

References

- Ahn, S., S. Dieckmann and M. F. Perez, 2008, Exploring the common factors in the term structure of credit spreads, *Arizona State University, working paper*.
- Armeanu, D., F. O. Balu and C. Obreja, 2008, Interest rate risk management using duration gap methodology. *Theoretical and Applied Economics*, 1, 3–10.
- Bao, J., J. Pan and J. Wang, 2011, The illiquidity of corporate bonds, *Journal of Finance*, 66, 3, 911–946.
- Beckworth, D., K. P. Moon and J. Holland Toles, 2010, Monetary policy and corporate bond yield spreads, *Applied Economics Letters*, 17, 1139–1144.
- Berd, A. M., R. Mashal and P. Wang, 2004, Consistent risk measures for credit bonds, *QCR Quarterly*, vol. 2004-Q3/Q4, Lehman Brothers.
- Bierwag, G. O., G. G. Kaufman and C. M. Latta, 1987, Bond portfolio immunization: Test of maturity, one- and two-factor duration matching strategies. *Financial Review*, May, 203–219.
- Bierwag, G. O., 1987. *Duration analysis: Managing interest rate risk*. Ballinger, Cambridge.
- Blanco, R., S. Brennan and I. W. Marsh, 2005, An empirical analysis of the dynamic relation between investment-grade bonds and credit default swaps, *Journal of Finance*, 60, 2255–2281.
- Bliss, R., 1997, Testing term structure estimation methods, *Advances in Futures and Options Research*, 9, 197–231.

- Bongaerts, D., F. De Jong and J. Driessen, 2011, Derivative pricing with liquidity risk: Theory and evidence from the credit default swap market, *Journal of Finance*, 66, 203–240.
- Burghardt, G. D., T. M. Belton, M. Lane and J. Papa, 2005, *The Treasury bond basis*. Library of investment and finance. McGraw-Hill, New York.
- Carcano, N. and S. Foresi, 1997, Hedging against interest rate risk: Reconsidering volatility-adjustment immunization, *Journal of Banking and Finance*, 21, 127–143.
- Carcano, N., 2009, Yield curve risk management: Adjusting principal component analysis for model errors, *Journal of Risk*, 12, 1, 3–16.
- Carcano, N., and H. Dall’O, 2011, Alternative models for hedging yield curve risk: An empirical comparison, *Journal of Banking and Finance*, 35, November, 2991–3000.
- Chambers, D. R., W. T. Carleton and R. M. McEnally, 1988, Immunizing default-free bond portfolios with a duration vector. *Journal of Financial and Quantitative Analysis*, 23, 89–104.
- Chang, J. H. and M. W. Hung, 2010, Liquidity spreads in the corporate bond market: Estimation using a semi-parametric model, *Journal of Applied Statistics*, 37, 3, 359–374.
- Chen, L., P. Collin-Dufresne and R. Goldstein, 2009, On the relation between the credit spread puzzle and the equity premium puzzle, *The Review of Financial Studies*, 22, 9, 3367–3409.
- Chen, L., D. Lesmond and J. Wei, 2007, Corporate yield spreads and bond liquidity, *Journal of Finance*, 62, 119–149.
- Choudhry, M., 2006, *The Futures Bond Basis*, John Wiley and Sons, West Sussex, England.
- Chance, D., 1989, *An introduction to derivatives*, Dryden, Virginia.
- Collin-Dufresne, P., R. S. Goldstein, and S. J. Martin, 2001, The Determinants of credit spread changes, *Journal of Finance*, 56, 2177–2207.
- Cumby, B. and M. Evans, 1995, The term structure of credit risk: Estimates and specification tests, Department of Economics, Georgetown University.
- Dastidar, S. G. and B. D. Phelps, 2009, Introducing LCS: Liquidity cost scores for U.S. credit bonds. *Barclays Capital Fixed-Income Research*, October 6.
- Dastidar, S. G. and B. D. Phelps, 2011, Credit spread decomposition: Decomposing bond-level credit OAS into default and liquidity components. *Journal of Portfolio Management*, Spring, 70–84.

- Duffie, D. and K. Singleton, 2003, *Credit Risk*, Princeton University Press, Princeton, NJ.
- Dynkin, L., A. Gould, J. Hyman, V. Konstantinovskiy and B. Phelps, 2007, *Quantitative Management of Bond Portfolios*, Princeton University Press, New Jersey.
- Elton, E., M. Gruber, D. Agrawal and C. Mann, 2001, Explaining the rate spread on corporate bonds, *Journal of Finance*, 56, 247–277.
- Eom, Y., J. Helwege and J. Huang, 2004, Structural models of corporate bond pricing: An empirical analysis, *Review of Financial Studies*, 17, 499–544.
- Ericsson, J. and O. Renault, 2006, Liquidity and credit risk, *Journal of Finance*, 61, 2219–2250.
- Falkenstein, E. and J. Hanweck, 1997, Minimizing basis risk from non-parallel shifts in the yield curve. Part II: principal components, *Journal of Fixed Income*, June, 85–90.
- Fama, E. F. and K. R. French, 1989, Business conditions and expected returns on stocks and bonds, *Journal of Financial Economics*, 25, 23–49.
- Fisher, L. and R. L. Weil, 1971, Coping with the risk of interest rate fluctuations: Returns to bondholders from naive and optimal strategies, *Journal of Business*, 4, 408–431.
- Fleming, J. and R. E. Whaley, 1994, The value of wildcard options, *Journal of Finance*, 49, 215–236.
- Fong, H. G. and F. J. Fabozzi, 1985, Derivation of risk immunization measures. In *Fixed Income Portfolio Management*. Dow Jones-Irwin, Homewood, IL, pp. 291–294.
- Fontana, A., 2010, Essays on credit spreads, Dissertation, University of Venice.
- Gabudean, R. and N. Schuehle, 2011, Volatility forecasting: A unified approach to building, estimating, and testing models, Barclays Research.
- Gabudean, R., A. Staal and A. Lazanas, 2012, Investing with risk premia factors: Return sources, portfolio construction, and tail risk management, Barclays Research.
- Grieses, R., 1986, Hedging corporate bond portfolios, *Journal of Portfolio Management*, Summer, 23–25.
- Grieses, R. and A. Marcus, 2005, Delivery options and treasury bond futures hedge ratios, *Journal of Derivatives*, 13, 70–76.

- Grievens, R., A. Marcus and A. Woodhams, 2010, Delivery options and convexity in Treasury bond and note futures, *Review of Financial Economics*, 19, 1–7.
- Henrard, M., 2006, Bond futures and their options: More than the cheapest-to-deliver; Quality option and margining, *Journal of Fixed Income*, 2, 62–75.
- Ho, T. S.Y., 1992, Key rate durations: Measures of interest rate risks, *Journal of Fixed Income*, 2, 29–44.
- Hodges, S. and N. Parekh, 2006, Term-structure slope risk: Convexity revisited, *Journal of Fixed Income*, 3, 54–60.
- Ilmanen, A., 2011, *Expected returns: An investor's guide to harvesting market rewards*, Wiley Finance.
- Ioannides, M. and F. S. Skinner, 1999, Hedging corporate bonds, *Journal of Business Finance & Accounting*, 26, 7 (Sept./Oct.), 919–944.
- Jacoby, G., R. C. Liao and J. A. Batten, 2009, Testing the elasticity of corporate yield spreads. *Journal of Financial and Quantitative Analysis*, 44, 3, 641–656.
- Klotz, R. G., 1985, *Convexity of fixed-income securities*. Salomon Brothers, New York.
- Kuberek, R. C. and G. P. Norman, 1983, Hedging corporate debt with U.S. Treasury bond futures, *Journal of Futures Markets*, 4, 345–353.
- Lesmond, D. A., J. P. Ogden and C. Trzcinka, 1999, A new estimate of transaction costs, *Review of Financial Studies*, 12, 1113–1141.
- Litterman, R. and J. Scheinkman, 1988, *Common factors affecting bond returns*, Financial Strategies Group Publications, September Goldman, Sachs & Co, New York.
- Lin, H., J. Wang and C. Wu, 2011, Liquidity risk and expected corporate bond returns, *Journal of Financial Economics*, 99, 628–650.
- Longstaff, F., S. Mithal and E. Neis, 2005, Corporate yield spreads: Default risk or liquidity? New evidence from the credit default swap market, *Journal of Finance*, 60, 2213–2253.
- Longstaff, F. A. and E. S. Schwartz, 1995, A simple approach to valuing risky fixed and floating rate debt, *Journal of Finance*, 50, 789–819.
- Macaulay, F. R., 1938, *The movements of interest rates, bond yields and stock prices in the United States since 1856*, National Bureau of Economic Research, New York.
- Marcus, A. and E. Ors, 1996, Hedging corporate bond portfolios across the business cycle, *Journal of Fixed Income*, 4, 4 (March), 56–60.

- Martellini, L. and P. Priaulet, 2001, *Fixed-income securities: Dynamic methods for interest rate risk pricing and hedging*, John Wiley & Sons Ltd, Baffins Lane, Chichester, England.
- Merton, R. C., 1974, On the pricing of corporate debt: The risk structure of interest rates, *Journal of Finance*, 29, 449–470.
- Moody's, 2011, *Corporate Default and Recovery Rates, 1920–2010*.
- Nashikkar, A., M. G. Subrahmanyam and S. Mahanti, 2011, Liquidity and arbitrage in the market for credit risk, *Journal of Financial and Quantitative Analysis*, 46, 627–656.
- Nawalkha, S. K. and D. R. Chambers, 1997, The M-vector model: Derivation and testing of extensions to M-square, *Journal of Portfolio Management*, Winter, 92–98.
- Nawalkha, S. K., G. M. Soto and N. A. Beliaeva, 2005, *Interest Rate Risk Modeling*, John Wiley & Sons, Inc., Hoboken, New Jersey.
- Nawalkha, S. K., G. M. Soto and J. Zhang, 2003, Generalized M-vector models for hedging interest rate risk, *Journal of Banking & Finance*, 27, 1581–1604.
- Ng, K. Y. and B. Phelps, 2010, Capturing credit spread premium, Barclays Research.
- Ng, K. Y. and B. Phelps, 2011, Promised spreads vs. realized returns, June 7, Conference Presentation, Barclays Research.
- O'Kane, D. and S. Turnbull, 2003, Valuation of credit default swaps, *Fixed Income and Quantitative Credit Research*, 2003, Q1/Q2, Lehman Brothers.
- Pedersen, C. M., 2006, Explaining the Lehman Brothers option adjusted spread of a corporate bond, *QCR Quarterly*, 2006, Q1, Lehman Brothers.
- Pond, M. and C. Mirani, 2009, TIPS: Predicting history, Barclays Research, March 13.
- Qi, H., S. Liu and C. Wu, 2010, Structural models of corporate bond pricing with personal taxes, *Journal of Banking and Finance*, 34, 1700–1718.
- Reitano, R. R., 1996, Non-parallel yield curve shifts and stochastic immunization. *Journal of Portfolio Management*, Winter, 71–78.
- Rendleman, R. J., 2004, Delivery options in the pricing and hedging of Treasury bond and note futures, *Journal of Fixed Income*, 2, 20–31.

Schaefer, S. M. and I. A. Strebulaev, 2008, Structural models of credit risk are useful: Evidence from hedge ratios on corporate bonds, *Journal of Financial Economics*, 90, 1–19.

Skinner, F. S., 1998, Hedging bonds subject to credit risk, *Journal of Banking and Finance*, 22, 321–345.

Van Landschoot, A., 2008, Determinants of yield spread dynamics: Euro versus US dollar corporate bonds, *Journal of Banking and Finance*, 32, 2597–2605.

Index

- ALM (Asset and Liability Management), 2
- barbell portfolio
 - hedging models, 34, 39
 - interest rate swaps, 16
 - sensitivity of PCA hedging models, 42
 - sub-sample analysis of bond futures, 41
 - testing hedging technique, 37, 38
 - US treasury bonds, 13, 14
- Barclays Gov/Corp Index, 101, 104, 106, 107
- BBB-rated bonds, 50
 - interest rates for, 56–7
 - statistics on spreads for, 62–3, 70
 - unexpected returns, 53–4, 59
 - yield curves, 62, 64–6, 68
- BK₁ model, Barclays, 109*n*4
- BK₂ model, Barclays, 95, 96, 109*n*6
- bond future, theoretical price of, 26
- BRAIS (Barclays Risk Analytics and Index Solutions), 108–9*n*1
- bullet portfolios
 - hedging models, 33–4, 39
 - interest rate swaps, 16
 - sensitivity of PCA hedging models, 42
 - sub-sample analysis of bond futures, 41
 - testing hedging technique, 37, 38
 - US treasury bonds, 13, 14
- butterfly portfolio
 - hedging models, 34, 39
 - interest rate swaps, 16
 - sensitivity of PCA hedging models, 42
 - sub-sample analysis of bond futures, 41
 - testing hedging technique, 37
 - US treasury bonds, 13, 14
- CDS (Credit Default Swaps)
 - basis, 51, 52, 69
 - hedging, 49, 51–2, 56, 112–14
 - hedging through T-bond futures and, 62, 68–70
- CDX contracts, 72, 74, 77*n*22
- CDX returns, 62, 85–6
- hedging strategies, 64, 66, 68–9, 71
- North American investment grade, 56
- CF (conversion factor), 26, 33
- CME (Chicago Mercantile Exchange), 33, 34, 45, 54–5, 74
- Consumer Confidence Index, 61, 67, 76*n*12
- convexity, concept of, 2, 17, 22

- corporate bond portfolios
 - aggregate, 48–9
 - CDS (Credit Default Swaps), 49, 51–2, 56, 62, 69–71, 112–14
 - dataset and calculation of unexpected returns, 52–6
 - equations using matrices and vectors, 72–4
 - equity index and volatility futures, 49–51
 - general framework, 56–9
 - hedging spreads, 48
 - hedging through T-bond futures, 59–61, 65–7
 - hedging through T-bond futures and credit default swaps, 62, 68–70
 - hedging through T-bond futures and S&P500 futures, 61, 67–8
 - methodology, 56–62
 - models for hedging, 4
 - predictability of hedging errors, 66
 - results by alternative hedging strategies, 62–70
 - statistics on spread of *BBB*-rated bonds, 63
 - treasury bond futures, 49, 76*n*9
 - variance reduction by alternative hedging, 64
- coupon bonds, 8, 11–12, 20*n*4, 53
- credit risk premium
 - analytical corporate excess returns, 82–7
 - analytical durations for non-call IG corporate index, 83
 - asset class performance and GDP growth, 97, 98, 99–100
 - asset class performance and inflation, 97, 98, 99–100
 - asset class performance with macroeconomic variables, 97, 99–100
 - constructing empirical duration measure, 87–90
 - corporate spreads and treasury yields, 94, 95
 - correlations of corporate spreads with treasury yields, 85–7, 96–100
 - default-adjusted duration, 83
 - duration ratios, 94, 95
 - empirical corporate excess returns, 87
 - long-term (Jan 1973–Nov. 2012), 93–100
 - measures of, 81–93
 - Non-Call Downgrade Tolerant (DGT) Corporate Index, 80, 85, 91–2, 103, 105–6, 109*n*2
 - Non-Call IG Corporate Index, 79, 80, 84–5, 89, 91, 93, 108, 109*n*2
 - optimal combination of IG corporates and treasuries, 101–7
 - option adjusted duration (OAD), 82–3
 - portfolio construction process, 103–4
 - selecting best empirical duration measure, 90–3
 - statistics of non-call corp indices, 85
- credit spread puzzle, 4, 48, 75*n*4
- CRSP database, 11–12, 33–4, 55
- CSA (Cash Settlement Amount), 56
- CTD (cheapest-to-deliver) bonds, 24–7, 39, 44, 77*n*19
- duration, 45*n*1
 - concept of, 2, 5*n*1, 17, 22
 - constructing empirical measure, 87–90
 - dynamic, in-sample empirical, 88
 - equation, 109*n*5
 - EWMA (exponentially weighted moving average), 89–92, 105, 106, 108
 - fixed, in-sample empirical, 88
 - forecast empirical, 89
 - long-term credit risk premium, 93–100
 - option adjusted duration (OAD), 83–8, 91, 92, 94–6
 - selecting best empirical measure, 90–3

- DV (duration vector) model, 3, 22, 45*n*2
 error-adjusted form, 38
 hedging results, 36–9, 41
 methodology, 30–2
 sub-sample analysis, 41
- end-of-the-month option, 45*n*4
- equity index and volatility futures, 49–51
- excess returns, 79–81
 analytical corporate, 82–7
 empirical corporate, 87
 long-term credit risk premium,
 93–100
- GDP (gross domestic product), asset
 class performance and, 97, 98,
 99–100
- GDV (generalized duration vector)
 model, 3, 22
 methodology, 30, 31–2
 minimization procedure, 46*n*8
- hedging equations, vectors and
 matrices, 72–4
- hedging errors
 predictability of, 66, 70–1
 standard deviation of, 20*n*5
- hedging methodology, 24–32
- hedging models
 DV (duration vector) model, 3, 22,
 30–2
 GDV (generalized duration vector)
 model, 3, 22, 30, 31–2
 multi-factor, 3, 22, 50, 70, 112–13
 PCA (principal component
 analysis), 8–11, 30
- Hessian matrix, PCA-hedging
 strategies, 19–20
- ICE (Intercontinental Exchange), 71
- IG Corporate Index, 79, 80, 108
- immunization, 2–3, 9, 22–3, 31
- index excess returns, 79–81
- industrial corporate bonds, 76*n*12
- inflation, asset class performance and,
 97, 98, 99–100
- interest rate risk, 2, 3–4
- interest rates, model error, 25
- interest rate swaps, PCA hedging
 strategies, 15, 16
- IRR (implied repo rate), 33, 77*n*19
- KRD (key rate duration)
 concept of, 3, 23, 45*n*2, 50
 error-adjusted form, 38
 hedging equations, 30, 32
 hedging results, 36–9, 41
 sub-sample analysis, 41
- ladder portfolio
 hedging models, 33, 39
 hedging quality, 53
 interest rate swaps, 16
 sensitivity of PCA hedging models, 42
 sub-sample analysis of bond
 futures, 41
 testing hedging technique, 37, 38
 US treasury bonds, 13, 14
- LCS (Liquidity Cost Scores), 75*n*2
- LDI (Liability Driven Investments), 7
- liability time bucket, 9, 20*n*7
- mean weights sensitivity, 43
- model error, interest rates, 25
- monetary policy, 75*n*7
- Moody's Baa Corporate Index,
 76*n*11–12, 96, 97
- M-square model, 3, 7, 17, 22
- multi-factor hedging techniques, 3, 22,
 50, 70, 112–13
- M-vector model, 3, 7, 17, 22
- Non-Call Downgrade-Tolerant (DGT)
 Corporate Index, 80, 85, 91–2, 103,
 105–6, 109*n*2
- Non-Call IG Corporate Index, 79, 80,
 84–5, 89, 91, 93, 108, 109*n*2
- PCA (principal component analysis)
 approximating unexpected return,
 17–18
 bullet portfolios, 11, 13, 14

- PCA (principal component analysis) –
continued
 controlling exposure to model errors, 23
 error-adjusted form, 38, 46*n*6
 hedging models, 8–11, 30, 45*n*2
 hedging results, 11–15, 36–43
 Hessian matrix of hedging strategies, 19–20
 immunization model, 22–3
 model errors, 16–18
 sensitivity of PCA hedging model, 42, 46*n*5
 statistical technique, 3, 7–8
 sub-sample analysis, 41
 USD interest rate swaps, 16
 US treasury bonds, 13, 14
 portfolio construction, 4–5
- S&P500 futures, 55
 hedging through T-bond futures and, 61, 67–8
 predictability of hedging errors, 66
 variance reduction, 64
- SEI (Standard Error of Immunization)
 hedging error, 34, 37, 38, 39, 41
 quality of hedging strategy, 12, 15
 USD interest rate swaps, 16
 US treasury bonds, 13
- self-financing constraint, 9, 18, 20*n*6, 24, 29, 30, 32
- sensitivity
 interest rate changes, 46*n*5
 mean weights, 43
 PCA hedging model, 42, 46*n*5
 volatility weights, 43
- Sharpe ratio, 79–80, 85, 92, 101–6, 108
- T-bond (treasury) futures, 49–52, 64, 65–7, 76*n*9
 CDX contract and, 64
 hedging through, 59–61, 65–7
 hedging through, and credit default swaps, 62, 68–70
 hedging through, and S&P500 futures, 61, 64, 67–8
 transaction fees, 12–13, 14
 treasury bonds, *see* T-bond futures; US treasury bonds
- unexpected returns
 approximating, 17–18
 corporate bonds and corporate yield curves, 52–4
 dataset and calculation of, 52–6
 North American investment grade CDX contracts, 56
 S&P500 futures, 55
 US Treasury bond futures and yield curves, 54–5
- US treasury bonds
 correlation of corporate spreads and treasury yields, 85–7, 96–100
 distance between yields of 2-, 5-, 10- and 30-year, 35
 futures and yield curves, 54–5
 hedging quality indicators, 13
 interest rate swaps, 15
 predictability of hedging errors, 66
 transaction fees, 14
- volatility weights sensitivity, 43
- wild card option, 45–6*n*4
- yield curve risk, 22
 dataset and testing approach, 32–6
 hedging methodology, 24–32
 model results, 36–43
- zero-coupon rates, 54, 68
 duration, 8
 maturity, 8, 25, 32
 Unsmoothed Fama-Bliss, 12, 33, 55
 zero-coupon risk-free rate, 8, 25
 zero-coupon yields, 57–60