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RICE AND CORN CONSUMPTION STATISTICS

by

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Rice and Corn Consumption Statistics

The Government of the Philippines has long recognized the importance of accurate food grain statistics upon which to base policies for production stimulation, marketing and price stability. Such statistics are equally important for efficient private trading. While major attempts have been made over the years to improve statistical accuracy, apparent inconsistencies and informational gaps remain. For example, in spite of an apparent average annual per capita increase of 0.6 percent in output (gross value added) since 1902, per capita rice consumption appears to have been higher during most pre-war as compared to post-war years. (See Chart 1).^{1/} With per capita income rising almost continuously in post-war years, per capita rice consumption appears to have remained almost constant (see Chart 2). And, since 1956, in spite of the rice price index generally remaining below that of corn, per capita corn consumption appears to have shown an annual average rate of increase of over 3 percent in contrast to the stable rice consumption pattern (see Charts 2 and 3). Considering that it is generally assumed that the income elasticity of demand for rice is positive in Asian rice-eating countries with income levels even higher than that of the Philippines, and that corn is an inferior good to rice, how can these contradictions be explained.^{2/}

^{1/} Richard W. Hooley, "Long-term Growth of the Philippine Economy, 1902-1961," The Philippine Economic Journal, First Semester 1968, p. 9.

^{2/} The UN FAO estimated the income elasticity of demand for rice in the Philippines at 0.4 in Indicative World Plan for Agricultural Development to 1975 and 1985, Vol. II, Explanatory Notes and Statistical Tables, Rome (1968), pp. 15-19. Gloria Vega-Yap and Remedios O. Alcantara provide confirming evidence that corn is also considered an inferior good to rice in the Philippines. They found that one-quarter of the households which ran short of rice would either borrow or buy rice on credit, rather than substitute other commodities. Those who substituted used corn, banana, bread and root crops. Many households reported mixing rice with corn (1 part of rice to anywhere from 1 part to 5 parts of corn) and other substitutes during periods of high rice prices. "Purchasing Patterns, Consumption Habits, and Preferences for Rice and Corn," The Philippine Agriculturist (June-July, 1961), p.19.

CHART I
 CRUDE ESTIMATE OF APPARENT PER CAPITA AVAILABILITY
 OF RICE AND CORN, 1909/10 - 1969/70

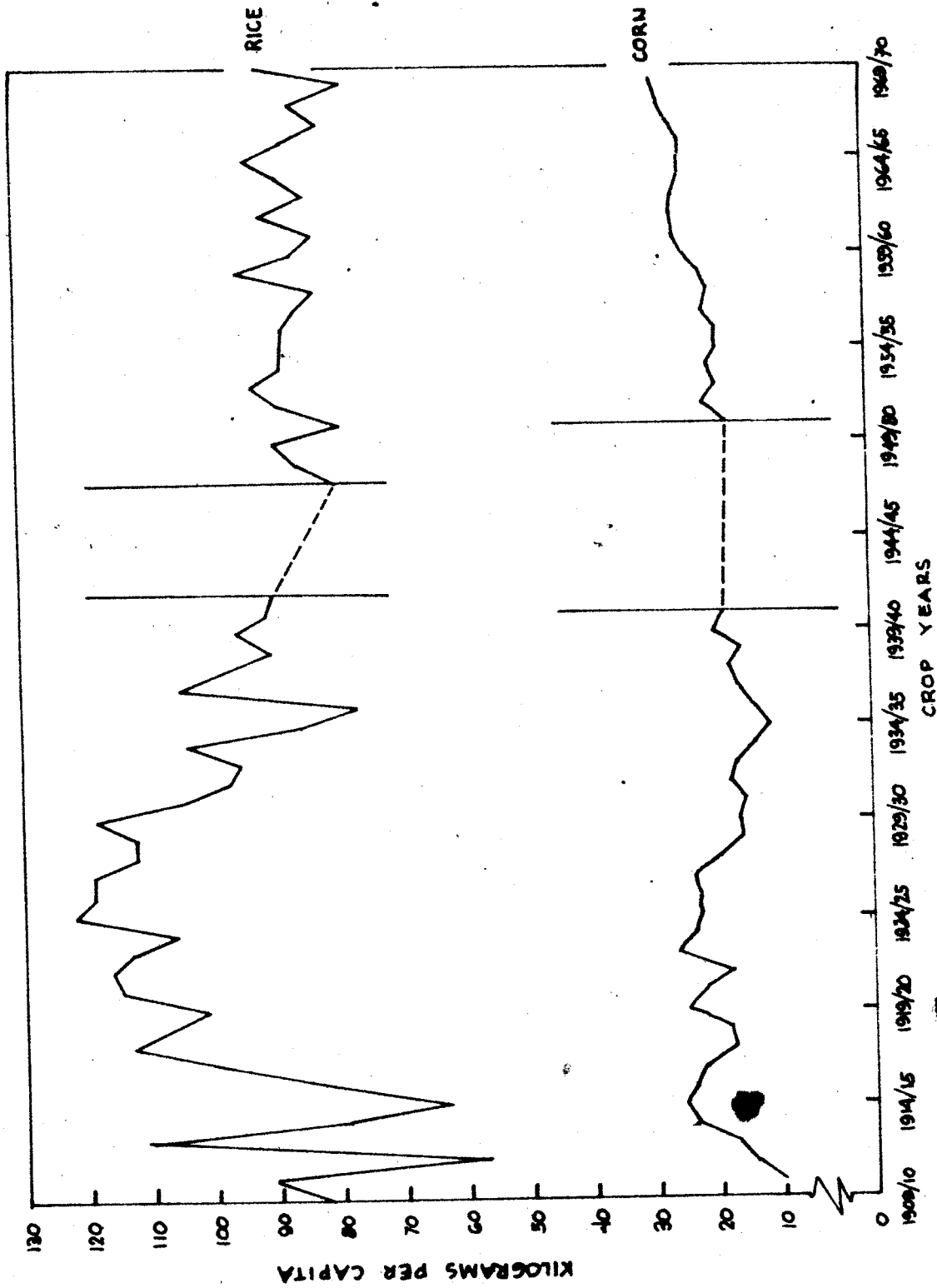


CHART 2

PHILIPPINES:

INDEXES OF PER CAPITA REAL INCOME
AND AVERAGE ANNUAL PER CAPITA CONSUMPTION OF CEREALS, 1950-1970
(1954/55 = 100)

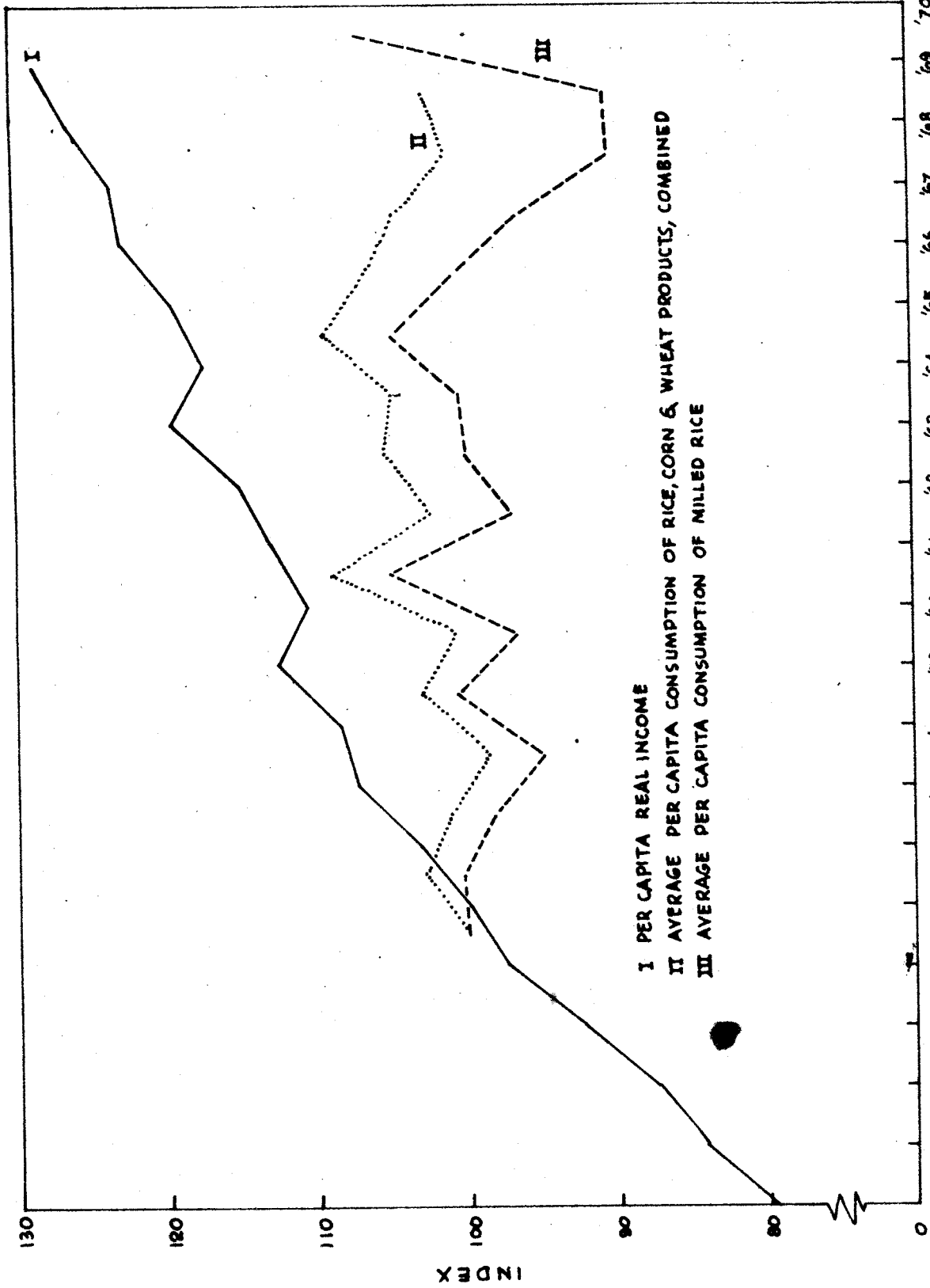
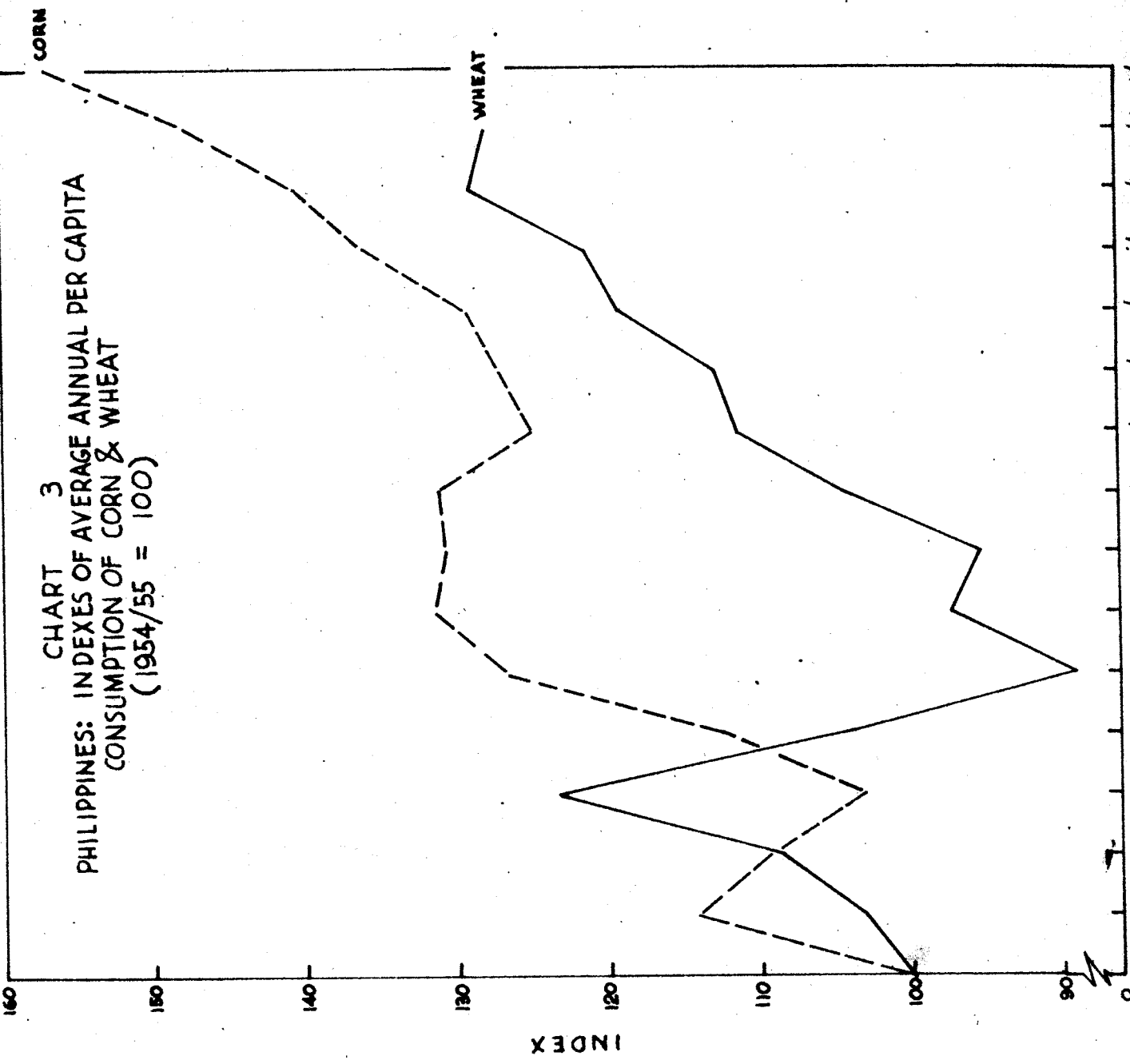


CHART 3
PHILIPPINES: INDEXES OF AVERAGE ANNUAL PER CAPITA
CONSUMPTION OF CORN & WHEAT
(1954/55 = 100)



In this article, illustration is given how available statistics with all their limitations can be used to provide an explanation of such apparent contradictions so as to give greater confidence for marketing and Government policy decisions. For this purpose the parameters of the determinants of domestic demand for rice are analyzed. The most important of these determinants are: 1) population level and its structure, 2) income levels, 3) prices of rice and substitute products, and 4) consumer tastes and preferences.^{3/}

1. Population and its structure. Population growth is a basic determinant of rice consumption over time. During the two inter-census periods from 1948 to 1970, the average annual population increase has approximated 3.1 percent. To the extent that per capita consumption is observed to change over time, it would be expected that such change could be explained by changes in parameters of the demand determinants other than gross population increase.

Changes in the structure of population could influence demand, and results of the PSSH surveys of 1958 and 1959 indicated that adult males (10 years old and older) do consume slightly more than adult females (2.299 compared to 2.105 cavans/capita/year) and double that of children (2.299 compared to 1.138 cavans/capita/year).^{4/} On the basis of these results and taking into account the declining age composition of the population in 1960 as compared to 1939, Golay calculated that the reduction in total cereal consumption would total no more than 2.3 percent over this 21 year period,

^{3/} Consumer tastes and preferences are not examined separately but their influences are indicated as appropriate, for example, the general assumption that corn is considered an inferior good to rice.

^{4/} Bureau of the Census and Statistics, PSSH, May 1958 and 1959 (mimeographed) reports of December 7, 1959 and October 25, 1960.

an annual rate of less than 0.1 percent.^{5/} And this reduction could be expected to affect all cereals, with but slight if any differential effects between rice and corn.

2. Income levels. It has been difficult to pinpoint the exact nature of the consumption response to changes in income in the Philippines, lacking statistical surveys upon which to base precise calculations. Studies by FAO and others in developing countries show that the income elasticity of demand for rice (measuring the percentage increase in quantity consumed from a one percent increase in income) generally declines as the per capita income increases. However, the absolute level of the income elasticity is considered by some authorities as more closely related to the level of rice (or cereal) consumption than to income.^{6/}

UN estimates of per capita income, rice and cereal consumption and income elasticities for the 1961-63 period are shown in Table 1. The general relationships premised are evident although there are exceptions. Burma, Cambodia and Taiwan with high levels of consumption appear to have low elasticities. Vietnam, on the other hand, is reported as having the highest consumption level along with a relatively high elasticity. This could reflect the low per capita income plus a low level of other carbohydrate substitutes. Japan, with the highest per capita income along with a negative elasticity, apparently has reached the stage where per capita rice consumption will decline with further income increases. The high Philippine income elasticity estimate might accord with its relatively low level of both rice and cereal consumption but not with its higher income level. In fact, as indicated in the following discussion, this high income elasticity estimate appears most unlikely from all other evidence.

^{5/} Frank H. Golay and Marvin E. Goldstein, Rice and People in 1990, US-AID, Manila (August 31, 1967), p. 28.

^{6/} M. J. Mittendorf, "Projecting Demand for Agricultural Products," in 1st National Seminar on Agricultural Marketing, DANR, Bureau of Plant Industry, Manila (September 7-27, 1965), pp. 216-218.

TABLE 1

Per Capita Income and Rice Consumption and Estimated Income
Elasticity of Demand for Rice in Selected Countries
1961-1963

C o u n t r y	Per Capita	Per Capita	Income Elasticity of Demand for Rice 1961 - 63	Per Capita
	National Income 1963 (US Dollars)	Rice Consumption (Average 1961-63 in kg/year)		Cereal Consumption (Average 1960/62 in Milled Rice Equivalent)
Burma	59	133	0.1	n.a.
Cambodia	104	149	0.0	n.a.
Ceylon	128	110	0.5	118
India	80	72	0.5	140
Indonesia	82	85	0.6	128 ^{1/}
Japan	559	116 ^{2/}	-0.1	150
Malaysia/Singapore	224	120	0.2	143 ^{1/}
Pakistan	82	94	0.4	154
Philippines	218 ^{3/}	89 ^{4/}	0.4	118
Taiwan	157	132	0.1	161
Thailand	98	123	0.2	150 ^{5/}
Vietnam	82	168 ^{6/}	0.4	n.a.

1/ 1961/63 average.

2/ For 1963, Japan Ministry of Health and Welfare, Bureau of Public Health, Nutrition in Japan, Tokyo (1964) estimated per capita consumption for the country as a whole at 128 kg. with non-agricultural households at 120 kg. and agricultural households at 143 kg.

3/ Peso income converted by UN at 2.358/1.

4/ This rice consumption estimate is somewhat higher than estimated by the author, see Charts 1 and 2.

5/ 1963/65 average.

6/ Luw-Mau-Thanh, Rice Production and Marketing in Vietnam, Republic of Vietnam, Post War Planning Group (September, 1967) estimated per capita consumption at 165 kg/capita.

Source: Income Elasticity and Rice Consumption: UN, FAO, "Indicative World Plan: Rice Projections to 1975 and 1985," Study Group on Rice Consultative Sub-Committee on the Economic Aspects of Rice, Tenth Session, CCP: RI 66/2 (July 5, 1966), with revised elasticities for Ceylon and Philippines from UN, FAO, Indicative World Plan for Agricultural Development to 1975 and 1985, Vol II - Explanatory Notes and Statistical Tables, Rome (1968), pp. 15-19.
Per Capita Income: UN Statistical Yearbook 1968, New York (1969), pp. 585-591. Per Capita Cereal Consumption: UN, FAO, The State of Food and Agriculture 1969, Rome (1969), p. 180.

Unfortunately, no reliable calculation has been made of the income elasticity for rice in the Philippines. The UN estimate referred to above was merely an estimate based on income and consumption levels relative to other Asian countries where income elasticity estimates have been made. Expenditure elasticities of demand for rice in the Philippines (measuring the percentage increase in expenditure for rice from a one percent increase in income) have been calculated in a recent study using expenditure statistics from the 1965 PSSH of the Bureau of Statistics.^{7/} These expenditure elasticities shown in Table 2 will differ from the true income elasticities but they should at least set upper limits.^{8/} Positive expenditure elasticities are indicated for all regions. For the country as a whole, the elasticity appears to be largest for rice producers but this pattern cannot be generalized for the regions. For example, in Cagayan Valley the expenditure elasticity of non-rice producers is larger than for rice producers, 0.57 compared to 0.47.

While this study suggest a lower income elasticity of demand for rice than the UN study, both indicate that it is positive. The problem then is how to explain the observed per capita consumption over time, as

^{7/} Reynaldo En. de Sagun, "Regional Differences in the Income Elasticity of Demand for Rice in the Philippines," to be published by the International Rice Research Institute, Los Baños, Laguna. While these same statistics appeared biased as a check on regional per capita consumption, they could still be reliable for a cross-sectional study of income elasticity as long as the bias in each region was consistent throughout the income range.

^{8/} This assumes that consumers, except in the high income brackets, may spend more on rice as income rises but the percentage increase in quantity purchased will not exceed the percentage increase in expenditure. Rather, the consumer is more apt to shift to a higher quality of rice resulting in larger percentage increase in expenditure than in quantity. This consumer response has been reported in many Philippine studies, see for example, Gloria Vega-Yap and Remedios O. Alcantara, Op. Cit. pp. 19 ff.

TABLE 2

Expenditure Elasticities of Demand for Rice Producers and
Non-Rice Producers in Regions of the Philippines
1965

<u>PSSH Regions</u>	<u>Rice Producers^{1/}</u>	<u>Non-Rice Producers</u>
Metropolitan Manila	-	0.13
Ilocos	0.059 ^{2/}	0.06 ^{2/}
Cagayan Valley	0.47	0.57
Central Luzon	0.39 ^{2/}	0.60
Southern Tagalog	0.40 ^{2/}	0.44 ^{2/}
Bicol	0.58 ^{2/}	0.12
Western Visayas	0.14	0.08
Eastern Visayas	0.17	0.17
N. & E. Mindanao	0.27	0.04 ^{2/}
S. & W. Mindanao	n.a.	0.11
Philippines	0.14(0.0149) ^{3/}	0.087(0.0117) ^{3/}

^{1/} Rice producers refer to those who reported income from the production of rice, it can include both farm workers and landlords.

^{2/} Elasticity calculation not statistically significant at 5% or 1% levels.

^{3/} Figures in parenthesis are standard errors.

Source: Reynaldo En. de Sagum, "Regional Differences in the Income Elasticity of Demand for Rice in the Philippines," to be published by the International Rice Research Institute, Los Baños, Laguna.

illustrated in Charts 1 and 2. Post-war consumption has apparently been lower than pre-war and has remained constant since 1952 in spite of continued per capita income growth.

These contradictions can best be approached by first examining the pre-war/post-war situations. Two considerations must be taken into account. According to Hooley, the per capita income probably declined slightly over the period from 1918 to 1938, the rate of decline increasing after 1928.^{9/} This is reflected in Chart 1 with the apparent decline in per capita rice consumption after 1928. However, the level of consumption during the pre-war period is undoubtedly biased on the high side in the earlier years and over the entire period in relation to post-war years.

As observed by Golay and Goldstein:

The decline in milled rice absorption in the post-war period as compared to earlier periods is more apparent than real. The use of commercial milling rates to adjust palay production for loss in milling, introduces an upward bias, the relative importance of which has shifted over the period examined. The proportion of palay production milled mechanically has increased over time and the share prepared by home 'pounding' has declined. Upward bias arises because the recovery rates for home pounding average some 15-25 percentage points lower than in mechanical milling.^{10/}

According to Census reports, the number of mechanical mills in the country increased from 452 in 1918 to 3,580 in 1948.^{11/} Moreover, there remains a question as to the accuracy of crop reporting in the pre-war period. Based on Department of Agriculture production reports, the apparent per capita consumption in 1938/39 was 89.5 kg. while on the basis of the 1939 Census it was only 70.2 kg. Taking these considerations into account,

^{9/} He concludes from calculations of gross value added in agriculture and non-agriculture that the compounded percentage rates of growth were -0.1 percent from 1918 to 1928 and -0.5 percent from 1928 to 1939, Op. Cit., p. 2.

^{10/} Op. Cit., p. 24.

^{11/} Census of the Philippines 1918 (Vol. IV, P. 557) and 1948 (Vol. IV, pp. 618-620).

there appears to be reasonable evidence that pre-war per capita rice consumption may not have been as high as post-war. With the higher income elasticity that would have been expected to accompany the lower pre-war income levels, per capita consumption decline after 1925 is consistent with the decline in per capita income.

Explanation of the apparent stability of post-war per capita rice consumption along with a rise in per capita consumption of corn and wheat products includes some of the same reasoning but is more involved. With improved crop reporting methods, especially after 1954, more confidence can be placed on absolute production levels. At the same time, the apparent constancy of milled rice absorption still evidenced some degree of unreality. Twenty percent of the palay production was still hand pounded as late as 1954/55, the percentage dropping to only 4.5 by 1967/68.^{12/} On this basis alone, there is reason to suspect that the real per capita consumption rose slightly after 1955, confirming evidence of a positive but small positive income elasticity.

On the other hand, there are other reasons to suggest that even though a positive income elasticity might be apparent from a one-period cross-section analysis, nevertheless per capita consumption might evidence but little increase over time. First, the distribution of income gains might favor those with higher incomes who have lower or even negative income elasticity. At least in Manila, there is some evidence to back this argument. The real wage rate indexes of laborers in industrial establishments in Manila have declined since 1955 in spite of rising average per capita national income. The indexes, using a 1955 base of 100, declined by

^{12/} BAE, Crop and Livestock Surveys, 1954/5 and 1967/8. The conversion rate of palay to milled rice has been held constant at 51 percent in this study being increased only as Government agencies acknowledged a change, i.e., to 52 percent for 1967/8 and 1968/9 production and to 53 percent for 1969/70 production.

December 1969 to 85.3 for skilled laborers and to 94.6 for unskilled laborers.^{13/} Also, the downward shift in the age composition of the Philippine population had some effect, even though small.

Even though the income elasticity might be positive, its effect on consumption could be offset if the price of rice increased relative to other goods. Comparing the Manila Consumers' Price Index excluding rice with the Manila Consumers' Rice Price Index (1955 = 100), there were some relative fluctuations but little average difference until 1964, see Chart 4. Beginning in 1964, the Rice Price Index has always been at least 13 percent above the Consumers' Price Index excluding rice and rose to 21 percent above in 1964, 44 percent above in 1967 and 22 percent above in 1969. During this period, increased per capita income could have been partially offset by the reduced real income effect from the increased rice price. This could have helped to hide the effect on rice consumption of a small positive income elasticity.^{14/}

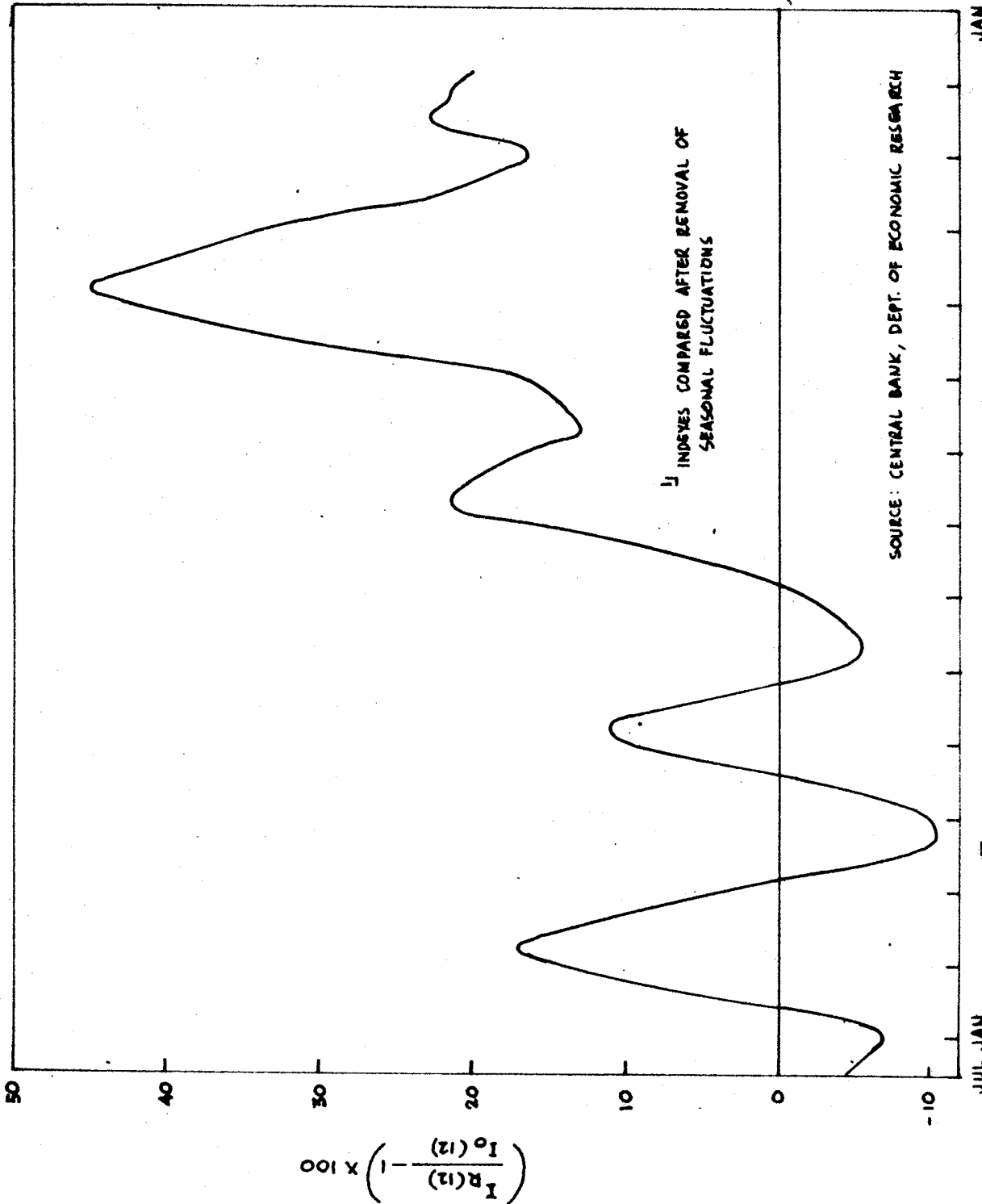
Finally, population migrations could influence the average income elasticity over time. For example, large population shifts have been taking place from rural to urban areas where wheat products are frequently substituted for rice (see, for example, the consumption pattern in Manila, Table 3). This also could explain part of the increase evidenced in per capita consumption of wheat. Such shifts also can involve higher rice prices in the city than in the rural areas which offset money income gains such that average rice consumption would remain relatively constant.

There remains the problem of explaining the increasing per capita consumption of corn since 1955. This is surprising in view of the popularly

^{13/} Central Bank Statistical Bulletins.

^{14/} Price and cross-elasticity effects are discussed in more detail in the next section, including a degree of qualification of this conclusion.

PERCENTAGE VARIATION OF MANILA CONSUMERS' RICE PRICE INDEX ABOVE AND BELOW PRICE INDEX EXCLUDING RICE 1955-1970¹
 (1955 = 100)



$$\left(\frac{I_R(12)}{I_0(12)} - 1 \right) \times 100$$

Manila price index

JUL JAN '54 '55 '56 '57 '58 '59 '60 '61 '62 '63 '64 '65 '66 '67 '68 '69 '70 JAN.

TABLE 3

FNRC Estimates of Annual Per Capita Consumption of Carbohydrate Foods
in the Philippines 1958 - 1969
 (in kg/capita in terms of rice calories)

Region ^{1/}	Year of Survey	Rice	Corn	Wheat and Products	Cassava	Sweet Potato (Camote)	Others ^{2/}	Total
Metropolitan								
Manila	1958	87.8	0.2	20.6	0.1	0.7	0.6	110.0
Ilocos-Mt. Prov.	1960	143.0	2.0	4.2	0.3	5.0	0.2	154.7
Cagayan Valley	1961	97.6	25.9	3.4	0.1	2.6	3.0	132.6
Central Luzon ^{3/}	1958	154.8	n.a.	n.a.	n.a.	n.a.	n.a.	
Southern Tagalog	1962	112.6	0.7	10.3	0.4	4.3	0.8	129.1
Bicol ^{4/}	1969	91.6	11.4	7.7	4.5	5.3	0.6	121.1
Total Luzon		120.3	n.a.	n.a.	n.a.	n.a.	n.a.	
Eastern Visayas	1965	55.0	59.9	4.7	4.3	9.0	1.9	128.8
Western Visayas	1964	94.1	28.1	4.0	1.4	1.6	0.5	129.7
N. & E. Mindanao	1967	91.2	30.5	6.1	0.9	2.9	0.8	132.4
S. & W. Mindanao	1966	84.5	36.8	4.6	1.4	1.7	0.5	129.5
Total Mindanao		87.1	33.0	5.5	1.1 ^{5/}	2.4	0.6	129.7
Philippines		99.5	24.1 ^{5/}	7.1 ^{5/}	1.8 ^{5/}	3.9 ^{5/}	0.9 ^{5/}	

1/ BCS (PSSH) regions.

2/ Includes taro, yam, white potatoes, and sago.

3/ Pilot study, degree of accuracy uncertain as sample size small.

4/ Preliminary.

5/ Does not include Central Luzon region.

Source: NSDB, NIST, Food and Nutrition Research Center, Manila (unpublished).

held opinion that rice is preferred to corn and that consumption will shift from corn to rice as incomes rise. Corn could have been substituted for rice if its price declined relative to rice. By comparing the Manila Consumers' Indexes for Rice and Corn, the opposite seems to have happened, at least for the Manila area, see Chart 5. Rice price declined relative to the corn price from 1956 until 1966 after which time the two prices returned to approximately their relative 1955 levels.

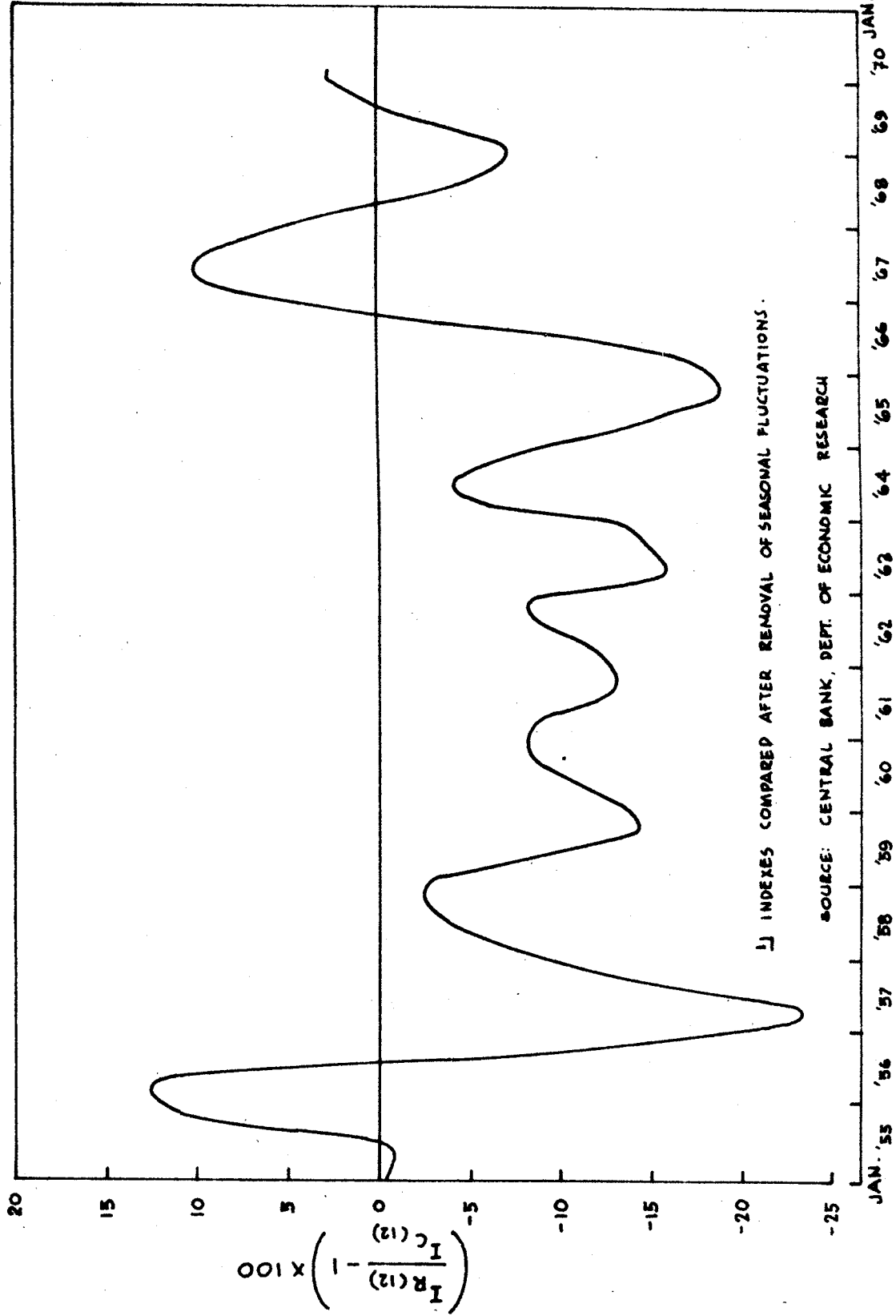
Another explanation has been suggested by Golay.^{15/} He concludes that the explanation of a shift from rice to corn lies in basic shifts in supply conditions. Corn supplies increased as the margin of cultivation was extended from alluvial valleys onto rougher land. And, as the rural population was redistributed to the frontier areas, corn consumption increased relative to rice because: 1) population increased relatively in the areas where corn was produced and 2) because lack of transport and marketing facilities necessitated direct, subsistence consumption.

To illustrate, from 1948 to 1960, two of the heavy corn eating areas, Mindanao and Cagayan Valley, had relatively high population growth rates.^{16/} Moreover, there is strong evidence to suggest that the lack of transport and marketing facilities could have affected consumption patterns as premised. This becomes apparent from the relative movement of rice and corn prices in the Eastern Visayas region where the corn/rice consumption ratio is the highest. Comparison of the Consumers' Rice Price Index to the Corn Price Index for Eastern Visayas is shown on Chart 6. In 1959 the rice index was 45 percent (Base 1957 = 100) above the corn index. While the rice

^{15/} Op. Cit., p. 30.

^{16/} Population estimates from the 1970 Census are not available to check relative growth rates since 1960.

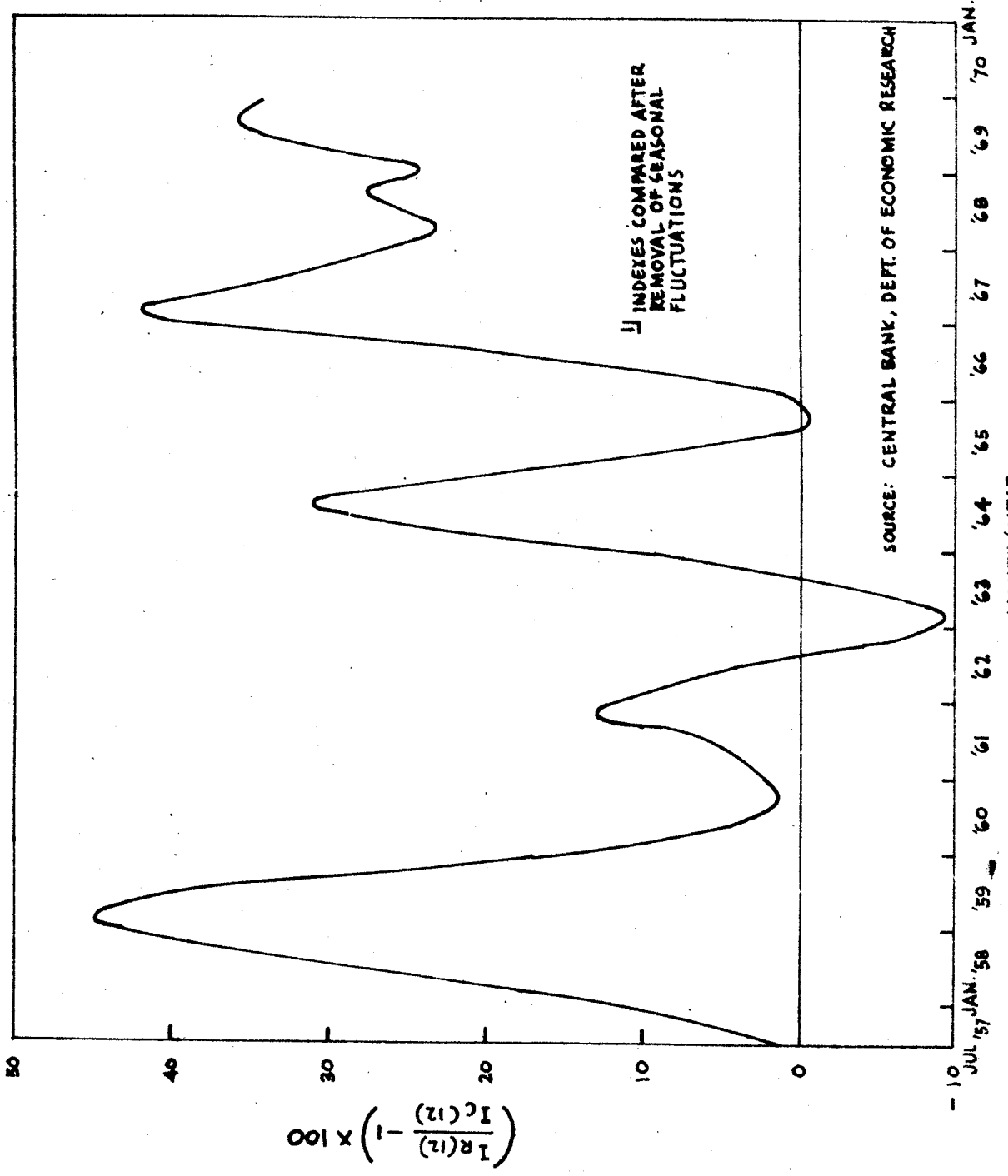
PERCENTAGE VARIATION OF MANILA CONSUMERS' RICE PRICE INDEX ABOVE AND BELOW CORN PRICE INDEX, 1955-1970 (1955 = 100)



I J INDICES COMPARED AFTER REMOVAL OF SEASONAL FLUCTUATIONS.

SOURCE: CENTRAL BANK, DEPT. OF ECONOMIC RESEARCH

CHART 6
PERCENTAGE VARIATION OF EASTERN VISAYAN CONSUMERS' RICE PRICE INDEX
ABOVE AND BELOW CORN PRICE INDEX, 1957-1970
(1957 = 100)



index dropped slightly below that of corn in 1962/63, the former has remained more than 23 percent above the corn index since mid-1966, reaching a peak of 42 percent higher in 1967. Marketing and transport facilities have apparently prevented market price adjustments such as have been evidenced in Manila.

3. Prices of rice and substitute products. Price elasticity of demand for rice indicates the percentage change of quantity that consumers will buy in response to a given percentage change in price. Knowledge of the price elasticity is especially important to a Government price stabilization agency in order to estimate the effect on demand of different price changes (or the quantity of rice that must be injected into the market to offset a given price rise).

Unfortunately, the precise determination of the price elasticity is a difficult problem and studies in low income countries have generally been unsatisfactory. However, an estimate of the income elasticity does give some guide on the assumption that the sum of the price elasticity, the income elasticity and the cross elasticities is equal to zero.^{17/} For the majority of the population in the Philippines who are "rice eaters" there is more likelihood of substituting a lower quality of rice rather than another cereal when the price of rice rises, with a similar effect in the opposite direction if the price falls.^{18/} For non-rice eaters (and to some extent even for rice

^{17/} Proofs have been provided for this assumption for the case of the individual consumer's demand for a commodity, see, for example, P. A. Samuelson, Foundations of Economic Analysis, Harvard University Press (1955), pp. 104-105. From this relationship, Frisch has derived similar relations for the total market by utilizing the concept of a "representative consumer," R. Frisch, "A Complete Scheme for Computing All Direct and Cross Demand Elasticities in a Model with Many Sectors," Econometrica (April, 1959), pp. 177-196.

^{18/} Rice has been treated as a homogeneous product in discussion of per capita consumption estimates. Considering probability of substitution between varieties of rice, any reduction in total rice consumption from a relative rise in the rice price would tend to be limited. Similarly, the price elasticity of a particular variety would be higher than for rice considered homogeneously.

eaters) some substitution with other carbohydrate foods is apt to take place if price changes but the cross elasticities (percentage change for example of the quantity of corn the consumer will buy in response to a given percentage change in the price of rice) will be positive. Thus, it follows that the price elasticity of demand for rice will be greater but of opposite sign than the income elasticity.

On this basis, one might expect the price elasticity of demand for rice in the Philippines to be somewhere from -0.3 to -0.5.^{19/} In a recent study by Mangahas covering the period from 1956 to 1968, price and quantity relationships of rice in the Philippine market have been developed from which a crude price elasticity can be approximated.^{20/} Applying his relationships to the year 1967/68 when the annual average rice price in Manila for Macan 2 variety was P1.72/ganta, a price elasticity of approximately -0.5 was indicated.^{21/} A one percent increase in price would have meant a decrease in consumer purchases over the year of approximately 13,600 tons of rice. The cross elasticities of demand for rice substitutes such as corn and wheat will vary depending upon tastes in different regions and can be expected to be positive but smaller than the price elasticity. Their effect will be to increase purchases of other carbohydrates as the price of a given carbohydrate such as rice or corn rises.

^{19/} This agrees with the conclusions reached by Mellor that the price elasticity would be slightly higher than the income elasticity for rice, J. W. Mellor, The Economics of Agricultural Development, Cornell University Press, Ithaca, New York (1966), p. 72.

^{20/} Mahar Mangahas, "Estimates of the Task of Rice Price Stabilization in the Philippines, 1969-1974," The Statistical Reporter (October-December, 1969) pp. 23-28.

^{21/} Randolph Barker has also reported an initial estimate of price elasticity of demand of -0.35, see IRRI, Research Review, Agricultural Economics, Los Baños (January 31, 1969) p. 4 (mimeographed).

4. Summary and conclusions. The income elasticity of demand for rice is probably slightly positive and could have been somewhat greater with lower pre-war per capita incomes. The relatively higher apparent pre-war rice consumption could well be a statistical illusion. Evidence suggests that production estimates may have biased upwards and the use of a constant conversion ratio to adjust palay production for loss in milling introduced an upward bias in both pre-war and early post-war rice consumption estimate. After 1955, increases in per capita consumption that might have been expected to accompany rising incomes could have been offset by large urban/rural population shifts, skewed increases in income distribution and shifts in supply conditions. This latter provides an important explanation for rising per capita corn production even though corn might be considered an inferior good to rice. As marketing and transport facilities improve to these outlying corn producing areas, relative price adjustments can be expected with the probability that rice may be increasingly substituted for corn.