ABSTRACT

Mathematical Modeling of Decision Making in Real Estate Contractual Negotiation. (May 1976)

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The objective of this research is to develop two mathematical models of net incomes of the seller and the purchaser in a real estate installment sale. The basis of the models is the present value concept. The objective is extended to include a decision making phase to determine the values of the four decision variables--the sale price of the real estate, the amount of down payment, the rate of interest, and the total number of monthly payments, which minimize the difference of the two net incomes.

The real estate considered in this study is a used residential rental property having a useful life of at least twenty years. It has a depreciable part which is the building and a nondepreciable, but appreciable, part which is the land. The real estate has an existing lien, called first lien, at the time of sale which is taken over by the purchaser. Additionally, a second lien will be owed by the purchaser to the seller, the terms of which are negotiable. The sale process is an installment sale providing for down payment and equal monthly payments over several years at a certain rate of interest.

The models are developed in segments--net income models in the

first year, net income models in intermediate years, and net income models in the last year. Net income in each of these years is discounted to time zero, which is the day of closing, to obtain its present value. These segment models are combined to form the complete models. The models are valid regardless of the month of sale and total number of monthly payments.

The decision making stage attempts to make the transaction mutually satisfactory to both the seller and the purchaser. The optimization problem is one of minimization. The constraints are linear. However, since the objective function is nonlinear and the tax-table is not definable by a single functional form, no known direct nonlinear programming technique is applicable. This leaves one with a choice of indirect methods of optimization--search techniques. The Davidon-Fletcher-Powell search technique with conjugate direction is applied for decision making in the present problem. An alternative solution and a non-mathematical decision-making technique are also indicated for solving the problem.

An example problem is given illustrating the use of the mathematical models and the application of the Davidon-Fletcher-Powell search technique.