HEDONIC PRICES OF INDONESIAN TEA

By

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I. INTRODUCTION

Tea plantations in Indonesia are managed by government companies, large private companies, and smallholders (small private tea farmers). The government PTP (Perusahaan Terbatas Perkebunan, Incorporated Plantation Companies) are vertically integrated and directly control planting, harvesting, processing, and marketing. In Indonesia, the PTP enterprises produce the majority of the tea that is traded in world markets.

Of the plantation or estate crops, tea is the fourth largest contributor to foreign exchange revenue, following rubber, coffee, and palm oil (Setiwati and Nasikun, 1991). As government-owned enterprises, the PTP enterprises are also used to stimulate development in rural areas and sometimes provide marketing outlets for products produced by smallholders. Large private plantation companies also have processing facilities on their plantations and buy tea produced by smallholders. While the PTP and large plantations generally have more than 1,000 hectares of tea, smallholders will have only one or two hectares of tea.

In 1991, there were 109 large government and private tea estates. From 1986 to 1991 the total planted area (Table 1) remained relatively stable while production

Table 1. Area of tea planted in Indonesia by type of company, 1986-1991

Type of Company	YEAR					
	1986	1987	1988	1989	1990	1991[a]
	(1,000 ha)					
Government Estates	48.6	47.9	47.6	49.5	49.5	49.5
Private Estates	23.3	22.4	26.9	27.7	28.3	28.4
Small-holders	54.4	50.3	50.8	52.2	51.2	51.3
Total	126.3	120.6	125.3	129.4	129.0	129.2

Source: Directorate General of Estates (1992), Ministry of Agriculture.
[a]Preliminary

Table 2. Production of tea in Indonesia by type of company, 1986-1991

Type of Company	YEAR					
	1986	1987	1988	1989	1990	1991[a]
	(1,000 metric tons)					
Government Estates	79.3	79.8	84.8	90.4	95.3	96.4
Private Estates	19.0	20.9	23.5	26.4	29.2	30.3
Smallholders	31.1	25.4	25.6	24.6	31.4	31.8
Total	129.4	126.1	133.9	141.4	155.9	158.5

Source: Directorate General of Estates (1992), Ministry of Agriculture.
[a]Preliminary

increased (Table 2). The increased production is due to increasing yields on government estates and increased planting and yield from large private estates. Smallholders have maintained a relatively constant area planted and have not experienced increasing yields. Yields from smallholders are lower than from private or government companies. In 1990 smallholders and PTPs had a similar number of hectares planted while production from the PTPs was more than three times greater than from smallholders (Directorate General of Estates, 1992). The increased production by the PTP companies is due to the introduction of new clones of cultivars that are being planted as plantations are rejuvenated and new areas are planted. Tea harvesting involves picking the newest leaf growth each time the plants produce new leaves. The new clones produce three and four new growth leaves each time while the older clones only produce two or three new-growth leaves. Two of the government companies that produce tea are located on Sumatra while five others are located on Java.

Indonesian firms sell three types of tea: green tea, olong tea, and black tea. The three types of tea are differentiated by degree of fermentation. Green tea is not fermented, olong tea is partially fermented, and black tea is fully fermented (approximately one hour). Most Indonesian tea is sold as black tea. Indonesia ranks fifth in black tea trading volume behind Sri lanka, India, China,

and Kenya and the Indonesian share of trading volume was 11 percent in 1990 (Table 3).

The value and quantity of exports has increased from 1986 to 1991 (Table 4). Major importing countries are Russia, Pakistan, USA, United Kingdom, Netherlands, Morocco, and the Federal Republic of Germany.

Important international tea auctions are in London, Calcutta, Chotagong, Colombo, Mombasa, and Jakarta. In Jakarta, tea is sold by the Joint Marketing Office of the PTP enterprises (Kantor Pemasaran Bersama Perkebunan referred to as KPB) at weekly auctions held on Wednesday at the Hotel Indonesia.

At the Jakarta KPB auction, companies wishing to sell a lot, send 25 samples (75 to 100 grams per sample) from each lot to the KPB 20 days prior to the auction. Samples are tested for quality and must meet minimum quality standards set by the KPB to be listed in the auction catalogue. Buyers may obtain samples up to two weeks prior to the auction. Tea is sold Free On Board (FOB) with pallet. Both private companies and PTP companies can provide lots to be sold at the auction.

At each auction, the auction manager provides the auctioneer and buyers a catalogue of tea available for sale. The Jakarta tea auction is an English auction with progressive bidding. The auctioneer gives the beginning price and then buyers bid by open outcry as led by the

Table 3. World exports of tea by country of origin volume and market share, 1986-1990

Country	YEAR				
	1986	1987	1988	1989	1990
	(1,000 metric tons) (percentage of market)				
India	203.1	201.9	201.0	211.6	199.7
	23	23	21	21	20
Sri Lanka	207.6	200.8	219.7	203.8	215.3
	24	23	23	20	21
China	172.0	174.3	198.3	204.6	195.5
	19	20	21	20	19
Kenya	115.5	134.8	138.2	163.2	169.6
	13	15	15	16	17
Indonesia	79.0	90.4	92.71	114.7	111.0
	9	10	10	11	11
Malawi	40.2	33.4	37.0	39.9	43.0
	5	4	4	4	4
Bangladesh	27.7	21.6	26.2	23.4	27.0
	3	2	3	2	3
Argentina	36.3	33.6	34.3	43.3	46.0
	4	4	4	4	5

Source: Directorate General of Estates (1992), Ministry of Agriculture.

Table 4. Quantity and value of tea exports from Indonesia 1986-1991

Year	Quantity	Value
	(100,000 metric tons)	($100,000 U.S.)
1986	79.040	99.094
1987	90.422	118.736
1988	92.687	125.309
1989	114.710	162.735
1990	110.963	181.017
1991	110.217	143.130

Source: Directorate General of Estates (1992), Ministry of Agriculture.

auctioneer. Bids are made in US cents per kilogram on full lots which cannot be divided and as shown in the catalogue. The minimum change in the progressive bidding is one-half U.S. cent per kilogram.

The auction manager and auctioneer have a catalogue that includes a "price idea" which is a goal that the manager feels represents a fair value of the lot. The price idea is based on the prices received the previous week for tea of comparable quality, trends in tea prices, and prices received at other auctions.

Lots are generally sold if the highest bid exceeds the price idea. If the highest bid is less than the price idea, the auctioneer will consult with the manager before declaring a lot to be sold. If a lot is not sold, the high bidder has exclusive negotiating rights on a lot for 24 hours after the auction. Lots for which there are no bidders or for which the high bidder does not negotiate a purchase during the 24 hour period are sold by private treaty negotiation.

Black Tea Grade Determination

Black tea grades are based the particle form (long or circle), particle size, amount of stalk and fibre (Radiana, 1983), and specific gravity. Black tea arriving from the fields is wilted, pressed, fermented, dried, and then sorted by particle size. Both Orthodox and CTC tea are sold at the

auctions. CTC tea has been through crushing, tearing, and curling processes before fermentation while Orthodox tea has not.

Particle size and type determines the grade of tea. During the grading process, black tea is divided into three grading groups: 1) leaf tea; 2) broken leaf tea; and 3) small tea (Darmawijaya et al., 1983). Leaf tea is from bud leaves that curl during the wilting process and remain as whole leaves through the processes. Leaf tea is further graded as orange pekoe superior (long, wirelike particles that include leaf tips), orange pekoe (long, wire-like particles without as many leaf tips), pekoe (long, wire-like with fewer leaf tips), souchong (rough granular), and pekoe souchong (rough granular with larger particles).

All of the tea used in this analysis are either broken tea or small tea.

Broken tea grades are from leaves that have not curled as much during wilting and have little and thin form when going through the pressing process. Broken tea is graded like whole leaf tea and classified as broken orange pekoe superior (BOP sup.), broken orange pekoe (BOP), broken pekoe (BP), broken souchong, and broken pekoe souchong, and broken tea (BT).

Small grades are also identified by particle size. Tippy fannings (particles include leaf tips), pekoe fannings (PF, very few leaf tips in the sample), and dust.

Both the broken and small grades can be further divided and given an Arabic number (CTC process) or a Roman numeral (Orthodox) to indicate particle size within the grade category (BOP.1 would be broken orange pekoe CTC process, largest particle size; BOP.II would be broken orange pekoe Orthodox process, slightly smaller particle size).

Each tea sample may have different chemical and taste characteristics that are not fully accounted for in the grading system.

That tea buyers also evaluate the chemical characteristics, color, and taste of the tea and the specific company and plantation (area within company) from which the tea was harvested. This suggests that the reputation of the supplying company or the plantation from which the tea comes may be factors that affect the price received.

Problem Statement

Because the PTP enterprises and private plantations are vertically integrated, managers can adjust harvesting and processing to respond to price signals. Price differentials may provide incentives to alter varieties produced, harvesting methods, or processing techniques. In the processing facilities, changes in the humidity level during fermentation, wilting time prior to fermentation, fermentation time, drying temperatures, and drying time may

be used to alter the color, particle size, chemical characteristics and taste of tea. Because tea is a very heterogeneous product, it is difficult for a grading system to fully reflect the true value of the tea in a given lot. This presents a particular problem for the auction manager who needs to develop price expectations in order to better manage the auction such that each lot receives the best possible price. Plantation managers need to know what incentives are offered for alternative grades so that they can evaluate whether the cost of changing production, harvesting, and/or processing procedures to produce a particular grade is greater than or less than the price differential received for that grade.

If the grading system is useful, price differences for different grades should be identifiable. In addition, it is possible to test whether there is evidence of reputation selling in the tea market. If there is reputation selling, company of origin or plantation of origin will explain tea price variation that cannot be explained by the grading system.

Hypothesis and Objectives

The hypothesis is that the price of tea in Indonesia is related to grade and company of origin or region. The general objective is to increase the knowledge of why prices for lots of tea vary. Specific objectives are:

1. To determine the relationship between price received for a lot and its grade; and
2. To determine whether company of origin or region of origin influences price received.

The results may influence managers to alter production, harvesting, and/or processing procedures so they can increase profit from tea. If premiums and discounts are associated with company management, management practices can be evaluated for adoption or abandonment depending on the relative costs and benefits.

Organization of Thesis

The remainder of the thesis is organized in five chapters. The conceptual framework of the research is in chapter II. The data and empirical model are discussed in chapter III. Chapter IV gives and addresses the results, and Chapter V presents the conclusions.

II. HEDONIC PRICING, REPUTATION SELLING, AND AUCTION THEORY

Modeling Indonesian tea auction price determination requires developing a model that incorporates concepts from the theories of hedonic pricing, reputation selling, and auctions.

Hedonic Pricing Theory

Hedonic price theory assumes goods are bundles of valuable characteristics. The values of goods are derived from the values of the characteristics that the goods possess. The characteristics can be valued either by firms purchasing inputs or by consumers who are purchasing consumer goods.

Price is an important signal in markets because it can provide incentives to producers of goods and may also serve as an indicator of quality (Simon, 1989). Real and perceived quality affects consumer choice (Robertson and Kassarjian, 1991). Generally, prices are reported for goods rather than characteristics while companies need to determine what characteristics to include in specific products. Hedonic price analysis involves translating observed market prices for goods into implicit prices of the

characteristics of the goods in question. By translating prices of goods into implicit prices of characteristics, firms can better understand the signals being sent in the market and produce products with characteristics for which the marginal implicit price of the characteristics exceeds the marginal cost of producing goods with that characteristic. Hedonic price functions are a regression of the observed price of a commodity against its quality attributes (Lucas, 1975).

The hedonic function for productive inputs are derived from the theory of the firm while hedonic functions for consumer goods are derived from the theory of consumer behavior.

Ladd and Martin (1976) and Wilson (1984) developed the hedonic pricing model from the theory of the firm. Wilson assumed a perfectly competitive, multiproduct, profit-maximizing firm. Output is a function of the characteristics of the goods used in the production process. Inputs have differing quantities of the characteristics. Solving yields the hedonic price function in which the observed prices of inputs are found to be equal to summation of the values of the marginal product of the characteristics (marginal implicit price of the characteristics or hedonic price) times the marginal yield of the characteristics from the input.

Similar functions for consumer goods are derived by

assuming that the arguments of the consumer's utility function are characteristics of goods (Lancaster, 1971 and Ladd and Suvannunt, 1976). The results of the utility maximization problem give the result that the price of the goods is equal to the summation over characteristics of the marginal utilities of the characteristics of the goods (marginal implicit prices or hedonic prices) times the marginal yields of the characteristics from the goods.

Rosen (1974) showed that empirical hedonic price functions identify neither demand or supply. Hedonic price functions are used to explain variation in prices of heterogenous products given that supply and demand systems have interacted to generate the general price level. Hedonic functions are not used to explain variation in the overall price level but are used to explain deviations in prices that are systematically associated with the characteristics of the goods. Brorsen, Grant and Rister, however, suggest that market forces operating over time must be considered when estimating hedonic functions with data that are generated over time.

Hedonic price analyses of tea have not been published. But hedonic models have been used for rice (Brorsen, Grant, and Rister, 1984), apples (Stephens, 1990), wheat (Espinosa and Goodwin, 1991; Veeman, 1987), cotton lint (Ethridge and Davis, 1982), juices and drinks (Margoluis and Tilley, 1982), Paris carcass lamb (O'Connell, 1986), barley (Wilson,

1984), and urban air quality (Murdoch and Thayer, 1988).

Reputation Selling Theory

Reputation (expected quality from the point of view of consumers) selling is the "goodwill" value of the firm's brand name or loyal customer patronage (Shapiro, 1983). Reputation may be a signal of expected quality (Turner et al. 1993). Reputation implies that the buyers have experience with a product or consult a reference group prior to making a purchase decision.

Reputation is particularly important when complete information about a product or service is difficult to obtain. For graded commodities, if reputation of the supplying firm is important, the grades have not adequately supplied the buyer with all the information that influences its value (Turner et al., 1993). Unlike other characteristics, firms build product reputation in the mind of the buyers rather than in the product itself. Reputation is a dynamic concept because of its experiential nature (personal or reference group). In addition, reputation is much like an investment that is built over time and depreciates over time (Shapiro, 1983). Reputation and quality are related because current reputations are based on past qualities.

Reputation selling is expected to be important for tea

because tea is extremely difficult to objectively grade. Reputation is important because buyers at the Jakarta tea auction are frequently repeat buyers at the auction. In addition, buyers can observe the prices paid for tea from different regions or companies by other buyers at the auction.

The only previous study of reputation selling in the agricultural economics literature was recently published by Turner et al. for feeder cattle at Georgia electronic auctions.

Auction Theory

Four types of auctions are identified by McAfee and McMillan (1987). The Jakarta tea auction is a progressive "English" auction where bidding opens low and edges upward as the bidders increase their bids. At the price where bidding discontinues the materials for sale are said to be or "hammered down" with the price at this point as "hammer price" (Ashenfelter, 1989). The auctioneer at the Jakarta tea auction uses a gavel to signal when a lot is sold.

McAfee and McMillan assume that bidders are risk neutral, bidders valuations are independent, bidders are symmetric (not recognizably different), payment is a function of the winning bid alone. In a progressive auction where the above assumptions apply, McAfee and McMillan demonstrate that the dominant strategy is to remain in the

budding until the price reaches the bidder's own valuation. The value received at an auction will then be approximated by the second highest bidder's valuation of a given lot because at the margin the high bidder must only marginally exceed the second highest bidder's valuation.

In auctions where there are a large number of bidders it is expected that the second highest bidder valuation will be very close to the highest bidder's valuation (McAfee and McMillan, 1987). In auctions where there is a small number of buyers, a reservation price may be used to assure that the bid approaches the value to the highest bidder.

III. DATA AND EMPIRICAL MODEL

Data

Data for 16,198 tea lots from 100 auctions that were held from January 1990 to December 1991 are used. The data used are from three government companies and two private companies. The companies were selected because complete data for all 100 auctions are available and the five companies actively participated in nearly every auction during the data period and produced from a variety of plantations in different locations. The five companies sell from 20 different regions or plantations. Of the 16,198 lots, 7,712 lots were sold at the auction or through negotiations to the highest bidder within 24 hours of the auction. Price for the remainder of the lots that were not sold at the auction were not available. The five companies represent about one-third of the total lots sold at the auction during 1990 and 1991. A total of 13 companies participated in the 100 auctions conducted during 1990 and 1991.

The data are from the auction manager's catalogue. Figure 1 shows a sample page from a catalogue. The catalogue contains the name of the company, number and date

PT. TEHNUSAMBA INDAH . -

AUCTION CH SAMPLE : NR.06
D A T E : FEBRUARY 7, 1990
T I M E : 10.00 LOCAL TIME

CATALOGUE NR.06 TOTALLY.1.440 CHESTS

CIANJUR . -

LOT NR.	CHOP	CHESTS	GRADE	WEIGHT GROSS	WEIGHT NETT		
96	012	~~60~~	BOP	3150	2820	198	200 HP
97	013	~~60~~	"	3150	2820		
98	014	~~60~~	BOP.F	3450	3120	198	200 HP
99	015	~~60~~	"	3450	3120		
100	016	~~60~~	"	3450	3120		
101	017	~~60~~	"	3450	3120		
102	010	~~50~~	DUST	3000	2750	168	160L HP
103	019	~~50~~	"	3000	2750		162L HP

G A R U T . -

104	001	~~60~~	BOP.F	3330	3000	198	
105	002	~~60~~	"	3330	3000		
106	003	~~60~~	"	3330	3000		
107	004	~~60~~	"	3330	3000		
108	005	~~60~~	"	3330	3000		200L HP
109	006	~~60~~	"	3330	3000		

SUKABUMI . -

110	011	~~60~~	BOP	3030	2700	198	200 HP
111	012	~~60~~	"	3030	2700		
112	006	~~60~~	BOP.F	3330	3000	198	
113	013	~~60~~	"	3330	3000		
114	014	~~60~~	"	3330	3000		200 HP
115	015	(60)	F F	3330	3000	170	
116	016	(60)	"	3330	3000		155 HA
117	007	~~50~~	DUST	2725	2500	158	157 (159) IP
118	008	~~50~~	"	2725	2500		157 (159) HA
119	009	~~50~~	"	2725	2500		157 (159) IP
120	010	~~50~~	"	2725	2500		157 (159) HA

BUYER : SHIPMENT PALLETIZED . -

Sk

JAKARTA JANUARY 23, 1990

BASYARUDDIN DJULAY

Figure 1. Sales made on sample 6 from PT Tehnusamba Indah from plantations Cianjur, Garut, and Sukabumi.

of the auction, "chop" which indicates the sequence of processing, number of chests (foil-lined, mahogany boxes) in which the tea in the lot is contained, the name of the region from which the lot came, grade, gross weight of the lot, net weight of the lot, the price idea for each lot, each bid on the lot, and the initials representing the buyer or high bidder's identity. A circle around a price on the catalogue indicates that the lot was sold to the high bidder either at the auction or within 24 hours of the auction. Figure 1 shows the first twenty-five sales made at Auction on sample number 6 for PT Tehnusamba Indah from plantation Cianjur, Garut, and Sukabumi. Lot number 96 came from chop (processing/harvesting sequence) 012, contained 60 chests with gross weight 3,150 kg, net weight 2,820 kg and graded as BOP, broken orange pekoe. The auction manager's price idea was 198 cents. The initial price bid was 200 cents at which time the lot was sold to IP (the buyer agency).

The five companies sold twenty-two grades of tea during the data period. The 39 different buyers were primarily from Indonesia, European countries, the United States, and Russia.

Empirical Models

Two alternative models are estimated in linear (Equations 1 and 2) and log-linear forms. The linear models imply that the premiums and discounts are constant in cents

per kilogram while the log-linear models imply that the premiums and discounts are constant percentages of the selling price. In the linear model the parameters indicate the number of cents that the price changes given a one unit change in the independent variables while in the log-linear model the parameters for continuous variable show the percentage that the price changes given a one percent change in the independent variable. In Equations 1, dummy variables are included to test for the effect of company while in Equations 2, dummy variables are included to account for regions (plantations). The empirical hedonic price models for Indonesian tea are:

$$(1)\quad P_{tk}=\alpha+\sum_{i=1}^{22}\delta_i GR_{itk}+\sum_{j=1}^{5}\gamma_j COM_{jtk}+\beta_1 CP_t+\beta_2 YR_t+\beta_3 LOT_{tk}+e_{tk}$$

$$(2)\quad P_{tk}=\alpha+\sum_{i=1}^{22}\delta_i GR_{itk}+\sum_{j=1}^{20}\gamma_j REG_{jtk}+\beta_1 CP_t+\beta_2 YR_t+\beta_3 LOT_{tk}+e_{tk}$$

where:

t is the number of the tea auction, t = 1, 2, 3, ..., 100;

k is the number of lot in auction t, k = 1, 2, 3, ..., K_t;

K_t is the number of lots sold in auction t;

P_{tk} is price received in US cents per kilogram for lot t;

GR_{itk} are dummy variables for grade, 1 if lot k from auction t is from GR_i, zero otherwise;

COM_{jtk} are dummy variables for producing company, 1 if lot k from auction t is from company j, zero otherwise;

REG_{jtk} are dummy variables for producing region or plantation within the company, 1 if lot k from auction t is from region j, zero otherwise;

CP_t London cash price of tea in US cents per pound for the month in which auction t was held;

YR_t dummy variable for year, one if auction t was sold in 1990 and zero if 1991;

LOT_{tk} is the number of kilograms in a given lot; and

e_{tk} is the error term.

The hypotheses are:

1. Characteristics measured by grade influence the price paid for Indonesian tea (one or more δ_i are not zero);
2. Company and/or region of origin influence price received above and beyond the factors measured by grade (one or more of the γ_j are not zero);
3. Indonesian tea prices are positively related to the general price of tea at the London market (β_1 is positive);
4. Year of the auction influences the price of tea with prices higher in 1991 because weather conditions in

1991 were dry producing higher quality characteristics for tea (β_2 is positive); and

5. Lot size is positively or negatively related to the price of tea (β_3 is positive or negative).

Grade, region and/or company variables are the characteristics of the tea. Company and region variables are included to test for company and region reputation which may be related to altitude, soil, processing skill, and cultivar used in the tea plantation.

To estimate the model, one of the variables in each of the grade and company/region groups of dummy variables are omitted (included in the intercept). For the grade dummy variables, DUST.III is used as the base. DUST.III is one of the lower grades so most other grades should sell at a premium to DUST.III. For the region variables, Gunung Dempo the only region from PTP X, is used as the base while PTP X is the base in the models that include dummy variables for company.

The errors for the lots that are in the same auction are assumed to be correlated. Define X as all of the variables in the model excluding the intercept. The equations can be represented by:

(3) $P_{tk}=\alpha+B'X_{tk}+\epsilon_{tk}+\mu_t$

(4) $E[\epsilon_{tk}]=E[\mu_t]=0$

(5) $Var[\epsilon_{tk}]=\sigma_\epsilon^2$

(6) $Var[\mu_t]=\sigma_\mu^2$

(7) $Cov[\epsilon_{tk},\mu_t]=0$

All error terms have variance:

(8) $Var[\epsilon_{tk}+\mu_t]=\sigma^2=\sigma_\epsilon^2+\sigma_\mu^2$

The disturbances have correlation because they have a common component for a given auction t:

(9) $Corr[\epsilon_{tk}+\mu_t,\epsilon_{tl}+\mu_t]=\rho=\sigma_\mu^2/\sigma^2$

The equations are estimated using a two-stage estimated generalized least squares estimator. The first-stage ordinary least squares residuals are used to estimate σ_ϵ^2 and σ_μ^2 which form the estimated variance-covariance matrix used for the second stage generalized least squares estimator. The estimator is asymptotically efficient (Greene, 1992).

IV. RESULTS

Descriptive statistics are in Table 5 and results of the Equation 1 and 2 are in Tables 6 and 7, respectively. Estimates for the double logarithmic forms of the equations are in Appendix Tables 1 and 2. The results are very similar and therefore the discussion centers on the results presented in Table 6 and 7.

The R^2's from the second stage estimation of Equations 1 and 2 are 0.600 and 0.606, respectively. Breusch and Pagan's Lagrange Multiplier test of the null hypothesis of no error component assoiated with auction (Judge et al., 1988, p. 487). The test statistics are 28068.122 and 27908.120 for Equations 1 and 2, respectively, and the null hypothesis is rejected indicating there is a variance component associated with auction.

Joint test of the null hypothesis that the grade effects are not significant (H_o: all δ_i are zero) is rejected with both Equations 1 and 2. Grade does provide buyers with useful information that influences price of tea at the auction. The base grade is DUST.III (Dust Three, Orthodox). Relative to the base in Equation 2, BP.1, PF.1, BM, PD, FANN, BOP.F, DUST, BOP, PF, PF.II, BT, BP, DUST.II, BP.I, PF.I, DUST.I, and DUST.1 have positive and

Table 5. Mean and standard deviation of variables used in the hedonic price equation for Indonesian tea.

VARIABLE	MEAN	STANDARD DEVIATION
LOT SIZE	2169.20	853.76
YEAR	90.65	0.48
CASH PRICE	87.40	12.70
BP.1 (Broken Pekoe One, CTC)	0.02	0.15
PF.1 (Pekoe Fanning One, CTC)	0.01	0.11
DUST.2 (Dust Two, CTC)	0.01	0.10
BM (Broken Mixed)	0.03	0.16
PD (Pekoe Dust)	0.02	0.15
FANN (Fanning)	0.02	0.13
BOP.F (Broken Orange Pekoe Fanning)	0.17	0.37
DUST (Dust)	0.10	0.29
BOP (Broken Orange Pekoe)	0.14	0.35
PF (Pekoe Fanning)	0.14	0.35
PF.II (Pekoe Fanning Two, Orthodox)	0.09	0.29
BT (Broken Tea)	0.09	0.29
BP (Broken Pekoe)	0.02	0.14
DUST.II (Dust Two, Orthodox)	0.03	0.18
BP.I (Broken Pekoe One, Orthodox)	0.05	0.21
PF.I (Pekoe Fanning One, Orthodox)	0.39	0.19
DUST.I (Dust One, Orthodox)	0.01	0.08
DUST.III (Dust Three, Orthodox)	0.01	0.11
DUST.1 (Dust One, CTC)	0.00	0.06
WALINI, PTP XII	0.04	0.21

Table 5. Continued

Variable	Mean	Standard Deviation
GUNUNG MAS, PTP XII	0.03	0.16
KONDANG, PTP XII	0.05	0.22
ARUM, PTP XII	0.03	0.16
HARENDONG, PTP XII	0.03	0.18
PASIR NANGKA, PTP XII	0.08	0.27
TANNAWATE, PTP XII	0.07	0.25
GOALPARA, PTP XII	0.07	0.26
SPERATA, PTP XII	0.07	0.26
SINUMBRA, PTP XII	0.08	0.27
RANTJABOLANG, PTP XII	0.06	0.24
MONTANA, PTP XII	0.08	0.27
PANGLEDJAR, PTP XII	0.05	0.22
PANGHEOTAN, PTP XII	0.02	0.15
KERTASARI, PT LONDON	0.02	0.13
CIANJUR, PT TEHNUSAMBA INDAH	0.02	0.15
GARUT, PT TEHNUSAMBA INDAH	0.02	0.14
SUKABUMI, PT TEHNUSAMBA INDAH	0.02	0.15
PARAKANSA, PTP XI	0.03	0.18
GUNUNG DEMPO, PTP X	0.12	0.32
PTP X	0.12	0.32
PTP XI	0.03	0.18
PTP XII	0.77	0.42
PT LONDON	0.02	0.13
PT TEHNUSAMBA INDAH	0.07	0.25

Table 6. Estimated coefficients for the hedonic price equation for Indonesian tea where company is included.

VARIABLE	ESTIMATED COEFFICIENT	t-STATISTIC
CONSTANT	2024.90	9.91**
LOT SIZE	-0.00	-7.95**
YEAR	-21.06	-9.44**
CASH PRICE	0.19	2.66**
BP.1 (Broken Pekoe One, CTC)	30.33	14.21**
PF.1 (Pekoe Fanning One, CTC)	36.04	15.72**
DUST.2 (Dust Two, CTC)	3.97	1.66
BM (Broken Mixed)	19.25	10.56**
PD (Pekoe Dust)	26.95	14.13**
FANN (Fanning)	19.27	9.61**
BOP.F (Broken Orange Pekoe Fanning)	51.77	31.44**
DUST (Dust)	23.58	14.32**
BOP (Broken Orange Pekoe)	55.06	33.39**
PF (Pekoe Fanning)	33.58	20.10**
PF.II (Pekoe Fanning Two, Orthodox)	23.92	14.73**
BT (Broken Tea)	16.82	10.43**
BP (Broken Pekoe)	10.91	5.62**
DUST.II (Dust Two, Orthodox)	10.29	5.76**
BP.I (Broken Pekoe One, Orthodox)	36.15	21.05**
PF.I (Pekoe Fanning One, Orthodox)	36.60	20.88**
DUST.I (dust One, Orthodox)	24.51	9.67**
DUST.1 (Dust One, CTC)	25.16	6.53**
PTP XI	-13.58	-8.82**

Table 6. Continued

VARIABLE	ESTIMATED COEFFICIENT	t-Statistic
PTP XII	-13.87	-17.45**
PT LONDON	-14.24	-9.73**
PT TEHNUSAMBA INDAH	3.67	3.47**
F-TEST FOR GRADE	193.84**	
F-TEST FOR COMPANY	213.68**	

* Significant at five percent confidence level
** Significant at one percent confidence level

significant coefficients, indicating these grades receive premiums, while DUST.2 is not significantly different from the base (DUST.III).

The null hypotheses that region and company dummy variables are not related to price (H_o: all γ_j are zero) arerejected. Company and region identification provides important information to buyers. Reputation selling is important in selling tea in Indonesia.

In Equation 2, the base region is Gunung Dempo from PTP X. Relative to the base, Walini, Kondang, Arum, Harendong, Pasir Nangka, Tannawate, Goalpara, Sperata, Sinumbra, coefficients , while Cianjur, Garut, and Sukabumi have positive and significant coefficients. These results suggest that the regional differences are clearly important factors and that buyers offer premiums and discounts for tea from certain regions.

Table 7. Estimated coefficients for the hedonic price equation for Indonesian tea with region included

VARIABLE	ESTIMATED COEFFICIENT	t-STATISTIC
CONSTANT	2014.60	11.08**
LOT SIZE	-0.00	-9.03**
YEAR	-20.95	-10.56**
CASH PRICE	0.19	2.99**
BP.1 (Broken Pekoe One, CTC)	25.32	8.78**
PF.1 (Pekoe Fanning One, CTC)	31.28	10.29**
DUST.2 (Dust Two, CTC)	0.86	0.31
BM (Broken Mixed)	12.46	4.75**
PD (Pekoe Dust)	20.95	7.74**
FANN (Fanning)	12.78	4.58**
BOP.F (Broken Orange Pekoe Fanning)	54.13	30.25**
DUST (Dust)	25.23	14.20**
BOP (Broken Orange Pekoe)	57.37	32.08**
PF (Pekoe Fanning)	36.68	20.07**
PF.II (Pekoe Fanning Two, Orthodox)	25.57	14.63**
BT (Broken Tea)	16.96	9.79**
BP (Broken Pekoe)	12.04	5.84**
DUST.II (Dust Two, Orthodox)	9.35	4.74**
BP.I (Broken Pekoe One, Orthodox)	30.08	11.48**
PF.I (Pekoe Fanning One, Orthodox)	30.98	11.68**
DUST.I (Dust One, Orthodox)	18.47	5.70**
DUST.1 (Dust One, CTC)	19.33	4.42**
WALINI, PTP XII	-4.11	-2.02*
GUNUNG MAS, PTP XII	-2.59	-1.15

Table 7. Continued

VARIABLE	ESTIMATED COEFFICIENT	t-STATISTIC
KONDANG, PTP XII	-5.02	-2.40*
ARUM, PTP XII	-6.48	-2.91**
HARENDONG, PTP XII	-4.12	-1.94*
PASIR NANGKA, PTP XII	-11.94	-10.35**
TANNAWATE, PTP XII	-13.69	-14.28**
GOALPARA, PTP XII	-10.40	-9.03**
SPERATA, PTP XII	-10.46	-8.47**
SINUMBRA, PTP XII	-9.17	-7.54**
RANTJABOLANG, PTP XII	-8.25	-6.83**
MONTANA, PTP XII	-15.13	-15.56**
PANGLEDJAR, PTP XII	-12.32	-9.42**
PANGHEOTAN, PTP XII	-18.93	-13.19**
KERTASARI, PT LONDON	-12.23	-7.90**
CIANJUR, PT TEHNUSAMBA INDAH	8.43	5.52**
GARUT, PT TEHNUSAMBA INDAH	3.78	2.40*
SUKABUMI, PT TEHNUSAMBA INDAH	6.13	3.97**
PARAKANSA, PTP XI	-5.45	-2.41*
F-TEST FOR GRADE	178.82**	
F-TEST FOR REGION	58.82**	

* Significant at five percent confidence level
** Significant at one percent confidence level

Rantjabolang, Montana, Pangledjar, Pangheotan, Kertasari, and Parakansa estate have negative and significant coefficients.

The coefficient of cash price is positive and large relative to its standard error. The results reveal that

Indonesian tea prices are positively and significantly related to the cash price in London.

The coefficient for the year variable is negative and significant, indicating that price in 1990 were approximately 20 cents higher than in 1991.

The lot size coefficient is negative and significant, indicating that larger lot sizes received a lower price than smaller lots. Several alternative explanations may include either a preference on the part of buyers for smaller lots or the possibility that the auction manager sets a lower reservation price for large lots because of the pecuniary economies of size associated with handling and selling larger lots.

V. CONCLUSIONS

Tea is an important source of export revenue in Indonesia and contributes to employment and agribusiness activities in rural areas. Understanding of factors that influencing the price of Indonesian tea would let managers evaluate the profitability of alternative production regions and companies and the usefulness of existing grading systems.

The general hypothesis of this thesis is that variation in prices received at auction can be explained by events in other related markets, tea grades, and region of production or company of origin. The hypotheses are tested using data from the Indonesian tea auction for five companies during 1990 and 1991. In general the hypotheses are supported.

Grade, region, company, lot size, and the London cash price affect the price of tea. Grades provide useful information to buyers. The reputation selling hypothesis is supported. Reputation of specific companies and regions are related to the price of tea. The number of repeat purchases and the difficulty of comprehensively and objectively grading tea make region/plantation reputation an important factor in price determination.

Tea prices in Indonesia are positively and significantly related to the price of tea in London. While Indonesia is a significant tea producing country, other countries have larger auctions.

These results may be useful as an initial step in providing auction management with a mathematical way of developing price expectations for various grades of tea from different regions in Indonesia. Models could be updated weekly and used to estimate price expectation for lots listed in the next auction.

Reputation selling implies either that some companies are doing a better job of processing or some regions produce tea with valuable characteristics that are not measured by the grading system. The specific reasons for region or company premiums and discounts should be examined.

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APPENDIX

Appendix Table 1. Parameter estimates for the double log version of hedonic price equation containing company dummy variables.

VARIABLE	ESTIMATED COEFFICIENT	t-STATISTIC
CONSTANT	17.74	16.01**
LOT SIZE	-0.03	-6.50**
YEAR	-0.14	-11.68**
CASH PRICE	-0.02	2.25*
BP.1 (Broken Pekoe One, CTC)	0.25	20.39**
PF.1 (Pekoe Fanning One, CTC)	0.28	20.83**
DUST.2 (Dust Two, CTC)	0.06	4.60**
BM (Broken Mixed)	0.15	14.41**
PD (Pekoe Dust)	0.12	19.25**
FANN (Fanning)	0.16	13.30**
BOP.F (Broken Orange Pekoe Fanning)	0.35	37.30**
DUST (Dust)	0.19	19.54**
BOP (Broken Orange Pekoe)	0.37	39.11**
PF (Pekoe Fanning)	0.25	26.12**
PF.II (Pekoe Fanning Two, Orthodox)	0.19	19.90**
BT (Broken Tea)	0.14	15.18**
BP (Broken Pekoe)	0.10	9.07**
DUST.II (Dust Two, Orthodox)	0.08	7.62**
BP.I (Broken Pekoe One, Orthodox)	0.27	27.45**
PF.I (Pekoe Fanning One, Orthodox)	0.28	27.25**
DUST.I (dust One, Orthodox)	0.19	12.81**
DUST.1 (Dust One, CTC)	0.20	9.06**
PTP XI	-0.09	-10.21**

Appendix Table 1. Continued

VARIABLE	ESTIMATED COEFFICIENT	t-STATISTIC
PTP XII	-0.09	-18.21**
PT LONDON	-0.09	-10.68**
PT TEHNUSAMBA INDAH	0.23	3.69**
F-TEST FOR GRADE	232.17**	
F-TEST FOR COMPANY	247.41**	

* Significant at five percent confidence level
** Significant at one percent confidence level

Appendix Table 2. Parameter estimates for the double log version of hedonic price equation containing regional dummy variables.

VARIABLE	ESTIMATED COEFFCIENT	t-STATISTIC
CONSTANT	18.00	71.46**
LOT SIZE	-0.03	-5.22**
YEAR	-0.15	-53.10**
CASH PRICE	0.03	8.09**
BP.1 (Broken Pekoe One, CTC)	0.32	16.71**
PF.1 (Pekoe Fanning One, CTC)	0.29	14.50**
DUST.2 (Dust Two, CTC)	0.08	4.61**
BM (Broken Mixed)	0.12	6.85**
PD (Pekoe Dust)	0.18	9.82**
FANN (Fanning)	0.13	6.84**
BOP.F (Broken Orange Pekoe Fanning)	0.37	31.52**
DUST (Dust)	0.17	14.81**
BOP (Broken Orange Pekoe)	0.39	33.47**
PF (Pekoe Fanning)	0.25	21.09**
PF.II (Pekoe Fanning Two, Orthodox)	0.18	15.78**
BT (Broken Tea)	0.16	14.20**
BP (Broken Pekoe)	0.10	7.24**
DUST.II (Dust Two, Orthodox)	0.06	4.30**
BP.I (Broken Pekoe One, Orthodox)	0.26	15.21**
PF.I (Pekoe Fanning One, Orthodox)	0.25	14.40**
DUST.I (Dust One, Orthodox)	0.14	6.49**
DUST.1 (Dust One, CTC)	0.14	5.13**

Appendix Table 2. Continued

VARIABLE	ESTIMATED COEFFICIENT	t-STATISTIC
WALINI, PTP XII	-0.04	-3.18**
GUNUNG MAS, PTP XII	-0.05	-3.02**
KONDANG, PTP XII	-0.05	-3.50**
ARUM, PTP XII	-0.06	-4.20**
HARENDONG, PTP XII	-0.05	-3.40**
PASIR NANGKA, PTP XII	-0.08	-11.15**
TANNAWATE, PTP XII	-0.08	-11.47**
GOALPARA, PTP XII	-0.07	-9.67**
SPERATA, PTP XII	-0.08	-9.83**
SINUMBRA, PTP XII	-0.06	-7.14**
RANTJABOLANG, PTP XII	-0.06	-7.72**
MONTANA, PTP XII	-0.11	-16.46**
PANGLEDJAR, PTP XII	0.10	-12.09**
PANGHEOTAN, PTP XII	-0.13	-13.13**
KERTASARI, PT LONDON	-0.07	-6.61**
CIANJUR, PT TEHNUSAMBA INDAH	0.09	8.83**
GARUT, PT TEHNUSAMBA INDAH	0.06	5.69**
SUKABUMI, PT TEHNUSAMBA INDAH	0.07	6.92**
PARAKANSA, PTP XI	-0.09	-6.29**
F-TEST FOR GRADE	219.48**	
F-TEST FOR REGION	68.23**	

* Significant at five percent confidence level
** Significant at one percent confidence level

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