BOSHIWENKU

博士文库

商业银行利率风险度量模型与管理模式研究

- 商业银行利率风险度量与管理的历史演变
- 零息票债券收益率曲线在利率风险度量中的基础作用
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- 中国零息票债券收益率曲线模型的构造
- 约束条件下中国商业银行利率风险的度量与管理

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摘　要

　　19 世纪 80 年代，美国第一宾夕法尼亚银行和大陆伊利诺斯银行破产，让人们深切地感受到了利率风险的破坏性。2003 年下半年，我国众多商业银行因所持国债价格大幅下跌而遭受巨额损失，也让国人开始意识到，原以为与我们无关的利率风险，已悄然站到了我们面前。对利率风险的研究，在我国已经不再只是有前瞻性的课题，而是有着重要的现实性。

　　为什么会有利率风险？利率风险为什么会对商业银行产生如此大的破坏性？利率风险度量与管理的机理是什么？利率风险的管理在我国有着什么特殊性？现有条件下我国商业银行对利率风险能有哪些作为？哪些措施有助于改善利率风险管理的约束？正是带着这些问题，我撰写了本书《商业银行利率风险度量模型与管理模式研究》。

　　本书共分为六章：

　　第一章研究商业银行利率风险度量与管理的历史演变，全章共分为三节。第一节阐述了商业银行利率风险的产生及演变。

首先从利率的本质和利率决定理论入手，论述了利率是受多种经济因素影响的内生变量，经济领域未来存在的诸多不确定决定了利率水平的不确定，从而决定了利率风险的不可避免性；接下来揭示了人们对商业银行利率风险所经历的漠视—关注—重视的认识发展过程。第二节分析了商业银行利率风险度量的历史演变。首先分析了单个证券利率风险度量所经历的平均期限—麦考莱持续期—修正持续期—有效持续期—期权调整持续期—凸度加持续期的演进过程，并指出演进的内在逻辑是假定条件逐步放松和衡量精度逐步提高；紧跟着阐述了商业银行利率风险的度量所经历的从指标法到估计法再到衡量法的历史演变，指出了演变的方向是利率风险度量的精度逐步提高，演变的原因是计算机技术发展所带来的度量成本的下降以及资产负债表复杂化所带来的度量收益的上升。第三节分析了商业银行利率风险管理的历史演变。本节的分析从商业银行利率风险内部管理的历史演变和商业银行利率风险外部监管的历史演变两个层次展开。本章的研究回答了利率风险的产生原因，刻画了西方发达的市场经济国家在不同的发展阶段对利率风险不同的度量与管理方法，为我国商业银行利率风险管理模式选择提供了历史参照。

第二章研究了商业银行利率风险的度量基础——零息票债券收益率曲线的构建，全章共分为三节。第一节论述了零息票债券收益率曲线在利率风险度量中的基础性作用，指出了零息票债券收益率曲线是利率期限结构理论的分析基础，是利率风险度量的标杆。第二节阐述了现行静态零息票债券收益率曲线简单模型的构造。根据构造原理的不同，本书把众多静态模型划分为直接法和间接法两大类，在简述两种方法各自不同的构造思想的基础上，对两种方法的优缺点及适应范围进行了比较。分段样条函数模型作为最常用的间接法，是本节研究的重点，

对它的三个关键环节——确定函数的阶数、确定所分的段数、确定各段的分解点，本书尤其给予了充分的论述。第三节研究了动态零息票债券收益率曲线模型的构造。对非确定性现金流金融产品，特别是与利率相关的随机现金流的金融产品进行利率风险度量，单纯依赖反映现行利率期限结构的静态零息票债券收益率曲线作标杆是不够的，而需要把零息票债券收益率曲线建成动态模型。按照构造原理的不同，动态模型可分为均衡模型和无套利模型两大类，其中均衡模型又分为单因子模型和多因子模型，无套利模型的典型是马尔可夫模型。这一节主要是对现有模型的解读，解读的重点在于模型的思想、模型的假设条件、模型的适用性以及模型的缺陷。本章的研究一方面为本书第三章、第四章的研究打下了基础，另一方面为第五章中国零息票债券收益率曲线的构建提供了理论框架。

　　第三章研究商业银行利率风险的度量模型，全章共分三节。第一节对敏感性缺口法、持续期缺口法和模拟法等商业银行三种常用的度量方法进行了比较分析，分析的重点在于三种方法的度量思想及优缺点。第二节阐述了广泛用于隐含期权金融工具利率风险度量的 OAS 模型，主要从 OAS 模型的基本思想、OAS 模型对利率风险的度量原理、OAS 模型的核心模块——提前偿付模型等三个方面展开，最后对 OAS 模型给予了自己的评价。第三节阐述了 VAR 模型对利率风险的度量，在分析 VAR 模型的基本原理和 VAR 的度量方法的基础上，书中对 VAR 模型度量利率风险给出了简单的评价。准确度量利率风险是商业银行有效管理利率风险的重要前提，本章的研究将有助于商业银行对利率风险的认识和把握。

　　第四章研究商业银行利率风险的管理模式，全章共分为三节，对应三种不同的利率风险管理模式。第一节论述的是基于利率预测的商业银行利率风险进攻型管理。利率风险进攻型管

理的宗旨是，在避免利率变动可能带来的损失的同时，还谋求从利率变动中获益。相对其他利率风险管理策略来说，进攻型管理显得更积极，但进攻型管理有效运用的前提是，商业银行能准确预测未来利率的变动，因此本节的重点放在利率预测上。利率预测包括两个层次：一是运用利率决定理论分析影响利率的因素；二是运用模型来定量预测未来利率的变动方向和变动幅度，可供运用的模型有多元回归模型、时间序列模型和动态模型，本书对三类模型的特征和局限性给予了较充分的阐述。本章的第二节阐述了基于资产负债管理的商业银行利率风险缺口管理，在描述利率风险缺口管理主要内容的基础上，在本节分析利率风险缺口管理和资产负债管理之间的关系，指出了利率风险缺口管理既是资产负债管理理论发展的结果，又是现代资产负债管理的核心；本节的最后对利率风险缺口管理作出了简单评价，认为缺口管理相对进攻型管理来讲，更符合风险管理的思想，管理效果也常常优于进攻型管理，不足的是一方面会增大商业银行的经营成本，另一方面对零息票债券收益率曲线是一条水平线的假设和资产负债利率同期同幅度变动的假设不符合现实。本章的第三节研究了基于套期保值的商业银行利率风险管理，与缺口管理的表内策略不同的是，套期保值是一种表外策略。套期保值的基本原理是建立对冲组合，使得当产生风险的一些因素发生变化时，对冲组合的净价值保持不变。商业银行对利率风险的套期保值有两种方式，一种是根据久期凸性原理，用资产组合作套期保值，另一种是用衍生金融工具来套期保值，对于两种方式的原理、特征及效果，在书中都作了分析和评价。本章从规范分析的角度回答了商业银行应该如何管理利率风险，为第六章研究约束条件下中国商业银行利率风险的度量与管理提供了理论上的参照系。

无论是分析历史演变，还是构建理论框架，都有一个重要

目的，就是服务于对中国的现实分析。第五章和第六章都是立足于中国的现实约束，运用前面构造的理论框架，分别探索中国的零息票债券收益率曲线的构建和中国的商业银行利率风险的度量与管理。

第五章研究中国零息票债券收益率曲线模型的构造，全章共分三节。第一节是对现有模型的评析，内容涉及到国内理论界和实务界在零息票债券收益率曲线构建中所取得的主要研究成果，包括国债基本定价模型、回归模型、样条函数模型和参数化模型等四种，评析的重点在于模型的优缺点及适应性，总体结论是，我国现有的研究都是把国外的模型简单地移植到中国来用，缺乏对中国特有的约束条件的分析，更没有立足中国的约束条件来构造零息票债券收益率曲线。第二节分析中国零息票债券收益率曲线构造的约束条件。由于估计零息票债券收益率曲线所需要的数据主要来自债券市场，这样，要研究零息票债券收益率曲线构造的约束条件，首先必须研究中国债券市场的现状和问题，而这一切又离不开对中国债券市场发展历史的分析，因此本节的内容包括中国债券市场发展的历史沿革、中国债券市场目前存在的主要问题和中国零息票债券收益率曲线构造的约束条件三个部分。最后的结论是，中国零息票债券收益率曲线构造的约束条件主要有交易所债券市场样本不足和银行间债券市场数据失真。本章的第三节是在约束条件下构造中国的零息票债券收益率曲线，内容涉及到约束条件下的数据采集及处理、约束条件下的模型构造及实证分析两个方面。采集和处理数据的基本思想是，为完整反映中国的利率期限结构，同时也是为了满足大样本的要求，采集的数据应该既包括交易所债券市场的数据，又包括银行间债券市场的数据；为尽量保证数据的真实性，银行间债券市场中交易过分稀少的品种不应在采集范围内，为消除两个市场因市场分割造成的价格差异，

银行间债券市场中采集的品种要作数据处理。处理的方式是运用回归模型，求取跨市场交易品种在两个市场交易价格之间的函数关系，并将这些关系应用到那些只在银行间债券市场交易的品种，从而实现消除流动性差异的目标。在模型构造及实证分析部分，本书运用现在国际上流行使用的样条函数模型和Nelson – Siegel 模型构造了我国的零息票债券收益率曲线，并对估计结果作出了分析和评价。鉴于中国零息票债券收益率曲线构建是中国商业银行度量和管理利率风险的标杆，本章的研究在书中有着不可或缺的重要作用。

第六章研究约束条件下中国商业银行利率风险的度量与管理，全章共分三节。要探索约束条件下中国商业银行利率风险的度量手段与管理模式，首先必须了解中国商业银行利率风险度量与管理的历史现状，因为历史和现状构成了未来制度演变的路径依赖，因此第一节对中国商业银行利率风险度量与管理的历史现状作了剖析。这一节的内容分利率风险度量的历史现状、利率风险内部管理的历史现状和利率风险外部监管的历史现状三个部分，每个部分都是从实务界的操作层面和学术界的研究层面两个层面来展开。本章的第二节分析了中国商业银行利率风险度量管理的约束条件，结论是，在我国，制约商业银行利率风险度量与管理的因素很多，其中最主要的制约因素有五个方面，一是利率形成机制非市场化的约束，二是利率风险管理的组织结构不完善的约束，三是利率衍生工具缺位的约束，四是商业银行资产负债缺乏流动性和多样性的约束，五是技术约束，这些制约因素构成了我国商业银行利率风险度量与管理的约束条件。第三节研究了不同约束条件下中国商业银行利率风险的度量与管理，首先研究的是现有约束条件下利率风险的度量与管理，认为在现有约束条件下，商业银行在利率风险度量与管理方面可以采取的举措主要有四个，分别是完善组织保

障、科学选择管理模式、充分利用开放式回购的做空机制和从契约上强化对隐含期权风险的管理。接下来，书中指出，利率市场化、资产证券化和重开国债期货三项有待推出的改革措施，将有利于改善利率风险度量管理的约束条件，并研究了这三项举措分步实施后，商业银行应该如何选择利率风险管理模式。

关键词：商业银行　零息票债券收益率曲线　利率风险
　　　　度量模型　管理模式

Abstract

In the 80's of 19th century, the bankruptcy of Pennsylvania Bank and Continental Illinois National Bank in the United States, makes people feel the destructiveness of the interest rate risk profoundly. In the second half of 2003, commercial banks of our country suffer a huge sum of loss, because of significant slump of bond price, which also makes people start to be aware of the interest rate risk that is thought to have nothing to do with us at first, but already quietly come out in front of us. The research on interest rate risk in our country has already no longer just a forward – looking topic, but has been realistic.

Why does the interest rate risk exist? Why does the interest rate risk lead to such a big destructiveness to the commercial bank? What are the measurement and management mechanism of interest rate risk? What particular functions of interest rate risk management have in our country? What do the commercial banks in our country do with the

interest rate risk under the existing conditions? Which measures contribute to the improvement of constrains of interest rate risk management? Just because of these problems, I write this dissertation – *The Measurement Model and the Management Mode of the Interest rate Risk in Commercial Banks.*

This dissertation is totally divided into six chapters:

The first chapter, which is composed of 3 sections, studies the historical evolvement of interest rate risk measurement and management. Section one depicts the production and development of interest rate risk in commercial bank. It elaborates that interest rate is an endogenous variable which is influenced by the various economic factors from the essence and the determinism of the interest rate. The uncertainty of the interest rate is decided by many indeterminations that exist in the economic realm in the future, which determines that the interest rate risk can't be avoided. Then it makes clear the experiences that people regard the interest rate risk in commercial bank from ignorance to concerning to attaching importance. The second section analyzes the historical evolvement of the measurement of interest rate risk in commercial banks. Firstly it analyses the evolvement process of individual security interest rate risk which goes through average maturity – Macaulay duration – modified duration – effective duration – option duration adjusted – convexity and duration, and points out that the gradual development of inherent logic is the relaxed condition of assumption and the improvement of measurement precision. Then it elaborates that the historical evolvement of the experience of interest rate risk measurement in commercial bank is from the index method to estimation method then to weighing method, pointing out that the direction of development is the improvement of accuracy of interest rate

risk measurement, and the reason is that the cost of measurement is reduced by the computer technique development and the income of measurement is raised by the complication of the balance sheet. Section 3 analyzes the historical evolvement of interest rate risk management of the commercial banks. The analysis of historical evolvement is developed from the internal management and exterior supervision of interest rate risk in commercial banks. Through the research of this chapter, it has answered the reason that the interest rate risks appear, has depicted different measurements and managements with the interest rate risk in developed market economy of the western countries at different developing stages, which provides the historical reference for mode selection of commercial bank interest rate risk management of our country.

Chapter two studies the measurement foundation of interest rate risk of commercial banks, the establishment of yield curve of zero – coupon bond. The whole chapter is divided into three sections. Section one discusses the basic function of yield curve of zero – coupon bond in the measurement of interest rate risk, pointing out that the yield curve of zero – coupon bond is the analytical foundations of the theory of interest rate's term structure, and also is the benchmark of the measurement of the interest rate risk. Section two elaborates the structure of a simple model on static yield curve of zero – coupon bond. According to the difference of constitution principle, the dissertation divides the numerous static models into direct ones and indirect ones. On the basis of setting forth the different constitution thoughts of two methods, it compares the merits, shortcomings, and the application scopes of the two methods. Spline model is the most common indirect method, and is the study emphasis of this section,

especially its three key approaches that are defining the rank of func-tion, the subinterval number to be divided, and knot of each subinter-val, which are fully elaborated in the dissertation. Section three stud-ies the structure of simple model on dynamic yield curve of zero – coupon bond. It is not enough if we just only depend on static yield curve of zero – coupon bond which reflects the current term structure of interest rate and make it the benchmark for financial products with uncertain cash flow, especially the measurement of interest rate risk on financial products with random cash flow which is related to inter-est rate, but need to set yield curve of zero – coupon bond as dynamic models. According to the difference of the constitution principle, the dynamic models can be divided into equilibrium model and non – ar-bitrage model, and equilibrium model can be divided into single fac-tor model and multi – factors model. This section is mainly the expla-nation of models, and the emphasis lies in the thought, assumption conditions, applicability and the shortcomings of these models. The research of this chapter, on one hand, sets a solid foundation for the following chapter three and chapter four, and on the other hand, pro-vides the theoretical frame for setting up yield curve of zero – coupon bond of China.

Chapter three which is divided into three sections, studies the measurement model of interest rate risk of commercial banks. Section one carries on comparative analysis for three commonly used methods of measurement in commercial bank, which are sensitivity gap method, duration gap method and simulation method. The analytical emphasis is the measurement thought, merits and shortcomings of three commonly used methods. Section Two elaborates the OAS model which is widely used for the measurement of embedded option finan-

cial tools. It main depicts the basic thought of OAS model, the principle of measuring the interest rate risk, the core mold of OAS model, that is payment in advance model, and gives my own appreciation for OAS model finally. Section three depicts the measurement of interest rate risk in VAR model. The dissertation gives simple appreciation for VAR model on the basis of analyzing the basic principle of VAR model and the measurement method of VAR. Measuring the interest rate risk accurately is the important premise that the commercial bank manages the interest rate risk effectively, so the research of this chapter will contribute to the understanding and the managing interest rate risk of commercial banks.

Chapter four which is divided into three sections, corresponding to the three different management modes for interest rate risk, studies the management of interest rate risk in commercial banks. What section one discusses is the offensive management with interest rate risk of commercial bank, according to the prediction of interest rate. The aim of offensive management with the interest rate risk is at the time of avoiding the loss brought by fluctuation of interest rate, still seeking to benefit from the fluctuation of interest rate. Compared with other management strategies of interest rate risk, the offensive management seems to be more actively. But for valid usage with the offensive management, the premise is the accurate estimation of fluctuation of interest rate in future, so the emphasis of this section is prediction of interest rate. The prediction of interest rate includes two layers. One is analyzing the factors which influence interest rate according to the interest rate decision theory. The other is predicting the fluctuant direction and range of interest rate in future by way of models. The models can be used include multiple regression model, time series

model and dynamic model. The dissertation gives abundant depiction about the characteristics and the limitations of the three models. Section two of this chapter elaborates the gap management of interest rate risk according to the management of assets and liabilities. The dissertation analyses the correlation between the gap management of interest rate risk and the management of assets and liabilities, basing on explaining the main contents about the gap management of interest rate risk, pointing out that the gap management of interest rate risk is not only the result of the development of the theory of assets and liabilities development, but also the core of modern management of assets and liabilities. The end of this section makes simple appreciation about the gap management of interest rate risk, deeming that the gap management even accords with the thought of the risk management and the result of management is also usually better than offensive management. One of this management's shortcomings is that, on one hand, it will add the management cost of commercial banks. On the other hand, it is not accordance with the reality that the assumption for zero – coupon bond yield curve is a horizontal line and the interest rates of assets and liabilities change for the same period and range. Section three of this chapter studies the management of interest rate risk according to hedge. Comparing with the gap management which is an in – balance – sheet strategy, the hedge is an off – balance – sheet strategy. The basic principle of hedge is that the net value of offsetting combination will keep constant when the factors producing risks change by establishing the offsetting combination. The hedge of interest rate risk in commercial bank has two methods. One is making hedge by asset combination according to the duration convexity principle. The other is making hedge by the derivative financial tools. The

principle, characteristics and results of two kinds of methods are analyzed and appraised in the dissertation. This chapter answers how the commercial bank manages interest rate risk from the angle of normative analysis and provides the frame of theoretical reference for chapter six which studies the measurement and management of interest rate risk under the restraint conditions.

No matter what the historical evolvement is analyzed or the theoretical frame is established, all have an important purpose that they serve the realistic analysis for China. Chapter five and chapter six of the dissertation base themselves upon realistic constraint of China, probing respectively the establishment of the zero – coupon bond yield curve of China, and the measurement and management of interest rate risk in commercial bank of China, by using the theoretical frame established before.

Chapter five which is divided into three sections, studies the establishment of Chinese zero – coupon bond model. The first section is the analysis of the existing model, which refers to the main research achievements in establishing the zero – coupon bond yield curve in domestic theoretical field and practical field, including national debt pricing model, regressive model, spline function model and parametric model. The analysis emphasizes on the models' advantages and disadvantages, as well as its applicability. The conclusion is that the current domestic research is just transferring the model of foreign countries to China, lacking the analysis for the particular restraint conditions of China, never to mention establishing zero – coupon bond yield curve basing on the restraint conditions of China. The second section analyzes the restraint conditions of establishing zero – coupon bond yield curve in China. In order to analyze the constraint condi-