Mathematical Modeling of Investments in an Imperfect Capital Market

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Abstract—We consider the problem of modeling the investments in an imperfect capital market in which the interest on loans significantly exceeds the interest on deposits. To determine the cash flow deflator, we propose to use the Cantor–Lippman model in which the investment environment is described by a pool of stationary and replicable projects. The pool of investment projects defines the investment function, which is built as the pointwise maximum of Laplace transforms of the cash flows of investment projects. The Cantor–Lippman model of investment in an imperfect capital market allows us to build a Bellman function, which can be used to assess the financial state of the investor. We study the properties of the Bellman operator in the problem of an optimal investment strategy. It is shown that the minimum positive root of the investment function should be used as a cash flow deflator. We also study a dynamic control system describing the investment process. Modes of balanced growth are built. The Neumann growth rate and the Neumann equilibrium states are determined. A weak turnpike theorem is proved.

Keywords: investments, Cantor–Lippman model, mathematical modeling of economics, NPV, IRR, Bellman operator, investment polynomial, linear programming problem.

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