Faustmann theory, steady state analysisand application to an evolving world

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Martin Faustmann developed in 1849 the theory of forest renewable resources on the specific assumption of infinite series of like rotations. In his conclusion, he insisted on his main discovery, from his own point of view: the land value remains unchanged, be it assessed for periodical or sustained revenues, for a forest capital in a steady state or not, for one stand or a set of stands. This assumption has the advantage to show that forest economics can be directly related to sustainable management.

However, Faustmann's theory is much more general than what he probably thought. The major advantage of successive like rotations is to result in simple calculations because of the mathematical properties of geometric series. It follows that the discovery of Faustmann is twofold :

- the forest value is the sum of the expected revenues provided that they are considered in net terms (after subtraction of all costs) and that they are discounted in order to be made comparable before addition;
- since expected revenues directly depends on the management that is planned, the best management maximizes the forest value of the forest.

Although Faustmann has applied these principles in a specific case, the latter is accessory and only the principles are important. We could turn this in another way: although Faustmann's formula is of relatively limited interest because it is depending on specific conditions (series of like rotations), Faustmann's theory is much more powerful and can be used in an evolving world. In fact, in another famous paper for forest economics, Paul A. Samuelson (1976) wrote on "Forest economics in an evolving society". In his paper, Samuelson develops interesting arguments in favor of Faustmann's theory. He recognizes also that "life is not a steady state" and that, on the contrary "incessant change is the law of life". However, he still uses the same assumption of a series of like rotations and adds that "it is no paradox that steady-state analysis is useful in the understanding of realistic trend analysis".

This is true that, in the real world, forestry is facing many changes, of ecological, economic and social natures: land use change, loss of biodiversity, climate change, variations of forest productivity, increasing risks, internalisation of non-marketed goods and services, increase of input costs (labour, energy), variations of forest products prices (roundwood, carbon, …), new expectations from society, etc. And one could add uncertainties to risks.

Following Samuelson's statement, the paper analyses the consequences of these changes for optimal forest management on the basis of the Faustmann's formula. For most changes, if feedback loops are taken into account, the optimal decision under change is not as different from the current decision as the first sight would have shown. However some of them could be drastic and have a significant effect: a continuous decrease of wood prices in front of increasing management costs, extreme climate changes that require a fast forest conversion, new public policies in favour of environmental services or bioenergy.

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