QUALITY INCENTIVES FOR SELECTED FOOD PRODUCTS IN WHOLESALE AND RETAIL MARKETS IN JAKARTA

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INTODUCTION

In Indonesia, significant changes have occurred in the production and marketing of rice and secondary crops, especially in Java. The development of markets for rice, mungbean, and peanuts has been characterised by increasing commercialization and increasing product differentiation associated with product attributes, qualities or characteristics.

During the period 1981 - 1991 Indonesian rice production increased from 3.27 to 44.32 millions tonnes, an increase of more than 35 per cent, due to the increase in productivity from 3493 kg/ha to 4351kg/ha and the harvest areas from 9.4 to 10.2 millions hectares. The yields of mungbean and peanuts also increased considerably by about 46 per cent and 10 per cent respectively (Department of Agriculture RI, 1992).

The demand for rice, mungbean and peanuts expanded considerably, primarily driven by an increase in human consumption. The changing socioeconomic and demographic structure of the Indonesian population has been an important determinant of changes in the pattern and composition of food consumption. This change in the consumption pattern is observable in both urban and rural areas. During the years 1981 - 1984 expenditure on food increased from 61.5 per cent of total expenditure in 1981 to 63.2 per cent in 1984. The data from Central Bureau of Statistics (CBS) show that there is a change in the consumption pattern. This is indicated by a reduction in proportion of total expenditure on starchy foods from 35.5 per cent in 1981 to 32.6 per cent in 1984.

Consumption of all staple foods is expected to continue to rise as income grows, but at a diminishing rate. As income grows, the consumer is increasingly aware of the quality of products purchased. According to traditional theory goods are the direct object of utility and the basic theory provides no guide to the effects on demand of specified change in the quality of goods. If analysis of the

determination of the price of products in retail and wholesale markets is to be in any sense complete it should take account of product characteristics.

This paper is a selective assessment of the scope for improvement in the efficiency of food markets, by looking at the financial rewards for specific improvements in quality. It is argued here that premia and discounts on product prices are linked to food quality and market services, and this linkage has important implications for the development of effective and efficient grading standards and market transactions as well as for the welfare of market participants in general.

ECONOMIC BACKGROUND

Conventional competitive economic theory begins with the hypothesis of price taking firms and consumers, buying and selling homogeneous commodities in well-defined markets. The simplifications of standard economic theory may be too great when considering highly differentiated products and the variety of factors influencing the consumer's decision processes. Product variety reflects the search for a match between the quantity and nature of characteristics which are imparted to products by firms and the quantity and mix of characteristics demanded by consumers.

Hayenga et.al (1985), Unnevehr (1986), Ladd and Suvannunt (1987), Quilkey et.al (1988), and Havrila (1989) observed that the consumer's willingness to pay for various prices for sub-sets of a product class are related to the presence or absence of certain attributes of the product. The theory underlying the model draws on the household production framework of Becker (1965) and Muth (1966), and the product characteristics approach of Lancaster (1966).

Becker and Muth present the idea that households are both consumers and producers of goods. The Muth and Becker model assumes non-joint individual production functions,

(1) $z_i = f_i(x_i, t_i, C_i)$; $i = 1, \ldots, m$

where z_i is the quantity of the i^{th} commodity produced by the sub-vector of market goods x_i, and t_i units of household time, and C_i is vector of production parameters representing technology and the household environment.

The idea presented by Lancaster involves examination of the characteristics properties of goods as they affect consumers' preferences instead of consideration of the good itself. In Lancaster's model it is assumed that each market good possesses a vector of characteristics (or qualities) that are objectively defined by all producers and consumers. Consumers purchase and consume combinations of goods and the level of utility attained is derived from the sum of characteristics belonging to these goods. According to Lancaster the household production function has the linear form:

(2) $z_i = \Sigma_j C_{ij} x_i$,

with C_{ij} being defined as the quantity of the ith characteristic contained in one unit of the j_{th} market good. Lancaster writes the individual's utility function as,

(3) $U = U(z_1, \ldots\ldots, z_j)$,

where z_i is the total amount of characterisitc j obtained by the consumer. The consumer chooses quantities of continuously variable commodities to maximise utility subject to the consumption technology and the budget constraint

(4) Max $U(z)$

S.T. $z = Cx$

$y \geq Px$

$z, x \geq 0$

where z is the vector (z_j)

C is the matrix (C_{ij})

y is consumer's income

P is a vector of commodity prices (p_i)

x is the vector (x_i)

Lucas (1975) provides a brief summary of how Lancaster came up with a solution. This program has a solution for the optimal bundle of characteristics (z^*). Lancaster suggests the most efficient way of obtaining any given bundle of characteristics, such as z^*. This is given by the solution to the problem:

(5) Min Px

S.T. $Cx \geq z^*$

$x \geq 0$

the dual of (5) is

Max ρz^*

S.T. $\rho C \leq P$

where ρ are the shadow prices of the characteristics. For constraints which are binding in the solution of above problem

(6) $P^a = \rho C^a$

where P^a is the solution sub-vector of P;

C^a is the solution sub matrix of C.

This result is a linear specification of the hedonic price function.

Lancaster's model has provided a useful framework for theorizing about product quality markets and has greatly stimulated interest in modelling the demand for quality. The Lancaster model suffers from a number of limitations because of the restrictiveness of the assumptions (i.e the consumer's welfare is independent of the distribution of characteristics among goods, and its dependence on a linear combination of consumption levels). However, it is obvious that utility may depend on the distribution of characteristics among products, and consumption relating goods to characteristics may not be linear. These issues have been addressed effectively by Hendler (1975), and Lucas (1975). A further limitation of the Lancaster model is that it is formulated in terms of objectively measurable characteristics. Socio-psychological aspects of shopping environments, which sometimes have no direct relationship with the physical characteristics of goods, have not generally been taken into account.

Related to the household production function are the several approaches to measuring the effects of quality differences on market behaviour. Quality differences among market goods have been of some interest to economists at least since the work of Waugh (1928) on vegetable prices. The hedonic price function approach appears to have its beginning in the simultaneous papers of Houthakker (1952) and Theil (1952), where market prices were specified as linear functions of a scalar level of quality, which was assumed to be available in the market in a continuum. This assumption is not always suitable for analysing issues about the changes in the range of qualities offered to a consumer.

DATA AND EMPIRICAL MODEL

According to Lucas (1975) a general form of the hedonic price function can be written :

$$(7) \qquad P_i = P(C_{i1}, \ldots, C_{ij}\ ;\ e_j) \qquad i = 1, \ldots, I;\ \text{and}\ j = 1, \ldots, J$$

where, P_i is the market price of the i^{th} commodity

C_{ij} is the amount of the j^{th} characteristic per unit of the i^{th} commodity

e_i is the disturbance term.

The regression coefficients provide information about the consumer's marginal valuation of quality improvement with respect to each individual characteristics. Price may be regarded as a bundle of characteristics of a product which identifies for the consumer a stable market value which typifies products with a known characterisites mix. Two categories of product characteristics may be distinguish, those which are objectively measurable, such as the size and shape of grain, percentage of broken grains, percentage of foreign matter content, percentage of off-colour grains, percentage of shrunken grains, and characteristics which satisfy subjective perceptions such as the shopping environment. The consumer is assumed to attach a certain weight to each characteristic.

The empirical part of this preliminarystudy is based on the cross-sectional data from wholesale and retail outlets in Jakarta 1992. The data on product characteristics were acquired from small samples of products collected from the sellers (wholesalers and retailers). Samples were taken of each grade of products offered by randomly chosen sellers. Prices and a variety of characteristics of the products were recorded for each sample.

The empirical form of the equation to be estimated may be written as:

(8) $$P_g = \alpha + \Sigma \beta_i C_i + \Sigma \beta_i Z_i + e_g$$

where, P_g is the price per kilogram

C_i are measurable characteristics, such as;

1. Size (mm)
2. Shape (ratio length/width)
3. Split (%)

4. Off-colour (%)

5. Broken (%)

6. Foreign matters (%)

7. Chalkiness (%)

8. Shrunken(%)

$Z_{|}$ are non-measurable characteristics, such as;

1. Supermarket and non-supermarket

($z_{|1}$= 1 if supermarket and $z_{|1}$=0 otherwise)

2. Packaged and un-packaged

($z_{|2}$= 1 if packaged and $z_{|2}$=0 otherwise)

α, $\beta_{|}$, $\beta_{|}$ are regression coefficients

ε_g are stochastic errors.

It is hyphothesised that the presence of defects such as broken grains, dirt (foreign matter), split, off-colour, and shrunken grains result in price discounts. Since consumers may be influenced not only by products characteristics but also by characteristics of the shopping environment, variables accounting for type of retailer and packaging were included in the model.

A list of continuous and dichotomous (dummy) variables, designed to capture the effects of the process of consumers' valuation of selected foods and the expected relationship of characteristics to food price is provided in Table 1.

THE RESULT

Estimates of implicit prices of the quality characteristics of selected foods are presented in Table 2 - 4. The implicit price represent the change in the food price for a one-unit change in the characteristics. The quality attributes included explain a large proportion of price variation in all three foods at wholesale and

Table 1. Expected signs of Implicit Marginal Values of Product Characteristics

Variable	Wholesale			Retail		
	P	M	R	P	M	R
Measurable characteristics						
1. Size	?	?	?	?	?	?
2. Shape	?	?	?	?	?	?
3. Split	-	-	n.a	-	-	n.a
4.Off-colour	-	-	n.a	-	-	n.a
5.Broken	n.a	n.a	-	n.a	n.a	-
6.Forreign matters	-	-	n.a	-	-	n.a
7.Chalkiness	n.a	n.a	-	n.a	n.a	-
8.Shrunken	-	-	n.a	-	-	n.a
Non-measurable characteristics						
9.Type of retailer (Supermarket)	n.a	n.a	n.a	+	+	+
10.Packaged	n.a	n.a	n.a	+	+	+

n.a = not applicable; P = peanuts; M = mungbean; R = rice.

retail level, indicating that characteristic variables included in the model provide good indicators of consumer preferences. The signs and significance, particularly for size and shape variables, of characteristics vary among foods and among market levels.

The rice data did not have enough samples which were off-colour or with foreign matter content to derive with confidence an implicit price for these characteristics. Preference for good quality products have the expected sign in wholesale and retail level, but preferences for size and shape attributes vary. Foreign matter seems to be a particularly significant determinant of price for peanuts and mungbeans at the wholesale level, but not at the retail level. At the wholesale level reduction in foreign matter content are rewarded significantly. The implicit prices of foreign matter content in the foods at the retail level are not statistically significant as they are at the wholesale level,

Table2. Parameter Estimates and t-values for Peanuts at Wholesale and Retail Levels

Variable	Wholesale		Retail	
	Estimate	t-value	Estimate	t-value
1. Size	91.44	1.42	-6.75	-0.10
2.Shape	64.77	1.37	65.97	0.86
3.Split	-11.73	-2.32	1.86	0.44
4.Off-colour	-11.95	-1.38	-31.05	-3.84
5.Foreign matter	-14.46	-1.86	-2.27	-0.18
6.Shrunken	-4.49	-3.79	-13.41	-5.63
7.Supermarket	n.a	n.a	173.46	4.74
8.Packaged	n.a	n.a	45.57	1.29
9.Constant	1461.20	13.42	1794.09	13.24
R^2	0.76		0.82	
F-value	13.94		50.74	
N	25		90	

n.a = not applicable

Table 3. Parameter Estimates and t-values for Mungbean at Wholesale and Retail Levels in Jakarta-1992

Variable	Wholesale		Retail	
	Estimate	t-value	Estimate	t-value
1.Size	-343.98	-5.56	-783.00	-7.24
2.Shape	-126.88	-0.91	31.18	1.63
3.Split	-8.87	-0.92	-33.24	-13.95
4.Off-colour	-4.55	-2.05	-2.21	-2.32
5.Foreign matter	-16.52	-1.47	-2.71	-0.65
6.Shrunken	-1.34	-0.19	-4.33	-1.67
7.Supermarket	n.a	n.a	150.07	13.22
8.Packaged	n.a	n.a	74.35	8.28
9.Constant	1813.33	10.79	1966.09	34.38
R^2	0.48		0.95	
F-value	3.79		169.01	
N	19		63	

n.a = not applicable

Table 4. Parameter Estimate and t-values for Rice at Wholesale and Retail Levels in Jakarta-1992

Variable	Wholesale		Retail	
	Estimate	t-value	Estimate	t-value
1.Size	-486.66	-1.48	245.48	1.16
2.Shape	-23.98	-0.61	-42.76	-1.82
3.Broken	-1.68	-0.91	-3.08	-2.10
4.Chalky	-17.01	-7.30	-9.19	-5.34
5.Supermarket	n.a	n.a	188.22	11.23
6.Packaged	n.a	n.a	188.22	11.23
7.Constanta	1393.95	9.37	959.96	8.50
R^2	0.77		0.82	
F-value	21.41		108.11	
N	25		141	

n.a = not applicable

clearly a reflection of the cleaning and sorting which take place at the wholesale level.

The consumers pay premia for better shopping environment (supermarket style and packaging). Both types of retail style and packaging variables play a significant role in consumer purchase decision and contribute to the value of the

product. The impact of shopping environment on price was tested using F-test (Doran and Guise, 1984 ch 7.)

$$(9) \qquad F_{m,\, n-k-1} = \frac{(RSS_0 - RSS_1)/M}{(RSS_{1/(n-k-1)})}$$

where, RSS_0 is the sum of squares of the residuals from the constraint model where the coefficient of the variables the effect of which is tested are set to zero. RSS_1 is the sum of squares of the residuals from the unconstrained model. M is the number of observations, and k is the number of regressors. The null hypothesis Ho : $\beta c = \gamma k = 0$ (where c=1 and k=1) was tested against an alternative hypothesis H1 : $\beta c = \gamma k = 0$.

Based on the F-test statistics the null hypothesis that the type of retailer and packaging variable have no impact on the level of retail price was rejected at the 5 per cent level of significance (Table 5). These findings suggest that consumers ascribe significantly different values to similar products purchased at different types of retailer. It appears that consumers do differentiate among apparently similar commodities on the basis of type of retailer. This perception seems to be related to the belief that some retailer offer better quality than others.

CONCLUSION

The objective of this study was the development and testing of simple hypotheses about the components of wholesale and retail prices in Jakarta of selected foods, (peanut, mungbean,and rice). To achieve this objective, hedonic price functions were estimated which take into account characteristics of grains size, shape, and per cent content of dirt and damage, and (for the retail level only) characteristics of the shopping environment. The result of this analysis strengthens the view that wholesale and retail prices of foods are related to a range of characteristics which are not necessarily the same at each market level.

Table 5. F-test for the Effect of Shopping Environment on Price

	RSS_0	RSS_1	M	n-k-1	F-stat
PEANUT					
Supermarket test	1074511.65	441947.91	1	82	117.36
Packaged test	441947.91	433029.12	1	81	1.66
MUNGBEAN					
Supermarket test	287926.31	66928.92	1	55	181.61
Packaged test	66928.92	29495.91	1	54	68.53
RICE					
Supermarket test	2629070.87	1322255.06	1	135	133.42
Packaged test	1322255.06	681011.91	1	134	126.18

The outcome of this preliminary and somewhat naive investigation into the implicit values of foods characteristics is consistent with the view that there is scope to improve food markets by looking at the specific improvement in quality for which premia exist. It is interesting to note that there is a significant reward for reducing foreign matter content in foodstuff at the wholesale level. But at retail level no pay-off could be identified for reducing dirt content. It also

appears that quality improvement is commodity-specific, particularly in respect of size and shape of products.

REFERENCES

Becker, G.S.(1965), 'A theory of the allocation of time', Economic Journal ,75,493-516.

Department of Agriculture-RI(1992), Vademekum Pemasaran 1981-1991, Direktorat Bina Usahatani dan Pengolahan Hasil, Jakarta.

Doran,H.E. and Guise,J.W.B.(1984), Single Equation Methods in Econometrics:Applied Regression Analysis, University of New England, Armidale.

Havrila,I.(1989), Product Characteristics and Pricing of Wollen Garments at Retail in Melbourne, Thesis-La Trobe University,Bundoora.

Hayenga,M.L., Grisdale,B.S., Kauffman,R.G., Cross,H.R. and Christian,L.L.(1985),'A carcas merit pricing system for the pork industry', American Journal of Agricultural Economics,66,315-319.

Hendler,R(1975),'Lancaster's new approach to consumer demand and its limitation', American Economic Review,65,194-200.

Houthakker,H.S.(1952),'Compensated changes in quantities and qualities consumed', Review of Economic Studies, 19,155-164.

Lancaster,K.J.(1966),'A new approach to consumer theory', Journal of Political Economy,74,132-157.

Lancaster,K.J.,(1971), Consumer Demand-A New Approach, Columbia University Press, New York.

Lucas,R.E.B.(1975),'Hedonic Price Function', Economic Enquiry, 13,157-178.

Muth,R.F.(1966),'Household production and consumer demand functions', Econometrica, 34,699-708.

Quilkey,J.J., Fawzya,N. and McColm,P.M.(1988), Prices of Characteristics for Dried Salted Fish at Retail in Markets in Jakarta, A paper presented to IFPC conference, Bangkok, 19-22 April.

Theil,H.(1952),'Qualities, prices and budget enquiries', Review of Economic Studies,19,129-147.

Unnevehr,L.J.(1986),'Consumer demand for rice grain quality and returns to research for quality improvement in Southeast Asia', American Journal of Agricultural Economics, 68,634-641.