

价格不确定性和 险偏好下碳汇管理的最优采伐决策

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Abstract: Forestry carbon sequestration represents a critical way to achieve the goal of mitigating climate change and carbon neutrality in China. However, fluctuations in timber and carbon prices pose greater risks for forest farmers in their management decisions. Thus, risk preferences play an important role in forestry production decisions. This study develops a dynamic Faustmann model to evaluate the impact of market uncertainty and risk preferences for the harvesting decisions on Chinese fir plantations in southeastern China. The model is solved by employing a dynamic programming algorithm with the Monte Carlo simulation method. Specifically, we use a linearization function to describe the land expectation value of the future rotation period, simplifying the model's solution. The regression results of the linearized function are significant and can fully represent the future land expectation value of different optimal risk tolerance levels with different discount rates and timber and carbon prices. The results indicate that risk-seeking forest farmers generate more revenue than risk-aversers to maximize the land expectation value. The results of the dynamic Faustmann model generally show a shorter optimal rotation period and a higher land expectation value when compared with the static Faustmann model. Sensitivity analysis shows that timber price is a key parameter affecting the management decisions on the carbon sequestration forests, and forest farmers can obtain additional revenue from the increased timber price volatility. In contrast, the impact of carbon price fluctuations is relatively small, but higher carbon price can help forest farmers generate more revenue from the projects. Our results demonstrate that the Chinese government should improve the long-term equilibrium level of the carbon price, which fully reflects the carbon sequestration benefits of forest stands, and motivates forest farmers to participate in carbon sequestration projects. In addition, advising forest farmers to select the appropriate rotation period for forest carbon projects based on their risk preferences enables them to maximize the benefits of carbon sequestration and timber harvesting.

Keywords: dynamic Faustmann model, carbon sequestration benefits, Monte Carlo simulation, dynamic programming, stochastic price, risk preferences