

# Impact of Permit Allocation on Cap-and-trade System Performance under Market Power

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Carbon market is established to achieve CO<sub>2</sub> emission reduction targets cost efficiently. However, the existence of market power usually has negative impacts on the cost-effectiveness of the carbon market. As market power-induced efficiency loss depends on permit allocation, the choice of permit allocation methods is likely to affect the cost-effectiveness of the carbon market. This paper theoretically examines the effect which yields some policy recommendations on how to choose a CO<sub>2</sub> emission permit allocation method for different industries.

We first construct theoretical leader-follower model in the carbon market to show how the choice of emission permit allocation method affects the cost-effectiveness of an ETS when market power exists. Meanwhile, we analyze the effect of emission permit allocation method on CO<sub>2</sub> cost pass-through for fairness consideration.

The model results show that proper choice of emission permit allocation method can help reduce the efficiency loss. Under grandfathering and benchmarking rules, the carbon market would be more efficient if the permits initially allocated to the dominant firm were closer to its CO<sub>2</sub> emissions. Under the auctioning rule, the dominant firm tends to lower the CO<sub>2</sub> price, which may result in efficiency loss. We also find that the CO<sub>2</sub> emission permit allocation method affects the CO<sub>2</sub> cost pass-through and the fairness of ETS. Although receiving free allocation of CO<sub>2</sub> emission permits under the grandfathering rule, firms still pass all the CO<sub>2</sub> cost through to downstream consumers, resulting in windfall profits. Under the benchmarking rule, firms just pass a small portion of the CO<sub>2</sub> cost. Under the auctioning rule, firms buy the CO<sub>2</sub> emission permits themselves and pass on all the CO<sub>2</sub> cost.

Based on these findings, we suggest that different emission permit allocation methods may be used in different industries. Firms in the power sector are likely to have the market power to determine the CO<sub>2</sub> price in the carbon market and the CO<sub>2</sub> cost pass-through potential in the product market. Thus, the benchmarking rule may be used for the power sector. Firms in energy-intensive industry have high CO<sub>2</sub> costs and would pass most CO<sub>2</sub> costs through to downstream consumers. Therefore, benchmarking is recommended for energy-intensive industry in a new carbon market and auctioning is suggested in a mature carbon market. As firms in the domestic sector have diverse products in the product market, auctioning is the best choice for the domestic sector. Since CO<sub>2</sub> costs in the domestic sector are relatively low, grandfathering could be the second choice for the sector.

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