Pricing Bermudan Swaptions In The Libor Market Model

Quantitative Analysis, Derivatives Modeling, and Trading Strategies
A Practitioner's Guide
Choice of One Factor Interest Rate Term Structure Models for Pricing and Hedging Bermudan Swaptions
The SABR/LIBOR Market Model
Monte Carlo Methods for Pricing and Hedging
Explicit European Swaption Formula in a Separable One-Factor Libor Market Model; Extension to Bond Futures and 2-Bermudan Swaptions
In the Presence of Counterparty Credit Risk for the Fixed-Income Market
The Valuation of Caps, Floors and Swaptions in a Multi-Factor Spot-Rate Model
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Risk Managing Bermudan Swaptions in the Libor BGM Model
With Smile, Inflation and Credit

Collected Papers of the New York University Mathematical Finance Seminar(Volume II)
two approaches to pricing
An Introduction to Quantitative Finance

MICAH JOEL

Quantitative Analysis, Derivatives Modeling, and Trading Strategies
Springer
This book contains lectures delivered at the celebrated Seminar in Mathematical Finance at the Courant Institute. The lecturers and presenters of papers are prominent researchers and practitioners in the field of quantitative financial modeling. Most are faculty members at leading universities or Wall Street practitioners. The lectures deal with the emerging science of pricing and hedging derivative securities and, more generally, managing financial risk. Specific articles concern topics such as option theory, dynamic hedging, interest-rate modeling, portfolio theory, price forecasting using statistical methods, etc. Contents:Estimation and Data-Driven Models:Transition Densities for Interest Rate and Other Nonlinear Diffusions (Y Aït-Sahalia)Hidden Markov Experts (A

Weigend & S-M Shi)When is Time Continuous? (A Lo et al.)Asset Prices are Brownian Motion: Only in Business Time (H Geman et al.)Hedging Under Stochastic Volatility (K Ronnie Sircar)Model Calibration and Volatility Smile:Determining Volatility Surfaces and Option Values from an Implied Volatility Smile (P Carr & D Madan)Reconstructing the Unknown Local Volatility Function (T Coleman et al.)Building a Consistent Pricing Model from Observed Option Prices (J-P Laurent & D Leisen)Weighted Monte Carlo: A New Technique for Calibrating Asset-Pricing Models (M Avellaneda et al.)Pricing and Risk Management: One- and Multi-Factor Valuation of Mortgages: Computational Problems and Shortcuts (A Levin)Simulating Bermudan Interest-Rate Derivatives (P Carr & G Yang)How to Use Self-Similarities to Discover Similarities of Path-Dependent Options (A Lipton)Monte Carlo Within a Day (J Cárdenas et al.)Decomposition and Search Techniques in Disjunctive Programs for Portfolio Selection (K Wyatt) Readership: Students and researchers in economics, finance and applied mathematics. Keywords: A

Practitioner's Guide World Scientific This book introduces the mathematics of stochastic interest rate modeling and the pricing of related derivatives, based on a step-by-step presentation of concepts with a focus on explicit calculations. The types of interest rates considered range from short rates to forward rates such as LIBOR and swap rates, which are presented in the HJM and BGM frameworks. The pricing and hedging of interest rate and fixed income derivatives such as bond options, caps, and swaptions, are treated using forward measure techniques. An introduction to default bond pricing and an outlook on model calibration are also included as additional topics.This third edition represents a significant update on the second edition published by World Scientific in 2012. Most chapters have been reorganized and largely rewritten with additional details and supplementary solved exercises. New graphs and simulations based on market data have been included, together with the corresponding R codes.This new edition also contains 75 exercises and 4 problems with detailed solutions, making it suitable for advanced

undergraduate and graduate level students.

Choice of One Factor Interest Rate Term Structure Models for Pricing and Hedging Bermudan Swaptions

John Wiley & Sons

An up-to-date look at the evolution of interest rate swaps andderivatives Interest Rate Swaps and Derivatives bridges the gapbetween the theory of these instruments and their actual use inday-to-day life. This comprehensive guide covers the main "rates"products, including swaps, options (cap/floors, swaptions), CMSproducts, and Bermudan callables. It also covers the main valuationtechniques for the exotics/structured-notes area, which remains oneof the most challenging parts of the market. Provides a balance of relevant theory and real-world tradinginstruments for rate swaps and swap derivatives Uses simple settings and illustrations to reveal keyresults Written by an experienced trader who has worked with swaps,options, and exotics With this book, author Amir Sadr shares his valuable insightswith practitioners in the field of interest rate derivatives-fromtraders and marketers to those in operations.

The SABR/LIBOR Market Model

John Wiley & Sons
The class of interest rate models introduced by O. Cheyette in 1994 is a subclass of the general HJM framework with a time dependent volatility parameterization. This book addresses the above mentioned class of interest rate models and concentrates on the calibration, valuation and sensitivity analysis in multifactor models. It derives analytical pricing formulas for bonds and caplets and applies several numerical valuation techniques in the class of Cheyette model, i.e. Monte Carlo simulation, characteristic functions and PDE valuation based on sparse grids. Finally it focuses on the sensitivity analysis of Cheyette models and derives Model- and Market Greeks. To the best of our knowledge, this sensitivity analysis of interest rate derivatives in the class of Cheyette models is unique in the literature. Up to now the valuation of interest rate derivatives using PDEs has been restricted to 3 dimensions only, since the computational effort was too great. The author picks up the sparse grid technique, adjusts it slightly and can solve high-dimensional PDEs (four dimensions plus time)

accurately in reasonable time. Many topics investigated in this book are new areas of research and make a significant contribution to the scientific community of financial engineers. They also represent a valuable development for practitioners.
Monte Carlo Methods for Pricing and Hedging
Springer Science & Business Media
In the framework of the Libor Market Model (LMM) an explicit pricing formula is obtained for European swaptions. The LLM used is a displaced diffusion also called Bond Market Model (BMM). The results are similar to the one obtained for the Gaussian HJM. The extension to bond futures and 2-Bermuda swaptions is also provided.
Explicit European Swaption Formula in a Separable One-Factor Libor Market Model; Extension to Bond Futures and 2-Bermudan Swaptions
John Wiley & Sons
This paper compares the pricing and hedging performance of the LMM model against two spot-rate models, namely Hull-White and Black-Karasinski, and the more recent Swap Market Model from an Asset-Liability-Management (ALM) perspective. In contrast to previous studies in the literature, our

emphasis here is on ALM and we use hedging performance on Bermudan swaptions to proxy risk management outcome of long-term mortgage loans. Our tests involve calibrating the four interest rate models to European swaption prices for EURO and USD over the period February 2005 to September 2007. The calibrated models are then used to price and hedge a constant 11-year Bermudan swaption portfolio using a series of interest rate swaps and a 1-year holding-revision period. Our empirical results show that, the calibrated parameters of all four models are stable and their pricing errors are small and comparable. No single model dominates in the pricing exercise. The hedging performance of all four models is similar for the Euro market. For the USD market, the short rate models perform marginally better than SMM and LMM. The HW model is marginally better than BK model in terms of model parameter stability and smaller pricing and hedging errors.

In the Presence of Counterparty Credit Risk for the Fixed-Income Market Oxford University Press

Offering a unique

balance between applications and calculations, Monte Carlo Methods and Models in Finance and Insurance incorporates the application background of finance and insurance with the theory and applications of Monte Carlo methods. It presents recent methods and algorithms, including the multilevel Monte Carlo method, the statistical Romberg method, and the Heath–Platen estimator, as well as recent financial and actuarial models, such as the Cheyette and dynamic mortality models. The authors separately discuss Monte Carlo techniques, stochastic process basics, and the theoretical background and intuition behind financial and actuarial mathematics, before bringing the topics together to apply the Monte Carlo methods to areas of finance and insurance. This allows for the easy identification of standard Monte Carlo tools and for a detailed focus on the main principles of financial and insurance mathematics. The book describes high-level Monte Carlo methods for standard simulation and the simulation of stochastic processes with continuous and discontinuous paths. It also covers a wide selection of

popular models in finance and insurance, from Black–Scholes to stochastic volatility to interest rate to dynamic mortality. Through its many numerical and graphical illustrations and simple, insightful examples, this book provides a deep understanding of the scope of Monte Carlo methods and their use in various financial situations. The intuitive presentation encourages readers to implement and further develop the simulation methods. *The Valuation of Caps, Floors and Swaptions in a Multi-Factor Spot-Rate Model* Springer Science & Business Media This article presents a novel approach for calculating swap vega per bucket in the Libor BGM model. We show that for some forms of the volatility an approach based on re-calibration may lead to a large uncertainty in estimated swap vega, as the instantaneous volatility structure may be distorted by re-calibration. This does not happen in the case of constant swap rate volatility. We then derive an alternative approach, not based on re-calibration, by comparison with the swap market model. The strength of the method is that it accurately estimates vegas for any volatility

function and at a low number of simulation paths. The key to the method is that the perturbation in the Libor volatility is distributed in a clear, stable and well understood fashion, whereas in the re-calibration method the change in volatility is hidden and potentially unstable.
CRC Press
In recent years, interest-rate modeling has developed rapidly in terms of both practice and theory. The academic and practitioners' communities, however, have not always communicated as productively as would have been desirable. As a result, their research programs have often developed with little constructive interference. In this book, Riccardo Rebonato draws on his academic and professional experience, straddling both sides of the divide to bring together and build on what theory and trading have to offer. Rebonato begins by presenting the conceptual foundations for the application of the LIBOR market model to the pricing of interest-rate derivatives. Next he treats in great detail the calibration of this model to market prices, asking how possible and advisable it is to enforce a simultaneous fitting to several market observables. He does so

with an eye not only to mathematical feasibility but also to financial justification, while devoting special scrutiny to the implications of market incompletenes s. Much of the book concerns an original extension of the LIBOR market model, devised to account for implied volatility smiles. This is done by introducing a stochastic-volatility, displaced-diffusion version of the model. The emphasis again is on the financial justification and on the computational feasibility of the proposed solution to the smile problem. This book is must reading for quantitative researchers in financial houses, sophisticated practitioners in the derivatives area, and students of finance.

Choice of Interest Rate Term Structure Models for Assets and Liability Management John Wiley & Sons

This paper investigates the effect of interest rate correlation in the pricing of Bermudan swaptions. Investigating both Gaussian Markov models and Libor Market models, we find that Bermudan swaption prices depend only weakly on the number of factors in the underlying interest rate model. Moreover, we find that prices of standard Bermudan swaptions

typically decrease slightly in the number of factors, primarily a consequence of effects on the time evolution of volatility induced by calibration of the model dynamics. Our findings are markedly different from those of Longstaff, Schwarz, and Santa-Clara (1999) who conclude that single-factor interest rate models significantly undervalue Bermudan swaptions. We argue that the conclusions of Longstaff, Schwarz, and Santa-Clara are due to non-standard choices of model dynamics and calibration methodology. Our study highlights the importance of using a reasonable set of calibration instruments when applying and comparing interest rate models. **Valuation of Exotic Interest Rate Derivatives - Bermudans and Range Accruals** A Simple Approach to the Pricing of Bermudan Swaptions in the Multi-Factor Libor Market ModelThis paper considers the pricing of Bermuda-style swaptions in the Libor market model (Brace et al (1997), Jamshidian (1997), Miltersen et al (1997)) and its extensions (Andersen and Andreasen (1998)). Due to its large number of state variables, application of lattice methods to this model

class is generally not feasible, and we instead focus on a simple technique to incorporate early exercise features into the Monte Carlo method. Our approach involves a direct search for an early exercise boundary parametrized in intrinsic value and the values of still-alive swaptions. We compare results of the proposed algorithm against prices obtained from Markov Chain approximation s and finite difference methods. The proposed algorithm is fast and robust, and produces a lower bound on Bermuda swaption prices that appears to be very tight for many realistic structures. The paper contains several numerical results against which other methods can be tested.Pricing Bermudan Swaptions in the LIBOR Market ModelBermudan Swaptions in the Libor Market ModelBermudan swaptions have until recently been valued using only one-factor models such as the Black-Derman-Toy (BDT) or Black-Karasinski (BK) models. The LIBOR Market (LM) model which is a more general multi-factor model is becoming increasingly popular as a benchmark model. Whereas the BDT and BK models can be approximated using a lattice facilitating easy valuation

of Bermudan swaption, the LM model doesn't conform to the lattice framework and as such the valuation seems very difficult. Monte-Carlo simulation is a popular alternative to the lattice framework for derivatives valution. In order to facilitate valuation of Bermudan swaptions the Monte-Carlo simulation technique must be extended. A few methods doing this are presently available, eg [And98]. A common feature of these methods is that the estimated option premia are only lower bounds on the true premia. The Stochastic Mesh method proposed by [BG97b] for valuation of Bermudan (equity) options with applications to equity options provides a lower and an upper bound. We have applied this method to the LM model and use this to verify the premia found by Andersen. We will also apply the approach suggested in [LS98] to the LM model and verify the premia found using that approach. As it turns out this approach is a special case of the [And98] approach.Furthermore we also examine the impact on the Bermudan swaption premia when moving from a LM model with only one factor to a LM model with multiple factors and do indeed find a significant--

but not dramatic--impact. We find the [And98] and [LS98] approaches to be mutually consistent and in line with results obtained from low-biased Stochastic Mesh estimates.Pricing of Bermudan Swaptions Under OIS DiscountingFactor Dependence of Bermudan Swaption PricesFact or Fiction?This paper investigates the effect of interest rate correlation in the pricing of Bermudan swaptions. Investigating both Gaussian Markov models and Libor Market models, we find that Bermudan swaption prices depend only weakly on the number of factors in the underlying interest rate model. Moreover, we find that prices of standard Bermudan swaptions typically decrease slightly in the number of factors, primarily a consequence of effects on the time evolution of volatility induced by calibration of the model dynamics. Our findings are markedly different from those of Longstaff, Schwarz, and Santa-Clara (1999) who conclude that single-factor interest rate models significantly undervalue Bermudan swaptions. We argue that the conclusions of Longstaff, Schwarz, and Santa-Clara are due to non-standard choices of

model dynamics and calibration methodology. Our study highlights the importance of using a reasonable set of calibration instruments when applying and comparing interest rate models.Monte Carlo Methods for Pricing and HedgingApplications to Bermudan Swaptions and Convertible BondsBermudan swaptionstwo approaches to pricingPricing of Bermudan Swaptions Using Calibrated LIBOR Market ModelsPricing Models for Bermudan-style Interest Rate DerivativesChoice of One Factor Interest Rate Term Structure Models for Pricing and Hedging Bermudan SwaptionsModeling Derivatives in C++
We build a multi-factor, no-arbitrage model of the term structure of spot interest rates. The stochastic factors are the short-term interest rate and the premia of the futures rates over the short-term interest rates. In the three-factor version of the model, for example, the first factor is the three-month LIBOR, the second factor is the premium of the first futures LIBOR over spot LIBOR, and the third factor is the incremental premium of the second futures over the first. The model provides an extension of the lognormal interest rate model of Black and Karasinski

(1991) to multiple factors, each of which can exhibit mean-reversion.This method is computationally efficient for several reasons. First, we suggest calibrating the model to LIBOR futures prices, which enables us to satisfy the no-arbitrage condition without resorting to iterative methods. Second, we modify and implement the binomial approximation methodology of Nelson and Ramaswamy (1990) and Ho, Stapleton and Subrahmanyam (1995) to compute a multi-period tree of rates with the no-arbitrage property. The method uses a recombining two or three-dimensional binomial lattice of interest rates that minimizes the number of states and term structures over time. In addition to these computational advantages, a key feature of the model is that it is consistent with the observed term structure of futures rates as well as the term structure of volatilities implied by the prices of interest rate caps and floors. We use the model to price European-style and Bermuda-style swaptions and yield-spread options.To implement the methodology, we first calibrate the model to the caplet implied-volatility curve on a given day, and then use the model to price

European-style swaptions. We find that the two-factor model, where the LIBOR mean reverts rapidly to a slowly mean-reverting second factor, overprices the swaptions relative to market quotations. However, introducing a third factor significantly reduces the overpricing. The calibrated model is used to price Bermudan-style swaptions and yield-spread options. Then, we re-calibrated the two-factor model simultaneously to caplet and swaption prices and use the model output to price Bermudan-style swaptions.

Robust Libor Modelling and Pricing of Derivative Products
World Scientific

A Simple Approach to the Pricing of Bermudan Swaptions in the Multi-Factor Libor Market Model

Modern Pricing of Interest-Rate Derivatives
Princeton University Press

The first swap was executed over thirty years ago. Since then, the interest rate swaps and other derivative markets have grown and diversified in phenomenal directions. Derivatives are used today by a myriad of institutional investors for the purposes of risk management, expressing a view on the market, and pursuing market opportunities that are

otherwise unavailable using more traditional financial instruments. In this volume, Howard Corb explores the concepts behind interest rate swaps and the many derivatives that evolved from them. Corb's book uniquely marries academic rigor and real-world trading experience in a compelling, readable style. While it is filled with sophisticated formulas and analysis, the volume is geared toward a wide range of readers searching for an in-depth understanding of these markets. It serves as both a textbook for students and a must-have reference book for practitioners. Corb helps readers develop an intuitive feel for these products and their use in the market, providing a detailed introduction to more complicated trades and structures. Through examples of financial structuring, readers will come away with an understanding of how derivatives products are created and how they can be deconstructed and analyzed effectively. *Irregular Grid Methods for Pricing High-dimensional Amercian Options* John Wiley & Sons The 2nd edition of this successful book has several new features. The calibration discussion of the basic LIBOR market

model has been enriched considerably, with an analysis of the impact of the swaptions interpolation technique and of the exogenous instantaneous correlation on the calibration outputs. A discussion of historical estimation of the instantaneous correlation matrix and of rank reduction has been added, and a LIBOR-model consistent swaption-volatility interpolation technique has been introduced. The old sections devoted to the smile issue in the LIBOR market model have been enlarged into a new chapter. New sections on local-volatility dynamics, and on stochastic volatility models have been added, with a thorough treatment of the recently developed uncertain-volatility approach. Examples of calibrations to real market data are now considered. The fast-growing interest for hybrid products has led to a new chapter. A special focus here is devoted to the pricing of inflation-linked derivatives. The three final new chapters of this second edition are devoted to credit. Since Credit Derivatives are increasingly fundamental, and since in the reduced-form modeling framework much of the technique involved is analogous to

interest-rate modeling, Credit Derivatives -- mostly Credit Default Swaps (CDS), CDS Options and Constant Maturity CDS - are discussed, building on the basic short rate-models and market models introduced earlier for the default-free market. Counterparty risk in interest rate payoff valuation is also considered, motivated by the recent Basel II framework developments.

Bermudan swaptions

World Scientific This book addresses selected practical applications and recent developments in the areas of quantitative financial modeling in derivatives instruments, some of which are from the authorsOCO own research and practice. While the primary scope of this book is the fixed-income market (with further focus on the interest rate market), many of the methodologies presented also apply to other financial markets, such as the credit, equity, and foreign exchange markets. This book, which assumes that the reader is familiar with the basics of stochastic calculus and derivatives modeling, is written from the point of view of financial engineers or practitioners, and, as such, it puts more emphasis on the practical applications of financial mathematics in the real

market than the mathematics itself with precise (and tedious) technical conditions. It attempts to combine economic insights with mathematics and modeling so as to help the reader develop intuitions. In addition, the book addresses the counterparty credit risk modeling, pricing, and arbitraging strategies, which are relatively recent developments and are of increasing importance. It also discusses various trading structuring strategies and touches upon some popular credit/IR/FX hybrid products, such as PRDC, TARN, Snowballs, Snowbears, CCDS, credit extinguishers. "

Monte Carlo Methods and Models in Finance and Insurance

Columbia University Press

Leveraging the explicit formula for European swaptions and coupon-bond options in HJM one-factor model, we develop a semi-explicit formula for 2-Bermudan options (also called Canary options). We first extend the European swaption formula to future times. So equipped, we are able to reduce the valuation of a 2-Bermudan swaption to a single numerical integration at the first expiry date. In that integration the most complex part of the embedded

European swaptions valuation has been simplified to perform it only once and not for every point. In a special but very common in practice case, we also provide a semi-explicit formula. Those results lead to a significantly more precise implementation of swaption valuation. The improvements extend even more favorable to sensitivity calculations.

Interest Rate Swaps and Their Derivatives

CRC Press Exotic interest rate derivatives are hard to value. Care must be taken to make sure that sources of volatility that impact the contingent claim are properly modeled, and that appropriate relationships are maintained between the underlying rates involved.In this presentation, we outline the issues involved in valuing exotics. We review valuation issues for interest rate derivatives in general, and for caps, floors and swaptions. We outline a pricing methodology and apply it to Bermudan swaptions, range accruals, callable range accruals, spread options and callable spread range accruals.Outline: - Review of interest rate modeling - Handling of vanilla options - - Forward Libor and swap rates - - Caps and

Floors - - Swaptions - - Cap stripping - - Smile lifting - Bermudan valuation - - Hedging Bermudans - - LGM model specification of the HW model - - Pricing cashflows and options under the LGM model - - Model calibration - - Numerical methods - Digital options - - Pricing via vanillas. - Range accruals - - Pricing as a portfolio of digitals - - Convexity adjustment - Change of measure and approximation - Callable range accruals - - Pricing under the one factor LGM model - - - Model calibration. - - - Use of control variates (adjusters). - - Calibration and pricing under the two factor LGM model - - - Model calibration. - Spread range accruals - - Pricing under the two factor LGM model. *Pricing Models for Bermudan-style Interest Rate Derivatives* An authoritative handbook on risk management techniques and simulations as applied to financial engineering topics, theories, and statistical methodologies The Handbook of Financial Risk Management: Simulations and Case Studies illustrates the practical implementation of simulation techniques in the banking and financial industries through the use of real-world

applications. Striking a balance between theory and practice, the Handbook of Financial Risk Management: Simulations and Case Studies demonstrates how simulation algorithms can be used to solve practical problems and showcases how accuracy and efficiency in implementing various simulation methods are indispensable tools in risk management. The book provides the reader with an intuitive understanding of financial risk management and deepens insight into those financial products that cannot be priced traditionally. The Handbook of Financial Risk Management also features: Examples in each chapter derived from consulting projects, current research, and course instruction Topics such as volatility, fixed-income derivatives, LIBOR Market Models, and risk measures Over twenty-four recognized simulation models Commentary, data sets, and computer subroutines available on a chapter-by-chapter basis As a complete reference for practitioners, the book is useful in the fields of finance, business, applied statistics, econometrics, and engineering. The Handbook of Financial Risk Management is also an

excellent text or supplement for graduate and MBA-level students in courses on financial risk management and simulation.

Applications to Bermudan Swaptions and Convertible Bonds

This book discusses the state-of-the-art and open problems in computational finance. It presents a collection of research outcomes and reviews of the work from the STRIKE project, an FP7 Marie Curie Initial Training Network (ITN) project in which academic partners trained early-stage researchers in close cooperation with a broader range of associated partners, including from the private sector. The aim of the project was to arrive at a deeper understanding of complex (mostly nonlinear) financial models and to develop effective and robust numerical schemes for solving linear and nonlinear problems arising from the mathematical theory of pricing financial derivatives and related financial products. This was accomplished by means of financial modelling, mathematical analysis and numerical simulations, optimal control techniques and validation of models. In recent years the computational

complexity of mathematical models employed in financial mathematics has witnessed tremendous growth. Advanced numerical techniques are now essential to the majority of present-day applications in the financial industry. Special attention is devoted to a uniform methodology for both testing the latest achievements and simultaneously educating young PhD students. Most of the mathematical codes are linked into a novel computational finance toolbox, which is provided in MATLAB and PYTHON with an open access license. The book offers a valuable guide for researchers in computational finance and related areas, e.g. energy markets, with an interest in industrial mathematics.

Efficient Control Variates and Strategies for Bermudan Swaptions in a Libor Market Model

This paper studies the effect of forward rate correlations on caplet and swaption prices. A two-factor HJM lognormal model of forward rates that implies a realistic covariance matrix of forward rates is constructed. A one-factor lognormal model, with the same forward rate volatilities as the two-factor one, is employed for comparison purposes. The

one- and two-factor models price European caplets identically. The one-factor model overprices European swaptions as expected. But the magnitude of overpricing is surprisingly small, less than three percent for at-the-money swaptions on five-year semi-annual swaps. The overpricing is less for shorter swap lengths. The surprising result is that the one-factor model underprices both American caplets and American-type swaptions. Five-year at-the-money American caplets on six-month rates are underpriced by as much as twelve percent and three-year at-the-money constant maturity Bermudan swaptions on two-year semi-annual swaps by as much as ten percent. The underpricing is relatively low for six-month and one-year options but increases with option maturity and forward rate decorrelation. Unlike constant maturity Bermudan swaptions, regular Bermudan swaptions are overpriced by the one-factor model by more than four percent in the case of three-year maturity swaptions. An intuitive explanation for the underpricing of American options under the one-factor model is offered. This explanation implies that

American options on any type of interest rate	security would be underpriced if perfect correlation	across the forward rate term structure is assumed.

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