his preferred consumption; in normal markets this is not so. Policymakers should be aware of the opportunities which market imperfections create to achieve objectives of social policy more economically through provision in kind than through cash payments. It will sometimes be the case that the disincentive effects of insurance can be avoided through provision in kind. In addition to cash and kind there is the promise made in cash adjusted for changes in the price level. Government could contribute to the reduction of imperfection in insurance markets by issuing real bonds.

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MATHEMATICAL APPROACHES TO THE MACROECONOMICS AND PLANNING OF OLD-AGE PENSION SYSTEMS

The American social security system has become a vast undertaking which affects the present or future welfare of nearly every citizen. By the end of 1965 over 163 million people had been issued social security account numbers. Today OASHDHI is paying benefits to 23 million people and collecting contributions from about 70 million employees and self-employed persons. Most striking is the fact that over the last 15 years income and expenditures of social insurance have risen over twice as fast as gross national product. Macroeconomic magnitudes of this order inevitably raise questions about the longrun stability of the system. It is obvious, for example, that social insurance expenditures cannot indefinitely increase faster than the gross national product. Much less obvious, however, is the rate of benefit increase that can be sustained in the long run and the characteristics of a plan consistent with this rate. The objective of this paper is to work out mathematical approaches that may assist social security planners in dealing with such problems in a rigorous analytical manner.

Since the inception of the social insurance program, critics have raised doubts in the popular mind about its solvency and issued ominous warnings about its ultimate burden. There seems to be implicit in such warnings the view that later generations will bear a heavier contribution burden in relation to benefits than earlier generations. Students of social insurance answer the question about solvency by pointing out that in a public insurance program there is no need to provide actuarial reserves against future contingencies. These are met from future income. But this means that the relationship between contingent benefits and future taxable income is of critical importance. This relationship leads directly to the question of benefit versus burden for succeeding generations.

We shall assume that in order to be sustainable the rates of contribution and benefit must not only adequately meet the needs of the present generation of beneficiaries but that they must also meet the needs of each succeeding generation and at the same time they must avoid allowing one generation to become a net burden on another. In other words, we need to devise an old age pension plan that meets the criteria of both social adequacy and intergenerational equity. We use this concept of equity to mean that each generation is entitled to benefits equal to the interest compounded value of its own contributions. The benefit