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The Demand for Beef in Indonesia: Implications for Australian Agribusiness*

Maradoli Hutasuhut[a], Hui-Shung (Christie) Chang[b], Garry Griffith[bc], Chris O'Donnell[b] and Howard Doran[b]

Abstract

Meat consumption, expenditure and socio-demographic data from the 1990, 1993 and 1996 SUSENAS Household Food Expenditure and Consumption Surveys were employed to estimate the demand for meats in Indonesia. The focus was on the Provinces of DKI Jakarta and West Java where about one-fourth of the Indonesian population reside. Statistical and econometric procedures were used to aggregate the 16 meat types recorded in the SUSENAS into four meat groups. They were then used to estimate the Linear Approximation of the Almost Ideal Demand System (LA/AIDS) model, taking into account zero observations and the restriction that budget shares must lie between zero and unity.

The demand for Meat Group 1 (dominated by beef) is income-inelastic, whereas that for Meat Group 2 (dominated by commercial and native chicken) is income-elastic. These two groups comprise nearly 95 per cent of all meat purchases. The estimated own-price elasticity of the beef group is -0.92, while that for the chicken group is -1.09. The cross-price elasticities indicate that all the meat groups are substitute goods, as expected.

The results suggest that the current focus of the Indonesian government on strengthening the domestic poultry industry is well placed, as the demand for chicken is likely to respond more quickly to income growth than the demand for beef. Further, consumers seem more likely to adapt their consumption patterns to chicken price changes than they will for beef price changes. However, these differences are relatively minor and there is still a major opportunity for Australian agribusiness firms in the cattle and beef sectors to take advantage of the projected rapid growth in Indonesian beef demand.

* The authors are with [a] the Indonesian Directorate-General of Livestock Services, Jakarta; [b] the University of New England, Armidale; and [c] NSW Agriculture, Armidale. This paper is taken from Hutasuhut's PhD thesis submitted to the University of New England and supervised by Chang, Griffith, O'Donnell and Doran. The authors appreciate the helpful comments of David Vere on an earlier draft.

1. Introduction

Indonesia's food consumption patterns have changed considerably in recent decades. With economic development, food has become less important in total household expenditures and the types of food purchased have changed significantly. For example, in 1970, both urban and rural consumers spent about 80 per cent of their total expenditure on food. However, in 1996, only 48 per cent of the total expenditure of urban consumers was spent on food while their counterparts in rural areas spent more than 63 per cent on food.

Between 1976 and 1996, the "prepared food" share in total food expenditure increased by 11 per cent in urban areas and by 8 per cent in rural areas. The share of "cereals", on the other hand, decreased by 13 per cent in urban areas and by 16 per cent in rural areas. Since 1993, the prepared food share has been higher than the cereal share in the total food expenditure of urban consumers (CBS 1998).

Meat has become a more important component of the Indonesian diet over this period, with a growth rate in consumption of over six per cent per annum during the 1980s (CBS 1996). However, annual per capita meat consumption in Indonesia (9.4 kg) is still very low, even compared with near neighbours. In South-East Asia in the early 1990s, only Bangladesh (2.8 kg), India (4.3 kg) and Sri Lanka (4.8 kg) had lower annual per capita meat consumption figures than Indonesia (Rutherford 1999). Low levels of domestic supply and restrictions on imports kept Indonesian meat consumption low.

During the 1990s the policy settings were changed to encourage livestock production and importation was made easier. In particular, livestock production was encouraged in some of the outlying provinces with the express purpose of supplying the Jakarta market. Domestic poultry production doubled from 1990 to 1997, and domestic beef production rose by about a third.

Beef imports from Australia alone rose from 2.3 kt in 1993 to 24.3 kt in 1997, while live feeder steer imports reached 428,000 in 1997 from virtually nothing just five years earlier (Riley *et al*. 2001). Most of Indonesia's beef and live cattle imports originate in Australia (see Table 1), and Indonesia remains the largest export destination for Australian live cattle with around 296,700 head exported in 2000 (Riley *et al*. 2001). However MLA note that the recent depreciation of the rupiah has restricted the buying power of Indonesian live cattle importers (MLA 2001).

Table 1: Australian exports of beef, veal and live cattle to Indonesia, 1993-2000

		1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Beef/veal	Volume (kt)	2.3	5.0	10.4	16.6	24.3	1.7	11.6	13.1
	Value ($A m)	1.6	17.5	30.8	40.5	59.4	6.1	33.3	40.8
Live cattle	Volume ('000)	58.3	118.0	226.4	389.0	428.1	42.4	157.3	296.7
	Value ($A m)	29.1	64.5	141.2	212.7	212.6	18.4	37.9	143.1

Source: Riley *et al.* (2001).

Indonesia has suffered major setbacks recently with the 1997/98 financial crisis and some ongoing political unrest, and beef and cattle imports from Australia have been badly affected (Table 1). However, incomes in Indonesia will increase as the country recovers from these crises, and this is likely to cause a further major transformation in Indonesian diets.

Consumers are expected to allocate an increasing proportion of their food expenditures to processed products and to livestock products such as meat, milk and eggs. Coupled with a population of more than 206.5 million with an annual growth rate of 1.04 per cent (in 1999), the demand for meats in Indonesia is expected to increase substantially in the near future. The World Bank (1992) predicts a growth rate of 5.8 per cent in overall meat demand and 10 per cent for intensive poultry, in the medium term. These rates are far in excess of the capacity of the local industries to supply.

Australian agribusiness firms are well placed to take advantage of this increasing demand, supplying both beef and live cattle. However, little is known about Indonesian meat demand parameters on which to base estimates of future demand. Further, as Indonesia operates a number of food supply and price policies, information on meat demand parameters are considered to be important inputs into the formulation of the next five-year Development Plans for the livestock/agricultural sectors.

In developed countries, meat demand has been studied intensively. Some Australian examples are Main *et al*. (1976), Fisher (1979), Murray (1984), Chalfant and Alston (1986), Beggs (1988), Cashin (1991) and Hutasuhut (1995). However, interest in this field in Indonesia in the past has been constrained by the availability of data. Previous demand elasticity estimates for meat and other livestock products vary greatly with different data sets and model specifications used in those studies (see Appendix 1 of Hutasuhut 2000). With more refined methods of analysis, advances in computing facilities and expansion of data, it is expected that this area of study will make a more significant contribution to policy decision-making processes in Indonesia in the near future.

Therefore, the main purpose of this paper is to report the results of a study concerned with producing more reliable demand parameter estimates of meat in Indonesia. Such estimates are useful for policy analysis and for future planning purposes. More precise income elasticities of various meat groups, for example, will allow observers to better predict the quantities of particular meats demanded in the next development stages. This information should also be useful for firms hoping to meet that future demand, such as Australian beef producers and exporters.

2. Specification of the demand function

The demand parameter estimates of interest are the own-price, cross-price and income elasticities of demand. These values indicate the percentage change in the quantity demanded of a particular meat type to a one per cent change in the price of that meat type, in the prices of substitute meat types, and in consumer incomes, respectively. They indicate the extent to which consumers adjust their purchases in response to changes in prices and incomes and, as such, allow policy makers to predict the impacts of various types of policy interventions, such as a minimum price policy or a taxation policy, on consumption.

Demand parameters are usually estimated by applying regression techniques to historical data on quantities demanded, prices and income. The regression techniques can focus on single equation models used to explain the demand parameters for a meat, or more sophisticated "systems" models which explain the demand of a group of meats simultaneously. A demand system approach was used here. This type of model provides greater efficiency of estimating the unknown parameters, and allows the restrictions from economic theory to be incorporated during estimation and cross-commodity impacts to be captured.

2.1 A truncated LA/AIDS model

The Linear Approximate version of the Almost Ideal Demand System (LA/AIDS) model was used as the basis for this study. The technical details of this model are given in the Appendix for interested readers. CARD (1987) suggests that of all the empirical demand systems applied to Indonesian data, the AIDS model has yielded the most robust results[1].

In this model the dependent variables are specified to be expenditure or "budget" shares. Since observed budget shares must lie between zero and one (ie, are "censored" or "truncated"), the estimated budget shares should not take on negative values or be greater than unity.

[1] Many studies of Australian meat demand also have used this model, including Chalfant and Alston (1986), Beggs (1988), Cashin (1991) and Hutasuhut (1995).

The estimation procedure has to account for these restrictions. In this study, following a method developed by Heien and Wessells (1990) and modified by Shonkwiler and Yen (1999), a truncated LA/AIDS model was estimated based on a two-stage estimation procedure to ensure that the estimated budget shares were truncated to lie between zero and one. Interested readers can obtain details of these methods from the authors.

2.2 Incorporating demographic variables

The AIDS and LA/AIDS models as originally proposed by Deaton and Muellbauer (1980a,b) (and as outlined in Appendix equation 1) contain only prices and expenditure as explanatory variables. Demographic variables were not considered. However such variables are crucial in household survey data where economic responses to price changes are greatly influenced by a range of personal, household and spatial effects.

In this study, socio-demographic effects were incorporated in the truncated LA/AIDS model by allowing the intercept term of each equation to be a function of demographic variables. Also included with the demographic variables were variables for different time periods, provinces and locations (rural and urban).

3. Data

The data used in this study were taken from the National Socio-Economic Survey (*Survei Sosial Ekonomi Nasional)* or SUSENAS. This is a cross-sectional household survey conducted annually by the Central Board of Statistic (CBS). The food consumption and expenditure module of SUSENAS is conducted every three years. During estimation, the 1990, 1993 and 1996 SUSENAS survey data are combined. By doing so, it is expected that price effects and changes over time in meat consumption patterns will be more adequately captured.

There are 12 categories of food consumption and expenditure in the most recent SUSENAS covering more than 200 individual food items. To reduce the computational burden, only the meat category was modelled in this study. Other categories such as fish, eggs and milk, cereals, vegetables, etc, which may be substitutes or complements with meat in household consumption decisions, were ignored.

There are about 65,000 household records in each of the recent SUSENAS food consumption and expenditure modules. Again to reduce the computational burden, two provinces were selected as case studies, DKI Jakarta and West Java. The population and level of meat consumption in these two provinces are broadly representative of Indonesia, and the availability and quality of information is a little better than average. In addition, about one-fourth of the Indonesian population live in these two Provinces.

For policy purposes, the distinction between urban and rural consumers was considered important because of differences in, for example, the level of income and lifestyle, and West Java was split into these two categories. This resulted in eight separate data sets - three years (1990, 1993, 1996) by three regions (DKI Jakarta, urban West Java, rural West Java), minus rural West Java in 1990 which was excluded because of concern over data reliability.

3.1 Data aggregation

There are 16 individual meat types recorded in the SUSENAS data, but many of the meat types have irregular purchase patterns and consequently are not easily amenable to econometric estimation of demand parameters. Therefore, it is necessary to reduce the 16 individual meat types to smaller and more manageable groups. The way in which the grouping is conducted is very important because inappropriate aggregation could influence subsequent demand estimation and test results (Nicol 1991).

Here, the “Stochastic Hicksian Aggregates” (SHA) technique was used where product pairs that have reasonably constant relative prices are grouped together (Nicol 1991). After experimentation with several technical choices in the clustering procedure, four aggregated meat groups were derived from the initial 16 disaggregated meat types. Initial and final meat groupings can be seen in Table 2.

After the aggregation process, the number of observations with the four meat groups that could be used for further estimation purposes was 8,168.

Table 2: Disaggregated meat types and aggregated meat groups

Code	Initial Aggregation	per cent	Code	Final Aggregation	per cent
1	Beef	32.60	MG1	beef (1), buffalo (2) and trimmings (14)	50.42
2	Buffalo	3.46			
3	Commercial chicken	61.27			
4	Native chicken	16.96	MG2	Commercial chicken (3), native chicken (4), goat/sheep meat (5), other fresh meat (7), dried meat (8), innards (13) and other offal (16)	87.20
5	Goat/sheep meat	3.23			
6	Other poultry meat	0.50			
7	Other fresh meat	0.50			
8	Dried meat	1.07			
9	Shredded fried meat	6.80	MG3	other poultry (6), canned (10), other processed (11) and bone (15)	5.27
10	Canned meat	1.01			
11	Other processed meat	0.56			
12	Liver	9.46	MG4	shredded fried (9) and liver (12)	16.26
13	Innards excluding liver	3.43			
14	Trimmings	14.36			
15	Bone (untrimmed)	3.20			
16	Other offal	0.74			

Notes: percentage was calculated based on the number of households that reported consumption on a particular meat type or group, divided by 8,231 observations.

Meat Group 1 (MG1) comprises beef, buffalo meat and trimmings and accounts for 31 per cent of the total meat expenditure (Table 3). Beef is the dominant individual meat type. In Indonesia beef and buffalo meat, from a consumer point of view, is virtually the same, both in quality and in the way the Indonesian people cook these two kinds of meats. Therefore, the results are consistent with prior expectations.

Table 3: Definition of meat groups

Meat Group	**Individual Meat Types in Each Meat Group**	**Average Budget Share**
1	Beef, buffalo meat and trimmings	0.307
2	Commercial chicken, native chicken, goat/sheep meat, other fresh meat, dried meat, innards and other offal	0.649
3	Other poultry, canned meat, other processed meat, untrimmed bone	0.021
4	Shredded fried meat and beef liver	0.023

Notes: The budget shares are the expenditures on each of the meat groups divided by total expenditure on meat.

Meat Group 2 (MG2) comprises commercial and native chicken meats, goat/sheep meat, other fresh meat, dried meat, innards excluding liver and other offal. MG2 accounts for 65 per cent of total meat expenditure of the respondents. The dominant meats in MG2 are commercial and native chicken.

Meat Group 3 (MG3) comprises other poultry meat, canned meat, other processed meat and untrimmed bone with the dominant individual product being untrimmed bone, while Meat Group 4 (MG4) comprises shredded fried meat and beef liver with the dominant individual meat being beef liver. Because MG3 and MG4 account for only a small percentage of the total meat expenditure (slightly above 2 per cent each), they are not discussed in detail hereafter.

3.2 Estimation of missing prices

Because some respondents did not report any consumption of some of the meat groups during the week of the surveys, there were missing prices on some observations. Missing prices were estimated using dummy variables representing years, provinces, and urban-rural regions, and prices of the other meats.

4. Results

4.1 System estimation results

In general, the estimated coefficients from the demand system model described in the Appendix were statistically significant at the 5 per cent level or better with only a few exceptions. The exceptions were three price coefficients. All the estimated coefficients associated with the dummy variables were statistically significant, indicating that temporal (years) and locational (provinces and urban-rural regions) effects are important in explaining meat consumption patterns in Indonesia.

4.2 Estimated elasticities

The estimated elasticities were computed at the sample means for each of the four meat groups for each of the eight data sets. In general, the estimated elasticities generated from this study conformed with economic theory and their magnitudes were in plausible ranges. As expected the results for MG1 and MG2 were more satisfactory than the results for MG3 and MG4 because of their relative shares in consumption. Thus, given the focus of this paper, only the results for MG1 and MG2 are reported.

Another general result was that the estimated elasticities for West Java, particularly from rural areas, tended to be less reliable than the results from DKI Jakarta. Fewer observations from rural and urban West Java and the deviation of some meat group prices from their mean values (outliers) resulted in contradictory signs and statistically insignificant results for some estimated elasticities.

The estimated expenditure elasticities of both major meat groups (Table 4) were positive which implies that demand for these meat groups can be expected to increase as income increases. The estimated expenditure elasticities for MG1 were less than unity (income-inelastic goods) whereas those for MG2 were greater than unity (income-elastic goods).

For example, the estimated value for MG1 in Jakarta in 1996 (0.74) suggests that if total expenditure on meat increases by ten per cent then the quantity demanded for products in the beef group will increase by 7.4 per cent, all other things equal.

The estimated expenditure elasticities for MG1 also vary across the data sets. Estimated expenditure elasticities for beef for rural consumers tend to be smaller.

This suggests that demand growth for beef would be smaller in the rural areas than in the urban areas.

Table 4: Expenditure, own-price and cross-price elasticities computed at the mean values across years, provinces and urban-rural regions

Data Set	Expenditure Elasticity		Own-Price Elasticity		Cross-Price Elasticity
	MG1	MG2	MG1	MG2	MG1 **wrt** MG2
1990. W. Java. Urban	0.70	1.14	-0.92	-1.09	0.21
	(0.002)	(0.001)	(0.004)	(0.003)	(0.005)
1990, DKI Jakarta	0.78	1.17	-0.91	-1.08	0.13
	(0.002)	(0.001)	(0.003)	(0.003)	(0.003)
1993, W. Java, Rural	0.51	1.12	-0.92	-1.09	0.41
	(0.005)	(0.001)	(0.006)	(0.002)	(0.008)
1993, W. Java, Urban	0.71	1.14	-0.92	-1.09	0.20
	(0.002)	(0.001)	(0.004)	(0.003)	(0.004)
1993, DKI Jakarta	0.79	1.17	-0.91	-1.08	0.13
	(0.002)	(0.001)	(0.003)	(0.003)	(0.003)
1996, W. Java, Rural	0.21	1.11	-0.93	-1.09	0.73
	(0.009)	(0.001)	(0.010)	(0.002)	(0.014)
1996, W. Java, Urban	0.63	1.13	-0.92	-1.09	0.29
	(0.003)	(0.001)	(0.005)	(0.002)	(0.005)
1996, DKI Jakarta	0.74	1.15	-0.92	-1.09	0.17
	(0.002)	(0.001)	(0.003)	(0.003)	(0.004)

Notes: Figures in brackets are the standard errors.

The estimated own-price elasticities are negative as expected (Table 4). The demand for MG1 is own-price inelastic whereas MG2 is own-price elastic. The estimated value for MG1 in Jakarta in 1996 (-0.92) suggests that if the price of beef increases by ten per cent then the quantity demanded of the beef group will decrease by 9.2 per cent. An inelastic demand for MG1 suggests that it has fewer close substitutes compared to MG2.

The estimated expenditure and own-price elasticities are comparable to recent previous Indonesian studies that use similar commodity coverage and similar methods (see Appendix 1 of Hutasuhut (2000)). For example, CARD (1987) reported own-price elasticities for all meat and dairy products of between -0.97 and -1.05, and expenditure elasticities for the same product aggregation of between 1.54 and 2.53. Since the CARD study was based on survey data collected in 1980, it appears that expenditure elasticities have fallen over time as Indonesian incomes have risen and as meat has become a more important component of the Indonesian diet over this period.

The cross-price elasticities estimated in this study suggest that MG2 is an unambiguous substitute for MG1 (Table 4). For example, the estimated value for MG2 in Jakarta in 1996 (0.17) suggests that if the price of the chicken group increases by ten per cent then the quantity demanded of products in the beef group will increase by 1.7 per cent.

It is normally considered that estimating price elasticities, particularly cross-price elasticities, is more difficult than income or expenditure elasticities, partly because of correlated prices and partly because of the level of aggregation (Deaton and Muellbauer 1980b, p. 78-82; Deaton 1987).

This problem is typically compounded with cross-sectional data where price variation is generally small, and when some budget shares are small. However, it seems not to be a serious problem here as nearly all price elasticity estimates are statistically significant, except for MG3 and MG4.

5. Conclusion

Apart from technical advances in the data handling and estimation methods used, which are reported elsewhere, the main conclusions of this study are as follows:

i. the estimated elasticities generated from this study conform with economic theory and their magnitudes are reasonable;

ii. while beef and chicken are substitutes for Indonesian households, the demand for beef is both income and own-price inelastic and the demand for chicken is both income and own-price elastic;

iii. there are important temporal (years) and locational (provinces and urban-rural regions) variations in meat demand;

iv. estimated expenditure elasticities for beef for rural consumers tend to be smaller; and

v. it appears that expenditure elasticities have fallen over time as Indonesian incomes have risen and as meat has become a more important component of the Indonesian diet.

While there are considerable uncertainties, incomes in Indonesia are expected to increase as the country recovers from recent crises, and this is likely to cause a further major transformation in Indonesian diets.

Consumers are expected to allocate an increasing proportion of their food expenditures to livestock products such as meat, milk and eggs. Coupled with a population growing at more than one per cent annually, the demand for meats in Indonesia is expected to increase substantially in the near future.

The results suggest that the current focus of the Indonesian government on strengthening the domestic poultry industry is well placed, as the demand for chicken is likely to respond more quickly to income growth than the demand for beef.

Further, since the demand for chicken is also own-price elastic, consumers seem more likely to adjust their chicken consumption to price changes than they do for beef. These conclusions confirm the relative sizes of World Bank (1992) predictions of a growth rate of 5.8 per cent in overall meat demand but 10 per cent for intensive poultry, in the medium term.

However, these projected growth rates in demand are thought to be far in excess of the capacity of the local industries to supply, even with continuation of the current production subsidies.

Australian agribusiness firms are well placed to take advantage of this increasing demand, supplying both beef and live cattle. Australia has a distinct transport cost advantage, a well-developed export infrastructure, a competitive exchange rate and a range of quality products to suit most market niches.

While the results also suggest that demand growth for beef would be smaller in the rural areas than in the urban areas, the geographical proximity and the association with tourism would suggest that marketing effort in the Eastern Islands would be well rewarded.

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Technical Appendix

A system of AIDS demand functions, in budget share form, is expressed as follows:

$$w_i = \alpha_i + \Sigma_j \gamma_{ij} \ln p_j + \beta_i \ln (X/P), \quad (1)$$

where w_i is the budget share for good i, p_j is the retail price for good j, X is total expenditure, P is defined as:

$$\ln P = \alpha_0 + \Sigma_k \alpha_k \ln p_k + \tfrac{1}{2} \Sigma_j \Sigma_k \gamma_{kj} \ln p_k \ln p_j, \quad (2)$$

and α_i, γ_{ij} and β_i are parameters to be estimated.

The restrictions from demand theory that can be imposed on equation (1) are:

Homogeneity restriction: $\Sigma\gamma_{ij} = 0, \quad i = 1, 2, ..., n; \quad (3)$

Symmetry restriction: $\gamma_{ij} = \gamma_{ji}, \quad \text{for } i \neq j; \text{ and} \quad (4)$

Adding-up restriction: $\Sigma\alpha_i = 1, \Sigma\gamma_{ij} = 0, \text{ and } \Sigma\beta_i = 0. \quad (5)$

Because equation (1) is non-linear in the parameters, the Stone price index is commonly used to replace the price index P (2), resulting in the "linearised" or "linear approximate" version of the AIDS model (LA/AIDS). The Stone price index P* is defined as:

$$\ln (P^*) = \Sigma w_k \ln p_k \quad (6)$$

Following Buse (1998), elasticities of the LA/AIDS model are calculated using the following formulae:

Expenditure elasticities: $n_i = 1 + \beta_i / w_i; \quad (7)$

Own-price elasticities: $e_{ii} = \gamma_{ii} / w_i - (1 + \beta_i); \text{ and} \quad (8)$

Cross-price elasticities: $e_{ij} = \gamma_{ij} / w_i - \beta_i w_j / w_i. \quad (9)$