Shade-grown coffee on neighboring farms: complements, substitutes, or negative spillovers?

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The spatial heterogeneity of land cover (sun grown vs. shade grown) systems are subject to pest infestations.

Results

The expected infestation state of cell (i, j) at time t+1 is:

\[ E(I_{i,j}^{t+1}) = E(I_{i,j}^{t}) + E(I_{i,j}^{t}) \times f(I_{i,j}^{t}) \]

where \( f(I_{i,j}^{t}) \) represents the time-dependent probability of pest infestation in cell (i, j).

The economic model consists of each farmer maximizing profit subject to the constraint that the total production of sun-grown coffee on neighboring farms is limited by the infestation state of the neighboring farm. The optimal strategy is denoted by the optimal strategy (\( \pi^* \)) and is given by:

\[ \pi^* = \arg \max_{\pi} \pi^T \cdot E(I_{i,j}^{t+1}) \]

The expected profit of producing sun-grown coffee on neighboring farms is given by:

\[ E(P) = \sum_{i,j} P(I_{i,j}) \cdot E(I_{i,j}^{t+1}) \]

where \( P(I_{i,j}) \) represents the price of coffee produced in cell (i, j).

Discussion

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Economic Production Function

The total production of coffee on neighboring farms is given by:

\[ P = \sum_{i,j} P(I_{i,j}) \]

The economic production function is a function of the infestation state of the neighboring farm and the price of coffee produced in cell (i, j).

Profit Function

The profit of producing sun-grown coffee on neighboring farms is given by:

\[ \Pi = P - C \]

where \( C \) represents the cost of coffee production in cell (i, j).

Conclusion

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The expected profit of producing sun-grown coffee on neighboring farms is limited by the infestation state of the neighboring farm. The optimal strategy is denoted by the optimal strategy (\( \pi^* \)) and is given by:

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