



汽车相关能源、环境 和交通政策研究

——混合CGE模型的构建和应用

孙 林 · 著

Automobile-related
Energy, Environment and Transportation Policy Research
-Construction and Application of a Hybrid CGE Model



上海社会科学院出版社

汽车相关能源、环境 和交通政策研究

——混合CGE模型的构建和应用

孙 林 · 著

Automobile-related
Energy, Environment and Transportation Policy Research
-Construction and Application of a Hybrid CGE Model



上海社会科学院出版社

图书在版编目(CIP)数据

汽车相关能源、环境和交通政策研究:混合
CGE 模型的构建和应用 / 孙林著. —上海:上海社会科
学院出版社, 2010

ISBN 978-7-80745-809-8

I. ①汽… II. ①孙… III. ①汽车-环境政策-均衡
模型-研究-中国 IV. ①X734.2

中国版本图书馆 CIP 数据核字(2010)第 257273 号

汽车相关能源、环境和交通政策研究

——混合 CGE 模型的构建和应用

著 者: 孙 林

责任编辑: 徐祝浩

封面设计: 闵 敏

出版发行: 上海社会科学院出版社

上海淮海中路 622 弄 7 号 电话 63875741 邮编 200020

<http://www.sassp.org.cn> E-mail: sassp@sass.org.cn

经 销: 新华书店

照 排: 南京理工出版信息技术有限公司

印 刷: 上海惠顿实业有限公司印刷部

开 本: 890×1240 毫米 1/32 开

印 张: 9.375

插 页: 2

字 数: 270 千字

版 次: 2011 年 9 月第 1 版 2011 年 9 月第 1 次印刷

ISBN 978-7-80745-809-8/X · 001

定价: 29.80 元

版权所有 翻印必究

前言



1. 研究背景

2010年,我国汽车新车市场销售规模超过美国历史最高水平,达到前所未有的1 826万辆;截至2011年6月,我国汽车保有量超过日本,达到7 802万辆(不包括三轮车和低速货车),成为全球第二大保有国。截至2010年9月,尽管我国千人汽车保有量(54辆)尚未超过世界平均水平(120辆),但是,从城市地区来看,我国已基本进入现代意义上的“汽车社会”。

随着汽车社会的到来,汽车特别是乘用车给人们的生活带来了极大的便利性,并正在改变社会大众的出行习惯。同时,正如发达国家所经历过的那样,在我国,随着以乘用车为主的汽车交通工具的普及,汽车交通产生的能源消费快速增长、城市空气质量下降、交通事故频发和交通拥堵常态化等“汽车交通外部性问题”日显突出。特别是汽车尾气排放导致的城市空气污染,直接影响了人们的健康,成为重大的社会问题。随着汽车普及率的持续提高,汽车保有量的不断膨胀,如果没有包括新能源汽车在内的汽车“节能减排”技术水平的迅速提高,必将导致汽车燃料消费量与尾气排放量的进一步扩大。

尽管即便是在发达国家,上述“汽车交通外部性问题”也没有获得根本性的解决,但是,发达国家已经过了汽车市场快速增长的发展阶段,社会汽车保有量趋于稳定甚至下降。另外,发达国家在过去几十年里,通过不断完善法律、法规、技术标准等规制性手段,税收和财政政策等经济手段,致力于缓解上述“汽车交通外部性问题”,并取得了显著的效果。

近十年来,我国政府认识到了“汽车交通外部性问题”的严重性。政策制定部门积极借鉴发达国家的经验,通过法律、法规、技术标准等

规制性手段,税收和财政政策等经济手段,促进汽车节能减排技术的开发和普及利用,并逐步开展体系化政策的制定工作。近几年出台的相关政策表明,我国政府利用法律、法规、技术标准,以及税收和财政政策,鼓励发展低油耗、低排放汽车和限制高油耗、高排放汽车的政策取向日渐明朗。

为了提高政策实施的效果,在政策制定阶段和实施之后,需遵循一定的评估原则,对实施的政策内容进行评估。与其他任何领域的政策一样,“汽车交通外部性问题”相关的政策也不例外。如果单从解决问题的角度来看,越激进的政策当然越有效果。但是,问题显然不会这么简单。评估一项政策,必须综合考虑政策实施所产生的成本与效益,这是评估任何政策的基本原则。

与发达国家不同,在我国目前的经济环境下,除了一般意义上的“成本与效益”政策评估原则外,在评估“汽车交通外部性问题”时,还需要考虑两个特殊因素。第一,我国汽车产业还处于“产业发展”的阶段,发展和壮大汽车产业是目前政策制定部门主要考虑的问题。因为,无论是从对相关产业的拉动效应,还是从对 GDP 增长、税收、就业的贡献,以及从提高我国产业技术水平的角度来看,汽车产业的“支柱产业”地位极其重要。第二,在被称为世界上竞争最激烈的我国汽车市场上,政府部门有意识培育和发展“自主品牌”汽车的倾向显著。这种现象反映了政府部门和产业界对“自主品牌”汽车在市场与技术主导权方面的追求,以及将汽车培育成为未来重要出口产品的热切期待。总之,在现阶段,“拥有自主品牌的汽车产业的发展壮大”是我国汽车产业的主旋律,而“汽车交通外部性问题”被看成是应该在汽车产业发展壮大的过程中逐步解决的问题。

另外,我们注意到,汽车是一个具有“生命周期”的资产性消费品。“汽车交通外部性问题”涉及汽车产品开发、生产、销售、保有、使用和报废等汽车生命周期各个环节。因此,要求评估“系统”能够覆盖汽车生命周期的各个阶段。否则,政策评估就有可能无法有效和客观地评估相关政策的成本与效益。

因此,在对“汽车交通外部性问题”相关政策进行评估时,除了需要

遵循一般意义上的“成本与效益”评估原则外,还需要进一步放大“评估体系”的外延。即在评估相关技术标准和税收、财政等相关政策时,需要将“汽车交通外部性问题”置于覆盖我国宏观经济、汽车产业及相关上下游产业、能源、环境和交通,以及汽车生命周期主要阶段的“大系统”中进行分析。

2. 主要目的

基于上述考虑,本书的目的是构建一个覆盖评估“汽车交通外部性问题”相关政策时所要求涉及的主要因素的可计算一般均衡模型(Computable General Equilibrium Model,简称CGE模型),以期能够在较全面的系统中分析某一单项政策或者叠加多项政策的综合政策。即构建一个研究汽车相关能源、环境和交通政策的动态混合CGE模型,并进行相关政策的评估和研究。之所以称其为“混合模型”,是因为本模型不但覆盖了标准CGE模型的宏观经济、汽车产业及主要上下游产业、汽车燃料部门以及所得分配、市场主体行为模式等方面的“价值模型”部分,而且,还嵌入了乘用车新车市场和乘用车保有市场的“数量模型”部分。因此,模型能够在可计算一般均衡理论的框架内,模拟汽车相关能源、环境和交通政策方面的技术标准和财政税收政策,评估政策对宏观经济、汽车产业以及上下游产业、汽车燃料消费、乘用车新车市场和保有市场的影响,实证研究和分析相关政策的成本与效益。

3. 主要内容

本书主要内容包括构建汽车(Automobile)相关能源(Energy)、环境(Environment)和交通(Transportation)政策研究的混合CGE模型(简称AEET-CGE模型),并进行相关政策的评估与分析。从模型构建的过程来看,除非移植一个成熟的模型,否则,任何一个分析具体政策问题的模型都有一个构建和积累的过程。AEET-CGE模型基于作者的前期研究成果。本书将详细介绍AEET-CGE模型的构建过程和应用分析。

第一章,首先对本书研究涉及的一些内容作出了界定;其次,介绍政策评估的含义和方法;第三,简要介绍笔者对可计算一般均衡(CGE)模型发展的一些基本认识。

第二章,介绍 AEET-CGE 模型的前期模型之一,即通常意义上的标准 CGE 模型,在这里笔者称之为“价值模型”(以货币为单位的模型)。该模型于 1999 年开发完成,曾经应用于我国加入 WTO 相关的贸易政策和碳税为主的“环境税”政策研究。由于本书第四章 AEET-CGE 模型的“价值模型”部分与本章模型的结构基本一致,因此,本章详细介绍了该“价值模型”的构建过程。同时,作为政策模拟的例子,介绍了二氧化碳税和二氧化硫税的政策模拟分析。另外,本章有 2 个附录,即本章模型的方程式体系和符号体系;方程式体系的瓦尔拉斯法则检验。

第三章,在介绍我国汽车、能源、环境和交通相关政策背景的基础上,介绍第四章 AEET-CGE 模型的另一个前期混合模型。该混合模型对经济结构描述相对简单,不足以涵盖“汽车交通外部性问题”涉及的一些重要因素,不便于分析相关政策变化对宏观经济、产业经济与汽车、能源、环境和交通问题之间的相互影响。但是,该混合模型的汽车市场选择模型完整地描述了汽车购买、保有、使用和报废等汽车生命周期的完整过程。因此,笔者称其为非标准 CGE 模型(价值模型)与车辆选择模型(数量模型)的混合模型。由于该混合模型的车辆选择模型部分构成了本书第四章 AEET-CGE 模型的车辆选择模型部分的基础,所以,本章详细介绍了该混合模型的构建过程。同时,还介绍了利用该模型进行的养路费向燃油附加税转变的“费改税”政策、《乘用车燃料消耗量限值》标准政策、燃料消耗量限值+绿色税制+补助金政策(叠加政策)和 2006 年 8 月实施的“乘用车消费税率调整政策”等政策模拟分析。本章附录为模型的方程式体系及说明。

第四章,主要介绍 AEET-CGE 模型的构建过程和应用分析。模型是分阶段逐步构建的;在模型构建过程中,对当时的相关政策进行了模拟分析;有些模拟是针对政府已经实施的政策,有些模拟是政府可能实施的政策方案。构建过程包括在第二章模型的基础上构建研究汽车相

关能源、环境和交通政策的标准 CGE 模型(价值模型);在第三章车辆选择模型(数量模型)的基础上构建汽车市场选择模型;联结标准 CGE “价值模型”与车辆选择“数量模型”,完成 AEET-CGE 模型。在内容安排方面,主要对 AEET-CGE 模型的“价值模型”部分与第二章模型的不同之处,“数量模型”部分与第三章模型的不同之处进行介绍。在模型应用方面,主要利用 AEET-CGE 模型进行了《乘用车燃料消耗量限值》标准、消费税、车辆购置税、燃油税等相关政策及叠加政策进行了模拟分析。本章附录为 AEET-CGE 模型的方程式体系和符号体系。

第五章,主要介绍了本书第四章 AEET-CGE 模型的主要功能、局限和今后改进的方向。

Preface



1. Background information of the research

In 2010, the market sale scale of new automobiles in China, which is the unprecedented number 18.26 million, exceeded that in the highest level in American history. By June, 2011, civilian vehicles in China, 78.02 million(excluding tricycles and low-speed trucks), had outnumbered that in Japan. By September, 2010, although the rate of vehicle ownership per 1,000 of population in China(54) had not exceeded the world average level(120), in the aspects of urban areas, China has basically entered the era of “Automobile Society” in the morden sense.

Accompanied by the coming of “Automobile Society”, automobiles, especially passenger cars, have become a great convenience to people’s life, and are changing the trip style of the whole society. At the same time, just as what the developed countries experienced, with the popularization of automobiles and other vehicles, the “negative externalities of automobile transportation”, such as the rapid increase in energy consumption arisen by automobile-transportaion, descended air quality in urban areas, frequent traffic accidents and constant traffic congestion, are coming out gradually. Especially the urban air pollution caused by automobile emission, which directly affects people’s health, has become a significant problem for the whole society. With the continuing automobile popularization and ceaseless expansion in automobile possession, if without the swift development of automobile “Energy

conservation and Emission reduction” technologies including new-energy vehicles, there is to be further increase in automobile fuel consumption and emission.

Even in developed countries, the above-mentioned “negative externalities of automobile transportation” do not have a in-nature solution. However, developed countries have already passed the stage when the automobile market fast develops and the vehicle ownership of the society as a whole is tending towards stability or even decline. In addition, during the past several decades, through regulatory measures such as improving laws, regulations and technological standards, together with taxation, financial policies and other economic means, developed countries devoted themselves to lessen the above-mentioned “negative externalities of automobile transportation” and made significant achievement.

In the recent ten years, the Chinese government has realized the gravity of the “negative externalities of automobile transportation”. Policy-making departments positively learn from developed countries’ experience. Through regulatory measures, they encourage the development and popularized use of automobile energy-conservation and emission-reduction technologies as well as gradually carry out the making of systematic policies. Just as what recent policies demonstrate, it has gradually become very unequivocal that the Chinese government’s policy tendency is to encourage the development of low-fuel-consumption and low-emission automobiles and restrict that of high-fuel-consumption and high-emission by laws, regulations, technological standards, taxation and other financial policies.

To improve the effects of policies, after the stages of making and carrying out policies, we need to follow certain principles of assessment and evaluate the content of the carried-out polices. Policies related to

“negative externalities of automobile transportation” are not excluded from this method; it is done just the same as the policies in any other field. If only observing from the perspective of solving problems, the more aggressive the policies, the better the outcomes. However, it is obvious that the problem is not this simple. To assess one policy, we need to comprehensively consider the cost and benefit by the carrying out of it. This is the fundamental principle of assessing any policy.

Different from developed countries, under the current economic circumstances in China, other than the generally-meant policy-assessing principles of “cost and benefit”, when assessing the “negative externalities of automobile transportation”, we need to consider two more special factors. Firstly, the automobile industry in China is still at the “industry-developing” stage, and thus for the policy-making department the main concern would be the development and expansion of the automobile industry. This is because the mainstay status automobile industry has in Chinese economy is extremely important, whether looking at the positive effects on related industries, contribution to GDP increase, taxation and employment, or improvement on the industrial technological level in China. Secondly, the automobile market in China is called to be with the fiercest competition in the world, and the tendency that the Chinese government consciously cultivates and develops “original brand” automobiles is very significant. This phenomenon reflects that the government and industrial community are in pursuit of the manipulation power of “original brand” automobile in the market and respects of technology, and are eagerly expecting to cultivate automobiles to become important export products in the future. All in all, at the present state, the main theme of the automobile industry in China is the development and expansion of the automobile industry with original brand; nevertheless,

the “negative externalities of automobile transportation” are regarded as to be gradually solved in the process of the development and expansion.

In addition, we have noticed that automobile, an article of consumption with capital nature, has its “life cycle”. The “negative externalities of automobile transportation” involve development of automobile products, manufacture, distribution, ownership, use, discard and other sections in the life cycle. Therefore, it is required that the assessment system can cover each section in the life cycle of automobiles. Otherwise, policy assessment may not be able to effectively and objectively evaluate the cost and benefit of related policies.

Therefore, when assessing the related policies of the “negative externalities of automobile transportation”, other than observing the generally-meant basic principles of assessment of cost and benefit, we need to further extend the “assessment system”. Namely, when evaluating related technological standards, taxation, finance-related policies, we need to analyze the “negative externalities of automobile transportation” in the “macro-system” that covers the Chinese macro-economy, automobile industry and pertinent upstream and downstream industries, energy, environment, transportation and the main stages in the automobile life cycle.

2. Main purpose of the research

Based on the above-mentioned concern, this book aims to construct an analyzing tool that covers the main factors involved in the assessment of related problems of the “negative externalities of automobile transportation”, hoping to analyze one certain policy or one compounded policy consisting of several policies in a relatively comprehensive system. Namely, we construct a hybrid CGE model that studies automobile-re-

lated policies in energy, environment and transportation, then assess and study the relevant policies. The reason why we call it a hybrid model is that this model not only covers the “value-model” sections (just as the standards CGE model) including aspects such as macro-economy, the automobile industry and its main upstream and downstream industries, automobile fuel department, income distribution and the behavior pattern of the market as the subject, but is also implanted a “quantity-model” part about the new passenger car market and the passenger car ownership market. Therefore, the model is able to simulate the technological standards and financial-and-taxation policies in automobile-related aspects such as energy, environment, and transportation, as well as evaluate the effects those policies have on macro-economy, the automobile industry and its upstream and downstream industries, automobile fuel consumption, new passenger car market and the ownership market, and empirically study and analyze the cost and benefit of the relevant policies.

3. Main Content

The main content of this book includes the construction of the hybrid CGE model (abbreviated as AEET- CGE Model) that investigates the policies about automobile -related energy, environment and transportation, and the assessment and analysis of those related policies. Looking at the process of model construction, unless transplanting a mature model, any model that analyzes a concrete policy-related problem is associated with a constructing and accumulating process. The AEET- CGE model has its base on the author's previous research achievements. This book explicitly discusses the construction process and the analysis of application of this AEET-CGE model in detail.

Chapter One first defines some content to which the research in this book refers; secondly, it discusses the implication and methodology of policy assessment; thirdly, the author talks about some of his basic understandings on the development of CGE model.

Chapter Two introduces the model from the earlier stage, i. e. the generally-meant standard CGE model, which the author calls “value-model” (a model quantified by currency). That model is fully developed by 1999 and was applied in studying those trade policies associated with China joining WTO and those “environmental taxes” (mainly the carbon tax). Due to the fact that the “value-model” part of AEET-CGE model in Chapter Four basically accords with the structure of the model in this chapter, this chapter explicitly introduces the construction process of that “value-model” in great detail. At the same time, the simulated policy analysis of carbon dioxide tax and sulfur dioxide tax are discussed as an example of the simulation. Other than that, this chapter has two appendixes, i. e. the description of the symbols and equation system of the model in this chapter, the Walras’s Law verification on the equation system.

In Chapter Three, based upon the introduction to the background of the policies related to automobile, energy, environment and transportation in China, we introduce another earlier-stage hybrid model of AEET-CGE model. That hybrid model has a relatively simpler explanation of the economic structure, not comprehensive enough to cover some important factors involved in the “negative externalities of automobile transportation”, thus being inconvenient for analyzing the interactive effects related policies have on macro-economy, industrial economy, automobile, energy, environment and transportation problems. However, the automobile market selection model in that hybrid model comprehen-

sively describes the complete life cycle of automobile purchase, possession, use, scrap, etc. Thus the author names it a hybrid model composed of the non-standard CGE mode (value-model) and vehicle selection model(quantity model). Because the vehicle selection part in that hybrid model lays a foundation for that in the AEET-CGE model described in Chapter Four, this chapter explicitly describes the construction process of that hybrid model. At the same time, this chapter introduces the simulated analysis on the “toll-to-tax policy”(i. e. transforming the road maintenance toll to additional fuel tax), the policy of *Passenger Car Fuel Consumption Limit Standard*, fuel consumption restriction plus green taxation plus subsidy policy (the compounded policy), the consumption tax rate adjustment policy implemented in August 2006, etc. , all using this model. The appendix to this chapter consists of the equation system and its description.

Chapter Four mainly discusses the construction process and the analysis of application of the AEET-CGE model. The model is built gradually stage by stage. In constructing the model, we simulated analysis on the policies then; some simulation targets the policies already implemented by the government, some simulates the policies which have the potential to be implemented. The process includes the construction of the standard CGE model(value model) that studies automobile-related energy, environment and transportation policies, the construction of the automobile market selection model based upon that quantity model in Chapter Three, and the completion of the hybrid AEET-CGE model by connecting the standard CGE value model and vehicle selection quantity model. In arranging the content, we mainly discuss the difference between the “value-model” in the AEET-CGE model and that in the model in Chapter Two, and also the difference between the quantity

model part and the model in Chapter Three. About the application of this model, we mainly use the AEET-CGE model to carry out simulated analysis on the *Passenger Car Fuel Consumption Limit Standard*, consumption tax, vehicle purchase tax, fuel tax and other related policies or compounded policies. The appendix to this chapter contains the equation system and symbol system of the AEET-CGE model.

Chapter Five mainly discusses the primary functions, limitation and the direction of future improvement of the AEET-CGE model mentioned in Chapter Four.

目 录

前言	001
----------	-----

第一章 政策评估与可计算一般均衡(CGE)模型	001
-------------------------------	-----

1.1 相关内容的界定	001
1.2 政策评估的含义和方法	006
1.3 作为政策评估工具的 CGE 模型	009
1.3.1 CGE 模型产生的背景	009
1.3.2 CGE 模型的求解工具	011
1.3.3 早期 CGE 模型的主要分类	013
1.3.4 标准 CGE 模型的主要特征	017

第二章 中国能源环境 CGE 模型的构建和应用	021
-------------------------------	-----

2.1 模型构建的背景与目的	022
2.1.1 模型构建的背景	022
2.1.2 模型构建的目的	025
2.2 模型构建的基本假设和一般手续	026
2.3 模型的构建过程	031
2.3.1 模型的结构概述	031
2.3.2 模型的生产结构	032
2.3.3 模型的所得分配与储蓄	048
2.3.4 模型的需求结构	050
2.3.5 模型其他相关问题	057