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Does Carbon Emission Trading Affect the Share of Labor Income in Firms? Quasi-Natural Experiment Based on Carbon Emission Trading Pilot

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***Abstract*—** *The long-term increase of the labor share of the factors in production is the nature of the socialism, but it will also face the impact of short-term external environment changes. This paper collects the panel data of non-financial A-share listed firms from 2007 to 2019 in China, and empirically analyzes the impact of carbon emissions trading on the labor income share of firms using the difference-in-difference method, and then conducts the analysis of heterogeneity and mechanism of impacts. The results show that the carbon emission trading significantly reduces the share of labor income of enterprises. The impacts are different among different types of enterprises, where the labor income share is reduced in enterprises with low-carbon emission, as well as in state-owned and small or medium-sized enterprises, while those of the high-carbon emission enterprises are improved significantly. The mechanism study further finds that the carbon emission trading impact negatively the share of labor income mainly through reducing their wage rate, but another potential mechanism, labor productivity, is not significant.*

***Keywords*—** *Carbon emission trading; labor income share; difference-in-difference model; wage rate.*

I. INTRODUCTION

Since the reform and opening up, China's economy has developed rapidly and capital accumulation is changing rapidly, but at the same time, there are some problems that cannot be ignored: the share of labor income is declining continuously [1-3]. In a horizontal international comparison, the share of labour income in developed countries is currently between 65 and 70 per cent, while China's share of labour income is only about 40 per cent, making it one of the lowest, and the gap continues to widen [4, 5]. Too low a share of labor income prevents workers from fully sharing in the fruits of economic development, which can lead to labor capital glut, income inequality, and even increase the likelihood of falling into a potential "middle-income risk " trap, to the detriment of China' s sustainable economic development [6,7]. In the new era of socialist development with Chinese characteristics, the academic research on labor income share places more emphasis on the microbehavioral basis and combines the change of labor income share with the basic conditions of our country. China's economy cannot take off without a large number of workers, and future economic growth will depend more on the contributions of highly qualified workers.

In the face of the global warming caused by the large amount of carbon emissions from concentrated production activities, carbon trading is a market type environmental regulation that has been widely adopted in many countries. Carbon emissions trading is based on cap-and-trade, pricing the emissions allowances of controlled enterprises, constraining the production activities of controlled enterprises in a cost-effective manner and providing incentives to reduce emissions, effectively meeting emission reduction targets. As the largest carbon emitter in the world, China's sustained and rapid economic growth depends on the factor input model, which leads to the increasingly serious problem of resource and environmental constraints. This provides an opportunity and gives full practical significance to the implementation of carbon emissions trading, which could be an important turning point in combating climate change. While the primary starting point for carbon trading to address climate change is to regulate the productive behaviour of microagents, macroeconomic and social changes will follow. At present, relevant research focuses on the impact of innovation activities and the positive impact of consensus. However, research on the social impacts of carbon markets, such as changes in social welfare levels and income distribution, has been notably inadequate, especially on the share of enterprise labour income, which has not been empirically tested. Therefore, this paper takes the official opening of carbon emissions trading in china in 2013 as the key time point, applies the double differential model to carry out a quasi-natural experiment, and probes into the relationship between carbon emissions trading and the share of labor income of enterprises.

II. THEORETICAL ANALYSIS OF FINANCIAL DEVELOPMENT AND GLOBAL VALUE CHAIN

This paper selected non-financial A-share listed companies from 2007-2019 as the research sample. Given that China' s pilot carbon-trading policy covers only companies in the pilot provinces (Beijing, Tianjin, Shanghai, Chongqing, Hubei, Guangdong, and Shenzhen), individuals in these provinces and cities are used as treatment groups and others as control groups. In order to ensure the stability and validity of the sample, the following individuals were excluded: enterprises that suffered continuous losses (marked PT, ST and * ST), data anomalies and missing values were significant, staff compensation payable was negative, the number of employees was less than 100, and the employee income share was greater than 1. In order

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to eliminate measurement errors due to inconsistencies in the development of the enterprise, the data related to capital are reduced by 1% [36,37]. In the end, panel data from 532 publicly traded companies were obtained for a total of 6,916 valid observations, all derived from the CSMAR database.

The double differential method used in the empirical part is often used to evaluate the "net processing effect" of policies or major events, which meets the research needs of this paper. The controlled enterprises in the pilot provinces and cities are treated as exogenous shocks, while other enterprises are treated as control groups.

$$LS_{it} = a_0 + a_1 treat + a_2 year + a_3 tdid + aS_{itt} + \lambda_i + \mu_t + \varepsilon_{it} \quad (1)$$

The variable interpreted is the share of the enterprise's labor income (LS). Employee income share is the micromeasure of labor income share. Based on the practice of lu zhengfei, wang xiongyuan and shen yongjian, this paper adopts the "labor distribution rate" in the survey and analysis of labor cost of industry proposed by the ministry of labor and social security in 2004, that is, the total salary of workers as a percentage of total operating income to measure the share of workers' income [38-40]. Reference selects control variables that typically use the characteristics of an enterprise. Control variables include: asset size, which is a logarithm of total assets; Company accounting performance (roa) as a ratio of net income to total assets; Capital intensity (ci) is the ratio of total assets to operating income of an enterprise; capital structure (lev), which is the ratio of total liabilities to total assets of an enterprise; the property of equity (soe), if the actual controlling state is artificial, the value of this variable is 1, otherwise 0; Capital output ratio, or ky, is the logarithm of net fixed assets as a percentage of principal operating income. In addition, two variables, wage rates and labour productivity, were not included in the baseline regression analysis but were used only for the mechanism analysis described later. The wage rate is the ratio of the remuneration payable to the number of workers employed by the enterprise, the labour productivity is the ratio of the added value to the number of workers employed by the enterprise, and the added value is expressed in terms of operating profit, total wages payable and depreciation of fixed assets.

III. RESEARCH DESIGN

1 DID Usage Premise

Parallel trend hypothesis is a prerequisite for the DID model to be effective. Parallel hypothesis assays can ensure that the difference between the treatment group and the control group before exogenous shock occurs does not change with time, while the difference has significant temporal variability after exogenous shock. As shown in table 1. As can be seen from the intersection multiplication regression factor, prior to the introduction of the carbon emissions trading policy in 2013, the dual interaction DID factor was not significant, i.e. the parallel trend hypothesis was adopted.

Parallel trend hypothesis

	before2	before3	before4	before5	before6
did	-0.0002	0.0001	-0.00002	-0.0005	-0.0006
	(0.001)	(0.001)	(0.001)	(0.01)	(0.001)
control	Yes	Yes	Yes	Yes	Yes
Area effect	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes
Individual effects	Yes	Yes	Yes	Yes	Yes
Sample size	6916	6916	6916	6916	6916
R2	0.0941	0.0941	0.0941	0.0941	0.0941

2 Benchmark regression results

Based on model (1), this paper empirically examines the impact of carbon trading system on the share of labor income of enterprises, as shown in table 2. Column 1 to column 3 of table 2 gradually add temporal fixation, provincial fixation and individual fixation. Table 2 shows that, taking into account the fixed effects and control variables at different levels, the double differential coefficient between columns 1 and 3 is significantly negative, indicating that the carbon trading system reduces the share of the enterprise's labour income. Of these, the third is listed as the benchmark result for this paper. The influence of control variables on the labor income share of enterprises is as follows: the effect of asset size on labor income share is negative, and the effect of asset size on labor income share is significant at 1% level, indicating that the increase of asset size of enterprises is not conducive to the increase of labor income share; The influence of capital structure (lev) on labor income share is not significant. The effect of capital output ratio (ky) on labor income share is not significant. The effect of capital intensity (ci) on labor income share is negative, and it is significant at 1% level, which indicates that the deepening of enterprise capital is not conducive to the increase of labor income share. The effect of roa on labor income share is positive and is significant at 1%, indicating that labor income share increases with the increase of company asset return.

Benchmark return of carbon emissions trading system to share of firms' labour income

variable	Share of labour income		
	（1）	（2）	（3）
did	-0.00056*	-0.00055*	-0.00054*
	（0..0003）	（0..00031 ）	（0.00031）
size	-0.0008***	-0.0008*	-0.00063***
	（0.0002）	（0.0002）	（0.00022）
roa	0.02151***	0.0214***	0.02***
	（0.00277）	（0.00277）	（0.00281）
lev	0.00012	0.00022	0.00068
	（0.00094）	（0.00094）	（0.00097）
ky	-0.00019	-0.00019	-0.00021
	（0.00016）	（0.00016）	（0.00017）
ci	-0.00032***	-0.00032***	-0.00025***
	（0.00006）	（0.00006）	（0.00007）
_cons	0.0027***	0.0254 ***	0.0176 **
	（0.000）	（0.000）	（0.009）
Area effect	No	Yes	Yes
Time effect	Yes	Yes	Yes
Individual effects	No	No	Yes
Sample size	6916	6916	6916
R2	0.1245	0.1515	0.0321

Note: * *, * * and * * * represent significant levels of 10%, 5% and 1%, respectively, with standard errors in parentheses, as shown in the table below.

3 Stabilisation test

In order to ensure the reliability of regression results, the following four methods are used for robustness testing. All the robustness tests again prove that the carbon trading system significantly reduces the share of firms' labour income.

(1) Counterfactual test

To further demonstrate that the emissions trading system significantly reduces the share of corporate labour income, sample data from 2007 to 2012 were selected using a counter-fact-checking method, and 2009 and 2010 were regressed as pilot policy implementation points. As shown in columns 1 and 2 of table, sample regressions were not significant and the counter-fact-checking was passed.

(2) Placebo test

In addition to carbon emissions trading policies and control variables, there may also be unobservable factors affecting the share of labor income of enterprises, so that there are significant differences between the experimental and control groups. Therefore, in order to eliminate the interference from such factors, the implementation of the carbon emissions trading system was brought forward to 2012, 2011 and 2010, respectively, if the did item is still significant at this time, indicating that the difference in the share of labour income between pilot and non-pilot enterprises is mainly due to non-observable factors. As shown in columns 3, 4 and 5 of table 3, the policy implementation point is not significant one, two and three years ahead of schedule, respectively, indicating that the carbon trading system is the main factor that triggers changes in the share of labour income of enterprises, and once again proving the reliability of the conclusions in this paper.

(3) Shrink the time window

In order to exclude interference from other events following the introduction of the carbon trading pilot policy, this paper narrows the window to double differential regression between 2009 and 2015 as the study period, as shown in column 6 of table 3. The result shows that the coefficient of the interaction term did not reach the significant level of 5%, which shows that the carbon trading system has a more obvious effect on the share of labor income of enterprises, which partly excludes the interference from other events after the pilot policy of carbon trading.

Stabilisation test results

Variable	Counterfact-checking 2007—2012		One year in advance	Two year in advance	Three year in advance	Shrinking Time 2009-2015
	（1）	（2）	（3）	（4）	（5）	（6）
did	-0.00006	-0.0004	0.00001	-0.00026	-0.00017	-0.00067**
	（0.0003）	（0.0003）	（0.00027）	（0.00028）	（0.0003）	（0.00027）
control	Yes	Yes	Yes	Yes	Yes	Yes
Area effect	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Individual effects	Yes	Yes	Yes	Yes	Yes	Yes
_cons	0.047***	0.047***	0.007**	0.00718**	0.0076***	0.046***
	（0.0065）	（0.0065）	（0.003）	（0.00293）	（0.0029）	（0.0058）
Sample size	5010	5010	6842	6916	6916	6572
R2	0.05	0.05	0.09	0.096	0.099	0.045

4 Heterogeneity Analysis

The above analysis verifies the effect of carbon trading system on the share of labor income of enterprises at the national level. However, China is a developing country with uneven development, and the effects of policy implementation are often heterogeneous at various levels. Thus, the analysis of corporate heterogeneity is based on Mayamin's thinking [42].

First, all sample companies were classified as high carbon emitters and low carbon emitters from a carbon emissions perspective, based on the classification of the Carbon Emissions Trading Network (CETN). Table 4, columns 1 to 2, presents the regression results for the two sample groups, high carbon and low carbon enterprises. The results show that the carbon trading system has a significant positive effect on the share of labor income of high carbon emitters and a significant negative effect on the share of labor income of low carbon emitters.

Heterogeneity analysis

	Enterprise emission characteristics		Business ownership		Enterprise size	
	（1）	（2）	（3）	（4）	（5）	（6）
did	0.0006*	-0.0016***	-0.0012***	0.0008	-0.00027	-0.0007**
	（0.0004）	（0.0004）	（0.0004）	（0.0006）	（0.0005）	（0.0004）
control	Yes	Yes	Yes	Yes	Yes	Yes
Area effect	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Individual effects	Yes	Yes	Yes	Yes	Yes	Yes
_cons	0.016**	0.017**	0.008	0.056***	0.035***	0.048***
	（0.017）	（0.013）	（0.0066）	（0.000）	（0.000）	（0.000）
Sample size	4567	2349	4422	2494	3458	3458
R2	0.03	0.03	0.004	0.0572	0.0364	0.106

Secondly, all sample firms were classified as SOEs and non-SOEs based on ownership. Tables 4, columns 3 and 4, are a regression of two sample groups, SOEs and non-SOEs. They found that SOEs were significantly negative at 1%, while non-SOEs did not show significant results, suggesting that the carbon emissions trading system had a greater and more pronounced impact on SOEs. This can be understood as a result of the fact that the carbon emissions trading system is primarily a government-led model, with State-owned enterprises receiving greater influence from government policies.

Finally, all sample enterprises were classified into SMEs and large enterprises based on the size of the enterprise. Tables 4, columns 5 and 6, are sample regressions of small and medium-sized enterprises grouped together. The results showed that SMEs were significantly negative at 5 per cent, while large enterprises did not show significant results, suggesting that SMEs were more affected by the carbon emissions trading system.

IV. Conclusions and Suggestions

Based on the data of A-share listed companies, this paper sets up a double differential model to investigate the impact of carbon trading system on the share of labor income of enterprises. The study found that: (1) the implementation of carbon trading system significantly reduced the share of labor income of enterprises, reflecting the disincentive effect of external environment policies on labor factor returns. (2) The impact of the carbon trading system on the share of labor income varies from enterprise to enterprise. The share of labor income of high carbon emitting enterprises has increased significantly, while the share of low carbon emitting enterprises, state-owned enterprises and small and medium-sized enterprises has decreased significantly. (3) Carbon trading affects a company's share of labor income by reducing its wage rate, not by increasing labor productivity. The mechanistic findings support the Follow the Cost Hypothesis rather than the Porter Hypothesis, suggesting that companies are now responding to environmental policies primarily by reducing labor costs, rather than by increasing R & D investment, technological innovation, and skills upgrading.

In view of the above research findings, the following countermeasures are proposed: (1) step by step to promote the implementation of the national carbon emissions trading system, appropriately reduce the impact on labor income. (2) We should pay attention to the fact that policy implementation cannot be one-size-fits-all. Under the current economic pressure, efforts should be strengthened for high-carbon emitting enterprises, while low-carbon emitting enterprises, state-owned enterprises and small and medium-sized enterprises should be slowed down appropriately. (3) Governments should increase their support for R & D and innovation in order to help enterprises cope with the pressures of environmental policies by shifting from reliance on ways to reduce labour costs to technological innovation.

Referenced

[1] Barbera A J, Mcconnell V D. The Impact of Environmental Regulations on Industry Productivity: Direct and Indirect Effects[J]. Journal of Environmental Economics & Management, 1990, 18(1):50-65.
[2] Brouwers R, Schoubben F, Van Hulle C. The Influence of Carbon Cost Pass Through on the Link Between Carbon Emission and Corporate Financial Performance in the Context of the European Union Emission Trading Scheme [J]. Business Strategy and the Environment，2018，27(8):1422-1436.
[3] Conyon M J. Labour's Share, Market Structure and Trade Unionism[J]. International Journal of Industrial Organization, 1994.12(1)
[4] Dark D F， Wassenhove LNV.Is Cap-and-Trade or Carbon Tax Better for Business?[J].The Business School of the Word，2016(10):01-02.
[5] Dobos I. The Effects of Emission Trading on Production and Inventories in the Arrow–Karlin Model[J]. International Journal of Production Economics，2005，93(1): 301-308.
[6] Growiec J. Determinants of the Labor Share: Evidence from a Panel of Firms[J]. Eastern European Economics, 2009, 50(5):23-65.
[7] Kristal T . The Capitalist Machine: Computerization, Workers Power, and the Decline in Labor Share within U.S. Industries[J]. American Sociological Review, 2013, 78(3):361-389.
[8] Oestreich A M，Tsiakas I. Carbon Emissions and Stock Returns: Evidence from the EU Emissions Trading Scheme[J]. Journal of Banking and Finance，2015，58:294-308.
[9] Porter M E, Linde C V D. Toward a New Conception of the Environment-Competitiveness Relationship[J]. Journal of Economic Perspectives, 1995, 9(4):97-118.
[10] Qi H. The Labor Share Question in China[J]. Monthly review (New York, N.Y.: 1949), 2014, 65(8):23.
[11] Rosenbaum P R, Rubin D B. Constructing a Control Group Using Multivariate Matched Sampling Methods That Incorporate the Propensity Score[J]. The American Statistician, 1985:39, 33-38.
[12] Shi B, Feng C, Qiu M, et al. Innovation Suppression and Migration Effect: The Unintentional Consequences of Environmental Regulation[J]. China Economic Review, 2017:S1043951X17301980.
[13] Zhang G, Zhang N. The Effect of China's Pilot Carbon Emissions Trading Schemes on Poverty Alleviation: A Quasi-Natural Experiment Approach[J]. Journal of Environmental Management, 2020, 271:110973.