

The attributes of the emission commodities in the EU carbon market and its Backward-bending Supply Curve

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Abstract

The European Union emission trading scheme (EU ETS) is by far the largest emission trading scheme in the world. Under the scheme, the carbon market was built to facilitate the emission trading. The only commodities in the carbon market is emission allowances, its economic characteristics influence the preference of market players, furthermore, influence the supply and demand of the carbon market. This research focus on the attributes of the emission allowances, and its supply curve under the background of the first two phases. The emission allowance is a special factor of production to the emitting companies, and can be “consumed” by them to produce energies, goods, and services. Beyond their consumption, the emitting companies should make a trade-off that whether to sell the

surplus allowance or reserve them. Both selling and reserving will bring utility to the emitting companies, and the optimum allowance supply of the emitting companies is to maximize their utility by selling a certain proportion of their surplus allowances under a certain price. Given the two endowments of emitting companies - free allocation and emission level - and a portfolio of allowance selling and reservation, the supply curve of emission allowances can be analyzed under the utility theory, in which the income effect and substitution effect are introduced. Followed the method of Barzel and McDonald (1973), we have built an economic model to analyze the supply curve of the emission allowances, and we conclude that the shape of the supply curve of emission allowances are decided by the elasticity of substitution between allowance selling and reservation. Furthermore, using the micro big data of the European Union Transaction Log (EUTL), we draw the supply curves in the Phase I of the EU ETS as well as the Phase II. Our results show that the shape of the supply curves was Backward-bending in both phase I and II, with the positive slope at a lower price level while negative at a higher price level. The shape of the supply curve implies that the emission allowance is a special production factor to the emitting

companies. With a certain endowment, the supply of an emitting company is determined by the positive income effect and the negative substitution effect. The income effect is dominating at a lower price level, which means the increase of price will bring more profits (utility). Accordingly, the allowance supply increase as the price increase. However, when the price comes to a higher level, the consumption of allowances is more expensive, so reserving allowances for future consumption is preferable. As a result, the substitution effect becomes stronger than the income effect, and the allowance supply descends as the price ascend.

Keywords: emission trading scheme; micro big data; backward-banding supply curve; utility; elasticity of substitution;

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