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AN EMPIRICAL TEST OF THE Z-GOODS MODEL OF AN AGRARIAN ECONOMY

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Development models usually postulate an agrarian sector in which labor is allocated to either food production or leisure. Stephen Hymer and Stephen Resnick, however, present a model in which the agrarian sector produces non-agricultural goods as well as food.[1] Non-agricultural goods, called "Z goods", are described as the "... variety of processing, manufacturing, construction, transportation, and service activities...[which] satisfy the needs for food, clothing, shelter, entertainment, and ceremony". Food production (F activities), consists of crops and the varied techniques of producing them which are options within "even the most primitive economy". Employment of labor in home manufacturing of Z goods is seen to limit expansion of commercial agriculture, i.e., the production and export of F goods. Commercial agriculture does expand, however, if superior substitutes for Z goods are available through trade with a domestic or foreign industrial sector. More specifically, as manufactured goods (M goods), substitute for Z goods, labor is reallocated from Z goods production to food production and food is traded by the agricultural sector for additional Z-substituting M goods. Conditions favorable to the process

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[1] See Stephen Hymer and Stephen Resnick, 1969.

noted by Hymer and Resnick are high income elasticity for M goods, variety in food production alternatives, an industrial sector attentive to requirements of the agricultural sector and the absence of trade barriers.

An important test of the model is whether Z goods, M goods and F goods are identifiable in an actual economy More importantly, do observed relationships among them demonstrate the hypothesized system of trade and substitution? Is the substitution of M for Z goods a necessary condition for expanded F production; are labor constraints critical in the development of peasant economies?

To answer these questions and to provide a test of the Z goods model, a study of village economies in Malaysia was undertaken. This paper concerns activities and goods observed in Malaysian villages[2] which were examined to learn if: (a) there exists a relationship between the amount of commercial agriculture and the incidence of Z goods, Z activities and M goods, (b) such relationship is inverse for Z goods and activities, (c) the relationship is positive for M goods, and (d) the relationship is dissimilar to that between income from F activities and incidence of Z and M goods and activities. Tests of these hypotheses constitute a test of the Z goods model but (d) perhaps needs some discussion.

Dissimilarity of labor and income relationships hypothesized in (a) and (d) above can, theoretically, be demonstrated if some M

[2]The Iban are a major dialect group comprising about one-third of the population in Sarawak, Malaysia. An Iban village corresponds to a longhouse averaging about nineteen households in this study.

goods are inferior, and must be demonstrated in order to show that a labor constraint exists. That is, if all Z goods are inferior to manufactured substitutes then data consistent with the Z goods model can also be consistent with the usual labor-leisure model of the agrarian sector.[3] From a viewpoint based on the latter model, it can be argued that when new labor is allocated to commercial agriculture from ranks of the leisurely or unemployed, the time lag between incidence of new income and casual purchases of income elastic M goods is sufficiently brief that cross-sectional analysis cannot distinguish the relationship between the amount of labor in commercial agriculture and labor-saving M goods from the relationship between income to commercial agriculture and income elastic M goods. A labor constraint is indicated if M goods confirmed as inferior in an income relationship are positively related to labor-associated measures of commercial agriculture.

Cross-sectional data comes from fifty-three villages in Kanowit District, Sarawak, Malaysia.[4] Since labor, tools and certain produce are shared within villages and not among them, villages are considered discrete and basic economic units. Commercial agriculture in Upriver Sarawak consists of rubber cultivation, of both low-yielding

[3] Labor-leisure models here refer to those which treat commodity production as the only distinguishable enterprise of the agrarian sector regardless of whether such enterprise is said to fully employ the rural labor force. See Jorgenson, Mellor, Ranis and others.

[4] The Sarawak Ministry of the Interior, the Kanowit District Council and the headmasters of six higher primary schools assisted in data collection for this study.

native stock and improved stock.[5] Four labor-associated measures of commercial agriculture are examined, namely the numbers of households per village which have: (1) no rubber (an inverse measure), (2) at least some immature improved stock, (3) at least some immature and mature improved stock, and (4) more than three acres of rubber. Measures 1 through 4 are in ascending order of labor requirements per unit of production. Younger and improved holdings require more care; mature improved holdings indicate prolonged cultivation of improved stocks; and 4, a measure of size, includes the more advanced farms counted in 2 and 3 as well as the larger holdings of unimproved stock. Measure 5, the frequency of households which often sell rubber, is an income-associated measure of rubber cultivation.

Frequencies of Z and M goods and activities are determined as either the number of households per village which use or possess an item, or the total number of people in the village who frequently perform an activity. Z and M goods and activities are distinguished according to their primary use and place of manufacture.

Each of the five measures of commercialization is entered as the dependent variable in a regression equation of the form:

$$Y_i = A_{i0} + A_{i1}X_1 + A_{i2}X_2 + \ldots + A_{i12}X_{12} + u_i, \qquad i = 1,2,3,4,5$$

[5] Commercial agriculture is an F activity in terms of the model. Adjustments among F activities may occur as additional labor becomes available to activities, (Hymer, Resnick, p. 494). Certain non-rubber food production and early commercial activities which are amenable to neither labor intensification nor extensification will decline relative to F activities which can absorb labor. They may decline absolutely if, as in the present case, they are seasonal and thus perhaps related to the necessity of home manufacture of Z goods. Seasonal activities which cannot absorb labor are treated as Z activities in this study (see Table 1).

Equations thus generated are numbered 1 through 5 for reference. Frequencies per village of Z and M goods and activities are entered as the independent variables X_j. Since the village is the unit of observation, Y_i can be regarded as the number of rubber production units operated at or above the indicated level of commercialization. Each production unit requires an amount of labor equal to that allocated to rubber cultivation by a typical household having, for example, more than three acres of rubber. The X_j, then, are differentiated by the amount of labor a unit of each adds or subtracts from the amount of labor available to rubber production units, Y_i. An A_{ij} is that fraction of a unit of Y_i added or subtracted by using the labor released or absorbed by a unit of X_j.[6]

An increasingly better fit of the data by equations 1 through 4, would indicate that there indeed exists a relationship between the intensity with which commercial agriculture is practiced and the frequency of use (or practice) of Z goods (or activities) and M goods. (See hypothesis (a) above.) M-good coefficients are expected to have positive signs in equations 2 through 4, and Z coefficients, negative signs (hypotheses (b) and (c)). Expectations regarding equation 1 are the reverse of those for equations 2 through 4 since

[6]The A_{ij} are quantitatively meaningful to the extent that Z and M items are substitutes and that all labor is employed. Generality and inaccuracy of measurements and effects produced from outside the model also affect estimates. Conceptually, the coefficients of Z variables are rates of product transformation between commercial agricultural produce and Z goods. Coefficients of M variables are the product of the rate of product substitution of Z and M in consumption and the rate of product transformation of F and Z in production.

Y_1 is a measure of the absence of commercial agriculture. Finally, superior goods (whether Z or M) are expected to be positively correlated with the income measure Y_5 in equation 5 while inferior goods (whether Z or M) would be negatively correlated (hypothesis (d)).

Results of least squares estimations of A_{4j} and A_{5j} are given in the accompanying table. A_{2j} and A_{3j} (not shown), had signs similar to the A_{4j}. The A_{3j} were generally smaller than the A_{4j}, and the A_{2j} were smaller than the A_{3j}. R-Squares of equations 2 and 3 were .543 and .828, respectively. The A_{1j} estimated in equation 1 were generally opposite in sign to the A_{2j}, A_{3j}, and A_{4j} (i.e., consistent with expectations), but only one coefficient was significant at the α=.05 level of significance and the R^2 of that regression was .24.

For completeness, a uniform set of independent variables is retained in all equations. Three independent variables from the original set are deleted because they are both insignificant and intercorrelated with other variables. Deleted variables are the Z goods and activities "homemade fishnets", "hunting with blowpipe and spear", and "mat weaving". Simple correlation between any two remaining variables is less than .3 in most cases and less than .6 in all cases.

II. Conclusion

Signs and significance levels of equation 4 strongly suggest the hypothesis that M goods substitute for Z goods as commercial agriculture expands. Moreover, ce the quantity of labor required per

TABLE 1: REGRESSIONS OF THREE MEASURES OF RUBBER PRODUCTION ON INCIDENCE OF M AND Z GOODS AND ACTIVITIES IN MALAYSIAN VILLAGES

Independent Variables No. of households having a good or practicing an activity	Regression Coefficients for Equations 4 & 5[a] Y_4: No. households having more than 3 acres rubber	 Y_5: No. households which often sell rubber
M Goods		
Boat Engine (superior)	-0.2445 (1.131)	-0.8812* (2.343)
Shotgun (superior)	+0.3215* (3.193)	+0.2894 (1.653)
Linoleum Rug (superior)	+0.1923 (1.247)	+0.0588 (0.219)
Manufactured Whiskey (inferior)	+0.3414* (3.789)	-0.5061* (3.230)
Manufactured Fishnet (inferior)	+0.6075* (2.824)	-0.559 (1.486)
Metal Roof (inferior)	+0.4339* (2.831)	+0.4179 (1.568)
Z Goods and Activities		
Plant Hill Rice	-0.7685* (2.578)	-0.3499 (0.675)
Wood Roof Shingles (superior)	-0.1307 (0.969)	+0.8002* (3.412)
Jaunts[b]	-0.2515 (1.366)	-0.0668 (0.209)
Weave Blankets	-0.4456* (2.709)	+0.3898 (1.362)
Gather Rattan	-0.0802 (0.615)	+0.1310 (0.577)
Trade in Edible Forest Produce	+0.0782 (0.611)	+0.0816 (0.367)
Intercept	-0.0937	+0.2434
R^2	.865	.549

[a]T ratios in parentheses, asterisks indicate coefficients which are significant at the α=.05 level in a two-tailed test.

[b]Months or years of travel for fortune and adventure by married or single men.

unit of rubber production increases from measure 2 to 4, increasing size of coefficients in equations 2 to 4[7] are highly indicative that equations 2 to 4 are labor-based relationships. Finally, equation 5 demonstrates that certain M goods described as inferior (see Table 1), in fact behave as inferior goods; the relationship between income and income-elastic M goods is dissimilar to equations 2 through 4 Thus, labor constrains commercial agriculture since, otherwise, inferior time-saving M goods would not be used.

Regression coefficients of Z goods and activities are less significant than coefficients of M goods, both as shown in the table and as indicated by the deletion of several Z items previously mentioned. Continuing incidence of Z goods and activities subsequent to M good acquisition results from the reluctance of villagers to discard old goods and forget old skills, and from the occasional use of outmoded Z goods as supplements to M goods. Additionally, certain Z goods inferior in their primary use may remain in use for secondary purposes. Reed and rattan mats, for example, are inferior to linoleum as floor coverings but are used as coverings, ground cloths and bedrolls. Thus, employment of Z goods as supplements to M goods and in secondary uses may cause the coefficient of Z goods to be less significant than those of M goods as found in this study.

Boat engines, fishnets, and shotguns constitute the interesting and complex cases of intermediate goods used in the production of

[7]Equations 2 and 3 are not shown; however, as reported in the preceding paragraph, the A_{3j} were smaller than A_{4j}, and the A_{2j} were smaller than the A_{3j}.

Z noted by Hymer and Resnick.[8] The negative coefficient of boat engines, which substitutes for paddling, perhaps signals the decline of river travel in favor of travel over newly built roads. The use of manufactured fishnets and shotguns might similarly decline when superior food procurement activities develop, such as domestic meat production and gardening or the purchase of tinned foods.

Apart from testable conclusions just presented a point concerning superior Z goods is in order. The superiority of some Z goods in the present case would seem not a major hindrance to development because (a) not all Z goods are superior, (b) the amount of superior Z goods consumed is reduced by competition from myriad M goods which are not technical substitutes for superior Z goods, and (c) in an active market a superior Z good encourages an eventually superior substitute. An example of the last is substitution of milled wood shingles for metal roofing which previously had replaced homemade wood shingles.

[8] See Hymer, Resnick, p. 459.

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