

incomes using an appropriate discount rate (0.05 in Park's study).

Briefly, the model used for estimating the rate of return was originally developed by Z. Griliches in which:

$$\text{Social Rate of Return} = \frac{\text{Perpetual flow of returns (PFR)}}{\text{Cumulated R\&E expenditures up to 1977 (CREE)}} =$$

$$\frac{\text{Interest income on cumulated past returns (ICPR) + Future annual return (FAR)}}{\text{Cumulated R\&E expenditures (CREE)}.2/}$$

The term CREE represents a sum of past R&E annual expenditures, where each past year's real expenditures are converted to the present value of 1977.

In a similar manner, cumulated past returns can be calculated as a sum of previous annual returns from R&E investments. ICPR simply expresses future interest income on these cumulated past returns. FAR represents the projected yearly return in a perpetual stream of future returns from CREE. Under the assumption of perfect foresight, yearly future return is assumed as equal to the 1977 return. PFR thus consist of two sources, ICPR and FAR.

The annual returns from R&E expenditures for developing and disseminating Tongil rice were calculated by estimating hypothetical losses in income, which would occur had the new varieties not been introduced on the farm fields. For this, the author employed a supply and demand framework as shown in Figure 1. He then assumed perfect elasticities in rice supply, i.e., that rice can be produced in Korea at a constant cost at OP in the diagram. Introduction of the new technology could then be seen as a shifting downward of the supply schedule from SS to S'S'. Then the hypothetical losses in income without the introduction of the improved varieties can be shown equal to the net losses in the consumer surplus identified by the shaded area PBBP'. The consequences of dynamic changes in the proportion of the area cultivated for Tongil rice were carefully worked out in a formula used for calculating net losses in income. Based on an estimate given in the KASS study, he assumed a rice demand elasticity of -0.4 for Korea.^{3/}

The economic (social) rate of return on R&E expenditures for Tongil rice was calculated by the author at 1200 percent. That is, from the vantage point of 1977, each one won worth of investment in Tongil rice development generated 12 won worth of return from the society's point of view. Although other studies show that the economic rate of return

2/ Z. Griliches, "Research Costs and Social Returns: Hybrid Corn And Related Innovation," Journal of Political Economy, October 1958.

3/ See Park, K. H., ibid, pp 26-40.