be applied to interactive displays. Interactive digital displays of the data sets can provide the flexibility your audience needs and enable them to get more answers from the data. A few chapters are entirely designed for interactive displays (Chapters 3 and 5) and the information they provide relates directly to screen use.

Disclosure 6: Visualization Solutions Are Technology-Agnostic

We decided to write this book to share our ideas with a larger audience. We offer ideas that focus on providing business value unconstrained by specific client needs or target technologies. With implementation technology requirements aside, we put aside interaction design details as well. The ideas we present

are strictly conceptual and can be recombined with other ideas, integrated into an existing solution, and tailored to a firm's specific needs. They make no presumptions about implementation and so address the largest possible audience. Each solution can be tailored on a case-by-case basis using the technology of your choosing.

Disclosure 7: Visualization Solutions Represent New Innovations

This book provides innovative methods for visualizing data. In many regards, traditional methods no longer work. The data to which we have access tends to be more varied and complex than before, and so we need to update our visualization methods. This book will expand your vocabulary of data visualization solutions to accommodate a whole new universe of how to display and interact with data.

We hope this collection of visualizations help you to select and implement solutions that best address your needs. Because some of the visualizations are new to your audience, you may need to explain how to read them. The more a new chart is used, the more familiar it will become. As the charts become familiar, your audience will require fewer explanations.

Supplemental Information

So you can reuse and apply the examples in the book, we have provided access to the materials online. Digital assets for both data and visuals are housed on the companion website: `http://www.wiley.com/go/visualizingfinancialdata`, where you can download all the sample data sets and visualization solutions we present. You can review sample data sets, compare them to your own, and with a gap analysis, decide how to work with variations in ranges or additional data points. Vector based pdfs' layout, scale, hierarchy, color, and font treatment can all be customized to your own needs. In addition, these files give you the flexibility to scale to the size you need and adjust as required.

The online materials are small starter kits that can help you put together a presentation, new report, project proposal, or even proof of concept prototype to demo. Over time you can use the supplemental information to try out new ideas, quickly share and gain consensus, and decide how to incorporate and proceed. Use the starter kits to articulate a vision you may have for changing a current communication strategy with a concrete example.