

University of the Philippines
SCHOOL OF ECONOMICS

Discussion Paper 8214

August 1982

AGRICULTURAL MODERNIZATION AND NON-AGRICULTURAL
✓EMPLOYMENT: AN ASIAN AND PACIFIC PERSPECTIVE

by

Florian A. Albuero

Note: UPSE Discussion Papers are preliminary versions
circulated privately to elicit critical comment.
They are protected by the Copyright Law (PD No. 49)
and are not for quotation or reprinting without
prior approval.

11/88 DP '97
10-29-97

ABSTRACT

The paper aims to provide a cross-country aggregate perspective of the interactions between agricultural modernization and non-agricultural employment in Asia and the Pacific. Following a Hymer-Resnick model, the results of the analysis indicates that increases in non-agricultural employment follow increases in agricultural modernization but that as the pace proceeds this type of employment falls off. Several indicators of agricultural modernization are explored in the analysis that reflect levels or stages of modernization. Although statistical fits are not thoroughly satisfactory, the results support the basic framework followed.

AGRICULTURAL MODERNIZATION AND
NON-AGRICULTURAL EMPLOYMENT:
AN ASIAN AND PACIFIC PERSPECTIVE

Florian A. Albuero*

1. Introduction

A small number of studies in the literature on agricultural modernization and development argue that non-farm economic activities grow from within the agricultural sector itself rather than are externally propelled. The more meaningful or comprehensive models posit the existence of non-manufactured non-farm goods as part of the range of choices determining economic (as well as social and demographic) behavior in an agrarian environment.¹

When viewed against prevailing policy thrusts for rural and agricultural development, this area in the field offers an interesting ground for empirical analysis. This paper aims to provide a cross-country aggregate perspective of the interactions between agricultural modernization and non-agricultural employment in Asia and the Pacific.

*Associate Professor, School of Economics, University of the Philippines. This paper was written while visiting with the Resource Systems Institute, East-West Center Hawaii in November and December 1981. The support of the Center during the visit is gratefully acknowledged.

The next section elaborates further the context for this study relying on some micro analytic foundation as well as the practical aspects of the problem. In the third section, the various measures used are defined and tested with the interactions empirically specified. The fourth section draws out some behavioral comparisons. Finally, the last section concludes.

2. Context

One departure point for looking at agricultural modernization and employment is the common policy thrust in developing country plans of increasing rural employment opportunities through rural industrialization.² This kind of strategy is construed to provide linkages with larger urban based industries, stimulate auxilliary industries, prevent agglomeration, and expand the base for manufactured exports. Rural industrialization would accelerate non-agricultural employment. Although the degree of employment generation may vary with the scale and kind of industries promoted, it is generally accepted that the employment concern is responded to. Moreover, the seeming acceptance of redundant employment in agriculture justifies the alternative (or complementary) emphasis on rural industries.

Depending on the extent to which this strategy is pursued, one would normally expect structural changes in agriculture in terms of products as well as magnitudes of non-agricultural employment.

On the analytical aspects of the agricultural modernization - non-agricultural activities, allowing for Z-goods implies an optimal basket of goods which include them. The theoretical foundations, results and implications are familiar in the literature and need no further review here. At low levels of development, Z-goods are predominant but sensitive commodities. At more sophisticated levels of modernization, factory type non-inferior manufactured products prevail in an optimal consumption basket.³ The new household economics likewise suggests that household decisions follow a behavior which can be explained along this framework.

The associated empirical evidence is quite limited and fragmentary.⁴ Where there are studies, one is basically left with a gap especially on the dynamic expectations regarding non-agricultural employment. For example, Anderson and Leiserson,⁵ while suggesting a framework for tracing the evolution of non-farm activities, fail to provide orders of magnitude on the effects of development on non-agricultural employment. In Gibb's work different categories of non-agricultural economic activities are

postulated based on responsiveness to agricultural productivity changes. The direct effect industries respond to immediate income increases and are mainly of "inferior goods" variety (the Z-goods industry in Hymer and Resnick). Two other industry categories are postulated to grow as on-farm development spreads -- indirect effect industries which are the backward linkage types of production activities and public service effect industries which presumably cater to tertiary demands. The micro data from Nueva Ecija, Philippines support the range of hypotheses implied in the framework. However although some comparisons are made, especially in terms of employment, among agricultural towns and with agriculturally-based cities one is left with the impression that it is the static distribution in non-agriculture that is adequately substantiated.⁶

Following an essentially similar framework, a study of two agricultural towns, at two different levels of modernization, does not appear to refute most of what is implied in the modernization - non-agricultural employment nexus.⁷ Comparisons in terms of employment growth show increasing employment at initial stages of an agricultural development, followed by a decline in employment growth. Analysis of the kinds of industries belonging to the specified categories (indicated previously) validates theoretical expectations. What is relevant to note is that the employment

structure is associated with capital resource needs that go with modernity. In particular, as development proceeds, employment opportunities may fall while capital needs accelerate even though the scale of establishments (measured by number of workers) increases.

Irrespective of the manner in which employment may be measured, it is argued that one can expect its behavior to be systematically related to the agricultural sector's overall modernization and growth. Whether over a span of time or looking at comparative agricultural development, it would seem that employment increases at first before falling out.⁸

Several policy implications are discernible in the empirical studies. First is simply the main finding of a large scope of non-agricultural activities and employment associated with agricultural productivity changes even without explicit drive for such.

Second, modernization creates a phase of low labor absorption. This partly depends on the degree and sophistication of development taking place. In concrete terms, there is expected to be a higher rate of employment with increases of agricultural productivity than of, say, rural agro-based industries.⁹

Third, rural industrial development at early growth stages appears to be internally self-generated and self-financed.¹⁰ This would mean that assuming that stage is identifiable, scarce development resources can be alternatively channeled and still obtain non-agricultural rural employment opportunities.

Finally, and in relation to the previous point, even narrow types of agricultural development policies have a significant contribution to broadening the base of modernization. In short, employment creation of the type deliberately sought through rural development can be satisfied by concentration on narrow agricultural strategies.

While the framework is intuitively logical, the fragmented analyses seem to rest on crude quantitative measures and simple statistical manipulations based on a small data base. Such limit and paucity of data as basis for important (policy) implications tend to raise questions of validity. Indeed some of the conclusions are not strictly warranted by the data and simple analysis.¹¹

Given this basic micro analytic framework however, it is possible to test it out at an aggregate level by undertaking a cross-country analysis looking into agricultural modernization and non-agricultural employment relationships. By examining a number

of countries which are in a wide spectrum of agricultural modernization, it is possible to see the patterns of non-agricultural employment.

The next section provides a perspective using data from 26 countries in Asia and the Pacific.¹² The primary interest is to understand the interactions between modernization and non-agricultural employment without necessarily imputing a strict behavioral pattern. With appropriate assumptions it is of course possible to advance behavioral notions to the data (See 4. below).

The initial task at hand is to determine the measures of agricultural modernization that would reflect various stages of development as hypothesized or pursued by policy. An associated task is to postulate what might be the behavior of the relationships within the framework.

3. Data and Analysis

It is argued here that a narrow measure of agricultural modernization is farm productivity while a broader index is gross domestic product (GDP) from agriculture. As a measure alone, farm productivity is really a specific area crop yield while agricultural GDP is value added in agriculture that comprises crop and non-crop economic

activities. It is true that crop value added is definitionally a component of agricultural GDP. But one is not necessarily similar or positively related to the other. Over time the values of one measure need not be consistently varying with the other since agricultural GDP is arrived at from a variety of agricultural outputs which have differences in patterns. More specifically, as used here, productivity is paddy rice yield while the broader measure is the proportion of GDP coming from agriculture. In summary, these two indices reflect the stages of agricultural modernization implied in the framework in the previous section.

The data come from various issues of the Food and Agriculture Organization (FAO) Yearbooks and the World Bank country tables.¹³ As defined in these sources, paddy rice yield is measured in kilograms per hectare and the broader index of agricultural development is the ratio of agricultural GDP to total GDP at current market prices of the country currency. Non-agricultural employment is defined in the absolute and as a ratio. In the former this is the residual from subtracting agricultural employment from total employment. Economically active employment means "all persons engaged in economic activity, whether as employees, own-account workers, salaried employees or unpaid workers assisting in the operation of a family farm or business."¹⁴ Agriculture includes

forestry, hunting and fishing. It is assumed that while there are possibly country nuances that prevent strict comparability, the definitions are commonly applied and fairly comparable across countries. The ratio measure is simply the ratio of non-agricultural employment to total employment.

Two other measures are applied — index of agricultural concentration and per capita food production index. The index of agricultural concentration measures the dominance (in terms of area) of a single crop in the agricultural sector.¹⁵

1975 is the common year for which data are available. Some of the analysis results do not include all countries in the list of Appendix 2. It is also not possible to obtain yearly data for some specific variables (e.g. non-agricultural employment) since the original country sources do not report yearly data.

The analysis will follow two tracks. The first compares the responsiveness of non-agricultural employment to agricultural modernization that reflects an early, and a later stage. The second examines the probable path of employment as continuous development is sustained using the same measure. Some description will be utilized and linear regression results will be reported.

Charts 1 and 2 plot for 1975 the percentage of non-agricultural employment to total employment on paddy rice and the percentage of agriculture in the GDP for the Asia and Pacific countries, respectively. In Chart 1 the pattern seems to be that there is a positive relationship between yield and non-agricultural employment. There are extremes that do not fall neatly such as Japan, Korea and Hongkong. The latter essentially exhibits a high percentage of non-agricultural employment and a low paddy rice productivity which is partly explained by its very nature of being a city-state i.e. without a substantial agricultural sector. Singapore is not found in Chart 1 because of data unavailability. Both Korea and Japan have been pursuing industrial sub-contracting that is consistent with agricultural development. The same three countries however do not exhibit similar extremities in Chart 2.

To ascertain the strength of the responsiveness an OLS regression equation was fitted into the data. The purpose of the fitting is essentially to ascertain some notion of the elasticities involved in the relationship. The equations are not purported to underlie a complete specification. The regression results the estimation of elasticities (at the means) of non-agricultural employment to the two measures of agricultural modernization.

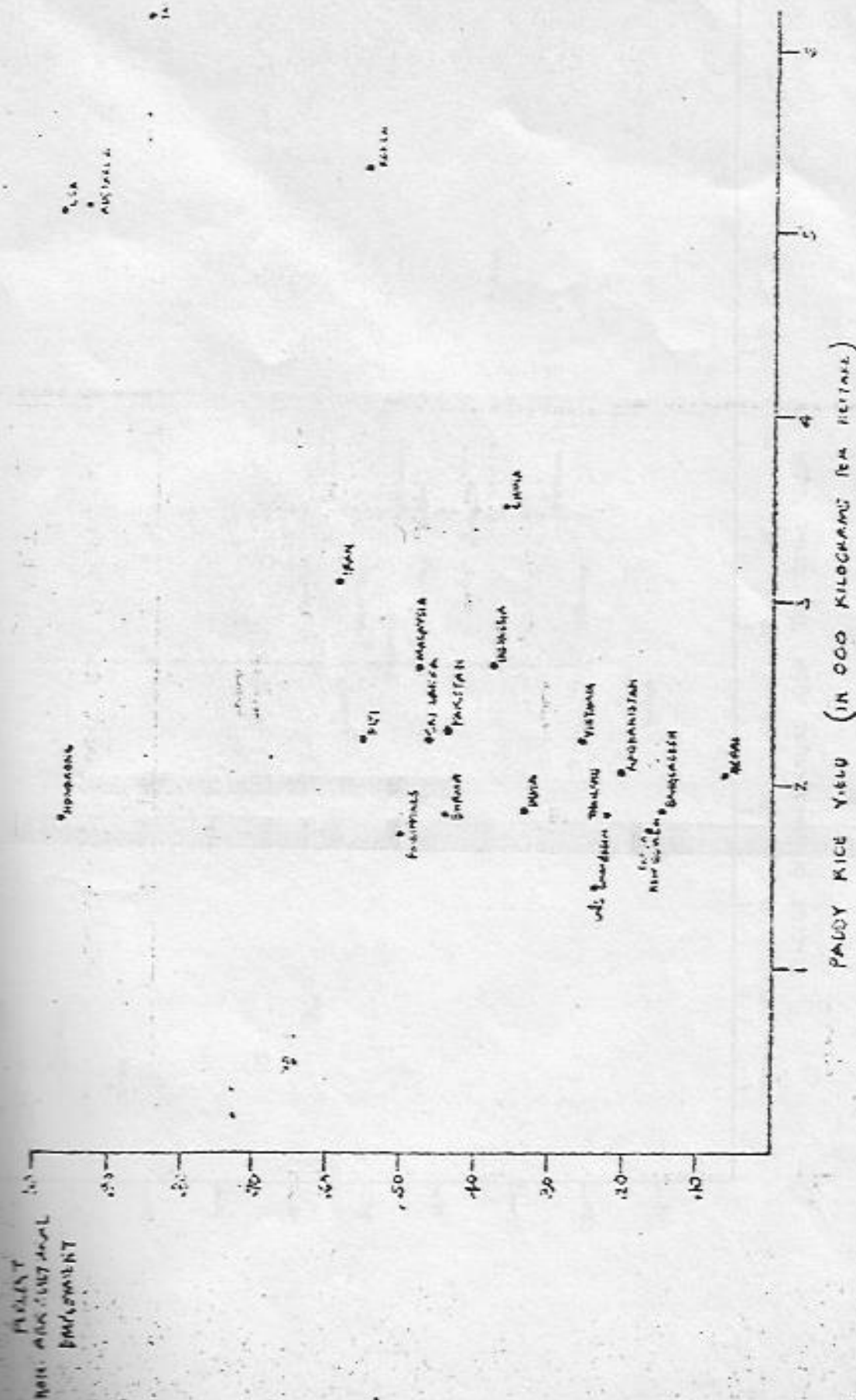


CHART 1

PERCENT AGRICULTURAL EMPLOYMENT AND PADDY RICE YIELD 1975

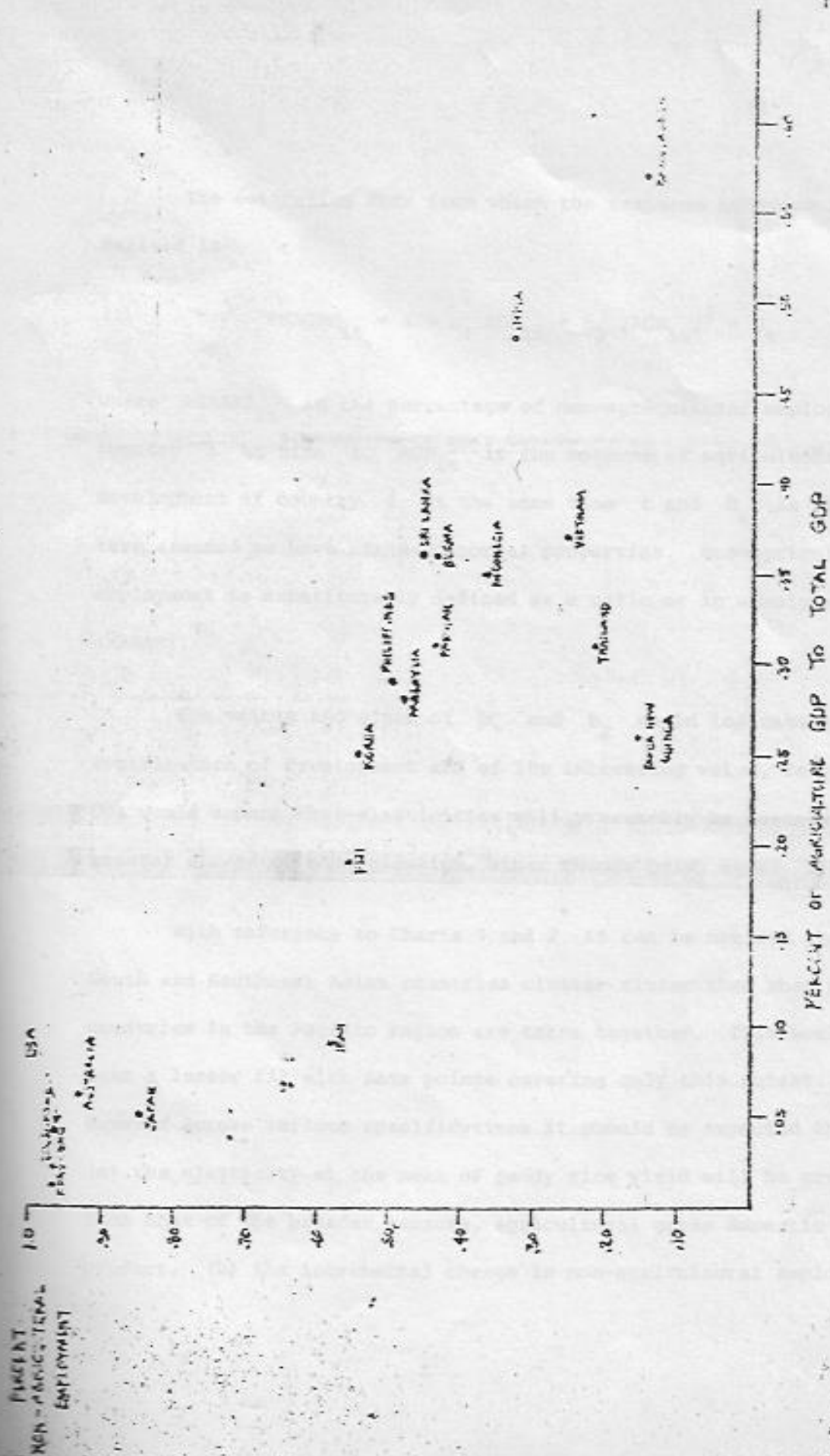


CHART 2

PERCENT NON-AGRICULTURAL EMPLOYMENT AND PERCENT OF AGRICULTURE GDP TO TOTAL GDP

The estimating form from which the response behavior is derived is

$$(1) \quad \text{PNAGRE}_{it} = a + b_1 \text{AGR}_{it} + b_2 [\text{AGR}_{it}]^2 + U_t$$

where PNAGRE_{it} is the percentage of non-agricultural employment of country i at time t , AGR_{it} is the measure of agricultural development of country i at the same time t and U_t is the error term assumed to have standard normal properties. Non-agricultural employment is substitutably defined as a ratio or in absolute terms (NAGRE).¹⁶

The values and signs of b_1 and b_2 would indicate the contribution of development and of its increasing value, respectively. One would expect that elasticities will presumably be lower with a greater spread of modernization, other things being equal.

With reference to Charts 1 and 2, it can be noticed that the South and Southeast Asian countries cluster closer than when all countries in the Pacific region are taken together. This would mean a lesser fit with data points covering only this subset. However across various specifications it should be expected that (a) the elasticity at the mean of paddy rice yield will be greater than that of the broader measure, agricultural gross domestic product, (b) the incremental change in non-agricultural employment

from changes in paddy rice yield will be positive, and negative for the late stage of modernization, and (c) there is a lower fit of the specification for the South and Southeast Asian countries.

The estimating equations using four indicators of agricultural development for all countries of Asia and the Pacific and for the sub-group of South and Southeast Asian countries reveal some interesting results. Agriculture's share in GDP and the index of agricultural concentration have strong influences on the variation of non-agricultural employment. Although both have negative coefficients only the former has been given sufficient explanation with regard to expectations.

The negative effect of concentration may be explainable in two ways. On the one hand, high concentration of land on a single crop could imply extensive mechanization under a basic enclave-type of agriculture and would not significantly affect non-agricultural employment. On the other a similar high concentration results in skewed (income) distribution that does not tend to favor the emergence of non-farm economic activities that would normally come under a broader development path (such as increase in rice yields).¹⁷

The use of per capita food production index to reflect modernization is really a misspecification of the problem. For one, it fails in the standard significance tests. For another, given its definition, it is difficult to conceptualize the mechanisms by which it affects (or is affected by) non-agricultural employment in part because of its encompassing nature.

Table 1 below summarizes the relevant results for the Asia and Pacific countries.

TABLE 1

REGRESSIONS OF NON-AGRICULTURAL
EMPLOYMENT: SUMMARY
ASIA AND PACIFIC COUNTRIES

VARIABLE	b_1	b_2	Elasticity*	R^2
PDYRY	>0	<0	6.62	0.11
PAGGDP	<0	>0	1.45	0.81
INAGRC	<0	>0	28.58	0.52
PCFDPR	<0	>0	0.96	0.06

*of b_1 at the mean values of the variables

PDYRY - Paddy rice yield (kilogram/hectare)

PAGGDP - Ratio of agriculture GDP to total GDP at market prices

INAGRC - Index of Agricultural Concentration (See Appendix 1)

PCFDPR - Per Capita food production index (See Appendix 1)

The table indicates that between palay yield and agricultural GDP, it is the former which has a higher elasticity than the latter. Moreover the coefficient of b_1 is positive as expected. The only drawback discernible from the table is the low value of \bar{R}^2 as compared with the specification using PAGGDP as the modernization index. Within the context outlined in the previous section, the coefficients of the development indices are not as critical as the signs and the implied elasticities. But even if the coefficient values are taken into account, the estimates show that PDYRY yields the largest positive (non-agricultural) employment contribution (although the level of significance is low).

The results for the South and Southeast Asian countries essentially reveal the same relative magnitudes of the elasticities although the \bar{R}^2 perceptibly suffer in significance.¹⁸ The directions of the relationships between modernization and non-agricultural employment are the same with the larger group of Asia and Pacific countries. Table 2 is a summary of the results for the South and Southeast Asian countries.¹⁹

TABLE 2
REGRESSIONS OF NON-AGRICULTURAL
EMPLOYMENT: SUMMARY^a
SOUTH AND SOUTHEAST ASIAN COUNTRIES

VARIABLE	b_1	b_2	Elasticity	R^2
PDYRY	>0	<0	8.36	-0.13
PAGGDP	<0	>0	0.84	0.26
INAGRC	<0	>0	28.13	0.29
PCFDPR	<0	>0	0.52	-0.08

^aSee Table 1 for legend.

In the context of the framework presented and the specifications followed in the data analysis, it is not really necessary to compare the two indices of agricultural development in order to trace effects on non-agricultural employment. It is sufficient to examine the signs and magnitudes of the modernization coefficients -- b_1 and b_2 . The second coefficient simply measures the incremental change in non-agricultural employment relative to a continuing (increasing) change in the variable. In other words, one need not look for different measures of the independent variable but assume that development takes place as the index increases at increasing rates. It is apparent from Table 1 that at early development stages non-agricultural employment is positive but declines as this kind of

growth proceeds. On the other hand as b_1 and b_2 for PAGGDP show, as a broader (later) form of agricultural modernization spreads, non-agricultural employment declines before picking up again. One may argue however that as PDYRY increases, this contributes to PAGGDP and therefore transmits effects on non-agricultural employment. This point is only partly true since other agricultural growth takes place and thus the impact on employment must net out the various responses. Note that the experience in agricultural development is the predominance of large export crops along with (or prior to) food crop expansion.

Equations (2) and (3) report the specifications for Asia and the Pacific in 1975

$$(2) \quad \text{PNAGRE}_{it} = 0.98 - 2.95 \text{ PAGGDP}_{it} + 2.69 (\text{PAGGDP}_{it})^2 + U_t$$

(-0.59) (1.11)

$$\bar{R}^2 = 0.81 \quad F = 39.36$$

$$(3) \quad \text{NAGRE}_{it} = 58015 + 43.72 \text{ PDYRY}_{it} - 0.005 (\text{PDYRY}_{it})^2 + U_t$$

(34.27) (-0.005)

$$\bar{R}^2 = 0.11 \quad F = 2.40$$

The numbers underneath the coefficients are the standard errors of the coefficients. The coefficients while as expected do not appear to be significant at usual levels and the \bar{R}^2 is quite low. This could partly be corrected by assuming a non-linear relation.

It can be seen that PAGGDP initially reduces non-agricultural employment before increasing it by equivalent magnitudes whereas PDYRY increases it by an amount relatively greater than it reduces with continuous improvements of paddy yield. All this seems consistent with what the framework argued the relationships to be.

The preceding relationships, when investigated in logarithmic transformation, lends an even stronger support to the hypothesis advanced. In particular, the fit (\bar{R}^2) improves substantially for the independent variable paddy rice yield and weakens for all other indices of agricultural modernization. The strength of the elasticities remain consistent with the results in the simple linear form (Table 1). Some differences are observable however in terms of the signs of the coefficients. Table 3 summarizes the results for the log-linear regressions as basis for deriving non-agricultural employment responses to the same set of modernization indicators.

TABLE 3

REGRESSIONS OF NON-AGRICULTURAL
EMPLOYMENT: SUMMARY^a
ASIA AND PACIFIC COUNTRIES
(Log Transformation)

VARIABLE	b_1	b_2	Elasticity	\bar{R}^2
PDYRY	>0	<0	2.34	0.26
PAGGDP	<0	<0	1.20	0.63
INAGRC	<0	>0	46.65	0.35
PCFDPR	<0	<0	0.75	0.01

^aSee Table 1 for legend.

4. Some Behavioral Patterns

It is possible to extend the previous analysis towards some behavioral notion of non-agricultural employment, partly to examine the consistency of the earlier results. By postulating, for example, homogeneity of non-agricultural employee characteristics one can specify a model explaining non-agricultural employment.

An important variable that can obviously determine non-agricultural employment behavior is some indicator of wage rates. However there is no index available from the data set reflecting wages for a common year or across the Asia and Pacific countries.

Hence it is difficult to build this into a specification.

Another determining variable would seem to be the past non-agricultural employment behavior in the sense of some lag structure. The danger here, as expected, will be the statistical problem of autocorrelation and non-independence. For example a specification of the type

$$(4) \quad \text{PNAGRE}_{it} = a + b_1 \text{AGR}_{it} + b_2 (\text{AGR}_{it})^2 + b_3 \text{PNAGRE}_{i,t-1} + U_t$$

will likely encounter problems that would call to question its proper interpretation. Nevertheless comparisons can perhaps be made with the parameters derived previously.

Table 4 below summarizes the results using (4) but allowing past non-agricultural employment behavior (1970) to influence current behavior. It has not been possible to use the past year's non-agricultural employment as an independent variable since the next earlier data for the variable is 1970. Note that the data for non-agricultural employment is 1975, which is being explained. Thus the specifications are at best exploratory. Nevertheless as pointed out the aim is simply to discern some consistency with the previous results and not to attribute particular behavioral patterns.

TABLE 4

EXTENDED REGRESSIONS OF NON-AGRICULTURAL
EMPLOYMENT: SUMMARY
ASIA AND PACIFIC COUNTRIES

VARIABLE	b_1	b_2	b_3	Elasticity*	\bar{R}^2
PDYRY	>0	<0	>0	0.18	0.99
PAGGDP	>0	<0	>0	0.09	0.99
INAGRC	<0	>0	>0	0.004	0.99
PCFDPR	-	-	-	-	-

*of b_1 at the mean values of the variables.

Elasticity values for PDYRY and PAGGDP are absolutely lower than the values in Table 1. The responsiveness of non-agricultural employment to PDYRY remains relatively greater than PAGGDP even though the signs are the same. The weakness of this specification is evident in the high values of the \bar{R}^2 .

5. Conclusions

The rationale set out for this study was to look at the interactions between agricultural modernization and non-farm employment in Asia and the Pacific. Based on some micro analytic foundations the analysis sought to provide a more quantitative means to the perspectives drawn in small studies.

It turns out that the results tend to be supportive of micro studies. In particular it is found that early stages of modernization reflected in increases of paddy yield lead to increases in non-agricultural employment. The mechanisms by which this takes place are through demand considerations (income effects) and through supply possibilities (non-farm economic activities).

Higher stages of agricultural modernization reflected in increases in the fraction of agricultural GDP to total GDP lower non-agricultural employment. Part of the reason for this phenomenon is the capital intensification of industries and thus lower labor absorption rates.

To be able to pinpoint at what development level higher forms of non-agricultural employment (and thus lower labor absorption) take place, more micro studies would be needed. The strong conclusion that can be drawn here is that narrower forms of agricultural modernization (such as productivity improvement programs) do stimulate non-agricultural economic activities which also tend to increase the overall agricultural GDP. A policy thrust therefore that mixes rural industrialization and yield acceleration will require a closer scrutiny in order to specify potential trade-offs as implied in the results. Indeed it may even be feasible that rural industrialization and manufacturing development will have

stronger linkages through small scale industrial employment (of less than 10 workers) that spins off from agricultural modernization. This is not inconsistent with some developed country experiences.²⁰ In short, non-agricultural employment may also be served equally well with on-farm on-agricultural development.

The specific policy conclusions attendant to the findings here are simply a re-echo of previous works. For example, in order to smoothen adjustments for non-agricultural economic activities, capacity building programs would make sense -- skills training for occupation in rural industries (of inferior goods), technical support in management and financial administration of rural non-agricultural establishments, and at some later stage financial resources to support capitalization and rural industrial development. Although these points do not follow from the analysis given in this paper, the findings, coupled with associated evidence from other studies support them and make the directions more concrete.

FOOTNOTES

¹ See for example the work of S. Hymer and S. Resnick, "A Model of An Agrarian Economy with Non-Agricultural Activities", American Economic Review (September 1967), 423-506. Although basically neo-classical in approach, this is probably the seminal theoretic work on this area. The new household economics, while somewhat peripheral partly alludes to optimal behavior. In this paper non-farm and non-agricultural are considered similar in concept.

² The magnitudes and scale of rural industrialization in the current Philippine Development Plan are not really clear-cut. However, it implies some amount of deliberate policy to directly promote non-farm activities. In the plan, "...rural-based non-farm activities will be promoted to increase employment and income opportunities of farm families. The regional industrial dispersal program of the government will support this strategy..." Five Year Development Plan 1978-1982 (Manila: September 1977),

³ S. Hymer and S. Resnick, op.cit.

⁴ One survey is E. Chuta and C. Liedholm, "Rural Non-Farm Employment: A Review of the State of the Art" MSU Rural Development Paper No. 4, Department of Agricultural Economics, Michigan State University (1979). A pioneering effort in the Philippines is the research works of A. Gibb among which are "A Note: Defining the Non-Farm Employment Question", Discussion Paper No. 71-14 UP Institute of Economic Development and Research (August 1971); "Report on On-Going Research: Some Evidence on the Impact of Agricultural Modernization on Non-Agricultural Incomes in Agricultural Market Center", Discussion Paper No. 72-4 UPIEDR (April 1972) and "Preliminary Data on Non-Farm Employment Changes in An Agricultural Sub-Region", Discussion Paper No. 72-19 UPIEDR (June 1972). A current large scale project is on-going in Thailand on off-farm employment reported in T. Onchan, P. Charsembut, R.L. Meyer and D.C. Mead, "Description of the Rural Off-Farm Employment Assessment Project in Thailand" Research Paper No. 1 Center for Applied Economics Research, Kasetsart University (Bangkok, Thailand, October 1979).

⁵ D. Anderson and M.W. Leiserson, Rural Enterprise and Nonfarm Employment (World Bank, January 1978).

Also Idem, Economic Development and Cultural Change (January 1980).

⁶ A. Gibb, "Some Evidence on Agriculturally-based Cities", Discussion Paper No. 72-17 UPIEDR (June 1972).

F.A. Albuero, "Comparative Agricultural Modernization and Non-Farm Economic Activities", Journal of Philippine Development (Second Semester 1979), 102-116 and Idem, "Comparative Agricultural Modernization and Non-Farm Employment" Discussion Paper No. 80-12 UPIEDR (December 1980).

⁸ Ibid.

⁹ Since the income spread of agricultural productivity changes is more than through direct installation of industries the income effect mechanism is more responsive to the usual Engel's law and thus stimulates non-agricultural economic activities faster.

¹⁰ The evidence is in the two papers cited in footnote 7.

¹¹ See especially section II in F.A. Albuero, "Comparative Agricultural Modernization and Non-Farm Employment", Discussion Paper No. 80-12 UPIEDR (December 1980).

¹² See Appendix 2 for a list of the Asia and Pacific countries included in this classification. Not all countries were included in the analysis for lack of available complete data.

¹³ For a description of the data set see C.C. Schlegel and E. Ng "The User's Guide to the PSI World Dataset" Technical Memorandum TM 81-1, Resource Systems Institute, East-West Center Hawaii (March 1981).

¹⁴ Ibid., 56. See Appendix 1 for complete definitions.

¹⁵ The food production index is broader than cereals and thus encompass other agricultural products that are basic parts of food. See Appendix 1.

¹⁶ See Appendix 1.

¹⁷ It is probably reasonable to suppose that rice production is more or less governed by a large number of farms independently distributed compared with other agricultural crops (e.g. export).

¹⁸ In a separate specification using PNAGRE as dependent variable with the PDYRY indicator, the R^2 is 0.21 but the coefficients are opposite to that of Table 2. Either one however does not yield significant coefficients.

¹⁹ The number of cases for the South and Southeast Asian countries is 13 for PAGGDP, 15 for INAGRC and 17 for PDYRY. The classification in Appendix 3 however indicates only 16 countries for the South and Southeast Asia.

²⁰ H.T. Oshima, "Labor-Force Explosion and the Labor-Intensive Sector in Asian Growth", Economic Development and Cultural Change (January 1971).

APPENDIX 1

DEFINITIONS OF VARIABLES

- PNAGRE - percent of non-agricultural employment to total employment. Employment is total economically active population (000) which means all persons engaged in economic activity, whether as employers, own-account workers, salaried employees, or unpaid workers assisting in the operation of a family farm or business. Economically active population in agriculture includes forestry, hunting and fishing.
- NAGRE - economically active non-agricultural population (000) derived by subtracting agricultural employment from total employment.
- PAGGDP - percent of agriculture GDP (at current prices, in million units) to total GDP (at current prices, million units).
- PDYRY - paddy rice yield in kilograms per hectare
- INAGRC - percentage computed by dividing the area planted in the largest single crop by the total area in the five largest crops.
- PCFDPR - per capita food production index (1952-56 = 100) calculated on a calendar-year. The number represents price-weighted production volume for production flowing to all sectors other than agriculture itself. This figure is compared with average volume during the base period. The food production index includes cereals, starchy roots, sugar, edible oil crops, wine, livestock, livestock products, etc.

APPENDIX 2

LIST OF ASIA AND PACIFIC COUNTRIES
INCLUDED IN THE ANALYSIS

1. Afghanistan
2. Australia
3. Bangladesh
4. Burma
5. Cambodia
6. China
7. Fiji
8. Hongkong
9. India
10. Indonesia
11. Iran
12. Japan
13. Korea
14. Laos
15. Malaysia
16. Nepal
17. New Zealand
18. Pakistan
19. Papua New Guinea
20. Philippines
21. Singapore
22. Sri Lanka
23. Taiwan
24. Thailand
25. U.S.A.
26. Vietnam

APPENDIX 3

DATA TABULATION
ASIA AND PACIFIC COUNTRIES

The data used for the analysis in the text are presented in this Appendix with Appendix 1 providing the complete definitions and measures of the variables. There are some arbitrary points in the regional classification. For example in the East Asia group of countries Fiji and Papua New Guinea are included although they are not conventionally done so. The Developed Pacific countries do not include Japan. All are for the year 1975.

<u>SOUTHEAST ASIA</u>	<u>NAGRE</u>	<u>PNAGRE</u>	<u>PDYRY</u>	<u>PAGGDP</u>	<u>INAGRC</u>	<u>PCFDPR</u>
Indonesia	17,574	.374	2,629	.348	63	113
Malaysia	1,979	.483	2,625	.277	-	153
Philippines	7,489	.504	1,721	.287	39	108
Singapore	830	.973	-	.019	-	221
Thailand	4,280	.223	1,825	.311	79	113
Burma	5,726	.445	1,816	.360	75	94
Cambodia	764	.239	1,429	-	90	39
Laos	381	.236	1,338	-	97	121
Vietnam	5,367	.264	2,260	.368	88	111

SOUTH ASIA

Afghanistan	1,330	.202	2,071	-	70	95
Bangladesh	3,780	.149	1,853	.570	91	94
India	80,348	.334	1,858	.478	39	101
Iran	5,072	.578	3,102	.091	73	117
Nepal	410	.068	2,074	-	59	94
Pakistan	8,608	.438	2,296	.308	54	114
Sri Lanka	2,167	.457	2,271	.361	50	88

EAST ASIA

China	142,175	.361	3,507	-	34	113
Hongkong	1,810	.967	1,792	.013	-	54
Japan	48,972	.852	6,187	.054	-	114
Korea	7,015	.553	5,324	.251	48	112
Taiwan	-	-	-	.140	-	-
Fiji	101	.561	2,255	.187	68	81
Papua New Guinea	218	.158	1,740	.259	-	108

<u>DEVELOPED PACIFIC</u>	<u>NAGRE</u>	<u>PNAGRE</u>	<u>PDYRY</u>	<u>PAGGDP</u>	<u>INAGRC</u>	<u>PCFDPR</u>
Australia	5,369	.932	\$,135	1064	70	116
New Zealand	1,093	.895	-	-	-	104
U.S.A.	91,872	.972	5,109	.044	-	121

Source: See Text.