Research on Innovative Development of Urban Low-carbon Technology and Green Economy

Jianxia Wang [1, a] *, Ding Ma [2, b], Jingjing Chen [2, c] ,and Yinuo Zhu [2, e]

[1*]Beijing Urban and Rural Innovation Development Doctoral Research Association, Beijing, 100000, China;

[b] Academic Department, Stamford International University, Thailand.

[c] Department of Art, Lu'an Vocational Technical College, China.

[d] Ninth Grade, Gaocheng Middle School, Anhui,China.

[a] sophia07.wang@gmail.com, [b] 2105100011@students.stamford.edu,

[c] dr.jingjingzhao@gmail.com,yinuo.promise@hotmail.com

Abstract. This paper focuses on analyzing the effects and mechanisms of green fiscal expenditure policies on low-carbon technology innovation. This section selects pilot cities with comprehensive demonstration of energy conservation and emission reduction fiscal policies as typical green fiscal expenditure policies from the city level, focusing on green fiscal expenditure.On this basis, this paper conducts econometric model analysis on the estimated coefficients of the benchmark regression, confirms the robustness of the benchmark regression results, and finds through heterogeneity analysis that the effect of the demonstration policy in promoting low-carbon technology innovation is more significant in non-resource-based cities and non-old industrial base cities.

1. Introduction

In Europe, many countries have implemented green fiscal and taxation policies, which mainly include the following four forms: First, environmental taxes are imposed on exhaust gas and waste emissions.[1] In 1991, Sweden, on the basis of a substantial reduction in income tax, imposed taxes on carbon-containing fuels, carbon dioxide emissions and exhaust emissions from domestic aircraft, which not only compensated for the reduction in tax revenue, but also played a role in controlling pollution. Second, the direction of tax law encouragement is changed to tax polluting behavior.Sweden imposes taxes on the use of leaded gasoline, heavily polluting diesel and chemical synthetic fertilizers. France and Germany impose taxes on polluted water sources, and the revenue is used to transform and improve wastewater treatment plants. Third, a cost-paying tax is levied on general waste and pollution. Germany has a wide range of tax items, including toxic waste and disposable fast food packaging.The Netherlands imposes taxes on the use of water-polluting raw materials and also taxes household waste.[2]

2. Urban low-carbon fiscal policy

Urban public finance is the government's allocation behavior to provide public products and public services to society, mainly focusing on meeting social public needs and making up for the defects of "market failure".[3] The Stern Report believes that "climate change poses a unique challenge in economics: it is the largest and most widespread market failure phenomenon to date."The low-carbon fiscal policy chain is a chain system of mutual promotion, coordination and unity formed by various fiscal policies selected (or formulated) for the development of low-carbon economy according to the policy correlation between each other.[4]

3. The important role of low-carbon finance

At present, the development of urban green finance is still in its early stages, and the main participating financial institutions are commercial banks. Therefore, the government should use "green credit" as a starting point and breakthrough for the implementation of green finance.[5] The government should improve the operating mechanism of green finance, firmly implement the credit policy of "protection and pressure", and limit the credit supply of "two highs and one surplus". The government should also increase policy support for green finance, speed up the research and introduction of loan interest subsidies, tax and fee reductions and other policies, accelerate the legalization of ecological and environmental protection, and create a good macro-policy environment for the development of green finance.[6]

We measure the level of inefficient investment (UE) of enterprises by constructing the following econometric model:

$$Inv_{i,t} = \beta_1 + \beta_2 Growth_{i,t} + \beta_3 Lev_{i,t} + \beta_4 Cash_{i,t} + \beta_5 Age_{i,t} + \beta_6 Size_{i,t}$$
$$+ \beta_7 \operatorname{Re}t_{t-1} + \beta_8 Inv_{i,t-1} + \sum Industry_i + \sum Year_i + \varepsilon_{i,t} \quad (1)$$

Among them, Inv represents the actual new investment expenditure = cash paid for the purchase and construction of fixed assets, intangible assets and other long-term assets + net cash paid for the acquisition of subsidiaries and other business units - net cash recovered from the disposal of fixed assets, intangible assets and other long-term assets - net cash received from the disposal of subsidiaries and other business units - (depreciation of fixed assets + amortization of intangible assets + amortization of long-term deferred expenses) / total assets at the beginning of the year;Growth represents the sales revenue growth rate; Age represents the age of the enterprise; Lev represents the debt-to-asset ratio of the enterprise; Cash represents the net cash flow from operating activities/total assets at the beginning of the year; Size represents the natural logarithm of the total assets of the enterprise; and Ret represents the stock return rate.

Urban development must integrate environmental and social responsibility into credit policies, credit management processes, and credit culture, establish a green credit mechanism that includes project review, product design, risk control, incentives and constraints, and information disclosure, and make corporate environmental protection performance an important part of credit marketing investigations and approvals.[7]

4. The impact of fiscal decentralization on urban development and low-carbon technology innovation

We refer to the experience of international green finance, and on the basis of fully grasping the connotation of urban ecological civilization and the direction of economic development transformation, develop a variety of financial instruments such as green financial management, green guarantees, green trusts, green insurance, green bonds, green industry funds, and explore the development of structural financial instruments such as carbon asset securitization, carbon trading CDS, emission rights trading and ecological compensation. The city's innovative green finance direct and indirect financing tools promote the development of the green economy.

We can find that fiscal decentralization has a significantly insufficient impact on the level of enterprise low-carbon technological innovation, indicating that fiscal decentralization can significantly inhibit enterprise low-carbon technological innovation in terms of both innovation quantity and quality.

(1) Benchmark regression results

Table 1 columns (1) to (4) show the benchmark regression results model of this paper. Columns (1) and (2) are the empirical regression results without adding control variables, and only controlling for the fixed effects of individual enterprises and years. The regression coefficient of fiscal decentralization on enterprise low-carbon technology innovation is significantly negative at

the 1% level, indicating that fiscal decentralization can significantly inhibit enterprise low-carbon technology innovation in terms of both innovation quantity and innovation quality.Columns (3) and (4) are the baseline regression results after adding control variables. After controlling for other variables that may affect corporate low-carbon technology innovation, the regression coefficients of fiscal decentralization on the quantity and quality of corporate low-carbon technology innovation have decreased in significance, but still have a 5% significance level. This shows that fiscal decentralization can significantly inhibit corporate low-carbon technology innovation.

Table 1 Benchmark regression results

Variable	LCT_PAT	LCT_LNV	LCT_PAT	LCT_LNV
	(1)	(2)	(3)	(4)
FE	-26.7251***	-15.6900***	-18.5890**	-17.9049**
	(7.7529)	(5.8443)	(7.6601)	(8.2018)
Asset			0.2555***	0.2469***
			(0.0671)	(0.0765)
Roa			-0.0712**	-0.0579**
			(0.0287)	(0.0251)
Lia			-0.0118	0.0060
			(0.0514)	(0.0448)
Ca			-0.0744	0.0040
			(0.0885)	(0.0647)
Pa			-0.0027	-0.0673
			(0.0650)	(0.0715)
Top			0.0070***	0.0086***
			(0.0041)	(0.0020)
PGDP			-0.4742***	-0.1400
			(0.1612)	(0.2236)
Fdi			0.0165	0.0131
			(0.0139)	(0.0150)
Gov			-0.0068	-0.0040
			(0.0044)	(0.0055)
Fin			-0.1998**	-0.0320
			(0.0923)	(0.1040)
Constant			2.1663	-2.1608
			(1.9088)	(2.4935)
Year fixed effects	Control	Control	Control	Control
Firm fixed effects	Control	Control	Control	Control
Observations	2824	2824	2822	2822
R-squared	0.115	0.043	0.149	0.074

Note: (1) The data in brackets are robust standard errors clustered to the city level; (2) *, **, and *** are significant at the 10%, 5%, and 1% levels, respectively.

In the context of high-quality economic development, resource-based cities and old industrial base cities face strong transformation constraints, and the conversion of new energy power is also strongly supported by local governments. To this end, this paper first selects whether the city where the enterprise is located is a new energy demonstration city, resource-based cities and old industrial base cities to regress the number of low-carbon patents of enterprises.

Table 2 Results of regional heterogeneity grouping regression on the number of low-carbon patents

Variable	Is it a new energy demonstration city?		Is it a resource-based city?		Is it an old industrial base city?	
	Yes	No	Yes	No	Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)
FE	16.7779	-47.4955	-48.6683	-23.3721**	-113.1401	-21.7853
	(23.2525)	(51.8700)	(329.7890)	(10.9316)	(143.2802)	(15.6776)
Asset	0.1060	0.2536**	-0.2693**	0.3417***	-0.0486	0.3237**
	(0.1286)	(0.0989)	(0.1227)	(0.0726)	(0.1733)	(0.0811)
Roa	0.0000	-0.0643	0.0000	-0.1184***	0.8116*	-0.1019***
	(0.0000)	(0.0411)	(0.0000)	(0.0415)	(0.4604)	(0.0335)
Lia	0.0841	-0.0189	-0.1078	0.0126	-0.0826	0.0045
	(0.0855)	(0.0675)	(0.0788)	(0.0620)	(0.0826)	(0.0630)
Ca	0.3887***	-0.1457	0.0000	-0.0586	0.0354	-0.0872
	(0.0604)	(0.1174)	(0.0000)	(0.0818)	(0.3643)	(0.0809)
Pa	0.2465*	-0.0864	0.0971	-0.0200	0.0655	-0.0719
	(0.1405)	(0.0764)	(0.1164)	(0.0792)	(0.0920)	(0.0972)
Top	0.0051	0.0108***	0.0047	0.0101***	0.0067**	0.0109***
	(0.0044)	(0.0032)	(0.0031)	(0.0130)	(0.0029)	(0.0034)
PGDP	-0.8619	-0.3868**	-0.1846	-0.7726***	0.1538	-0.6865**
	(0.5834)	(0.1961)	(0.2750)	(0.2497)	(0.2483)	(0.2685)
Fdi	-0.0369	0.0110	0.0588	0.0194	0.0755*	0.0171
	(0.1432)	(0.0185)	(0.0603)	(0.0159)	(0.0427)	(0.0163)
Gov	-0.0060	-0.0059	-0.0056	-0.0071	-0.0065*	-0.0053
	(0.0182)	(0.0058)	(0.0048)	(0.0076)	(0.0036)	(0.0137)
Fin	0.0134	-0.1578	-0.3708	-0.2602**	0.1670	-0.3214***
	(0.2789)	(0.1177)	(0.3553)	(0.1092)	(0.1933)	(0.1136)
Constant	9.2517	1.1565	5.9413**	4.0490	-0.6919	3.3893
	(6.4215)	(2.4463)	(2.3934)	(2.9787)	(3.3260)	(3.4191)
Year fixed effects	Control	Control	Control	Control	Year fixed effects	Control
Firm fixed effects	Control	Control	Control	Control	Firm fixed effects	Control
Observations	686	2177	419	2433	558	2165
R-squared	0.072	0.164	0.147	0.187	0.129	0.189

5. Innovative solutions for urban green economy

Green fiscal policy plays a pivotal role in promoting the development of urban low-carbon economy. Urban low-carbon finance plays the following important roles:

Enhance the overall effectiveness of policies and improve the efficiency of fiscal funds. The key role of green and low-carbon finance is to maximize the coordination of related policies, minimize the constraints of related policies, and comprehensively weigh the relationship between various policies when formulating policies. It can make various policies interconnected and coordinated, and effectively overcome the isolation and limitations of individual policies. Green economic and low-carbon finance can play the synergistic role between various fiscal policies for developing a low-carbon economy and enhance the overall effectiveness of policies.Cities can integrate various basic and specific fiscal policies through low-carbon finance to form a policy synergy and achieve the policy effect of "1+1>2". Low-carbon finance will enable the same fiscal capital investment to achieve more carbon reduction effects and improve the efficiency of fiscal funds.

Ensure the consistency of policies. The transformation of the economic development model to a low-carbon economy is a long-term task and cannot be achieved overnight. Although the focus of low-carbon economic policies in different periods is different, the policies must remain consistent. Similarly, low-carbon fiscal policies in different periods must also be consistent.The overall fiscal plan in the green economy and low-carbon finance is the overall fiscal strategy for supporting the development of low-carbon economy in the medium and long term. The basic policies and specific policies in different periods are formulated under the guidance of the overall strategy and according to the development of low-carbon economy in each period. It not only ensures that the basic policies and specific policies in different periods have their own emphasis, but also keeps the policies consistent and connected.

6.Summary

Technological innovation is the core driving force for achieving green and low-carbon development. At present, cities are still in the middle stage of industrialization and urbanization, and there is a strong coupling relationship between economic development and energy consumption and carbon emissions. Urban development needs to take into account both economic and social sustainable development and the realization of carbon neutrality goals, and must rely on technological innovation.

Acknowledgements

References

[1] Makeeva E , Murashkina I , Mikhaleva I .The impact of R&D tax incentive programs on the performance of innovative companies[J].Foresight, 2019, 21(5):545-562.

[2] Dominique, Guellec, &, et al. The impact of public R&D expenditure on business R&D*[J]. Economics of Innovation & New Technology, 2003.

[3] Gentry W M , Hubbard R G . Entrepreneurship and Household Saving[J]. Advances in Economic Analysis & Policy, 2004, 4(1):1053-1053.

[4] Fang Xingcun, Tian Shuying, Wang Xiaoling. Fiscal decentralization, industrial agglomeration and green economic efficiency - an empirical analysis based on panel data of 270 cities at prefecture level and above[J]. Exploration of Economic Issues, 2019(11):164-172.

[5] Litvack J, Seddon J, Ahmad J, et al.Decentralization briefing notes[J]. World Bank WBI Working Papers, 1999.

[6] Wang Wei. Fiscal decentralization in my country's market-oriented reform[D]. Xiamen University, 2003.

[7] Tiebout, C. A pure theory of local expenditures[J]. Journal of political economy, 1956, 64（5）：416-424.