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Theoretical Framework and Empirical Simulation of Policy Design on Trans-Dimensional Resource Recycling

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Abstract : Resource recycling process contains a subsystem with interactions of three dimensions including coupling allocation of primary and secondary resources, responsibility coordination of stakeholders in forward and reverse supply chains, and trans-boundary transfer of hidden resource and environmental responsibilities between regions. Overlap or lack of responsibilities is easy to appear at the intersection of the three management dimensions. It is urgent to make an overall design of the policy system for recycling resources. From theoretical perspective, this paper analyzes the unique external differences of resource and environment in various dimensions and explores the reason why the effects of trans-dimensional policies are strongly correlated. Taking the example of the copper resources contained in the waste electrical and electronic equipment, this paper constructs reduction effect accounting model of resources recycling and set four trans-dimensional policy scenarios including resources tax and environmental tax reform of the raw and secondary resources, application of extended producer responsibility system, promotion of clean development mechanism, and strict entry barriers of imported wastes. In these ways, the paper simulates the impact effect of resources recycling process on resource deduction and emission reduction of waste water and gas, and constructs trans-dimensional policy mix scenario through integrating dominant strategy. The results show that combined application of various dimensional policies can achieve incentive compatibility and the trans-dimensional policy mix scenario can reach a better effect. Compared with baseline scenario, this scenario will increase 91.06% copper resources reduction effect and improve emission reduction of waste water and gas by eight times from 2010 to 2030. This paper further analyzes the development orientation of policies in various dimension. In resource dimension, the combined application of compulsory, market and authentication methods should be promoted to improve the use ratio of secondary resources. In supply chain dimension, resource value, residual functional value and potential information value contained in waste products should be fully excavated to construct a circular business system. In regional dimension, it should give full play to the comparative advantages of manufacturing power to improve China’s voice in resource recycling in the world.

Keywords : resource recycling, trans-dimension, policy design, incentive compatibility, life cycle
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