GROWTH AND EQUITY ASPECTS OF ALTERNATIVE CREDIT ALLOCATION POLICIES FOR THE SMALLHOLDER COCONUT DEVELOPMENT PROGRAMME IN INDONESIA

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Introduction

Indonesia is the second largest coconut producing country in the world. However, declining production of copra and increased domestic demand for coconut oil have combined since the late 1970s to turn Indonesia from an exporter into an importer of copra. The decline in production has been attributed to a lack of replanting resulting in a high proportion of old, unproductive palms (Davis and Sudasrip).

Most coconut farms in Indonesia are small. In Sulawesi Utara (North Sulawesi), the main copra producing province, the average area of coconuts per farm is 2.7 hectares (World Bank). It is claimed that smallholder coconut farmers are unable to finance replanting without access to cheap credit (Koestono). The Government of Indonesia (GOI) has therefore implemented a number of credit schemes, including the Smallholder Coconut Development Project (SCDP).

Because the funds the GOI can allocate for farm credit are limited, it is necessary to decide how much credit is to be provided for different groups of farmers. It is evident that different allocations (for example, between large and small farmers) will have different effects on the GOI's declared objectives of growth and equity. The purpose of the study reported in this paper is to evaluate, in terms of these objectives, some alternative credit policies within the SCDP in Sulawesi Utara.

Twelve credit policies were considered. These were distinguished according to two criteria: the target farm size groups eligible to receive credit and the maximum coconut area per farm to be replanted under the scheme. The following four farm size groups were defined:

Small (S)	:	0.50 to 1.33 ha
Medium (M)	:	1.34 to 2.66 ha
Large (L)	:	2.67 to 4.00 ha
Very Large (VL)	:	More than 4.00 ha

Using this classification, four target groups were then specified, as follows:

I	S, M, L, VL
II	S, M, L
III	S, M
IV	M, L, VL

For each of these four target groups, credit policies were considered with the maximum replanted area per farm set in turn at 1.0, 1.5, and 2.0 hectares. Analysis was also carried out for the no credit case.

Research Approach

Each of the credit policies considered can be viewed as an alternative development project with associated costs and benefits. Such projects can be evaluated using an appraisal method such as that proposed by Little and Mirrlees (hereafter L-M). However, because of the emphasis placed by the GOI on both growth and equity, a method that accounts for impacts on different income groups was indicated, and the method proposed by Squire and Tak (hereafter S-T) was chosen.

The S-T method is a modification of the L-M procedure wherein net economic benefit is augmented to derive net social benefit as:

(1a) $NSB = NEB - \Delta C[(\beta_c - (d/v)]$

where:

NSB	=	net social benefit;
NEB	=	the L-M measure of net economic benefit calculated assuming consumption rate of interest equal to the opportunity cost of capital and constant marginal utility of consumption;
C	=	incremental consumption arising from the project, valued at market prices;
β_c	=	a factor to convert market prices of consumption into equivalent border prices;
d	=	distributional weight measuring the value of one unit of consumption accruing to a particular income group relative to the value to the average income group; and
v	=	social value of uncommitted public income relative to the value of consumption at the average income level.

In the above, d is a weighted average across income groups where, for the i-th group,

(1b) $d_i = (\overline{C}/C_i)^n$,

where:

$\overline{C}$	=	average consumption level;
C_i	=	consumption level for group i; and
n	=	the elasticity of marginal utility of consumption.

Furthermore,

(1c) $v = q/ [\beta_c(p + gn)]$,

where:

q	=	opportunity cost of capital;
p	=	pure time preference rate; and
g	=	expected rate of growth in per capita consumption.

Application of the S-T method to the alternative SCDP credit policies requires a two stage analysis. First, impacts of alternative policies at the farm level must be estimated. Second, these farm level effects must be aggregated to project level to calculate the NSB of each alternative.

The Farm Decision Model

A programming approach was used to model decisionmaking by representative Sulawesi Utara coconut farmers. Models representing small, medium, large, and very large coconut farms were built using data collected by a survey of 195 potential participants in SCDP in the study area.

The farm model has a planning horizon of 40 years, reflecting the approximate projected economic life of the hybrid palms and of the existing coconut palms. The objective function is the maximization of the present value of the planning period of farm household consumption above basic needs. The model is formulated in Bellman type dynamic programming (DP) terms (Nemhauser) with net cash position being the only state variable linking stages (years). Each stage optimization is performed by parametric linear programming (LP) using a matrix that reflects one annual production cycle. The DP recursive equation is maximized by the inclusion in the LP matrix of a linearly segmented representation of the objective, formulated as a function of the carried over value of the state variable.

The model can be expressed in DP terms as:

(2) $f_n(s_n) = \max_{d_n}(c_n + \alpha f_{n-1} s_{n-1})$, $n = 2, ..., 40$, where:

(3) $s_{n-1} = r_n(s_n, d_n) - c_n$, and

(4) $f_1(s_1) = \max_{d_1}(c_1 + s_0)$.

In these equations:

$f_n(s_n)$	=	the present value of an optimal policy over the remaining n stages, starting that stage with a net cash position of s_n;
d_n	=	a vector of decision variables relating to crops grown, use of credit, etc., at stage n;
c_n	=	consumption above basic needs at stage n;
α	=	a discount factor reflecting time preference; and
r_n	=	a function defining the net cash flow at stage n, which cash may be either consumed or carried to the next period.

By way of simplification, to reduce the substantial computational task, the model was solved assuming that a steady state prevailed for years 10 to 40. However, the model was solved sequentially, in recursive fashion, for the more important development stages of years 1 to 9.

The same basic LP model was used at all stages of the above calculations, adjusted as required for each stage, each credit policy, and each type of farm.

The LP matrix embodies activities and constraints reflecting the division of the year into two cropping seasons--wet and dry--and into two 3-month periods within each season. Activities in the model reflect coconut production and harvesting, cropping and intercropping with short term crops, and use of labour and animal power (including appropriate hiring activities). Borrowing other than SCDP credit, such as short term government credit and other borrowing from money lenders, is also included. The extent of borrowing is constrained to reflect criteria adopted by lenders. Basic family needs of food and cash are specified and must be met in each 3-month period. Surplus cash generated by sale of copra or other crops may be consumed in the current year or may be transferred to the closing cash position. Similarly, short term debts may be repaid or increased in the current year, with any outstanding borrowings at the end of the year being transferred as debits to the closing cash position. All prices and costs are at constant (1979) prices.

The choice between consumption and saving is accommodated in the DP model in a manner consistent with the optimal investment theory of Hirschleifer; that is, consumption is deferred when the rate of return on capital is more than the time preference rate. In this study, the time preference rate is taken to be 3 percent while the rate of return on capital is generated within the model according to the investment opportunities available.

The matrix for the steady state case comprises 107 constraints and 113 activities. The matrix is larger for the other stages because of the need to incorporate the linearly segmented function for $f_n(s_n)$, the extent of the enlargement depending on the number of segments needed.

The model was used to estimate the impacts of alternative credit policies on production, consumption, and labour use for the four representative farms (S, M, L, and VL). These results were then aggregated to project level in accordance with the S-T framework, accounting for the numbers of farmers able to receive credit within the limit of the funds available.

Impact of Alternative Credit Policies at the Farm Level

The effects of credit with different maximum areas replanted per farm are summarized for the four farm size categories in table 1. The table shows that provision of credit leads to an increase in the annual values of crop production and consumption per farm for all farm sizes. Moreover, except for small farmers, the benefits increase with increases in the maximum eligible area. In the case of small farms, the total area of coconuts is less than 1.0 hectare, so that increases in the eligible area beyond this level have no effect.

The increases shown in table 1 in the annual values of crop production arise in consequence of the much higher yield of hybrid coconuts compared with the palms they replace. Except during the first 3 years after replanting, there is a decline in the value of other crops produced. This is because intercropping is not possible under mature hybrid palms.

Table 1 also shows that in most cases provision of credit leads to a reduction in the amount of hired labour used. However, total labour use is increased (not shown in the table). The decline in use of hired labour arises because family labour can be used to harvest nuts from the short hybrid palms, whereas specialist labour must be employed to harvest from the tall palms.

Net Social Benefits of Alternative Credit Policies

NSBs were estimated using equation 1. NEB was found as incremental gross benefit minus corresponding costs. Gross benefit was the incremental crop production valued at border prices. Costs included labour, valued at its economic shadow price, and other inputs, valued at border prices. Border prices were derived from the corresponding c.i.f. or f.o.b. prices, adjusted for transfer payments, domestic transport, and other distribution costs. The procedures described by Irvin (ch. 5) were followed.

Incremental consumption, ΔC, was found by aggregating consumption increases, valued at market prices, for the four farm size groups and for employed labourers. In estimating the conversion factor, β_c, it was not possible due to lack of data to decompose the consumption bundle into traded and nontraded goods. Consequently, a standard conversion factor was used for incremental consumption. Following the World Bank estimate for the SCDP, this factor was taken to be 1.0.

The distributional weight, d, was derived for selected values of n from the consumption levels of different groups of farmers and farm workers using the procedure described by Bruce.

The social value of uncommitted public income, v, was estimated from the opportunity cost of capital, q, taken as 10.5 percent, the time preference rate, p, taken as 3 percent, and the rate of growth of consumption, g, taken also as 3 percent, and a marginal propensity to save, s, of 0.28. These estimates have been discussed by Nehen.

The appropriate value of n, the elasticity of marginal utility of consumption, depends on the emphasis to be placed on equity considerations; the higher the value of n, the greater the emphasis on equity. A typical range is from 0.5 to 1.5 (Bruce; and Irvin, ch. 8), and in this study four values were used; i.e., 0.5, 0.75, 1.0, and 1.5

Table 1. Annual Values of Crops and Consumption, and Use of Hired Labour for Different Credit Policies and Farm Sizes[a]

Farm Size	Value of Crops				Value of Consumption				Use of Hired Labour[b]			
	W/P	A	B	C	W/P	A	B	C	W/P	A	B	C
	-Rp 10^3-				-Rp 10^3-				-Work days-			
Small	521	822	822	822	120	450	450	450	29	0	0	0
Medium	1020	1330	1510	1620	470	770	950	1080	63	52	45	29
Large	1340	1660	1820	1970	690	950	1080	1340	130	120	140	146
V. Large	2230	2490	2670	2880	1130	1260	1460	1000	490	420	490	490

[a] W/P = without project; A = maximum of 1.0 ha/farm; B = 1.5 ha/farm; C = 2.0 ha/farm.

[b] Refers to steady state period (years 10 to 40) only.

Table 2 shows the NSBs for the 12 credit policies and for the four values of n considered. The table also includes the NEBs for each credit policy to provide a basis for comparison with the NSBs. As can be seen from the table, for each target group, NEB and NSB are both maximized when the maximum eligible coconut area per farm is 1.0 hectare. It may be concluded that regardless of equity considerations it is better to restrict credit to 1.0 hectare per farm. This contrasts with the present limit of 2.0 hectares per farm.

The results in table 2 show that, for all values of n less than 1.5, NSB is maximized for target group IV, which excludes the small farms. When n is set at 1.5, it becomes optimal to select target group III, comprising small and medium sized farms only. Thus, this analysis shows that the optimal policy is affected by equity considerations only if strong emphasis is placed on the equity objective. Larger farms should be favoured if economic growth is given priority while smaller farms should receive the credit if equity is paramount.

Table 2. Summary of NPVs of NEBs and NSBs of the Alternative Credit Packages (in Rp 10^9) for Different Values of n

Target group	Maximum eligible area	NEB	NSB			
			n=0.5	n=0.75	n=1.0	n=1.5
I (S, M, L, VL)	1.0	142.6*	112.7*	121.6*	132.0*	162.4*
	1.5	142.5	100.8	110.2	121.2	153.5
	2.0	130.5	90.2	99.3	109.9	141.1
II (S, M, L)	1.0	150.6*	113.3*	115.5*	134.9*	169.3*
	1.5	142.1	100.4	103.1	124.7	162.0
	2.0	133.7	92.1	94.6	116.2	154.5
III (S, M)	1.0	145.4*	103.9*	118.0*	135.7*	186.1**
	1.5	142.1	87.4	115.7	132.7	181.2
	2.0	113.0	72.8	86.5	103.6	152.4
IV (M, L, VL)	1.0	164.9**	123.7**	131.2**	137.2**	165.7*
	1.5	146.3	103.2	111.0	117.3	147.1
	2.0	137.8	94.2	102.1	108.5	138.6

* superior within each target group.

**superior within each target group and across all the target groups.

Note

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References

Bruce, C., *Social Cost-Benefit Analysis: A Guide for Country and Project Economists to the Derivation and Application of Economic and Social Accounting Prices*, Staff Working Paper No. 239, World Bank, Washington, D.C., 1976.

Davis, T. A. and Sudasrip, H., "Methods of Rejuvenation and Replanting of Coconut Stands in Indonesia," in *Kumpulan Makala dan Pembahasan Pertemuan Teknis Kelapa ke V,* Direktorat Jenderal Perkebunan dengan Pemerintah Daerah Tingkat I Sulawesi Utara, Manado, 1978.

Hirschleifer, J., "On the Theory of Optimal Investment Decisions," *Journal of Political Economy*, Vol. 66, No. 1, Aug. 1958.

Irvin, G., *Modern Cost-Benefit Analysis*, Macmillan, London, 1978.

Koestono, "Program Peremajaan Pada Pelita III," in *Kumpulan Makala dan Pembahasan Pertemuan Teknis Kelapa ke V,* Direktorat Jenderal Perkebunan dengan Pemerintah Daerah Tingkat I Sulawesi Utara, Manado, 1978.

Little, I. M. D. and Mirrlees, J. A., *Project Appraisal and Planning for Developing Countries,* Heinemann, London, 1974.

Nehen, I. K., "Shadow Pricing in Project Evaluation: A Case Study of Pekalen Sampean Irrigation Project, East Java, Indonesia," M.Ec. dissertation, University of New England, Armidale, 1978.

Nemhauser, G. L., *Introduction to Dynamic Programming,* John Wiley, New York, 1966.

Squire, L. and Tak, H. van der, *Economic Analysis of Projects,* Johns Hopkins University Press, Baltimore, 1975.

World Bank, *Indonesia Smallholder Coconut Development Project,* Staff Appraisal Report, Washington, D.C., 1980.

RAPPORTEUR'S REPORT—Lars Brink

The discussion recognized the conditions under which crop insurance schemes are successful or unsuccessful. Particular attention was given to insurance based on average yields for homogeneous areas, as that approach may be the only way to deal with problems of complete administration, adverse selection, and moral hazard. The problem of measuring the impact of crop insurance on production or income was mentioned, and difficulties in separating crop insurance effects from the effects of extension efforts and new technology were identified. State run versus parastatal or private agencies were discussed. A technical point relating to the indicator of risk bearing capacity was brought up, particularly in connection with differences between small and large farms. A multivariate approach was advocated.

The discussion of credit policies centred on the identification of target groups for the coconut development programme, and, how the group definitions would affect the interpretation of the results. It was also recognized that a credit scheme is only one part of the development programme, and further, that the amount of credit granted is only one dimension of the credit scheme. Concerns were raised regarding the adequacy of the modelling approach.

Participants in the discussion included J. C. Abbott, M. G. Chandrakanth, Graeme Donovan (Session Chairman), J. B. Hardaker, P. C. Lambrecht, G. T. Magagula, A. McLeod, and V. Steigerwald.