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责任编辑、责任校对：卢喜观　　封面设计：张沐沉

吉林大学出版社出版　　吉林大学出版社发行
（长春市东中华路 37 号）　　吉林农业大学印刷厂印刷

开本：850×1168 毫米　1/32　　1998 年 6 月第 1 版
印张：18.75　插页：2　　1998 年 8 月第 1 次印刷
字数：466　千字　　印数：1—3 000 册

ISBN 7—5601—2142—X/F・429　　定价：27.00 元

前　言

我国的社会主义市场经济给企业的经营者提供了机遇，同时也带来了风险。由于存在着所谓的市场失灵问题，所以政府必须适当地干预经济以发挥自己应有的作用。经济周期波动的预测与分析有助于政府的经济决策及企业的经营决策，因此有重要的实际意义。

经济决策的主要目标是经济增长、充分就业和物价稳定。为达到这些目标，政府必须对国民经济的运行进行适时和适度的调控。调控的主要手段是财政政策和货币政策。不论政策手段的选取还是力度的确定无不依赖对经济周期波动的预测和分析。

在市场经济的条件下，企业的经营决策必须考虑经济形势的变化。企业的经营决策者想要知道的是经济周期波动的转折点于何时出现，经济增长率大致会是多少，通货膨胀率会有多大，利率变动的前景等等。这些问题都必须通过预测来加以解决。经济环境的急剧变化对于经营的成败有重大影响，因此预测是经营中不可缺少的环节，往往决定企业的命运。在发达国家不仅政府、经济研究机构，甚至不少企业都有专门从事经济预测的部门。可喜的是，目前在我国也已出现了这样的趋势，特别是企业逐渐认识到在市场经济的条件下经济预测的重要性。本书就是为了适应国内对经济周期波动预测和分析的需要而出版的。

本书有三个特点，第一是注重实用性。编著者都有多年从事经济预测及其研究工作的经历，因此在取材与写法上能充分注意实用性。诺贝尔经济学奖获得者萨谬尔森早在1976年就说过“现在是电子计算机预报的时代”，使用计算机已是进行高

水平经济预测的前提条件。正因为如此，本书对所介绍的方法都给出了完整、清晰的计算步骤，使读者在没有现成软件的条件下也可以编程进行计算。

本书较全面地介绍了本世纪60年代以来国际上研究经济周期波动的各种实用的经济计量方法。首先是季节调整法，由于季节性变动因素的干扰，给准确地检测出真正的经济周期波动带来困难，所以必须在进行经济分析之前剔除季节因素。本书介绍了多种季节调整法，如虚拟变量法、移动平均法、X-11方法以及X-11 ARIMA方法等等。70年代以来西方经济学界开展了“增长循环”的研究，这就需要将除去季节因素的时间序列进行分解，将趋势和循环要素分离开，以研究循环要素的变化。本书介绍了三种目前国际上常用的长期趋势分解方法，即回归分析法、移动平均法及阶段平均法，并分析了各种方法的长处和不足。

随着经济的发展和统计体系的完善，统计指标的数目日趋庞大，形成了规模巨大的信息资源。如何迅速准确地加工提炼出反映经济运行状态的景气指标和信息，是进行景气分析前的一项重要工作。本书介绍了多种实用的景气指标的选择方法：时差相关分析方法、K-L信息量方法、基准循环分段平均法、聚类分析方法、峰谷对应法以及由美国全国经济研究局(NBER)穆尔和希斯金提出的定性和定量相结合的指标选择方法——“评分系统”。还介绍了能自动准确地测定经济时间序列转折点（峰、谷）的时点的Bry-Boschan方法。

本书着重介绍了景气指数方法。景气指数方法是一种实证的景气观测方法，是目前国际上普遍使用的对经济周期波动转折点进行测定、分析和预测的有效方法。景气指数方法的出发点是经济各领域的波动并不是同时发生的，而是一个从某些领域向其他领域，从某些产业向其他产业，从某些地区向其他地区波及、渗透的极其复杂过程。从这一认识出发，由各领域中

选择出一批对景气变动敏感、有代表性的经济指标，用数学方法合成为一组景气指数（先行、一致、滞后），将它们作为测定和分析经济波动的综合尺度。利用先行指数来预测经济周期波动的转折点，目前仍被公认为是最好的方法。本书介绍了目前国际上许多国家和经济组织正在使用的扩散指数、合成指数以及美国全国经济研究局(NBER)的 J. H. Stock 和 M. Watson 利用状态空间模型方法开发的一种新的景气指数——S-W景气指数。

根据本书所述内容编制的《宏观经济周期波动预测分析软件包》，已在国家信息中心、国家统计局、国家计委、中国人民银行、卡斯特经济评价中心等单位作为日常的分析工具广为利用且获得好评，也是本书有实用性的有力佐证。

本书还介绍了两种宏观经济监测预警信号系统的制作方法。首先介绍了预警信号系统，这一预警信号系统是利用一组反映经济运行状态的敏感性指标。然后，运用有关的数据处理方法，将多个指标合并为一个综合性指标，并通过类似于一组交通管制信号红、黄、绿灯的标志，根据这组指标对当时经济状况发出不同的信号，通过观察分析信号的变动情况，来判断未来经济运行的趋势，并明确提示经济决策部门应当针对当前经济运行的态势采取何种调控措施，也可对企业的投资及经营策略起到方向性的指导作用。其次介绍了美国的穆尔和扎尔诺维茨提出来的景气序列信号系统。这一预警信号系统是利用先行合成指数的变化率和一致合成指数的变化率来发出信号，指示未来的景气动向，被称为反周期政策的触发器。

商情调查法是二次大战后，欧美国家首先发起的，到50年代中叶，世界各国已广泛推广。商情调查方法是一种较快了解经济情况的便捷途径，也称为晴雨表系统。目前世界上广泛开展的商情调查主要有三种类型：景气动向调查、设备投资意向调查、消费调查。本书详细介绍了商情调查问卷的设计、调查

方式、调查结果的汇总与分析以及中国人民银行开展的“工业景气调查”和日本经济企划厅的“消费动向调查”。

本书第二个特点是力图囊括近年来研究经济周期波动的新方法。1988年美国J. H. Stock和M. Watson提出了新的景气指数概念和编制方法。他们认为景气变动不应仅仅是针对GNP的变动而言，而应该把景气循环看作更广泛的包括金融市场、劳动市场、商品销售市场在内的总体经济活动的循环，而在这些总量经济指标共同变动背后，存在着一个共同的因素，这一因素可由一个单一的、不可观察的基本变量来体现。这一基本变量代表了总的经济状态，它的波动才是真正的景气循环。这一不可观测的基本变量被称为S-W景气指数。由于S-W景气指数是建立在严密的数学模型基础上，所以和扩散指数(*DI*)、合成指数(*CI*)等传统的景气循环测定方法相比有了很大的进步。这样自合成指数问世以来，景气指数法经历了四分之一世纪的停滞不前的阶段之后，终于有了明显的进展。本书介绍了求解这一不可观测的基本变量的状态空间方法和卡尔曼滤波以及S-W景气指数的具体计算方法及在我国宏观经济分析与预测中的计算实例。

迄今为止，国内对经济周期波动的分析和预测方法主要集中于时域内，即直接分析数据随时间变化的结构特征。实际上，时间序列的谱分析方法从频域角度还提供了另一种研究周期波动的有力工具。谱分析方法把时间序列看作是互不相关的不同频率分量的叠加，利用富氏变换和功率谱密度函数等手段，通过衡量各分量的相对重要性，可以找出序列中存在的主要频率分量，从而把握序列的周期波动特征，并有助于更深入地研究各种不同周期的特殊形态及其内在形成机制。因此，在研究经济周期波动方面，它具有时域方法所无法替代的优势。本书较为详细地介绍了谱分析的基本原理和各种常用的谱估计方法，特别是结合实际研究经验，指出了在应用中需注意的若干问

题，并对我国经济的周期波动特征进行了实证分析，取得了很有说服力的结果。

80年代发展起来的协整(Cointegration)概念和方法，使经济计量模型建立在更加合理的统计学基础之上，并且能更好反映经济系统的固有特点。这个特点是经济运行中存在产生短期不均衡的可能性，但是所发生的这种短期偏离，随着时间的推移将会向长期均衡调整。本书介绍了这一方法并给出景气调整的误差修正模型的例子。虽然篇幅较短，读者仍可以达到学以致用的目的。

混沌理论与方法是近年来用于研究不确定性问题及其性质的一种新的方法论体系。本书简明清晰地介绍了一些常用方法及其计算步骤，从不同角度分析了我国经济周期波动的原因。其中既有经济结构等经济运行机制的内在原因，也有外部环境、政策因素等随机干扰的原因，为经济周期波动的分析提供了新的思路。

本书的第三个特点是有所创新。经济计量模型中的双重逐步回归是由我国学者提出的，但其计算步骤有误。本书改正了其错误，力图使该模型得以广泛应用并恢复其应有的地位。关于联立方程模型，本书给出了基于前定变量的2SLS、LIML、3SLS主成分估计，这三种主成分估计具有表达式简单、对称、拟合精度高的特点。在时间序列分析方面，本书对MA模型给出了模型参数与白噪声同时迭代估计的方法；对VAR模型，给出了修正的最小二乘估计，该方法所占内存少，与国内外现行算法相比，可以处理更多指标的时间序列模型。对VAR模型还提出了通过联立方程求解参数估计的新思路。关于Jury准则，本书指出了某些专著中的错误，并给出了反例，对多维平稳性检验，给出了用待定系数法求系统的特征多项式，并结合Jury准则对多维系统作平稳性检验。在周期波动的不确定性分析方法方面，本书指出Hurst指数算法的错误，并用蒙特卡洛法证实

了原来算法有较大的抽样方差，提出了无常数模型及几种新算法和修正参数。此外还给出了非线性动态系统的多项式拟合方法，为计算李雅普诺夫指数等不确定性分析方法开辟了新的思路。

本书是在我们编写讲义的基础上增添了近年来教学的新内容和科研成果编成的。各章分别由下列同志执笔：

高铁梅：　第 1 — 7 章、第 9 章 6 节、第 11 章；

姜诗章：　第 8 章、第 9 章、第 12 章、第 13 章；

陈　磊：　第 10 章；

最后由我进行了审阅和定稿。

在本书出版之际，对多年来在提供数据、信息、机遇、合作等方面给我们以帮助和支持的中国人民银行调查统计司、国家信息中心经济预测部、中国社会科学院数量经济技术经济研究所、财政部综合司、原物资部信息中心、原商业部信息中心等单位表示衷心的感谢。正是在这样的环境下，我们才有条件为宏观经济管理部门提供现代化的工具，才有机会多次向中央提交有参考价值且被国家领导人阅批的研究报告，才有可能先后两次获得国家科技进步三等奖。

在编写本书的过程中，吉林大学商学院周光亚教授仔细审阅并修改了本书部分章节，并提出了不少宝贵的意见；硕士研究生李宏纲、范国刚、赵昕东参加了本书部分章节的计算工作；张桂莲工程师、李宏纲、范国刚为本书的排版花费了不少精力。尤其应该提到的是吉林大学出版社卢喜观先生的热情鼓励、鞭策和帮助。我们在此表示诚挚的谢意。

最后，应该指出的是由于我们水平有限，错误或不当之处在所难免，我们诚恳地欢迎同行专家和读者批评指正。

董文泉

1998 年 5 月

Preface

The socialist market economy of our country has provided good opportunities for the enterprise manager, and at the same time it has also brought some risks to them. Since there exists the problem of "an out-of-order market", the government must do something to intervene efficiently with the present economy and work to bring its role into full play. The forecasting and analysis of economic cycles are therefore helpful for the government to make the policy decision and for enterprise to manage its business, so they are of great practical significance.

The chief purpose of making economic decisions is to promote economic growth, provide full employment and stabilize commodity prices. To achieve these goals, the government must impose some appropriate update and control on the operation of the national economy. The principal control tools are fiscal and monetary policies. No matter what policy you choose and to what extent you carry out the policy, you will have to depend on forecasting and analysis of economic cycles.

Under the condition of market economy, the changes of economic situation must be taken into consideration in any enterprise management decision-making. What the decision makers concern are when the turning-point of economic cycles will emerge, what the approximate economic growth rate and inflation rate will be, and what the prospect of the change in interest rate will be, and so on. To know all about these, you will have to turn to forecasting. Sharp changes of economic situation have great influence on the success and failure in management, thus forecasting is very essential and decisive to the enterprise management. In developed countries, not only the governments and their economic research institutions, but also many enterprises have departments engaging in economic forecasting. It is encouraging that there has now appeared such a trend in our country. More and more enterprises have come to realize the importance of economic forecasting under the condition of market economy. This book is published to meet the requirement in forecasting and analysis of economic cycles in our country.

This book has three obvious features. The first one is that it is very practical. All the writers of this book have engaged in economic forecasting

and its research for many years, and they paid more attentions to the practical use while they were collecting materials and writing this book. Since computers are a necessity for making a high-level economic forecasting nowadays, as Samuelson Paul Anthony, the winner of Nobel Prize in Economics, said early in 1976, "It's an age for computers to make forecasting." The methods for making forecasting introduced in this book are all given in complete and clear computing procedures, enabling its readers to calculate according to these procedures without having any required computer programs.

This book also introduced the various kinds of practical calculating methods in a comprehensive way. They have been employed in the worldwide research of economic cycles since 1960s of this century. Among these methods the first one is the seasonal-adjusting method. The interference of seasonal fluctuation makes it difficult to detect correctly the authentic economic cycles, so the seasonal factors must be ruled out before conducting economic analysis. Different kinds of seasonal-adjusting methods were introduced in this book, such as dummy variable, moving average, X-11 methods, and X-11 ARIMA methods, etc. In the research of "growth cycle" in the Economics of the West since 1970s, the seasonally adjusted series are decomposed into the trend and cycle factors. This book introduced three long-term trend decomposition methods that are used internationally at present, namely regression analysis, moving average and phase average, and analyzed the advantages and shortcomings of the different kinds of methods.

With the development of economy and improvement of statistics system, the number of statistics index is becoming more and more, forming a large-scale data source. How to process and extract rapidly and correctly economic indicators and message that reflect the economic situation becomes an important job before making the economic cycles analysis. This book presented many kinds of practical methods of selecting indicators, such as time difference correlation analysis, K-L information, state average of reference cycles, cluster analysis, cyclical pattern matching method, and the scoring system —— a method choosing indicator qualitatively and quantitatively, presented by Moore and Sicks who are at NBER, and we also introduced the Bry-Boschan method that is used to measure automatically the turning point in economic time series.

This book introduced as a focal point the index of business conditions, which is a positive observation method. It is an effective one universally employed to determine, analyze, and forecast the turning point of economic cycles. According to this method we know that the cycle does not occur in all

fields at the same time, but spreads from certain fields to other fields, from certain industry sections to other sections, or from certain regions to other regions. From this point of view, selecting some economic indicators that are typical and sensitive to fluctuation, are composed of leading index, coincident index, lagging index by mathematical method, and then taking them as a comprehensive measure, with which business fluctuation can be detected and analyzed. Using leading indexes to forecast the turning point of economic cycles is still being considered as the best method. This book introduced the diffusion index and composite index used by many countries and economic organizations now. In addition, a new index —— S-W index that was developed with the State Space Model by Stock and Waston who are also at NBER, was introduced in this book.

"The software package for analyzing and forecasting the economic cycles" taken from this book has been used as a tool for routine analysis, received satisfied effects and got high appraisal in the State Information Center, the State Statistics Bureau, the State Planning Commission, the People's Bank of China and China Economic Monitoring Center, etc. This is a favorable proof of the book's feature of being practical.

This book also introduced two methods of making business warning signal system. The warning system uses some sensitive indicators that reflect the state of economic situation. Then it uses the related data processing method to combine some indicators into one composite index. These indicators, just like the traffic lights in red, yellow and green, give different signals in different economic situations. Through forecasting the economic development trend by observing and analyzing the changes of signals, and reminding the economic decision-making departments of taking some measures to control the economic operation, thus it plays a decisive role in investing and making managing decisions. This book then introduced the sequential signals of recession and recovery set up by Moore and Zarnowiaz. This sequential signal system uses the changing rate in leading composite index and in coincident composite index to send out the signal, indicating the direction of economic cycles in the future. This system is called the trigger of the countercyclical policy.

Business Survey Method was first put forward by some countries in Europe and America after World War II. In the middle of 1950s, it became popular due to its convenience of understanding the economic situations. This survey was also called barometer system. At present, there are three popular business survey methods in the world: economic cycles trend survey, equipment investment intention survey and consumption survey. This book

went into detail the poll design of business survey, the way of business survey, the total and analysis of survey outcome. Moreover, this book also introduced the "industry business survey" carried out by People's Bank of China and "Consumer survey" developed by Japan Economic Planning Agency.

The second feature of this book is that it tried to include the new methods for studying economic cycles. In 1988, J.H. Stock and M. Waston put forward a new index of economic conditions. They thought that the change of economic cycles should include not only the change of GNP, but also the fluctuations of many economic activities that contain financial market, labor market and commodity market. The co-movements in those macroeconomics aggregates can be reflected by a single and unobservable variable. This fundamental variable stands for the overall economic situations. It is its fluctuation that represents economic cycles. This unobservable variable is called the S-W index. Since it is based on the complicated mathematical model, this index has made a great progress compared with traditional methods of measuring economic cycles such as *DI* and *CI*. This book introduced the State Space Method and the Kalman Filter to estimate the S-W index. It also presents the specifically computational example of China's macroeconomics analysis and forecasting with the index.

So far, the analysis and forecasting of economic cycles in our country mainly focus on the time domain, which analyzes directly the structural characters of data changing with time. In fact, spectral analysis of time series provides another powerful tool to study economic cycles in terms of the frequency domain. Spectral methods take the time series as the sum of many uncorrelated frequency components. Taking advantages of Fourier transform and power spectrum density function and judging the relative significance of every component, we can find the main frequency components in time series and master the fluctuating properties of time series. It can also help us to study the special shapes and inherent forming mechanism of different cycles. Hence, in the research of economic cycles, spectral analysis has its own advantage that cannot be replaced by other methods in time domain. This book has a detailed introduction about the basic principal of spectral analysis and many methods of spectral estimation. Specially, this book lists some problems that require attentions in applying the tool, made some empirical analyses about China's economic cycles and got several conceivable results.

The concept and method of cointegration, which have been studied since 1980s, make the model of econometrics have more reasonable basis of Statistics and reflect the inherent characteristics of economic system much

better. One characteristic is the possibility that exists the short run inequilibrium in the economy. When the inequilibrium happens, the economy will be adjusted to the long run equilibrium with time flying. This method is introduced with an ECM of regulating the economic cycles. Although the content is not in detail, the readers are able to use it for the purpose of application.

Chaos is a new system to study the uncertainty and its natures. We introduced some common methods and calculation procedures, and analyzed the reasons of economic cycles in China from different perspectives. These reasons include not only the inherent reasons such as the economic structure, but also the random disturbances such as outside environment and policy factors.

The third feature of this book is some innovations. The two step-by-step regression model was put forward by Chinese scholars, but there are several mistakes in the calculation procedure. In this book we had corrected these mistakes in an attempt to use it widely and recognize of its important uses.

About the simultaneous equations, we provided the estimation methods 2SLS, LIML, 3SLS based on the principal components of predetermined variables. The estimation has the characteristics of simplicity, symmetrical expression and good fitness. As for the time series analysis, we provided the estimation method of parameter and white noise iteration for MA model. For VAR model we provided the correcting OLS, which need only smaller memory storage and can deal with more indicators compared with the algorithm being used now. The new train of thought to estimate the parameter was provided for VAR model by solving the parameters of the simultaneous equations. Concerning of Jury criterion, we pointed out some mistakes found in some books and provided some counter examples. To test the multidimensional stationary, we used indeterminate coefficient method to calculate the eigenpolynomial of the system by applying Jury criterion. To analyze the uncertainty of economic cycles, we pointed out the mistakes of Hurst index in calculation, proved that the original algorithm had a larger sample variance by using Monte Carlo method, and put forward the model without constant, other new algorithms and adjusted parameters. In addition, we also provided polynomial fitness of nonlinear dynamic system to open up the new thought for calculating Lyapunov exponent and other calculation method.

This book was compiled on the basis of our original teaching materials, and was written and added with some achievements in our recent research. Writers and their work in this book are listed below: Tiemei Gao: Chapter 1-

7, Section 6 in Chapter 9, Chapter 11, Shizhang Jiang: Chapter 8–9, Chapter 12–13, Lei Chen: Chapter 10, I checked and finalized this book.

At the time of publishing this book, we'd like to express our gratitude to the Research and Statistics Department of the People's Bank of China, the Economic Forecasting Department of the State Information Center, the Research Institute of Quantitative & Technical Economics, Chinese Academy of Social Sciences, the Comprehensive Planning and Reform Department, the Ministry of Finance, the original China National Materials & Equipment Information Center, the Commercial Information Centre of the Ministry of Internal Trade, who have provided data, information, chances and cooperation for many years. It is under such environments that the authors have the chances to provide the modern tools for macroeconomics management departments and to submit the consulting report to the super government and have the possibility to win twice the State's Science and Technology Progress Prize.

In the course of compiling this book, Prof. Guangya Zhou checked and made some corrections of some parts of this book and gave some valuable advice. Engineer Guilian Zhang did a lot of jobs in composing this book and graduate students Honggang Li, Guogang Fan and Xindong Zhao did some calculation work for this book. Here, we would like to give our special thanks to Prof. Xiguan Lu of Jilin University Press. This book was written by his enthusiastic encouragement and helps.

We sincerely hope the specialists and readers using this book will kindly forward their criticisms and suggestions for improving this book.

Wenquan Dong

May, 1998

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