Journal Club Ideas

Weston Barger

March 29, 2017

Papers

• The investment return from a portfolio with a dynamic rebalancing policy - Wise (1996)

  Abstract

  An analysis is made of the effect on portfolio performance if assets are continually rebalanced to constant market value proportions, relative to the passive buy and hold strategy. The probability that one strategy outperforms the other is evaluated on the basis of a geometric diffusion model of market prices and by reference to historical data.

• Volatility harvesting: Why does diversifying and rebalancing create portfolio growth? - Bouchey et al. (2012)

  Abstract

  Investors have traditionally equated volatility with risk and viewed it as unavoidable. However, volatility also affects how returns compound over time, which raises the question: Is it possible to profit from volatility? The answer is a definitive yes. This article explores the concept of volatility harvesting, or the extra growth generated from systematically diversifying and rebalancing a portfolio. The authors use the term harvesting because the activity is akin to farming, where seeds are spread widely and results are patiently harvested over time. This is in contrast to hunting for securities with high return potential. The excess return from volatility harvesting is not an expected arithmetic excess return derived from forecasting skill, security selection, or an informational advantage. Rather, it is the excess compounded return generated from rebalancing volatile assets over multiple time periods. This excess growth is available in liquid markets with assets that have volatilities greater than zero and correlations less than one. However, only investors with the discipline to trade systematically will harvest this extra growth.

• Implied volatility of leveraged ETF options - Leung and Sircar (2015)

  Abstract

  This paper studies the problem of understanding implied volatilities from options written on leveraged exchanged-traded funds (LETFs), with an emphasis on the relations between options on LETFs with different leverage ratios. We first examine from empirical data the implied volatility surfaces for LETFs based on the S&P 500 index, and we introduce the concept of moneyness scaling to enhance their comparison with non-leveraged ETF implied volatilities. Under a multiscale
stochastic volatility framework, we apply asymptotic techniques to derive an approximation for both the LETF option price and implied volatility. The approximation formula reflects the role of the leverage ratio, and thus allows us to link implied volatilities of options on an ETF and its leveraged counterparts. We apply our result to quantify matches and mismatches in the level and slope of the implied volatility skews for various LETF options using data from the underlying ETF option prices. This reveals some apparent biases in the leverage reflected in the different products, long and short with leverage ratios two times and three times.


  Abstract

  Employee stock options (ESOs) are American-style call options that can be terminated early due to employment shock. This paper studies an ESO valuation framework that accounts for job termination risk and jumps in the company stock price. Under general Lévy stock price dynamics, we show that a higher job termination risk induces the ESO holder to voluntarily accelerate exercise, which in turn reduces the cost to the company. The holder’s optimal exercise boundary and ESO cost are determined by solving an inhomogeneous partial integro-differential variational inequality (PIDVI). We apply Fourier transform to simplify the variational inequality and develop accurate numerical methods. Furthermore, when the stock price follows a geometric Brownian motion, we provide closed-form formulas for both the vested and unvested perpetual ESOs. Our model is also applied to evaluate the probabilities of understating ESO expenses and contract termination.

- Randomization and the American put - Carr (1998)

  Abstract

  While American calls on non-dividend paying stocks may be valued as European, there is no completely explicit exact solution for the values of American puts. We use a technique called randomization to value American puts and calls on dividend-paying stocks. This technique yields a new semi-explicit approximation for American option values in the Black-Scholes model. Numerical results indicate that the approximation is both accurate and computationally efficient.

- Mean field games and systemic risk - Carmona et al. (2013)

  Abstract

  We propose a simple model of inter-bank borrowing and lending where the evolution of the logmonetary reserves of N banks is described by a system of diffusion processes coupled through their drifts in such a way that stability of the system depends on the rate of inter-bank borrowing and lending. Systemic risk is characterized by a large number of banks reaching a default threshold by a given time horizon. Our model incorporates a game feature where each bank controls its rate of borrowing/lending to a central bank. The optimization reflects the desire of each bank to borrow from the central bank when its monetary reserve falls below a critical level or lend if it rises above this critical level which is chosen here as the average monetary reserve. Borrowing from or lending to the central bank is also subject to a quadratic cost at a rate which can be fixed by the regulator. We solve explicitly for Nash equilibria with finitely many players, and we show that in this model the central bank acts as a clearing house, adding liquidity to the system without affecting its systemic risk. We also study the corresponding Mean Field Game in the limit of large number of banks in the presence of a common noise.
• Mean field and n-agent games for optimal investment under relative performance criteria - Lacker and Zariphopoulou (2017)

Abstract

We analyze a family of portfolio management problems under relative performance criteria, for fund managers having CARA or CRRA utilities and trading in a common time horizon in log-normal markets. We construct explicit time-independent equilibrium strategies for both the finite population games and the corresponding mean field games, which we show are unique in the class of time-independent equilibria. In the CARA case, competition drives agents to invest more in the risky asset than they would otherwise, while in the CRRA case competitive agents may over- or under-invest, depending on their levels of risk tolerance.

• Implied vol for any local-stochastic vol model - Lorig et al. (2013)

Abstract

We consider an asset whose risk-neutral dynamics are described a general local-stochastic volatility model. In this setting, we derive a family of asymptotic expansions for the transition density of the underlying as well as for European-style option prices and for implied volatilities. Our expansions are numerically efficient. Approximate transition densities and implied volatilities are explicit; they do not require any special functions nor do they require numerical integration. Approximate option prices require only a Normal CDF (as is the case of the Black-Scholes setting). Additionally, we establish rigorous error bounds for our transition density expansion. To illustrate the accuracy and versatility of our implied volatility expansion, we implement our expansion under five different model dynamics: CEV local volatility, quadratic local volatility, Heston stochastic volatility, 3/2 stochastic volatility, and SABR local-stochastic volatility. Our implied volatility expansion is found to perform favorably compared to other well-known expansions for these models.

• Put-call symmetry: Extensions and applications - Carr and Lee (2009)

Abstract

Classic put-call symmetry relates the prices of puts and calls at strikes on opposite sides of the forward price. We extend put-call symmetry in several directions. Relaxing the assumptions, we generalize to unified local/stochastic volatility models and time-changed Levy processes, under a symmetry condition. Further relaxing the assumptions, we generalize to various asymmetric dynamics. Extending the conclusions, we take an arbitrarily given payoff of European style or single/double/sequential-barrier style, and we construct a conjugate European-style claim of equal value, and thereby a semi-static hedge of the given payoff.

Book Chapters

• Continuous-time stochastic control and optimization with financial applications (Chapters 3 or 4) - Pham (2009)

• Applied Stochastic Control of Jump Diffusions (Chapter 1) - Øksendal and Sulem (2005)

• Stochastic calculus for finance II: Continuous-time models (Chapters 7 or 8) - Shreve (2004)
References


