摘　要

迎接数字经济时代，激活数据要素赋能。作为当今中国经济发展的主旋律，“数字经济”以其独特优势创造了一批新的产业和新的商业模式，深刻影响着政府的治理模式、企业的生产方式和居民的消费方式，为经济的发展创造了一批新的增长点，直接或间接地影响着人与自然环境的关系。那么当今正蓬勃发展的数字经济在推动经济向高质量转型的同时，能否助力城市低碳发展？为此本文试图研究数字经济能否推动各城市低碳发展，进而为我国实现“数字强国”和“双碳目标”的双赢局面提供政策建议。

本文以中国 2006—2017 年 283 个地级及以上城市面板数据为样本，研究数字经济发展对城市低碳发展的影响。首先，本文在前期理论分析的基础上，构建双向固定模型，实证检验数字经济发展对城市碳排放和碳强度的影响。其次，对基准回归模型进行一系列稳健性检验，其中包括工具变量法、引用“宽带中国”政策冲击、替换被解释变量和解释变量、缩尾处理、剔除地级市和省会城市、剔除其他政策影响等方法。再次，构建中介效应模型检验数字经济发展影响城市碳排放和碳强度的机制渠道，并利用面板门限模型检验在差异性产业集聚水平下数字经济发展对城市碳排放和碳强度的非线性特征。随后，分析了城市所处区位、城市规模、城市创新水平的异质性。再者，构建空间计量模型检验城市数字经济发展的空间碳减排效应。最后，从县域层面进一步探索数字经济发展的碳减排作用。

主要结论如下：（1）数字经济发展具有明显的碳减排作用，显著降低城市的碳排放和碳强度，在一系列稳健性检验下该结论仍然成立。（2）数字经济发展通过优化能源消费结构、改善能源利用效率和驱动城市绿色创新等方式来降低城市碳排放和碳强度。（3）随着产业集聚水平的提升，数字经济发展对碳排放和碳强度的影响呈现为先扬后抑的非线性特征。（4）异质性分析发现，数字经济发展的碳减排效应在中西部、规模更大和创新水平更高的城市更明显。（5）数字经济发展具有明显的空间碳减排效应，能够在降低本地碳排放和碳强度的同时抑制周边地区的碳排放和碳强度。并在宏观层面拓展分析中发现，数字经济发展对各县域仍具有明显的碳减排作用。

结合研究结论，本文提出以下政策建议：一是深入推进数字中国建设，推动数字经济与实体经济的融合发展，最大限度释放数字经济发展的节能降碳效应；二是激励各企业优化能源消费结构，改善能源利用效率，同时驱动城市绿色创新，增强传导路径，深化数字经济发展的节能降碳效应；三是推动数字经济与产业集聚协调发展，警惕企业“重产能、轻效率”现象，加快完善产业布局体系，引导释放数字经济发展的效率节能效应；四是加大对中西部地区、大型城市和高创新水平城市发展数字经济的扶持力度，在资金

和人力资源方面帮扶中小型城市和低创新水平城市，尽快完善产业结构体系，提高其产业集聚水平和科技创新水平；五是加强城市之间的信息、知识、技术的互惠共享，充分发挥数字经济在节能降碳中的辐射带动作用。

关键词：数字经济；碳排放；碳强度；产业集聚

Abstract

Welcome the era of digital economy and activate the empowerment of data elements. As the main theme of China's economic development today, the "digital economy" has created several new industries and new business models with its unique advantages, profoundly affecting the government's governance model, the production methods of enterprises, and the consumption patterns of residents, creating several new growth points for economic development, directly or indirectly affecting the relationship between man and the natural environment. So, while promoting the transformation of the economy to high quality, can the booming digital economy contribute to the low-carbon development of cities? For this reason, this thesis attempts to study whether the digital economy can promote the low-carbon development of cities, and then provide policy suggestions for my country to achieve a win-win situation of "digital power" and "dual carbon goals".

This article uses the panel data of 283 cities at or above the prefecture level in China from 2006 to 2017 as a sample to study the impact of digital economic development on urban low-carbon development. First, based on the previous theoretical analysis, this thesis constructs a two-way fixed model to empirically test the impact of digital economic development on urban carbon emissions and carbon intensity. Secondly, a series of robustness tests were conducted on the benchmark regression model, including the instrumental variable method, citing the "Broadband China" policy impact, replacing the explained variables and explanatory variables, shrinking processing, excluding prefecture-level cities and provincial capital cities, and excluding other policies. influence methods. Thirdly, an intermediary effect model is constructed to test the mechanism channels through which digital economic development affects urban carbon emissions and carbon intensity, and a panel threshold model is used to test the nonlinear characteristics of digital economic development on urban carbon emissions and carbon intensity under different levels of industrial agglomeration. Subsequently, the heterogeneity of city location, city size, and urban innovation level was analyzed. Furthermore, a spatial econometric model is constructed to test the spatial carbon emission reduction effect of urban digital economic development. Finally, the carbon emission reduction effect of digital economic development is further explored from the county level.

The main conclusions are as follows: (1) Digital economic development has an obvious carbon emission reduction effect, significantly reducing the city’s carbon emissions and carbon

intensity. This conclusion still holds true under a series of robustness tests. (2) Digital economic development reduces urban carbon emissions and carbon intensity by optimizing energy consumption structure, improving energy utilization efficiency, and driving urban green innovation. (3) As the level of industrial agglomeration increases, the impact of digital economy development on carbon emissions and carbon intensity shows a non-linear characteristic of first increasing and then decreasing. (4) Heterogeneity analysis found that the carbon emission reduction effect of digital economic development is more obvious in cities in the central and western regions, with larger scales and higher levels of innovation. (5) Digital economic development has an obvious spatial carbon emission reduction effect, which can reduce local carbon emissions and carbon intensity while suppressing carbon emissions and carbon intensity in surrounding areas. In the expanded analysis at the macro level, it was found that the development of the digital economy still has a significant carbon emission reduction effect on various counties.

Based on the research conclusions, this article puts forward the following policy recommendations: First, further promote the construction of Digital China, promote the integrated development of digital economy and real economy, and maximize the energy-saving and carbon-reduction effects of digital economic development; second, encourage enterprises to optimize their energy consumption structure , improve energy utilization efficiency, while driving urban green innovation, strengthening transmission paths, and deepening the energy-saving and carbon-reducing effects of digital economic development; third, promoting the coordinated development of digital economy and industrial agglomeration, being wary of the phenomenon of enterprises "emphasizing production capacity over efficiency," and accelerating improvement The industrial layout system will guide the release of the efficiency and energy-saving effects of digital economic development; fourth, we will increase support for the development of the digital economy in central and western regions, large cities and high-innovation cities, and assist small and medium-sized cities and low-income cities in terms of funds and human resources. An innovative city should improve its industrial structure system as soon as possible and improve its industrial agglomeration level and technological innovation level; fifth, it is to strengthen the reciprocal sharing of information, knowledge, and technology between cities and give full play to the radiating and driving role of the digital economy in energy conservation and carbon reduction.

Key Words: digital economy; carbon emission; carbon intensity; industrial agglomeration

目　录

1　绪论 1
1.1　研究背景与研究意义 1
1.1.1　研究背景 1
1.1.2　研究意义 2
1.2　研究内容、技术路线与方法 2
1.2.1　研究内容 2
1.2.2　技术路线 3
1.2.3　研究方法 4
1.3　创新点与不足 5
1.3.1　研究创新点 5
1.3.2　研究不足 5
2　文献综述 6
2.1　数字经济的研究现状 6
2.1.1　数字经济的内涵 6
2.1.2　数字经济的测度 7
2.1.3　数字经济的效应 8
2.2　碳排放的研究现状 10
2.2.1　碳排放的测度 10
2.2.2　碳排放的影响因素 11
2.3　数字经济发展对碳排放的影响研究 12
2.4　文献评述 13
3　理论分析与研究假说 14
3.1　数字经济、能源消费与低碳发展 14
3.2　数字经济、城市绿色创新与低碳发展 16
4　数字经济与城市低碳发展的实证分析 18
4.1　研究设计、变量选取与数据说明 18
4.1.1　研究设计 18
4.1.2　变量选取 18
4.1.3　数据说明 20
4.2　基准估计 21
4.3　内生性分析 23

4.4 稳健性检验 27
4.5 中介机制检验 28
4.5.1 能源消费结构和能源利用效率的中介效应 28
4.5.2 城市绿色创新的中介效应 29
5 拓展分析 31
5.1 门限效应分析 31
5.2 异质性分析 34
5.3 空间溢出效应分析 37
5.4 宏观层面拓展分析 39
6 主要结论与政策建议 41
6.1 主要结论 41
6.2 政策建议 41
参 考 文 献 43
致 谢 48

TABLE OF CONTENTS

1 Introduction 1
1.1 Background and significance 1
1.1.1 Background 1
1.1.2 Implications of the study 2
1.2 Research content, technical route and methods 2
1.2.1 Study Content 2
1.2.2 Technical Route 3
1.2.3 Research Methods 4
1.3 Innovations and shortcomings 5
1.3.1 Research innovation 5
1.3.2 Insufficient research 5
2 Literature Review 6
2.1 Research status of digital economy 6
2.1.1 Connotation of the digital economy 6
2.1.2 Measurement of the digital economy 7
2.1.3 Effects of the digital economy 8
2.2 Current status of research on carbon emissions 10
2.2.1 Measurement of carbon emissions 10
2.2.2 Factors influencing carbon emissions 11
2.3 Research on the impact of the development of the digital economy on carbon emissions 12
2.4 Literature Review 13
3 Theoretical Analysis and Research Hypotheses 14
3.1 Digital economy, energy consumption and low-carbon development 14
3.2 Digital economy, urban green innovation and low-carbon development 16
4 An empirical analysis of the digital economy and low-carbon urban development 18
4.1 Study design, variable selection, and data interpretation 18
4.1.1 Study design 18
4.1.2 Variable selection 18
4.1.3 Data description 20
4.2 Baseline estimates 21

4.3 Endogeneity analysis 23
4.4 Robustness test 27
4.5 Intermediary Mechanism Test 28
4.5.1 The mediating effect of energy consumption structure and energy efficiency 28
4.5.2 The mediating effect of urban green innovation 29
5 Extended analysis 31
5.1 Threshold effects analysis 31
5.2 Heterogeneity analysis 34
5.3 Analysis of spatial spillover effects 37
5.4 Macro-level extended analysis 39
6 Key findings and policy recommendations 41
6.1 Main findings 41
6.2 Policy recommendations 41
References 43
Acknowledgments 48

图目录

图 1.1 技术路线图.....4
图 4.1 平行性趋势检验.....26

表目录

表 4.1 主要变量定义及数据来源 20
表 4.2 各变量描述性统计 21
表 4.3 基准回归结果 22
表 4.4 工具变量检验 24
表 4.5 “宽带中国”外生冲击检验 26
表 4.6 稳健性检验—替换被解释变量和核心解释变量以及缩尾处理 27
表 4.7 稳健性检验—剔除直辖市和省会城市以及剔除其他政策影响 28
表 4.8 中介机制检验—能源消费结构与能源利用效率 29
表 4.9 中介机制检验—城市绿色创新 30
表 5.1 门限存在性检验 33
表 5.2 双重门限回归结果 34
表 5.3 区域异质性 35
表 5.4 城市规模异质性 36
表 5.5 城市创新水平异质性 37
表 5.6 邻接矩阵下的 Moran's I 指数 38
表 5.7 空间杜宾模型回归结果 39
表 5.8 县域层面拓展分析 40

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