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THE GREEN REVOLUTION IN A MACROECONOMIC PERSPECTIVE: THE PHILIPPINE CASE

Romeo M. Bautista

Trade and Macroeconomics Division

International Food Policy Research Institute
1200 Seventeenth Street, N.W.
Washington, D.C. 20036-3006 U.S.A.

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ABSTRACT

This paper analyzes the income and equity effects of the dramatic growth in rice yield in the Philippines during the "green revolution" period 1965-80 using a modified Social Accounting Matrix (SAM) framework. Proportionately larger income benefits are found to accrue to the large-farm than the small-farm households, indicating a negative equity effect under the historical policy regime and economic structure. The results of counterfactual simulation involving a more active promotion of small-farm production point to a complementarity, rather than a tradeoff, between the twin objectives of growth and equity.

THE GREEN REVOLUTION IN A MACROECONOMIC PERSPECTIVE: THE PHILIPPINE CASE

1 INTRODUCTION

The widespread adoption of high-yielding "modern" rice varieties in several Asian countries that began in the second half of the 1960s is popularly referred to as the "green revolution." It represented a major technological development in the agricultural economies of those countries, contributing heavily to the dramatic increases in farm productivities and rural incomes that likely would also have had significant macroeconomic repercussions.

While there is a voluminous empirical literature on the income and equity effects of the green revolution,[1] surprisingly little work has been done on the quantitative assessment of those effects in an economywide framework. Most of the relevant studies are concerned with the direct impact on farm incomes from the analytical perspective of a rural household or a farm village; where indirect income effects (beyond agriculture) are evaluated, the analysis is invariably confined to the local or regional economy. In the Philippine context, the preponderant approach is to analyze inter-farm differences in adoption of modern varieties and their effects on the various sources of income from rice production, using survey data on selected farm villages in a few rice-growing regions (see, for example, IRRI 1987 and David et al. 1994).

In this paper, we examine quantitatively the effects on national income and its distribution among different household groups arising from

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[1]As reviewed, for example, in David and Otsuka (1994) and Hazell and Ramasamy (1991).

the observed rapid growth of rice yield in the Philippines during 1965-80. A modified Social Accounting Matrix (SAM) framework is used, taking into systematic account the interrelations among production, household incomes, and household expenditures in rural and urban areas as well as the macroeconomic linkages of sectoral activities. The modifying features of the Philippine model that improve on the standard SAM framework consist of using marginal (rather than average) budget shares for the different household groups and using input coefficients for the green-revolution technology in rice (instead of the base-period average coefficients).[2]

Rice production in the Philippines grew rapidly at an average annual rate of 4.3 percent during 1965-80--nearly double the 2.3 percent growth in the preceding ten years (Table 1). However, not only rice but also corn, coconut, and "other crops" (including nontraditional export crops such as banana, pineapple, and coffee) achieved faster output growth during the green-revolution (GR) period in comparison to 1955-65. As a group the nonrice crops actually contributed more than the rice sector to the rapid agricultural growth in the Philippines during 1965-80.

The main source of crop output growth shifted from the expansion of cultivated area in 1955-65 to the improvement of land productivity in 1965-80. Indeed, the technological change associated with the green revolution was land-augmenting, adoption of the modern rice varieties

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[2]Notwithstanding these modifications, the Philippine model has the well-known drawbacks of other SAM-based models, including the assumption of demand-driven adjustments, absence of relative price and monetary effects, externally determined exports, and exogenous government and capital accounts. The chronically low labor force utilization in the Philippines and liberal access to foreign capital during the study period serve to mitigate the limitations of a multiplier model in the present application.

being accompanied by increased use of fertilizer and irrigation water. The average annual growth of land productivity in rice improved from about one percent in 1955-65 to 3.67 percent in 1965-80.[3] Much less emphasized in discussions of Philippine agricultural development during the GR period is the corresponding improvement for nonrice crops, which in the aggregate showed yield increases averaging 2.73 percent annually in 1965-80 (from an average growth rate of about one percent also in 1955-65). In view of the larger share of nonrice crops in total crop production (76 percent in value-added terms), it is of interest to compare the magnitude of the income effects of the green revolution in rice with that of the concurrent productivity growth in other crops.

While the total income of rice producers was undoubtedly enhanced by the accelerated productivity growth during 1965-80, how the income gains from the green revolution were shared and the impact on overall income distribution remain an open question. There was a large disparity in land productivity between irrigated and nonirrigated areas, the improved rice technology effectively discriminating against upland farms and many small farms that did not have access to irrigation water.[4] The greater availability of credit and fertilizer subsidies to the more affluent producers as well as their greater access to infrastructure investments would also have slanted the structure of income growth toward the large farms (David 1989). These policy biases against small producers applied

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[3]Calculated from basic data given in David et al. (1987).

[4]The following data, from Herdt and Wickham (1978:5), on average yields (in tons per hectare) during 1968-76 in Philippine rice farms using modern and traditional varieties, with and without irrigation, are quite revealing: modern varieties--irrigated, 2.1 vs. nonirrigated, 1.4; traditional varieties--irrigated, 1.8 vs. nonirrigated, 1.3.

not only to rice but also to other agricultural products. Given the more labor-intensive consumption pattern among small-farm (and lower-income) households, the demand-side macroeconomic linkage effects of agricultural growth would have been reduced--which has further repercussions on overall income growth and distribution (Bautista 1990).

Another consideration, and this adds to the interest in the comparative income effects of the productivity increases in rice and in other crops, is the major presence in the export crop sector of foreign firms engaged in plantation farming and large-scale processing. Apart from the adverse equity effect of capital-intensive production, the linkage to the rest of the economy would have been weakened by the profit remittances of multinational companies (Ranis and Stewart 1987). Furthermore, in the livestock sector, technological change favored less labor-intensive and more import-dependent production, which became increasingly commercialized and large-scale in the 1970s (Unnevehr and Nelson 1985).

Indeed, the rapid agricultural growth during 1965-80 appeared to have had only a limited impact on total labor force utilization (Tidalgo and Esguerra 1984). Agricultural labor use had not been helped by the substantial farm mechanization that was effectively subsidized by cheap credit, low tariff rates on imported capital goods, and exchange rate overvaluation that prevailed during the period (Bautista 1987). This would explain, at least in part, the stagnation of real rural wages in the face of a rapidly expanding agricultural sector.[5]

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[5]There is ample evidence that the adoption of agricultural machinery has had both labor-displacing and wage-depressing effects without significantly affecting yields (Ahammed and Herdt 1985). However, in rice production, "with modern varieties and double cropping

Based on counterfactual SAM-model simulation, we also explore how the income and equity effects arising from the productivity increases in rice and other crops during the GR period would have been modified had the government effectively promoted small-farm agriculture. It has been argued in the development literature that agricultural growth focused on smaller-sized farms and lower-income households leads to a more rapid, equitable and geographically dispersed overall growth because of their substantial labor-intensive linkages to the rest of the economy.[6]

Section 2 discusses the SAM framework and the Philippine SAM used in the study. The effects of the green revolution in rice and of the productivity improvement in other crops during 1965-80 are estimated in Section 3. The results of the counterfactual experiments emphasizing small-farm production are presented in Section 4. The paper ends, in Section 5, with a brief summary of findings and some concluding remarks.

2 THE SAM FRAMEWORK

A SAM describes quantitatively, in a square table, the transactions taking place in an economy during a specified period of time.[7] Each account in the SAM is represented by a row and a column of the table; expenditures are shown in the columns and receipts in the rows. Two basic

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in irrigated areas, labor use per hectare per year has increased even though tractors are used" (David et al. 1994:81).

[6]For an early statement, see Mellor (1976). This argument has been raised in support of an agriculture-led development strategy; see also Adelman (1984), Mellor (1987), and Adelman and Taylor (1990), among others.

[7]See Pyatt and Round (1977) for an early discussion of the SAM structure, and de Melo (1988), Pyatt (1988), and Robinson and Roland-Horst (1988) for perspectives on SAM-based modeling.

properties of the SAM are that each transaction is represented by a single entry and that row sums must equal column sums for the accounts to balance.

The SAM can be expressed either algebraically as accounting identities (stating that receipts must equal expenditures for each account), or as numbers that represent the data base for a given benchmark period (typically a year). The numerical SAM integrates national income, input-output, flow-of-funds, and foreign trade statistics into a comprehensive and consistent data set. For analytical purposes, the algebraic SAM can be transformed into a multisectoral model of the economy in which the interlinkages among sectoral production, household incomes and expenditures, and macroeconomic balances are systematically taken into account.

The Philippine SAM, which has 1979 as base year, consists of 21 endogenous and three exogenous accounts. There are 11 production sectors, including three agricultural sectors (palay or unmilled rice, other crops, and livestock), three other primary sectors (fishery, forestry, and mining), three manufacturing sectors (food, light, and other), fertilizer, and services. Value-added payments are received in the labor income and two "other value added" (agricultural and nonagricultural) accounts. Seven endogenous institutional accounts are distinguished, pertaining to five household groups (Metro Manila, other urban, large farmers, small farmers, and other rural) and two "enterprises" (agricultural and nonagricultural). Table 2 shows that households in Metro Manila had the highest average income in 1979, followed by the large-farm and other urban households. Small-farm and other rural households were on average the poorest, which is consistent with the high poverty incidence found among landless agricultural workers and cultivators of small-sized farms (Balisacan 1992).

The distinction between endogenous and exogenous accounts in the SAM is crucially important. Exogenous income changes from the government, rest-of-the-world (ROW), and capital accounts are assumed to affect the endogenous accounts as they get transmitted through the interdependent SAM system in a multiplier process.

Table 3 contains the transactions matrix of the Philippine SAM.[8] Dividing each element in the endogenous accounts by the column sum (representing total income) yields the corresponding matrix of expenditure coefficients (or average shares), as shown in Table 4. Each column in the coefficient matrix adds up to unity.

Value added in rice production amounted to 7.53 billion pesos in 1979, representing about 20 percent of crops and livestock value added which in turn accounted for about 20 percent of total value added in the Philippine economy. As might be expected, the two crop sectors have relatively weak backward linkages but strong forward linkages to the other production sectors. The most important intermediate inputs to rice production are fertilizer and services, which jointly account for only 11 percent of the total value of rice output. On the other hand, 89 percent of rice output and 62 percent of other crop output are purchased as intermediate demand, largely by the food processing sector. The latter, along with services, is characterized by strong production linkages, both forward and backward.

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[8]See the Appendix below for a discussion of its construction and the principal sources of data used.

On the consumption side, we note first that there are no entries for household expenditures in the (unmilled) rice account. Domestic purchases of processed food (including milled rice) and services represent the two largest expenditure shares, ranging from 44 percent for Metro Manila households to more than 60 percent for small-farm and "other rural" households. The latter two household groups are relatively the poorest (as indicated earlier), and their budget shares for capital-intensive "other manufactures" and for imported goods are seen to be the lowest.

A final observation from Table 4 is that the largest value-added shares are found in the primary sectors (1-6), among which rice and the "other crops" sector have the largest labor-income shares. Along with the patterns of household consumption, this has significant implications for promoting equitable growth in an economy with high levels of labor unemployment and underemployment.

Analytically, the total income (row sum) in each endogenous account is equal to the sum of products of the expenditure coefficient and corresponding income plus the total exogenous income from the government, ROW, and capital accounts; that is,

$$Y = A_n Y + X \qquad (1)$$

where Y is a column vector (21x1) of total incomes in the 21 endogenous accounts, X is a column vector (21x1) of total exogenous incomes, and A_n is the expenditure coefficient matrix (21x21) pertaining to the endogenous accounts.

Equation (1) can be solved for Y in terms of X as follows:

$$Y = (I - A_n)^{-1}X = M_aX \quad (2)$$

where M_a is the SAM multiplier matrix. Equation (2) can be used to calculate the endogenous incomes associated with any constellation of total exogenous incomes, given M_a. Also, the effects on Y arising from any given changes in X (e.g., an income injection in the rice account due to the green revolution) can be derived from equation (2). In the latter application, use of the accounting multiplier matrix M_a has the limitation that fixed average expenditure propensities (implying that the elasticities are each equal to one) are being assumed. A more realistic approach would be to allow the expenditure elasticities to be non-unitary and use marginal, rather than average, expenditure shares.

In our SAM model, flexibility on the expenditure side is incorporated by replacing the average budget shares for the five household groups in the A_n matrix by their marginal shares. The latter are obtained by multiplying the average shares by the corresponding expenditure elasticities.[9] In production, the Leontief technology of fixed (average) coefficients is assumed, except that in the rice sector the input coefficients for "irrigated rice," representing the green-revolution technology, are used. It is evident from Table 5 that the GR technology made greater use of intermediate inputs (in particular, fertilizer) and generated less value added per unit of rice output. The modified SAM coefficient matrix is shown in Table 6.

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[9]Derivation of the marginal budget shares (included in the modified coefficient matrix shown in Table 5) made use of the expenditure elasticity estimates in Tan and Tecson (1974), Pante (1979), Habito (1989), and Balisacan (1992)--subjectively adjusted to keep the sum along each column equal to one.

Changes in the endogenous incomes (dY) can be expressed, therefore, in terms of changes in the exogenous incomes (dX) as follows:

$$dY = C_n dY + dX = (I - C_n)^{-1} dX = M_c dX \qquad (3)$$

where C_n and M_c are the modified SAM coefficient and multiplier matrices, respectively, incorporating the marginal household expenditure shares and technological change in the use of intermediate and primary inputs for rice production.

The multiplier matrix M_c is given in Table 7. Among other things, it provides information on the relative strength of sectoral growth linkages to household incomes. The crops, livestock, and fishery sectors generally show greater multiplier effects on household incomes than the other producing sectors. Between the two crop sectors, rice has a relatively weaker income linkage with each of the five household groups than other crops; for instance, a ten-peso increase in exogenous rice demand (gross output) will lead to a 5.27-peso rise in income for small-farm households, whereas a similar increase in the "other crops" account will yield a 5.80-peso income gain.

It would appear that there is a greater income benefit from increasing agricultural (crop and livestock) output to small farmers in comparison to large farmers; however, in proportionate terms (i.e., relative to the 1979 income levels of the two household groups), the response of large-farm income is more significant. The multiplier matrix also shows larger positive effects on the incomes of Metro Manila and other urban households than on other rural household income in absolute terms, presumably reflecting a heavy orientation of rural consumption expenditures to products of urban industry.

The direct and indirect effects of rising household incomes on labor and nonlabor value added can also be discerned from Table 7. It is notable that small-farm and other rural households have the largest multiplier effects on all three components of value added and hence on national income or GDP. The following increases in GDP (in 1979 pesos) are associated with a ten-peso income injection for each of the indicated household groups: 10.7 (Metro Manila), 12.7 (other urban), 11.9 (large-farm), 16.1 (small-farm), and 16.3 (other rural).

3 EFFECTS OF THE GREEN REVOLUTION

The high-yielding rice varieties were introduced in 1966 and both large and small farms in the Philippines are known to have widely adopted these varieties by 1980 (Herdt 1987). The new technology, however, was notably much less effective in raising yields where water levels could not be strictly regulated. It is reasonable to identify the effective adoption of the green-revolution technology during 1965-80 with the expansion of irrigated rice area--which increased from 960 to 1606 thousand hectares (Barker et al. 1985:260).

In this section, we are interested in the income and equity effects of the green revolution in comparison to those of the increased productivity in other crops. As indicated earlier, crop yields grew at a compound annual rate of 3.67 percent for rice and 2.73 percent for nonrice crops. These growth rates are assumed, in our SAM-based analysis, to represent the exogenous income injections to the rice and other crops accounts that initiate the multiplier process leading to higher income levels for all the endogenous accounts of the Philippine SAM.

The pre-GR (1965) level of total income (or gross value of output) in the rice account, in 1979 prices, can then be taken as $10.219/(1.0367)^{14}$ = 6.170 billion pesos. It follows that rice production would have expanded, as a result of the yield increases during 1965-80, by $6.170[(1.0367)^{15} - 1] = 4.425$ billion pesos. This incremental income for the rice account represents the exogenous component associated with the green revolution, corresponding to the first term in the vector dX in equation (3) above, which would have induced further income increases for rice and the other endogenous accounts after the first round of the SAM multiplier process. The income effects of the green revolution for the 21 endogenous accounts, calculated from the base model using equation (3), are shown in the first two columns of Table 8. It bears emphasizing that the income changes calculated for the endogenous accounts are estimates of the difference between the income levels with and without the green revolution based on the price structure prevailing in 1979.

Among the production accounts outside rice, the largest income effects of the green revolution are seen to be in food processing and services--which reflect their dominance in the consumption basket for each household group. In proportionate terms, the fishery, livestock, other crops, light manufactures, and fertilizer accounts also show a relatively significant impact. The effect on national income (labor income plus other value added) is 8.320 billion pesos, or 9.4 percent of the pre-GR (1965) level, in 1979 prices.[10] It is notable that the proportionate

[10]Based on the compound annual GDP growth rate of 5.9 percent during 1965-80, total value added in 1965 can be calculated as the 1979

increase in labor income is markedly lower than that in other value added (agricultural), indicating one inequitable aspect of the distribution of income gains from the green revolution.

Income in each of the endogenous institutional accounts is seen to increase, suggesting the across-the-board character of the income benefits from the green revolution. Agricultural enterprises and large-farm households gained proportionately more than small-farm households, which is consistent with the inequitable structure of GR-induced agricultural growth alluded to above. On the other hand, larger income benefits accrued to other rural households, in proportionate terms, relative to Metro Manila and other urban households; this pattern of indirect income effects represents one favorable aspect of income redistribution induced by the green revolution in the Philippines.

Estimation of the effects of productivity growth in other crops during 1965-80 follows the procedure used above for rice. The exogenous income injection for nonrice crop producers is calculated at 9.319 billion pesos in 1979 prices,[11] which remarkably is more than double the exogenous income increase for rice farmers due to the green revolution. This amount is entered as the second element in the dX vector in equation (3) relating to the other crops account. Calculation of dY, using the same multiplier matrix M_c and the exogenous income injections for the rice and other crops accounts, gives the estimated income effects of the observed yield increases in rice and other crops, shown in columns (3) and (4) of Table 8. The seperate multiplier effects of productivity growth in other crops

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value divided by $(1.059)^{14}$ = 88.971 billion pesos (in 1979 prices).

[11]Derived from $[30.082/(1.0243)^{14}][(1.0243)^{15} -1]$.

during 1965-80 is obtained, as shown in column (5) and in proportionate terms in column (6), by subtracting the dY estimates for rice in column (1) from the corresponding entries in column (3).

It is notable that the income increments for the other production sectors resulting from the yield growth in other crops during 1965-80 are in most cases significantly larger than those arising from the green revolution in rice. The impact on total value added is 18.509 billion pesos (in 1979 prices), or 20.8 percent of the 1965 GDP level; this is significantly greater than that resulting from productivity growth in rice. Finally, as found earlier also for rice, labor income increases by much less than other value added (agricultural), the income gains are greater for large-farm than small-farm households, and other rural households benefit more than the Metro Manila and other urban households.

The relative contributions of production and consumption linkages (associated with the intermediate input and final demands, respectively) to the total income increments in the endogenous accounts are also worth examining. Setting the marginal household expenditure propensities in the coefficient matrix C_n equal to zero and redoing the above SAM calculations provide an estimate of the production linkage effects in isolation. Subtracting this from the total linkage effects (given in Table 8) yields the estimated consumption linkage effects.

As shown in Table 9, consumption linkages account for 54 percent of the total increase in endogenous incomes resulting from yield increases for both rice and other crops during 1965-80. The greater importance of consumption linkage effects is widely observed in the empirical literature. Consumption linkages have been estimated to account for 78 to 82 percent of the income multiplier effects under various types of rice technology for small and medium farms in Asia and for 42 to 71 percent for estate agriculture in Africa and Latin America (Haggblade and Hazell 1989:357). The above estimate of 54 percent for the Philippines seems therefore on the low side. One possible reason would be that the consumption expenditures of rural households benefiting from productivity growth are heavily oriented to imported goods or to products of import-dependent domestic industries, as has been observed in a survey of a rice farming village in Laguna province (Ranis et al. 1989).

4 PROMOTING SMALL-FARM PRODUCTION

One of the stylized facts about Philippine agriculture is that small farmers have received less attention and support from the government in comparison to the large farmers and agricultural enterprises. This has led to the benefits of agricultural research, input subsidies, and infrastructure investment accruing disproportionately to the large-sized farms. With respect to the macroeconomic policy environment, there is wide agreement that the unfavorable effects of foreign trade and payments restrictions, the low interest rate policy and effective rationing of institutional credit, and the urban bias in government spending during 1965-80 impinged much more heavily on small farmers (Bautista 1987, 1992; David 1989). These policy distortions have contributed to the continued high incidence of rural poverty and the failure of the rapid agricultural growth observed above to be translated into a rapid and sustainable economic growth.

How would the Philippine economy have fared during the green-revolution period under conditions more favorable to small-farm agriculture? The argument against promoting small-farm production is based on the possible tradeoff between equity and growth. As indicated above, however, the strong intersectoral growth linkages of small farms, including the direct and indirect consumption-linkage effects arising from the increased income of small-farm households, can lead to an outcome that is favorable to both equity and growth.

In this section, we make use of the Philippine SAM to examine the income effects of increasing public support for the small-farm sector. Government investments and subsidies are assumed in this counterfactual experiment to be redirected to small farms, which raises the latter's productivity and value-added share. In view of the greater labor intensity of production in smaller-sized farms, the share of labor income in sectoral value added is also expected to increase. Would such small-farm development program, which is pro-equity by intention, have lead to a lower or higher GDP relative to the base-model result?

The counterfactual experiment is simulated in the SAM model by adding 10 percentage points to the marginal labor share in gross income for each of the three agricultural (crops and livestock) accounts, and lowering the nonlabor share commensurately. The increment in labor income is allocated equally to small-farm and other rural households, the landless workers in the latter group benefiting from the increased labor use in agricultural production. Lastly, the nonlabor value-added payments to large-farm households and enterprises are reduced by 20 and 80 percent, respectively, of the total decline in nonlabor income.

The same exogenous income increases as calculated before are used, sectoral productivity growth in rice and in other crops being assumed in the small-farm development experiment to match what was achieved during 1965-80. Table 10 presents the results of the SAM model simulation, including the percentage deviations from the corresponding results of the base model. It is evident that the income effects on the SAM's endogenous accounts are generally not insignificant. In terms of the impact on total value added, the results indicate increases of 8.658 and 19.241 billion pesos (in 1979 prices) associated with the productivity growth in rice and in other crops, respectively. These are higher by 4.1 and 3.9 percent, respectively, than the calculated GDP effects from the base model (shown in Table 8 as total linkage effects). Thus, the overall income effect of increased emphasis on small-farm production during the green-revolution period would have been significantly positive.

With respect to the redistribution of incomes, Table 10 indicates that the counterfactual experiment leads, as might be expected, to a gain in income for small-farm households and a reduction for large-farm households and agricultural enterprises. What is remarkable is that incomes also increase--relative to the base-model results--for other rural, other urban, and Metro Manila households; that they do so *in descending order of magnitude* reflects the pattern of labor-intensive linkages of small-farm households favoring the local rural economy over other parts of the nonfarm economy. Not only are more landless rural workers employed as small farms expand production; the increased demand for locally produced goods and services provides an additional boost to "other rural" household income.

The breakdown of the income multiplier effects of crop productivity growth during 1965-80 under the small-farm development experiment into those arising from production and consumption linkages is shown in Table 11. As in the base-model results (contained in Table 9), consumption linkages represent the more important source of endogenous income growth.

Moreover, consumption linkage effects account for virtually all the income increases in the counterfactual experiment relative to the base model. This would seem to bear out the stronger consumption linkages of production growth in small farms than in large farms and agricultural enterprises.

To recapitulate, the above findings do not indicate a tradeoff between growth and equity in the promotion of small-farm agriculture in the Philippines. Indeed, the results of counterfactual simulation would suggest that past neglect of small-farm development has had a significant cost in terms of both economic growth and poverty reduction in the Philippines.

5 CONCLUSION

This paper has examined, in a macroeconomic context and with emphasis on the demand side, the income and equity effects of the rapid growth in rice productivity in the Philippines during the green-revolution period 1965-80. A modified SAM framework is employed that incorporates the technological change in rice production and the marginal expenditure propensities associated with nonunitary income elasticities of household consumption.

The results of SAM analysis indicate that the observed productivity growth in rice and in other crops during the green-revolution period led to income increases of 8.3 and 18.5 billion pesos (in 1979 prices), respectively. Therefore, contrary to popular impression, the green revolution in the rice sector did not represent the dominant source of growth during 1965-80. Productivity growth in other crops as a group is shown above to have had a greater contribution not only to agricultural growth but also to GDP growth.

Consumption linkages are found to account for a more significant part of the total income effects than production linkages, but to a lesser extent than that generally found in developing countries. The pattern of household consumption expenditures matters; a greater orientation to labor-intensive, domestically produced goods and services would have enhanced the multiplier effects on the demand side.

Productivity growth in both rice and other crops resulted in higher incomes for all household groups. However, proportionately larger income benefits accrued to the large-farm than the small-farm households, indicating a negative equity effect under the historical policy regime and economic structure. These findings are consistent with the observed reduction in poverty incidence and increased income inequality among rural households, based on FIES (Family Income and Expenditure Survey) data for 1965 and 1971 (Balisacan 1992, Bautista 1992).

The counterfactual experiment involving a more active promotion of small-farm production points to a complementarity, rather than a tradeoff, between the twin objectives of growth and equity. Incomes of small-farm and other rural households increase by more than those of the higher-income Metro Manila and other urban households, while large-farm household income declines. The effect on GDP is an increase of about four percent relative to the base-model result. These findings support the conclusion that an increased emphasis on small-farm development during the green-revolution period would have contributed to the achievement of a more rapid and egalitarian growth of the Philippine economy.

APPENDIX: Construction of the 1979 Philippine SAM

The 85x85 input-output table for 1979, prepared by the National Statistics Office (NSO), was the basic data source for sectoral intermediate purchases and output sales. The total transactions and import matrices were collapsed into the 11x11-sector breakdown of the Philippine SAM; the input-output table of domestic transactions was then derived by subtracting the import matrix from the total transactions matrix.

The NSO I-O table also provided the basis for the commodity structure of the major final demand components (total household consumption, government current expenditures, investment, and exports) and of the primary input payments (labor income, other value added, and indirect taxes less subsidies).

The household classification into Metro Manila, other urban, and rural was based on the 1979 SAM (worksheet copy) of the NSO. Rural households were further distinguished into large-farm, small-farm, and other rural households, the first two being identified with ownership of farms of less than five hectares (small farms) and at least five hectares (large farms). As of 1980, small farms accounted for 86 percent of the total number of farms in the Philippines.

Patterns of consumption expenditures by sectoral product and household group were obtained by using the consumption transformation matrices from the NSO SAM, and reconciled with the household expenditures by income group (deciles) for 1978 derived in Habito (1989).

The distribution of value added by household group, current transfers between institutions, and savings by institutions were largely based on the NSO SAM, adjusted and reconciled with the patterns derived in Bautista (1986) and Habito (1989) for 1978 and in Lamberte et al. (1992) for 1979. Based on the broad definition of agriculture in the national income accounts, agricultural enterprises and other value added in the SAM included those in crops, livestock, fishery, and forestry; the remaining production sectors were included in nonagricultural enterprises and other value added.

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Table 1-- Average annual growth of agricultural production by commodity, 1955-80 (percent)

	1955-65	1965-80
All crops	3.4	5.2
Rice	2.3	4.3
Corn	5.3	5.6
Sugarcane	2.9	2.9
Coconut	3.4	4.2
Others	4.4	7.3
Livestock	2.0	6.4

Source: David, Barker and Palacpac (1987:413).

Table 2--Total and average household incomes, 1979

Household group	No. of households (thousands)	Total income (million pesos)	Average income (thousand pesos)
Metro Manila	1,014	47,330	46.7
Other urban	1,786	44,144	24.7
Large farmers	450	14,359	31.9
Small farmers	2,764	47,793	17.3
Other rural	2,144	29,398	13.7

Source: Author's calculations based on FIES (Family Income and Expenditure Survey), 1980 Census of Agriculture and 1979 SAM data from the National Statistics Office (NSO), Manila.

Table 3--SAM transactions matrix, 1979 (billion pesos)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. Rice	0.318	0.000	0.000	0.000	0.000	0.000	8.783	0.000	0.000	0.000	0.000
2. Other crops	0.318	2.045	0.078	0.014	0.000	0.000	14.282	1.150	0.307	0.000	0.382
3. Livestock	0.000	0.000	1.494	0.000	0.000	0.000	8.298	0.000	0.000	0.000	0.393
4. Fishery	0.000	0.000	0.000	0.171	0.000	0.000	1.448	0.000	0.049	0.000	0.240
5. Forestry	0.000	0.007	0.000	0.000	0.285	0.022	0.035	3.353	0.062	0.000	0.346
6. Mining	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.549	0.047	0.554
7. Food processing	0.000	0.000	2.617	0.355	0.000	0.000	7.835	0.113	1.031	0.000	2.115
8. Light manufacturing	0.008	0.092	0.000	0.022	0.003	0.007	0.241	5.126	0.349	0.004	2.553
9. Other manufacturing	0.332	0.611	0.286	0.772	0.374	0.988	2.769	2.738	10.882	0.202	17.210
10. Fertilizer	0.645	0.977	0.000	0.249	0.000	0.000	0.000	0.000	0.000	0.011	0.000
11. Services	0.507	0.909	0.877	0.746	0.244	0.490	6.836	3.435	8.196	0.327	14.579
12. Labor	3.822	10.696	2.986	3.676	1.241	1.574	6.251	4.043	5.815	0.171	41.739
13. Other V.A.:Agr.	3.707	13.361	3.555	5.606	3.220						
14. Other V.A.:Nonagr.						3.764	12.025	5.042	12.065	0.381	53.774
15. Metro Manila											
16. Other urban											
17. Small farmers											
18. Large farmers											
19. Other rural											
20. Enterprises:Agr.											
21. Enterprises:Nonagr.											
22. Government	0.183	0.800	0.237	0.458	0.408	0.591	2.184	2.508	6.672	0.120	8.195
23. ROW	0.380	0.586	0.407	0.191	0.111	0.322	3.271	3.891	19.786	0.756	5.143
24. Saving											
Total	10.219	30.083	12.535	12.264	5.886	7.760	74.256	31.398	65.762	2.021	147.223

Table 3. cont'd.

	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
1. Rice				0.000	0.000	0.000	0.000	0.000			0.000	0.300	0.818	10.219
2. Other crops				1.114	1.971	3.733	0.723	1.905			0.086	2.078	-0.103	30.083
3. Livestock				0.416	0.579	0.501	0.159	0.366			0.034	0.000	0.295	12.535
4. Fishery				1.281	2.364	3.373	0.650	2.461			0.106	0.121	0.000	12.264
5. Forestry				0.104	0.207	0.284	0.057	0.206			0.003	0.883	0.032	5.886
6. Mining				0.025	0.029	0.027	0.007	0.020			0.005	5.102	1.390	7.760
7. Food processing				7.585	9.938	16.605	3.199	10.684			0.480	9.526	2.173	74.256
8. Light manufacturing				2.238	3.736	4.321	1.045	3.144			0.191	6.381	1.937	31.398
9. Other manufacturing				2.801	2.680	2.242	1.166	1.643			2.210	5.366	10.490	65.762
10. Fertilizer				0.015	0.010	0.000	0.000	0.004			0.000	0.000	0.110	2.021
11. Services				8.776	11.616	13.725	3.262	7.602			14.322	11.704	39.070	147.223
12. Labor														82.014
13. Other V.A.: Agr.														29.449
14. Other V.A.: Nonagr.														87.051
15. Metro Manila	19.505		2.729							22.562	0.934	1.600		47.330
16. Other urban	20.034		0.999							20.027	1.137	1.947		44.144
17. Small farmers	23.475	5.513							8.394	5.625	2.685	2.100		47.792
18. Large farmers	2.064	1.226							6.026	4.039	0.000	1.004		14.359
19. Other rural	16.936	0.000	0.411							10.396	0.700	0.955		29.398
20. Enterprises: Agr.		22.089									1.460	0.089		23.638
21. Enterprises: Nonagr.			82.669								4.128	1.911		88.708
22. Government		0.620	0.241	9.336	1.723	0.701	1.111	0.414	1.026	2.899	0.000	0.208		40.635
23. ROW		0.001	0.001	1.307	1.833	0.900	0.938	0.276			0.840		19.705	60.645
24. Saving				12.331	7.458	1.380	2.041	0.672	8.192	23.160	11.313	9.369		75.916
Total	82.014	29.449	87.050	47.329	44.144	47.792	14.358	29.397	23.638	88.708	40.634	60.644	75.917	

Table 4--Average coefficient matrix, 1979

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. Rice	0.0311	0.0000	0.0000	0.0000	0.0000	0.0000	0.1183	0.0000	0.0000	0.0000	0.0000
2. Other crops	0.0311	0.0680	0.0062	0.0011	0.0000	0.0000	0.1923	0.0366	0.0047	0.0000	0.0026
3. Livestock	0.0000	0.0000	0.1192	0.0000	0.0000	0.0000	0.1117	0.0000	0.0000	0.0000	0.0027
4. Fishery	0.0000	0.0000	0.0000	0.0140	0.0000	0.0000	0.0195	0.0000	0.0007	0.0000	0.0016
5. Forestry	0.0000	0.0002	0.0000	0.0000	0.0485	0.0028	0.0005	0.1068	0.0009	0.0000	0.0024
6. Mining	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0083	0.0232	0.0038
7. Food processing	0.0000	0.0000	0.2088	0.0290	0.0000	0.0000	0.1055	0.0036	0.0157	0.0000	0.0144
8. Light manufacturing	0.0008	0.0030	0.0000	0.0018	0.0006	0.0010	0.0032	0.1633	0.0053	0.0021	0.0173
9. Other manufacturing	0.0325	0.0203	0.0228	0.0629	0.0636	0.1274	0.0373	0.0872	0.1655	0.0998	0.1169
10. Fertilizer	0.0631	0.0325	0.0000	0.0203	0.0000	0.0000	0.0000	0.0000	0.0000	0.0054	0.0000
11. Services	0.0496	0.0302	0.0700	0.0608	0.0414	0.0632	0.0921	0.1094	0.1246	0.1621	0.0990
12. Labor	0.3740	0.3556	0.2382	0.2997	0.2108	0.2029	0.0842	0.1288	0.0884	0.0847	0.2835
13. Other V.A.:Agr.	0.3628	0.4441	0.2836	0.4571	0.5469						
14. Other V.A.:Nonagr.						0.4851	0.1619	0.1606	0.1835	0.1887	0.3653
15. Metro Manila											
16. Other urban											
17. Small farmers											
18. Large farmers											
19. Other rural											
20. Enterprises:Agr.											
21. Enterprises:Nonagr.											
22. Government	0.0179	0.0266	0.0189	0.0374	0.0693	0.0762	0.0294	0.0799	0.1015	0.0594	0.0557
23. ROW	0.0372	0.0195	0.0324	0.0156	0.0189	0.0414	0.0440	0.1239	0.3009	0.3746	0.0349
24. Saving											
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 4. cont'd.

	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1. Rice				0.0000	0.0000	0.0000	0.0000	0.0000			0.0000	0.0050	0.0108
2. Other crops				0.0235	0.0446	0.0781	0.0504	0.0648			0.0021	0.0343	-0.0014
3. Livestock				0.0088	0.0131	0.0105	0.0111	0.0125			0.0008	0.0000	0.0039
4. Fishery				0.0271	0.0535	0.0706	0.0453	0.0837			0.0026	0.0020	0.0000
5. Forestry				0.0022	0.0047	0.0059	0.0040	0.0070			0.0001	0.0146	0.0004
6. Mining				0.0005	0.0007	0.0006	0.0005	0.0007			0.0001	0.0841	0.0183
7. Food processing				0.1603	0.2251	0.3474	0.2228	0.3634			0.0118	0.1571	0.0286
8. Light manufacturing				0.0473	0.0846	0.0904	0.0728	0.1070			0.0047	0.1052	0.0255
9. Other manufacturing				0.0592	0.0607	0.0469	0.0812	0.0559			0.0544	0.0885	0.1382
10. Fertilizer				0.0003	0.0002	0.0000	0.0000	0.0001			0.0000	0.0000	0.0014
11. Services				0.1854	0.2631	0.2872	0.2272	0.2586			0.3524	0.1930	0.5146
12. Labor													
13. Other V.A.: Agr.													
14. Other V.A.: Nonagr.													
15. Metro Manila	0.2378		0.0314							0.2543	0.0230	0.0264	
16. Other urban	0.2443		0.0115							0.2258	0.0280	0.0321	
17. Small farmers	0.2862	0.1872							0.3551	0.0634	0.0661	0.0346	
18. Large farmers	0.0252	0.0416							0.2549	0.0455	0.0000	0.0166	
19. Other rural	0.2065		0.0047							0.1172	0.0172	0.0157	
20. Enterprises: Agr.		0.7501									0.0359	0.0015	
21. Enterprises: Nonagr.			0.9497								0.1016	0.0315	
22. Government		0.0211	0.0028	0.1973	0.0390	0.0147	0.0774	0.0141	0.0434	0.0327		0.0034	
23. ROW				0.0276	0.415	0.0188	0.0653	0.0094			0.0207		0.2596
24. Saving				0.2605	0.1689	0.0289	0.1421	0.0229	0.3466	0.2611	0.2784	0.1545	
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 5--Input structures for irrigated and nonirrigated rice, 1979

	Irrigated rice		Nonirrigated rice	
	Input purchases	Input coefficients	Input purchases	Input coefficients
1. Irrigated rice	200.5	0.0280	0.0	0.0000
Nonirrigated rice	0.0	0.0000	117.8	0.0381
2. Other crops	272.3	0.0381	45.7	0.0149
3. Livestock	0.0	0.000	0.0	0.0000
4. Fishery	0.0	0.000	0.0	0.0000
5. Forestry	0.0	0.000	0.0	0.0000
6. Mining	0.0	0.000	0.0	0.0000
7. Food processing	0.0	0.000	0.0	0.0000
8. Light manufacturing	5.9	0.0008	1.9	0.0006
9. Other manufacturing	294.1	0.0411	37.9	0.0124
10. Fertilizer	574.8	0.0803	69.7	0.0227
11. Services	434.4	0.0607	125.7	0.0410
Total intermediate inputs	1782.0	0.3524	1301.1	0.4247
12. Labor income	2521.0	0.3524	1301.1	0.4247
13. Nonlabor value added	2429.9	0.3396	1277.5	0.4169
20. Government	134.7	0.0188	48.3	0.0158
21. Rest-of-the-world (Imports)	287.6	0.0402	38.7	0.0126
Total	7155.2	1.0000	3064.3	1.000

Source: Calculated from the 85 x 85 Input-Output Transactions Table for 1979 (Special tabulation), National Statistics Office.

Note: Input purchases are in million pesos.

Table 6--Modified coefficient matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1 Rice	0.0280	0.0000	0.0000	0.0000	0.0000	0.0000	0.1183	0.0000	0.0000	0.0000	0.0000
2 Other crops	0.0381	0.0680	0.0062	0.0011	0.0000	0.0000	0.1923	0.0366	0.0047	0.0000	0.0026
3 Livestock	0.0000	0.0000	0.1192	0.0000	0.0000	0.0000	0.1117	0.0000	0.0000	0.0000	0.0027
4 Fishery	0.0000	0.0000	0.0000	0.0140	0.0000	0.0000	0.0195	0.0000	0.0007	0.0000	0.0016
5 Forestry	0.0000	0.0002	0.0000	0.0000	0.0485	0.0028	0.0005	0.1068	0.0009	0.0000	0.0024
6 Mining	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0083	0.0232	0.0038
7 Food processing	0.0000	0.0000	0.2088	0.0290	0.0000	0.0000	0.1055	0.0036	0.0157	0.0000	0.0144
8 Light manufacturing	0.0008	0.0030	0.0000	0.0018	0.0006	0.0010	0.0032	0.1633	0.0053	0.0021	0.0173
9 Other manufacturing	0.0411	0.0203	0.0228	0.0629	0.0636	0.1274	0.0373	0.0872	0.1655	0.0998	0.1169
10 Fertilizer	0.0803	0.0325	0.0000	0.0203	0.0000	0.0000	0.0000	0.0000	0.0000	0.0054	0.0000
11 Services	0.0607	0.0302	0.0700	0.0608	0.0414	0.0632	0.0921	0.1094	0.1246	0.1621	0.0990
12 Labor income	0.3524	0.3556	0.2382	0.2997	0.2108	0.2029	0.0842	0.1288	0.0884	0.0847	0.2835
13 Other V.A.:Agr.	0.3396	0.4441	0.2836	0.4571	0.5469	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14 Other V.A.:NonAgr.	0.0000	0.0000	0.0000	0.0000	0.0000	0.4851	0.1619	0.1606	0.1835	0.1887	0.3653
15 Metro Manila	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16 Other urban	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
17 Small farmers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
18 Large farmers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19 Other rural	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20 Enterprises:Agr.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
21 Enterprises:Nonagr.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
1 Rice	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2 Other crops	0.0000	0.0000	0.0000	0.0120	0.0220	0.0510	0.0200	0.0360	0.0000	0.0000
3 Livestock	0.0000	0.0000	0.0000	0.0220	0.0190	0.0150	0.0220	0.0140	0.0000	0.0000
4 Fishery	0.0000	0.0000	0.0000	0.0340	0.0540	0.0710	0.0450	0.0840	0.0000	0.0000
5 Forestry	0.0000	0.0000	0.0000	0.0030	0.0050	0.0060	0.0040	0.0070	0.0000	0.0000
6 Mining	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7 Food processing	0.0000	0.0000	0.0000	0.2030	0.2250	0.3470	0.2230	0.3630	0.0000	0.0000
8 Light manufacturing	0.0000	0.0000	0.0000	0.0600	0.0850	0.1080	0.0730	0.1280	0.0000	0.0000
9 Other manufacturing	0.0000	0.0000	0.0000	0.0750	0.0460	0.0230	0.0610	0.0280	0.0000	0.0000
10 Fertilizer	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11 Services	0.0000	0.0000	0.0000	0.2430	0.2960	0.3160	0.2660	0.2940	0.0000	0.0000
12 Labor income	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
13 Other V.A.:Agr.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14 Other V.A.:NonAgr.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15 Metro Manila	0.2378	0.0000	0.0314	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2258
16 Other urban	0.2443	0.0000	0.0115	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0634
17 Small farmers	0.2862	0.1872	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3551	0.0455
18 Large farmers	0.0252	0.0416	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2549	0.0455
19 Other rural	0.2065	0.0000	0.0047	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1172
20 Enterprises:Agr.	0.0000	0.7501	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
21 Enterprises:Nonagr.	0.0000	0.0000	0.9497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 7--Multiplier matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1 Rice	1.0945	0.0688	0.0986	0.0698	0.0620	0.0546	0.2001	0.0482	0.0363	0.0334	0.0611
2 Other crops	0.2212	1.2612	0.2437	0.1883	0.1704	0.1460	0.4068	0.1767	0.1010	0.0900	0.1655
3 Livestock	0.1026	0.1073	1.2722	0.1068	0.0965	0.0871	0.2406	0.0761	0.0566	0.0535	0.0989
4 Fishery	0.1059	0.1111	0.1107	1.1207	0.0997	0.0879	0.1192	0.0766	0.0555	0.0535	0.0970
5 Forestry	0.0328	0.0346	0.0330	0.0329	1.0817	0.0306	0.0315	0.1585	0.0194	0.0178	0.0348
6 Mining	0.0077	0.0063	0.0060	0.0068	0.0055	1.0058	0.0063	0.0056	0.0134	0.0279	0.0101
7 Food processing	0.5394	0.5655	0.8099	0.5739	0.5095	0.4484	1.6444	0.3963	0.2981	0.2746	0.5017
8 Light manufacturing	0.1952	0.2060	0.1948	0.1959	0.1824	0.1642	0.1840	1.3386	0.1099	0.1045	0.1973
9 Other manufacturing	0.3153	0.2875	0.3062	0.3327	0.3122	0.3758	0.3191	0.3402	1.3554	0.2800	0.3881
10 Fertilizer	0.0978	0.0490	0.0182	0.0347	0.0126	0.0110	0.0319	0.0112	0.0074	1.0122	0.0123
11 Services	0.7404	0.7228	0.7747	0.7331	0.6661	0.6390	0.7563	0.6461	0.5095	0.5344	1.7245
12 Labor income	0.8456	0.8488	0.8073	0.7750	0.6483	0.6030	0.7236	0.5755	0.3898	0.3805	0.7343
13 Other V.A.:Agr.	0.5654	0.6836	0.5711	0.6679	0.7612	0.1650	0.3886	0.2382	0.1092	0.1007	0.1856
14 Other V.A.:NonAgr.	0.4692	0.4538	0.5079	0.4631	0.4174	0.8914	0.6397	0.5824	0.5086	0.5124	0.8213
15 Metro Manila	0.3291	0.3257	0.3306	0.3107	0.2681	0.3867	0.3466	0.2958	0.2315	0.2303	0.3987
16 Other urban	0.3126	0.3099	0.3120	0.2940	0.2527	0.3487	0.3213	0.2722	0.2101	0.2087	0.3649
17 Small farmers	0.5267	0.5803	0.5207	0.5526	0.5559	0.3011	0.4219	0.3078	0.1917	0.1854	0.3438
18 Large farmers	0.1732	0.2001	0.1752	0.1950	0.2116	0.0921	0.1363	0.0951	0.0572	0.0552	0.0972
19 Other rural	0.2291	0.2279	0.2256	0.2137	0.1823	0.2279	0.2236	0.1864	0.1395	0.1380	0.2469
20 Enterprises:Agr.	0.4241	0.5128	0.4284	0.5010	0.5710	0.1238	0.2915	0.1787	0.0819	0.0755	0.1392
21 Enterprises:Nonagr.	0.4456	0.4309	0.4824	0.4398	0.3964	0.8465	0.6075	0.5531	0.4830	0.4866	0.7800

	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
1 Rice	0.0887	0.0648	0.0575	0.0666	0.0763	0.1051	0.0735	0.1079	0.0561	0.0568
2 Other crops	0.2391	0.1799	0.1516	0.1684	0.2036	0.2973	0.1936	0.2876	0.1549	0.1502
3 Livestock	0.1388	0.1001	0.0929	0.1149	0.1253	0.1570	0.1243	0.1591	0.0874	0.0918
4 Fishery	0.1445	0.1039	0.0928	0.0987	0.1301	0.1690	0.1168	0.1835	0.0898	0.0920
5 Forestry	0.0439	0.0314	0.0286	0.0313	0.0403	0.0506	0.0363	0.0545	0.0272	0.0283
6 Mining	0.0065	0.0046	0.0044	0.0055	0.0061	0.0072	0.0059	0.0073	0.0041	0.0044
7 Food processing	0.7290	0.5324	0.4721	0.5475	0.6272	0.8636	0.6042	0.8869	0.4607	0.4671
8 Light manufacturing	0.2622	0.1871	0.1705	0.1878	0.2384	0.3017	0.2159	0.3271	0.1622	0.1689
9 Other manufacturing	0.3283	0.2293	0.2284	0.3036	0.3096	0.3460	0.3106	0.3562	0.2021	0.2249
10 Fertilizer	0.0179	0.0132	0.0115	0.0129	0.0155	0.0216	0.0146	0.0219	0.0114	0.0114
11 Services	0.8768	0.6305	0.5868	0.7022	0.8325	0.9934	0.7728	0.9816	0.5497	0.5797
12 Labor income	1.5775	0.4184	0.3803	0.4453	0.5261	0.6685	0.4947	0.6746	0.3635	0.3760
13 Other V.A.:Agr.	0.2658	1.1949	0.1713	0.1922	0.2334	0.3171	0.2194	0.3232	0.1685	0.1696
14 Other V.A.:NonAgr.	0.5472	0.3934	1.3644	0.4361	0.5067	0.6222	0.4774	0.6277	0.3426	0.3601
15 Metro Manila	0.5245	0.2068	0.4628	1.2249	0.2634	0.3288	0.2479	0.3317	0.1799	0.4420
16 Other urban	0.5090	0.1911	0.4012	0.2073	1.2430	0.3039	0.2287	0.3066	0.1662	0.3990
17 Small farmers	0.6050	0.6854	0.2687	0.2409	0.2869	1.3726	0.2698	0.3775	0.5562	0.2696
18 Large farmers	0.1253	0.3057	0.1084	0.0748	0.0895	0.1176	1.0842	0.1194	0.3181	0.1100
19 Other rural	0.3892	0.1320	0.2368	0.1426	0.1674	0.2102	0.1575	1.2121	0.1148	0.2366
20 Enterprises:Agr.	0.1994	0.8963	0.1285	0.1442	0.1751	0.2379	0.1646	0.2424	1.1264	0.1272
21 Enterprises:Nonagr.	0.5197	0.3736	1.2958	0.4142	0.4812	0.5909	0.4534	0.5961	0.3254	1.3419

Table 8--Income effects: Base-model results

Endogenous accounts	Productivity growth in: Rice		All crops		Other crops	
	Income change (billion pesos 1979 prices) (1)	Change from 1979 level (percent) (2)	Income change (billion pesos 1979 prices) (3)	Change from 1979 level (percent) (4)	Income change billion pesos (1979 prices) (5)	Change from 1979 level (percent) (6)
Rice	4.843	47.39	5.484	53.67	0.641	6.27
Other crops	0.979	3.25	12.732	42.32	11.753	39.07
Livestock	0.454	3.62	1.454	11.60	1.000	7.98
Fishery	0.469	3.82	1.504	12.26	1.035	8.44
Forestry	0.145	2.47	0.468	7.94	0.322	5.48
Mining	0.034	0.44	0.093	1.20	0.059	0.76
Food processing	2.387	3.21	7.657	10.31	5.270	7.10
Light manufacturing	0.864	2.75	2.783	8.86	1.920	6.11
Other manufacturing	1.395	2.12	4.074	6.20	2.679	4.07
Fertilizer	0.433	21.43	0.889	44.04	0.457	22.61
Services	3.276	2.23	10.012	6.80	6.736	4.58
Labor income	3.742	4.56	11.652	14.21	7.910	9.64
Other V.A.:Agr.	2.502	8.50	8.872	30.13	6.370	21.63
Other V.A.:Nonagr.	2.076	2.39	6.305	7.24	4.229	4.86
Metro Manila	1.456	3.08	4.491	9.49	3.035	6.41
Other urban	1.383	3.13	4.271	9.68	2.888	6.54
Small farmers	2.331	4.88	7.738	16.19	5.408	11.32
Large farmers	0.766	5.34	2.631	18.32	1.865	12.99
Other rural	1.014	3.45	3.138	10.67	2.124	7.22
Enterprises:Agr.	1.877	7.94	6.655	28.16	4.779	20.22
Enterprises:Nonagr.	1.972	2.22	5.987	6.75	4.016	4.53

Table 9-- Income effects associated with production and consumption linkages, 1965-80 (billion pesos, 1979 prices)

Productivity growth in:	Total linkage	Production linkage	Consumption linkage
Rice	8.320	3.803 (45.7)	4.517 (54.3)
Other crops	18.509	8.515 (46.0)	9.994 (54.0)

Source: Author's calculations.

Note: Numbers in parentheses are percentages of total.

Table 10--Income effects: Small-farm development experiment

Endogenous accounts	Productivity growth in: Rice		All crops		Other crops	
	Income effects (billion pesos 1979 prices) (1)	Deviation from base-model results (percent) (2)	Income effects (billion pesos 1979 prices) (3)	Deviation from base-model results (percent) (4)	Income effects (billion pesos 1979 prices) (5)	Deviation from base-model results (percent) (6)
Rice	4.865	0.46	5.556	1.30	0.691	7.70
Other crops	1.039	6.10	12.923	1.50	11.885	1.12
Livestock	0.486	7.12	1.556	7.03	1.070	6.99
Fishery	0.507	8.12	1.626	8.11	1.119	8.10
Forestry	0.157	7.93	0.504	7.84	0.348	7.80
Mining	0.036	5.19	0.098	5.93	0.062	6.35
Food processing	2.570	7.69	8.242	7.64	5.672	7.62
Light manufacturing	0.932	7.89	3.000	7.77	2.068	7.72
Other manufacturing	1.467	5.17	4.301	5.57	2.834	5.77
Fertilizer	0.437	1.02	0.904	1.65	0.467	2.24
Services	3.479	6.20	10.657	6.44	7.177	6.56
Labor income	4.520	20.80	14.099	21.00	9.579	21.10
Other V.A.:Agr.	1.930	-22.87	7.082	-20.18	5.152	-19.12
Other V.A.:Nonagr.	2.206	6.24	6.716	6.52	4.510	6.65
Metro Manila	1.615	10.88	4.991	11.12	3.376	11.24
Other urban	1.539	11.23	4.762	11.49	3.223	11.62
Small farmers	2.434	4.42	8.105	4.74	5.672	4.88
Large farmers	0.576	-24.88	1.994	-24.21	1.418	-23.94
Other rural	1.266	24.92	3.932	25.31	2.665	25.49
Enterprises:Agr.	1.425	-24.07	5.230	-21.42	3.805	-20.38
Enterprises:Nonagr.	2.095	6.24	6.379	6.54	4.284	6.68

Table 11-- Income effects associated with production and consumption linkages: Small-farm development experiment (billion pesos, 1979 prices)

Productivity growth in	Total linkage	Production linkage	Consumption linkage
Rice	8.656 (4.0)	3.802 (0.0)	4.854 (7.5)
Other crops	19.241 (4.0)	8.518 (0.0)	10.724 (7.3)

Source: Author's calculations.

Note: Numbers in parentheses are percentage changes from base-model results.