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Estimation of Market Power in India's Instant Coffee Market

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Degree of Instant Competition:

Estimation of Market Power in India's Instant Coffee Market

Satish Y. Deodhar and Vivek Pandey[*]

Abstract

The new competition policy of the Government of India seeks to promote competition to protect consumer interests and increase market efficiency. In fact, the degree of price transmission between farmers and final consumers also depends on the degree of competition in the processing sector. Moreover, policy of trade liberalization too is expected to have impact on domestic markets. It becomes imperative, therefore, that one knows the degree of competition in various domestic industries. Instant coffee market in India is a duopoly of Nestlé and Hindustan Lever for decades. They also differentiate their products through branding. At the same time, however, incumbents might have perceived potential competition from another firm, Tata Coffee. In fact, instant coffee can be considered as a part of a larger beverage market with numerous competing products. With trade liberalization, imports have also started trickling in. Thus, circumstantial evidence regarding degree of competition or the market power in the instant coffee market is rather mixed one. By econometrically estimating the perceived first-order supply relation and the demand function, we calculate the market power parameter. Results indicate that the market is not characterized by collusive behaviour. It is quite close to perfectly competitive behaviour although we cannot reject the Cournot-Nash behaviour as well. The econometric study may be complemented by in-depth case study on coffee procurement, processing, and pricing by leading producers. Similar estimations of market power and case studies may be undertaken for other industries as well.

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1.   The Instant Coffee Market

Legend has it that circa 1600, Baba Budan, a pilgrim returning to India, carried several coffee beans from the city of Mocha in Yemen and planted them in India. From these initial seeds, India's coffee plantation industry has grown to a production level of about 275 thousand tonnes of coffee beans. Historically India has been exporting most of its coffee beans. However, domestic consumption is on the rise. Now, more than a fourth of the coffee beans are used for domestic processing and consumption. In fact, volume of sales has increased by about 30 percent in the last 5 years. Consumers in the southern states of India are mostly coffee (non-tea) drinkers. While their traditional preference has been for filter coffee, with the invention and commercial application of freeze-drying technology by Nestlé, and, with changing lifestyles over the decades, instant coffee is gaining ground in the minds of consumers. Similarly, in the northern states of India, while proportion of tea drinkers is larger, those who drink coffee prefer only instant coffee. As a result, demand for instant coffee has a wider acceptance across the country (Euromonitor, 2006).

In the year 2005, formal-sector retail sales of processed coffee were about 14 thousand tonnes valuing 4.3 billion rupees. The size of instant coffee was about 4.4 thousand tonnes valuing at little more than 3 billion rupees. Evidence from Latin America shows that due to high capital intensity of the instant coffee production, firm concentration is very high in those markets (Talbot, 1997). India has witnessed a duopoly market for instant coffee. Initially Nestlé was the only player in the domestic market. However, in 1969 Hindustan Lever launched its brand, Bru, and has become a major competitor of Nestlé since then. Nestlé had to come out with Sunrise, its own equivalent of Bru, and now these two rival brands completely dominate the domestic instant coffee market. Though Nestlé has been a leader, market share of Bru has increased over time and currently it stands at about 40 percent. Tata Coffee too produces instant coffee, although at this time it caters only to export market. A few years ago, however, it has augmented its plant capacity to 2500 tonnes a year, and, has introduced Tata Kaapi and Tata Café brands of instant coffee in the domestic market.

As far as competition from imports is concerned, the domestic industry was protected through quantitative restrictions till the year 2000. Currently, no import quota exists but a

'moderate' customs duty of 30 percent is applied on instant coffee (CBEC, 2006). Accordingly, during the financial year 2005-06, instant coffee worth Rs. 4.1 crore was imported and it represented a 46 percent rise in imports over the previous year (DGFT, 2006). So far, no foreign direct investment has come forth from major coffee producers such as Maxwell House or Folgers. Starbucks is thinking of making an entry, but it will be in food service industry where Barista and Café Coffee Day already have been operating their coffee shops. In this paper, we study the market for instant coffee (powder) sold to the final consumers.

2.   Motivation

The instant coffee market is an interesting case of an imperfectly competitive market. The market structure is a duopoly, for Nestlé and Hindustan Lever have been the only two firms operating in this market for decades. Through branding, both have introduced a certain degree of product differentiation and brand loyalty. Therefore, one may conjecture a high degree of market power enjoyed by these firms. Having had enough time to give signals to each other, one could even hypothesize a tacitly collusive behaviour between the two firms. On the other hand, however, apart from the competition between the two, the incumbent duopolists might have perceived a potential competition from the prospective entrant, Tata Coffee, invoking the seminal idea of limit pricing (Bain, 1949). Moreover, if the industry is envisaged in a broader context – i.e., beverage segment, then the existence of a number of competing products may lead one to conjecture a more competitive behaviour by the firms. Therefore, if one motivates a *Folk Theorem* argument (Friedman, 1971), any outcome - collusive, Cournot-Nash, or competitive is possible depending upon the kind of strategic interaction the firms may have between them. In a recent paper, Adams (2006) made observations on the beer markets in US and Germany. He points out that production technologies and consumer preferences determine the structure and the vigour of competition. While scale augmenting automation has led US beer industry to have a 4-firm concentration ratio of

0.95, in the German market, preference for local beers (competing products) over national brands has led to a low 4-firm concentration ratio of just 0.29.

In this context, we would like to estimate the degree of competition in the Indian instant coffee market. This exercise is important not merely from academic perspective mentioned above, but from the emerging policy perspectives as well. The new Competition Act, 2002 which replaced the Monopolies and Restrictive Trade Practices (MRTP) act, emphasizes competition to protect consumer interests and promote efficiency (ML&J, 2003). The commission would, therefore, like to know degree of market power in various domestic industries. Until 1992-93, the marketing of coffee beans was wholly administered by the Coffee Board – a statutory organization set up under the Coffee Act, 1942. However, Coffee Board's role in marketing the beans has been completely eliminated over time. Amendments made in its role in 1996 allow the growers to sell their produce directly to the processing firms. This implies that growers are now exposed to free-market price realization for their beans. Although this seems only fair, evidence suggests that price transmission between farmers and consumers depends on the degree of market power in the processing sector (e.g. Fletcher and Deodhar, 1998). The higher the degree of market power in the processing sector, the lower is the transmission of hike (fall) in retail (farm gate) prices to farmers (final consumers). Therefore, both from farmers' and consumers' perspective, it is important to know the degree of market power in the processing industry. Moreover, Hwang and Mai (1988) show that impact of trade restriction (or its elimination) will depend on the initial values of conjectural variation in the domestic market. If a domestic industry is collusive in nature, trade liberalization will have an impact by increasing competition in the market. However, in the presence of quota or tariff-rate-quota, domestic firms might have behaved in Cournot-Nash form, and, therefore, pro-competitive impact of trade liberalization may not be as much as it would have been if the domestic market were collusive. Thus knowing the degree of market power empirically assumes importance.

3. Methodology

Most industrial organization economists agree that the appropriate measure of the degree of market power is the distance between price (P) and marginal cost (MC), i.e. the ability

of a firm/industry to raise price above marginal cost. A unit-less measure for the market power is the familiar Lerner Index:

$$(1) \qquad L = \frac{P - MC}{P}$$

This can be measured directly if adequate data on firms' marginal cost are available. Unfortunately such detailed information about marginal cost is rarely available. Most of the research in the Structure-Conduct-Performance tradition adopted a proxy for the Lerner Index originally introduced by Collins and Preston (1969) which uses average variable cost (AVC) rather than marginal cost. However, except for competitive firms in long-run equilibrium, average (variable) cost is not a good approximation to the marginal cost. An alternative index, Tobin's q, a firm's financial market value divided by replacement cost of its tangible assets, should on average, equal one under competitive conditions. But if intangible assets (for example expense on advertising and research and development) are large and ignored in the valuation of the firm, then q could exceed one even in the absence of market power. Measures of profits and rate of returns are not good substitutes either for the price-cost margin. They use accounting as opposed economic definitions of cost, employ arbitrary depreciation rules, and do not treat the cost of advertising and research and development reasonably. Fisher and McGowan (1983) indicate that the time profile of the benefits derived from investments, depreciation methods used and the growth rates of the firms differ among firms, hence, the comparison of accounting rates of return is misleading.

The emergence of the new empirical industrial organization was to some extent motivated by the dissatisfaction over these issues. Survey articles by Bresnahan (1989) and Perloff (1992) show that in the last decade, relatively complete structural econometric models based on formal profit-maximizing theories have been used to estimate the degree of market power in specific industries. This literature has grown into several directions, the variety reflecting the differences in the availability of the data and the institutional details of the industries. The approach followed in this paper is a special case of the model suggested by Bresnahan (1982). The aim is to estimate the parameter of market power using a standard structural econometric method. Consider a duopoly in the instant coffee

market. Let firm 1 expect firm 2 to produce q_2^e units of output. If firm 1 produces q_1

units of output, then the total output that it expects to be sold in the market is $Q = q_1 + q_2^e$.

The profit maximizing problem for firm 1 is given by:

(2)   Arg max $[P(Q)q_1 - c_1(q_1)]$,
          q_1

where $P(Q)$ is the inverse demand function and $c_1(q_1)$ is firm 1's total cost function. The

first-order condition for this problem is:

(3) $P(Q) + \left[\dfrac{dP}{dQ} \quad \dfrac{dQ}{dq_1}\right] q_1 = MC_1(q_1)$

where MC_1 (.) is firm 1's marginal cost. If the derivatives are treated as discrete changes,

then the change in Q can be expressed as: $dQ = dq_1 + dq_2^e$ and hence,

(4) $\dfrac{dQ}{dq_1} = \left[1 + \dfrac{dq_2^e}{dq_1}\right]$

In the equilibrium, $q_2^e = q_2$, therefore, the equilibrium expression (3) can be re-written as:

(5) $P(Q) + \dfrac{dP}{dQ}\left[1 + \dfrac{dq_2}{dq_1}\right] q_1 = MC_1(q_1)$.

The term dq_2/dq_1 in the equation (5) is the conjectural variations term. It summarizes

how firm 1 conjectures firm 2 will vary its output when firm 1 makes a small change in

output. Denote this term as V. Assuming that the firms are symmetric, (i.e. they have

identical costs), and, therefore, produce the same level of output, then equation (5) can be

generalized to n firms as:

(6) $\quad P(Q) + \dfrac{dP}{dQ}\left[\dfrac{1+(n-1)V}{n}\right]Q = MC$

The above equation can be rewritten as:

(7) $\quad P(Q) + \lambda\dfrac{dP}{dQ}Q = MC$, where

(8) $\quad \lambda = \left[\dfrac{1+(n-1)V}{n}\right]$

The parameter λ is the market power parameter and the left-hand-side of equation (7) is called the perceived marginal revenue. From equation (7), it is obvious that if firms demonstrate Bertrand-Nash or competitive behaviour, value of λ will be 0 and equation (7) gives the usual condition of price equal to marginal cost in a perfectly competitive market. If firms demonstrate perfectly collusive behaviour, then the value of λ becomes 1 so that it mimics the profit maximizing behaviour of a monopolist. Similarly, λ will take a value of $1/n$ if the firms behave in Cournot-Nash fashion, i.e., $V = 0$. In a duopoly case, therefore, this value will be 0.5. From (8) it is easily verified that collusive behaviour will imply $V = 1$, and perfectly competitive behaviour will imply $V = -1/(n-1)$. In a duopoly case this value will be -1. Moreover, Lerner Index as described in (1) can now be expressed as:

(9) $\quad L = -\lambda\dfrac{dP}{dQ}\dfrac{Q}{P}$, or $\quad L = \dfrac{-\lambda}{\eta_d}$,

where η_d is the price elasticity of market demand[†].

[†] Although Lerner Index (L) is easy to get from the market power parameter and price elasticity of demand, ideally one would like to estimate mark up of price over marginal cost, (P-MC) / MC. This index is called the Mark-up Index (M). It can be derived as: $M = L / (1 - L)$.

Given the above theoretical background, the following empirical procedure can be adopted to estimate the degree of market power in the Indian instant coffee market.

Suppose the demand function is specified in linear form as:

(10) $Q_t = \alpha_0 + \alpha_1 P_t + \alpha_2 Z_t + \varepsilon_{t1}$.

Here Q_t is the quantity of instant coffee sold, P_t is the retail price, Z_t is a vector of exogenous variables and ε_{t1} is the error term. Moreover, suppose that marginal cost takes the following functional form:

(11) $MC_t = \gamma_0 + \gamma_1 W_t + \gamma_2 T$.

W_t is the wholesale price of the essential input i.e. green coffee beans. Trend changes in other input cost such as packaging, transport, unskilled labor etc. are captured in the trend variable T. Overall, marginal costs are assumed to be constant with respect to output. This amounts to considering decreasing average cost in a capital intensive plant and linear variable cost. Equation (11) can now be substituted into profit-maximizing condition (7). Rearranging terms, the following linear equation is derived:

(12) $P_t = \gamma_0 + \gamma_1 W_t + \gamma_2 T + \gamma_3 Q_t + \varepsilon_{t2}$,

where the variables are defined as above, ε_{t2} is the error term, and $\gamma_3 = -\lambda \, [dP_t/dQ_t]$. From equation (10), the slope of the inverse demand function $[dP_t/dQ_t]$ is given by the term $1/\alpha_1$. Therefore, the market power parameter is nothing more than the product of two regression coefficients with a negative sign, i.e., $\lambda = -\alpha_1 \gamma_3$.

It should be noted at this point that Bresnahan (1982) presented a generalized form of this approach where marginal cost is assumed variable. If equation (11) had an additional term $\gamma_4 Q_t$ on the right hand side, it would mean MC_t varies with respect to output. In that case, the coefficient of Q_t in equation would have been $(\gamma_3 + \gamma_4)$. Since marginal cost is not known, the value of γ_4 in equation (11) is not known, and, therefore, the individual

value of γ_3 cannot be found, even though the estimated value of $(\gamma_3 + \gamma_4)$ is known. Consequently, λ cannot be identified. Bresnahan showed that this problem can be

resolved by adding one more variable in the demand equation, namely $P_t Z_t$. Buschena and Perloff (1991) and Deodhar and Sheldon (1997) used this approach to estimate market power in the coconut oil exports market and Soya meal export market respectively. This study is a special case of Bresnahan (1982) approach where identification problem does not arise in the first place.

4. Data, Regression and Results

Data

Table 1 describes the variables used in the estimation procedure. It was observed that in the past retail price of instant coffee has been changed at most three times a year. Hence we used triannual data points for our analysis. Data on aggregate quantities of instant coffee sold in India (Q_t) was collected from Euromonitor (2006). Due to the high moisture-absorption property of instant coffee, consumers mostly buy the 50 gm packets. Prices of both brands are very close to each other. In fact, currently (October, 2006) price of both the brands is Rs. 37 per 50 gm. Hence, average retail price (P_t) of instant coffee was constructed by collecting price data on 50 gm packets of Bru and Sunrise brands from the authorized dealers of Hindustan Lever and Nestlé. Some data were also collected from CERC (1998). For estimation purpose we converted all the data into tonnes-equivalent values. Wholesale price data on Robusta green coffee were collected for the period 1996-2006 from the Coffee Board of India publication *Indian Coffee*. Data on per capita income (Y_t) were collected from the CMIE database. Data on wholesale price index (WPI) and consumer price index (CPI) for industrial workers, used to express nominal variables in real terms, were also obtained from CMIE database. 1993-94 was considered as the base period for the price indices.

Table 1: Description of Variables

Variables	Description
P_t	Real retail average price of instant coffee in Indian market: Rs/tonne
Q_t	Volume of instant coffee sold in India: tonnes/4 months
T	Trend variable: 1, 2…
Y_t	Real per-capita income of Indian population: Rs/4 months
W_t	Real wholesale price of green coffee (Robusta): Rs/tonne

Regressions

In order to evaluate the degree of market power we estimated equations (10) and (12) econometrically. Based on R-square, t-statistics, and Durbin-Watson tests; double-log and lin-log forms of estimation are chosen for best fit of the regression equations. Essentially, the equation (10) and (12) are estimated in the following form:

$$(13) \quad \log Q_t = \hat{\alpha}_0 + \hat{\alpha}_1 \log P_t + \hat{\alpha}_2 \ \log Y_t + \xi_{t1}$$

$$(14) \quad P_t = \hat{\gamma}_1 \log W_t + \hat{\gamma}_2 \log T + \hat{\gamma}_3 \log Q_t + \xi_{t2}$$

Regression equation (13) is the demand function, and regression equation (14) is a supply relation in terms of first-order condition. Hausman specification test showed the problem of simultaneity between the two equations. Hence, OLS estimators would not be consistent and efficient. Using rank and order conditions, it was also observed that both the equations in the model were over identified. We used the method of 3SLS, which was developed by Zellner and Theil (1962) as a logical extension of Theil's 2SLS.

Table 2: 3SLS Estimation of the Model

$$\log Q_t = 16.9 - 1.67 \log P_t + 1.37 \log Y_t$$

$$(1.2)^1 \quad (-1.64)^2 \qquad (5.3)^3$$

R-square between observed and predicted = 0.60

$D_U = 1.282 < DW = 1.62 < (4-D_U) = 2.72$ at 1% significance

$$P_t = 28257 \log Q_t + 19564 \ \log W_t - 20440 \ \log T$$

$$(2.13)^3 \qquad (2.56)^3 \qquad (-2.4)^3$$

Raw Moment R-square = 0.90

$D_U = 1.428 < DW = 1.62 < (4-D_U) = 2.572$ at 1% significance

[1] figures in parenthesis refer to t-ratios, [2] significant at 5% one-tail test, [3] significant at 1% two-tail test.

The R-squares for both equations are satisfactory, and the Durbin-Watson ratios lie in the range, D_U and $(4-D_U)$, where the null hypothesis of no autocorrelation, positive or negative cannot be rejected at 1% significance level. In case of the demand equation, the R-square is 0.60. We did not have any consistent dataset on any competing product for instant coffee. We did try using wholesale price series of tea. However, equation results were not satisfactory. In fact, results improved after removing the proxy price for the competing product. Similarly, we assume that the supply relation passes through origin. I.e. price and marginal cost are zero when output, and input price are zero, and effects of other variables are captured by the trend variable[‡].

Results

If the two equations were to be estimated in levels, then λ is calculated by finding out the product $(-\alpha_1 \gamma_3)$ from equations (10) and (12). However, for better econometric results, these equations were estimated in double-log form and lin-log form respectively.

[‡] One certainly cannot assume away intercept term for a demand function. Supply relation can be considered passing through origin. Theil (1978) points out that if there is an economic justification for removing intercept term, the slope coefficient may be estimated with greater precision than with the intercept term left in.

Therefore, the coefficients $\hat{\alpha}_1$ and $\hat{\gamma}_3$ from equations (13) and (14) need to be

appropriately transformed to get their coefficient-equivalents of equations in levels.

(15) $\hat{\alpha}_1 = \dfrac{\text{Relative change in } Q_t}{\text{Relative change in } P_t} = \dfrac{\Delta Q}{\overline{Q}} \bullet \dfrac{\overline{P}}{\Delta P}$, therefore

(16) $\alpha_1 = \dfrac{\overline{Q}}{\overline{P}} \bullet \hat{\alpha}_1 = \dfrac{1076.1}{370230} * (-1.6757) = -0.0049$

(17) $\hat{\gamma}_3 = \dfrac{\text{Absolute change in } P_t}{\text{Relative change in } Q_t} = \dfrac{\Delta P}{\Delta Q} \bullet \overline{Q}$, therefore

(18) $\gamma_3 = \dfrac{\hat{\gamma}_3}{\overline{Q}} = \dfrac{28257}{1076.1} = 26.25$

(19)   Market Power $\lambda = -\alpha_1 \gamma_3 = -(-0.0049) * (26.25) = 0.128$

The estimated value of market power parameter λ is 0.128. This value is quite close to competitive solution ($\lambda = 0$) than to collusive solution ($\lambda = 1$). It is also lower than the Cournot-Nash solution ($\lambda = 0.5$). Given the value of λ and the price elasticity of market demand, the mark-up of price over marginal cost turns out to be 0.08 or 8 percent. The market power parameter λ, however, is a multiplication of two coefficients from two different regression equations, it does not have a standard error of its own to test hypothesis of a perfectly competitive, Cournot-Nash or a collusive solution. Therefore we bootstrap the equations to get a standard error for the market power parameter.

Bootstrapping for λ

We conduted the bootstrap procedure (Efron, 1979) in order to estimate an empirical standard error for the market power parameter. This procedure enables us to generate a distribution for the market power parameter λ. The procedure is a computer-intensive, non-parametric approach to statistical inference based on data resampling. It involves saving the regression errors for each observation; randomly sampling the errors with replacement; generating a new dependent variable by using the resampled errors, and finally, regressing the newly created dependent variable on explanatory variables. Judge *et al.* (1988) give a good explanation of this procedure. For the present model, this

procedure was performed 1000 times on both the equations (13) and (14), and λ was calculated each time, giving a standard error of 0.5. On the basis of this procedure, we

could reject the hypothesis of collusive bahaviour but the hypothesis of perfect competition and Cournot-Nash behaviour could not be rejected (Table 3). Figure 1 gives the histogram of boostrap distribution of λ.

Table 3: Hypothesis Testing for Bootstrapped λ

Hypothesis	Test Statistic	Remark
H_0: $\lambda = 0$, H_1: $\lambda > 0$ (Perfect Competition)	0.25 5% or 1% test.	Cannot reject H_0 at significance, one-tail
H_0: $\lambda = 1$, H_1: $\lambda < 1$ 1% (Collusive behaviour) test	-1.74	Reject H_0 at 5% and significance, one-tail
H_0: $\lambda = 0.5$, $H_{1:}$ $\lambda \neq 0.5$ 5% or 1% (Cournot-Nash behaviour) test	-0.74	Cannot reject H_0 at significance, two-tail

Figure 1: Frequency distribution of λ
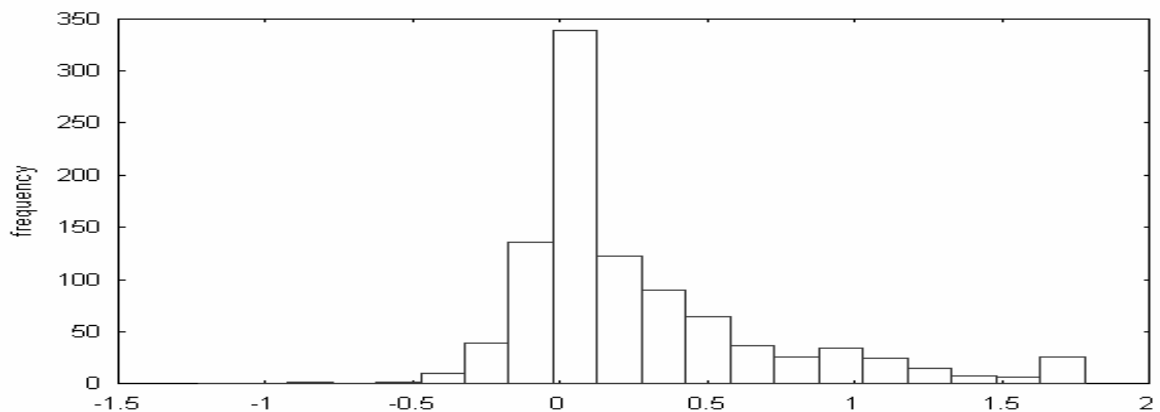
5.   Summary and Conclusions

The new competition policy of the Government of India that replaced MRTP, seeks to promote competition to protect consumer interests and increase market efficiency. It becomes imperative, therefore, that one knows the degree of competition in various domestic industries. In fact, the degree of price transmission between farmers and final consumers also depends on the degree of competition in the processing sector. Moreover, policy of trade liberalization too is expected to have impact on domestic markets. The impact will be more pronounced if the existing domestic competition is characterized by collusive behaviour.   Therefore, one would like to know the existing degree of competition in the domestic markets. In this context, we study India's instant coffee market. Circumstantial evidence regarding competition in the instant coffee market is rather mixed one. The market is a virtual duopoly of Nestlé and Hindustan Lever for decades. The companies have branded their products and product differentiation exits. At the same time, however, Tata Coffee seems to offer potential competition to the incumbents. In fact, instant coffee can be considered as a part of a larger beverage market with numerous competing products. Moreover, since the year 2000, import quota has been removed and only a 'moderate' customs duty of 30 percent is charged on imports. Since then, imports have been growing although they are marginal at this time in absolute terms.

The degree of competition in the instant coffee market was estimated by measuring the market power parameter econometrically. The estimated value for λ (0.123) is much closer to 0 than to 1, indicating that the industry does not engage in collusive behaviour. Based on bootstrap procedure we cannot reject the null hypothesis of perfect competition or Cournot-Nash behaviour. Thus, one can infer that degree of competition is somewhere between perfectly competitive to Cournot-Nash behaviour.   Trade liberalization may contribute to competition in the market, however, given the sufficient degree of competition already in the market, the impact may not be as pronounced.   Having estimated the degree of competition, one may focus on the issue of degree of price transmission between farm-gate coffee prices to retail prices. The current study could be complemented by in-depth case study on procurement, processing and pricing of instant

coffee by leading producers. Econometric estimation of market power and in-depth case studies could also be done for other industries. The current paper considers a static model to estimate degree of competition. Given sufficient data, one should be able to consider dynamic strategic interaction among the firms and non-constancy of marginal cost.

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