

# *EFFECTIVENESS AND EQUITY COMPARISON OF PERSONAL CARBON TRADING AND CARBON TAX IN PRIVATE TRANSPORT: BASED ON DRIVING DECISION MODEL AND CASE STUDY IN CHINA*

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## **Overview**

The private road transport sector is one of the major sources of CO<sub>2</sub> emissions currently. To control CO<sub>2</sub> emissions from private vehicles, two policy tools—a personal carbon tax and personal carbon trading in the transportation sector (TPCT for short)—have been discussed in many studies. In this paper, to compare the effectiveness and equity of these two instruments, a theoretical individual driving decision model is built, and two scenarios of carbon tax and TPCT are analyzed. The model proves that TPCT provides more incentive to reduce personal driving demands; however, a carbon tax can correspond to the criteria of equity that TPCT may not meet. To test the theoretical model, a stated preference survey of 700 samples is conducted among Chinese city drivers. The survey results provide empirical support for the theoretical conclusions and verify the potential for changing driving behavior under different policies. Compared to a carbon tax, the TPCT policy leads to a greater reduction of CO<sub>2</sub> emissions in the private transport sector, at the expense of equity, under the circumstances that prevail in China.

The paper is organized as follows: Part Two gives a brief introduction to TPCT and reviews the comparison between carbon tax and PCT. To compensate for the existing research, Part Three proposes an individual driving decision model to compare the effectiveness and equity of the two policies. In Part Four, survey data are used to test the reliability of modelling results. Conclusions and suggestions are provided in Part Five.

## **Methods**

Individual driving decision model and stated preference survey.

## **Results**

First, TPCT is better at incentivizing the promotion of carbon-reduction in the private transport sector.

Second, the difference in CO<sub>2</sub> emission reduction effects between carbon tax and TPCT increases along with the quota tightness. The difference increases along with the tax rate at first, and then decreases when tax rate keeps growing. But the reduction effect has no significant positive or negative relationship with personal income.

Third, the personal carbon tax may be not in line with the criteria of equity with the definition of relationship between changes in consumer surplus and income; the specific effect depends on the rigidity of driving demand. PCT in the private transport sector may not meet the criteria of equal distribution either. It depends on the ratio between gasoline expense and income, tax rate, and the distribution of carbon quotas.

## Conclusions

TPCT is shown to be an effective policy for carbon reduction in the long term. However, considering its possible negative effect on social equity, TPCT is more suitable when there is an urgent need to reduce the carbon emitted from private transport. The government should take its disadvantage into full account before introducing TPCT, and it may be better to implement some redistribution policies at the same time to reduce the adverse influence on equity (although this may lead to multi-intervention and further distortion). On the contrary, private carbon tax is also a feasible instrument for encouraging consumers to reduce high-carbon traveling behaviors and offers possible benefits in terms of reducing social disparities. However, the motivation provided by private carbon tax is weaker than with TPCT.

## References

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