


# 中国投入产出分析 应用论文精萃

SELECTED PAPERS ON ANALYTICAL PURPOSES  
OF I-O TECHNIQUES IN CHINA

主编 许宪春 刘起运 主审 陈锡康

Editor-in-Chief Xu Xianchun Liu Qiyun  
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# 《中国投入产出分析应用论文精萃》

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of I-O Techniques in China

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# 序

列昂惕夫创立的投入产出理论问世已近 70 年,投入产出表的编制和分析技术日臻完善,投入产出技术在世界各国已得到广泛的普及和应用,并取得了显著的经济和社会效益。目前国际投入产出技术有如下三个发展趋势:

第一,编表工作经常化和制度化。根据国际投入产出协会 2000 年年度报告,目前世界上有 80 多个国家和地区定期编制投入产出表,一些发达国家如日本、美国以及一些发展中国家如中国、印度每隔 4—5 年编制一次,甚至还有少数国家如荷兰每年编制一次。投入产出表已成为国民经济核算体系的一个重要组成部分。第二,投入产出技术与其他管理科学方法和数量经济方法,如经济计量学、数学规划、数理统计等日益融合。第三,投入产出技术的应用领域日益扩大,特别是在可持续发展(包括环境保护、资源利用、温室气体排放等)、知识创新、生产率增长,以及经济全球化(包括编制国际投入产出表、包含进口矩阵的 C 型投入产出表)等方面的应用越来越受到各国的重视。

早在 20 世纪 60 年代初,我国一些科研单位和高等院校就开始投入产出技术的研究工作,并编制了我国 1973 年全国实物型投入产出表、化工部门投入产出表和鞍山钢铁公司投入产出表。此后山西省编制了 1979 年山西省价值型投入产出表。目前我国编制投入产出表的工作已制度化,迄今为止国家统计局已成功编制了 1983、1987、1990、1992、1995、1997、2000 年全国价值型投入产出表,另外还编制了 1992 年实物型投入产出表和部分年份的不变价投入产出序列表,目前正在着手编制 2002 年全国投入产出表。国家信息中心从 1988 年开始,加入由日本亚洲经济研究所组织的、

由美国及亚洲其他 8 个主要国家(地区)参与的国际投入产出联接表的编制和应用研究系列项目。该项目以 5 年为一个阶段,编制了 1985、1990 和 1995 年国际投入产出联接表,目前正在编制 2000 年表。除此之外,我国的各省、区、市统计局与国家统计局同步编制各自的地区投入产出表,有些工业企业也编制了企业投入产出表,这在国际上是不多见的。

回顾我国投入产出表编制的历程,可以发现如下几个变化:一是投入产出表编制工作越来越规范化和制度化。二是投入产出表的国际可比性越来越强。随着我国国民经济核算体系由 MPS 转向 SNA,从 1992 年开始我国编制的投入产出表基本上以国际公认的国民经济核算体系为框架,大大增强了其国际可比性。三是投入产出表的规模逐步扩大,编制的手段越来越丰富。我国的投入产出表的部门规模已由早期的几十个部门扩展到目前的 124 个部门。另外,编制的方法也由过去单一依靠直接分解法,转变为直接分解法结合间接推导的方法,今后还将尝试商品流量法。

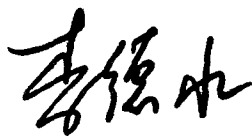
作为一种现代管理科学方法,投入产出技术目前已在我国国民经济的诸多领域得到成功应用。自改革开放以来,投入产出技术被普遍地用于研究国民经济各部门间的数量依存关系,规划未来时期的经济活动,研究和分析重要决策和重大事件(如增加投资、价格调整、加入世界贸易组织、获得奥运会和世博会的主办权等)对国民经济的影响,研究产品的价格形成机制,通过编制企业的投入产出表提高企业的经济效益和管理水平等,为各级党政领导提供了许多有重要参考价值的意见和建议,并在实践中取得了良好的经济和社会效益。近几年来,我国投入产出学者又开拓了一些新的应用领域,在国内外产生了较为广泛的影响。例如,由我国著名学者陈锡康教授提出的投入占用产出技术,在国际投入产出学界产生了重要影响,受到了国际著名学者如列昂惕夫、美国科学院院士瓦尔特·艾萨德等人的高度评价。该技术目前已在水利、粮食产量预测、金融、教育、能源利用、环境保护、对外贸易等多个领域得到广泛应用,尤其是陈锡康教授将此技术成功用于全国粮食产量预测,为宏观经济决策部门提供了重要的参考依据,得到了中央领导及相关部门的多次表扬和充分肯定。又如,我国著名学者刘起运教授提出了投入产出对称数学模型,拓宽了投入产出分析应用的手段和范围。再如,我国不少学者对投入产出技术进行了理论与方法探讨,在非线性和动态化研究方面也取得了一批可喜的成果。另外,投入产出技术在高新技术产业、资源环境等方



面的应用也得到了一定的发展。

为了满足社会经济理论与实践工作者和其他对投入产出技术感兴趣的人们了解和掌握投入产出技术的需要,为了展示和总结我国投入产出研究取得的丰硕成果,为了促进投入产出技术的发展与应用水平的提高,中国投入产出学会历时一年征集了上百篇国内优秀的投入产出分析应用论文,经过多轮严格筛选最终选定其中 35 篇,收录于《中国投入产出分析应用论文精萃》。本书有如下几个特点:一是所收集论文的水平是国内同类研究成果中较高或最高的。本书收集的论文都是在通过专家组的严格初审、复审后才脱颖而出的,具有较高的代表性和参考价值。二是侧重于投入产出的分析应用。由于本书的宗旨是为了向社会提供投入产出分析应用的大餐,因此对其中一些侧重于理论的应征论文只好忍痛割爱。三是涉及的应用领域广。本书收集的论文几乎涉及在国民经济各个领域中的应用。四是作者代表性强。在收集的论文作者中,不乏大名鼎鼎的老前辈,也有初出茅庐、崭露头角的后起之秀。五是收集的论文大都是已公开发表的优秀文章,但也有少量刚出炉尚未发表的力作。希望本书的出版会推动我国投入产出分析应用水平上一个新的台阶。

国家统计局局长



2004 年 1 月 15 日于北京

# Preface

Input-Output theory was founded by Wassily W. Leontief and it has been nearly 70 years since then. The compilation techniques of Input-Output(I-O) table and its analytical techniques are getting improved day by day, and the input-output techniques have been widely popularized and applied in the world, resulting in significant social and economic benefits. At present the international input-output techniques develop mainly in three directions as follows:

Firstly, the compilation work of I-O tables becomes a regular practice. According to the annual report of 2000 of International Input-Output Association, more than 80 countries and regions compile their input-output tables regularly in the world at present. For example, some developed countries like Japan and United States of America (USA), as well as some developing countries like China and India, compile their I-O tables once every 4 or 5 years, a few countries like Holland even compile its I-O table each year. The I-O tables have become an important part of the national economic accounting system. Secondly, input-output techniques are combining more and more closely with other management science and quantitative economics methods such as econometrics, mathematical programming, mathematical statistics. Thirdly, the application fields of input-output techniques are expanding rapidly, and that in some scopes, especially in sustainable development (including environmental protection, utilization of resources, greenhouse gas emission, and so on), knowledge innovation, productivity growth, and economic globalization (including compilation of international input-output tables, C-type input-output table with import matrix), and so forth, have got more and more attention in many countries.

Early in the beginning of the 1960s, some scientific research institutions and universities in China began to study input-output techniques. They compiled a national physical I-O table for 1973, an I-O table of chemical industry, and an I-O table of Anshan Steel and Iron Corporation. Later Shanxi Province compiled a monetary I-O table for 1979. Now the compilation of I-O tables has been institutionalized in China, so far the National Bureau of Statistics (NBS) has successfully compiled a series of value-type national I-O tables for 1983, 1987, 1990, 1992, 1995, 1997 and 2000, as well as a physical I-O table for 1992 and I-O tables at constant prices for some years. For the moment the NBS is preparing to compile a national I-O table for 2002. Since 1988 the State Information Center joined a series of programs organized by Institute of Developing Economies of Japan (IDE) and co-worked with USA and other 8 Asian countries (regions) with emphasis on the compilation of linked international I-O tables and their applications. Up to now, they have compiled the linked international I-O tables for 1985, 1990 and 1995 respectively, and are constructing the one for 2000. In addition, all regional statistical offices at levels of province, autonomous region and municipality, as well as some

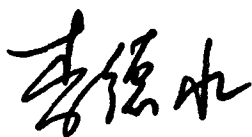


industrial enterprises in China also compiled their own tables.

Reviewing the course of compilation of I-O tables in China, we can find the following changes: Firstly, the compilation work of I-O tables becomes more and more standardized and institutionalized. Secondly, the international comparability of China's I-O tables keeps on improving. With the transition of China's national economic accounting system from MPS to SNA, I-O tables are basically based on the framework of internationally accepted System of National Accounts (SNA) since 1992, which greatly improved their international comparability. Thirdly, the size of I-O tables is expanding step by step, while the means of compilation become more and more enriched. The size of China's input-output tables has expanded from early dozens of sectors to currently 124 ones. In addition, the method of compilation also has changed from direct decomposition method into the combination of direct decomposition with indirectly derivative method, and the commodity flow method will be tried in the future. As a means of modern management science, now input-output technique has seen successful applications in many fields of the national economy. Since China's reform and opening up to the outside world, it has been widely applied to study the quantitative relationships among every sector of the national economy, plan the economic activities in future period, study and analyze the impacts of important policy-making and major events (e. g. increment of investment, price adjustment, entry into the World Trade Organization, winning the host of the Olympic Games and World Exhibition Fair, and so on) upon the national economy, look into the mechanism of price formation of products, and to improve the economic benefits and management level of enterprises by compiling their own input-output tables and so on. These applications have produced a lot of important opinions and suggestions for the leaders of the Party and the governments at various levels, resulting in better economic and social benefits in practice. In recent years, some input-output scholars in China developed some new I-O techniques again, which have produced comparatively extensive influences at home and abroad. For example, input-occupancy-output technique initiated by professor Chen Xikang, a famous scholar in input-output technique, has generated a wide range of impacts in international input-output circle, and been awarded high praise of international famous scholars such as Wassily W. Leontief, Walter Isard (academician of USA Academy of Science), etc. . Presently this technique has been applied to water conservancy, grain output prediction, finance, education, energy utilization, environmental protection, foreign trade and so on. Particularly, professor Chen has applied this technique successfully to China's grain output prediction, which laid an important foundation for macroeconomic decision-making, and have got praise and affirmation from Central leaders and related departments for many times. Another example is that famous scholar, Professor Liu Qiyun has put forward a symmetrical model of input-output, which has widened the means and the application ranges of input-output techniques. Many scholars in China have probed into the theory and method of I-O techniques, leading to a series of gratifying outcomes with regard to non-linearization and dynamics of I-O techniques. In addition, input-output techniques also have seen some progress in applying them to high-technology industry, resources and environment, etc. .

In order to meet the needs of persons engaging in socio-economic theory and practice as well as those who are interested in I-O techniques, to demonstrate and summarize the abundant achievements made in I-O field, and to stimulate the development of I-O techniques and improvement of their applications, the Chinese Input-Output Society spent one year collecting over one hundred papers on analytical purposes of I-O techniques at home. After several rounds of strict screening of these papers, finally 35 ones were selected and assembled in a book entitled *Selected Papers on Analytical Purposes*

of I-O Techniques in China. This book has the following characteristics: Firstly, the level of the papers collected is the relatively high or highest one among domestic similar research, because they are selected through preliminary and final strict examination by experts group. Secondly, it attaches great importance to analytical purposes of I-O techniques. As this book aims to offer a big meal of analytical purposes of I-O techniques to the entire society, so some collected papers with emphasis on I-O theory have to be given up with reluctance. Thirdly, the application fields are very wide. The papers collected in this book cover nearly all main fields of the economy to which the I-O techniques apply. Fourthly, the authors have strong representativeness. Among the authors, there are not only famous senior scholars, but also up-and-coming young researchers who just show their intelligence. Fifthly, most of the papers collected are published ones, except for a few of top quality papers which are just completed and not published yet. Hopefully, the publication of this book will push up the level of I-O analysis and application in China to a new stage.



Li Deshui

Commissioner of NBS

January 15, 2004 in Beijing

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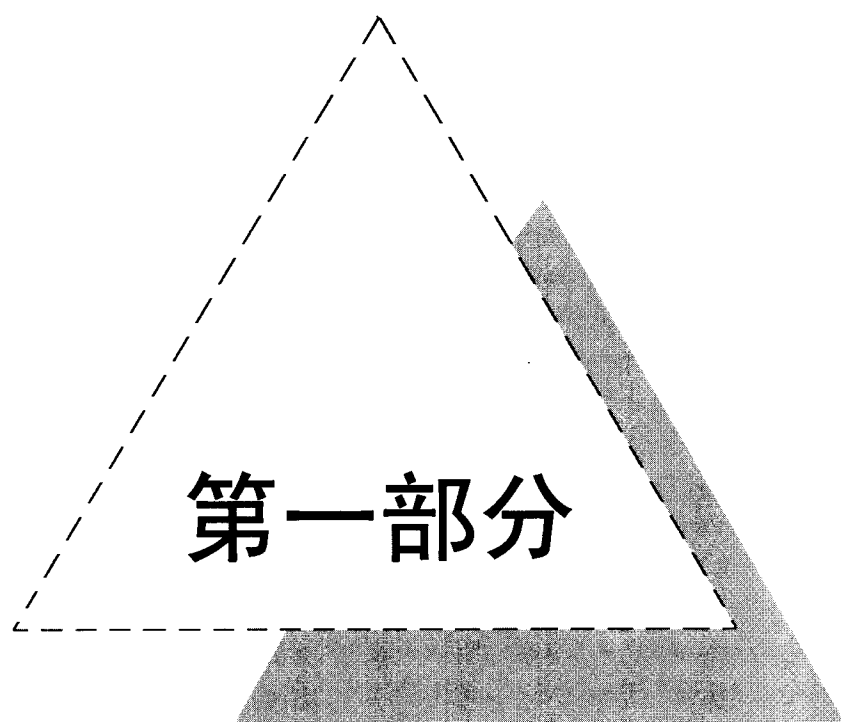
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# 投入占用产出 技术及其应用





# 投入占用产出技术 及其非线性和 动态化研究<sup>①</sup>

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## 一、投入占用产出的理论与方法研究

### 1. 占用的科学概念及其重要性

20 世纪 80 年代初我们受中央有关部门的委托进行全国粮食产量预测研究。为此,编制了中国农业投入产出表。发现耕地和水在粮食生产中起重要作用,但耕地和水等自然资源在传统的投入产出分析中完全没有得到反映,进而发现固定资产、劳动力等在投入产出分析中也基本上没有得到反映。由此产生把“占用”引入传统投入产出分析的思想。

占用是生产过程的前提和基础。在进行生产以前,必须具有掌握相应科学技术和管理知识的劳动力、固定资产、流动资金、以及自然资源(耕地、矿产资源等)等。生产的规模和效益在很大程度上是由占用品的数量和质量所决定的。为了提高生产水平首先就要求提高劳动力的熟练程度和采用先进的机器设备,即提高占用品的数量和质量。

占用与投入是两个不同的概念。投入产出分析中的投入是指生产过程中的消耗,这由投入产出表中总投入包括中间投入与最初投入两部分的内容可以看出。中间投入是指生产过程对系统各部门的产出的消耗,如材料、动力和劳务等的消耗。最初投入是指生产过程对初始要素,如固定资产、劳动等的消耗,表现为固定资产折旧、从业人员报酬等。所以投入产出分析实际上是研究生产过程中各种初始要素和中间要素的消耗与系统中各部门产出之间的数量关系。

投入产出分析的不足之处是没有反映占用与产出之间联系和占用对产出的制约。例如,在投入产出分析中当给定最终需求向量以后,利用以下公式

$$X = (I - A)^{-1} Y$$

就可以计算出各部门的总产出向量  $X$ ,但是如果占用的自然资源、生产能力和劳动力等得不到保证,计算出来的各部门总产出可能无法实现。

投入占用产出技术中的占用是指对生产中长期使用的物品,如固定资产、流动资产、劳动力、科技和教育、自然资源等的拥有状况。占用、投入与产出三者之间存在辩证关系。第一,占用是投入与产出的前提和基础。投入与产出的规模、数量和质量取决于占用品的数量和质量。在现代生产活动中企业拥有的管理人员、技术人员和工人的素质,占有的固定资产等的状况、占有的矿藏的自然条件等对投入和

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