

The Macroeconomic Impact of Carbon Tax Collection Under Tax Neutrality Constraints

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Abstract. Levying a carbon tax is the main path to achieving the "dual carbon" goal, but implementing a carbon tax policy will have a negative impact on the macro economy. This article constructs a static CGE model, with tax neutrality as the premise, to simulate the impact of carbon tax collection on the macro economy under different policy scenarios. The results indicate that imposing a carbon tax and reducing other taxes to maintain tax neutrality can alleviate the adverse effects on the macro economy. Among them, collecting carbon tax and reducing value-added tax can effectively alleviate the decline of GDP and added value of the secondary industry, and drive the increase of total domestic investment; Levying carbon tax and reducing value-added tax can effectively control the rise of CPI; Levying carbon tax and reducing Personal income tax can increase EV of residents' welfare. Finally, this article proposes countermeasures and suggestions: 1. Adopting a tiered carbon tax implementation strategy to achieve emission reduction goals. 2. Establish a horizontal transfer payment system for carbon tax revenue between provinces to coordinate the balanced development of various provinces in China. 3. Coordinate carbon tax and Carbon emission trading, and avoid overlapping of carbon tax and Carbon emission trading.

Keywords: Tax neutrality, Carbon tax, Macroeconomics, CGE model.

1. Introduction

In the 2018 Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming at 1.5°C, it was pointed out that due to human activities, the global average temperature has increased by 1°C compared to before the Industrial Revolution, and global warming has already had an impact on human society and nature [1]. The report proposes a path to control global warming at 1.5°C, which means that global carbon emissions must be reduced by 45% by 2030 compared to 2020 and reach global "net zero" emissions by 2050. Therefore, in 2020, China explicitly proposed the goal of achieving "carbon peak" by 2030 and "carbon neutrality" by 2060. At present, the main ways to achieve the goal of "double carbon" include carbon substitution, carbon emission reduction, Carbon cycle, carbon sequestration, building a carbon market trading system, and implementing a carbon tax system [2].

The implementation of carbon tax policy can further reduce carbon emissions. The imposition of carbon tax will increase energy prices, increase enterprise production costs, force enterprises to improve production technology or change production mode, improve energy efficiency, research and develop clean energy production technology, internalize the negative Externality of enterprise production, and achieve sustainable development of green economy. At the same time, the impact of taxation on the economy is broad. Although imposing a carbon tax can reduce emissions, it means that for industry, production costs increase, profits decrease, and enterprises have to limit or compress industrial production, which will inevitably affect employment [3]. At the same time, the enthusiasm of enterprises for investment is greatly reduced, thereby inhibiting economic growth [4]. It should be emphasized that the proportion of China's industrial added value in GDP has declined year by year in recent years, and the imposition of carbon tax may lead to premature Deindustrialization. In addition, some developed countries have imposed carbon tariffs on Chinese products under the guise of environmental protection, resulting in the loss of price advantages for Chinese export products and having a significant impact on Chinese exports. However, China's industrial transformation and upgrading have not yet been completed, and low-carbon technologies are not yet mature. The hasty

imposition of carbon taxes will lead to an increase in imports and further have a negative impact on China's economic growth [5].

This article establishes a static CGE model to simulate the impact of carbon tax collection on China's macro economy under the premise of neutral tax constraints. Firstly, simulate the impact of different carbon tax prices (30 yuan/t, 60 yuan/t, 90 yuan/t) [6] on macroeconomic factors such as economic growth, industrial structure, and government revenue and expenditure [7]. Secondly, with tax neutrality as the constraint, that is, the government's tax revenue remains unchanged, the impact of reducing other tax rates (such as corporate income tax, value-added tax, Personal income tax, etc.) by imposing carbon tax on the macro-economy is studied to provide theoretical support for the formulation of the optimal strategy that takes into account environmental improvement and economic development.

2. Model construction

In this paper, a static computable general equilibrium (CGE) model is used to construct a social accounting matrix based on China's input-output table in 2018, combined with China's fiscal revenue and expenditure statement, China's tax data of various industries, China's macro data, etc., and then a model system is constructed according to relevant theories [8]. The model system mainly includes six modules: Production module, revenue and expenditure module, international trade module, welfare module, carbon emission module, balance closure module.

2.1. Production module

The production module is described by five layers of CES functions [9]. The total output of the first layer is composed of energy-capital-labor factor inputs and non-energy intermediate inputs. The second level of energy-capital-labor factor input is composed of energy-capital factor and labor factor. The third layer of energy-capital elements is decomposed into capital elements and energy elements bundle. The fourth layer of energy elements are decomposed into fossil energy elements and electric energy elements; The fifth layer, fossil energy elements are decomposed into coal, oil and natural gas; The power energy elements are decomposed into thermal power, hydropower, nuclear power and wind power [10].

Take the first CES production combination function as an example:

$$\min PKEL_i \cdot KEL_i + PND_i \cdot PND_i \quad (1)$$

$$s.t. QX_i = \lambda_i^q \left(\beta_{keli} KEL_i^{-\rho_i^q} + \beta_{ndi} ND_i^{-\rho_i^q} \right)^{\frac{1}{-\rho_i^q}} \quad (2)$$

Where, i represents each department; $PKEL$ is energy-capital-labor factor price, KEL is energy-capital-labor factor input quantity. PND is the price of non-energy intermediate input factors, and ND is the amount of non-energy intermediate input factors. QX is output; ρ_i^q is the elasticity of substitution of non-energy intermediate inputs and energy-capital-labor factor inputs. λ_i^q is the scale parameter; β_{keli} , β_{ndi} are the share parameters, $\beta_{keli} + \beta_{ndi} = 1$.

2.2. Revenue and expenditure module

Total resident income:

$$TYH = \sum_i pl_i \cdot l_i + rk \cdot YH_k + YH_e + YH_g + eh \cdot YH_f \quad (3)$$

Resident savings:

$$SH = sh \cdot TYH \quad (4)$$

Residents' consumption of product i :

$$DH_i = \frac{\mu h_i(1-sh)(1-th)TYH}{PQ_i} \quad (5)$$

In the formula: i represents each department, TYH represents the total income of residents; $\sum_i pl_i \cdot l_i$ is the total labor income of each department; $r \cdot YH_k$ is the total capital income, and rk is the resident capital income/total capital income; YH_e is the transfer payment from enterprises to residents; YH_g is the transfer payment made by the government to residents; $e \cdot YH_f$ is the resident's foreign income, eh is the expected exchange rate of the Renminbi; μh_i is the proportion coefficient of residents' consumption of product i ; sh is the coefficient of residents' savings ratio; th is the resident Personal income tax; PQ_i is the price of product i .

Total revenue of the enterprise:

$$TYE = (1 - rk) \sum_i pk_i \cdot k_i \quad (6)$$

Transfer payments from enterprises to residents:

$$YH_e = re \cdot TYE \quad (7)$$

Enterprise savings:

$$SE = (1 - re)(1 - te)TYE \quad (8)$$

Enterprise investment:

$$INV_i = inv_i \cdot \frac{SE+SH+SG+SF}{PQ_i} \quad (9)$$

In the formula: TYE represents the total revenue of the enterprise; $\sum_i pk_i \cdot k_i$ is the total capital income of each department; $re \cdot TYE$ is the transfer payment made by the enterprise to residents, and re is the proportion of the transfer payment made by the enterprise to residents; SE represents corporate savings, te represents corporate income tax; INV_i represents enterprise investment, inv_i is the investment ratio coefficient of department i ; SG represents government savings; SF represents foreign savings.

Total government revenue:

$$TYG = GVAT_i + GEXCT_i + GIETAX_i + GHTAX + GWY + CTAX + GOTAX \quad (10)$$

Government transfer payments to residents:

$$YH_g = rg \cdot TYG \quad (11)$$

Government transfer payments to foreign countries:

$$YW_g \cdot eh = rwg \cdot TYG \quad (12)$$

Government savings:

$$SG = sg \cdot TYG \quad (13)$$

Government consumption of product i :

$$DG_i = \frac{\mu g_i(1-rg-rwg-sg)TYG}{PQ_i} \quad (14)$$

In the formula: TYG represents the total government revenue; $GVAT_i$ is the value-added tax income of department i ; $GEXCT_i$ is the consumption tax income of department i ; $GIETAX_i$ represents the corporate income tax income of department i ; $GHTAX$ represents resident income tax income; GWY represents the government's foreign revenue; $CTAX$ represents carbon tax revenue; $GOTAX$ is other Indirect tax income. $rg \cdot TYG$ is the transfer payment made by the government to residents, and rg is the proportion of transfer payments made by the government to residents; $rwg \cdot TYG$ is the government's transfer payments to foreign countries, and rwg is the proportion of government foreign transfer payments; $sg \cdot TYG$ is government savings, and sg is

the proportion of government savings; μg_i is the proportion coefficient of government consumption of product i .

2.3. International Trade Module

In the trade module, the output of domestic production activities is composed of net added value of production activities and intermediate inputs in the form of a CES function [11]; The distribution of domestically produced products is decomposed into exports and domestically produced domestic sales using the CET function form; Domestic market goods are synthesized in the form of a CES function from domestic production, domestic sales, and imports; The distribution of goods in the domestic market is decomposed into intermediate inputs and household consumption, domestic investment, and domestic government consumption using the CET function.

2.4. Welfare module

In the welfare module, Hicks Equivalence Change (EV) is used to measure the impact of policy shocks on residents' welfare. When EV is positive, it indicates that residents' welfare has improved after policy implementation. On the contrary, if the EV changes to negative, it indicates that the implementation of the policy will harm the welfare of residents.

$$EV = E(U^s, PQ^b) - E(U^b, PQ^b) = \sum_i PQ_i^b \cdot HD_i^s - \sum_i PQ_i^b \cdot HD_i^b \quad (15)$$

In the formula, $E(U^s, PQ^b)$ represents the level of utility after policy implementation, and $E(U^b, PQ^b)$ represents the level of utility before policy implementation; PQ_i^b represents the consumption price of the i commodity before the implementation of the policy, HD_i^b represents the consumption quantity of the i commodity before the implementation of the policy, HD_i^s represents the consumption quantity of the i commodity after policy implementation.

2.5. Carbon emission module

The determination of CO_2 emission coefficient is calculated using the CO_2 emissions of three fossil fuels in China and the actual energy consumption. The CO_2 emissions are based on the statistical data of International Energy Statistics. The specific results are shown in Table 1:

Table 1. Carbon dioxide emission coefficient

type	CO_2 emission (million tons)	Final deman (Hundred million yuan)	CO_2 Emission coefficien (Ton/ten thousand yuan)
Coal	6 258.80	29 946.30	20.90
Oil	1 151.30	51 628.10	2.23
Natural gas	194.40	5 907.60	3.29

CO_2 Emissions:

$$TCO_2 = \sum_i CO_{2i} + \sum_j CO_{2j} = \sum_j E_{i,j} \cdot \theta_j \cdot tc + (HD_j + GD_j) \cdot \theta_j \quad (16)$$

CO_2 emission intensity:

$$TCOEI = \frac{TCO_2}{GDP} \quad (17)$$

Total carbon tax revenue:

$$CTAX_j = \sum_j E_{i,j} \cdot \theta_j \cdot tc \quad (18)$$

Where, i represents each sector and j represents energy type (coal, oil, natural gas); E is the energy demand, θ is the energy emission coefficient, tc is the carbon tax rate. HD is the residential energy demand, GD is the government energy demand.

2.6. Balanced closing module

The balance closure module includes product market equilibrium, capital market equilibrium, labor market equilibrium, international balance of payments equilibrium, savings and investment equilibrium. Product market equilibrium means that total demand equals total supply; The capital market equilibrium assumes that the capital price is an endogenous variable. After the impact of economic policies, due to the change of capital price, enterprises can adjust capital, realize free flow of capital, and finally realize the full utilization of capital. The assumption of labor market equilibrium is that the wage is an endogenous variable. After the impact of economic policy, the labor market is cleared by the full adjustment of the wage. The balance of international payments selects foreign savings as the exogenous variable, and the exchange rate is closed by the endogenous rule, which means that the change of import and export can affect the whole economy through the change of exchange rate. Adopting the neoclassical rule of closure, investment is determined by savings, and all savings in the economy will be converted into investment.

3. Empirical research

This article divides and consolidates the 2018 input-output table in China based on research needs, dividing 153 departments into 26 industry sectors. Based on the 2018 input-output table, combined with China's financial revenue and expenditure final statement, and China's segmented industry tax data, a social accounting matrix was constructed.

3.1. Policy simulation scenario settings

In order to study the impact of carbon tax on the macro economy under the neutral constraint of tax revenue, this paper first simulated the impact of carbon tax on the macro factors such as CO_2 emission, government revenue and expenditure, economic growth and industrial structure adjustment in China. The carbon tax rates are 15 yuan/ton, 30 yuan/ton and 45 yuan/ton respectively. Secondly, we simulate the reduction of other tax rates, such as enterprise income tax, value-added tax and individual income tax, while imposing carbon tax, so as to maintain the neutrality of government tax revenue, and study the impact of carbon tax on CO_2 emission, economic growth and industrial structure under the condition of tax neutrality. The specific policy simulation scenario Settings are shown in Table 2.

Table 2. Policy simulation scenario setting

Serial Number	Policy simulation scenario setting
S_1	Levy carbon tax, with a carbon tax rate of 15 yuan/ton;
S_2	Levy carbon tax, with a carbon tax rate of 30 yuan/ton;
S_3	Levy carbon tax, with a carbon tax rate of 45 yuan/ton;
S_4	Levy a carbon tax at a rate of 15 yuan/ton, while reducing corporate income tax by 2.8% to maintain tax neutrality;
S_5	Levy a carbon tax at a rate of 30 yuan/ton, while reducing corporate income tax by 5.1% to maintain tax neutrality;
S_6	Levy a carbon tax at a rate of 45 yuan/ton, while reducing corporate income tax by 7.0% to maintain tax neutrality;
S_7	Levy a carbon tax at a rate of 15 yuan/ton, while reducing value-added tax by 1.4% to maintain tax neutrality;
S_8	Levy a carbon tax at a rate of 30 yuan/ton, while reducing value-added tax by 2.5% to maintain tax neutrality;
S_9	Levy a carbon tax at a rate of 45 yuan/ton, while reducing value-added tax by 3.5% to maintain tax neutrality;
S_{10}	The carbon tax rate is 15 yuan/ton, and the Personal income tax is reduced by 6.8% to maintain tax neutrality;
S_{11}	The carbon tax rate is 30 yuan/ton, and the Personal income tax is reduced by 12.2% to maintain tax neutrality;
S_{12}	The carbon tax rate is 30 yuan/ton, and the Personal income tax is reduced by 12.2% to maintain tax neutrality;

3.2. Simulation results of carbon tax only scenario

Simulate the implementation of carbon tax collection policy, i.e. policy simulation scenario S_1 – S_3 . The impact on the macro economy. The simulation results are shown in Table 3.

Table 3. Only carbon tax scenario simulation

	Unit: %		
index	S_1	S_2	S_3
CO_2 emission	-15.217	-25.253	-32.565
Government revenue	0.506	0.912	1.249
Nominal GDP	-0.036	-0.059	-0.077
Nominal added value of primary production	0.011	0.007	-0.004
Nominal added value of secondary production	-0.204	-0.347	-0.456
Nominal added value of three industries	0.081	0.142	0.189
Real GDP	-0.087	-0.168	-0.224
Actual added value of primary production	-0.038	-0.112	-0.188
Actual added value of secondary production	-0.526	-0.944	-1.261
Actual added value of tertiary industry	0.065	0.090	0.120
CPI	0.196	0.374	0.513
Total investment	-0.202	-0.317	-0.427
GINI coefficient	0.000	-0.001	-0.001
EV increase (billion yuan)	-177.219	-465.742	-781.351

The results show that the carbon tax can significantly inhibit the CO_2 emissions. When the carbon tax rates are 15 yuan/ton, 30 yuan/ton and 45 yuan/ton, the CO_2 emissions decrease by 15.217%, 25.253% and 32.565%. It can be seen that the higher the carbon tax rate is, the effect of inhibiting CO_2 emission is obvious, but the marginal amount of CO_2 emission decrease decreases with the increase of the carbon tax rate. Government revenue increases by 0.506%, 0.912% and 1.249%, but nominal GDP decreases by 0.036%, 0.059% and 0.077%, that is, with the increase of carbon tax rate, government revenue increases in a positive proportion while nominal GDP decreases in a positive proportion. If calculated based on the base period price, GDP decreases by a larger proportion. The real GDP decreased by 0.087%, 0.168% and 0.224% respectively, and the carbon tax had a more obvious inhibitory effect on economic growth.

The imposition of carbon tax has almost no effect on the nominal added value of the primary industry, and the actual added value of the primary industry gradually declines with the increase of the carbon tax rate. The nominal and actual added value of the secondary industry is greatly affected. With the increase of tax rate, the added value of the secondary industry drops significantly. The added value of the tertiary industry increases in proportion to the tax rate. This is mainly because the mining and manufacturing industries in the secondary industry are greatly affected by the carbon tax policy, and the added value of the secondary industry declines due to the increase in production costs and investment transfer. When the tax rate is low, the industrial structure shifts to the primary and tertiary industries, and with the rise of the tax rate, the industrial structure tilts to the tertiary industry in a large number.

The carbon tax rate of 15 yuan/ton, 30 yuan/ton, and 45 yuan/ton will lead to a corresponding increase in CPI of 0.196%, 0.374%, and 0.513%. When CPI rises, the currency in the hands of residents will depreciate, resulting in a decrease in residents' income, a decrease in consumer purchasing power, and a decrease in social welfare levels, which will have a negative impact on economic development. Total investment decreased by 0.202%, 0.317% and 0.427% respectively. The impact of carbon tax on the Secondary sector of the economy may be the reason for the decrease in investment. However, the implementation of carbon tax will also encourage investors to pay more attention to environmental, social and governance factors, promote the transformation of the industry to low emission areas, and increase the diversity of investment opportunities. Different carbon tax rates have little impact on the GINI coefficient, mainly because policy simulations implement the

same carbon tax rate nationwide. Designing regional differentiated carbon tax rates or regional carbon compensation mechanisms can coordinate income distribution between different regions in China and reduce the GINI coefficient. The social welfare EV significantly decreases with the increase of carbon tax rate, and the marginal decrease is greater than the marginal increase of carbon tax rate.

3.3. Simulation results of imposing carbon tax and reducing other tax scenarios

The main purpose of imposing a carbon tax is to reduce CO_2 Emissions do not increase government revenue, so we take tax neutrality as a constraint to study the impact of reducing corporate income tax, value-added tax and Personal income tax rates on the macro-economy while collecting carbon taxes. After testing, when the carbon tax rates are 15 yuan/ton, 30 yuan/ton, and 45 yuan/ton, the corresponding reduction of corporate income tax by 2.8%, 5.1%, and 7% can maintain tax neutrality, corresponding to scenario simulation S_4 - S_6 ; The corresponding reduction of 1.4%, 2.5%, and 3.5% in value-added tax can maintain tax neutrality, corresponding to scenario simulation S_7 - S_9 ; The corresponding reduction of Personal income tax by 6.8%, 12.2% and 16.7% can maintain tax neutrality, corresponding to scenario S_{10} - S_{12} . The policy simulation results are shown in Table 4.

Table 4. Levying Carbon Tax and Reducing Other Taxes

Unit: %

index	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}
CO_2 emission	-15.191	-25.233	-32.600	-15.054	-25.055	-32.378	-15.209	-25.254	-32.618
Government revenue	0.001	-0.007	-0.009	0.002	0.012	-0.010	-0.006	-0.004	-0.003
Nominal GDP	-0.033	-0.054	-0.069	-0.134	-0.234	-0.322	-0.034	-0.055	-0.071
Nominal added value of primary production	0.035	0.051	0.053	0.028	0.038	0.039	0.055	0.085	0.101
Nominal added value of secondary production	-0.142	-0.232	-0.296	-0.288	-0.498	-0.667	-0.168	-0.282	-0.364
Nominal added value of three industries	0.037	0.062	0.080	-0.043	-0.080	-0.120	0.037	0.062	0.080
Real GDP	-0.082	-0.158	-0.231	-0.085	-0.165	-0.240	-0.082	-0.159	-0.232
Actual added value of primary production	0.010	-0.027	-0.079	0.035	0.019	-0.006	0.043	0.031	0.001
Actual added value of secondary production	-0.434	-0.782	-1.051	-0.463	-0.837	-1.118	-0.465	-0.841	-1.131
Actual added value of tertiary industry	0.004	-0.022	-0.053	0.025	0.019	0.002	0.032	0.030	0.019
CPI	0.184	0.356	0.498	0.076	0.162	0.220	0.181	0.352	0.491
Total investment	0.003	0.062	0.107	-0.205	-0.321	-0.428	-0.151	-0.220	-0.281
GINI coefficient	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EV increase (billion yuan)	-215.653	-547.081	-855.048	152.554	116.832	88.788	568.541	680.197	825.559

The results show that both the policy simulation $S_4 - S_{12}$ can keep the government revenue basically unchanged and achieve the effect of tax neutrality. On this basis, when the carbon tax rate is 15 yuan/ton, 30 yuan/ton and 45 yuan/ton, the CO_2 emission decreases by about 15%, 25% and 32%, and the reduction ratio of CO_2 emission is positively correlated with the carbon tax rate, but has little relationship with the reduction of other tax rates. When the carbon tax is imposed, the corporate income tax ($S_4 - S_6$) and individual income tax ($S_{10} - S_{12}$) will be reduced, and the nominal GDP will decrease by -0.033%, -0.054%, -0.069%, and -0.034%, -0.055%, -0.071% respectively. Compared with $S_1 - S_3$, The imposition of carbon tax and the reduction of corporate income tax can reduce the decline of nominal GDP more than the reduction of individual income tax,

and mitigate the negative impact of carbon tax on the economy. However, the imposition of carbon tax and the reduction of value-added tax ($S_7 - S_9$) will aggravate the decline of nominal GDP. The performance of real GDP is the same as expected. Compared with $S_1 - S_3$, the imposition of carbon tax while reducing corporate income tax, value-added tax, and personal income tax ($S_4 - S_{12}$) will inhibit the decline of real GDP, among which the effects are in descending order of corporate income tax, personal income tax, and value-added tax. The reason why the reduction of value-added tax will aggravate the decline of nominal GDP and ease the decline of real GDP may be because the decrease of value-added tax rate, the reduction of production costs of enterprises, and the decline of product prices. Nominal GDP is calculated based on the current price, and the decline of current product prices may aggravate the decline of GDP, while real GDP is calculated based on the base price. Falling product prices boost consumption, and real GDP increases.

As for the added value of the Primary sector of the economy, the nominal added value of the primary industry increased little due to the imposition of carbon tax alone, while the added value of the primary industry increased significantly due to the imposition of carbon tax and the reduction of other taxes; The actual added value of the primary industry decreases significantly due to the imposition of carbon tax alone. The imposition of carbon tax and the reduction of corporate income tax can reduce the actual added value of the primary industry, but the actual added value of the primary industry still decreases. The reduction of value-added tax or Personal income tax can reduce the actual added value of the primary industry to increase. As for the added value of the Secondary sector of the economy, the collection of carbon tax has a great impact on the nominal added value of the secondary industry and the actual added value of the secondary industry. Cooperating with other tax reduction policies can alleviate the decline of the added value of the secondary industry. Among them, the collection of carbon tax and the reduction of corporate income tax have the best effect. It is worth noting that the collection of carbon tax and the reduction of value-added tax will aggravate the decline of the added value of the secondary industry. For the added value of the Tertiary sector of the economy, collecting carbon tax and reducing other taxes will reduce the increase of the nominal added value and the actual added value of the tertiary industry. Among them, collecting carbon tax and reducing value-added tax will reduce the nominal added value of the tertiary industry, and collecting carbon tax and reducing enterprise income tax will reduce the actual added value of the tertiary industry.

Compared with $S_1 - S_3$, the imposition of carbon tax and the reduction of enterprise income tax and the imposition of carbon tax and the reduction of individual income tax have no significant impact on CPI. The imposition of carbon tax and the reduction of value-added tax can effectively control the rise of CPI, and the growth rates of $S_7 - S_9$ are 0.076%, 0.162% and 0.220 respectively. The imposition of carbon tax and the reduction of value-added tax can not increase the total domestic investment, but the imposition of carbon tax and the reduction of personal income tax can promote the growth of total investment, but the growth effect is general, $S_{10} - S_{12}$ corresponding to the growth rate of total investment is -0.151%, -0.220%, -0.281%. The imposition of carbon tax and the reduction of enterprise income tax can well promote the growth of total investment, and the growth rates of $S_4 - S_6$ correspond to the total investment growth rates of 0.003%, 0.062% and 0.107%. Imposing a carbon tax and lowering other tax rates has no effect on the GINI coefficient. The imposition of carbon tax and the reduction of corporate income tax will further increase the loss of residents' welfare EV, while the imposition of carbon tax and the reduction of value-added tax and the imposition of carbon tax and the reduction of personal income tax will increase the residents' welfare EV, among which the imposition of carbon tax and the reduction of personal income tax is more effective.

4. Conclusion and suggestion

4.1. Conclusion

Build static CGE simulation, this paper firstly simulates the only implement a carbon tax policy impact on the macro economy, second simulation in a carbon tax and other tax reduction to keep the tax levy a tax on carbon neutral conditions for CO_2 reductions, government revenue and expenditure and economic growth, industrial structure, the influence of macro elements such as to seek the optimal carbon tax policy implementation strategy, To help achieve the dual carbon target on schedule and promote the common development of the environment and economy. The simulation results of CGE model show that: (1) Carbon tax has obvious effect on CO_2 emission reduction. When the carbon tax rate is 15 yuan/ton, 30 yuan/ton and 45 yuan/ton, the CO_2 emission decreases by 15.217%, 25.253% and 32.565%. (2) The imposition of carbon tax will inhibit economic growth, have the greatest impact on the added value of the secondary industry, and lead to premature deindustrialization. (3) The imposition of carbon tax will lead to a rise in the price level of residents, a decline in total domestic investment, and a substantial decline in social welfare EV. (4) The imposition of carbon tax and the reduction of other taxes at the same time can achieve the CO_2 emission reduction target and reduce the impact on the macro-economy at the same time. Among them, the imposition of carbon tax and the reduction of value-added tax can effectively alleviate the decline of GDP and the added value of the secondary industry, and promote the increase of China's total investment; Carbon tax and VAT reduction can effectively control the rise of CPI. A carbon tax and a reduction in personal income tax could increase household welfare EV.

4.2. Suggestion

Establish a scientific and reasonable carbon tax collection system to achieve the goal of CO_2 emission reduction. At present, China's carbon tax system is still in the stage of theoretical research. In the future, a step carbon tax implementation strategy can be adopted. A lower carbon tax rate can be set in the initial stage of carbon tax collection, and then gradually increased in the later stage to avoid a major impact on the economy. In addition, China has a vast territory, and different regions differ greatly in resource endowment and economic development, so it is possible to set up regional differential tax rates, such as imposing a higher tax rate in economically developed areas and setting a lower tax rate in less developed areas and areas with difficulties in green and low-carbon transformation, so as to coordinate the balanced development of China's regions.

Keep government revenue neutral and reduce the negative impact of carbon tax on the macro economy. While imposing carbon tax, China can adopt preferential policies such as reducing other taxes, return part of the carbon tax revenue to enterprises that actively implement carbon emission reduction policies and achieve remarkable results, and subsidize individuals who purchase energy-saving products, macro-adjust China's tax structure, maintain government revenue neutrality, ease the tax pressure on enterprises, and prevent premature deindustrialization.

Carbon tax revenue should be used rationally, a horizontal transfer payment system for carbon tax revenue between provinces should be established, and the central government and local governments should set up "carbon fund" accounts to manage carbon tax funds, so as to realize the transfer of carbon compensation from local to central to local. For regions with backward scientific and technological level, technical assistance should be strengthened to improve carbon emission performance, while for regions with advanced scientific and technological level, policy restrictions should be strengthened to encourage low-carbon development of enterprises and realize low-carbon transformation of economic development, so as to better coordinate the contradiction between social and economic development and ecological and environmental protection.

Coordinate carbon tax and carbon trading to avoid overlapping of carbon tax and carbon trading. China has implemented national carbon trading, so the coordination with carbon trading needs to be considered in advance before the introduction of carbon tax. For enterprises that have been included

in the carbon trading market, they can be exempted from carbon tax and re-set free carbon emission quotas to reduce the burden on enterprises.

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