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AGRICULTURAL POVERTY IN PANAMA FOR ASIAN PERSPECTIVE

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The paper offers an Asian frame of reference to the technological and institutional dualism within agriculture in Panama and its role in defining the character of Panamanian rural poverty. Firstly, it draws up a profile of poverty farms which corroborates the descriptive profile yielded by a study conducted by the Panamanian government. Next, it outlines the economics of underdevelopment and then proceeds to an extensive discussion of the development of poverty theories, particularly with reference to agriculture. It then presents a regression model based on the relationships hypothesized in the theoretical formulations, and using 1970 farm data for each of Panama's 66 Districts.

Based on the regression results showing that Panamanian farmers of all sizes are responsive to economic opportunities, the paper recommends the abandonment of high selective price support and of government import monopoly by IMA in favor of world market prices. Taking into consideration the crucial importance of locational variables as determinants of farm income, the paper further proposes a homestead land redistribution program by making all public farmlands available for permanent settlement by farm households. This would serve to reconcentrate farm settlements in areas with more favorable locational characteristics. Finally, to complement the price and land reform measures, it is suggested that multi-purpose cooperatives be established, like the Farmers' Associations of East Asia.

Introduction

Agricultural poverty as an acute form of underdevelopment and distributive inequity in resource access has much in common the world over. However, seen from an Asian perspective, the extent of technological and institutional dualism within agriculture in Panama and its role in defining the character of Panamanian rural poverty offer an interesting comparative frame of reference. By Asian standards, Panama is not an overcrowded, land-scarce country. It shares a common Latin American legacy characterized by large-scale plantation-style farming alongside a vast number of small farms comparable in size to the typical Asian farms. The resulting skewed size distribution of farms yields an astounding Gini coefficient of

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0.8. Even more dramatic is the following statistics: poverty farms as defined in the paper accounted for 23.5 per cent in farm numbers but only 0.98 per cent of the land in farms.

The extreme size distribution has given rise to plantations large enough to admit the use of North American-style mechanization and to mini-farms whose basic implements continue to be the digging-stick and machete. Government price policy and labor codes made it profitable to employ such extreme dualism in technology. In contrast to the Asian norm where unit land productivity on small farms exceeds substantially that on large farms, the opposite is true in Panama by a several-fold margin. In this light, land redistribution in Asia — where there is comparatively little difference in the state-of-the-art and skill levels between big and small farmers and where size-difference in land yields is in an agreeable direction — is much more likely to lead to results consistent with output growth than in Panama. Perhaps it is not surprising in retrospect that Panama should have experimented (unsuccessfully) with a mild form of Socialist collective farms under its agrarian reform program in the 1970s which on paper permitted technological leap-frogging from the digging-stick to the machine tractor, instead of the more straightforward land redistribution and land-to-the-tiller programs centered on family farms.

Institutionally, the poverty farms suffered more frequently from a lack of title to their land which further limited already circumscribed market access for them. With about half of the land in farms in Panama in the public domain, opportunities for government action programs to rationalize property rights and land use, title, and distribution suggest themselves. Inapt anachronistic agrarian statutes, which serve to freeze uneconomic land use pattern and, thus, to harm rather than protect the poverty farms, offer further scope for remedial policy action. Political will appears to be the only missing ingredient. In all these regards, the perspective afforded by Panamanian poverty may be particularly pertinent to the Philippines.

1. Agricultural Poverty Defined

We all recall stories about turn-of-the-century immigrants arriving on the shores of their new country with a pack on their backs, virtually penniless, and a few years later emerging as substantial citizens owning thriving businesses. These are more than stories. The process is still going on, although the settings may be different. Today's stories may deal with Koreans in Los Angeles, or migrants from

India in Panama City, or Cuban refugees in Miami. Their common trait is that they take whatever jobs they could find, work exceedingly hard, and save every penny possible while acquiring skills and language facility for a career, usually in business. These immigrants illustrate a particular class of poor people who don't remain poor for long.

In the native population of the poor, there are those who also fit the label of "transient poor." On the other hand, there are those among the poor who, in the language of the sociologist, seem to be "sociologically adjusted" to being poor. These are the poor for whom public action programs are needed to raise their aspirations, widen their circumscribed horizon, and give them access to skills and other necessary means for vertical mobility. This type of poverty has resource allocation implications. It implies underdeveloped and underutilized human resources. As such it represents investment opportunities for society, and not merely the object of eradication. It is the positive aspect of the "war against poverty" that is best stressed. There is a third category of poor consisting of the aged, the disabled, and members of broken families. In general, the problem calls for income transfers except where private responsibilities can be clearly established and legally enforced.

Society's main burden in dealing with poverty, thus, comes down to the task of distinguishing between the "transient poor" for whom no social action is required, and the "non-transient poor" who are the target for public policy. The economist usually gets around this problem by invoking the life-cycle income concept. This begs the operational question of how do we know *ex ante* the future income profiles of the individual members of a heterogeneous population of poor. Poverty profiles of the subgroups help. In what follows, poverty is to be understood as non-transient and requiring social action of an investment nature.

For the purpose of defining poverty in Panama's agriculture, it is probably sufficient to take farm households whose extreme low-income status has been an inter-generational reality. It is reasonable to suppose that a farm household eking out a precarious living on a small plot of land (often on hillsides), using no other farm implements than a metal-tipped digging stick and a machete, is a descendant of similar households going back several generations. In fact, in such a household it is common to see three generations living together. We hold that these households represent the non-transient poor. Operationally, this study has adopted farm households with

0.5 - 1.99 hectares as constituting (non-transient) critical poverty. The 1970 census of agriculture showed that 74 per cent of these poverty households reported farming as the principal occupation. In contrast, most of the households with less than 0.5 hectares of land reported non-farming activities as the principal occupation. These mini "farms" which often were nothing more than garden plots of rural residences are accordingly excluded from the ranks of poverty farms. Although some no doubt belonged in the category, they are likely to represent households with disability or otherwise diminished capacity. The total number (13,156) of mini "farms" accounted for 12.6 per cent of all farms in Panama. Of this number, nearly half reported less than one-tenth of a hectare — an area far too small for "serious farming" as a means of livelihood.

2. An Analytical Profile of Agricultural Poverty

Panama, as a country with a Gini coefficient of land holding concentration of 0.784, has one of the most skewed farm size distributions in the world. The coefficient is calculated from the 1970 census; it is not much different in 1980 (see Section 7). Exclusion of the "non-farms" discussed earlier from the broad census coverage would change the coefficient somewhat but not enough to alter this characterization. Leaving out the "non-farms" (of size under half a hectare), the small farms with 0.5 — 1.9 hectares of land, defined as poverty farms in this study, numbered 21,680 in 1970 out of a total number of farms of 92,061 (*Census of Agriculture*, 1970, Vol. IV, Table 6). In relative numbers, poverty farms accounted for 23.5 per cent of the total farm number but reported only 0.98 per cent of the land in farms. The poverty farms also employ the "digging stick" technology. They follow (as do the larger farms) the practice of allowing substantial acreage to lie in fallow. This is in sharp contrast with East Asian farmers, who with the help of land-saving, labor-using modern "seed-fertilizer-water-based" technology, are able to squeeze enough output out of their one-hectare farms to afford a comfortable level of living. This may sound like an oversimplification neglecting the underlying differences. The point, however, is that there are, indeed, critical, underlying differences but that these differences are **not** "given." They have to do with levels of economic development in agriculture and are, thus, amenable to changes. Even nature's endowment can be altered by man. Acid soils can be corrected by applications of lime, nutrient-deficit soils by proper fertilization, uncertain moisture condition in rainfed areas by irrigation, water-logged land by drainage. As T. W. Schultz has long held, instead of a niggardly endowment of nature (as the classical eco-

nomist would have it) being exhausted by man's continuous exploitation, the soils of the world today are much better than they were, say, in the Middle Ages.

Agricultural poverty in Panama is thus a classical case of underdevelopment aggravated by size-related dualism within the sector itself. The potentials for development are vast precisely because of the present low level of productivity (e.g., Panama's rice yield is about 1/3 the East Asian level). This makes the "war on poverty" in agriculture all the more rewarding, challenging, and, indeed, compelling.

Given the skewed landholding pattern (aggravated by widespread landholding without title) and the primitive state-of-the-art on the poverty farms, their conditions could have been mitigated if the large farms had conducted themselves in ways that generated a strong demand for labor (either hired or, indirectly, via share-cropping for the minifundistas). Latifundias in Panama, however, tend to be of two kinds. The first type is concerned with cattle ranching, utilizing large pastures for low-intensity grazing. Land in farms increased by 56 per cent in the 1950s and by another 16 per cent in the 1960s, or an astonishing total expansion of 81 per cent in two decades (Census, IV-18). Land in pasture, starting from 47.6 per cent of all land in farms in 1950, reached 54.5 per cent in 1970. The type and prevalence of ranching did little to generate employment for the minifundistas. To complete the picture, one should add that the fallow practice (a testimony to lack of modern fertilization and crop-rotation techniques) kept 10.4 per cent of the land out of cultivation in 1970 (down from 12.3 per cent in 1960 and 18.4 per cent in 1950). The other type of latifundias consists of crop-growing plantations. Both because their huge size can accept the indivisibility inherent in North American style mechanization and because government-created distortions in relative input prices make the adoption of such mechanization profitable, crop production on these farms gives rise to little employment. Large rice plantations in Chiriqui prepare and seed their land with hired specialized machine operators, spray their fields with airplanes (often North American-piloted), and bring in their crop with huge harvesters. What little employment that is generated requires skills that can hardly be provided by the poverty farms.

Government interventions take the form of a minimum wage in agriculture (B/.4.50 or $4.50 a day currently, B/.2 or $2.00 in 1970),

employer social security contributions (of 11%), labor codes discouraging hiring of workers — all tending to raise the cost of hired workers. On the other side of the coin, the Government of Panama subsidizes capital by setting a ceiling on agricultural loan interest rate at 3 percentage points below the market (current ceiling = 9.5%), with the gap being covered by a 1 per cent surcharge on nonagricultural commercial loans, and by tariff-free preferences for imported farm inputs. These measures, together with high price supports (rice, the principal grain crop, at two to three times the world price level), may be congenial to the plantation owners. Their negative effect on employment for the poor is clear. By going against Panama's labor-abundant resource endowment, the policy also leads to a high-cost agriculture. As if to compensate for this tilt, the government has several programs for the poverty sector (some specially for the indigenous Indian population). Unfortunately, it is probably fair to say that the weight of these programs seems to be on social welfare (as valuable as that may be) rather than on production (where the long-term solution lies), although the line between the two may not always be clear. The recent budget crunch has also pretty much decimated the poverty-oriented programs. Nor has the presence of government agricultural parastatals helped. According to the latest information, all of these government enterprises are losing money; one of the banana corporations has ceased operation, as has one of the sugar mills.

A separation of production-directed policies and programs from those for social welfare would contribute to clarity of purpose and to their cost effectiveness.

As is true with most developing countries' early industrialization policy, Panama's has been oriented toward import-substitution. This is high-cost industrialization requiring high tariff protection usually supported by quotas, an overvalued exchange rate, a low interest rate to subsidize capital, and a cheap food policy. Agriculture as the dominant sector bears the brunt of paying for the high cost of industrialization. It is squeezed by the government through its cheap food and other ancillary policies. As Panama exhausted the import-substituting possibilities in industry (a process hastened by the limited size of the country's economy and by agriculture's failure to expand its market for industry's output), it turned to import-substitution for agriculture. This has resulted in an elaborate system of subsidies and high support prices for agriculture to enable it to meet the high cost of producing for self-sufficiency. Excess production over domestic demand is beginning to occur (in rice). Indiscri-

minate import-substitution without regard for the "infant industry" principle breeds inefficient, "hot-house" types of industry and agriculture which in turn create a vested interest against economic reform aimed at removing protection and artificial stimuli and reorienting the economy in the direction of comparative advantage.

3. A Statistical Profile of Agricultural Poverty

In statistically outlining the poverty profile, it is useful to contrast the characteristics of the poverty farms as defined in the earlier sections, against those of the other or non-poverty farms. The following table summarizes the different attributes between poverty farms (PF) and other farms (OF).

Table 1 — Poverty Farms and Other Farms Compared, Republic of Panama, 1970[a]

	Characteristics or Items	Source (b)	PF (a)	OF (a)
1.	Absolute number of farms	IV-6	21,680	70,381
2.	Relative number of farms (%)	IV-6	23.6%	76.4%
3.	% area by each category of farms	IV-6	1.0%	99.0%
4.	Average size of farm (hectare)	IV-6	0.95	29.50
5.	% farms by owners with title	III-6	12.4%	23.1%
6.	% area by owners with title	III-3	11.1%	41.4%
7.	% farms with farming as main occupation	III-6	73.6%	89.0%
8.	% operators age 55 +	III-4	22.7%	28.8%
9.	% operators age < 25	III-7	8.8%	5.5%
10.	% area cultivated by tenant	III-9	14.4%	6.0%
11.	% farms using organic fertilizer	I-4	0.6%	1.0%
12.	% farms using inorganic fertilizer	I-4	4.9%	8.9%
13.	Average rate of application (gross weight, inorganic)			
14.	kg. per ha.-land applied	I-4	571	518
15.	kg. per ha.-all land	I-4	22	19
16.	% farms with land in fallow	III-19	6.6%	40.3%
17.	% area in fallow	III-19	3.7%	10.4%
18.	% farms only 1 year on the land	III-23	20.7%	6.1%
19.	No. persons per farm	III-27	5.1	5.7
20.	No. persons occupied May 9-15, 1971 per reporting farm	III-30	1.7	3.2
21.	No. man-days w/o pay per reporting farm[c]	III-30	6.1	7.9
22.	No. man-days w. pay per reporting farm[d]	III-30	8.2	24.3
23.	No. all man-days per all reporting farm	III-30	6.8	13.0
24.	% farms with paid workers	III-30	8.5%	21.1%

Table 1 (continued)

Characteristics or Items	Source (b)	PF (a)	OF (a)
25. Wages paid man-day (Balboas or dollars)	III-30	1.54	2.82
26. % farms with exclusively unpaid family labor	III-31	92.1%	80.2%
27. % farms which made sales	III-28-36	36.9%	61.7%
28. % farms reporting with sales <B.200	III--36	93.7%	61.0%
29. % farms using only human power	III-40	91.7%	79.5%
30. % farms using animal power	III-40	3.0%	10.7%
31. % farms with off-farm sales by walking	III-43	73.2%	13.9%
32. % households dependent exclusively on farming	III-45	39.9%	66.2%
33. % households whose operators had off-fm. income	III-45	28.7%	13.0%
34. % farms which borrowed in 1970-71	III-46	2.8%	12.1%
Of the borrowing farms:	III-46		
35. % from state institution		74.0%	70.4%
36. % from private banks		4.2%	13.5%
37. % from other sources		21.8%	16.1%
38. % farms receiving technical assistance	III-50	1.5%	3.3%
39. No. cattle per reporting farm	II-10	6.4	43.1
40. No. cattle per all farm (heads)	II-10	0.4	17.7
41. % farms reporting cattle	II-10	6.9%	41.1%
42. No. pigs per all farm	II-20	0.8	1.8
43. % farms with pigs	II-20	23.0%	40.9%
44. No. chickens per all farm	II-24	21.2	42.4
45. % farms with chickens	II-24	83.0%	82.7%

(a) Includes only farms with 0.5 hectares of land or more. "Poverty farms" (PF) are those in size classes 0.5-0.9 and 1-1.9 hectares. "Other farms" are those with 2 hectares or more.

(b) *Censos Nacionales de 1970: Censo Agropecuario,* Direccion de Estadistica y Censo, Contraloria General. Republica de Panama.

(c) Virtually all farms of all sizes reporting unpaid (family) workers.

(d) Only 8% of the poverty farms reported paid workers while 21% of other farms so reported.

A quick summary of the characteristics of our poverty farms follows. As compared with the other farms, poverty farms (1) had only one-thirtieth the land resource on average; (2) were much less frequently protected by land title, without which it is difficult to obtain credit, so that only 3% obtained credit, a rate one-fourth that of other farms (nor did state lending institutions try to correct unequal access); (3) were only slightly less dependent on farm incomes for a living; (4) were not much different in operator's age; (5) displayed much higher tenancy rates; (6) used fertilizer less frequently

(where applied, however, application rates are about the same as on larger farms) as well as at lower rates in relation to international standards; (7) suffered from insecure tenure with the rate of newly occupied farms (of only one year's occupancy) three times as high; (8) had about the same number of persons per farm and almost the same number of family members working on the farm without pay; (9) hired far fewer workers and paid lower wages on the rare occasions when such hiring was made; (10) relatively few (37% as compared with 62%) made any sales — virtually all of them under $200 a year, with marketing done for the most part by walking; (11) relied almost entirely on human power, with only 3% using some animal power; (12) state technical assistance reached few farmers in any size category but this was especially true with poverty farms; (13) only a negligible proportion raised cattle while reporting far smaller numbers per farm as well; (14) the comparative picture for smaller animals was similar, although with less striking differences.

Although comprehensive income statistics is not available at this stage of research to permit a more conventional definition of agricultural poverty, the expedient size-based definition of poverty farms avoids a long list of problems which in the main have to do with (1) presence of transitory income (including the life cycle-related income changes) and their compositional changes over time, and (2) the conceptual and statistical difficulties in making the income statistics all-inclusive. Nonetheless, it may be tempting to make a guesstimate of the poverty farm's annual income. The 1970 census reported that 40 per cent of poverty farms indicated farming as the only source of income and 74 per cent as the main occupation (items 7 and 32, Table 1), while 29 per cent have operators earning some off-farm income. This writer on the basis of his field knowledge of farms at the lowest end of the size-income scale both in the interior of Panama and elsewhere is inclined to place the 1970 per capita income (current prices) on full-time poverty farms (40% total) at perhaps $60 per annum. With the rural minimum wage in 1970 at $2 a day, where applicable, and an off-farm worker often on seasonal jobs, we offer guesstimates of per capita income of $100 for households whose income were mainly agricultural (34% of all poverty farms) and of $150 for the remaining 26 per cent of poverty households that were mainly nonagricultural in source of income. The weighted average per capita income for all poverty farms is $100 in round numbers, or $500 per household. All this is, of course, conjectural and offered as nothing more than a suggestive (probably, generous) "ball park" figure.

4. Economics of Agricultural Underdevelopment

Peasants are economic men the world over. They tend to behave rationally — cost minimizing, output maximizing, or more generally, profit maximizing — subject to the frame of reference (prices, government regulations, institutions, and the state-of-the art) in which they are placed. Because the economic milieu varies, their behavioral patterns may differ apparently. When faced with new (unit) cost reducing production possibilities, the peasant makes a rational decision to adopt or reject the innovation at hand after comparing alternative income outcomes and the added risk that adoption entails.

Innovations are the key to agricultural development. Without them, agricultural production is subject to increasingly severe diminishing returns to resources employed because of inelastic land supply. Feeding increasing populations inexorably forces mankind back to the subsistence level of living. Such was the bleak message of Malthus, Ricardo, and Mill. It was proved false only because of man's ingenuity in achieving new, ever more productive technologies made possible by application of modern sciences (biology, chemistry, mechanics, plant pathology, genetics, hydraulics), a catalogue now supplemented by the "new genetics" and limited tillage techniques. Agricultural production possibilities have become open-ended, unknown to the classicist.

While the stock of technological knowledge grows ever larger, it represents only a potential for countries still using centuries-old methods of farming. To transfer the new technologies, extensive "adaptive" R & D has to be made locally. Given the externalities and scale economies of modern R & D for agriculture, the government has a natural role to assume here. Failure to do so is to leave the country's agriculture mired in low productivity and poverty. As T. W. Schultz has cogently argued, where there is low-productivity, low-income agriculture, the problem is not that the peasants are tradition-bound and negate any demand for new technologies, rather the problem is one of failure on the supply (government) side, incentive issues included. To paraphrase Schultz's colorful expression: Given new profitable production possibilities and efficient incentive (well-functioning markets and prices), the peasant the world over "will turn sand into gold."

The peasant as with most economic decision-makers is a risk-avoider, and innovations entail new risk and uncertainty. It takes time to fully understand the new technology and its hidden con-

sequences. Adoption makes the farmer more dependent on purchased new types of inputs and on increased cash sales to pay for rising out-of-pocket expenses; he becomes, in short, more vulnerable to the vagaries of the marketplace and weather. And although the individual farmers may not be aware of it, under the competitive structure of agriculture and the generally low demand elasticities for its products, popular adoption of what appeared to be profitable innovations leads to depressed market prices that in the long run strip the producers of all but normal returns. The competitive system is marvelous for consumers but is much less kind to the producers. [In this context, one understands a little better why governments in affluent countries whose agriculture faces recurrent innovations and low demand elasticities (price, income, and population) have all come to the aid of agriculture via price support and production control]. Poverty in agriculture can worsen in such a dynamic context. Risk aversion is a matter of degree. In general, poor farmers operating at or close to subsistence are more risk averse than bigger farmers. Small farmers tend to be less willing or to hesitate longer in adopting new technologies, even when technologies are scale-neutral technically, without being any less rational than the bigger farmers who adopt. Small farmers also have lesser access to credit, to markets for the new inputs, and to government services, and with less education, their ability to decode the new technology is more limited. Thus, they see less attractive income outcomes and associated (subjective) probabilities. Failing to adopt the new technology, the small farmers are hit by price declines doubly hard, for they do not have the increased output produced at lower cost to offset the price drop. Here, we have a clue for a dynamic theory of poverty in agriculture.

Fortunately, price declines following innovations need not be universal. In developing countries with high income elasticity of demand for food and high population growth, the problem tends to be of an entirely different kind, namely, supply failing to keep pace with increased demand, leading to rising real price of food. Thus, agricultural poverty in Panama has a double meaning. As a matter of underdevelopment, it means low-productivity and low-income for the bulk of the people in farming. But continued low-productivity (a situation not remediable over the long term by government price support, but requiring improved technologies for solution, as argued earlier), in combination with rising demand for food, means increased urban poverty. This follows because the poorest families spend up to 80 per cent or more of their household budget on basic food (the wage good par excellence). A 10 per cent supply shortfall

can lead to as much as a 30 per cent decline in the real income of these families and in their food consumption. Meanwhile, reduction in real income and food consumption by the rich is trivial. Hunger and severe malnutrition for the poor can be triggered by fairly minor negative movements in basic food supply unless government intervenes.

For Panama, as a small "price-taker" country in international markets, there is no question of driving down prices even if its pending new agricultural policy initiatives should hasten technological advancement at a rate causing supply shifts to outpace demand increases. For Panama can reduce import or move any quantity of excess supply overseas at the ruling world prices. From a commodity price standpoint, the outlook for agricultural development to solve rural poverty is favorable. This is also to say that a successful war on poverty in agriculture basically requires no government price intervention. In the context of Panama's price supports, however, increased agricultural productivity without resource outflow from agriculture would mean increased government budget deficit unless support prices are lowered.

Government intervention in the developing countries tends to begin with a policy of cheap food, both to provide a subsistence floor for the urban poor and to squeeze agriculture in accommodation of high-cost, early-phase industrialization. With limited power of taxation to effect transfers and given the extended period of time it takes for the "trickle-down" process to reach the poor, cheap food is often the only effective way to provide a minimum security floor for the poor, together with some kind of rationing procedure to ensure quantities consistent with the floor. India and a number of other countries siphon off a portion of the basic food supply, sometimes at the processing point, at a low price for the official "fair price shops," where the poor obtain their rationed basic foods at equally low prices. The unrequisitioned amount is sold by the processor-distributors in the free market. The different demand elasticities between the poor and the nonpoor and their interplay with supply elasticities can be such as to produce a higher "blended price" to the producers than the price that would have emerged from a unified market without government intervention. This is not to say that such a happy outcome is usual, nor that, if true, it holds in the long run (Hayami, Subbarao, and Otsuka, 1982).

In general, the outcome of the squeeze policy on agriculture, of which underpricing of basic food is only one aspect, is not so

happy for the farmer. Governments have tended to avoid or to reduce land tax because, as a squeeze mechanism, it is too explicit. Instead, they have opted for more subtle instruments: export tax, export quota, over-valued exchange rate, marketing board operations (IMA in Panama). Under conditions of inflation, these squeeze measures taken in combination tend to rise in intensity in real terms. Soon farmers lose incentive to produce, domestic consumption rises (in part, stimulated by falling real prices), exports decline, and in due course, the country becomes a net importer of food if it was once a net exporter (as many LDCs used to be). As the process goes on, government increasingly realizes the need to restore incentives for the farmers. Producers' prices are raised, but it is less easy to reverse the cheap food policy. All the more so, since import-substituting industrialization is not an approach that favors employment growth and the "trickle-down" process. The poor are apt to become even more dependent on cheap food during this growth phase. As a result, government begins to incur increasing budget deficits from its food operation. Small farmers meanwhile had either fled the countryside to add to the urban slum population or turned into subsistence farmers supplying their own inputs for the most part and producing for their own household consumption. New price signals from government provide neither incentive nor confidence nor the means for small farmers to respond. It is the larger producer who responds. In Panama, the responses have tended to be distorted as the government incentive package itself contained distortions: excessive support prices, interest rate and other forms of capital subsidies, and labor codes raising the cost of hiring agricultural workers. The country's agricultural policy package has done little to improve the poor farmers' resource base and capacity to produce, while weakening the employment effect of the large farmers' response. Nor has the cheap food aspect of the total policy worked very well in Panama; the principal wage good, rice, is more expensive at retail in Panama than in the U.S., and far more so than in South Asian countries where similar policies are pursued.

This is not the place to analyze the implications of the fiscal gap stemming from Panama's agricultural policy. Suffice it to say that it is considered a serious burden fiscally, and the dimensions of the problem (accumulation of excess production, resource cost, and distributive inequity) grow. A rather obvious way to deal with much of the problem without abandoning the basic elements of the policy (low consumer prices and high incentive for producers) is the imposition of a countervailing lump sum land tax. A substantive land tax, with its principle and legal basis properly established, can also be

imposed on other grounds to correct the present skewed land holding and land use pattern discussed in an earlier section.

Meanwhile, as Panama enters a more export-oriented phase of economic development, in and outside agriculture, comparative advantages will be more closely observed. For a labor-abundant country, the new strategy should benefit the poor and the working class in general. As the group's income status rises toward the middle class, a surge in demand for the basic food, grains, is apt to take place for two reasons:

(a) the relatively high income elasticity and the numerical weight of the class, and

(b) transformation in consumption of food from direct consumption of cereals to indirect consumption of grains via meats and other animal products. It takes, on average, 4-5 units of grains to produce one equivalent unit of meat in caloric terms. It is against this background that one can understand Taiwan's "grain import explosion" in the 1970s from what used to be basic food balance a few short years earlier.

The opportunities and challenge for Panama's agriculture implicit in the new development strategy are clear. It is difficult to argue too strongly for agricultural development for the country — a development that makes much economic sense, given the sector's substantial untapped potentials in land use and in its current appallingly low level of productivity and technology. And to return to the poverty subject: Since Panama's agricultural poverty is a matter of underdevelopment, agricultural development is, in effect, war against poverty. Cast in these terms, the undertaking becomes essentially an investment proposition capable of high rates of return, as thoughtfully formulated agricultural programs in other developing countries have suggested.

5. Poverty Theory for Agriculture

Farm as a Firm-Household Complex

Standard poverty theories deal primarily with wage earners and their households and with the characteristics of the poor interacting with the economic environment. In agriculture, the typical economic unit is a family farm which is a household-firm complex. In a market context, the unit is both a utility and profit maximizer. In isolation,

it maximizes household utility subject to the production function. In either case, there is a need to merge the two branches of microeconomic theory which are usually presented separately, the theory of the firm and the theory of the household involving leisure-income choice. One may also note that in agriculture utility maximization via leisure-income choice operates more fully since the choice-making is not constrained by standard work-day and work-week definitions in the cities. The required extension to deal with agricultural household income determination is a complete specification of the production side: resources at the family farm's disposal, the state-of-the-art employed, and conditions of access to input markets serving agriculture.

A family farm is a true microeconomic unit. It has no shares listed at the stock exchanges; it has no national credit rating; it employs almost exclusively unpaid family members. As such, it is totally dependent on the local capital and labor markets. The family labor has no opportunity cost (save for leisure's marginal valuation) if there is no local market and out-migration is taken as a longer-term undertaking. Nor can the farm operator "fire" his family members for low productivity at the margin. Meanwhile, absence of a weekly payroll (to meet) confers on the family farm greater immunity from cash-flow precipitated bankruptcy. Looking at the argument in real terms, a family farm, when pressed by survival-subsistence considerations, is in a position to maximize its output by applying unpaid family labor to the point where marginal product is zero. It is for this reason that the family farm is said to be efficient in a static Walras-Barone sense for countries with overpopulation (Georgescu-Roegen).

But in a dynamic development context, the lack of an effective "weeding-out" instrument to force the unproductive, inefficient producers out of business means that agricultural poverty can persist unless local factor (and product) markets function in a way that permits reorganization of the family farm to reflect market opportunity costs of the factors (Tang, 1958). The burden of the argument here is that location variables bearing on market conditions need to be introduced in the household income determination function in agriculture. (Reorganization may take the form of part-time farming or consolidation of full-time farms).

Standard theory of the firm assumes that all firms are in a position to reach the profit maximizing output level, i.e., they are not constrained by the budget as households are. This assumption re-

quires factor markets that function without imperfection. We have just argued that in agriculture especially, the relevant markets are the local factor markets. It can be added now that extensive research done on geographical distribution of agricultural poverty (Tang, 1958) suggests that the degree of imperfection in local factor and product markets is directly related to the remoteness of the locality from centers of industrial-urban development. Small farms have limited access to markets for yet another reason. Farming is risky; there is uncertainty about the weather and about the price. The latter uncertainty is great in agriculture because of the length of the production period, of the exogenous weather, and of the competitive structure of the industry. Under uncertainty, rational behavior of a (normal) risk-averse individual requires that some profit be foregone for the sake of prudence. Thus, less than the "optimum" amount of borrowing may be sought. Utility rather than profit is said to be maximized. This self-applied restraint is called "internal capital rationing," in distinction from another restraint, "external capital rationing," which is imposed by the lender on small firms operating in risky areas. Both forms of rationing cause the firm to stop short of profit or income maximization, and both hit selectively harder at the small firms.

In farming, because of the inherent risk, the small producers fare all the worse. All the more so under external rationing, if they are tenant farmers, or possess land without title, or are very young or very old, uneducated, producing little for the market, and with large dependent household responsibilities. To complete the argument on risk, it is well to restate an earlier point concerning added new risks implicit in innovation adoption. The fact that small farmers are more risk-averse than their larger counterparts, extends the self-perpetuating nature of poverty to the dynamic realm helpful to an understanding of underdevelopment. In this regard, additional dynamics can be sketched out. Critical poverty implies, in an extreme form, disease, malnutrition, debilitation, abbreviated life span, which in turn perpetuate the low-income condition. Poverty means inability to accumulate savings for one's old age or for a rainy day; the poor, therefore, accumulate children (who are also a producer good) for security. To ensure fair odds for security, the number of births is certain to be such as to lead to subdivision of the family farm until the process is checked by the Malthusian subsistence, or absolute poverty (Tang, 1979). Such is the vicious circle of poverty.

Further dynamic insights into the problem can be had by recalling that modernization of agriculture means, among other things, a

transfer of agricultural activities of an intermediate character to industry. Agriculture, unlike industry, is constrained by space and paced by time sequences set by nature. A crop may take half a year to mature with all the different farm tasks to be performed sequentially along the way, beginning with land preparation and seeding. There is no way to compress these tasks into simultaneity as one can with the assembly of cars in a factory. The momentous invention of the "factory system" never was meant for agriculture. But indirectly, by transferring to an industry not constrained by land space and sequential temporal ordering of processes, agricultural modernization has, in effect, been able to relax the time-space constraint — a feat of immense significance in a development context and in any forward-looking assessment of man's ability to feed his ever increasing number and at ever higher quantitative and qualitative standards. As examples of such activities transfer: electric and mechanical energy replacing power from horses and oxen (which have to be fed by agriculture), chemical fertilizers replacing organic fertilizers (which have to be produced and gathered on farms). Equally important are new inputs and practices which alter the time frame of crop growth, and selective mechanization which eases peak season bottlenecks, so as to permit the planting of two crops a year instead of one, or three crops a year instead of two.

The new production possibilities under modern technologies are limitless. Some are of the Green Revolution type and are particularly suited for small farms endowed with ample family labor. Their economic-technical attributes are land-saving and labor-absorbing. Others are suited for North American-style agriculture with large scale mechanization aimed at conserving scarce labor. Dualism in Panama attests to problems embedded in the system of land tenure and landholding and to price distortions within the segmented structure. At any rate, for the poverty farms the direction is clear, and in relation to their present low level of technology, the potentials are multi-faceted and boundless. To be noted here is the further fact that, technically-speaking, the Green Revolution technology is technically scale-neutral in that the new inputs involved (fertilizer-seed-water) are highly divisible and can be purchased in small quantities by small farms no less well than in large quantities by large farms. This is not to say that economic (non-technical) differences (in price paid, in market access, etc.) do not exist between large and small farms.

One worrisome detail remains. Schultz's thesis about the declining economic value of farm land (1964) is valid for the U.S. and

other developed countries. For the LDCs which use the Green Revolution for modernization, the case is less clear. Given the difference in labor and land supply elasticities and the yield-increasing bias of the Green Revolution, it is highly likely that rising land rent will soak up much of the gain in farm productivity. This analysis is also in the context of relatively strong demand shifts for food. The disincentive posed for the tenant-operators in making innovation-adoption decision and the biased effect on the functional distribution of income are important considerations for a government's land policy which should include land tax, land rent, and land redistribution aspects. In anticipation of the regression model in Section 6, the foregoing arguments suggest introduction of location variables describing the land holding and tenure pattern of the locality in which farms are situated. Such variables, in addition to serving as proxies for the atmosphere for innovations, may also indicate the degree of market access impediment suffered by small holders.

Human Capital Theory Revisited

Following the initial flush of T. W. Schultz's seminal works of the late 1950s and those of his Chicago colleagues and students, the weight of the findings of the human capital theorists began to lose some substance, as versions of screening and signaling roles which schooling is hypothesized to play, made their appearance in the literature. These developments are reviewed and referenced in Professor Sahota's literature survey on poverty theories. This writer, as early as 1961, presented a paper at the Annual Meetings of the Econometric Society, based on his research conducted in 1959-60 during his visit to Osaka University; it was argued that Schultz's methodology of using earning differentials between individuals with varying amounts of schooling raised a number of issues: (1) With education, externalities can be significant, not captured by private earning differentials. (2) Given the linkages between schooling, natural ability (imperfectly measured by I.Q.), family background, and motivation, returns to schooling are overstated so long as I.Q., motivation and family circumstances are also determinants of income. (3) Schooling and academic degrees conceivably may be used by employers as a convenient index for screening job applicants; and where licensing is required in certain occupations (either imposed by government, by private professional associations, or by labor unions) degrees may become "quasi-union cards." The paper (Tang, 1963), which the writer published in a Japanese theoretical economic journal (in deference to the Osaka hosts), began with empirical estimation of real agricultural output of Japan, 1880-1938, net of all in-

put costs, and attributed (after due consideration for all the factors lurking back of the growth accounting methodology) the "unexplained" output residual to a Japanese human investment package whose cost was obtained from a detailed compilation of the relevant government budget items. The econometric tool used was a distributed lag regression combining the inverse of Fisher's arithmetic progression and Koyck's geometrically convergent time profiles. The data reflect social returns (instead of Schultz's private earnings), and they are not muddied up by I. Q., motivation, and family ties considerations since there was no reason to suppose that over the 60-year period there had been net changes in these aspects of the Japanese farm population (whose size has remained stationary, as did the number of farms). Equally important, the family farms in Japan knew their family members and their traits, and there was no need for any labor market screening or signaling devices. What Japan got out of schooling its farm population was the social contributions its educated members made via the production process over and above what would have been the product without schooling. The study under review came close to giving this result without "contamination" by the aspects reviewed by Professor Sahota and summarized here in the context of a specific study. The study is reviewed, at the risk of appearing self-serving, for the purpose of stressing that the agricultural setting offers methodological advantages that other economic settings do not possess for human capital studies.

Absence of the screening-signaling role in the family farm context has been argued. A further distinction is that there are several ways in which schooling can express its production effects: (a) something akin to "technology decoding" and "dexterity effect," (b) factor combination effect (in single-product cases), (c) resource allocation effect (in multi-product cases), (d) profit-maximization effect (where inputs are no longer given but functions of schooling), and (e) on a grander scale, dynamic disequilibrium-managing effect. It is clear that all of these effects become operative if (a) the person in whom education is embodied is not a mere employee performing some specific task or tasks but an entrepreneur-operator (as with a farm-operator) who has embodied in him all of the functions (effects) enumerated above, and (b) for the effects enumerated above to be full, the economic setting must be dynamic. Before Schultz's celebrated *Transforming Traditional Agriculture* (1964), this writer advanced a hypothesis (1959), backed by limited but plausible empirical evidence that in agricultural settings, where for want of developments on both the demand and supply side, farmers generation after generation simply repeated the same processes (well

worked out and fine-tuned by earlier generations), education can have little or no production value.

The point being made here is not who said what before whom. Rather, it is important to realize that education, often seen as a panacea, is economically quite useless (except as a consumption good) unless the economy is undergoing development. The more rapid the development, the higher is education's contribution to productivity. The lesson is especially appropriate for agriculture where the varied ways in which education can contribute economically are least restricted.

6. Regression Results

The Regression Model

The basic regression is a micro agricultural production function in which X_1 is gross value of agricultural output and X_2 a vector of standard farm inputs. Farms differ in technical and price efficiency, depending on their individual characteristics (represented by a vector called X_3) and their individual characteristics of the localities in which they are situated (represented by a vector called X_4). The model is

$$(1) \quad X_1 = AX_2^{\alpha} e^{\beta X_3 + \gamma X_4}$$

or

$$(2) \quad ln\, X_1 = ln\, A + \alpha\, ln\, X_2 + \beta X_3 + \gamma X_4$$

where A is the scale factor, α the output elasticity with respect to each of the inputs (i.e., per cent change in X_1 for each 1 per cent change in X_2), and β and γ are coefficients to be interpreted as per cent change in X_1 for each *percentage point* change in X_3 *and* $X4$, respectively. It will be seen that all the X_3 and X_4 variables are indexes or rates in percentages, sometimes close or equal to zero. The model chosen is advantageous. The term lnA can be interpreted as the "total input (X_2) productivity" term which is modified linearly by X_3 and X_4.

The data are average farm data for each of Panama's 66 districts reported in the Census of Agriculture for 1970. The census data are supplemented by data on locational (district) characteristics from several other Panamanian sources: Ligia Herrera, *Niveles de Desarrollo Relativo de los Distritos del Pais*, 1970 and Ministerio de Salud, *Necesidades Basicas del Sector Salud*, May 1980. The original plan was to run the regression on 1970 and 1980 data for comparison.

The 1980 Agricultural Census is, however, not yet ready for use by researchers. In a later section of this Report, changes during 1970-80 in the basic structure of agriculture and in the profile of the poverty farms are presented and analyzed within the limits of several *preliminary* computer-printed 1980 census tables made available to the Critical Poverty Project, courtesy of *Contralorio General* of Panama and subject to possible future revision.

X_1 is defined as gross value of agricultural output, as estimated by us from the census crop and livestock production statistics and the national product prices calculated from values and quantities sold reported in the 1970 census. Agricultural census district data permit use of a single input variable, area of land in farms. Omission of non-land inputs which vary in relative importance depending on type of farming and on relative input prices need not pose a serious estimation problem because several variables on farm-household and district locational characteristics serve as controls. Type of farming which bears on input mixes is controlled by per cent of area planted to crops and per cent of area irrigated, while locational variables serve to "hold constant" regional input prices. Land, as the single input, is implicitly a proxy for all the conventional inputs; its exponent or elasticity is thus suggestive of whether returns to scale are increasing, decreasing, or constant.

Theories presented in the earlier sections of this Consolidated Report (containing revised parts of the Interim Report for July 23-August 20, 1983) and knowledge about agricultural production function and the institutional setting in which farming takes place, lead to the following list of explanatory variables. The choice and definition of these variables are conditioned by Panama's data base. The variables, their computer codes and the expected signs of their (net) relationships with agricultural output (or productivity) are presented below.

X_1 or dependent variable

Output: Gross value of agricultural output (PCVA).

X_2 or input variable

Land: Land area per average district farm, or farm size (FS +).

X_3 or farm-household characteristics

Age: % farm operators of age under 25 (FARAG —)
Experience: % operators with under 2 years of farming history (FH-)
Education: Literacy rate — district rate assumed to apply to farm sector (PALFA?)

Tenancy: Tenancy rate, % farms tenant-operated (IENIND +)
Absenteeism: % Farms operated by paid administrator (LFPA?)
Type of farming: % Area planted to crops (ATEPEC +)
Irrigation: % Area irrigated (IAPTA +)
Mechanization: % Farms using tractor(s) (NFT +)
Credit: % Farms receiving loans from private banks (FRCPB +)
Marketing: % Farms doing marketing on foot (FMGF —)
Extension: % Farms receiving technical assistance (TASS +)
Title: % Farms without legal title (FWT —)
Fragmentation: Average number of parcels per farm (AVG —)

X_4 or district characteristics

Road: Density of road (1974) (DCXS +)
Growth dynamics: Annual rate of population growth (TAC +)
Health: Summary index of public health (Health +)
Life span: Life expectancy (LE ±)
Concentration: Gini coefficient of farm size distribution (Gini —)
Poverty incidence: % Farms defined as poverty farms (PF?)
Location economics:
District dummy for metropolitan location —
1 for metropolitan, 0 for other location (DM +)
District dummy for sparse and remote location —
1 for S-D location, 0 for others (DSR —)

Empirical Results

Table 2 presents a summary of the empirical results. The preeminence of land or farm size as a determinant of output per farm is as expected. The estimated output elasticity with respect to land (0.828) is suggestive of decreasing returns to scale. The import of the missing input variables (labor, capital, fertilizer and other current inputs) is made less critical by the use of certain control variables to hold constant type of farming, practices, and relative input prices. On the whole, the regression results turned out to be quite satisfactory and capable of useful and interesting interpretations — all the more so in light of the severe data limitations.[1]

Age (of the operator) in farming is likely to be non-linearly related to productivity. Regression experiment with an "under-age"

1 This is a good place to acknowledge the valuable contributions, especially in data assembly and computation, of Miss Leda Arrue and Mr. Antonio Olivita, in their respective capacity as graduate research assistant and computer programmer for the project on assignment from the Panamanian Ministry of Planning and Economic Policy.

(<25 years) index failed to produce the expected negative effect on productivity. It is doubtful that a combination of "under-age" and "over-age" (55 +) indexes would produce different results since variability in the two indexes tends to be offsetting. A plausible interpretation of the finding is that under the traditional "chuzo" (digging-stick) technology prevalent on the small farms, skill plays a limited role and that, under the "extended family" arrangement in rural Panamanian household setting, variations in the age of the operator need not be accompanied by similar age differences among the family workers. The insignificance of management experience of the farm operator (via FH variable) as a determinant of productivity can be explained in similar terms.

Table 2

DEP VARIABLE LPCVA

Source	DF	Sum of Squares	Mean Square	F Value	Prob F
Model	13	33.715666	2.593513	24.651	0.0001
Error	60	6.312440	0.105207		
C Total	73	40.028106			

Root Mse	0.324357	R-Square	0.8423
Dep Mean	6.570437	Adj R-Sq	0.8081
C.V.	4.936609		

Variable	DF	Parameter Estimate	Standard Error	T for HO Parameter = 0	Prob T
Intercep	1	3.338155	0.479830	6.957	0.0001
LFS	1	0.826791	0.134452	6.149	0.0001
LE	1	-0.00556453	0.003549566	-1.568	0.1222
TAC	1	0.061792	0.017430	3.545	0.0008
IAPTA	1	0.084355	0.020311	4.153	0.0001
FRCPB	1	0.019439	0.006243505	3.113	0.0028
ATEPEC	1	0.024030	0.005884897	4.083	0.0001
HEALTH	1	0.004504182	0.002482578	1.814	0.0746
DSR	1	-0.172091	0.167793	-1.026	0.3092
DM	1	0.244224	0.154753	1.578	0.1198
DCXS	1	0.008083567	0.004199908	1.925	0.0590
PF	1	0.005506355	0.005292238	1.040	0.3023
GINI	1	0.00418102	0.00301289	-1.388	0.1704
NFT	1	0.015052	0.006191582	2.431	0.0181

Despite its positive predicted sign, education, whether represented by the literacy rate or per cent of adult population with primary education, did not exert significant influence on productivity. For Panama this is perhaps not surprising and for reasons not dissimilar to those attributed to the skill and experience variables. Education can have its impact on production through several effects: technology decoding effect, complex dexterity effect, resource allocation effect, profit maximization effect, and disequilibrium-coping effect. As was argued in the earlier human capital theory section, such effects find full expression in agriculture when the sector is undergoing dynamic changes as supply and demand conditions alter under economic and technological development. However, in Schultz's "traditional agriculture," approximated by the subsistence-oriented "chuzo" farming setting, education is likely to have little or no effect on production (Schultz 1964, Tang 1959). A technical point worth noting (which reinforces the insignificant finding) is that when education appears in an income generating function along with inputs as independent variables, its production effect is in part nullified by the specification. Variable inputs whose derived demand is a function of education are statistically held constant. This is an estimation problem that comes under the general heading of endogeneity in econometrics. This is not the place to discuss solutions to the problem. Suffice it to suggest that given the fact that land is the only input in our regression, the endogenous variable issue becomes essentially moot. Lastly, we note that there is no doubt there is some "slippage" in the education variable employed in that it relates to the adult population of each district, rather than its farm operators.

Tenancy, with an average rate of 16 per cent for the country, is scarcely a problem in Panama. In no district did the rate reach 40 per cent in 1970. Recent general equilibrium literature on share tenancy yields conclusions that go against the conventional view predicting suboptimal input demand. While the requirement of perfect markets compromises the empirical force of the theory, some members of the School of "New Economic History" have appealed to historical evidence from tenancy contracts in reaching similar conclusions against the conventional view. More generally, as Schultz has long ago pointed out (1940), the conventional view on share tenancy becomes untenable when placed in a context of risk and uncertainty

and factor market imperfections. We take the expected impact of tenancy on productivity to be uncertain. The regression estimate is consistent with this expectation, with the estimated parameter being not significantly different from zero. Absentee or corporate ownership where the farm enterprise itself is operated by paid managers or administrators showed no significant effect. We have earlier predicted uncertain effect.

Type of farming, as represented by per cent of area planted to crops (a high value-added activity per unit area as compared with pasture for grazing purposes), is expected to have a positive effect on farm productivity. This is confirmed by the highly significant estimated parameter. Panamanian agriculture can be fairly described as extensive farming, with only 15 per cent of its farm land in crops (annual and "permanent" or tree crops). Most of the rest was in pasture, both sown and natural, but a large fraction (unusual by standards of modern farm practices) was allowed to lie in fallow. There was also a great deal of variability in land use, with the type of farming variable ranging from a low of 2.6 per cent to a high of 67.9 per cent. Irrigation is expected to exert similar effects on farm productivity by raising yields, reducing their variability, and sometimes by allowing multiple cropping. This is confirmed by the estimated parameter. Both variables also serve to control for non-land input use in the context of our single-input specification. Irrigation is especially crucial to the "Green Revolution" technology centering on fertilizer-responsive new high-yielding seed varieties. Panama does not produce its own locally-adapted seed varieties through adaptive research and development, and is resorting primarily to imports instead. On this point, the size of the economy is critical. Panama is spending a somewhat larger fraction of GNP (under 0.1%) on agricultural research than does the United States (about 0.04%). But in absolute dollar amounts, Panama's 1980-81 expenditures come to only $3 million (mostly spent on non-current items and including USAID contributions of $6 million over five years — Sahota, 1983) — a sum too small for modern agricultural research where scale economies loom large — as compared with a 1980 U.S. budget of $1.1 billion (Schultz, 1983). In this perspective, cooperative and coordinated agricultural research among Central American nations is a natural suggestion.

Irrigation, unaccompanied by seed variety improvement, can be singularly unrewarding. At any rate, irrigation as an investment is subject to the rate of return test. Relatively few fields are irrigated in the U.S. as compared with East Asia where the economics of farm-

ing is quite different. The fact that our regression result suggests an expected rise of 8 per cent in agricultural productivity for each percentage point increase in relative irrigated acreage need not mean that further extension of irrigation is warranted in Panama under the current agricultural state of the art.

Farm credit extended by private banks appears to be a significant determinant of farm productivity, although its coverage was limited, with no district showing more than 10 per cent of its farms receiving credit. The regression finding also supports the inference that government farm credit facilities have not served to offset the uneven distribution of private lending institutions across Panama. Otherwise, there would have been no relationship between private bank lending and farm productivity. The poverty profile presented in an earlier section showed poverty farms enjoying far more limited access to organized credit. The regression result is none too reassuring insofar as remedy via state credit intervention is concerned.

TAC, annual population growth rate, is best viewed as a proxy for local economic development. As a measure of change, it is better than indexes of the level of development in establishing the influence of local nonagricultural development on the farm sector. TAC displays great variability ranging from −2.6 per cent a year for Santa Isabel, Colon during 1960-1970 to an astounding 19.3 per cent for San Miguelito adjacent to Panama City proper. In fast growing districts, markets (especially, labor market) function better and agriculture is better served by them. Farms are more nearly able to optimize in response to superior market opportunities which, among other things, raise the opportunity cost of farm family labor. Higher farm productivity tends to be the result (Tang, 1958). It is reassuring that the empirical result strongly confirms these expectations, with each percentage point rise in TAC generating a 6 per cent increase in farm productivity. It is reassuring for one other reason, though implicit in the preceding description of the adjustment process. Since there is no suggestion of nonlinearity in the relationship between TAC and farm productivity across district farms of varying size, we have from our regression result the inference that farms of all sizes do adjust (enjoying the same proportional productivity rise per unit increase in TAC), when given the incentive and means to respond. It should be noted, however, that proportional responses on small farms translate into small absolute improvement per unit (percentage point) increase in economic development.

DM, the metropolitan dummy, is introduced in the spirit of

Schultz's locational hypothesis (investigated in Tang, 1958) which is the basis for the TAC-related hypothesis as well. Panama's official "Metropolitan Area" (the densely populated Colon-Panama City corridor along both sides of the Panama Canal Zone) is hypothesized to exert powerful influences on agriculture beyond what is accounted for by TAC. DM's coefficient, significant at the 6 per cent level, suggests that metropolitan location enabled a farm to increase its resource productivity by 28 per cent. (Calculation of the increase is from the anti-logs of the constant and DM's coefficient.) DM's effect comes on top of the effect that TAC generated for the nine metropolitan districts.

There are two other location variables to be taken up. DSR is a dummy for districts characterized by "sparse and remote farming." Districts in and adjacent to Darien Province, several districts in Colon, Bocas del Toro, and Veraguas Provinces, and the two island districts in Panama Province are so classified (11 districts in all). It is hypothesized that DSR districts suffer disadvantages in production and marketing beyond what an ordinary transportation-communications index may convey. The latter index DCXS is based on road density (an index of kilometers of road per square kilometer of area). DCXS carries an estimated coefficient that is of the correct (positive) sign and significant at the 3 per cent level. DSR's coefficient is also of the correct (negative) sign and significant at the 15 per cent level. By virtue of their having zero road density, the DSR districts suffered a 9 per cent loss in resource productivity relative to the district with the national average density (11.8% in index number with 100% for Arraijan, a metropolitan district). In addition, these 11 DSR districts suffered a further loss in productivity of 16 per cent for farming under severely sparse and remote conditions, in relation to the remaining 55 districts in Panama where the Boserup (1965) conditions were more nearly met. It also turns out that the locational variables did a more satisfactory job in revealing the impact on farm productivity of the complex of forces represented by them than direct measures on marketed surplus were able to do.

Land fragmentation was insignificant in Panama. The country-wide average number of parcels per farm was only 1.4 in 1970, with little district variability around the average. The largest number of parcels was found in Santa Isabel, Colon at 2.1. Not surprisingly, fragmentation did not statistically show any impact on farm productivity. Technical assistance from the state reached few farmers in Panama in 1970. Nationwide, only 2.56 per cent of the farms

received technical assistance, with a range from zero to just under 10 per cent. Poverty farms reported 1.5 per cent as compared with 3.3 per cent for others. Not surprisingly, given its lack of coverage and depth, technical assistance showed no significant impact on agricultural productivity. These two variables were dropped from the regression results in Table 2. The mechanization index NFT, per cent farms with tractors, showed the predicted positive effect on productivity with a coefficient significant at less than 1 per cent. Average level of mechanization was low in Panama with the tractorization index NFT at just 2.4 per cent. NFT's variability is, however, very great, with concentration in those districts with large-scale plantations. Changuinola district in Bocas del Torro and the four plantation districts in Chirigui accounted for 45 per cent of all wheeled and crawler tractors (2,683 in number) in Panama. In fact, NFT acts as a plantation-farming dummy variable. The remaining 55 per cent of the tractors were scattered among the other 60 districts, with a sizeable fraction represented by government-financed tractors made available to *asentamientos* (the Panamanian soft version of socialist collective farms) and, to a lesser extent, to *cooperativas agricoles* and *juntas agrarias*. These organizations numbered 181, 43, and 30, respectively, according to *Atlas Nacional de Panama* (1975, p. 55). In passing, it is noted that production on mechanized state-sponsored farms has declined from 3.5 per cent of the total in 1975 to 0.9 per cent in 1981 (Direccion Nacional de Planificacion Sectorial, Ministry of Agricultural Development), attesting to declining influence of group farming in its dual demonstration of not only mechanized farming in place of the digging-stick or "chuzo" technology, but of alternative farming organization to the family farm. In many instances, failure of the experiment has reached the point where the digging stick has once again returned as the tractors vanished.

The next category of explanatory variables consists of health variables. Variable HEALTH is essentially a public health variable since five of its seven components are concerned with vaccinations and immunizations. Its construction is based on a crude version of factor analysis. Its highly significant (at 4%) coefficient is of the expected positive sign. Life expectancy LE interestingly has a significant (at 6%) negative coefficient. A reasonable inference is that, unlike expenditures on public health measures which required little or no displacement of other household outlays, increased LE in a district is the result of household investment in nutrition and health as well as community expenditures. Furthermore, longer LE induces households to invest more in the schooling of their children. These investments are capable of generating future income streams with

high rates of return. But in current production terms, these investments and working capital and other requirements for farming are competitive, resulting in some "crowding-out" of the latter and, hence, in lower productivity of the other inputs employed.

The size distribution variables are the last to be taken up. The Gini coefficient, as a summary measure of inequality of farm size distribution, has the expected negative sign for its parameter (significant at 8%). The underlying hypothesis is that under extremely skewed size distribution where Gini exceeded 0.9 in several districts (cf. a high national average of 0.784), markets are likely to be less well developed than in comparable agricultural districts with more egalitarian size distribution (with Gini in the 0.5 range as was found in some districts). The poverty farm index PF (per cent of farms of 0.5 ha. or more that were in the designated PF category of 0.5-1.9 ha.) turns out to be not significant under the two-tailed test appropriate for hypothesized relationships without clear predictions as to the sign. Its positive sign is, nevertheless, worth speculating about. With farm size and the Gini coefficient for a district being held statistically constant, a rise in relative PF numbers has to be compensated for by size increases on the part of farms in the larger size categories, i.e., the Lorenz curves intersect each other. Given the vast yield and technological differences between the poverty farms and the large farms, farm productivity tends to be higher, therefore, in districts with large presence of poverty farms. Ministry of Agricultural Development studies suggest yield ratios on the order of 4 to 1 in favor of large farms in rice and corn production. In passing, we note that the Panamanian size-yield relationship is the exact opposite of the relationship in Asian agriculture where basically the same technology is employed on large and small farms. It is also to be noted that the seemingly paradoxical result obtained because of what is being held constant in the regression. The result by no means suggests that having more poverty farms in a district is the way for that district to achieve higher average farm productivity. In fact, the Gini coefficient makes it clear that skewed farm size distribution is detrimental to average productivity.

7. Temporal and International Perspectives

During 1970-1980 the number of "farms" in Panama as reported by the two decennial agricultural censuses showed an improbable increase of some 40 per cent (1980 statistics cited here are from preliminary tabulations made by *Contraloria Generale* for the Poverty Project). The statistical increase came from the unpre-

cedented growth of suburban residences and of rural weekend and holiday residences *(fincas)* owned by affluent city dwellers. These residences were classified as "farms" by census definition inasmuch as their gardens may have yielded a few fruits and vegetables for home consumption. Elimination of such non-farms from the totals of both years produces a much altered picture. The number of real farms (i.e., farms operated by individuals who considered themselves to be in farming) totaled 76,706 in 1980, down slightly (by 2.4%) from 78,577 in 1970. Poverty farm numbers showed virtually no change, 15,916 in 1970 and 16,011 in 1980, a rise of 0.6 per cent. Non-poverty farms declined in numbers from 62,641 in 1970 to 60,695 in 1980, a drop of 3.1 per cent. The decade was thus characterized by essential stability in the size and structure of the sector. For a decade in which Panama enjoyed relatively strong real growth (at 4.6% a year in GDP), failure of agriculture to reduce its farm numbers via stepped up outmigration did little to relieve poverty in the sector. Poverty farms remained unchanged not only in numbers but in average size as well (0.98 ha. in 1970 and 0.99 ha. in 1980), while non-poverty farms enjoyed a 10 per cent increase in average size, from 24.7 to 27.1 hectares.

Panama is classified by the World Bank as an "upper middle-income" country. Value added in its agriculture rose at an average rate of 1.5 per cent in real terms during 1970-81. This is not quite half the average rate of 3.1 per cent for all the other "upper middle-income" countries for which comparable data are available (computed from *World Development Report*, 1983, Table 6). Consistent with this comparison is Panama's 1979-81 index of food production per capita of 102 per cent (1969-71 = 100%) which pales in comparison against the average index of 113 per cent for the entire "upper middle-income" group of countries (21 in all). At the same time, Panama's agricultural labor force accounted for about the same fraction of total labor force in 1970 (51%) and in 1980 (27%) as the group averages (49% and 30%, respectively — *World Development Report*, 1983, Table 21). The gap in per-capita food production is also reflected in comparative food intake levels. Panama's 1980 daily per capita calorie supply amounted to only 2,163, against an average of 2,724 for its peer income group. The figure places Panama dead last (if one properly discounts Iran's caloric intake in view of its unusual circumstances in 1980) among the upper middle-income group, 21 per cent below the group average, and 40 per cent below the group leaders, Greece and Yugoslavia. Even more striking, Panama's per-capita food intake standard turns out to be 3 per cent below the average for the low-income economies (*World Development Report*, Table 24).

On the other hand, Panama ranks well ahead of its peer income countries in such human investment indicators as literacy and life expectancy. Adult literacy in Panama stands at 85 per cent in 1980 as compared with 76 per cent for the peer group; for life expectancy at birth in 1981 the comparative figures are 71 and 65 years, respectively (*World Development Report* 1983, Table 1). It is probable that the above countrywide comparative data also hold for the agricultural sector. From these figures and the earlier comparative statistics on agricultural performance, we have the inference that Panamanian agriculture is characterized by a notable gap between what has been achieved and what is achievable. Hans Singer has long concluded as an empirical generalization that such disequilibria are likely to be accompanied by above-average growth rates in the years ahead. Here, we have a clue for optimism for the future prospects in Panamanian agriculture. It is to be noted that this assessment will be reinforced in the following section where policy implications of this study are discussed.

8. Policy Recommendations

Between 1970 and 1980, poverty in agriculture remained serious and unchanged in Panama. This is true both in absolute number of poverty farms (16,000 in round numbers in both years) and as a per cent of total farm numbers (20-21%). A poverty farm is identified on the basis of "permanent characteristics" of the farm, uninfluenced by transitory or life-cycle income movements. A Panamanian government study (MIPPE 1979) of the profile of poverty estimated that (in 1970 statistics) of the rural poor more than 40 per cent had no formal education; that most of them employed only human power in farming working on small plots of land; and that they tended to farm under "dispersed" conditions at considerable distances (compounded by a general lack of roads) from distribution and information centers and to be burdened with low and uncertain land tenure status. The poverty profile yielded by the methodology in this study confirms the descriptive profile of rural poverty of the government study. The persistence of poverty during the 1970s suggests that neither Panama's relatively vigorous growth rate (at 4.7% a year) in that period nor the government's economic policy for agriculture had been effective in alleviating poverty in that sector.

The regression model builds on the relationships hypothesized in the theoretical sections of this study. The production function itself is an unrestricted Cobb-Douglas in the inputs, with "neutral" shifters represented by variables describing micro farm-household

characteristics and locational (district) characteristics. The estimated coefficients reflect *net* relationships for each of the explanatory variables while holding all others constant. Yet, it should be clear that these variables may interact with one another. Because of numerous complex interactions that may exist among a large number of variables, no attempt is made to introduce explicit interaction terms in the regression. The recommended policy package that follows is, however, best seen as consisting of elements that are complementary to one another, so that in their collective impact on production and income, as may be gauged from the estimated coefficients, the whole is likely to be larger than the sum of the parts.

Among the LDCs, Panama is unique in several essential respects relevant to agricultural policy analysis. About half the land in farms in Panama is publicly-owned (almost entirely by the national government) while some 80 per cent of farms (with little difference between poverty and other farms) reported some untitled public land under cultivation. This ownership pattern (true in both 1970 and 1980) puts the government in an unusually favorable position to correct the extraordinarily skewed farm size distribution (Gini = 0.784). The skewed size distribution made extreme technological dualism (the digging stick vs. North American-style mechanization) possible in Panama; government price distortions made it profitable. The nature of price distortions also sets Panama apart from the ordinary LDCs. While the typical LDC squeezes agriculture in order to have cheap food for its cities and industries, Panama pushes up food prices in order to subsidize agricultural producers. If the corrective doubling or tripling of basic food prices is an open invitation to massive street riots as reform-minded governments in Egypt, Poland, Morocco, and Tunisia, among others, have discovered, price-reform in Panama should be, comparatively speaking, almost easy. Furthermore, if food security, in a most elemental sense, for the masses is a compelling reason for the LDC's cheap food policy. Panama's price policy aggravates urban and rural poverty while benefiting a small number of large commercial farms. It is convenient to place policy discussions that follow under three headings: price reform, land reform, and institutional reform.

Price reform

The regression results show that Panamanian farmers of all sizes are responsive to economic opportunities. This is clear from the significant coefficients on variables reflecting changes in opportunity cost of labor, marketing opportunities, input supply conditions,

credit availability, transport cost, etc. The study's findings also suggest constant proportional response on the part of farms of all sizes. However, in absolute terms, proportionality translates into small responses on small farms and big responses on big farms to the same unit change in opportunities, a fact not entirely reassuring from the standpoint of public policy.

Responsiveness to changes in economic opportunities is reducible to price responsiveness. This is not to say, however, that price reform alone can carry the load. Without altering the basic conditions of the locality in which the poverty farms are situated as well as the farms' own characteristics (especially, education, skills, technological horizon) price incentive alone can do little to remove poverty. Panama's longstanding price support makes the point quite clear.

Price reform in Panama means abandonment of high selective price supports (essentially limited to field crops) and of government import monopoly by IMA in favor of world market prices. Numerous studies in recent years attest to the high cost (in consumer welfare loss and in government budget). Panama as an LDC can ill afford such costs, all the more so since the incidence of welfare loss falls sharply on the poor who spend proportionally more on food and the poor in Panama are far poorer than those in the developed countries whose price support and agricultural protectionism Panama seems to have borrowed. The MIPPE (1979) study cited earlier estimated that 58 per cent of household income was spent on food by the lowest income group (monthly household income in Panama City of less than $100 in 1972) as comared with perhaps 20 per cent for U.S. households below the poverty line.

To accept international (border) prices is to observe the principle of comparative advantage. For a labor-abundant country, such observance maximizes employment and employment growth which are in turn the most basic solution to poverty as a distributional phenomenon. It is also, as Schultz has long argued, the way to maximize returns on human capital in which Panama, to its credit, has invested substantially in the 1970s. Price reform in Panama means removal of capital subsidy for large mechanized farms and of populist labor codes, all tending to overprice labor and reduce farm employment. Finally, price support as the policy instrument to foster import-substitution in agriculture has contributed little, if anything, to that end. MIDA's statistics makes it clear that there have

been no noticeable upward trends in the production of the supported crops. There appears to be a moderate downtrend in wheat production during 1969-83, accompanied by strong declines in planted area. In the case of beans, another staple of importance, the downtrend has been marked in production and planted area. Even the leading staple, rice — the centerpiece of the support program — presents a mixed picture, with essentially long-term stagnation in production and planted area.

The case for price reform seems clear even without the detailed price policy analysis which is the subject of two large-scale studies now under way in Panama under the sponsorship of the USAID and the World Bank. Subject to the more complete findings and recommendations of these studies, the present policy plea is a return to free markets and prices. The dismantling of the price support apparatus might be allowed to take place gradually over a period of several years.

Land Reform

Land reform, broadly conceived, is more feasible politically in Panama than is generally the case in the Third World. The physical dimension of agricultural poverty, as portrayed by a relative number of poverty farms of about 25 per cent cultivating just under 1 per cent of the land in farms, can be addressed through an appropriate redistribution of government-owned farm land which amounts to nearly half of all the land in farms in Panama. Government land is presently farmed by individuals without yielding revenues to the public treasury. But to secure title to such land under his cultivation the farmer must pay the Institute of Agrarian Reform the full "market price" of the land. It is not surprising that the unusual land tenure system has persisted under these circumstances. With costless government land freely available at the "extensive margins," small Panamanian cultivators, with the help of machetes and the digging sticks, practiced the slash and burn method of farming. As the exhausted land is abandoned or allowed to lie in fallow, larger farmers and ranchers, through their force of presence and more advanced farming practices, added these acreages to their "holdings." Poverty farms pushed themselves ever deeper and higher into the remote mountainous interior, while the farm size distribution became more skewed. Regression findings made clear the crucial importance of the locational variables as determinants of farm income. A homestead land redistribution program by making all public farm land (after

setting aside suitable acreages for present occupiers of the land) available for permanent settlement (with title, free except for a documentation fee) by farm households would serve to "reconcentrate" farm settlements in areas with more favorable locational characteristics and with a density suitable for Boserup's growth conditions.

An argument of increasing currency is that economic efficiency can be achieved under any major type of tenure system, including socialist agriculture as a form of land tenure arrangement. This is true, it is argued, as long as all parties to the tenure relationship have clearly defined property rights to entitle them to the fruits of their contributions to production. In the case of state ownership of land, a further proviso is that the state acts, in D. Gale Johnson's apt phrase, as a "good landlord," i.e., behaving in ways tending to promote efficient use of resources (Johnson, 1982, 845-46).

In Panama, there are no clearly defined tenure relationships on the publicly-owned half of the farmland between the cultivators and the state. There are no contractual agreements binding the parties to a set of rights and obligations. (Nor is there an effective land tax on private land or an equivalent "in-lieu" assessment on public land under private use which might serve to regulate land use for greater efficiency.) Mutual encroachment among users of public land further weakens the already uncertain and ambiguous tenure relationships. Failure of the Government of Panama to behave as a "good landlord" has encouraged slash-and-burn style of farming and other uneconomic forms of land use. The Government of Panama may thus be termed a "bad landlord," in Johnson's frame of reference, not because of harsh exploitation or anything else that it does but because of what it does not do: To define clearly tenure relationships and the rights and obligations of the parties thereto.

Johnson, having declared socialist agriculture as being no less eligible for efficiency considerations, went on to say that there are predilections in the socialist system which tend to make the state a "bad landlord." He could have just as well generalized it by extending the argument to state landlordism in general. Without markets (their less than perfect workings notwithstanding) to set land rents, it is difficult to promote economic efficiency from the center. Then, there is the problem of politics and self-serving bureaucracies in the management of publicly-owned land. The inference here goes against the Panamanian experiments of the 70s involving *asantamientos* and other variants. While these organizations can serve other functions than farming per se where scale economies may loom large, there are

superior alternatives available. This will be discussed in the section on institutional reform.

Panama's publicly-owned farmland yields no rental income for the national treasury. By failing to act as a "good landlord," the state has at the same time contributed to uncertainty in Panamanian agriculture and to economic inefficiency and underdevelopment and extreme technological dualism. For policy suggestion, it is difficult not to think of a U.S.-style "Homestead Act." The U.S. Homestead Act of 1862 gave free land to actual settlers. Under a similar law, (1) Panama would transfer public land with title (under appropriate size limitation) to all landless and under-sized *farm households;* (2) present occupiers of public land of longstanding would be allowed to keep and receive title to a portion, subject to size limitation, of the land farmed by them; (3) all such transfers of title are free, except for payment to cover the cost of survey and transaction fee; (4) these steps are best accompanied by a land tax (ideally assessed on potential rather than actual productivity) to be imposed on all privately owned land (including the land title before the land reform under discussion) in order to discourage uneconomic use of land and to raise revenue for the state needed for infrastructural investment and R and D activities for agriculture.

Institutional Reform

Earlier we have noted that the policy recommendations, though offered under separate headings for ease of presentation, are all technical complements to one another. Their interactions cause the whole to be larger than the sum of the parts. More specifically, the price and land reforms as recommended in the above sections will do little to generate sustained agricultural development in Panama unless the dominant chuzo sector is transformed into a modern agriculture.

Modern agriculture requires, in Schultz's frame of reference (1964), as a foundation new production possibilities which generate new profitable investment opportunities. This in turn requires state sponsored and coordinated — but local — adaptive R and D activities to lay the technical ground for the new production possibilities. Beyond that, modern agriculture requires extension of the new technical knowledge to its farmers, ready market access for them to the modern inputs and to credit, markets to absorb its growing output, and opportunities for its members to spend their rising income (as well as to save desired portions of them). In this regard, it is hard to think of an institutional or organizational reform that surpasses

the ubiquitous Farmers' Association (FA) in non-Communist East Asia. The FA is a multi-purpose cooperative, with voluntary peasant membership drawn from nearby villages, which handles such activities useful to the farm community as: banking (savings deposit and loan); processing, marketing and storage of farm products; distribution of consumer goods (including durables and after-service) and of farm inputs; rental and repair of farm equipment and machinery; agricultural extension as well as such other services as health clinic and day care center that the members may choose to have. The FA is also a general information clearinghouse and may act as an agent of the government in implementing public policy and as a contact point between farm people and government representatives in the locality. The FAs are managed by directors elected by the membership and aided by other elected officers. Their charters, by-laws, and annual reports are subject to public regulatory standards and scrutiny. It is well to note explicitly that farming as such remains in the hands of individual family farms. The FAs assume only those functions whose scale-economies requirements exceed the bounds of individual farms.

To return to the earlier complementarity argument, it is useful to remind ourselves that without the "reconcentration" of Panama's farm population, the setting-up of FAs would be virtually impossible in the thinly populated areas, their operations more costly and their benefits more limited. Thus, land reform suggested in the preceding section is complementary to institutional reform. Similarly, price reform is complementary in that it offers an efficient incentive to which farmers, now armed with modern farming techniques and know-how can respond. On the other hand, without efficient incentives afforded by price reform, even the most modern agriculture will stagnate and wither. In the same vein, human investment on which Panama has spent greater effort (relative to GNP) than its peer-income countries is a complement to the suggested reforms as a package. With the lead the country enjoys in this regard (though not well represented in agriculture) and the fact that it is unusually well-positioned to mount the reform package for reasons stated earlier, Panama can have a bright future in its agriculture.

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