Monitoring Indonesian Food Crop Incomes, Wage Rates, and Labor Absorption: Uses and Limitations of the Central Bureau of Statistics Farm Cost Structure Survey (*Survei Struktur Ongkos*)

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ABSTRACT

This export provides an assessment of the available data sources on wage rates and employment in the food crop sector of Indonesia. Analysis indicated that it is difficult to assess changes in real wages due to significant differences in the inflation rates measured by alternative cost-of-living indexes. However, alternative data series showed similar trends in nominal wages over the past decade. The available data on food crop employment are either too incomplete or too micro-level in nature to permit an assessment of trends in labor absorption. Several modifications are suggested to improve the structure of cost survey data for future monitoring of these important indicators of rural welfare.

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MONITORING INDONESIAN FOOD CROP INCOMES, WAGE RATES, AND LABOR ABSORPTION: USES AND LIMITATIONS OF THE CENTRAL BUREAU OF STATISTICS FARM COST STRUCTURE SURVEY (*SURVEI STRUKTUR ONGKOS*)

For more than 20 years, the Indonesian Central Bureau of Statistics (*Biro Pusat Statistik*, BPS) has undertaken an annual nationwide survey of food crop production costs at the farm level. Called the *Survei Struktur Ongkos Usahatani Padi dan Palawija* (Farm Cost Structure Survey for Rice and Secondary Food Crops), the survey collects information on crop output, planted acreage, and the use of variable inputs. Quantity and expenditure data are recorded for labor, chemical inputs, and seed. Expenditure data only is recorded for animal and machinery services and other cash costs. The survey questionnaire asks about irrigation and intensification program status, but provides few data on socioeconomic characteristics of the farm household.

Traditionally, BPS has processed the *Survei Struktur Ongkos* questionnaires by manual methods, publishing the results in highly aggregated provincial or island-group tables that show only a small subset of the farm budget data collected in the survey. The table figures are in per hectare units, thus obscuring any relationship between farm size and productivity. There is information on cash costs for hired labor, but the data on physical labor inputs and implicit wages are available only for rice in special tabulations from the Ministry of Agriculture (MOA). Valuable information on crop varieties, irrigation status, and other technology indicators has been lost in the course of manual processing and aggregation.

Despite these limitations, creative econometricians—armed with heroic assumptions—have managed to coax estimates of key crop supply parameters out of the published tables. Yet these estimated parameters, essential for informed food policy analysis, have often been criticized for using inadequate data. The forms of data processing and publication have also prevented the more straightforward, but equally valuable, monitoring of wage rates, employment, and input use in food crop production.

For the monitoring study's work on comparative advantage and food policy modeling, BPS specially processed the 1989 survey data from 14 of Indonesia's 27 provinces that together contribute about 90 percent of the country's total production of rice and secondary crops. The study provided BPS with two computers, custom software, and training for data entry and cleaning. When data entry got under way, it became clear that the use of computers greatly speeded processing of questionnaires and the preparation of data for publication. Senior staff in the BPS Bureau of Agriculture and Industry Statistics decided that the computerized system would be used routinely for future rounds of the *Struktur Ongkos* survey. Recognizing also that the availability of computer files with household-level data would permit a wide new range of analyses, BPS staff requested that the monitoring study team make constructive criticisms and suggestions on improvements in design of the questionnaire and survey.

This paper represents the formal response by the study team to the request from BPS. We assess the representativeness and quality of the *Survei Struktur Ongkos* data, and offer specific suggestions for changes that would, in most cases, require few marginal costs in data collection and processing. Most of what follows has already been discussed with BPS staff, but there is also new material on agro-climatic mapping and other variables that might be added to the questionnaire, and on possible avenues for cooperation between BPS and other government agencies in future survey design, implementation, and analysis. Our suggestions have arisen in the course of our own specialized analyses of the *Struktur Ongkos* surveys, so it is inevitable that future users with different analytical objectives will contribute points that we have overlooked.

Sample Representation

Sampling for the *Struktur Ongkos* surveys is coordinated with the national program for food crop cuttings from which crop yield statistics are derived. During the late 1980s, the national crop-cutting sample was selected by BPS in Jakarta using the sampling frame of the 1983 Agricultural Census. The 1989 crop-cutting and *Struktur Ongkos* samples were designed to be comparable by commodity and season and proportional in area to official estimates of provincial harvest areas in the 1986 calendar year (*Biro Pusat Statistik* 1988). At the field level, secondary crop cuttings are undertaken by subdistrict agricultural officials (*mantri tani*), while staff from local statistical offices (*mantri statistik*) follow these up with the cost structure interviews.

For rice and the major secondary crops, a total of more than 130,000 crop cuttings have been taken annually in recent years. The *Struktur Ongkos* survey covers a second, randomly selected, 15 to 20 percent subsample of more than 20,000 households. In view of selection procedures and size, the sample should, in principle, provide information on the determinants of food crop productivity that closely parallels the data used for national crop yield estimates.

Crop Harvest Areas

In the monitoring study's report on comparative advantage in secondary crops, the correspondence between principle and practice was judged by comparing indicators of crop supply from the two sources. When these indicators diverge, one must consider the field-level problems that arise due to the sheer difficulty of implementing standardized surveys in a country as large and diverse as Indonesia. We concluded that the *Survei Struktur Ongkos* division that collects data is doing a good job of selecting provincial sample sizes that represent official statistics on harvest areas. The few minor misrepresentations apparent in 1989 would be expected as a result of normal fluctuations in crop supply between agricultural years, since the 1989 sample was designed to represent 1986 production. Although the sample is not intended to be representative below the provincial level, the fit between harvest area and sample shares at the district (*kabupaten*) level is also reasonably good. Sample shares follow harvest areas closely for districts with moderate or low production, but the major production districts for specific crops are under-represented in some cases.

The cost structure survey is designed to capture seasonality in production on a quadrimester (four-month) basis, corresponding to the major data compilation rounds for official food crop statistics. There is variability among provinces in the seasonal representativeness of the cost structure survey. For example, quadrimester harvest shares were represented reasonably well in South Sulawesi and East Java, but the Lampung samples for corn and soybeans corresponded rather poorly to actual harvest patterns. As noted above, the 1989 sample was designed to correspond to the distribution of production during 1986, but year-to-year variability in rainfall will accelerate or delay planting schedules. In both the crop-cutting and farm cost surveys, the timeliness of data collection may be affected by practical constraints such as impassible roads.

Overall, the 1989 *Struktur Ongkos* survey captured regional and seasonal crop production patterns in a manner that represented official statistics more than adequately for our purposes. Such a conclusion was significant, for it allowed us to assume that the importance of production systems for a given crop could be inferred from the sample sizes that emerged in the survey.

Crop Yields

More troublesome, however, were the frequent and significant discrepancies between official crop yields at the provincial level and those derived from the *Survei Struktur Ongkos*, a problem that was anticipated by BPS staff at the time that data entry began. Table 1 compares published BPS figures with the *Survei Struktur Ongkos* data after the latter were cleaned carefully. The crop-cutting

Table 1. Secondary crop yields in 1989, in kilograms per hectare

	Irrigated Paddy				Corn			
Province	Official	S.O.	% Diff.	*N*	Official	S.O.	% Diff.	*N*
Aceh	3,870	4,380	13.2	539	1,969	2,365	20.1	34
S. Sumatera	3,350	3,620	8.1	475	1,911	2,430	27.2	21
Lampung	4,170	4,230	1.4	293	2,193	2,330	6.2	135
W. Java	5,030	4,650	-7.6	2,245	2,237	2,626	17.4	88
C. Java	5,130	4,920	-4.1	1,640	2,322	2,597	11.8	601
Yogyakarta	5,320	5,200	-2.3	158	1,979	2,175	9.9	69
E. Java	5,260	5,100	-3.0	1,481	2,246	2,844	26.6	965
Bali	5,050	5,640	11.7	322	1,995	2,702	35.4	145
NTB	4,310	3,840	-10.9	296	1,818	814	-55.2	28
NTT	3,020	4,050	34.1	95	1,722	1,807	4.9	357
N. Sulawesi	4,170	4,700	12.7	200	2,024	2,530	25.0	101
S. Sulawesi	4,250	4,470	5.2	765	1,609	1,898	18.0	328
S.E. Sulawesi	3,350	3,228	-3.6	59	1,775	1,790	0.8	105
Overall[a]	4,740	4,690	-1.1	9,265	2,129	2,390	12.3	2,977
Difference as % of sample SD[b]	3.3%				17.5%			
Between-province CV	18.1%	15.2%			11.1%	24.4%		

Table 1. (continued)

Province	Soybean				Cassava			
	Official	S.O.	% Diff.	*N*	Official	S.O.	% Diff.	*N*
Aceh	994	1,308	31.6	85	12,300	8,260	-32.8	14
S. Sumatera	1,094	1,268	15.9	19	12,800	10,286	-19.6	49
Lampung	893	740	-17.2	63	12,800	11,483	-10.3	146
W. Java	1,109	1,010	-8.9	48	12,800	14,120	10.3	160
C. Java	1,202	958	-20.3	201	12,700	14,678	15.6	331
Yogyakarta	1,206	1,157	-4.1	121	12,300	17,229	40.1	54
E. Java	1,158	1,046	-9.7	566	12,300	13,197	7.3	379
Bali	1,146	1,196	4.4	43	13,400	16,828	25.6	27
NTB	1,078	668	-38.1	71	11,300	4,833	-57.2	17
NTT	1,020	1,020	0.0	8	10,900	5,203	-52.3	133
N. Sulawesi	1,051	1,868	77.7	26	10,500	14,356	36.7	35
S. Sulawesi	1,096	1,389	26.8	33	11,200	8,658	-22.7	23
S.E. Sulawesi	1,183	1,267	7.1	31	11,600	3,805	-67.2	18
Overall[a]	1,098	1,068	-2.7	1,315	12,200	12,604	3.3	1,827
Difference as % of sample SD[b]	4.8%				4.9%			
Between-province CV	8.2%	26.6%			7.3%	39.0%		

[a]Overall yields for paddy *sawah* (wetland) include North Sumatera.

[b]Difference as a percentage of sample standard deviation (SD) shows absolute difference between overall yield estimates divided by standard deviation of yield in the *Survei Struktur Ongkos* (S.O.) sample. Between-province coefficient of variation (CV) shows standard deviation of average provincial yields divided by overall mean yield estimates.

estimates are based on the output taken from a standard measurement area, while the cost survey yields represent the farmer's self-reported production divided by the land area planted to a crop.

For irrigated rice, soybeans, and cassava, average yields in the *Survei Struktur Ongkos* sample as a whole are quite close to official national figures. If the latter are taken to represent population means, then *Survei Struktur Ongkos* sampling errors—below five percent of a standard deviation—fall within acceptable limits. For all crops, however, *Survei Struktur Ongkos* yield averages often differ greatly from official estimates at the provincial level. The correspondence is generally closest for rice, but more problematic for secondary crops. With the sole exception of the minor province of West Nusa Teuggara (Nusa Teuggara Barat, NTB), *Survei Struktur Ongkos* corn yields are consistently higher than official estimates. This trend occurs despite a large sample as compared to soybeans and cassava, for which alternative estimates differ, but without a consistent direction.

Official statistics are based upon physical measurements of output at the time of harvest. This should be a superior method as compared to respondent recall. However, estimating per hectare output even from crop cuttings is surely a difficult task for the secondary crops, which are planted at diverse seeding rates, with uneven row spacings, and in complex intercropping systems.

The *Survei Struktur Ongkos* sample size is usually less than one-fifth of that used for crop cuttings. This presumably accounts for part of the discrepancy in yields, but it is also apparent in Table 1 that sample sizes at the provincial level bear little relationship to the magnitude of difference between alternative estimates. Different methods for data recording and validation are also likely sources of discrepancy. For the crop-cutting sample, the enumerator weighs output from a standard fresh crop cutting and measures plant spacings within the field from which the cutting is taken. Secondary crop-cutting measurements are undertaken exclusively by the *mantri tani*, while this task is shared by the *mantri tani* and *mantri statistik* in the case of rice. In the *Survei Struktur Ongkos* interview, the *mantri statistik* converts local post-harvest forms of marketed or stored output to the standard units required in the questionnaire.

As compared to the secondary crops, the two paddy yield forms, harvested dried unhusked rice (*gabah kering panen*) or ground dried unhusked rice (*gabah kering giling*), are fairly easy to record with reasonable accuracy. However, dry unhusked corn (*tongkol kering*) must often be converted to dry seed (*pipilan kering*). In the cost structure survey, farmers may report cassava output in the form of dried cassava (*gaplek*), which must then be converted to fresh root equivalent. If these conversions are not made, estimated yields will be too high in the case of corn, whereas cassava yields would be too low. Imprecision in local units of weight and volume, and the field worker's assumptions about crop moisture content are further sources of error that could bias yield estimates in either direction.

Cross-checking suspicious yields with questionnaire information on output values and prices was the most time-consuming task in cleaning the data set. All data were examined record-by-record to fix obvious data entry errors. This often involved comparison of individual farm records with yield and price information from a given farmer's "neighbors," that is, farms within the same subdistrict (*kecamatan*) and seasonal (sub-round) block that constitutes the basic unit of *Survei Struktur Ongkos* sampling. When necessary, uncorrectable outliers were deleted from further analysis.

One bias toward underestimation of yields doubtless remains in the data sets finally used in our analyses. Implausibly high per hectare values were removed, but it proved more difficult to identify data transcription errors at the low range of yields and input use. Crop yields well below average levels may occur due to the effects of drought, pests, and other growing-season problems. Similarly, yields and input use are low in traditional secondary crop systems, as well as in the dry season when moisture availability is uncertain.

BPS staff point out that the primary purpose of the *Struktur Ongkos* survey is to estimate production costs, not yields. The *Survei Struktur Ongkos* publications themselves estimate gross income based on official yields rather than on the farm production data collected in the survey. Although staff of the *Survei Struktur Ongkos* division have confidence in the quality of their survey, the use of official figures is intended to ensure consistency among alternative BPS publications on the food crop sector.

Indeed, the official yields themselves represent the result of ad hoc adjustments so that statistics from the Bureau of Agriculture are free of extreme year-to-year fluctuations and correspond to figures published by other BPS divisions concerned with food consumption, marketing, and trade (personal communication with Suwandhi, head, BPS Bureau for Agriculture and Industry Statistics). Field observations suggest that crop yields vary more among and within provinces than official figures show. The *Survei Struktur Ongkos* results support such a conclusion. The survey demonstrates differences in farm technology that are logically associated with the yield variation revealed in the data.

Improving the Yield Data

One clear recommendation arising from our experience is that the *Survei Struktur Ongkos* questionnaire should allow different types and, perhaps, grades of output (*bentuk hasil*) to be recorded by the *mantri statistik* as appropriate given local forms of crop storage and market sales in each region. Local units of volume or weight obviously must be converted to kilograms or liters by the enumerator, but corn, for example, can be recorded and coded as "dry and unhusked"—rather than "dry seed"—if this is what farmers store and market. Similarly cassava should be recorded as *gaplek* rather than fresh roots if this is the form that farmers report. Since the data will now be processed on PC computers at BPS, it will be easy and more consistent if the conversions, respectively, to dry seed corn and fresh cassava roots are made in Jakarta rather than by the *mantri statistik* in the field. The necessary change in the questionnaire would be straightforward (simply an expanded set of codes for yield forms) and should simplify the work of the *mantri statistik*, since there would no longer be the task—and scope for error—when making form and value (price) conversions during the farm interview.

An additional change that should be considered is that of expanding the information on the initial crop cutting that precedes the *Survei Struktur Ongkos* interview. Presently, the questionnaire includes the data on crop-cutting weight. This information alone appears to be sufficient to duplicate crop-cutting yield estimates for rice, soybeans, and peanuts, since these crops are harvested from a standard area of 2.5 meters square. Hence, the crop-cutting yield estimate provides a cross-check to the farmer's recall information on total farm output. For corn and the root crops, however, the crop-cutting yield estimate is based on additional measurements of plant spacing and density per hectare, but these data are not copied to the *Survei Struktur Ongkos* questionnaire. If this information were available, cross-checks would be possible for the most problematic crops. Although much of the discrepancy between *Survei Struktur Ongkos* and official yields would be likely to persist, these cross-checks would lead to greater confidence in the *Survei Struktur Ongkos* data themselves.

The Farm Cost Data

Having discussed the primary issues related to sample representativeness, we now turn our attention to the *Survei Struktur Ongkos* data on input use. We focus primarily on wage rates and labor absorption, since these variables combine to determine the incomes of Indonesia's poorest rural groups. Recent policy discussions have contained frequent references to the question of poverty alleviation, yet the information base on Indonesia's rural labor markets is limited. National Labor

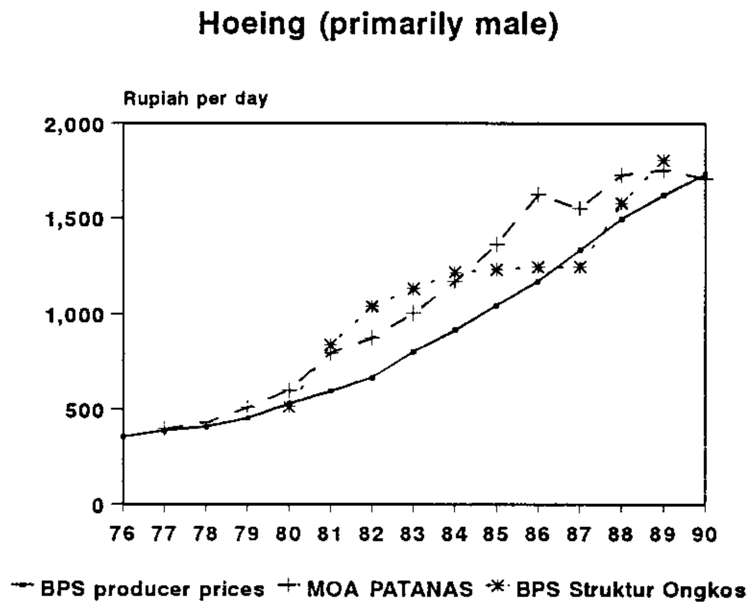
Force Surveys (SAKERNAS) have suffered from changes in format, definitions, and coverage that make time-series analysis difficult (Korns 1987). Regular surveys of wage rates are conducted by BPS and MOA, but information on hours worked is also necessary to estimate labor income. Computerized *Survei Struktur Ongkos* data sets will permit trends in wages and labor absorption to be analyzed as a time series. This objective will be furthered by more complete data processing and a few changes in questionnaire format.

We devote less attention here to the other cost data, but Adinugroho (1992) examines the statistical distributions of input use and prices in the *Survei Struktur Ongkos*. In general, the survey provides clear quantity and cost data on seed and chemical inputs. Information on other costs is in value terms alone, but this was sufficient for the modeling and cost analyses undertaken by the monitoring study.

Rural Wage Rates

The wage rate information available in the *Survei Struktur Ongkos* is implicit, that is, one must calculate a wage rate by dividing the farmer's reported expenditures on hired labor by the number of labor days hired. In contrast, BPS and MOA collect explicit wage data in separate, monthly rural surveys of the major provinces. The BPS producer price survey effort has been in progress since 1976 in 14 provinces, mainly covering wages in rice farming at the *kecamatan* level. The PATANAS (National Farmer Panel) surveys by MOA have been conducted in selected villages of Java and Sulawesi since 1983. PATANAS covers both rural farm and nonagricultural wages, but data collection was sporadic during much of the 1980s because of budgetary problems (personal communication, B. Hutabarat, Center for Social and Agro-Economic Research).

The assessment of trends in wage rates entails a short story at present. Figure 1 shows that the three alternative wage rate series—BPS *Survei Struktur Ongkos* for rice, the BPS producer price series, and MOA's PATANAS—present roughly similar pictures of nominal wage growth in West Java, one of the few provinces for which the PATANAS series is complete. The BPS producer price series is very smooth, perhaps suspiciously so since it is essentially linear from the early 1980s onward. The correspondence between alternative series is closest for planting wages. Although divergences can be seen in the direction of hoeing wage growth between the years 1980 and 1989, all three sources arrive at a similar absolute level in 1990. For the 1976-90 period as a whole, the three series show nominal wage rates increasing at average rates of 10 to 12 percent annually between 1976 and 1990. Hence, the alternative data series provide a reasonably consistent picture of wage growth



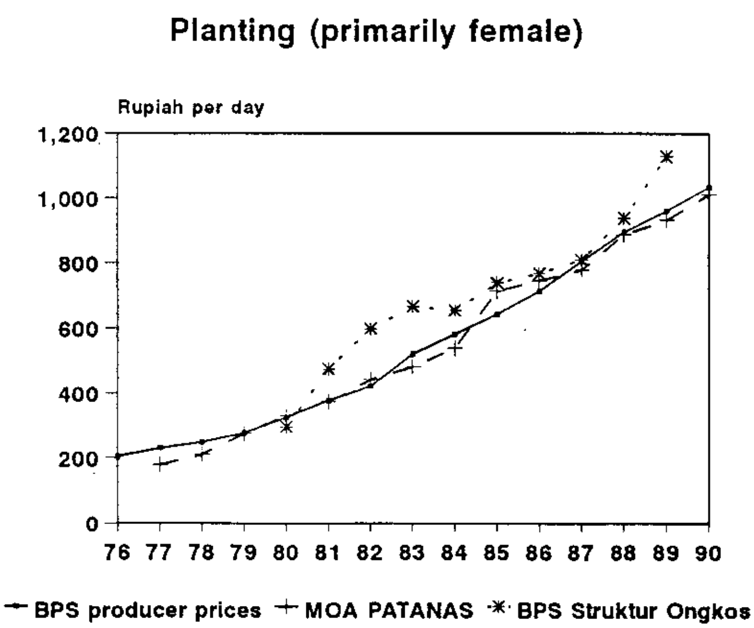


Figure 1. West Java wage rate series

in West Java over the past 15 years. A similar basic conclusion applies to East Java, for which the data are also relatively complete.

Trends are much less clear for the Outer Islands, however, doubtless due to smaller sample sizes and less intensive supervision of data collection. As compared to Java, the *Survei Struktur Ongkos* rice wage series for the Outer Islands show more erratic changes between years, whereas the BPS producer price series often exhibit a step pattern with extended periods of constant nominal wages followed by sudden jumps (*Biro Pusat Statistik* 1991a, 1991b). But there is a consistent pattern in regional wage differentials shown in all wage series. Agricultural wages are lowest on Java, particularly in Central Java, and increase as one moves to the west and east into the islands of Sumatera and Sulawesi.

Economists are, of course, concerned with real, inflation-adjusted wages, not nominal values. Here we are in murky water. Trends in real wages are unclear from the mid 1980s onward because alternative BPS price deflators provide dramatically different stories. Figure 2 shows the West Java producer price hoeing wage divided by four alternative BPS deflators. The individual plots are based upon price indexes with differing base years and, therefore, reflect indexed trends rather than absolute wage levels.

All deflated series present a consistent picture between the years 1976 and 1985. Real wages were more or less constant from 1979 to 1983, but increased quite sharply between 1983 and 1985. It was during these years that Indonesia experienced a sharp increase in rice production and the achievement of rice self-sufficiency, but it would be simplistic to conclude that growth in rice was the sole determinant of growth in real wages (see the discussion of farm diversification and rural labor mobility contained in Rural Dynamics Study 1985). From 1985 onward, however, one would, depending upon choice of deflator, conclude that the real hoeing wage either declined sharply or moderately, or was stable, or increased up to 1989. If attention is limited to the two most plausible rural deflators (the nine basic commodities price index and the farmer terms of trade producer price index), then the picture is one of either stagnation or moderate decline in the real hoeing wage from 1985 to 1990. These results are for West Java, where the data are complete. Patterns off Java are even harder to interpret.

Inconsistency among deflators is due to differences in the basic price series and differences in the weights given to individual items in an index. Three of the four deflators used in Figure 2 are derived from separate BPS price surveys, each encompassing a different set of commodities and weights. Godfrey, Swenson, and Kasryno (1988) demonstrate that the weight given to rice is a key

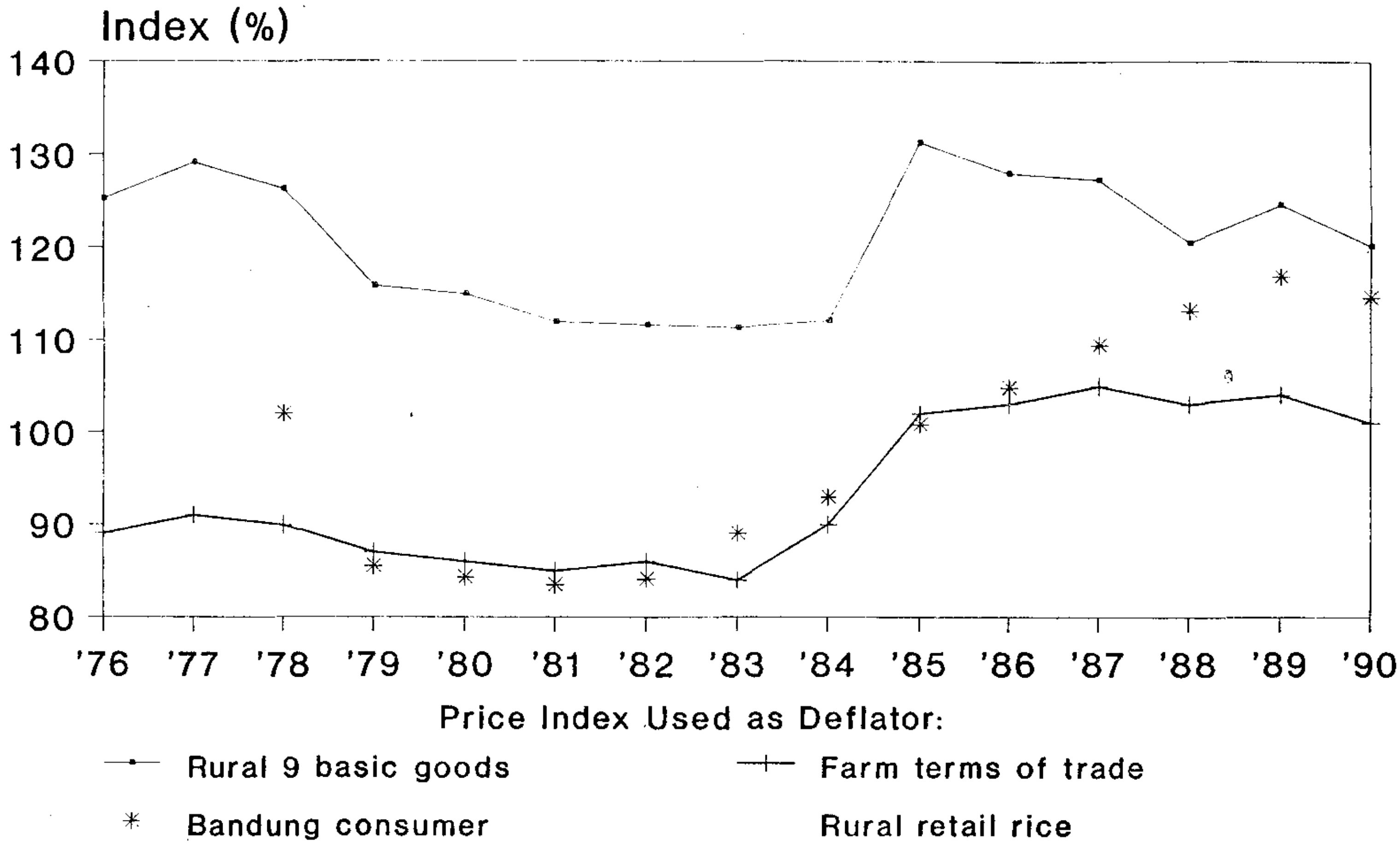


Figure 2. Indexes of real hoeing wages in West Java (all data from BPS)

determinant of estimated real wage changes. Naylor (1990) has shown the manner by which errors in chili pepper prices have distorted the BPS farmer terms of trade index. Other, as yet undiscovered, measurement and weighting problems may exist, but why the divergence among deflators should become so great after 1985 is unclear. Given the importance of wage rates as indicators of rural welfare and development, it would be appropriate for either BAPPENAS or BPS to chair an interdepartmental team for investigating the problem.

Food Crop Employment

Since the time of the intensive village studies undertaken during the decade 1973-83 by researchers at the Survey Agro-Economy in Bogor, there have been few reliable new primary data—certainly nothing at the national level—for assessing trends in labor absorption in Indonesian agriculture (Strout [1985] reviews the history of the Survey Agro-Economy). *Survei Struktur Ongkos* data tabulated specially for MOA provide indicators of hired labor use in rice cultivation alone. The data on family labor and secondary crops have never been processed, so these tables give only a partial picture that may often be influenced by year-to-year variation in the samples taken in some provinces. As is discussed below, inconsistent methods of field data collection may also justify skepticism when interpreting a share of the *Survei Struktur Ongkos* results.

Figure 3 shows average hired labor use in irrigated rice for six provinces in which sample sizes and data quality are deemed adequate. The most striking aspect of the graphs is the high use of hired labor on Java as compared to the Outer Island provinces. With the exception of 1980, during which measured wage labor was exceptionally high throughout Java, around 150 hired labor days were employed per rice crop during the 1980s. No sustained trends are apparent for this period, with the possible exceptions of the steady increases after 1984 in West Sumatera, and the moderate upward trend in South Sulawesi, where hired labor is used almost exclusively in the harvest. It is perhaps notable that hired labor use was lowest during the year 1984 in West and East Java, since it was during the years 1984-85 that real wages appear to have jumped sharply (Figure 2). Given these highly aggregated data, however, it is difficult to do more than speculate about a wage response to labor scarcity at that time, since we cannot control for substitutions between family and wage labor. Although the West and East Java samples are quite large (about 2,200 and 1,500 farmers, respectively), it is likely that the moderate year-to-year changes in labor use are due, in part, to simple sampling variation.

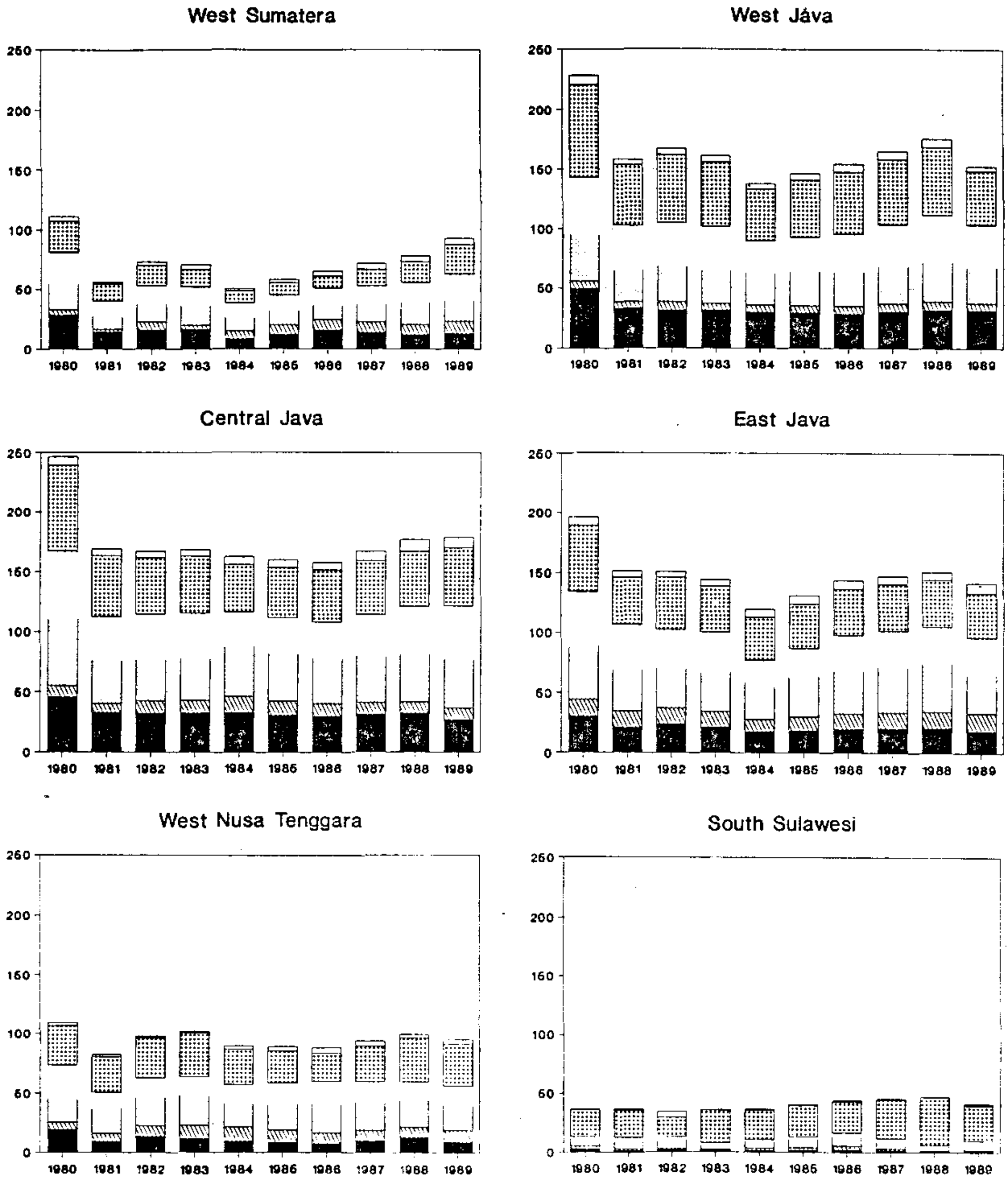


Figure 3. Hired lab[illegible] use in irrigated rice

SOURCE: *BPS Struktur Ongkos*, zero labor days per hectare.

Note: From the bottom, stacked bars show hoeing, plowing, planting, weeding, harvest, and other labor.

Hired labor data for upland rice in the principal producing provinces are presented in Figure 4. The sample sizes are much smaller than for irrigated rice, averaging below 200 farmers per province in 1989. The charts show much greater year-to-year variation, but, again, no clear trends in employment are visible. There are also two cases in which wage labor use declined sharply (South Sumatera in 1982 and East Nusa Tenggara [Nusa Tenggara Timur, NTT] in 1984), indicating that there may have been major changes in sample design or size in these provinces and years. This suggests that as computer files on annual *Struktur Ongkos* surveys accumulate over time, it will be important that BPS maintain some record of problems and constraints arising in survey implementation so as to assist in interpretation of the data as a time series.

Although the figures on hired labor are not, in and of themselves, very illuminating, they are indicative of the type of detailed employment data that will be provided on a regular basis by a computerized *Survei Struktur Ongkos* with the complete data on family labor and wages. It will be especially important to improve clarity in the concepts and coverage of labor use. At present, the questionnaire defines a "labor day" as any work period of at least one hour in duration, without identifying the worker's age and sex. This definition may be acceptable for hired laborers in rice production, but it complicates interpretation of the data on family labor in rice and all labor used in secondary crops.

Hired workers in food crop production are typically adults for whom work hours and wage rates are set on a full- or half-day basis. However, family labor often includes children and may be undertaken for shorter periods. This occurs most frequently in weeding and crop maintenance (*pemeliharaan*). Many farmers report that family members undertake these activities for at least one hour daily throughout the growing season. Extremely high labor figures may result on a per hectare basis, but "daily" doubtless often means simply that the farmer walks by his fields regularly or sends his children out to weed and scare away birds. Much of this work is done in the slack period between planting and harvest when the opportunity cost of family labor is likely to be lower than the market wage rate.

Hoeing and plowing are almost exclusively male activities, but planting, weeding, and harvest may be carried out by both sexes. The implicit wage data suggest that male and female work activities differ by crop. Planting and weeding wages are often relatively low in rice cultivation. Low wages may indicate that these activities are performed by women, but there are also known to be arrangements under which low wages in preharvest activities are compensated by the right to participate in and receive a share (*bawon*) of the rice harvest. Preharvest wages are higher in corn

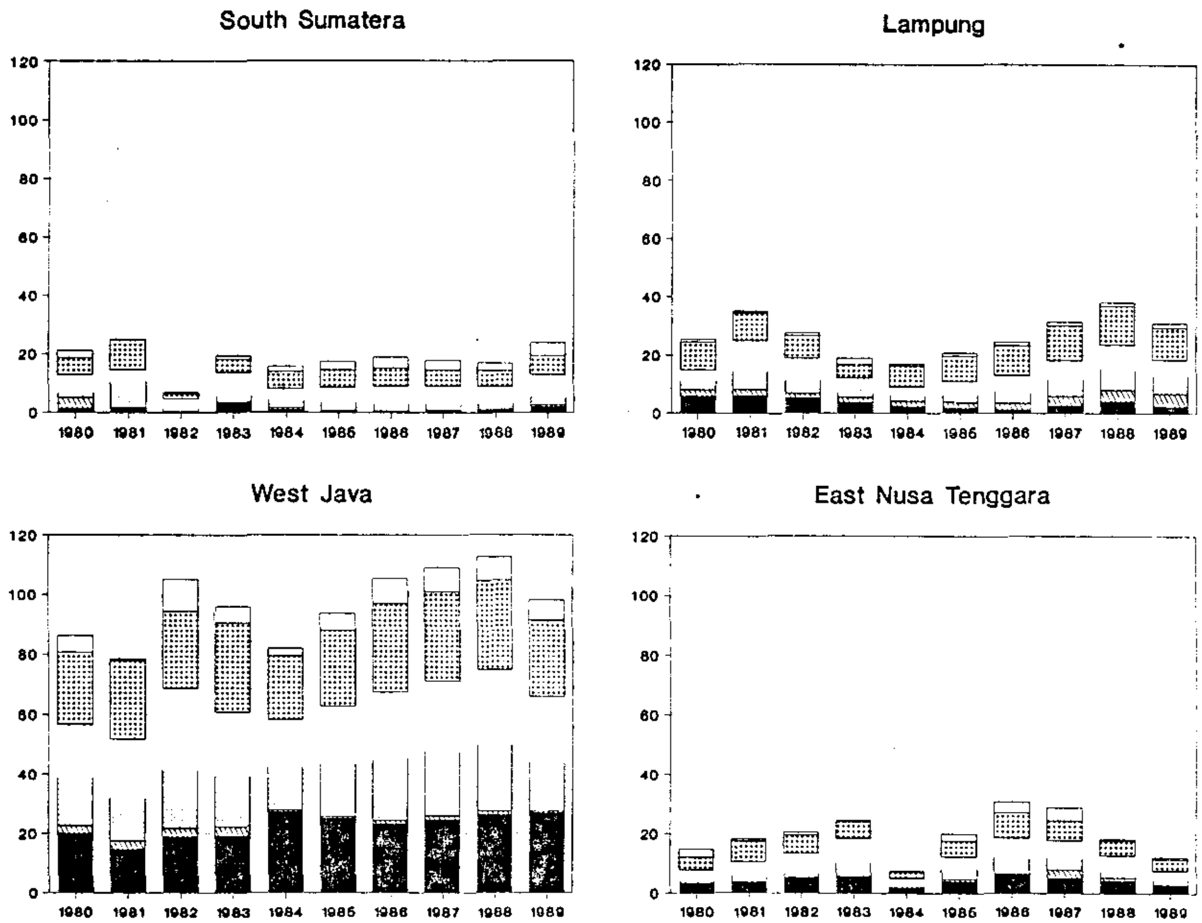


Figure 4. Hired labor use in upland rice

SOURCE: *BPS Struktur Ongkos*, labor days per hectare.

Note: From the bottom, stacked bars show hoeing, plowing, planting, weeding, harvest, and other labor.

and cassava production, but the survey does not reveal whether this is due to a predominance of male labor in secondary crop production or to differing work and harvest share arrangements. The picture would be clearer if gender differences could be distinguished, in addition to there being greater clarity in the definition of a "labor day."

Improving the Employment and Wage Data

Survei Struktur Ongkos information on "labor days" (both family and hired) should be published routinely. In addition, several changes in the questionnaire should be considered. The "labor day" should be redefined so that only sustained, intensive activities are recorded. There are two alternatives for this. A workday might be defined as a period of at least three hours on any given day, not one hour as now. Or, a standard half-day unit could be used, with the workday being recorded as either "early morning until noon" (*pagi sampai siang*) or a "full day" (*pagi sampai sore*) depending upon local custom.

Choosing between a three-hour versus a half-day definition would require some thought with a view to the practical difficulties encountered by enumerators in the field. The three-hour definition would more accurately capture sustained work effort, but it would complicate the interview since it requires that the farmer think in terms of hours. The half-day definition follows common practice and does not require calculation of hours, but it would likely lead to some underestimation of total family labor use. As noted above, the problem of day length is less troublesome for non-family workers since it is customary for such labor to be employed for either a half or full day even when mutual self-help activities (*gotong-royong*) are practiced.

Male and female labor should be distinguished in the questionnaire so that differences in labor use and wages by gender are clear. It is also desirable that information about daily wage payments be recorded explicitly for farms that use paid farm laborers. The information should indicate whether the wage is for a half day or a full day, and the definition of wage should include the value of meals and cigarettes. As compared to other wage rate surveys, the *Survei Struktur Ongkos* could provide a consistent set of wage and employment data that is national in scope and more specific to crop and labor task.

Land

The value of land is often the largest component of farm production costs. Land is also the most difficult input to value with precision, since it is not an explicit cost of production for farm owner-operators. The value of land is determined by a variety of characteristics that affect productivity and costs: soil fertility, slope, investments in terracing and irrigation, and location with respect to roads, markets, and non-agricultural activities. Most of these characteristics are not presently captured by the *Survei Struktur Ongkos*. Irrigation status is recorded, but there are no data on slope and soil type that are major determinants of productivity for the rain-fed secondary crops.

The questionnaire's sections VI.1 through VI.3 request information on land tenancy and rental costs. These data can be used for estimating land costs as one part of total production costs. In the 1989 survey, about 9 percent of the sample farmers reported renting land in arrangements that were about equally divided between cash rental and share tenancy. With the present questionnaire, however, it is often unclear whether the farmer's response to the questions refers to the land from which the survey crop was harvested or to other plots. The data would be much more useful if there were additional questions that asked about the size and irrigation status of rented plot(s). In addition, with the addition of a simple zero-one code for the direction of the transfer, it would be possible to enlarge the sample of observations by requesting information from landowners who rent land out to other farmers.

Field Problems

In the course of cleaning and analyzing the data, we encountered problems that arise in the course of completing and editing the *Survei Struktur Ongkos* interviews in the field. Most glaring among these was an almost perfect homogeneity in per hectare labor use figures for all crops in North Sumatera. Suspicious regularities also appeared in input and cost data from other provinces, but usually at the level of individual sampling units; that is, four to five farmers interviewed in a given season by a single *mantri statistik*. Since so few data from the questionnaire have ever been processed and published by BPS, it is understandable that field workers may attempt to reduce unnecessary costs of data collection. Labor use questions are typically the most time-consuming part of a farm interview and, hence, these are the prime candidates for time-saving efforts. Since the *Survei Struktur Ongkos* data will now be available for analysis in household-level form, additional training of field workers is desirable, particularly if it is decided to modify the questionnaire as proposed in this report.

Reducing an Irrelevant Survey Section

The present *Survei Struktur Ongkos* questionnaire is a lean survey instrument, but could be made leaner still. We do not see the purpose for section VII on "end-of-year food stocks." If the objective is to measure household food security, then the data should capture food stocks during the preharvest (*paceklik*) months, which often do not correspond to the end of the calendar year. For example, the main corn harvest often occurs in December in East Java, but in March in NTT. Given the present format, a comparison of these provinces would show high stocks in East Java and much lower stocks in NTT at the end of the calendar year, but this information clearly does not permit conclusions to be drawn about relative food security in the two provinces.

Additions to the Questionnaire and Survey Format

The previous section examined ways in which the *Struktur Ongkos* survey might better achieve its primary objective of providing broadly representative information on input use, costs, and incomes in food crop agriculture. The present section proposes the addition of several new variables that would sharpen cross-sectional analyses of cost, supply, and income differences among regions and socioeconomic groups. We are fully aware that survey costs will increase with greater comprehensiveness of the survey instrument, so the discussion addresses some of the likely costs of the changes we propose. Any decisions to adopt our proposed changes should be made in interdepartmental discussion among parties that are separately responsible for implementation (BPS), analysis (MOA), planning (BAPPENAS and MOA's Planning Bureau), and funding (BAPPENAS).

Exogenous Farmer Characteristics

Econometric analyses of cross-section data are often complicated by a statistical bias known generally as "sample selectivity," that is, unobserved (and, at times, unobservable) processes by which households make choices that determine their membership in sample subgroups. For example, most rice farmers use urea and TSP, but some belong to the subgroup using no chemical fertilizers. Some farmers participate in crop intensification programs, but many choose not to. Some farmers plant improved crop varieties and some do not. In regression analyses that seek to "explain" crop productivity and income, the use of zero-one dummy variables to control for group membership produces biased parameter estimates insofar as the farmer's choice of group membership is the result of an endogenous decision-making process in which cropping intensity, expected yields and income are determined simultaneously.

In practice, the magnitude of this bias is influenced by the relative proportions of a sample falling into various subgroups. For example, urea is used by more than 90 percent of irrigated rice farmers in the *Survei Struktur Ongkos* sample, but less than 20 percent of farmers apply any potassium. Hence, as compared to urea, a much larger bias would result if one either "dummys out" or simply deletes non-users of potassium from the analysis.

In regression analysis, straightforward two-stage estimation procedures are commonly used to correct for endogeneity and sample selectivity bias. In the first stage, fixed, exogenous characteristics of the farmer are used to predict either group membership or the values of other endogenously determined variables for individual households. These predicted values, or statistics derived from them, then substitute for the original data in the second-stage analysis of factors influencing crop productivity and income.

The *Survei Struktur Ongkos* questionnaire presently provides little information on exogenous characteristics of the farm other than irrigation and land tenancy (with the latter being arguably endogenous). There are data on location (*kabupaten* and *kecamatan*), but these are not ideal proxies for distance and village accessibility that influence decisions on input use and participation in intensification programs. The survey provides no data at all on exogenous characteristics of the farmer, for example, age, years of experience, sex, and education level. For farmers planting secondary crops on dry fields, it would be ideal to have some information on land slope and terracing.

The addition of questions on the above farmer characteristics would be straightforward, require little additional interviewing time, and could greatly improve the robustness of econometric analyses. Similarly, it would be fairly easy to add a question on the approximate distance between the farm household and the nearest market. Data on landforms would be more difficult to measure accurately without significant changes in field survey techniques (see below), but would be highly desirable in the analysis of productivity.

Agro-climatic and Landform Characteristics

Official estimates of crop productivity are made by administrative region, thus obscuring the variations in soils, climate, and land use that influence productivity within provinces and subprovincial districts. It would be highly desirable to capture regional agro-climatic variability and, at the same time, to be able to relate this information back to the administrative units in which extension and other programs are planned and implemented. The monitoring study's work on comparative advantage took a step toward this goal by linking the *Survei Struktur Ongkos* data with a map of Indonesia's agro-climatic zones that was developed at the Agency for Agricultural Research and Development (Las et al. 1991). Although drawn at a very small scale, the map was able to distinguish productivity and cost differentials in a few agro-climatic domains.

More sophisticated computer digitization of land-use maps is currently being undertaken in Indonesia at government agencies dealing with land-use planning, integrated pest management, and water resource development. The linkage of such land maps with the *Survei Struktur Ongkos* sampling design could be a fruitful area for future cooperation between BPS and these agencies. If sample units—farms, households, or census blocks—could be located more precisely with respect to agro-ecological zones, it would be possible to better quantify the environmental characteristics associated with productivity, incomes, and poverty. Such information could be valuable for more efficient targeting of a variety of public programs in agriculture. If linkages were also made to income and expenditure surveys such as SUSENAS, the National Socio-Economic Survey (*Survei Sosial Ekonomi Nasional*), there would be potential benefits in a wide range of programs for public health, nutrition, and poverty alleviation.

Such a cooperative undertaking would require careful preparation, a full discussion of which is beyond the scope of this report. But we can outline a few modifications to the present *Survei Struktur Ongkos* questionnaire that would sharpen the understanding of the relationship between agro-climatic environment and productivity.

It would be helpful if there were additional information on landform characteristics, particularly in rain-fed crop production. Thought should be given to adding simple questions to indicate the approximate slope of rain-fed soils and whether or not the soils are terraced. Elevation also has a strong association with crop productivity. While it would doubtless be impractical to provide altimeters to the *mantri statistik*, it should be possible for them to roughly estimate elevation by relating the location of a sample farm to some nearby location of known elevation, for example, the administrative offices of the *kecamatan*.

Productivity is also strongly influenced by pests, diseases, rainfall, and soil type. The questionnaire presently asks about agronomic problems that affect harvest conditions, but the data suggest that the *mantri statistik* may often have an insufficient technical background to interpret and probe the farmer's response. For example, downy mildew, a serious disease of corn, is sometimes cited as a growing-season problem in rice, cassava, and soybeans. Over and above errors in diagnosis by the farmer, the presence or absence of growing-season problems often bears little relation to the farmer's assessment of whether the harvest was above or below normal. Specific pests and diseases may exist to some degree every season, so that the farmer has come to accept the condition as normal. In analyzing the data set, however, it is difficult to interpret the impact of growing-season problems since there is no objective indication of their severity.

Since an individual *mantri statistik* worker normally conducts no more than five *Survei Struktur Ongkos* interviews for a given crop and season, it should be feasible to undertake interviews or, at least, edit the questionnaires in cooperation with either the *mantri tani* or the local agricultural extension worker. A brief supplement to the questionnaire might contain technical questions on soils, slope, and local cropping system constraints that would be completed by agricultural officials. By taking advantage of their technical expertise, it would be possible to increase, with little cost, the survey's information on agro-climatic determinants of productivity, in addition to improving the data on growing-season problems. Such cooperation would be a natural extension of the collective effort currently undertaken in the crop-cutting survey just prior to the *Survei Struktur Ongkos* interview.

Intercropping

The *Survei Struktur Ongkos* questionnaire presently contains a simple "yes-no" question about whether a given crop is grown in monoculture or interplanted in a mixed stand. Although rare in irrigated rice production, intercropping was practiced by almost 30 percent of the farmers planting upland rice and secondary crops. Yields of individual crops may be lower in intercropping stands, but overall land use is more intensive and incomes are often higher as compared to those for single crops planted in monoculture. Moreover, production costs of individual crops should be lower in mixed stands, since labor inputs and some cash costs are spread over two or more crops (see the discussion in Falcon et al. 1984). However, it was impossible to allocate these joint costs in our comparative advantage study since the survey provides no information about the types of intercrops, or about their contribution to farm income.

Seasonal intercropping is often part of an overlapped sequence of planting and harvest activities undertaken throughout the agricultural calendar. Going one step further, food crop production is merely one of various agricultural activities undertaken by Indonesia's farm households. In interpreting the *Survei Struktur Ongkos* data, one must bear in mind that the survey captures seasonal costs and returns of specific food crops, but it does not measure annual farm income and welfare. Fully capturing annual incomes would require much greater complexity in the sample design and survey instrument. BPS conducts periodic surveys of total farm income (the *Survei Pendapatan*

Petani, Farmer's Income Survey), but these provide much less detail on production costs than is contained in the *Survei Struktur Ongkos*.

Given limited budgets, we cannot recommend that the survey be redesigned so as to provide detailed annual data on all farm activities. However, by adding a few additional questions on intercropping, the present survey would permit more accurate estimation of costs, incomes, and supply responsiveness in food crop production. It would be straightforward to request data on output and values of the intercrops. These data would need to be coded as "actual" or "expected" depending upon whether harvest of the intercrops had occurred at the time of the interview.

Cooperation between BPS and Other Departments

BPS is Indonesia's undisputed authority for the publication of official statistics on the agricultural sector. Although BPS undertakes and processes most national surveys of food crop production and costs, this agency nonetheless depends upon a variety of MOA offices for basic data on crop areas, secondary crop yields, and land use, in addition to all production data for agricultural subsectors such as tree crops, livestock, and fisheries. BPS cooperates on a routine basis with MOA in the collection of paddy yield data, as well as with MOA and the National Logistics Agency (*Badan Urusan Logistik*, BULOG) in surveys of paddy and secondary food crop prices (*harga gabah dan palawija*) at the producer level. Our observations indicate that these cooperative undertakings have been very successful in improving data consistency and quality. For this reason, we believe that cooperation in the *Struktur Ongkos* survey is quite feasible and likely to benefit all organizations.

The monitoring study's interim report argued that cooperation between departments can be most beneficial when it takes advantage of the relative strengths of each institution. BPS has a strong comparative advantage in mass sampling, data collection and processing, but more limited competence for analytical studies related to agricultural policy. In contrast, agencies within MOA often face resource constraints in primary data collection and processing, but they have greater technical knowledge of agriculture and are best able to determine information needs for planning and policy. Logic dictates that these technical agencies should play a lead role in determining data needs and undertaking analysis, letting BPS take major responsibility for designing and conducting surveys, and for processing data into the form desired for analysis.

Given MOA's greater understanding of regional patterns of agriculture, central MOA agencies, in cooperation with regional offices of BPS and MOA, should also play a part in survey implementation and data validation, both in the field and when data processing occurs at BPS. BPS has final authority over data collection, so the appropriate role for MOA is to support rather than to supervise these activities. The purpose would be to develop a shared understanding of technical issues of concern to MOA (e.g., the implications of current policy issues for data requirements) and practical constraints faced by BPS (e.g., field problems in survey implementation). Such cooperation would well serve the ultimate, mutually beneficial goals of improved efficiency, comprehensiveness, and quality in data generation and analysis.

The previous section suggested that data quality and comprehensiveness would be improved by coordination in the field between the *mantri statistik* and agricultural workers at the *kecamatan* level. We have also proposed that a central team be formed to monitor and evaluate trends in rural wage rates and price levels. Additional efforts can be made to cooperate in improving the *Survei Struktur Ongkos* questionnaire in ways that would certainly not be limited to the changes we have proposed here.

A final area of cooperation lies in future survey design. Beginning in 1992 or 1993, BPS plans to replace the annual food crop survey with a triennial rotation of cost structure surveys covering food crops, perennials, and other subsectors. We recommend that BAPPENAS, as planning and funding authority, chair a formal working group to ensure that survey design and implementation are fully consistent with the information needs of policymakers, planners, and analysts.

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