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青年学术文库

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总 序

一个没有思想活动和缺乏学术氛围的校园，哪怕它在物质上再美丽、再现代，在精神上也是荒凉和贫瘠的。欧洲历史上最早的大学就是源于学术。大学与学术的关联不仅体现在字面上，更重要的是，思想与学术，可谓大学的生命力与活力之源。

中南财经政法大学是一所学术气氛浓郁的财经政法高等学府。范文澜、嵇文甫、潘梓年、马哲民等一代学术宗师播撒的学术火种，50多年来一代代薪火相传。在世纪之交，在合并组建新校而揭开学校发展新的历史篇章的时候，学校确立了“学术兴校，科研强校”的发展战略。这不仅是对学校50多年学术文化与学术传统的历史性传承，而且是谱写21世纪学校发展新篇章的战略性手笔。

“学术兴校，科研强校”的“兴”与“强”，是奋斗目标，更是奋斗过程。我们是目的论与过程论的统一论者。我们将对宏伟目标的追求过程寓于脚踏实地的奋斗过程之中。由学校斥资资助出版《中南财经政法大学青年学术文库》，就是学校采取的具体举措之一。

本文库的指导思想或学术旨趣，首先，在于推出学术精品。通过资助出版学术精品，形成精品学术成果的园地，培育精品意识和精品氛围，提高学术成果的质量和水平，为繁荣国家财经、政法、管理以及人文科学研究，解决党和国家面临的重大经济、社会问题，作出我校应有的贡献。其次，培养学术队伍，特别是通过对一批处在“成长期”的中青年学术骨干的成果予以资助推出，促进学术梯队的建设，提高学术队伍的实力与水平。最后，培育学术特色。通过资助在学术思想、学术方法以及学术见解等方面有独到和创新之处的成果，培育科研特色，力争通过努力，形成有我校特色的学术流派与学术思想体系。因此，本文库重点面向中青年，重

点面向精品，重点面向原创性学术专著。

春华秋实。让我们共同来精心耕种文库这块学术园地，让学术果实挂满枝头，让思想之花满园飘香。



2009年10月

Preface

A university campus, if it holds no intellectual activities or possesses no academic atmosphere, no matter how physically beautiful or modern it is, it would be spiritually desolate and barren. In fact, the earliest historical European universities started from academic learning. The relationship between a university and the academic learning cannot just be interpreted literally, but more importantly, it should be set on the ideas and academic learning which are the so-called sources of the energy and vitality of all universities.

Zhongnan University of Economics and Law is a high education institution which enjoys rich academic atmosphere. Having the academic germs seeded by such great masters as Fanwenlan, Jiwenfu, Panzinian and Mazhemin, generations of scholars and students in this university have been sharing the favorable academic atmosphere and making their own contributions to it, especially during the past fifty years. As a result, at the beginning of the new century when a new historical new page is turned over with the combination of Zhongnan University of Finance and Economics and Zhongnan University of Politics and Law, the newly established university has sets its developing strategy as "Making the University Prosperous with Academic Learning; Strengthening the University with Scientific Research", which is not only a historical inheritance of more than fifty years of academic culture and tradition, but also a strategic decision which is to lift our university onto a higher developing stage in the 21st century.

Our ultimate goal is to make the university prosperous and strong, even through our struggling process, in a greater sense. We tend to unify the destination and the process as to combine the pursuing process of our magnificent goal with the practical struggling process. The youth's Academic Library of Zhongnan University of Economics and Law, funded by the university, is one of our specif-

ic measures.

The guideline or academic theme of this library lies first at promoting the publishing of selected academic works. By funding them, an academic garden with high - quality fruits can come into being. We should also make great efforts to form the awareness and atmosphere of selected works and improve the quality and standard of our academic productions, so as to make our own contributions in developing such fields as finance, economics, politics, law and literate humanity, as well as in working out solutions for major economic and social problems facing our country and the Communist Party. Secondly, our aim is to form some academic teams, especially through funding the publishing of works of the middle - aged and young academic cadreman, to boost the construction of academic teams and enhance the strength and standard of our academic groups. Thirdly, we aim at making a specific academic field of our university. By funding those academic fruits which have some original or innovative points in their ideas, methods and views, we expect to engender our own characteristic in scientific research. Our final goal is to form an academic school and establish an academic idea system of our university through our efforts. Thus, this Library makes great emphases particularly on the middle - aged and young people, selected works, and original academic monographs.

Sowing seeds in the spring will lead to a prospective harvest in the autumn. Thus, let us get together to cultivate this academic garden and make it be opulent with academic fruits and intellectual flowers.

Wu Handong

October, 2009

摘 要

国内外学者关于 FDI、对外贸易对东道国碳排放的影响进行了很多研究，其中探讨了 FDI、对外贸易主要通过规模效应、结构效应、技术效应影响东道国碳排放。在此基础上，国外学者进一步研究了不同的国际溢出渠道所发挥的技术效应对东道国碳排放影响的差异，而国内学者对此研究极少，仅有一两篇文献从 FDI 技术水平溢出渠道进行初步考察。因此，在引进国外研究成果的基础上，本书以中国工业为样本进行延伸与补充，系统、深入研究国际技术溢出对中国工业能源消费碳排放影响的内在机理，具有较重要的理论价值。

“十二五”《规划纲要》提出“积极应对全球气候变化”的国家战略：中国要“充分发挥技术进步的作用，完善体制机制和政策体系”，通过“加强气候变化领域国际交流”，“在科学研究、技术研发和能力建设方面开展务实合作”。通过低碳技术创新来促进中长期能源消费碳减排已成为人们的共识。目前中国工业能源消费碳减排领域存在的主要问题：一是工业化国家普遍存在的高碳“锁定效应”；二是低碳技术创新基础薄弱，接近 70% 的低碳核心技术仍然依赖进口（邹骥，2010）；三是低碳技术创新路径与中国经济条件相脱离。结果导致低碳技术创新能力不足的困境，若中国在低碳技术的国际转移与扩散过程中注重技术路径的优化，就有可能缓解这一困境。本书以此为切入点，探讨基于国际技术溢出渠道的中国工业能源消费碳减排技术创新路径优化的政策转型方向、目标与内容。

论文内容主要围绕以下几个方面展开：第一，综述国内外与低碳经济相关的理论研究基础，并针对技术进步对生态环境影响，FDI、对外贸易对生态环境影响的相关文献与研究进展进行了总结与述评；第二，分析国际技术溢出对工业能源消费碳排放影响的内在机制，建立一般均衡模型深入剖析；第三，从多重角度对中国工业能源消费碳排放的现状进行了测度，包括工业能源消费碳排放量、工业能源消费碳排放强度、工业能源消

费碳排放绩效以及工业能源消费碳排放的驱动因素、对外贸易隐含碳排放量、低碳经济水平指数等方面；第四，以工业能源消费碳排放强度来表征工业碳减排技术，运用工业行业面板数据实证检验了 FDI、对外贸易技术溢出的碳减排效应，此外，基于对外贸易隐含碳排放量与低碳经济水平考察了 FDI 技术效应；第五，以工业能源消费碳排放绩效来表征工业碳减排技术，运用工业行业、省际工业面板数据实证检验了 FDI、对外贸易技术溢出的碳减排效应。具体而言，论文分七章。

第一章为导论。首先阐述了选题的背景以及选题的理论与实践意义，提出了研究的基本思路，包括研究目标、研究框架、研究内容与研究方法，总结了研究的创新之处，并指明了未来可能进一步研究的方向。

第二章为文献综述。首先阐述了与本文选题相关的低碳经济理论基础，包括生态足迹理论、资源环境脱钩理论以及环境库兹涅茨曲线理论、纳入环境因素的新古典与内生经济增长理论等反映生态环境测度、经济发展与生态环境关系的相关理论。其次，分别回顾并梳理了技术进步、FDI、对外贸易对生态环境影响的国内外文献，在此基础上，整理了近年来国外学者对不同的国际溢出渠道所发挥的技术效应对东道国碳排放影响的研究成果，以及国内的初步研究概况。最后，作出了简要述评与研究展望。

第三章为内在机制。首先，建立了技术因素对生态环境影响的一般均衡理论分析框架，结论发现碳排放量由经济规模、产业结构以及碳排放强度三个因素共同决定。其次，将生产函数具体设定为柯布一道格拉斯生产函数形式，根据成本最优化决策的条件推导出产业结构与碳排放强度的决定因素，并将其纳入碳排放量的决定因素方程，结果直观反映出碳排放量与经济规模、人均资本存量之间呈正相关关系，而与自主研发创新、FDI、对外贸易以及碳排放税费之间呈负相关关系。为进一步有效区分 FDI、对外贸易技术溢出的碳减排效应，分别将碳排放变动相对于 FDI、对外贸易变动的反应弹性分解为规模效应、结构效应以及技术效应三个部分。最后，从理论上阐述了 FDI 技术溢出、对外贸易技术溢出对工业能源消费碳排放的影响路径，并由此提出了假说 1—7。

第四章为指标的构建、测度与分解。首先运用投入产出表构建了 FDI、对外贸易技术溢出路径的度量指标，从多重角度测度了中国工业能源消费碳排放的变化规律，包括工业能源消费碳排放量、碳排放强度、碳排放绩效、对外贸易隐含碳排放量以及低碳经济水平指数，并进一步探讨了工业

能源消费碳排放的驱动因素。结论表明,其一,工业能源消费碳排放量的变化趋势以 2005 年为分水岭,2005 年以前保持稳定,2005 年以后,大部分工业行业呈现明显的上升趋势;其二,工业能源消费碳排放强度的变化总体上呈现出波动式下降的趋势,仅在 2004 年大部分行业出现小幅反弹的特征;其三,中西部地区工业能源消费碳排放绩效明显高于东部地区,其中,中西部地区工业能源消费碳排放绩效的提升主要依靠技术进步,而东部地区主要依赖技术效率的改进;其四,工业能源消费碳排放绩效的变化规律存在明显的行业异质性。进一步从工业行业能源消费碳排放的驱动因素来看,生产技术效应与结构效应能明显降低工业能源消费碳排放,而规模效应与结构生产技术效应对工业能源消费碳减排存在负面影响,其余因素的作用不明显。

第五章为国际技术溢出对中国工业能源消费碳排放强度影响的实证分析。首先,对第三章提出的假说 1—3 的实证分析沿袭 Grossman and Krueger (1991) 的思路设立了静态与动态模型,考察了 FDI 技术溢出的碳减排效应及研发投入强度、企业所有制结构、行业结构等行业特征对该效应的影响。结果表明,FDI 技术水平溢出对工业行业能源消费碳排放强度的影响不明显,前向技术溢出短期有利于降低工业行业能源消费碳排放强度,长期可能存在抑制作用,而后向技术溢出能明显降低工业行业能源消费碳排放强度;研发投入强度、行业结构对 FDI 技术垂直溢出有明显的促进作用,而企业所有制结构存在负面作用。其次,对第三章提出的假说 4—7 的实证分析依据类似的研究思路,考察了对外贸易技术溢出对工业行业能源消费碳排放强度以及碳排放量的影响,检验了研发投入、企业所有制结构以及行业碳排放强度等行业特征因素对进口贸易技术前向溢出与出口贸易技术后向溢出的碳减排效应的作用。结果显示,进口贸易技术水平溢出能显著促进工业行业能源消费碳排放强度的提高,而出口贸易技术后向溢出的影响方向相反,其中,研发投入强度、企业所有制结构对进口贸易技术水平溢出存在抑制作用,且企业所有制结构对出口贸易技术后向溢出也存在负面作用。此外,FDI 行业结构是影响中国对外贸易隐含碳排放的主导因素,具体来看,FDI 行业结构变化促进了贸易隐含碳排放的增加;投资的贸易隐含碳强度一直在下降,且降幅不断增大;FDI 数量变化对贸易隐含碳排放的影响不稳定,两者不存在明显关联,同时,FDI 和 OFDI 均对中国低碳经济的发展均有正面的促进作用,而促进

作用的差异主要源于作用途径不同。

第六章为国际技术溢出对中国工业碳排放绩效影响的实证分析。本章与第五章的主要区别在于表征碳减排技术水平的指标选择不同，模型设立均沿袭 Grossman and Krueger (1991) 的思路，对 FDI、对外贸易技术溢出的碳减排效应分区域、分行业进行考察。结果表明，三大区域影响程度与影响方向均存在明显的区域异质性；FDI 技术溢出抑制了技术进步，而 FDI 技术垂直溢出促进了技术效率的改进，且 FDI 技术前向溢出效应大于后向溢出效应；出口贸易技术水平溢出抑制了技术进步，而出口贸易技术水平溢出与后向溢出有利于技术效率的提升；进口贸易技术水平溢出抑制了技术效率的改进，而进口贸易技术前向溢出对技术效率存在积极的促进作用。最后，阐明了碳排放量、碳排放强度与碳排放绩效指数之间的关联，结合第五章与本章的检验结论，对所得结论的原因展开了深层次的剖析。

第七章为主要研究结论与政策建议部分。在对国际技术溢出的碳减排内在机制及其效应的研究结论进行梳理的基础上，提出了基于国际技术溢出的中国低碳技术创新能力提升路径，主要围绕“产学研用”创新平台、产业链一体化平台以及投资经营环境的制度平台三个平台的构建与完善展开，以不断培育中国低碳技术的创新能力，并通过调整外资与对外贸易的工业结构、区域结构，建立公平、有效的碳减排合作机制，制定合理的引资政策，通过 FDI 产业关联渠道促进国内相关产业的低碳技术改进，实现产业链的清洁生产，减轻国际碳减排转移的压力，同时，积极优化 FDI 的产业分布结构和来源结构，以最大限度地发挥外资与对外贸易技术溢出对中国工业能源消费碳减排的积极效应。

关键词：FDI；对外贸易；碳排放强度；碳排放绩效；技术效率；技术进步

Abstract

Scholars at home and abroad have made lots of researches on the effects of FDI and international trade on the carbon emission of host country, and they discussed that FDI and international trade mainly through the influence of scale effect, composition effect and technical effect on carbon emission of host country. Based on this, Scholars abroad have made further studies on the different technical effects of different international spillover channels on the carbon emission of host country, however, seldom domestic studies is on this topic, only one or two papers has preliminarily investigated this topic from the perspective of technology horizontal spillover channel from FDI, therefore this paper takes China industry as sample to extend and resupply, and makes systematic and in-depth study of inner mechanism of the effects of international technology spillovers on the carbon emission of industrial energy consumption in China, which has deep theoretical value.

The Twelfth Five – Year Plan proposes the state strategy about how to cope with the international climate change, which means that China should make full use of technology advancement, improve system mechanism and policy system, and carry out pragmatic cooperation in scientific research, technology research and development and capacity building through strengthening international exchange in the field of climate change. It has become a general consensus that middle – long period carbon emission reduction of energy consumption could be enhanced through technology innovation of low carbon. The main problems exists in the field of carbon emission reduction of industrial energy consumption recently in China are as follows. Firstly, the high carbon lock – in effect universally exists in industrialized countries. Secondly, the technology innovation basis of low carbon is weak, nearly seventy percent of core technology types of low carbon relies on

the import. Thirdly, technology innovation path of low carbon is separated from the economic condition in China. All of these cause the dilemma of the insufficient of technology innovation ability of low carbon, if China could pay attention to the optimization of the technology paths during the course of international transfer and diffusion of technology of low carbon, this dilemma could be alleviated. Based on this point, this paper studies the policy transition, objectives and contents which do benefits to optimize the paths of carbon emission of industrial energy consumption reduction technology innovation from the perspective of international technology spillover channels in China.

The content of this paper is mainly surrounding the following aspects: Firstly, this paper tries to review the basis of theoretical research related with Low - Carbon economics, summarizes and comments the literatures and research progresses in the fields of the researches on the effects of technology advancement on ecological environment, and the effects of FDI and international trade on ecological environment. Secondly, this paper analyzes the inner mechanism of the effects of international technology spillovers on carbon emission of industrial energy consumption, builds up a general equilibrium model to make an in - depth analysis. Thirdly, this paper estimates the current situation of carbon emission of industrial energy consumption from multiple angles, including carbon emissions of industrial energy consumption, carbon emission intensity of industrial energy consumption, carbon emission performance of industrial energy consumption, carbon emissions embodied in the trade, low - carbon economy index and driving forces of carbon emissions of industrial energy consumption. Fourthly, carbon emission intensity of industrial energy consumption is used to characterize industrial carbon emission reduction technology, and this paper examines the effects of technology spillovers from FDI and international trade on industrial carbon abatement based on the panel data from industrial sectors. Besides, this paper examines the technical effects of FDI on carbon emissions embodied in the trade and low - carbon economy index. Fifthly, carbon emission performance of industrial energy consumption is used to characterize industrial carbon emission reduction technology, and this paper examines the effects of technology spillovers from FDI and international trade on industrial carbon abatement based on the panel data

from industrial sectors and provincial industry. Specifically, this paper is divided into 7 chapters.

Chapter I is introduction. This chapter presents the research background, research significance in theory and practice, proposes the research train of thought, including research objective, research skeleton, research content and research method, summarizes research innovation, and points out the future direction for further research.

Chapter II is literature review. This chapter firstly introduces the theoretic basis of Low – Carbon economics related with the research, including ecological footprint theory, decoupling theory of resources and environment and theory of the environmental Kuznets curve, neo – classic economic growth theory and endogenous growth theory that embraced the environmental factors, which reflect analysis of ecological environment and the relationship between economic development and ecological environment, then this chapter reviews and collates literatures at home and abroad about the effects of technology advancement, FDI and international trade on ecological environment respectively, based on these, this chapter also arranges the recent research findings abroad about the different technical effects of different international spillover channels on the carbon emission of host country, and domestic elementary research status. Finally, this chapter makes a brief review and research prospect.

Chapter III is inner mechanism. This chapter builds up the theoretic analysis framework of a general equilibrium about the effect of technical factor on ecological environment, the result indicates that carbon emissions is determined by the factors of economic scale, industrial structure and carbon emission intensity, based on this, this chapter sets production function into Cobb – Douglas production function form, deduces the determining factors of industrial structure and carbon emission intensity according to the condition of cost optimal decision, and substitutes the determining factors of industrial structure and carbon emission intensity into the equation which determines carbon emissions. The result directly reflects that economic scale and per capital stock has promotion effects on carbon emissions, however, independent research and development innovation, FDI, international trade and carbon emissions tax and charge have negative effects on

carbon emissions. In order to further effectively distinguish the effects of FDI and international trade on carbon emission reduction, this chapter divides FDI elasticity and international trade elasticity of carbon emissions into scale effect, composition effect and technical effect respectively. Finally, this chapter makes theoretic discuss on the influence paths of technology spillovers of FDI and international trade on carbon emission of industrial energy consumption, and thus proposes hypothesis 1 - 7.

Chapter IV is the construction, measurement and decomposition of indexes. This chapter firstly constructs the measure indexes of technology spillover path of FDI and international trade based on the input - output tables, estimates the change regulation of carbon emission of industrial energy consumption in China from multiple angles, including the indexes of carbon emissions, carbon emission intensity and carbon emission performance of industrial energy consumption, carbon emissions embodied in the trade, low - carbon economy index, and makes a further discussion about the driving forces of carbon emissions of industrial energy consumption. Results show that, first place, the year 2005 is taken as the line of demarcation of change regulation of carbon emissions of industrial energy consumption, the year before the index keeps constant, but the year after the index of most industrial sectors shows an up trend obviously. Second place, carbon emission intensity of industrial energy consumption tends to volatility - downward trend as a whole, and the index of most industrial sectors appears a slight rebound in 2004. Third place, carbon emission performance of industrial energy consumption in middle and western region is higher than the index in eastern region, among which, the improvement of carbon emission performance of industrial energy consumption in middle and western region is mainly depended on technology progress, but the improvement of carbon emission performance of industrial energy consumption in eastern region is mainly depended on technology efficiency advancement. Fourth place, the change regulation of carbon emission performance of industrial energy consumption shows obvious heterogeneous in different sectors. Then the research on the driving forces of carbon emissions of industrial energy consumption indicates that production technology effect and composition effect obviously reduce carbon emissions of industrial energy consumption.