Introduction to Financial Econometrics and Statistics

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Abstract

The main purposes of this introduction chapter are (i) to discuss important financial econometrics and statistics which have been used in finance and accounting research and (ii) to present an overview of 98 chapters which have been included in this handbook. Sections 1.2 and 1.3 briefly review and discuss financial econometrics and statistics. Sections 1.4 and 1.5 discuss application of financial econometrics and statistics. Section 1.6 first classifies 98 chapters into 14 groups in accordance with subjects and topics. Then this section has classified the keywords from each chapter into two groups: finance and accounting topics and methodology topics. Overall, this chapter gives readers of this handbook guideline of how to apply this handbook to their research.

1.1 Introduction

Financial econometrics and statistics have become very important tools for empirical research in both finance and accounting. Econometric methods are important tools for asset-pricing, corporate finance, options, and futures, and conducting financial accounting research. Important econometric methods used in this research include: single equation multiple regression, simultaneous regression, panel data analysis, time-series analysis, spectral analysis, nonparametric analysis, semiparametric analysis, GMM analysis, and other methods.

Portfolio theory and management research have used different statistics distributions, such as normal distribution, stable distribution, and log-normal distribution. Options and futures research have used binomial distribution, log-normal distribution, non-central Chi-square distribution, Poisson distribution, and others. Auditing research has used sampling survey techniques to determine the sampling error and non-sampling error for auditing. Risk management research has used Copula distribution and other distributions.

Section 1.1 is the introduction. Section 1.2 discusses financial econometrics. In this section, we have six subsections. These subsections include single equation regression methods, simultaneous equation models, panel data analysis, as well as alternative methods to deal with measurement error, time-series analysis, and spectral analysis. In the next section, Sect. 1.3, we discuss financial statistics. Within financial statistics, we discuss six subtopics, including statistical distributions; principle components and factor analysis; nonparametric, semiparametric, and GMM analyses; and cluster analysis. After exploring these topics, we discuss the applications of financial econometrics and financial statistics in Sects. 1.4 and 1.5. In Sect. 1.6, we discuss the overview of all papers included in this handbook in accordance with the subject and methodologies used in the papers. Finally in Sect. 1.7, we summarize all the chapters in this handbook and add our concluding remarks.

As mentioned previously, Sect. 1.2 covers the topic of financial econometrics. We divide this section into six subsections. Within Sect. 1.2.1, we talk about single equation regression methods. We discuss some important issues related to single equation regression methods, including Heteroskedasticity, Specification Error, Measurement Error, Skewness and the Kurtosis Effect, Nonlinear Regression and Box-Cox transformation, Structural Change, the Chow Test and Moving Chow Test, Threshold Regression, Generalize Fluctuation Test, Probit and Logit Regression for Credit Risk Analysis, Poisson Regression, and Fuzzy Regression. The next subsection, Sect. 1.2.2, analyzes simultaneous equation models. Within the realm of simultaneous equation models, we discuss two-stage least squares estimation (2SLS) method, seemly unrelated regression (SUR) method, three-stage least squares estimation (3SLS) method, and disequilibrium estimation method. In Sect. 1.2.3, we study panel data analysis, in which we go over fixed effect model, random effect model, and clustering effect. The next subsection, Sect. 1.2.3, explores alternative methods to deal with measurement error. The alternative methods we look over in this section includes LISREL model, multifactor and multi-indicator (MIMIC) model, partial least square method, and grouping method. After we discuss alternative methods to deal with measurement error, we examine in Sect. 1.2.4 time-series analysis. We include in our section about time-series analysis some important models, including ARIMA, ARCH, GARCH, fractional GARCH, and combined forecasting. In Sect. 1.2.5, we look into spectral analysis.

In the following section, Sect. 1.3, we discuss financial statistics, along with four subsequent subtopics. In our first subsection, Sect. 1.3.1, we discuss some important statistical distributions. This subsection will look into the different types of distributions that are in statistics, including Binomial and Poisson distribution, normal distribution, log-normal distribution, Chi-square distribution, and non-central Chi-square distribution, Wishart distribution, symmetric and non-symmetric stable distributions, and other known distributions. Then, we talk about principal components and factor analysis in Sect. 1.3.2. In the following subsection, Sect. 1.3.3, we examine nonparametric, semi-parametric, and GMM analyses. The last subsection, Sect. 1.3.4, explores cluster analysis.

After discussing financial econometrics, we explore the applications of this topic in different types of financial and accounting field research. In Sect. 1.4, we describe these applications, including asset-pricing research, corporate finance research, financial institution research, investment and portfolio research, option pricing research, future and hedging research, mutual fund research, hedge fund research, microstructure, earnings announcements, real option research, financial accounting, managerial accounting, auditing, term structure modeling, credit risk modeling, and trading cost/transaction cost modeling.

We also discuss applications of financial statistics into different types of financial and accounting field research. Section 1.5 will include these applications in asset-pricing research, investment and portfolio research, credit risk management research, market risk research, operational risk research, option pricing research, mutual fund research, hedge fund research, value-at-risk research, and auditing.

1.2 Financial Econometrics

1.2.1 Single Equation Regression Methods

There are important issues related to single equation regression estimation method. They are (a) Heteroskedasticity, (b) Specification error, (c) Measurement error, (d) Skewness and kurtosis effect, (e) Nonlinear regression and Box-Cox transformation, (f) Structural change, (g) Chow test and moving Chow test, (h) Threshold regression, (i) Generalized fluctuation, (j) Probit and Logit regression for credit risk analysis, (k) Poisson regression, and (l) Fuzzy regression. These issues are briefly discussed as follows:

(a) Heteroskedasticity
- White (1980) and Newvey and West (1987) are two important papers discussing how the heteroskedasticity test can be performed. The latter paper discusses heteroskedasticity when there are serial correlations.

(b) Specification error
- Specification error occurs when there is missing variable in a regression analysis. To test the existence of specification error, we can refer to the papers by Thursby (1985), Fok et al. (1996), Cheng and Lee (1986), and Maddala et al. (1996).

(c) Measurement error
- Management error problem is when there exists imprecise independent variable in a regression analysis. Papers by Lee and Jen (1978), Kim (1995, 1997, 2010), Miller and Modigliani (1966), and Lee and Chen (2012) have explored how measurement error methods can be applied to finance research. Lee and Chen have discussed alternative errors in variable estimation methods and their application in finance research.

(d) Skewness and kurtosis effect
- Both skewness and kurtosis are two important measurement variables to prepare stock variation analysis. Papers by Lee (1976a), Sears and Wei (1988), and Lee and Wu (1985) discuss the skewness and kurtosis issue in asset pricing.

(e) Nonlinear regression and Box-Cox transformation
- Nonlinear regression and Box-Cox transformation are important tools for finance, accounting, and urban economic researches. Papers by Lee (1976, 1977), Lee et al. (1990), Frecka and Lee (1983), and Liu (2006) have discussed how nonlinear regression and Box-Cox transformation techniques can be used to improve the specification of finance and accounting research. Kau and Lee (1976), and Kau et al. (1986) have explored how Box-Cox transformation can be used to conduct the empirical study of urban structure.

(f) Structural change
- Papers by Yang (1989), Lee et al. (2011b, 2013) have discussed how the structural change model can be used to improve the empirical study of dividend policy and the issuance of new equity.

(g) Chow test and Moving Chow test
- Chow (1960) has proposed a dummy variable approach to examine the existence of structure change for regression analysis. Zeileis et al. (2002)

have developed software programs to perform the Chow test and other structural change models which has been frequently used in finance and economic research.

(h) Threshold regression
- Hansen (1996, 1997, 1999, 2000a, and 2000b) have explored the issue of threshold regressions and their applications in detecting structure change for regression.

(i) Generalize fluctuation test
- Kuan and Hornik (1995) have discussed how the generalized fluctuation test can be used to perform structural change to regression.

(j) Probit and Logit regression for credit risk analysis
- Probit and Logit regressions are frequently used in credit risk analysis. Ohlson (1980) used the accounting ratio and macroeconomic data to do credit risk analysis. Shumway (2001) has used accounting ratios and stock rate returns for credit risk analysis in terms of Probit and Logit regression techniques. Most recently, Hwang et al. (2008, 2009) and Cheng et al. (2010) have discussed Probit and Logit regression for credit risk analysis by introducing nonparametric and semi-parametric techniques into this kind of regression analysis.

(k) Poisson regression
- Lee and Lee (2012) have discussed how the Poisson Regression can be performed, regardless of the relationship between multiple directorships, corporate ownership, and firm performance.

(l) Fuzzy regression
- Shapiro (2005), Angrist and Lavy (1999), and Van Der Klaauw (2002) have discussed how Fuzzy Regression can be performed. This method has the potential to be used in finance accounting and research.

1.2.2 Simultaneous Equation Models

In this section, we will discuss alternative methods to deal with simultaneous equation models. There are (a) two-stage least squares estimation (2SLS) method, (b) seemly unrelated regression (SUR) method, (c) three-stage least squares estimation (3SLS) method, (d) disequilibrium estimation method, and (e) generalized method of moments.

(a) Two-stage least squares estimation (2SLS) method
- Lee (1976a) has applied this to started market model; Miller and Modigliani (1966) have used 2SLS to study cost of capital for utility industry; Chen et al. (2007) have discuss the two-stage least squares estimation (2SLS) method for investigating corporate governance.

(b) Seemly unrelated regression (SUR) method
- Seemly unrelated regression has frequently used in economic and financial research. Lee and Zumwalt (1981) have discussed how the seemly unrelated regression method can be applied in asset-pricing determination.

(c) Three-stage least squares estimation (3SLS) method
  – Chen et al. (2007) have discussed how the three-stage least squares estimation (3SLS) method can be applied in corporate governance research.
(d) Disequilibrium estimation method
  – Mayer (1989), Martin (1990), Quandt (1988), Amemiya (1974), and Fair and Jaffee, (1972) have discussed how alternative disequilibrium estimation method can be performed. Tsai (2005), Sealey (1979), and Lee et al. (2011a) have discussed how the disequilibrium estimation method can be applied in asset-pricing test and banking management analysis.
(e) Generalized method of moments
  – Hansen (1982) and Hamilton (1994, ▶ Chap. 14) have discussed how GMM method can be performed. Chen et al. (2007) have used the two-stage least squares estimation (2SLS), three-stage squares method, and GMM method to investigate corporate governance.

1.2.3 Panel Data Analysis

In this section, we will discuss important issues related to panel data analysis. They are (a) fixed effect model, (b) random effect model, and (c) clustering effect model.

Three well-known textbooks by Wooldridge (2010), Baltagi (2008) and Hsiao (2003) have discussed the applications of panel data in finance, economics, and accounting research. Now, we will discuss the fixed effect, random effect, and clustering effect in panel data analysis.

(a) Fixed effect model
  – Chang and Lee (1977) and Lee et al. (2011a) have discussed the role of the fixed effect model in panel data analysis of dividend research.
(b) Random effect model
  – Arellano and Bover (1995) have explored the random effect model and its role in panel data analysis. Chang and Lee (1977) have applied both fix effect and random effect model to investigating the relationshipbetween price per share, dividend per share, and retained earnings per share.
(c) Clustering effect model
  – Papers by Thompson (2011), Cameron et al. (2006), and Petersen (2009) review the clustering effect model and its impact on panel data analysis.

1.2.4 Alternative Methods to Deal with Measurement Error

In this section, we will discuss alternative methods of dealing with measurement error problems. They are (a) LISREL model, (b) multifactor and multi-indicator (MIMIC) model, and (c) partial least square method, and (d) grouping method.

(a) LISREL model
  – Papers by Titman and Wessal (1988), Chang (1999), Chang et al. (2009), Yang et al. (2010) have described the LISREL model and its way to resolve the measurement error problems of finance research.

(b) Multifactor and multi-indicator (MIMIC) model
  – Chang et al. (2009) and Wei (1984) have applied in the multifactor and multi-indicator (MIMIC) model in capital structure and asset-pricing research.
(c) Partial least square method
  – Papers by Core (2000), Ittner et al. (1997), and Lambert and Lacker (1987) have applied the partial least square method to deal with measurement error problems in accounting research.
(d) Grouping method
  – Papers by Lee (1973), Chen (2011), Lee and Chen (2013), Lee (1977b), Black et al. (1972), Blume and Friend (1973), and Fama and MacBeth (1973) analyze grouping method and its way to deal with measurement error problem in capital asset-pricing tests.

There are other errors in variable method, such as (i) Classical method, (ii) instrumental variable method, (iii) mathematical programming method, (iv) maximum likelihood method, (v) GMM method, and (vi) Bayesian Statistic Method. Lee and Chen (2012) have discussed all above-mentioned methods in details.

1.2.5 Time Series Analysis

In this section, we will discuss important models in time-series analysis. They are (a) ARIMA, (b) ARCH, (c) GARCH, (d) fractional GARCH, and (e) combined forecasting.

– Two well-known textbooks by Anderson (1994) and Hamilton (1994) have discussed the issues related to time-series analysis. We will discuss some important topics in time-series analysis in the following subsections.
– Myers (1991) discloses ARIMA's role in time-series analysis: Lien and Shrestha (2007) discuss ARCH and its impact on time-series analysis: Lien (2010) discusses GARCH and its role in time-series analysis: Leon and Vaello-Sebastia (2009) further research into GARCH and its role in time series in a model called Fractional GARCH.
– Granger and Newbold (1973), Granger and Newbold (1974), Granger and Ramanathan (1984) have theoretically developed combined forecasting methods. Lee et al. (1986) have applied combined forecasting methods to forecast market beta and accounting beta. Lee and Cummins (1998) have shown how to use the combined forecasting methods to perform cost of capital estimates.

1.2.6 Spectral Analysis

Anderson (1994), Chacko and Viceira (2003), and Heston (1993) have discussed how spectral analysis can be performed. Heston (1993) and Bakshi et al. (1997) have applied spectral analysis in the evaluation of option pricing.

1.3 Financial Statistics

1.3.1 Important Statistical Distributions

In this section, we will discuss different statistical distributions. They are: (a) Poisson distribution, (c) normal distribution, (d) log-normal distribution, (e) Chi-square distribution, (f) non-central Chi-square distribution.

Two well-known textbooks by Cox et al. (1979) and Rendleman and Barter (1979) have used binomial, normal, and lognormal distributions to develop an option pricing model. The following subsections note some famous authors that provide studies on these different statistical distributions. Black and Sholes (1973) have used lognormal distributions to derive the option pricing model. Finally, Aitchison and Brown (1973) is a well-known book to investigate lognormal distribution. Schroder (1989) has derived the option pricing model in terms of non-central Chi-square distribution.

Fama (1971) has used stable distributions to investigate the distribution of stock rate of returns. Chen and Lee (1981) have derived statistics distribution of Sharpe performance measure and found that Sharpe performance measure can be described by Wishart distribution.

1.3.2 Principle Components and Factor Analysis

Anderson's (2003) book entitled "*An Introduction to Multivariate Statistical Analysis*" has discussed principal components and factor analysis in detail. Chen and Shimerda (1981), Pinches and Mingo (1973), and Kao and Lee (2012) discuss how principal components and factor analyses can be used to do finance Lee et al. (1989) and accounting research.

1.3.3 Nonparametric and Semi-parametric Analyses

Ait-Sahalia and Lo (2000), and Hutchison et al. (1994) have discussed how nonparametric can be used in risk management and derivative securities evaluation. Hwang et al. (2010), and Hwang et al. (2007) have used semi-parametric to conduct credit risk analysis.

1.3.4 Cluster Analysis

The detailed procedures to discuss how cluster analysis can be used to find groups in data can be found in the textbook by Kaufman and Rousseeuw (1990). Brown and Goetzmann (1997) have applied cluster analysis in mutual fund research.

1.4 Applications of Financial Econometrics

In this section, we will briefly discuss how different methodologies of financial econometrics will be applied to the topics of finance and accounting.

(a) Asset-pricing Research
- Methodologies used in asset-pricing research include (1) Heteroskedasticity, (2) Specification error, (3) Measurement error, (4) Skewness and kurtosis effect, (5) Nonlinear regression and Box-Cox transformation, (6) Structural change, (7) Two-stage least squares estimation (2SLS) method, (8) Seemly unrelated regression (SUR) method, (9) Three-stage least squares estimation (3SLS) method, (10) Disequilibrium estimation method, (11) Fixed effect model, (12) Random effect model, (13) Clustering effect model of panel data analysis, (14) Grouping method, (15) ARIMA, (16) ARCH, (17) GARCH, (18) Fractional GARCH, and (19) Wishart distribution.

(b) Corporate Finance Research:
- Methodologies used in Corporate finance research include (1) Heteroskedasticity, (2) Specification error, (3) Measurement error, (4) Skewness and kurtosis effect, (5) Nonlinear regression and Box-Cox transformation, (6) Structural change, (7) Probit and Logit regression for credit risk analysis, (8) Poisson regression, (9) Fuzzy regression, (10) Two-stage least squares estimation (2SLS) method, (11) Seemly unrelated regression (SUR) method, (12) Three-stage least squares estimation (3SLS) method, (13) Fixed effect model, (14) Random effect model, (15) Clustering effect model of panel data analysis, and (16) GMM Analysis.

(c) Financial Institution Research
- Methodologies used in Financial Institution research include (1) Heteroskedasticity, (2) Specification error, (3) Measurement error, (4) Skewness and kurtosis effect, (5) Nonlinear regression and Box-Cox transformation, (6) Structural change, (7) Probit and Logit regression for credit risk analysis, (8) Poisson regression, (9) Fuzzy regression, (10) Two-stage least squares estimation (2SLS) method, (11) Seemly unrelated regression (SUR) method, (12) Three-stage least squares estimation (3SLS) method, (13) Disequilibrium estimation method, (14) Fixed effect model, (15) Random effect model, (16) Clustering effect model of panel data analysis, (17) Semiparametric analysis.

(d) Investment and Portfolio Research
- Methodologies used in investment and portfolio research include (1) Heteroskedasticity, (2) Specification error, (3) Measurement error, (4) Skewness and kurtosis effect, (5) Nonlinear regression and Box-Cox transformation, (6) Structural change, (7) Probit and Logit regression for credit risk analysis, (8) Poisson regression, and (9) Fuzzy regression.

(e) Option Pricing Research
- Methodologies used in option pricing research include (1) ARIMA, (2) ARCH, (3) GARCH, (4) Fractional GARCH, (5) Spectral analysis, (6) Binomial distribution, (7) Poisson distribution, (8) normal distribution,

(9) log-normal distribution, (10) Chi-square distribution, (11) non-central Chi-square distribution, and (12) Nonparametric analysis.

(f) Future and Hedging Research
- Methodologies used in future and hedging research include (1) Heteroskedasticity, (2) Specification error, (3) Measurement error, (4) Skewness and kurtosis effect, (5) Nonlinear regression and Box-Cox transformation, (6) Structural change, (7) Probit and Logit regression for credit risk analysis, (8) Poisson regression, and (9) Fuzzy regression.

(g) Mutual Fund Research
- Methodologies used in mutual fund research include (1) Heteroskedasticity, (2) Specification error, (3) Measurement error, (4) Skewness and kurtosis effect, (5) Nonlinear regression and Box-Cox transformation, (6) Structural change, (7) Probit and Logit regression for credit risk analysis, (8) Poisson regression, (9) Fuzzy regression, and (10) Cluster analysis.

(h) Credit Risk Modeling
- Methodologies used in credit risk modeling include (1) Heteroskedasticity, (2) Specification error, (3) Measurement error, (4) Skewness and kurtosis effect, (5) Nonlinear regression and Box-Cox transformation, (6) Structural change, (7) Two-stage least squares estimation (2SLS) method, (8) Seemly unrelated regression (SUR) method, (9) Three-stage least squares estimation (3SLS) method, (10) Disequilibrium estimation method, (11) Fixed effect model, (12) Random effect model, (13) Clustering effect model of panel data analysis, (14) ARIMA, (15) ARCH, (16) GARCH, and (17) Semiparametric analysis.

(i) Other Application
- Financial econometrics is also important tools to conduct research in (1) Trading cost/transaction cost modeling, (2) Hedge fund research, (3) Microstructure, (4) Earnings announcement, (5) Real option research, (6) Financial accounting, (7) Managerial accounting, (8) Auditing, and (9) Term structure modeling.

1.5 Applications of Financial Statistics

Financial statistics is an important tool for research in (1) Asset-pricing research, (2) Investment and portfolio research, (3) Credit risk management research, (4) Market risk research, (5) Operational risk research, (6) Option pricing research, (7) Mutual fund research, (8) Hedge fund research, (9) Value-at-risk research, and (10) Auditing research.

1.6 Overall Discussion of Papers in this Handbook

In this section, we classify 98 papers (chapters 2–99) which have been presented in Appendix 1 in accordance with (A) Chapter titles and (B) Keywords.

(A) Chapter title classification in terms of Chapter Titles

Based on chapter titles, we classify 98 chapters into the following 14 topics:

(i) Financial Accounting (▶ Chaps. 2, 9, 10, 61, 97)
(ii) Mutual Funds (▶ Chaps. 3, 24, 25, 68, 88)
(iii) Microstructure (▶ Chaps. 4, 44, 47, 96)
(iv) Corporate Finance (▶ Chaps. 5, 21, 30, 38, 42, 46, 60, 63, 75, 79, 95)
(v) Asset Pricing (▶ Chaps. 6, 15, 22, 28, 34, 36, 39, 45, 50, 81, 85, 87, 93, 99)
(vi) Options (▶ Chaps. 7, 32, 37, 55, 65, 84, 86, 90, 98)
(vii) Portfolio Analysis (▶ Chaps. 8, 26, 35, 53, 67, 73, 80, 81, 83)
(viii) Risk Management (▶ Chaps. 11, 13, 16, 17, 23, 27, 41, 51, 54, 72, 91, 92)
(ix) International Finance (▶ Chaps. 12, 40, 43, 59, 69)
(x) Event Study (▶ Chap. 14)
(xi) Methodology (▶ Chaps. 18, 19, 20, 29, 31, 33, 46, 49, 52, 56, 57, 58, 62, 74, 76, 77, 78, 82, 89)
(xii) Banking Management (▶ Chap. 64)
(xiii) Pension Funds (▶ Chap. 66)
(xiv) Futures and Index Futures (▶ Chaps. 48, 70, 71, 94)

(B) Keywords classification

Based on the keywords in Appendix 1, we classify these keywords into two groups: (i) finance and accounting topics and (ii) methodology topics. The number behind each keyword is the chapter it is associated with.

(i) Finance and Accounting Topics

Abnormal earnings (87), Accounting earnings (87), Activity-based costing system (27), Agency costs (5, 97), Aggregation bias (43), Analyst experience (2), Analyst forecast accuracy (63), Analysts' forecast accuracy (97), Analysts' forecast bias (63, 97), Arbitrage pricing theory (APT) (6, 7, 36, 81), Asset (93), Asset allocation (45), Asset allocation fund (88), Asset pricing (34, 81), Asset return predictability (76), Asset returns (52), Asset-pricing returns (96), Asymmetric information (5), Asymmetric mean reversion (15), Asymmetric stochastic volatility (62), Asymmetric volatility response (15), Balanced scorecard (29), Bank capital (13), Bank holding companies (13), Bank risks (13), Bank stock return (6), Banks (12), Barrier option (65), Basket credit derivatives (23), Behavioral finance (55, 66, 73), Bias (57), Bias reduction (92), Bid-ask spreads (96, 99), Binomial option pricing model (37), Black-Scholes model (7, 90), Black-Sholes option pricing model (37), Board structure (42), Bond ratings (89), Bottom-up capital budgeting (75), Bounded complexity (85), Bounds (71), Brier score (72), Brokerage reputation (63), Business cycle (67), Business models (75), Business performance evaluation (29), Business value of firm, Buy-and-hold return (50), Calendar-time (50), Calendar-time portfolio approach (14), Call option (37), Capital asset-pricing model (CAPM) (6, 25, 28, 36, 81, 93), Capital budgeting (75, 29), Capital markets (25), Capital structure (5, 60), Carry trade (69), Case-Shiller home price indices (19), CEO compensation (97), CEO stock options (97), Change of measure (30), Cheapest-to-deliver bond (71), Chicago board of trade, (71), Cholesky decomposition (23), Closed-end Funds (25), Comparative financial systems (12), Composite trapezoid rule (51), Comprehensive earnings (87), Compromised solution (89),

Price on earnings model (10), Pricing (78), Pricing performance (98), Probability of informed trading (PIN) (96), Property (78), Property rights (12), Put option (37), Put-call parity (37), Quadratic cost (93), Quality options (71), Random number generation (49), Range (74), Rank dependent utility (83), Rating migration (72), Rational bias (2), Rational expectations (43), Real estate (78), Real sphere (59), Realized volatility (74), Recurrent event (72), Recursive (85), Reflection principle (65), Regime-switching hedging strategy (70), Registered trading firms (17), Relative value of equity (75), Research and development expense (61), Restrictions (59), Retention option (75), Return attribution (75), Return models (10), Reverse-engineering (16), Risk (83), Risk adjusted performance (3), Risk aversion (55), Risk management (41, 49, 67, 74, 80), Risk measurement (26), Risk premium (80), Risk-neutral pricing (32), Robust estimation (41), S&P 500 index (7), Sarbanes-Oxley act (63), SCAD penalty (77), Scale-by-scale decomposition (19), Seasonality (33), Semi-log (78), Sentiment (30), Shape parameter (82), Share prices (59), Share repurchases (38), Sharpe ratios (35, 53), Short run (59), Short selling (26), Short-term financing (64), Signaling hypothesis (79), Sigma (37), Smile shapes (32), Smooth transition (74), Special items (61), Speculative bubbles (73), Spot price (33), Stationarity (10), Statistical learning (77), Stochastic discount factors (25, 35), Stochastic interest rates (98), Stochastic order (83), Stochastic volatility (44, 84, 85, 92, 98), Stock market overreaction (15), Stock markets (67), Stock option (65), Stock option pricing (98), Stock price indexes (62), Stock/futures (44), Strike price (55), Structural break (31), Subjective value (30), Substantial price fluctuations (82), Sustainable growth rate, synergy (21), Synthetic utility value (68), Systematic risk (3, 79), TAIEX (45), Tail risk (67), Timberland investments (34), Time-varying risk (25), Time-varying risk aversion (40), Time-varying volatility (15), Timing options (71), Tobin's model (99), Top-down capital budgeting (75), Total risk (79), Tournament (73), Trade direction (96), Trade turnover industry (9), Transaction costs (99), Transfer pricing (29), Treasury bond futures (71), Trend extraction (18), Trust (12), Turkish economy (59), U.S. stocks (52), Ultrahigh-dimensional data (77), Unbiasedness (43), Uncertainty avoidance (12), Uncovered interest parity (69), Unexpected volatility shocks (15), Unsystematic risk (3), Utility-based hedging strategy (70), VaR-efficient frontier (45), Variability percentage adjustment (21), Visual Basic for applications (37), Volatility index (VIX) (92), Volatility (37, 80), Volatility co-persistence (44), Volatility daily effect (92), Volatility dependencies (62), Volatility feedback effect (15), Weak efficiency (43), Weak instruments (95), Wealth transfer (75), Write-downs (61), Yaari's dual utility (83), Yield curve (39), Zero-investment portfolio (50).

(ii) Methodology Topics

A mixture of Poisson distribution (98), Analyst estimation (ANOVA) (2, 28), Analytic hierarchy process (29), Analysis of variance (19), Anderson-Darling statistic (20), Anderson-Rubin statistic (95), ANST-GARCH model (asymmetric nonlinear smooth transition- GARCH model) (15), Approximately normal distribution (28), ARCH (41, 44), ARCH models (32), ARX-GARCH (autoregressive (AR) mean process with exogenous (X)

Heath-Jarrow-Morton model (86), Hedonic models (78), Heston (84), Heterogeneity (43), Heteroskedasticity (57), Hidden Markov models (85), Hierarchical clustering with K-Means approach (30), Hierarchical system (68), Huber estimation (66), Hyperparameter estimation (85), Hypothesis testing (53), Ibottson's RATS (50), Infinitely divisible models (48), Instrumental variable (IV) estimation (95, 57), Johnson's Skewness-adjusted *t*-test (14), Joint-normality assumption (94), Jones (1991) model (61), Jump detection (18), Jump dilution model (30), Jump process (56), Kalman filter (66), Kolmogorov-Smirnov statistic (20), Kupiec's proportion of failures test (48), Large-scale simulations (14), Latent variable (60), Least squares (78), Likelihood maximization (32), Linear filters (18), Linear trend model (88), LISREL approach (36, 60), Locally linear quantile regression (54), Logistic smooth transition regression model (69), Logit regression (27), Log-likelihood function (99), Lognormal (65), Long-horizon event study (14), Long memory process (31, 32), Loss distribution (20), Loss function (51), MAD model (26), Matching procedure (63), Mathematical optimization (55), MATLAB (90), Maximum likelihood (35, 38, 52), Maximum likelihood estimation (MLE) (36, 44, 71), Maximum sharp measure (94), Markov Chain Monte Carlo (MCMC) (62, 69, 85), Mean-variance ratio (53), Measurement error (36, 57), Method of maximum likelihood (51), Method of moments (35), A comparative study of two models SV with MCMC algorithm (62), Microsoft Excel (37), Multiple indicator multiple causes (MIMIC) (36), Minimum generalized semi-invariance (94), Minimum recording threshold (20), Minimum value of squared residuals (MSE loss function) (10), Minimum variance efficiency (35), Misspecification (44), Model formulation (38), Model selection (56, 77), Monitoring fluctuation test (31), Monte Carlo simulation (11, 23, 32, 49, 57), Moving average method (88), Moving estimates processes (79), MSE (62), Multifactor diffusion process (56), Multifactor multi-indicator approach (36), Multiple criteria and multiple constraint linear programming (29), Multiple criteria decision making (MCDM) (68), Multiple indicators and multiple causes (MIMIC) model (60), Multiple objective programming (26), Multiple regression (6, 9), Multi-resolution analysis (19), Multivariate technique (89), Multivariate threshold autoregression model (17), MV model (26), Nonlinear filters (18), Nonlinear Kalman filter (22), Nonlinear optimization (38), Non-normality (41), Nonparametric (7), Nonparametric density estimation (86), Nonparametric tests (28), Normal copula (11), Normal distribution (45), Ohlson model (87), Order flow models (4), Ordered logit (27), Ordered probit (27), Ordinary least-squares regression (63, 73), Ordinary least-squares (OLS) (90, 39, 95, 36), Orthogonal factors (6), Outlier (33), Out-of-sample forecasts (56), Panel data estimates (12, 40, 38), Panel data regressions (42, 2), Parametric approach (51), Parametric bootstrap (35), Partial adjustment (93), Partial linear model (54), Penalized least-squares (77), Prediction test (31), Principle component analysis (89, 91), Principle component factors (21), Probability density function (27), Quantile autoregression (QAR) (41), Quadratic trend model (88), Quantile dependence (67), Quantile regression (41, 54, 67), Quasi-maximum likelihood (22),

Quasi-maximum likelihood estimation strategy (48), Random walk models (4), Rank regressions (63), Realized distribution (58), Rebalancing model (26), Recursive filters (85), Recursive programming (37), Reduced-form model (23, 93), Regime-switch model (69), Regression models (85, 78), Revenue surprises rotation-corrected angle (84), Ruin probability (20), Seemingly unrelated regressions (SUR) (40, 93), Semi-parametric approach (51), Semi-parametric model (54), Serial correlation (44), Shrinkage (77), Simple adjusted formula (84), Simulations (55), Simultaneous equations (60, 93, 95, 87), Single clustering (24), Single exponential smoothing (88), Skewed generalized student's t (51), Skewness (57), Specification test (56), Spectral analysis (19), Standard errors in finance panel data (30), Standardized Z (21), State-space model (39, 66), Static factor model (11), Stepwise discriminant analysis (89), Stochastic dominance (83), Stochastic frontier analysis (13), Structural change model (79), Structural equation modeling (SEM) (60), Structural VAR (17), Student's t-copula (8, 52), Student's t-distribution (62), Seemingly unrelated regression (SUR) (43), Survey forecasts (43), Survival analysis (72), SVECM models (59), Stochastic volatility (SVOL) (62), Tail dependence (52), Taylor series expansion (90), t-Copula (11), Tempered stable distribution (48), Term structure (32, 39, 71), Term structure modeling (86), Time-series analysis (18, 34, 41), Time-heterogeneity (72), Time-series and cross-sectional effects (12), Time-varying covariate (72), Time-varying dependence (8), Time-varying parameter (34), Time-varying rational expectation hypothesis (15), Trading simulations (4), Two-sector asset allocation model (45), Two-stage estimation (52), Two-stage least square (2SLS) (95), Two-way clustering method of standard errors (42), Unbounded autoregressive moving average model (88), Unconditional coverage test (51), Unconditional variance (70), Uniformly most powerful unbiased test (53), Unit root tests (10), Unit root time series (31), Unweighted GARCH (44), Value-at-risk (VAR) (45, 54, 83, 20, 26, 41, 48, 51, 76), Variable selection (77), Variance decomposition (76), Variance estimation (70), Variance reduction methods (32), Variance-gamma process (82), VG-NGARCH model (82), Visual Basic for applications (VBA) (37), Volatility forecasting (74), Volatility regime switching (15), Volatility threshold (58), Warren and Shelton model (87), Wavelet (18), Wavelet filter (19), Weighted GARCH, (44), Weighted least-squares regression (14), Wilcoxon rank test (21), Wilcoxon two-sample test (9), Wild-cluster bootstrap (24), and Winter's method (88).

1.7 Summary and Conclusion Remarks

This chapter has discussed important financial econometrics and statistics which have been used in finance and accounting research. In addition, this chapter has presented an overview of 98 chapters which have been included in this handbook. In Sect. 1.2 "Financial Econometrics," we have six subsections which are: a single equation regression methods, Simultaneous equation models, Panel data analysis, Alternative methods to deal with measurement error, Time-series analysis, and

Spectral Analysis. Section 1.3 "Financial Statistics" has four subsections: Important Statistical Distributions, Principle components and factor analysis, Nonparametric and Semi-parametric analyses, Cluster analysis review and discuss financial econometrics and statistics. In Sect. 1.4 "Applications of financial econometrics," we briefly discuss how different methodologies of financial econometrics will be applied to the topics of finance and accounting. These methods include: Asset-pricing Research, Corporate Finance Research, Financial Institution Research, Investment and Portfolio Research, Option Pricing Research, Future and Hedging Research, Mutual Fund Research, and Credit Risk Modeling. Section 1.5, "Applications of Financial Statistics," states that financial statistics is an important tool to conduct research in the areas of (1) Asset-pricing Research, (2) Investment and Portfolio Research, (3) Credit Risk Management Research, (4) Market Risk Research, (5) Operational Risk Research, (6) Option Pricing Research, (7) Mutual Fund Research, (8) Hedge Fund Research, (9) Value-at-risk Research, and (10) Auditing. Section 1.6 is an "Overall Discussion of Papers in this Handbook." It classifies 98 chapters into 14 groups in accordance to Chapter title and keywords.

Appendix 1: Brief Abstracts and Keywords for Chapters 2 to 99

Chapter 2: Experience, Information Asymmetry, and Rational Forecast Bias

This chapter uses a Bayesian model of updating forecasts in which the bias in forecast endogenously determines how the forecaster's own estimates weigh into the posterior beliefs. The model used in this chapter predicts a concave relationship between accuracy in forecast and posterior weight that is put on the forecaster's self-assessment. This chapter then uses a panel regression to test the analytical findings and find that an analyst's experience is indeed concavely related to the forecast error.

Keywords: Financial analysts, Forecast accuracy, Information asymmetry, Forecast bias, Bayesian updating, Panel regressions, Rational bias, Optional bias, Analyst estimation, Analyst experience

Chapter 3: An Overview of Modeling Dimensions for Performance Appraisal of Global Mutual Funds (Mutual Funds)

This paper examines various performance models derived by financial experts across the globe. A number of studies have been conducted to examine investment performance of mutual funds of the developed capital markets. The measure of performance of financial instruments is basically dependent on three important models derived independently by Sharpe, Jensen, and Treynor. All three models are based on the assumptions that (1) all investors are averse to risk, and are single period expected utility of terminal wealth maximizers, (2) all investors have

identical decision horizons and homogeneous expectations regarding investment opportunities, (3) all investors are able to choose among portfolios solely on the basis of expected returns and variance of returns, (4) all trans-actions costs and taxes are zero, and (5) all assets are infinitely divisible. Overall, this paper has examined nine alternative mutual funds measure. The method used in this kind of research is regression analysis.

Keywords: Financial modeling, Mutual funds, Performance appraisal, Global investments, Evaluation of funds, Portfolio management, Systematic risk, Unsystematic risk, Risk adjusted performance, Prediction of price movements

Chapter 4: Simulation as a Research Tool for Market Architects

This chapter uses simulation to gain insights into trading and market structure topic by two statistical methods. The statistical methods we use include experimental design, and careful controls over experimental parameters such as the instructions given to participants. The first is discrete event simulation and the model of computer-generated trade order flow that we describe in Sect. 3. To create a realistic, but not ad hoc, market background, we use draws from a log-normal returns distribution to simulate changes in a stock's fundamental value, or P*. The model uses price-dependent Poisson distributions to generate a realistic flow of computer-generated buy and sell orders whose intensity and supply-demand balance vary over time. The order flow fluctuations depend on the difference between the current market price and the P* value. In Sect. 4, we illustrate the second method, which is experimental control to create groupings of participants in our simulations that have the same trading "assignment." The result is the ability to make valid comparisons of trader's performance in the simulations.

Keywords: Trading simulations, Market microstructure, Order flow models, Random walk models, Experimental economics, Experimental control

Chapter 5: Motivations for Issuing Putable Debt: An Empirical Analysis

This paper is the first to examine the motivations for issuing putable bonds in which the embedded put option is not contingent upon a company-related event. We find that the market favorably views the issue announcement of these bonds that we refer to as bonds with European put options or European putable bonds. This response is in contrast to the response documented by the literature to other bond issues (straight, convertible, and most studies examining poison puts), and to the response documented in the current paper to the issue announcements of poison-put bonds. Our results suggest that the market views issuing European putable bonds as helping mitigate security mispricing. Our study is an application of important statistical methods in corporate finance, namely, Event Studies and the use of General Method of Moments for cross-sectional regressions.

Keywords: Agency costs, Asymmetric information, Corporate finance, Capital structure, Event study methodology, European put, General method of moments, Management myopia, Management entrenchment, Poison put

Chapter 6: Multi Risk-Premia Model of U.S. Bank Returns: An Integration of CAPM and APT

Interest rate sensitivity of bank stock returns has been studied using an augmented CAPM: a multiple regression model with market returns and interest rate as independent variables. In this chapter, we test an asset-pricing model in which the CAPM is augmented by three orthogonal factors which are proxies for the innovations in inflation, maturity risk, and default risk. The methodologies used in this chapter are multiple regression and factor analysis.

Keywords: CAPM, APT, Bank stock return, Interest rate risk, Orthogonal factors, Multiple regression

Chapter 7: Non-parametric Bounds for European Option Prices

This chapter derives a new nonparametric lower bound and provides an alternative interpretation of Ritchken's (1985) upper bound to the price of the European option. In a series of numerical examples, our new lower bound is substantially tighter than previous lower bounds. This is prevalent especially for out-of-the-money (OTM) options where the previous lower bounds perform badly. Moreover, we present that our bounds can be derived from histograms which are completely nonparametric in an empirical study. We first construct histograms from realizations of S&P 500 index returns following Chen et al. (2006), calculate the dollar beta of the option and expected payoffs of the index and the option, and eventually obtain our bounds. We discover violations in our lower bound and show that those violations present arbitrage profits. In particular, our empirical results show that out-of-the-money calls are substantially overpriced (violate the lower bound). The methodologies used in this chapter are nonparametric, option pricing model, and histograms methods.

Keywords: Option bounds, Nonparametric, Black-Scholes model, European option, S&P 500 index, Arbitrage, Distribution of underlying asset, Lower bound, Out-of-the-money, Kernel pricing

Chapter 8: Can Time-Varying Copulas Improve Mean-Variance Portfolio?

This chapter evaluates whether constructing a portfolio using time-varying copulas yields superior returns under various weight updating strategies. Specifically, minimum-risk portfolios are constructed based on various copulas and the Pearson

correlation, and a 250-day rolling window technique is adopted to derive a sequence of time-varied dependences for each dependence model. Using daily data of the G-7 countries, our empirical findings suggest that portfolios using time-varying copulas, particularly the Clayton-dependence, outperform those constructed using Pearson correlations. The above results still hold under different weight updating strategies and portfolio rebalancing frequencies. The methodologies used in this chapter are Copulas, GARCH, Student's *t*-Copula, Gumbel Copula, Clayton Copula, Time-Varying Dependence, Portfolio Optimization, and Bootstrap.

Keywords: Copulas, Time-varying dependence, Portfolio optimization, Bootstrap, Out-of-sample return, Performance evaluation, GARCH, Gaussian copula, Student's *t*-copula, Gumbel copula, Clayton copula

Chapter 9: Determinations of Corporate Earnings Forecast Accuracy: Taiwan Market Experience

This chapter examines the accuracy of the earnings forecasts by the following test methodologies. Multiple Regression Models are used to examine the effect of six factors: firm size, market volatility, trading volume turnover, corporate earnings variances, type of industry, and experience. If the two-sample groups are related, Wilcoxon Two-Sample Test will be used to determine the relative earnings forecast accuracy. Readers are well advised and referred to the chapter appendix for methodological issues such as sample selection, variable definition, regression model, and Wilcoxon tow-sample test.

Keywords: Multiple regression, Wilcoxon two-sample test, Corporate earnings, Forecast accuracy, Management earnings, Firm size, Corporation regulation, Volatility, Trade turnover, Industry

Chapter 10: Market-Based Accounting Research (MBAR) Models: A Test of ARIMAX Modeling

This study uses standard models such as earnings level and earnings changes, among others. Models that fit better to the data drawn from companies listed on the Athens Stock Exchange have been selected employing autoregressive integrated moving average with exogenous variables (ARIMAX) models. Models I (price on earnings model) "II (returns on change in earnings divided by beginning-of-period price and prior period)" V (returns on change in earnings over opening market value), VII (returns deflated by lag of 2 years on earnings over opening market value), and IX (differenced-price model) have statistically significant coefficients of explanatory variables. These models take place with backward looking information instead of forward looking information that recent literature is assessed. The methodologies used in this chapter are price on earnings model, return models, autoregressive moving average with exogenous variables (ARIMAX), minimum value of squared residuals (MSE loss function), and Dickey-Fuller test.

Keywords: Market-based accounting research (MBAR), Price on earnings model, Earnings level, Earnings change, Return models, Autoregressive moving average with exogenous variables (ARIMAX), Minimum value of squared residuals (MSE loss function), Unit root tests stationarity, Dickey-Fuller test

Chapter 11: An Assessment of Copula Functions Approach in Conjunction with Factor Model in Portfolio Credit Risk Management

This study uses a mixture of the dynamic factor model of Duffee (1999) and a contagious effect in the specification of a Hawkes process, a class of counting processes which allows intensities to depend on the timing of previous events (Hawkes 1971). Using the mixture factor- contagious-effect model, Monte Carlo simulation is performed to generate default times of two hypothesized firms. The goodness-of-fit of the joint distributions based on the most often used copula functions in literature, including the Normal, t-, Clayton, Frank, and Gumbel copula, respectively, is assessed against the simulated default times. It is demonstrated that as the contagious effect increases, the goodness-of-fit of the joint distribution functions based on copula functions decreases, which highlights the deficiency of the copula function approach.

Keywords: Static factor model, Dynamic factor model, Correlated defaults, Contagious effect, Hawkes process, Monte Carlo simulation, Normal copula, *t*-copula, Clayton copula, Frank copula, Gumbel copula

Chapter 12: Assessing Importance of Time-Series Versus Cross-Sectional Changes in Panel Data: A Study of International Variations in Ex-Ante Equity Premia and Financial Architecture

This chapter uses simultaneous equation modeling and uses Hausman test to determine whether to report fixed or random-effects estimates. We first report random-effects estimates based on the estimation procedure of Baltagi (Baltagi 1981; Baltagi and Li 1995; Baltagi and Li 1994). We consider that the error component two-stage least squares (EC2SLS) estimator of Baltagi and Li (1995) is more efficient than the generalized two-stage least squares (G2SLS) estimator of Balestra and Varadharajan-Krishnakumar (1987). For our second estimation procedure, for comparative purposes, we use the dynamic panel modeling estimates recommended by Blundell and Bond (1998). We employ the model of Blundell and Bond (1998), as these authors argue that their estimator is more appropriate than the Arellano and Bond (1991) model for smaller time periods relative to the size of the panels. We also use this two-step procedure, use as an independent variable the first lag of the dependent variable, reporting robust standard errors of Windmeijer (2005). Thus, our two different panel estimation techniques place differing emphasis on cross-sectional and time-series effects, with the Baltagi-Li

estimator emphasizing cross-sectional effects and the Blundell-Bond estimator emphasizing time-series effects.

Keywords: Panel data estimates, Time-series and cross-sectional effects, Econometrics, Financial institutions, Banks, Financial markets, Comparative financial systems, Legal traditions, Uncertainty avoidance, Trust, Property rights, Error component two-stage least squares (EC2SLS), The generalized two-stage least squares (G2SLS)

Chapter 13: Does Banking Capital Reduce Risk?: An Application of Stochastic Frontier Analysis and GMM Approach

This chapter employs stochastic frontier analysis to create a new type of instrumental variable. The unrestricted frontier model determines the highest possible profitability based solely on the book value of assets employed. We develop a second frontier based on the level of bank holding company capital as well as the amount of assets. The implication of using the unrestricted model is that we are measuring the unconditional inefficiency of the banking organization. This chapter applies generalized method of moments (GMM) regression to avoid the problem caused by departure from normality. To control for the impact of size on a bank's risk-taking behavior, the book value of assets is considered in the model. The relationship between the variables specifying bank behavior and the use of equity is analyzed by GMM regression.

Keywords: Bank capital, Generalized method of moments, Stochastic frontier analysis, Bank risks, Bank holding companies, Endogeneity of variables

Chapter 14: Evaluating Long-Horizon Event Study Methodology

This chapter examines the performance of more than 20 different testing procedures that fall into two categories. First, the buy-and-hold benchmark approach uses a benchmark to measure the abnormal buy-and-hold return for every event firm, and tests the null hypothesis that the average abnormal return is zero. Second, the calendar-time portfolio approach forms a portfolio in each calendar month consisting of firms that have had an event within a certain time period prior to the month, and tests the null hypothesis that the intercept is zero in the regression of monthly portfolio returns against the factors in an asset-pricing model. This chapter also evaluates the performance of bootstrapped Johnson's skewness-adjusted *t*-test. This computation-intensive procedure is considered because the distribution of long-horizon abnormal returns tends to be highly skewed to the right. The bootstrapping method uses repeated random sampling to measure the significance of relevant test statistics. Due to the nature of random sampling, the resultant measurement of significance varies each time such a procedure is used. We also evaluate simple nonparametric tests, such as the Wilcoxon signed-rank test or the Fisher's sign test, which are free from random sampling variation.

Keywords: Long-horizon event study, Johnson's Skewness-adjusted *t*-test, Weighted least-squares regression, Bootstrap test, Calendar-time portfolio approach, Fama-French three-factor model, Johnson's skewness-adjusted t-statistic, Large-scale simulations

Chapter 15: Effect of Unexpected Volatility Shocks on Intertemporal Risk-Return Relation

This chapter employs the ANST-GARCH model that is capable of capturing the asymmetric volatility effect of a positive and negative return shock. The key feature of the model is the regime-shift mechanism that allows a smooth, flexible transition of the conditional volatility between different states of volatility persistence. The regime-switching mechanism is governed by a logistic transition function that changes values depending on the level of the previous return shock. With a negative (positive) return shock, the conditional variance process is described as a high (low)-persistence-in-volatility regime. The ANST-GARCH model describes the heteroskedastic return dynamics more accurately and generates better volatility forecasts.

Keywords: Intertemporal risk-return relation, Unexpected volatility shocks, Time-varying rational expectation hypothesis, Stock market overreaction, Expected market risk premium, Volatility feedback effect, Asymmetric mean reversion, Asymmetric volatility response, Time-varying volatility, Volatility regime switching, ANST-GARCH model

Chapter 16: Combinatorial Methods for Constructing Credit Risk Ratings

This chapter uses a novel method, the Logical Analysis of Data (LAD), to reverse-engineer and construct credit risk ratings which represent the creditworthiness of financial institutions and countries. LAD is a data-mining method based on combinatorics, optimization, and Boolean logic that utilizes combinatorial search techniques to discover various combinations of attribute values that are characteristic of the positive or negative character of observations. The proposed methodology is applicable in the general case of inferring an objective rating system from archival data, given that the rated objects are characterized by vectors of attributes taking numerical or ordinal values. The proposed approaches are shown to generate transparent, consistent, self-contained, and predictive credit risk rating models, closely approximating the risk ratings provided by some of the major rating agencies. The scope of applicability of the proposed method extends beyond the rating problems discussed in this study, and can be used in many other contexts where ratings are relevant. This study also uses multiple linear regression to derive the logical rating scores.

Keywords: Credit risk rating, Reverse-engineering, Logical analysis of data, Combinatorial optimization, Data-mining, Creditworthiness, Financial strength, Internal rating, Preorder, Logical rating score

Chapter 17: Dynamic Interactions in the Taiwan Stock Exchange: A Threshold VAR Models

This chapter constructs a six-variable VAR model (including NASDAQ returns, TSE returns, NT/USD returns, net foreign purchases, net domestic investment companies (dic) purchases, and net registered trading firms (rtf) purchases) to examine: (i) the interaction among three types of institutional investors, particularly to test whether net foreign purchases lead net domestic purchases by dic and rtf (the so-called demonstration effect); (ii) whether net institutional purchases lead market returns or vice versa, and (iii) whether the corresponding lead-lag relationship is positive or negative? Readers are well advised to refer to chapter appendix for detailed discussion of the unrestricted VAR model, the structural VAR model, and the threshold VAR analysis. The methodologies used in this chapter are multivariate threshold autoregression model, structural VAR, and Block Granger Causality.

Keywords: Demonstration effect, Multivariate threshold autoregression model, Foreign investment, Lead-lag relationship, Structural VAR, Block Granger causality, Institutional investors, Domestic investment companies, Registered trading firms, Qualified foreign institutional investors

Chapter 18: Methods of Denoising Financial Data

This chapter uses denoising analysis which imposes new challenges for financial data mining due to the irregularities and roughness observed in financial data, particularly, for instantaneously collected massive amounts of tick-by-tick data from financial markets for information analysis and knowledge extraction. Inefficient decomposition of the systematic pattern (the trend) and noises of financial data will lead to erroneous conclusions since irregularities and roughness of the financial data make the application of traditional methods difficult. The methodologies used in this chapter are linear filters, nonlinear filters, time-series analysis, trend extraction, and wavelet.

Keywords: Jump detection, Linear filters, Nonlinear filters, Time-series analysis, Trend extraction, Wavelet

Chapter 19: Analysis of Financial Time: Series Using Wavelet Methods

This chapter presents a set of tools, which allow gathering information about the frequency components of a time-series. In the first step, we discuss spectral

analysis and filtering methods. Spectral analysis can be used to identify and to quantify the different frequency components of a data series. Filters permit to capture specific components (e.g. trends, cycles, seasonalities) of the original time-series. In the second step, we introduce wavelets, which are relatively new tools in economics and finance. They take their roots from filtering methods and Fourier analysis, but overcome most of the limitations of these two methods. Their principal advantages derive from: (i) combined information from both time-domain and frequency-domain and (ii) their flexibility as they do not make strong assumptions concerning the data generating process for the series under investigation.

Keywords: Filtering methods, Spectral analysis, Fourier transform, Wavelet filter, Continuous wavelet transform, Discrete wavelet transform, Multi-resolution analysis, Scale-by-scale decomposition, Analysis of variance, Case-Shiller home price indices

Chapter 20: Composite Goodness-of-Fit Tests for Left Truncated Loss Sample

This chapter derives the exact formulae for several goodness-of-fit statistics that should be applied to loss models with left-truncated data where the fit of a distribution in the right tail of the distribution is of central importance. We apply the proposed tests to real financial losses, using a variety of distributions fitted to operational loss and the natural catastrophe insurance claims data. The methodologies discussed in this chapter are goodness-of-fit tests, loss distribution, ruin probability, value-at-risk, Anderson-Darling statistic, Kolmogorov-Smirnov statistic.

Keywords: Goodness-of-fit tests, Left-truncated data, Minimum recording threshold, Loss distribution, Heavy-tailed data, Operational risk, Insurance, Ruin probability, Value-at-risk, Anderson-Darling statistic, Kolmogorov-Smirnov statistic

Chapter 21: Effect of Merger on the Credit Rating and Performance of Taiwan Security Firms

This chapter identifies and defines variables for merger synergy analysis followed by principal component factor analysis, variability percentage adjustment, and performance score calculation. Finally, Wilcoxon sign rank test is used for hypothesis testing. We extract principle component factors from a set of financial ratios. Percentage of variability explained and factor loadings are adjusted to get a modified average weight for each financial ratio. This weight is multiplied by the standardized Z value of the variable, and summed a set of variables get a firm's performance score. Performance scores are used to rank the firm. Statistical significance of difference in pre- and post-merger rank is tested using the Wilcoxon sign rank.

Keywords: Corporate merger, Financial ratios, Synergy, Economies of scale, Credit rating, Variability percentage adjustment, Principle component factors, Firm's performance score, Standardized Z, Wilcoxon rank test

Chapter 22: On-/Off-the-Run Yield Spread Puzzle: Evidence from Chinese Treasury Markets

This chapter uses on-/off-the-run yield spread to describe "on-/off-the-run yield spread puzzle" in Chinese treasury markets. To explain this puzzle, we introduce a latent factor in the pricing of Chinese off-the-run government bonds and use this factor to model the yield difference between Chinese on-the-run and off-the-run issues. We use the nonlinear Kalman filter approach to estimate the model. The methodologies used in this chapter are CIR model, nonlinear Kalman filter and Quasi-maximum likelihood model.

Keywords: On-/off-the-run yield spread, Liquidity, Disposition effect, CIR model, Nonlinear Kalman filter, Quasi-maximum likelihood

Chapter 23: Factor Copula for Defaultable Basket Credit Derivatives

This chapter uses a factor copula approach to evaluate basket credit derivatives with issuer default risk and demonstrate its application in a basket credit linked note (BCLN). We generate the correlated Gaussian random numbers by using the Cholesky decomposition, and then, the correlated default times can be decided by these random numbers and the reduced-form model. Finally, the fair BCLN coupon rate is obtained by the Monte Carlo simulation. We also discuss the effect of issuer default risk on BCLN. We show that the effect of issuer default risk cannot be accounted for thoroughly by considering the issuer as a new reference entity in the widely used one factor copula model, in which constant default correlation is often assumed. A different default correlation between the issuer and the reference entities affects the coupon rate greatly and must be taken into account in the pricing model.

Keywords: Factor copula, Issuer default, Default correlation, Reduced-form model, Basket credit derivatives, Cholesky decomposition, Monte Carlo simulation

Chapter 24: Panel Data Analysis and Bootstrapping: Application to China Mutual Funds

This chapter estimates double- and single-clustered standard errors by wild-cluster bootstrap procedure. To obtain the wild bootstrap samples in each cluster, we reuse the regressors (X), but modify the residuals by transforming the OLS residuals with weights which follow the popular two-point distribution suggested by Mammen (1993) and others. We then

compare them with other estimates in a set of asset-pricing regressions. The comparison indicates that bootstrapped standard errors from double clustering outperform those from single clustering. They also suggest that bootstrapped critical values are preferred to standard asymptotic *t*-test critical values to avoid misleading test results.

Keywords: Asset-pricing regression, Bootstrapped critical values, Cluster standard errors, Double clustering, Firm and time effects, Finance panel data, Single clustering, Wild-cluster bootstrap

Chapter 25: Market Segmentation and Pricing of Closed-End Country Funds: An Empirical Analysis

This chapter finds that for closed-end country funds, the international CAPM can be rejected for the underlying securities (NAVs) but not for the share prices. This finding indicates that country fund share prices are determined globally, whereas the NAVs reflect both global and local prices of risk. Cross-sectional variations in the discounts or premiums for country funds are explained by the differences in the risk exposures of the share prices and the NAVs. Finally, this chapter shows that the share price and NAV returns exhibit predictable variation, and country fund premiums vary over time due to time-varying risk premiums. The chapter employs Generalized Method of Moments (GMM) to estimate stochastic discount factors and examines if the price of risk of closed-end country fund shares and NAVs is identical.

Keywords: Capital markets, Country funds, CAPM, Closed-end funds, Market segmentation, GMM, Net asset value, Stochastic discount factors, Time-varying risk, International asset pricing

Chapter 26: A Comparison of Portfolios Using Different Risk Measurements

This study uses three different risk measurements: the Mean-variance model, the Mean Absolute Deviation model, and the Downside Risk model. Meanwhile short selling is also taken into account since it is an important strategy that can bring a portfolio much closer to the efficient frontier by improving a portfolio's risk-return trade-off. Therefore, six portfolio rebalancing models, including the MV model, MAD model and the Downside Risk model, with/without short selling, are compared to determine which is the most efficient. All models simultaneously consider the criteria of return and risk measurement. Meanwhile, when short selling is allowed, models also consider minimizing the proportion of short selling. Therefore, multiple objective programming is employed to transform multiple objectives into a single objective in order to obtain a compromising solution. An example is used to perform simulation, and the results indicate that the MAD model, incorporated with a short selling model, has the highest market value and lowest risk.

Keywords: Portfolio selection, Risk measurement, Short selling, MV model, MAD model, Downside risk model, Multiple objective programming, Rebalancing model, Value-at-risk, Conditional value-at-risk

Chapter 27: Using Alternative Models and a Combining Technique in Credit Rating Forecasting: An Empirical Study

This chapter first utilizes the ordered logit and the ordered probit models. Then, we use ordered logit combining method to weight different techniques' probability measures, as described in Kamstra and Kennedy (1998) to form the combining model. The samples consist of firms in the TSE and the OTC market, and are divided into three industries for analysis. We consider financial variables, market variables as well as macroeconomic variables and estimate their parameters for out-of-sample tests. By means of Cumulative Accuracy Profile, the Receiver Operating Characteristics, and McFadden, we measure the goodness-of-fit and the accuracy of each prediction model. The performance evaluations are conducted to compare the forecasting results, and we find that combing technique does improve the predictive power.

Keywords: Bankruptcy prediction, Combining forecast, Credit rating, Credit risk, Credit risk index, Forecasting models, Logit regression, Ordered logit, Ordered probit, Probability density function

Chapter 28: Can We Use the CAPM as an Investment Strategy?: An Intuitive CAPM and Efficiency Test

The aim of this chapter is to check whether certain playing rules, based on the undervaluation concept arising from the CAPM, could be useful as investment strategies, and can therefore be used to beat the Market. If such strategies work, we will be provided with a useful tool for investors, and, otherwise, we will obtain a test whose results will be connected with the efficient Market hypothesis (EMH) and with the CAPM. The methodology used is both intuitive and rigorous: analyzing how many times we beat the Market with different strategies, in order to check whether when we beat the Market, this happens by chance.

Keywords: ANOVA, Approximately normal distribution, Binomial distribution, CAPM, Contingency tables, Market efficiency, Nonparametric tests, Performance measures

Chapter 29: Group Decision Making Tools for Managerial Accounting and Finance Applications

This chapter adopts an Analytic Hierarchy Process (AHP) approach to solve various accounting or finance problems such as developing a business performance evaluation system and developing a banking performance evaluation system. AHP uses

hierarchical schema to incorporate nonfinancial and external performance measures. Our model has a broader set of measures that can examine external and nonfinancial performance as well as internal and financial performance. While AHP is one of the most popular multiple goals decision-making tools, Multiple Criteria and Multiple Constraint (MC^2) Linear Programming approach also can be used to solve group decision-making problems such as transfer pricing and capital budgeting problems. The methodologies used in this chapter are Analytic Hierarchy Process, multiple criteria and multiple constraint linear programming, and balanced scorecard and business performance evaluation.

Keywords: Analytic hierarchy process, Multiple criteria and multiple constraint linear programming, Business performance evaluation, Activity-based costing system, Group decision making, Optimal trade-offs, Balanced scorecard, Transfer pricing, Capital budgeting

Chapter 30: Statistics Methods Applied in Employee Stock Options

This study provides model-based and compensation-based approaches to price subjective value of employee stock options (ESOs). In model-based approach, we consider a utility-maximizing model that the employee allocates his wealth among the company stock, market portfolio, and risk-free bond, and then derive the ESO formulae which take into account illiquidity and sentiment effects. By using the method of change of measure, the derived formulae are simply like that of the market values with altered parameters. To calculate compensation-based subjective value, we group employees by hierarchical clustering with K-Means approach and back out the option value in an equilibrium competitive employment market. Further, we test illiquidity and sentiment effects on ESO values by running the regressions which consider the problem of standard errors in finance panel data.

Keywords: Employee stock option, Sentiment, Subjective value, Illiquidity, Change of measure, Hierarchical clustering with K-Means approach, Standard errors in finance panel data, Exercise boundary, Jump diffusion model

Chapter 31: Structural Change and Monitoring Tests

This chapter focuses on various structural change and monitoring tests for a class of widely used time-series models in economics and finance, including $I(0)$, $I(1)$, $I(d)$ processes and the co-integration relationship. In general, structural change tests can be categorized into two types: One is the classical approach to testing for structural change, which employs retrospective tests using a historical data set of a given length; the other one is the fluctuation-type test in a monitoring scheme, which means for given a history period for which a regression relationship is known to be stable,

we then test whether incoming data are consistent with the previously established relationship. Several structural changes such as CUSUM squared tests, the QLR test, the prediction test, the multiple break test, bubble tests, co-integration breakdown tests, and the monitoring fluctuation test are discussed in this chapter, and we further illustrate all details and usefulness of these tests.

Keywords: Co-integration breakdown test, Structural break, Long memory process, Monitoring fluctuation test, Boundary function, CUSUM squared test, Prediction test, Bubble test, Unit root time series, Persistent change

Chapter 32: Consequences of Option Pricing of a Long Memory in Volatility

This chapter use conditionally heteroskedastic time-series models to describe the volatility of stock index returns. Volatility has a long memory property in the most general models and then the autocorrelations of volatility decay at a hyperbolic rate; contrasts are made with popular, short memory specifications whose autocorrelations decay more rapidly at a geometric rate. Options are valued for ARCH volatility models by calculating the discounted expectations of option payoffs for an appropriate risk-neutral measure. Monte Carlo methods provide the expectations. The speed and accuracy of the calculations is enhanced by two variance reduction methods, which use antithetic and control variables. The economic consequences of a long memory assumption about volatility are documented, by comparing implied volatilities for option prices obtained from short and long memory volatility processes.

Keywords: ARCH models, Implied volatility, Index options, Likelihood maximization, Long memory, Monte Carlo, Option prices, Risk-neutral pricing, Smile shapes, Term structure, Variance reduction methods

Chapter 33: Seasonal Aspects of Australian Electricity Market

This chapter develops econometric models for seasonal patterns in both price returns and proportional changes in demand for Australian electricity. Australian Electricity spot prices differ considerably from equity spot prices in that they contain an extremely rapid mean reversion process. The electricity spot price could increase to a market cap price of AU$12,500 per Megawatt Hour (MWh) and revert back to a mean level (AUD$30) within a half hour interval. This has implications for derivative pricing and risk management. We also model extreme spikes in the data. Our study identifies both seasonality effects and dramatic price reversals in the Australian electricity market. The pricing seasonality effects include time-of-day, day-of-week, monthly, and yearly effects. There is also evidence of seasonality in demand for electricity.

Keywords: Electricity, Spot price, Seasonality, Outlier, Demand, Econometric modeling

Chapter 34: Pricing Commercial Timberland Returns in the United States

This chapter uses both parametric and nonparametric approaches to evaluate private- and public-equity timberland investments in the United States. Private-equity timberland returns are proxied by the NCREIF Timberland Index, whereas public-equity timberland returns are proxied by the value-weighted returns on a dynamic portfolio of the US publicly traded forestry firms that had or have been managing timberlands. Static estimations of the capital asset-pricing model and Fama-French three-factor model are obtained by ordinary least squares, whereas dynamic estimations are obtained by state-space specifications with the Kalman filter. In estimating the stochastic discount factors, linear programming is used.

Keywords: Alternative asset class, Asset pricing, Evaluation, Fama-French three-factor model, Nonparametric analysis, State-space model, Stochastic discount factor, Timberland investments, Time series, Time-varying parameter

Chapter 35: Optimal Orthogonal Portfolios with Conditioning Information

This chapter derives and characterizes optimal orthogonal portfolios in the presence of conditioning information in the form of a set of lagged instruments. In this setting, studied by Hansen and Richard (1987), the conditioning information is used to optimize with respect to the unconditional moments. We present an empirical illustration of the properties of the optimal orthogonal portfolios. The methodology in this chapter includes regression and maximum likelihood parameter estimation, as well as method of moments estimation. We form maximum likelihood estimates of nonlinear functions as the functions evaluated at the maximum likelihood parameter estimates.

Keywords: Asset-pricing tests, Conditioning information, Minimum variance efficiency, Optimal portfolios, Predicting returns, Portfolio management, Stochastic discount factors, Generalized, Method of moments, Maximum likelihood, Parametric bootstrap, Sharpe ratios

Chapter 36: Multi-factor, Multi-indicator Approach to Asset Pricing: Method and Empirical Evidence

This chapter uses a multifactor, multi-indicator approach to test the capital asset-pricing model (CAPM) and the arbitrage pricing theory (APT). This approach is able to solve the measuring problem in the market portfolio in testing CAPM, and it is also able to directly test APT by linking the common factors to the macroeconomic indicators. We propose a MIMIC approach to test CAPM and APT. The beta estimated from the MIMIC model by allowing measurement error on the market

portfolio does not significantly improve the OLS beta, while the MLE estimator does a better job than the OLS and GLS estimators in the cross-sectional regressions because the MLE estimator takes care of the measurement error in beta. Therefore, the measurement error problem on beta is more serious than that on the market portfolio.

Keywords: Capital asset-pricing model, CAPM, Arbitrage pricing theory, Multifactor multi-indicator approach, MIMIC, Measurement error, LISREL approach, Ordinary least square, OLS, General least square, GLS, Maximum likelihood estimation, MLE

Chapter 37: Binomial OPM, Black-Scholes OPM and Their Relationship: Decision Tree and Microsoft Excel Approach

This chapter will first demonstrate how Microsoft Excel can be use to create the Decision Trees for the Binomial Option Pricing Model. At the same time, this chapter will discuss the Binomial Option Pricing Model in a less mathematical fashion. All the mathematical calculations will be taken care by the Microsoft Excel program that is presented in this chapter. Finally, this chapter also uses the Decision Tree approach to demonstrate the relationship between the Binomial Option Pricing Model and the Black-Scholes Option Pricing Model.

Keywords: Binomial option pricing model, Decision trees, Black-Sholes option pricing model, Call option, Put option, Microsoft Excel, Visual Basic for applications, VBA, Put-call parity, Sigma, Volatility, Recursive programming

Chapter 38: Dividend Payments and Share Repurchases of U.S. Firms: An Econometric Approach

This chapter uses the econometric methodology to deal with the dynamic interrelationships between dividend payments and share repurchases and investigate endogeneity of certain explanatory variables. Identification of the model parameters is achieved in such models by exploiting the cross-equations restrictions on the coefficients in different time periods. Moreover, the estimation entails using nonlinear optimization methods to compute the maximum likelihood estimates of the dynamic random-effects models and for testing statistical hypotheses using likelihood ratio tests. This study also highlights the importance of developing comprehensive econometric models for these interrelationships. It is common in finance research to spell out "specific hypotheses" and conduct empirical research to investigate validity of the hypotheses.

Keywords: Compustat database, Corporate policies, Dividends, Dynamic random-effects models, Econometric methodology, Endogeneity, Maximum likelihood, Intangible assets, Model formulation, Nonlinear optimization, Panel data, Share repurchases

Chapter 39: Term Structure Modeling and Forecasting Using the Nelson-Siegel Model

In this chapter, we illustrate some recent developments in the yield curve modeling by introducing a latent factor model called the dynamic Nelson-Siegel model. This model not only provides good in-sample fit, but also produces superior out-of-sample performance. Beyond Treasury yield curve, the model can also be useful for other assets such as corporate bond and volatility. Moreover, the model also suggests generalized duration components corresponding to the level, slope, and curvature risk factors. The dynamic Nelson-Siegel model can be estimated via a one-step procedure, like the Kalman filter, which can also easily accommodate other variables of interests. Alternatively, we could estimate the model through a two-step process by fixing one parameter and estimating with ordinary least squares. The model is flexible and capable of replicating a variety of yield curve shapes: upward sloping, downward sloping, humped, and inverted humped. Forecasting the yield curve is achieved through forecasting the factors and we can impose either a univariate autoregressive structure or a vector autoregressive structure on the factors.

Keywords: Term structure, Yield curve, Factor model, Nelson-Siegel curve, State-space model

Chapter 40: The Intertemporal Relation Between Expected Return and Risk On Currency

The literature has so far focused on the risk-return trade-off in equity markets and ignored alternative risky assets. This chapter examines the presence and significance of an intertemporal relation between expected return and risk in the foreign exchange market. This chapter tests the existence and significance of a daily risk-return trade-off in the FX market based on the GARCH, realized, and range volatility estimators. Our empirical analysis relies on the maximum likelihood estimation of the GARCH-in-mean models, as described in Appendix A. We also use the seemingly unrelated (SUR) regressions and panel data estimation to investigate the significance of a time-series relation between expected return and risk on currency.

Keywords: GARCH, GARCH-in-mean, Seemingly unrelated regressions (SUR), Panel data estimation, Foreign exchange market, ICAPM, High-frequency data, Time-varying risk aversion, High-frequency data, Daily realized volatility

Chapter 41: Quantile Regression and Value-at-Risk

This chapter studies quantile regression (QR) estimation of Value-at-Risk (VaR). VaRs estimated by the QR method display some nice properties. In this chapter, different QR models in estimating VaRs are introduced. In particular, VaR estimation based on quantile regression of the QAR models, Copula models,

ARCH models, GARCH models, and the CaViaR models is systematically introduced. Comparing the proposed QR method with traditional methods based on distributional assumptions, the QR method has the important property that it is robust to non-Gaussian distributions. Quantile estimation is only influenced by the local behavior of the conditional distribution of the response near the specified quantile. As a result, the estimates are not sensitive to outlier observations. Such a property is especially attractive in financial applications since many financial data like, say, portfolio returns (or log returns), are usually not normally distributed. To highlight the importance of the QR method in estimating VaR, we apply the QR techniques to estimate VaRs in International Equity Markets. Numerical evidence indicates that QR is a robust estimation method for VaR.

Keywords: ARCH, Copula, GARCH, Non-normality, QAR, Quantile regression, Risk management, Robust estimation, Time series, Value-at-risk

Chapter 42: Earnings Quality and Board Structure: Evidence from South East Asia

Using a sample of listed firms in Southeast Asia countries, this chapter examines the association among board structure and corporate ownership structure in affecting earnings quality. The econometric method employed is regressions of panel data. In a panel data setting, I address both cross-sectional and time-series dependence. Following Gow et al. (2010), I employ the two-way clustering method where the standard errors are clustered by both firm and year in my regressions of panel data.

Keywords: Earnings quality, Board structure, Corporate ownership structure, Panel data regressions, Cross-sectional and time-series dependence, Two-way clustering method of standard errors

Chapter 43: Rationality and Heterogeneity of Survey Forecasts of the Yen-Dollar Exchange Rate: A Reexamination

This chapter examines the rationality and diversity of industry-level forecasts of the yen-dollar exchange rate collected by the Japan Center for International Finance. We compare three specifications for testing rationality: the "conventional" bivariate regression, the univariate regression of a forecast error on a constant and other information set variables, and an error correction model (ECM). We extend the analysis of industry-level forecasts to a SUR-type structure using an innovative GMM technique (Bonham and Cohen 2001) that allows for forecaster cross-correlation due to the existence of common shocks and/or herd effects. Our GMM tests of micro-homogeneity uniformly reject the hypothesis that forecasters exhibit similar rationality characteristics.

Keywords: Rational expectations, Unbiasedness, Weak efficiency, Micro-homogeneity, Heterogeneity, Exchange rate, Survey forecasts, Aggregation bias, GMM, SUR

Chapter 44: Stochastic Volatility Structures and Intra-day Asset Price Dynamics

This chapter uses conditional volatility estimators as special cases of a general stochastic volatility structure. The theoretical asymptotic distribution of the measurement error process for these estimators is considered for particular features observed in intraday financial asset price processes. Specifically, I consider the effects of (i) induced serial correlation in returns processes, (ii) excess kurtosis in the underlying unconditional distribution of returns, (iii) market anomalies such as market opening and closing effects, and (iv) failure to account for intraday trading patterns. These issues are considered with applications in option pricing/trading strategies and the constant/dynamic hedging frameworks in mind. The methodologies used in this chapter are ARCH, maximum likelihood method, and unweighted GARCH.

Keywords: ARCH, Asymptotic distribution, Autoregressive parameters, Conditional variance estimates, Constant/dynamic hedging, Excess kurtosis, Index futures, Intraday returns, Market anomalies, Maximum likelihood estimates, Misspecification, Mis-specified returns, Persistence, Serial correlation, Stochastic volatility, Stock/futures, Unweighted GARCH, Volatility co-persistence

Chapter 45: Optimal Asset Allocation Under VaR Criterion: Taiwan Stock Market

This chapter examines the riskiness of the Taiwan stock market by determining the VaR from the expected return distribution generated by historical simulation. Value-at-risk (VaR) measures the worst expected loss over a given time horizon under normal market conditions at a specific level of confidence. VaR is determined by the left tail of the cumulative probability distribution of expected returns. Our result indicates the cumulative probability distribution has a fatter left tail, compared with the left tail of a normal distribution. This implies a riskier market. We also examined a two-sector asset allocation model subject to a target VaR constraint. The VaR-efficient frontier of the TAIEX traded stocks recommended, mostly, a corner portfolio.

Keywords: Value-at-risk, Asset allocation, Cumulative probability distribution, Normal distribution, VaR-efficient frontier, Historical simulation, Expected return distribution, Two-sector asset allocation model, Delta, gamma, Corner portfolio, TAIEX

Chapter 46: Alternative Methods for Estimating Firm's Growth Rate

The most common valuation model is the dividend growth model. The growth rate is found by taking the product of the retention rate and the return on equity. What is less well understood are the basic assumptions of this model. In this paper, we demonstrate that the model makes strong assumptions regarding the financing mix of the firm. In addition,

we discuss several methods suggested in the literature on estimating growth rates and analyze whether these approaches are consistent with the use of using a constant discount rate to evaluate the firm's assets and equity. The literature has also suggested estimating growth rate by using the average percentage change method, compound-sum method, and/or regression methods. We demonstrate that the average percentage change is very sensitive to extreme observations. Moreover, on average, the regression method yields similar but somewhat smaller estimates of the growth rate compared to the compound-sum method. We also discussed the inferred method suggested by Gordon and Gordon (1997) to estimate the growth rate. Advantages, disadvantages, and the interrelationship among these estimation methods are also discussed in detail.

Keywords: Compound sum method, Discount cash flow model, Growth rate, Internal growth rate, Sustainable growth rate

Chapter 47: Econometric Measures of Liquidity

A security is liquid to the extent that an investor can trade significant quantities of the security quickly, at or near the current market price, and bearing low transaction costs. As such, liquidity is a multidimensional concept. In this chapter, I review several widely used econometrics or statistics-based measures that researchers have developed to capture one or more dimensions of a security's liquidity (i.e., limited dependent variable model (Lesmond et al. 1999) and autocovariance of price changes (Roll 1984)). These alternative proxies have been designed to be estimated using either low-frequency or high-frequency data, so I discuss four liquidity proxies that are estimated using low-frequency data and two proxies that require high-frequency data. Low-frequency measures permit the study of liquidity over relatively long time horizons; however, they do not reflect actual trading processes. To overcome this limitation, high-frequency liquidity proxies are often used as benchmarks to determine the best low-frequency proxy. In this chapter, I find that estimates from the effective tick measure perform best among the four low-frequency measures tested.

Keywords: Liquidity, Transaction costs, Bid-ask spread, Price impact, Percent effective spread, Market model, Limited dependent variable model, Tobin's model, Log-likelihood function, Autocovariance, Correlation analysis

Chapter 48: A Quasi-Maximum Likelihood Estimation Strategy for Value-at-Risk Forecasting: Application to Equity Index Futures Markets

The chapter uses GARCH model and quasi-maximum likelihood estimation strategy to investigate equity index futures markets. We present the first empirical evidence for the validity of the ARMA-GARCH model with tempered stable innovations to estimate 1-day-ahead value-at-risk in futures markets for the S&P 500, DAX, and Nikkei. We also provide empirical support that GARCH

models based on the normal innovations appear not to be as well suited as infinitely divisible models for predicting financial crashes. In our empirical analysis, we forecast 1 % value-at-risk in both spot and futures markets using normal and tempered stable GARCH models following a quasi-maximum likelihood estimation strategy. In order to determine the accuracy of forecasting for each specific model, backtesting using Kupiec's proportion of failures test is applied.

Keywords: Infinitely divisible models, Tempered stable distribution, GARCH models, Value-at-risk, Kupiec's proportion of failures test, Quasi-maximum likelihood estimation strategy

Chapter 49: Computer Technology for Financial Service

This chapter examines the core computing competence for financial services. Securities trading is one of the few business activities where a few seconds of processing delay can cost a company big fortune. Grid and Cloud computing will be briefly described. How the underlying algorithm for financial analysis can take advantage of Grid environment is chosen and presented. One of the most popular practiced algorithms Monte Carlo Simulation is used in our cases study for option pricing and risk management. The various distributed computational platforms are carefully chosen to demonstrate the performance issue for financial services.

Keywords: Financial service, Grid and cloud computing, Monte Carlo simulation, Option pricing, Risk management, Cyberinfrastructure, Random number generation, High end computing, Financial simulation, Information technology

Chapter 50: Long-Run Stock Return and the Statistical Inference

This chapter introduces the long-run stock return methodologies and their statistical inference. The long-run stock return is usually computed by using a holding strategy more than 1 year but up to 5 years. Two categories of long-run return methods are illustrated in this chapter: the event-time approach and calendar-time approach. The event-time approach includes cumulative abnormal return, buy-and-hold abnormal return, and abnormal returns around earnings announcements. In former two methods, it is recommended to apply the empirical distribution (from the bootstrapping method) to examine the statistical inference, whereas the last one uses classical *t*-test. In addition, the benchmark selections in the long-run return literature are introduced. Moreover, the calendar-time approach contains mean monthly abnormal return, factor models, and Ibbotson's RATS, which could be tested by time-series volatility.

Keywords: Long-run stock return, Buy-and-hold return, Factor model, Event-time, Calendar-time, Cumulative abnormal return, Ibottson's RATS, Conditional market model, Bootstrap, Zero-investment portfolio

Chapter 51: Value-at-Risk Estimation via a Semi-Parametric Approach: Evidence from the Stock Markets

This study utilizes the parametric approach (GARCH-based models) and the semi-parametric approach of Hull and White (1998) (HW-based models) to estimate the Value-at-Risk (VaR) through the accuracy evaluation of accuracy for the eight stock indices in Europe and Asia stock markets. The measure of accuracy includes the unconditional coverage test by Kupiec (1995) as well as two loss functions, quadratic loss function and unexpected loss. As to the parametric approach, the parameters of generalized autoregressive conditional heteroskedasticity (GARCH) model are estimated by the method of maximum likelihood and the quantiles of asymmetric distribution like skewed generalized student's t (SGT) can be solved by composite trapezoid rule. Sequentially, the VaR is evaluated by the framework proposed by Jorion (2000). Turning to the semi-parametric approach of Hull and White (1998), before performing the traditional historical simulation, the raw return series is scaled by a volatility ratio where the volatility is estimated by the same procedure of parametric approach.

Keywords: Value-at-risk, Semi-parametric approach, Parametric approach, Generalized autoregressive conditional heteroskedasticity, Skewed generalized student's *t*, Composite trapezoid rule, Method of maximum likelihood, Unconditional coverage test, Loss function

Chapter 52: Modeling Multiple Asset Returns by a Time-Varying *t* Copula Model

This chapter illustrates a framework to model joint distributions of multiple asset returns using a time-varying Student's *t* copula model. We model marginal distributions of individual asset returns by a variant of GARCH models and then use a Student's *t* copula to connect all the margins. To build a time-varying structure for the correlation matrix of *t* copula, we employ a dynamic conditional correlation (DCC) specification. We illustrate the two-stage estimation procedures for the model and apply the model to 45 major US stocks returns selected from nine sectors. As it is quite challenging to find a copula function with very flexible parameter structure to account for difference dependence features among all pairs of random variables, our time-varying *t* copula model tends to be a good working tool to model multiple asset returns for risk management and asset allocation purposes. Our model can capture time-varying conditional correlation and some degree of tail dependence, while it also has limitations of featuring symmetric dependence and inability of generating high tail dependence when being used to model a large number of asset returns.

Keywords: Student's *t* copula, GARCH models, Asset returns, U.S. stocks, Maximum likelihood, Two-stage estimation, Tail dependence, Exceedance correlation, Dynamic conditional correlation, Asymmetric dependence

Chapter 53: Internet Bubble Examination with Mean-Variance Ratio

This chapter illustrates the superiority of the mean-variance ratio (MVR) test over the traditional SR test by applying both tests to analyze the performance of the S&P 500 index and the NASDAQ 100 index after the bursting of the Internet bubble in 2000s. This shows the superiority of the MVR test statistic in revealing short-term performance and, in turn, enables investors to make better decisions in their investments. The methodologies used in this chapter are mean-variance ratio, Sharpe ratio, hypothesis testing, and uniformly most powerful unbiased test.

Keywords: Mean-variance ratio, Sharpe ratio, Hypothesis testing, Uniformly most powerful unbiased test, Internet bubble, Fund management

Chapter 54: Quantile Regression in Risk Calibration

This chapter uses the CoVaR (Conditional VaR) framework to obtain accurate information on the interdependency of risk factors. The basic technical elements of CoVaR estimation are two levels of quantile regression: one on market risk factors; another on individual risk factor. Tests on the functional form of the two-level quantile regression reject the linearity. A flexible semi-parametric modeling framework for CoVaR is proposed. A partial linear model (PLM) is analyzed. In applying the technology to stock data covering the crisis period, the PLM outperforms in the crisis time, with the justification of the backtesting procedures. Moreover, using the data on global stock markets indices, the analysis on marginal contribution of risk (MCR) defined as the local first order derivative of the quantile curve sheds some light on the source of the global market risk.

Keywords: CoVAR, Value-at-risk, Quantile regression, Locally linear quantile regression, Partial linear model, Semi-parametric model

Chapter 55: Strike Prices of Options for Overconfident Executives

This chapter uses Monte Carlo simulation to investigate the impacts of managerial overconfidence on the optimal strike prices of executive incentive options. Although it has been shown that optimally managerial incentive options should be awarded in-the-money, in practice, most firms award them at-the-money. We show that the optimal strike prices of options granted to overconfident executive are directly related to their overconfidence level, and that this bias brings the optimal strike prices closer to the institutionally prevalent at-the-money prices. The Monte Carlo simulation procedure uses a Mathematica program to find the optimal effort by managers and the optimal (for stockholders) contract parameters. An expanded discussion of the simulations, including the choice of the functional forms and the calibration of the parameters, is provided.

Keywords: Overconfidence, Managerial effort, Incentive options, Strike price, Simulations, Behavioral finance, Executive compensation schemes, Mathematica optimization, Risk aversion, Effort aversion

Chapter 56: Density and Conditional Distribution Based Specification Analysis

This chapter uses densities and conditional distributions analysis to carry out consistent specification testing and model selection among multiple diffusion processes. In this chapter, we discuss advances to this literature introduced by Corradi and Swanson (2005), who compare the cumulative distribution (marginal or joint) implied by a hypothesized null model with corresponding empirical distributions of observed data. In particular, parametric specification tests in the spirit of the conditional Kolmogorov test of Andrews (1997) that rely on block bootstrap resampling methods in order to construct test critical values are discussed. The methodologies used in this chapter are continuous time simulation methods, single process specification testing, multiple process model selection, and multifactor diffusion process, block bootstrap, and jump process.

Keywords: Multifactor diffusion process, Specification test, Out-of-sample forecasts, Conditional distribution, Model selection, Block bootstrap, Jump process

Chapter 57: Assessing the Performance of Estimators Dealing with Measurement Errors

This chapter describes different procedures to deal with measurement error in linear models, and assess their performance in finite samples using Monte Carlo simulations, and data on corporate investment. We consider the standard instrumental variables approach proposed by Griliches and Hausman (1986) as extended by Biorn (2000) [OLS-IV], the Arellano and Bond (1991) instrumental variable estimator, and the higher-order moment estimator proposed by Erickson and Whited (2000, 2002). Our analysis focuses on characterizing the conditions under which each of these estimators produces unbiased and efficient estimates in a standard "errors in variables" setting. In the presence of fixed effects, under heteroscedasticity, or in the absence of a very high degree of skewness in the data, the EW estimator is inefficient and returns biased estimates for mismeasured and perfectly measured regressors. In contrast to the EW estimator, IV-type estimators (OLS-IV and AB-GMM) easily handle individual effects, heteroskedastic errors, and different degrees of data skewness. The IV approach, however, requires assumptions about the autocorrelation structure of the mismeasured regressor and the measurement error. We illustrate the application of the different estimators using empirical investment models.

Keywords: Investment equations, Measurement error, Monte Carlo simulations, Instrumental variables, GMM, Bias, Fixed effects, Heteroscedasticity, Skewness, High-order moments

Chapter 58: Realized Distributions of Dynamic Conditional Correlation and Volatility Thresholds in the Crude Oil, Gold, and Dollar/Pound Currency Markets

This chapter proposes a modeling framework for the study of co-movements in price changes among crude oil, gold, and dollar/pound currencies that are conditional on volatility regimes. Methodologically, we extend the Dynamic Conditional Correlation (DCC) multivariate GARCH model to examine the volatility and correlation dynamics depending on the variances of price returns involving a threshold structure. The results indicate that the periods of market turbulence are associated with an increase in co-movements in commodity (gold and oil) prices. The results imply that gold may act as a safe haven against major currencies when investors face market turmoil.

Keywords: Dynamic conditional correlation, Volatility threshold, Realized distribution, Currency market, Gold, Oil

Chapter 59: Pre-IT Policy, Post-IT Policy, and the Real Sphere in Turkey

We estimate Two SVECM (Structural Vector Error Correction) Models for the Turkish economy based on imposing short run and Long-run restrictions that accounts for examining the behavior of the real sphere in the Pre-IT policy (before Inflation-Targeting adoption) and Post-IT policy (after Inflation-Targeting Adoption). Responses reveals that an expansionary interest policy shock leads to a decrease in price level, a fall in output, an appreciation in the exchange rate, an improvement in the share prices in the very short run for the most of Pre-IT period.

Keywords: SVECM models, Turkish economy, Short run, Long run, Restrictions, Inflation targeting, Pre-IT policy, Post-IT policy, Share prices, Exchange rate, Monetary policy shock, Output, Price level, Real sphere

Chapter 60: Determination of Capital Structure: A LISREL Model Approach

In this chapter, we employ structural equation modeling (SEM) in LISREL system to solve the measurement errors problems in the analysis of the determinants of capital structure and find the important factors consistent with capital structure theory by using date from 2002 to 2010. The purpose of this chapter is to investigate whether the influences of accounting factors on capital structure change and whether the important factors are consistent with the previous literature. The methodologies discussed in this chapter are structural equation modeling (SEM), multiple indicators and multiple causes (MIMIC) model, LISREL system, simultaneous equations, and SEM with confirmatory factor analysis (CFA) approach.

Keywords: Capital structure, Structural equation modeling (SEM), Multiple indicators and multiple causes (MIMIC) model, LISREL system, Simultaneous equations, Latent variable, Determinants of capital structure, Error in variable problem

Chapter 61: Evaluating the Effectiveness of Futures Hedging

This chapter examines the Ederington hedging effectiveness (EHE) comparisons between unconditional OLS hedge strategy and other conditional hedge strategies. It is shown that OLS hedge strategy outperforms most of the optimal conditional hedge strategies when EHE is used as the hedging effectiveness criteria. Before concluding that OLS hedge is better than the others; however, we need to understand under what circumstances the result is derived. We explain why OLS is the best hedge strategy under EHE criteria in most cases, and how most conditional hedge strategies are judged as inferior to OLS hedge strategy by an EHE comparison.

Keywords: Futures hedging, Portfolio management, Ederington hedging effectiveness, Variance estimation, Unconditional variance, Conditional variance, OLS hedging strategy, GARCH hedging strategy, Regime-switching hedging strategy, Utility-based hedging strategy

Chapter 62: Evidence on Earning Management by Integrated Oil and Gas Companies

This chapter uses Jones Model (1991) which projects the expected level of discretionary accruals and demonstrates specific test methodology for detection of earnings management in the oil and gas industry. This study utilized several parametric and nonparametric statistical methods to test for such earnings management. By comparing actuals versus projected accruals, we are able to compute the total unexpected accruals. We also correlate unexpected total accruals with several difficult to manipulate indicators that reflect company's level of activities.

Keywords: Earning management, Jones (1991) model, Discretionary accruals, Income from operations, Nonrecurring items, Special items, Research and development expense, Write-downs, Political cost, Impression management, Oil and gas industry

Chapter 63: A Comparative Study of Two Models SV with MCMC Algorithm

This chapter examines two asymmetric stochastic volatility models used to describe the volatility dependencies found in most financial returns. The first is the autoregressive stochastic volatility model with Student's t-distribution (ARSV-t), and the second is the basic Svol of JPR (1994). In order to estimate these models, our analysis is based on the Markov Chain Monte Carlo (MCMC) method. Therefore,

the technique used is a Metropolishastings (Hastings 1970), and the Gibbs sampler (Casella and George 1992; Gelfand and Smith 1990; Gilks et al. 1993). The empirical results concerned on the Standard and Poor's 500 composite Index (S&P), CAC40, Nasdaq, Nikkei, and Dow-Jones stock price indexes reveal that the ARSV-t model provides a better performance than the Svol model on the Mean Squared Error (MSE) and the Maximum Likelihood function.

Keywords: Autoregression, Asymmetric stochastic volatility, MCMC, Metropolishastings, Gibbs sampler, Volatility dependencies, Student's t-distribution, SVOL, MSE, Financial returns, Stock price indexes

Chapter 64: Internal Control Material Weakness, Analysts' Accuracy and Bias, and Brokerage Reputation

This chapter uses the Ordinary Least-Squares (OLS) methodology in the main tests to examine the impact of internal control material weaknesses (ICMW hereafter) on sell side analysts. We match our ICMW firms with non-ICMWs based on industry, sales, and assets. We re-estimate the models using rank regression technique to assess the sensitivity of the results to the underlying functional form assumption made by OLS. We use Cook's distance to test the outliers.

Keywords: Internal control material weakness, Analyst forecast accuracy, Analyst forecast bias, Brokerage reputation, Sarbanes-Oxley act, Ordinary least squares regressions, Rank regressions, Fixed effects, Matching procedure, Cook's distance

Chapter 65: What Increases Banks' Vulnerability to Financial Crisis: Short-Term Financing or Illiquid Assets?

This chapter applies Logit and OLS econometric techniques to analyze the Federal Reserve Y-9C report data. We show that short-term financing is a response to the adverse economic shocks rather than a cause of the recent crisis. The likelihood of financial crisis actually stems from the illiquidity and low creditworthiness of the investment. Our results are robust to endogeneity concerns when we use a difference-in-differences (DiD) approach with the Lehman bankruptcy in 2008 proxying for an exogenous shock.

Keywords: Financial crisis, Short-term financing, Debt maturity, Liquidity risk, Deterioration of bank asset quality

Chapter 66: Accurate Formulae for Evaluating Barrier Options with Dividends Payout and the Application in Credit Risk Valuation

This chapter approximates the discrete dividend payout by a stochastic continuous dividend yield, so the post dividend stock price process can be approximated by another log-normally diffusive stock process with a stochastic continuous payout ratio up to the ex-dividend date. Accurate approximation analytical pricing

formulae for barrier options are derived by repeatedly applying the reflection principle. Besides, our formulae can be applied to extend the applicability of the first passage model – a branch of structural credit risk model. The stock price falls due to the dividend payout in the option pricing problem is analog to selling the firm's asset to finance the loan repayment or dividend payout in the first passage model. Thus, our formulae can evaluate vulnerable bonds or the equity values given that the firm's future loan/dividend payments are known.

Keywords: Barrier option, Option pricing, Stock option, Dividend, Reflection principle, Lognormal, Credit risk

Chapter 67: Pension Funds: Financial Econometrics on the Herding Phenomenon in Spain and the United Kingdom

This chapter uses the estimated cross-sectional standard deviations of betas to analyze if manager's behavior enhances the existence of herding phenomena and the impact of the Spanish and UK pension funds investment on the market efficiency. We also estimate the betas with an econometric technique less applied in the financial literature: state-space models and the Kalman filter. Additionally, in order to obtain a robust estimation, we apply the Huber estimator. Finally, we apply several models and study the existence of herding toward the market, size, book-to-market, and momentum factors.

Keywords: Herding, Pension funds, State-space models, Kalman filter, Huber estimation, Imitation, Behavioral finance, Estimated cross-sectional standard deviations of betas, Herding toward the market, Herding toward size factor, Herding toward book-to-market factor, and Herding toward momentum factor

Chapter 68: Estimating the Correlation of Asset Returns: A Quantile Dependence Perspective

This chapter uses the *Copula Quantile-on-Quantile Regression* (C-QQR) approach to construct the correlation between the conditional quantiles of stock returns. This new approach of estimating correlation utilizes the idea that the condition of a stock market is related to its return performance, particularly to the conditional quantile of its return, as the lower return quantiles reflect a weak market while the upper quantiles reflect a bullish one. The C-QQR approach uses the copula to generate a regression function for modeling the dependence between the conditional quantiles of the stock returns under consideration. It is estimated using a two-step quantile regression procedure, where in principle, the first step is implemented to model the conditional quantile of one stock return, which is then related in the second step to the conditional quantile of another return.

Keywords: Stock markets, Copula, Correlation, Quantile regression, Quantile dependence, Business cycle, Dynamics, Risk management, Investment, Tail risk, Extreme events, Market uncertainties

Chapter 69: Multi-criteria Decision Making for Evaluating Mutual Funds Investment Strategies

This chapter uses the criteria measurements to evaluate investment style and investigate multiple criteria decision-making (MCDM) problem. To achieve this objective, first, we employ factor analysis to extract independent common factors from those criteria. Second, we construct the evaluation frame using hierarchical system composed of the above common factors with evaluation criteria, and then derive the relative weights with respect to the considered criteria. Third, the synthetic utility value corresponding to each investment style is aggregated by the weights with performance values. Finally, we compare with empirical data and find that the model of MCDM predicts the rate of return.

Keywords: Investment strategies, Multiple Criteria Decision Making (MCDM), Hierarchical system, Investment style, Factor analysis, Synthetic utility value, Performance values

Chapter 70: Econometric Analysis of Currency Carry Trade

This chapter investigates carry trade strategy in the currency markets whereby investors fund positions in high interest rate currencies by selling low interest rate currencies to earn the interest rate differential. In this chapter, we first provide an overview of the risk and return profile of currency carry trade; second, we introduce two popular models, the regime-switch model and the logistic smooth transition regression model, to analyze carry trade returns because the carry trade returns are highly regime dependent. Finally, an empirical example is illustrated.

Keywords: Carry trade, Uncovered interest parity, Markov chain Monte Carlo, Regime-switch model, Logistic smooth transition regression model

Chapter 71: Analytical Bounds for Treasury Bond Futures Prices

This study employs a maximum likelihood estimation technique presented by Chen and Scott (1993) to estimate the parameters for two-factor Cox-Ingersoll-Ross models of the term structure. Following the estimation, the factor values are solved for by matching the short rate with the cheapest-to-deliver bond price. Then, upper bounds and lower bounds for Treasury bond futures prices can be calculated. This study first shows that the popular preference-free, closed-form cost of carry model is an upper bound for the Treasury bond futures price. Then, the next step is to derive analytical lower bounds for the futures price under one- and two-factor Cox-Ingersoll-Ross models of the term structure.

Keywords: Treasury bond futures, Delivery options, Cox-Ingersoll-Ross models, Bounds, Maximum likelihood estimation, Term structure, Cheapest-to-deliver bond, Timing options, Quality options, Chicago board of trade

Chapter 72: Rating Dynamics of Fallen Angels and Their Speculative Grade-Rated Peers: Static Versus Dynamic Approach

This study adopts the survival analysis framework (Allison 1984) to examine issuer-heterogeneity and time-heterogeneity in the rating migrations of fallen angels (FAs) and their speculative grade-rated peers (FA peers). Cox's hazard model is considered the pre-eminent method to estimate the probability that an issuer survives in its current rating grade at any point in time t over the time horizon T. In this study, estimation is based on two Cox's hazard models, including a proportional hazard model (Cox 1972) and a dynamic hazard model. The first model employs a static estimation approach and time-independent covariates, whereas the second uses a dynamic estimation approach and time-dependent covariates. To allow for any dependence among rating states of the same issuer, the marginal event-specific method (Wei et al. 1989) was used to obtain robust variance estimates. For validation purpose, the Brier score (Brier 1950) and its covariance decomposition (Yates 1982) were applied to assess the forecast performance of estimated models in forming time-varying survival probability estimates for issuers out-of-sample.

Keywords: Survival analysis, Hazard model, Time-varying covariate, Recurrent event, Brier score, Covariance decomposition, Rating migration, Fallen angel, Markov property, Issuer-heterogeneity, Time-heterogeneity

Chapter 73: Creation and Control of Bubbles: Managers Compensation Schemes, Risk Aversion, and Wealth and Short Sale Constraints

This chapter takes an alternative approach of inquiry – that of using laboratory experiments – to study the creation and control of speculative bubbles. The following three factors are chosen for analysis: the compensation scheme of portfolio managers, wealth and supply constraints, and the relative risk aversion of traders. Under a short investment horizon induced by a tournament compensation scheme, speculative bubbles are observed in markets of speculative traders and in mixed markets of conservative and speculative traders. The primary method of analysis is to use live subjects in a laboratory setting to generate original trading data, which are compared to their fundamental values. Standard statistical techniques are used to supplement analysis in explaining the divergence of asset prices from their fundamental values.

Keywords: Speculative bubbles, Laboratory experimental asset markets, Fundamental asset values, Tournament, Market efficiency, Behavioral finance, Ordinary least squares regression, Correlation

Chapter 74: Range Volatility: A Review of Models and Empirical Studies

In this chapter, we survey the significant development of range-based volatility models, beginning with the simple random walk model up to the conditional autoregressive range (CARR) model. For the extension to range-based multivariate volatilities, some approaches developed recently are adopted, such as the dynamic conditional correlation (DCC) model, the double smooth transition conditional correlation (DSTCC) GARCH model, and the copula method. At last, we introduce different approaches to build bias-adjusted realized range to obtain a more efficient estimator.

Keywords: Range, Volatility forecasting, Dynamic conditional correlation, Smooth transition, Copula, Realized volatility, Risk management

Chapter 75: Business Models: Applications to Capital Budgeting, Equity Value, and Return Attribution

This chapter describes a business model in a contingent claim modeling framework. The chapter then provides three applications of the business model. Firstly, the chapter determines the optimal capital budgeting decision in the presence of fixed operating costs, and shows how the fixed operating cost should be accounted by in an NPV calculation. Secondly, the chapter determines the values of equity value, the growth option, the retention option as the building blocks of primitive firm value. Using a sample of firms, the chapter illustrates a method in comparing the equity values of firms in the same business sector. Thirdly, the chapter relates the change in revenue to the change in equity value, showing how the combined operating leverage and financial leverage may affect the firm valuation and risks.

Keywords: Bottom-up capital budgeting, Business model, Capital budgeting, Contingent claim model, Equity value, Financial leverage, Fixed operating cost, Gross return on investment (GRI), Growth option, Market performance measure, NPV, Operating leverage, Relative value of equity, Retention option, Return attribution, Top-down capital budgeting, Wealth transfer

Chapter 76: VAR Models: Estimation, Inferences, and Applications

This chapter provides a brief overview of the basic Vector autoregression (VAR) approach by focusing on model estimation and statistical inferences. VAR models have been used extensive in finance and economic analysis. Applications of VAR models in some finance areas are discussed, including asset pricing, international finance, and market microstructure. It is shown that such approach provides a powerful tool to study financial market efficiency, stock return predictability, exchange rate dynamics, and information content of stock trades and market quality.

Keywords: VAR, Granger-causality test, Impulse response, Variance decomposition, Co-integration, Asset return predictability, Market quality, Information content of trades, Informational efficiency

Chapter 77: Model Selection for High-Dimensional Problems

This chapter introduces penalized least squares, which seek to keep important predictors in a model, while penalizing coefficients associated with irrelevant predictors. As such, under certain conditions, penalized least squares can lead to a sparse solution for linear models and achieve asymptotic consistency in separating relevant variables from irrelevant ones. We then review independence screening, a recently developed method for analyzing ultrahigh-dimensional data where the number of variables or parameters can be exponentially larger than the sample size. Independence screening selects relevant variables based on certain measures of marginal correlations between candidate variables and the response. Finally, we discuss and advocate multistage procedures that combine independence screening and variable selection and that may be especially suitable for analyzing high-frequency financial data.

Keywords: Model selection, Variable selection, Dimension reduction, Independence screening, High-dimensional data, Ultrahigh-dimensional data, Generalized correlations, Penalized least squares, Shrinkage, Statistical learning, SCAD penalty, Oracle property

Chapter 78: Hedonic Regression Models

The chapter examines three specific, different hedonic specifications: the linear, semi-log, and Box-Cox transformed hedonic models and applies them to real estate data. It also discusses recent innovations related to hedonic models and how these models are being used in contemporary studies. This provides a basic overview of the nature and variety of hedonic empirical pricing models that are employed in the economics literature. It explores the history of hedonic modeling and summarizes the field's utility-theory-based, microeconomic foundations. It also provides a discussion of and potential solutions for common problems associated with hedonic modeling.

Keywords: Hedonic models, Regression, Real estate, Box-Cox, Pricing, Price indexes, Semi-log, Least squares, Housing, Property

Chapter 79: Optimal Payout Ratio Under Uncertainty and the Flexibility Hypothesis: Theory and Empirical Evidence

We theoretically extend the proposition of DeAngelo and DeAngelo's (2006) optimal payout policy in terms of the flexibility dividend hypothesis. We also

introduce growth rate, systematic risk, and total risk variables into the theoretical model. We use a panel data collected in the USA from 1969 to 2009 to empirically investigate the impact of growth rate, systematic risk, and total risk on the optimal payout ratio in terms of the fixed-effects model. Furthermore, we implement the moving estimates process to find the empirical breakpoint of the structural change for the relationship between the payout ratio and risks and confirm that the empirical breakpoint is not different from our theoretical breakpoint. Our theoretical model and empirical results can therefore be used to identify whether flexibility or the free cash flow hypothesis should be used to determine the dividend policy.

Keywords: Dividends, Payout policy, Optimal payout ratio, Flexibility hypothesis, Free cash flow hypothesis, Signaling hypothesis, Fixed effect, Clustering effect, Structural change model, Moving estimates processes, Systematic risk, Total risk, Market perfection

Chapter 80: Modeling Asset Returns with Skewness, Kurtosis, and Outliers

This chapter uses an exponential generalized beta distribution of the second kind (EGB2) to model the returns on 30 Dow-Jones industrial stocks. The model accounts for stock return characteristics, including fat tails, peakedness (leptokurtosis), skewness, clustered conditional variance, and leverage effect. The goodness-of-fit statistic provides supporting evidence in favor of EGB2 distribution in modeling stock returns. The EGB2 distribution used in this chapter is a four parameter distribution. It has a closed-form density function, and its higher-order moments are finite and explicitly expressed by its parameters. The EGB2 distribution nests many widely used distributions such as normal distribution, log-normal distribution, Weibull distribution, and standard logistic distribution.

Keywords: Expected stock return, Higher moments, EGB2 distribution, Risk management, Volatility, Conditional skewness, Risk premium

Chapter 81: Does Revenue Momentum Drive or Ride Earnings or Price Momentum?

This chapter performs dominance test to show that revenue surprises, earnings surprises, and prior returns, each lead to significant momentum returns that cannot be fully explained by the others, suggesting that each convey some exclusive and unpriced information content. Also, the joint implications of revenue surprises, earnings surprises, and prior returns are underestimated by investors, particularly when information variables point in the same direction. Momentum

cross-contingencies are observed in that momentum profits driven by firm fundamental information positively depend on the accompanying firm market information, and vice versa. A three-way combined momentum strategy may offer monthly return as high as 1.44%.

Keywords: Earnings surprises, Momentum strategies, Post-earnings-announcement drift, Revenue surprises

Chapter 82: A VG-NGARCH Model for Impacts of Extreme Events on Stock Returns

This chapter compares two types of GARCH models, namely, the VG-NGARCH and the GARCH-jump model with autoregressive conditional jump intensity, i.e., the GARJI model, to make inferences on the log of stock returns when there are irregular substantial price fluctuations. The VG-NGARCH model imposes a nonlinear asymmetric structure on the conditional shape parameters in a variance-gamma process, which describes the arrival rates for news with different degrees of influence on price movements, and provides an ex ante probability for the occurrence of large price movements. On the other hand, the GARJI model, a mixed GARCH-jump model proposed by Chan and Maheu (2002), adopts two independent autoregressive processes to model the variances corresponding to moderate and large price movements, respectively.

Keywords: VG-NGARCH model, GARCH-jump model, Autoregressive conditional jump intensity, GARJI model, Substantial price fluctuations, Shape parameter, Variance-gamma process, Ex ante probability, Daily stock price, Goodness-of-fit

Chapter 83: Risk-Averse Portfolio Optimization via Stochastic Dominance Constraints

This chapter presents a new approach to portfolio selection based on stochastic dominance. The portfolio return rate in the new model is required to stochastically dominate a random benchmark. We formulate optimality conditions and duality relations for these models and construct equivalent optimization models with utility functions. Two different formulations of the stochastic dominance constraint, primal and inverse, lead to two dual problems which involve von Neuman–Morgenstern utility functions for the primal formulation and rank dependent (or dual) utility functions for the inverse formulation. We also discuss the relations of our approach to value-at-risk and conditional value-at-risk.

Keywords: Portfolio optimization, Stochastic dominance, Stochastic order, Risk, Expected utility, Duality, Rank dependent utility, Yaari's dual utility, Value-at-risk, Conditional value-at-risk

Chapter 84: Implementation Problems and Solutions in Stochastic Volatility Models of the Heston Type

This chapter compares three major approaches to solve the numerical instability problem inherent in the fundamental solution of the Heston model. In this chapter, we used the fundamental transform method proposed by Lewis to reduce the number of variables from two to one and separate the payoff function from the calculation of the Green function for option pricing. We show that the simple adjusted-formula method is much simpler than the rotation-corrected angle method of Kahl and Jäckel and also greatly superior to the direct integration method of Shaw if taking computing time into consideration.

Keywords: Heston, Stochastic volatility, Fourier inversion, Fundamental transform, Complex logarithm, Rotation-corrected angle, Simple adjusted formula, Green function

Chapter 85: Stochastic Change-Point Models of Asset Returns and Their Volatilities

This chapter considers two time-scales and uses the "short" time-scale to define GARCH dynamics and the "long" time-scale to incorporate parameter jumps. This leads to a Bayesian change-point ARX-GARCH model, whose unknown parameters may undergo occasional changes at unspecified times and can be estimated by explicit recursive formulas when the hyperparameters of the Bayesian model are specified. Efficient estimators of the hyperparameters of the Bayesian model can be developed. The empirical Bayes approach can be applied to the frequentist problem of partitioning the time series into segments under sparsity assumptions on the change-points.

Keywords: ARX-GARCH, Bounded complexity, Contemporaneous jumps, Change-point models, Empirical Bayes, Frequentist segmentation, Hidden Markov models, Hyperparameter estimation, Markov chain Monte Carlo, Recursive filters, Regression models, Stochastic volatility

Chapter 86: Unspanned Stochastic Volatilities and Interest Rate Derivatives Pricing

This chapter first reviews the recent literature on the Unspanned Stochastic Volatilities (USV) documented in the interest rate derivatives markets. The USV refers to the volatilities factors implied in the interest rate derivatives prices that have little correlation with the yield curve factors. We then present the result in Li and Zhao (2006) that a sophisticated DTSM without USV feature can have serious difficulties in hedging caps and cap straddles, even though they capture bond yields well. Furthermore, at-the-money straddle hedging errors are highly correlated with cap-implied volatilities and can explain a large fraction of hedging errors of all caps and straddles across moneyness and maturities. We also present a multifactor

term structure model with stochastic volatility and jumps that yields a closed-form formula for cap prices from Jarrow et al. (2007). The three-factor stochastic volatility model with Poisson jumps can price interest rate caps well across moneyness and maturity. The econometric methods in this chapter include extended Kalman filtering, maximum likelihood estimation with latent variables, local polynomial method, and nonparametric density estimation.

Keywords: Term structure modeling, Interest rate volatility, Heath-Jarrow-Morton model, Nonparametric density estimation, Extended Kalman filtering

Chapter 87: Alternative Equity Valuation Models

This chapter examines alternative equity valuation models and their ability to forecast future stock prices. We use simultaneous equations estimation technique to investigate the stock price forecast ability of Ohlson's model, Feltham and Ohlson's Model, and Warren and Shelton's (1971) model. Moreover, we use the combined forecasting methods proposed by Granger and Newbold (1973) and Granger and Ramanathan (1984) to form combined stock price forecasts from individual models. Finally, we examine whether comprehensive earnings can provide incremental price-relevant information beyond net income.

Keywords: Ohlson model, Feltham and Ohlson model, Warren and Shelton model, Equity valuation models, Simultaneous equations estimation, Fundamental analysis, Financial statement analysis, Financial planning and forecasting, Combined forecasting, Comprehensive earnings, Abnormal earnings, Operating earnings, Accounting earnings

Chapter 88: Time Series Models to Predict the Net Asset Value (NAV) of an Asset Allocation Mutual Fund VWELX

This research examines the use of various forms of time-series models to predict the total net asset value (NAV) of an asset allocation mutual fund. The first set of model structures included simple exponential smoothing, double exponential smoothing, and the Winter's method of smoothing. The second set of predictive models used represented trend models. They were developed using regression estimation. They included linear trend model, quadratic trend model, and an exponential model. The third type of method used was a moving average method. The fourth set of models incorporated the Box-Jenkins method, including an autoregressive model, a moving average model, and an unbounded autoregressive and moving average method.

Keywords: NAV of a mutual fund, Asset allocation fund, Combination of forecasts, Single exponential smoothing, Double exponential smoothing, Winter's method, Linear trend model, Quadratic trend model, Exponential trend model, Moving average method, Autoregressive model, Moving average model, Unbounded autoregressive moving average model

Chapter 89: Discriminant Analysis and Factor Analysis: Theory and Method

This chapter discusses three multivariate techniques in detail: discriminant analysis, factor analysis, and principal component analysis. In addition, the stepwise discriminant analysis by Pinches and Mingo (1973) is improved using a goal programming technique. These methodologies are applied to determine useful financial ratios and the subsequent bond ratings. The analysis shows that the stepwise discriminant analysis fails to be an efficient solution as the hybrid approach using the goal programming technique outperforms it, which is a compromised solution for the maximization of the two objectives, namely, the maximization of the explanatory power and the maximization of discriminant power.

Keywords: Multivariate technique, Discriminant analysis, Factor analysis, Principle component analysis, Stepwise discriminant analysis, Goal programming, Bond ratings, Compromised solution, Explanatory power, Discriminant power

Chapter 90: Implied Volatility: Theory and Empirical Method

This chapter reviews the different theoretical methods used to estimate implied standard deviation and to show how the implied volatility can be estimated in empirical work. The OLS method for estimating implied standard deviation is first introduced and the formulas derived by applying a Taylor series expansion method to Black-Scholes option pricing model are also described. Three approaches of estimating implied volatility are derived from one, two, and three options, respectively. Because of these formulas with the remainder terms, the accuracy of these formulas depends on how an underlying asset is close to the present value of exercise price in an option. The formula utilizing three options for estimating implied volatility is more accurate rather than other two approaches. In this chapter, we use call options on S&P 500 index futures in 2010 and 2011 to illustrate how MATLAB can be used to deal with the issue of convergence in estimating implied volatility of future options.

Keywords: Implied volatility, Implied standard deviation (ISD), Option pricing model, MATLAB, Taylor series expansion, Ordinary least-squares (OLS), Black-Scholes Model, Options on S&P 500 index futures

Chapter 91: Measuring Credit Risk in a Factor Copula Model

This chapter uses a new approach to estimate future credit risk on target portfolio based on the framework of CreditMetricsTM by J.P. Morgan. However, we adopt the perspective of factor copula and then bring the principal component analysis concept into factor structure to construct a more appropriate dependence structure among credits. In order to examine the proposed method, we use real market data instead of a virtual one. We also develop a tool for risk analysis which is convenient to use,

especially for banking loan businesses. The results show the fact that people assume dependence structures are normally distributed will indeed lead to risks underestimate. On the other hand, our proposed method captures better features of risks and shows the fat-tail effects conspicuously even though assuming the factors are normally distributed.

Keywords: Credit risk, Credit VaR, Default correlation, Copula, Factor copula, Principal component analysis

Chapter 92: Instantaneous Volatility Estimation by Nonparametric Fourier Transform Methods

This chapter conducts some simulation tests to justify the effectiveness of the Fourier transform method. Malliavin and Mancino (2009) proposed a nonparametric Fourier transform method to estimate the instantaneous volatility under the assumption that the underlying asset price process is a semi-martingale. Two correction schemes are proposed to improve the accuracy of volatility estimation. By means of these Fourier transform methods, some documented phenomena such as volatility daily effect and multiple risk factors of volatility can be observed. Then, a linear hypothesis between the instantaneous volatility and VIX derived from Zhang and Zhu (2006) is investigated.

Keywords: Information content, Instantaneous volatility, Fourier transform method, Bias reduction, Correction method, Local volatility, Stochastic volatility, VIX, Volatility daily effect, Online estimation

Chapter 93: A Dynamic CAPM with Supply Effect: Theory and Empirical Results

This chapter first theoretically extends Black's CAPM, and then uses price, dividend per share, and earnings per share to test the existence of supply effect with US equity data. A simultaneous equation system is constructed through a standard structural form of a multi-period equation to represent the dynamic relationship between supply and demand for capital assets. The equation system is exactly identified under our specification. Then, two hypotheses related to supply effect are tested regarding the parameters in the reduced-form system. The equation system is estimated by the Seemingly Unrelated Regression (SUR) method, since SUR allows one to estimate the presented system simultaneously while accounting for the correlated errors.

Keywords: CAPM, Asset, Endogenous supply, Simultaneous equations

Chapter 94: A Generalized Model for Optimum Futures Hedge Ratio

This chapter proposes the generalized hyperbolic distribution as the joint log-return distribution of the spot and futures. Using the parameters in this distribution, we derive several most widely used optimal hedge ratios: minimum variance,

maximum Sharpe measure, and minimum generalized semivariance. To estimate these optimal hedge ratios, we first write down the log-likelihood functions for symmetric hyperbolic distributions. Then, we estimate these parameters by maximizing the log-likelihood functions. Using these MLE parameters for the generalized hyperbolic distributions, we obtain the minimum variance hedge ratio and the optimal Sharp hedge ratio. Also based on the MLE parameters and the numerical method, we can calculate the minimum generalized semivariance hedge ratio.

Keywords: Optimal hedge ratio, Generalized hyperbolic distribution, Martingale property, Minimum variance hedge ratio, Minimum generalized semi-invariance, Maximum Sharp measure, Joint-normality assumption, Hedging effectiveness

Chapter 95: Instrument Variable Approach to Correct for Endogeneity in Finance

This chapter reviews the instrumental variables (IV) approach to endogeneity from the point of view of a finance researcher who is implementing instrumental variable methods in empirical studies. This chapter is organized into two parts. Part I discusses the general procedure of the instrumental variable approach, including Two-Stage Least Square (2SLS) and Generalized Method of Moments (GMM), the related diagnostic statistics for assessing the validity of instruments, which are important but not used very often in finance applications, and some recent advances in econometrics research on weak instruments. Part II surveys corporate finance applications of instrumental variables. We found that the instrumental variables used in finance studies are usually chosen arbitrarily, and very few diagnostic statistics are performed to assess the adequacy of IV estimation. The resulting IV estimates thus are questionable.

Keywords: Endogeneity, OLS, Instrumental variable (IV) estimation, Simultaneous equations, 2SLS, GMM, Overidentifying restrictions, Exogeneity test, Weak instruments, Anderson-Rubin statistic, Empirical corporate finance

Chapter 96: Application of Poisson Mixtures in the Estimation of Probability of Informed Trading

This research first discusses the evolution of probability of informed trading in the finance literature. Motivated by asymmetric effects, e.g., return and trading volume in up and down markets, this study modifies a mixture of the Poisson distribution model by different arrival rates of informed buys and sells to measure the probability of informed trading proposed by Easley et al. (1996). By applying the expectation–maximization (EM) algorithm to estimate the parameters of the model, we derive a set of equations for maximum likelihood estimation and these equations are encoded in a SAS Macro utilizing SAS/IML for implementation of the methodology.

Keywords: Probability of informed trading (*PIN*), Expectation–maximization (EM) algorithm, A mixture of Poisson distribution, Asset-pricing returns, Order imbalance, Information asymmetry, Bid-ask spreads, Market microstructure, Trade direction, Errors in variables

Chapter 97: CEO Stock Options and Analysts' Forecast Accuracy and Bias

This chapter uses ordinary least squares estimation to investigate the relations between CEO stock options and analysts' earnings forecast accuracy and bias. Our OLS models relate forecast accuracy and forecast bias (the dependent variables) to CEO stock options (the independent variable) and controls for earnings characteristics, firm characteristics, and forecast characteristics. In addition, the models include controls for industry and year. We use four measures of options: new options, existing exercisable options, existing unexercisable options, and total options (sum of the previous three), all scaled by total number of shares outstanding, and estimate two models for each dependent variable, one including total options and the other including new options, existing exercisable options, and existing unexercisable options. We also use both contemporaneous as well as lagged values of options in our main tests.

Keywords: CEO stock options, Analysts' forecast accuracy, Analysts' forecast bias, CEO compensation, Agency costs, Investment risk taking, Effort allocation, Opportunistic earnings management, Opportunistic disclosure management, Forecasting complexity

Chapter 98: Option Pricing and Hedging Performance Under Stochastic Volatility and Stochastic Interest Rates

This chapter fills this gap by first developing an implementable option model in closed form that admits both stochastic volatility and stochastic interest rates and that is parsimonious in the number of parameters. Based on the model, both delta-neutral and single-instrument minimum variance hedging strategies are derived analytically. Using S&P 500 option prices, we then compare the pricing and hedging performance of this model with that of three existing ones that, respectively, allow for (i) constant volatility and constant interest rates (the Black-Scholes), (ii) constant volatility but stochastic interest rates, and (iii) stochastic volatility but constant interest rates. Overall, incorporating stochastic volatility and stochastic interest rates produces the best performance in pricing and hedging, with the remaining pricing and hedging errors no longer systematically related to contract features. The second performer in the horse-race is the stochastic volatility model, followed by the stochastic interest rates model and then by the Black-Scholes.

Keywords: Stock option pricing, Stochastic volatility, Stochastic interest rates, Hedge ratios, Hedging, Pricing performance, and Hedging performance

Chapter 99: The Le Châtelier Principle of the Capital Market Equilibrium

This chapter purports to provide a theoretical underpinning for the problem of the Investment Company Act. The theory of the Le Chatelier Principle is well known in thermodynamics: The system tends to adjust itself to a new equilibrium as far as possible. In capital market equilibrium, added constraints on portfolio investment in each stock can lead to inefficiency manifested in the right-shifting efficiency frontier. According to the empirical study, the potential loss can amount to millions of dollars coupled with a higher risk-free rate and greater transaction and information costs.

Keywords: Markowitz model, Efficient frontiers, With constraints, Without constraints, Le Chatelier principle, Thermodynamics, Capital market equilibrium, Diversified mutual funds, Quadratic programming, Investment company act

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