Improving Indonesia's Beef Industry

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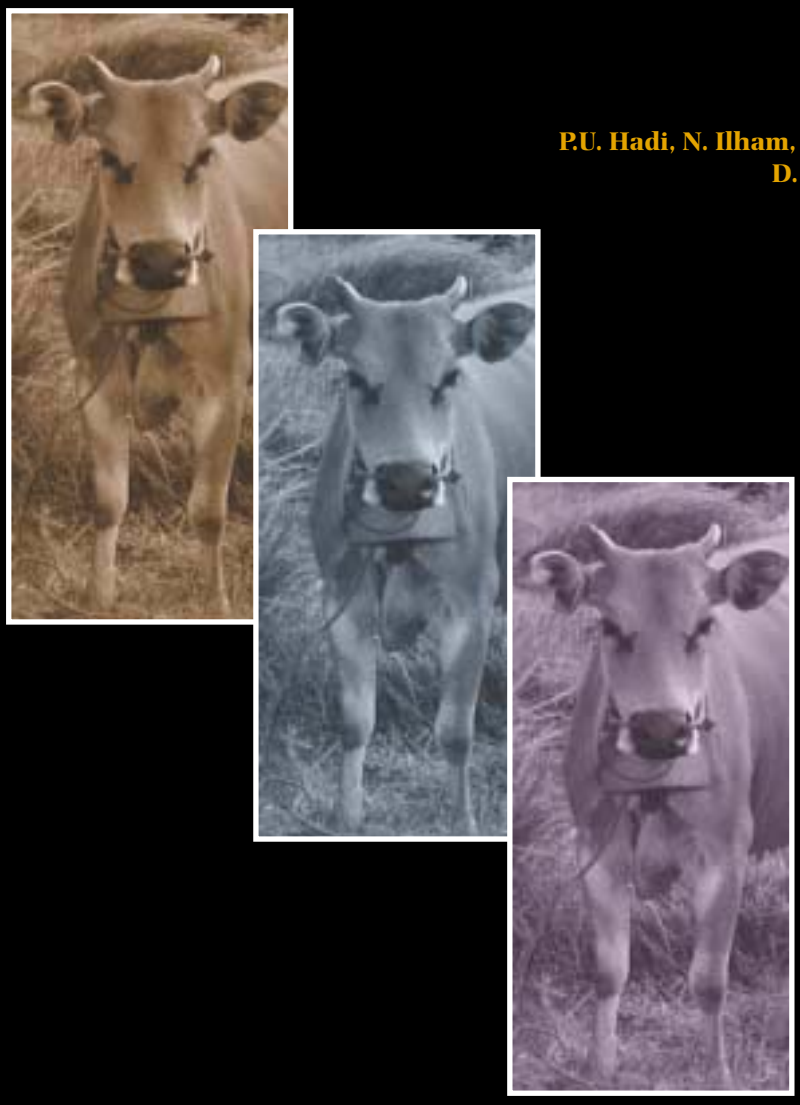

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Summary and Conclusions

The analysis in this report provides guidance on how best to facilitate the development of the Indonesian beef industry. From the government's viewpoint, the industry's development path should proceed in a way that:

- improves the incomes of smallholder producers;
- encourages a sustainable and efficient domestic production capacity; and
- satisfies the growing demands of Indonesia's consumers for beef in ways that improve the overall performance of the economy.

Key Findings from the Survey Work

An extensive field survey was conducted in the major beef-producing and beef-consuming provinces in Indonesia. The survey covered cattle producers (smallholder breeders, smallholder partnership fatteners, smallholder non-partnership fatteners, company feedlots); marketing personnel (village, subdistrict and inter-regional traders); beef wholesalers and retailers at supermarkets, wet markets and meat shops; shipping companies involved in transporting live cattle; land transport companies; the processing sector (including government and private abattoirs); and government officials concerned with cattle and beef industry policy issues. Both qualitative and quantitative information were recorded in a series of questionnaires.

The quantitative information was used to construct a detailed value chain of cattle production through to processing and final consumption. This value chain is an important component of the database for the beef industry model constructed for the study.

Key findings from the survey work are as follows.

- The economic crisis of 1997 had a severe impact on the beef industry. Many feedlot and partnership operations collapsed, the domestic breeder herd decreased with the high rupiah price for beef, beef processing became less efficient as a reduction in slaughter throughput increased unit costs of slaughtering, and beef sales declined sharply as per capita incomes fell.

- The beef industry has largely recovered since 1999, which saw a resumption of significant live cattle imports, though depletion of native feeder cattle is continuing.
- Smallholder production still accounts for over 80% of beef production, but the expansion prospects of this sector are seriously constrained by low breeding herd productivity and particularly a scarcity of readily available forage in particular regions.
- The value chains show how the value of retail beef sales is broken up into the cost of cattle leaving the farm or arriving in Indonesia (in the case of imported cattle); processing costs; transport costs; and various cattle, trader margin and beef selling costs. The value shares along the chain differ according to the type of cattle (domestic feeder cattle, imported feeder cattle, and imported beef). A feature of the value chain for domestic feeder cattle is a very high trader margin in facilitating the flow of cattle from farm through to processing and final consumption. These high margins mean reduced incomes for producers and higher prices to consumers.
- In particular regions, there is an increasing demand by smallholder fatteners for more productive breeds of cattle capable of higher average daily weight gains than traditional native cattle.
- The continuing economic recovery is encouraging higher beef consumption and highlighting the need to strengthen the supply capability of smallholders.
- The government already has in place an array of programs to improve smallholder performance. They include:
  - the provision of artificial insemination services, credit schemes and extension services to assist breeders and fatteners; and
  - the nucleus estate and smallholder system introduced to develop partnerships between smallholders and commercial feedlots.
- The structure of beef sales differs between outlets. Wet markets still dominate sales of beef, but supermarkets sell most imported beef and beef from imported cattle.

Key Insights from the Modelling Work

We have constructed a detailed economic model of the Indonesian beef industry. The model describes the links between cattle production, processing and final consumption. It incorporates the behavioural responses of smallholder producers, commercial feedlots,

processors, transport operators, traders and consumers to changes in the incentives environment facing them. The model provides a means of analysing the effects on Indonesia's beef industry of changes occurring in each part of the value chain. Such changes include:

- policy changes, such as changes in taxes and tariffs;
- macroeconomic developments, such as changes in the exchange rate and in Indonesia's rate of overall economic growth; and
- industry-specific and overseas developments, such as changes in the cost of live cattle imported from Australia.

We have used the model to analyse a number of issues of current relevance:

- increases in tariffs to achieve self-sufficiency in beef production;
- an increase in the retribution charge on cattle;
- improvements in beef–cattle processing efficiency;
- improvements in the technical efficiency of smallholder beef production in both breeding and fattening;
- a reduction in live cattle selling costs;
- an appreciation of the rupiah; and
- changes in the prices of chicken and fish relative to beef.

Some key insights are as follows.

- Achieving self-sufficiency in beef production through tariffs on imported beef and imported live cattle is not a sensible policy objective. Smallholder breeders have limited scope for expanding production; very high tariffs on imported beef would be needed to raise prices to producers sufficiently to encourage enough production to replace imports. The significant increase in beef retail prices would cause beef consumption to fall considerably. Imported feeder cattle are essential for the Indonesian beef industry to provide it with enough flexibility to rapidly expand production. Pursuing self-sufficiency through tariffs on imported feeder cattle would destroy the commercial feedlot sector, cause a big reduction in beef consumption and dramatically reduce the incomes of smallholder fatteners.

Beef self-sufficiency could better be achieved through research and development to increase the productivity of native cattle in both breeding and fattening, than through tariffs on beef and live cattle imports. The productivity increases at home, if they are achievable, will add to the incomes of smallholder producers and also benefit consumers.

- A doubling of the retribution charge on marketing cattle would have only a minor impact on the beef industry. Domestic beef production would fall slightly and beef imports would increase slightly. Live cattle imports would fall, as would beef consumption. That said, it is important to acknowledge that the retribution charge is a tax on internal trade. Trade, both internal and external, provides the means through which wealth is created. A tax on trade is not an efficient way of raising government revenue.

- Improvements in beef processing efficiency will deliver gains to producers in terms of higher incomes, production and farm cattle prices and gains to consumers in terms of lower beef retail prices and increased beef consumption. Processing costs are not a major part of the total cost structure in the value chain. Processing margins represent less than 10% of the farm value of cattle.

- Improving technical efficiency can do much to improve Indonesia's beef cattle production and the incomes of smallholders. The constraint on expanding breeding cattle numbers severely curtails the development of a smallholder beef industry in Indonesia. There is a need to develop production systems that will allow for larger-scale and more specialised breeding. More efficient native cattle breeding will deliver significant improvements in beef self-sufficiency and smallholder fattener incomes. Consumers also gain substantially through lower beef prices and increased consumption. More efficient native cattle fattening will also deliver significant gains to consumers, though its effects would be much less pronounced than is the case with smallholder breeding efficiency improvements.

- Measures to reduce native cattle marketing costs provide a big boost to the incomes of smallholder fatteners and significant flow-on effects to smallholder breeders. However, they provide a disadvantage to commercial feedlots.

- Currency fluctuations are a big problem for Indonesia's beef industry. An appreciating value of the rupiah will stimulate production and profits of commercial feedlot operations and reduce production and profits of smallholder producers. Beef imports will increase and falling domestic retail prices for beef will increase beef consumption.

- At present, Indonesian feedlots are totally dependent on live feeder cattle imports from northern Australia. Northern Australia is the only supplier of large, consistent lines of *Bos indicus* cattle that are free from foot-and-mouth disease and meet the tight specifications for feedlot entry. The output and profitability of commercial feedlots are highly sensitive to the price of imported live cattle from Australia. More expensive live cattle imports mean increased demands for imported beef and reduced total expenditure on beef. They also mean falling feedlot production and profitability, and small increases in production and the incomes of smallholder producers.

- Changes in the prices of competing meats such as chicken and fish have big potential implications for Indonesia's beef producers. If, for example, the retail prices of chicken and fish fall significantly relative to beef, this will cause the farm price for cattle to fall, a significant contraction in cattle production, a significant decline in live cattle imports and in beef imports, and a big decline in the incomes of beef producers.

- It is likely that Indonesia's economic development will favour commercial feedlot operations at the expense of smallholder producers. Growth in gross domestic product (GDP) per capita will increase the demand for beef and beef consumption. Strong growth in GDP is likely to lead to an exchange rate appreciation that will stimulate live cattle imports and the profitability of commercial feedlots.

Improving Smallholder Performance

Improving smallholder performance remains the key to improving Indonesia's beef industry. Our simulations show that:

- measures to reduce trader, transport and processing margins can do much to improve smallholder incomes; and

- measures to improve smallholder productivity, particularly the productivity of native cattle breeding, are vital in improving the ability of smallholders to expand production of fattened cattle.

The government is already involved in research projects to improve cattle breeding. Some projects are achieving significant gains and need to be expanded. A major extension effort will be required to improve the technical and managerial skills of smallholder producers so that they can adopt better practices, particularly for improved breeding performance, and to demonstrate the best production options for their farms.

The following other initiatives should also be undertaken.

- increased use of semen from superior sires;

- intensification of artificial insemination services in major farming areas, by increasing the number and skill of inseminators;
- use of high-quality bulls in areas where sufficiently large herds can be accumulated;
- increased use of better milking cows for breeding (such as friesian/holstein), particularly in high areas with sufficient feed;
- integration of cattle breeding with rice growing in a crop–livestock system in rice-producing areas; and
- further integration of cattle fattening with the waste products from agricultural processing (tofu, cassava, palm oil, pineapple and sugar).

The government can undertake a range of initiatives to make trading relationships more efficient and to reduce trader margins. One is to provide livestock selling centres with cattle weighing equipment. Extension and educational initiatives will be needed to ensure that farmers are aware of the alternative opportunities for selling their cattle, the cost of each, and the advantages to them of more direct and more accurate selling methods.

Our analysis shows that improvements in the productivity of smallholder breeders are passed forward to improve smallholder fattener production and income and consumer welfare (through lower retail prices and increased consumption of beef). The smallholder breeder sector as a whole is unable to capture these gains as higher income. Similarly, improvements in the productivity of smallholder fatteners are captured as high incomes of fatteners and by consumers. Again, the breeding sector as a whole is unable to capture these gains. The most effective way to raise the income of the smallholder breeding sector is to reduce the large margins between breeder and consumer.

Improving Efficiency at Commercial Feedlots

The feedlot sector has a number of commercial advantages in beef production relative to smallholder producers:

- large-scale operations and a low unit cost of production;
- access to large quantities of good-quality forage and concentrate at reasonable prices;
- professional management of livestock nutrition and animal health; and
- access (provided the exchange rate is reasonably strong) to large lines of imported feeder cattle of the right specification (age, weight, breed) to perform well in the feedlot.

There are several initiatives needed from government that would improve the feedlot operating environment as well as the economy's overall performance. Because of the feedlot sector's considerable production flexibility, measures to reduce feedlot costs would cause a significant expansion in feedlot production.

- The capacity of quarantine services needs to be improved by providing more space for cattle inspection and a more efficient inspection service. Quarantine bottlenecks add unnecessarily to live cattle import costs.
- The value-added tax on live cattle imports should be removed. This tax acts exactly like a tariff and raises the cost of importing, adds to feedlot costs and reduces feedlot production and profitability.
- The nucleus estate and smallholder system should be voluntary. There are too many examples where, because of poor performance by smallholder partnership producers, the performance of live imported cattle is lower than it should be. A voluntary partnership scheme would allow business partnerships between smallholder and feedlots to form only when there was a mutual advantage to both parties. Specialisation of business partnerships around the partnership model is needed to achieve this. Voluntary arrangements are more likely to provide technology transfer to small farmers while assisting feedlots to expand their production.
- Above all, sound macroeconomic management and industry policies will deliver strong economic growth, rising per capita incomes, stable interest rates, unimpeded access to credit and an appreciating rupiah. Our analysis shows that this combination of events will provide strong incentives for feedlots to expand their production to meet an expanding demand for beef.
- The major constraint on feedlot expansion prospects is the supply of suitable live cattle from Australia. Growing demand by Indonesia's feedlots for Australian live cattle over the longer term could lead to live cattle price increases which would curtail feedlot production and encourage a stronger switch toward imported beef. It is important that the government does not seek to oppose this switch through raising taxes on live cattle and imported beef.

Enhancing the Interests of Beef Consumers

The welfare of Indonesia's beef consumers will best be served by a policy environment that encourages an efficient use of resources in beef production while at the same time keeping open the trade in imported live cattle and beef. In this policy environment, consumers will be able to consume beef at world prices. The tariff reforms after the financial crisis have

ensured that only a low tariff (5%) remains on imported beef. Consumer welfare would be enhanced by removing this tariff.

Removal of the value-added tax on live cattle imports, together with the various other measures discussed above to decrease feedlot costs, would also add to consumer welfare.

Finally, consumers and producers benefit from productivity improvements in native cattle breeding and fattening through lower retail prices for beef and increased consumption.

1 Introduction

Background

Although small, the beef industry in Indonesia makes an important contribution to the country. As well as providing a source of meat protein to consumers, it provides employment and income for millions of rural families and investment opportunities for private companies, both of which are important for Indonesia's regional development. Through its demand for inputs and through the sale of cattle along the beef value chain, it also provides a stimulus to many other sectors of economic activity.

Until the advent of the so-called Asian financial crisis in mid-1997, steadily increasing per capita incomes and strong population growth in Indonesia were driving a rapid increase in beef consumption, though from an extremely low base. During the first half of the 1990s, the growth in beef demand outstripped the capacity of Indonesia's cattle herd to supply that beef. Increasingly, Indonesia resorted to imports of live cattle for subsequent fattening and slaughter, and to imports of frozen boxed beef. Tariffs on imports were set to assist both smallholder producers and company feedlots: there were no tariffs on imported breeder cattle, a 10% tariff on imported live feeder cattle and a 35% tariff on frozen beef.

The aim of the zero tariff on breeder cattle imports was to encourage breeding to improve herd quality and productivity. The high tariff on imported beef was aimed at raising its price and encouraging the consumption of domestic beef relative to imported beef. The aim of the lower tariff on feeder cattle was to encourage company feedlot operations to increase their quality and quantity of production. The differentiated tariff policy had the effect of encouraging imports of feeder cattle and the profitability of feedlot operations relative to imports of boxed beef.

The government had in place policies to encourage live cattle imports and modernise Indonesia's traditional beef production sector, which is based around low productivity smallholder operations. There was considerable investment in large-scale company feedlots and in the associated infrastructure such as yards, loading and unloading facilities, and dedicated transport ships to move live cattle from northern Australian ports to Indonesia. There were also some new developments in processing facilities.

However, the massive devaluation of the rupiah in the second half of 1997 and the financial crisis that followed had a devastating impact on Indonesia's beef industry. Because of the high cost of foreign currency, live cattle imports for domestic production became uneconomic. Virtually overnight, about 25% of production was eliminated, resulting in expensive feedlots becoming idle. The rupiah price of local cattle produced by the smallholder sector increased sharply, encouraging people to slaughter scarce breeding cattle. Consumer demand for beef declined as household incomes fell. Abattoirs were not used to capacity, because of a substantial decline in the number of cattle being slaughtered. Slaughtering facilities became inefficient.

One policy response of the government to the financial crisis was to reduce the tariff on imported feeder cattle to zero and the tariff on imported beef to 5% in January 1998. The tariff cut reduced the cost of imported beef, though this effect was greatly outweighed by the devaluation of the rupiah. With economic recovery and a strengthening of the demand for beef, this policy change will tend to encourage imports of beef relative to live cattle.

The crisis highlighted the risks in a strategy that relies heavily on imports of live cattle; it also called into question the profitability of the extensive private investment in company feedlots and the infrastructure needed to support them.

To maximise its contribution to the Indonesian economy, the beef industry must:

- meet the requirements of Indonesian consumers for beef; and
- represent an efficient use of the resources Indonesia devotes to beef production.

This will require some reliance on imports of live cattle and of beef in situations where the imported beef can be obtained more cheaply than the value to Indonesia of the resources needed to generate an equivalent amount of domestic beef production. The policy environment for the beef industry needs to be designed with these objectives in mind.

The Study

The crisis of 1997 exposed structural weaknesses in Indonesia's beef cattle production and processing sectors. It also exposed some lack of knowledge among researchers and policy advisers in Indonesia concerning:

- the economic drivers of the cattle and beef industry;
- the interactions between production (smallholder and corporate), processing, marketing and imports (both live cattle and beef); and
- the likely impacts of a range of developments on the performance of Indonesia's beef industry.

In response to a request from the Indonesian government for an evaluation of the impact of the Asian financial crisis on Indonesia's beef industry, the Australian Centre for International Agricultural Research (ACIAR) funded a preliminary study by Hadi et al. *(1999)*.

It became clear from the preliminary study that there was an urgent need for an analytical modelling framework to help beef industry analysts and advisers understand how changes in the general economic environment and in government policy are likely to impact on each component of the cattle–beef supply chain, from production through to sales. Such an understanding is a prerequisite to identifying a plan to improve efficiency in key parts of the supply chain and to strengthen beef industry performance.

The project described in this report aimed to meet these needs. It represented the implementation phase of the preliminary study and had the following objectives:

- to construct a detailed quantitative picture of the structure of the Indonesian cattle–beef value chain;
- to construct an analytical framework around this picture by specifying the behavioural relationships of each segment in the chain;
- to use the analytical framework to explore the impact of macroeconomic and other developments on the industry, and to evaluate the contribution of a range of measures to improve industry performance; and
- to ensure that personnel at the Center for Agro Socio-Economic Research and Development can continue to use and maintain the framework so that they can provide sound advice to the Indonesian government on beef industry issues.

The focus of the project was consistent with the agricultural development priorities of the Indonesian government. These recognise the need to strengthen domestic beef production. There have been no previous attempts to develop a quantitative framework for analysing beef industry issues in Indonesia. Without a framework, advisers have not been able to analyse possible effects of the Asian crisis on the beef industry and advise the government on how best to respond. Nor have they been able to analyse the impacts on the industry of the government's decision to reduce the tariff on imported beef to 5% and the tariff on imported cattle to zero. The framework makes it possible to identify and prioritise the reforms needed throughout the beef industry to improve its growth prospects and contribution to the Indonesian economy.

The benefits of the project will, in the first place, accrue to Indonesia, but other developing countries may be interested in replicating this initiative. As per capita incomes increase in developing countries, consumer demand for beef protein also increases. This is likely to provide increased opportunities for domestic beef industries and will increase the value to these countries of a quantitative capacity to analyse them.

This Report

This report describes the development of the analytical framework.

Chapters 2–5 describe the Indonesian beef industry. Chapter 2 looks at Indonesia's beef industry development in the context of likely developments in the global beef industry. Particular reference is made to Australia's beef industry development, because a key concern for the Indonesian beef industry is the likely availability of live cattle from Australia to support Indonesia's commercial feedlot production. Chapter 3 looks at the structure of Indonesia's cattle and beef industry production and policy settings. Chapter 4 looks at processing. Chapter 5 considers trade and marketing.

Chapter 6 provides a detailed description of the Indonesia beef model constructed as part of this study.

Chapter 7 describes the survey work undertaken to construct the value chain used by this model. It highlights the key features of the value chain, from farm cattle production through to demand for beef in various markets.

Chapter 8 describes the application of the model using various policy simulations and outlines key findings.

2 Indonesia in the Global Beef Industry

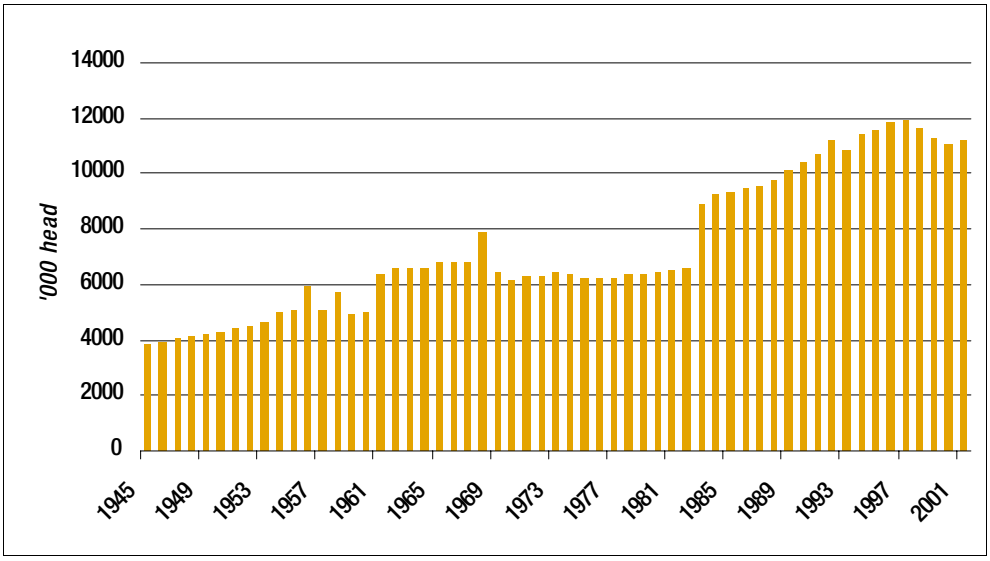
This section describes Indonesia's beef cattle industry in the global context. It describes changes in the cattle population since independence in 1945, changes in beef production in the past decade and the impact of other meat products. It then describes the import of live cattle and beef, and the impact of the Australian beef industry. Finally, it discusses developments in the global beef industry.

Indonesia's Cattle Population

Figure 2.1 shows the cattle population in Indonesia from 1945 (the year of independence) to 2001. The figure exhibits four phases: 1945–68, 1969–83, 1984–98 and 1999–2001.

In the first phase of about 23 years, the beef cattle population increased continuously up until 1956. It then fluctuated from 1957 to 1960 due to disease. Between 1961 and 1968 the cattle population recovered.

Figure 2.1 Beef cattle population in Indonesia, 1945–2001.



Data source: DGLS (2001)

Between 1969 and 1983, the population stagnated, probably because of rice production policies. During this period, the government attempted to achieve rice self-sufficiency through massive intensification programs that involved the development and rehabilitation of irrigation networks, particularly on Java. Provision of irrigation water to the rice fields was tightly scheduled and farmers had to prepare their land at times that would allow them to obtain the limited irrigation water. At the same time, the government introduced hand-tractors and mini-tractors for rapid and efficient land preparation and to reduce planting time.

The mechanisation program aimed to overcome a shortage of labour and draught animals for land preparation. However, the demand for mechanisation was steadily increasing because of the following advantages over conventional practices:

- more rapid land preparation that met the tight irrigation schedule;
- lower cost;
- the fact that it was easier to hire a tractor than labour or draught animals; and
- better quality of land preparation.

As a result, mechanisation eventually replaced the labour and draught animal supply it was intended to supplement. Cattle owners lost revenues from cattle renting. Moreover, they were no longer able to use their own cattle to prepare their land and therefore reduce cash expenditure.

The mass intensification programs resulted in the removal of grazing land that had previously remained uncultivated during the dry season. Feed shortages during the dry season became a serious problem threatening the economic viability of cattle production. Farmers faced family labour shortages and lacked the funds to hire labour to collect forage such as agricultural waste and natural grass. This constrained the size of cattle herds.

In 1982 and 1983, the cattle population increased rapidly. The International Fund for Agricultural Development (IFAD) and the Asian Development Bank (ADB) funded projects to boost cattle production. Under the IFAD project, a large number of shahiwal and brahman cross bulls were imported for natural breeding with Bali cattle. At the same time, the ADB project imported female shahiwal cattle. Both projects aimed to increase cattle productivity through an increased birth rate, a smaller calving interval and an increased average daily weight gain.

Table 2.1. Cattle population by province, 1997 and 2000.

Province	Population Head 1997	Population Head 2000	Change (%)	Share 1997	Share 2000	Change (%)
Aceh	680,027	668,489	–1.70	6.36	6.07	–0.29
North Sumatra	268,364	247,781	–7.67	2.51	2.25	–0.26
West Sumatra	415,252	429,336	3.39	3.88	3.90	0.02
Riau	135,253	144,678	6.97	1.26	1.31	0.05
Jambi	151,108	142,054	–5.99	1.41	1.29	–0.12
South Sumatra	515,539	420,617	–18.41	4.82	3.82	–1.00
Bengkulu	94,522	79,180	–16.23	0.88	0.72	–0.16
Lampung	451,913	375,115	–16.99	4.23	3.41	–0.82
Sumatra	2,711,978	2,507,250	–7.55	25.36	22.78	–2.59
Jakarta	0	0	0	0	0	0
West Java	183,286	174,697	–4.69	1.71	1.59	–0.13
Middle Java	1,260,278	1,317,341	4.53	11.79	11.97	0.18
Yogyakarta	197,428	206,714	4.70	1.85	1.88	0.03
East Java	2,282,670	3,312,015	45.09	21.35	30.09	8.74
Java	3,923,662	5,010,767	27.71	36.70	45.52	8.82
Bali	538,753	529,074	–1.80	5.04	4.81	–0.23
West Nusatenggara	471,847	376,526	–20.20	4.41	3.42	–0.99
East Nusatenggara	717,111	485,329	–32.32	6.71	4.41	–2.30
Nusatenggara	1,727,711	1,390,929	–19.49	16.16	12.64	–3.52
West Kalimantan	163,295	151,598	–7.16	1.53	1.38	–0.15
Middle Kalimantan	48,282	45,326	–6.12	0.45	0.41	–0.04
South Kalimantan	166,597	143,416	–13.91	1.56	1.30	–0.26
East Kalimantan	84,733	50,773	–40.08	0.79	0.46	–0.33
Kalimantan	462,907	391,113	–15.51	4.33	3.55	–0.78
North Sulawesi	294,666	276,524	–6.16	2.76	2.51	–0.24
Middle Sulawesi	262,027	234,444	–10.53	2.45	2.13	–0.32
South Sulawesi	840,642	718,139	–14.57	7.86	6.52	–1.34
Southeast Sulawesi	289,143	300,451	3.91	2.70	2.73	0.03
Sulawesi	1,686,478	1,529,558	–9.30	15.77	13.89	–1.88
Maluku	109,835	97,938	–10.83	1.03	0.89	–0.14
Papua[a]	6980	80,462	15.28	0.65	0.73	0.08
Maluku and Papua	179,635	178,400	–0.69	1.68	1.62	–0.06

[a] Formerly Irian Jaya

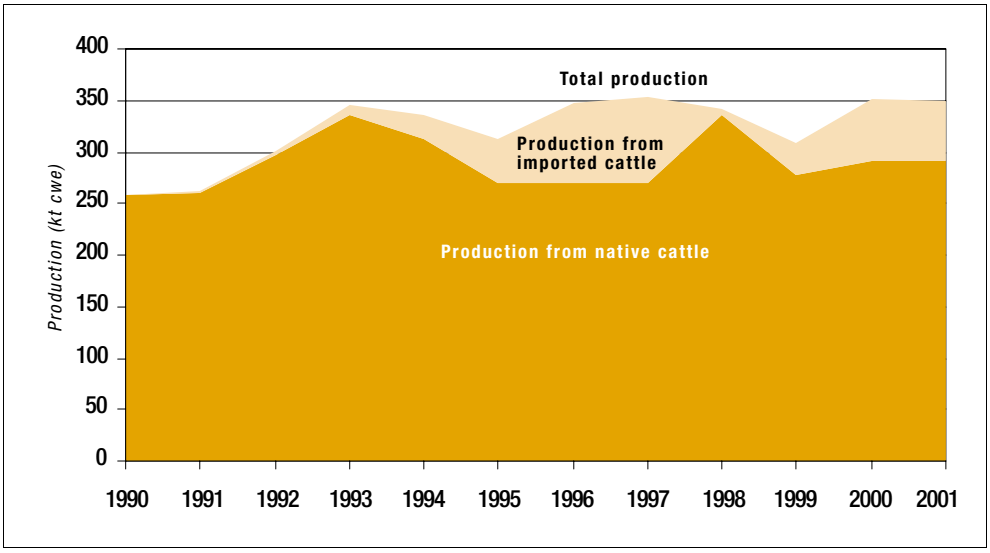
Source: DGLS, processed

Between 1984 and 1998, the cattle population increased as a result of the previous development programs, with numbers peaking in 1998.

Between 1999 and 2000, cattle numbers declined, due to a big reduction in imported live cattle from Australia (from 424,000 head in 1997 to 41,000 head in 1998, before a partial recovery to 100,000 head in 1999). Live cattle imports became uneconomic with the massive depreciation of the rupiah. As farmers cashed in on the high rupiah prices that they could get for their cattle, the number of native cattle slaughtered exceeded the natural increase in numbers. Calving rates also decreased.

Table 2.1 shows beef cattle populations in different provinces in 1997 and 2000. Java Island remains the major source of beef cattle. The cattle population on Java increased from 37% of the whole in 1997 to 46% in 2000. East Java, Middle Java and Yogyakarta provinces have traditionally been prominent sources of cattle. The number of cattle in West Java Province decreased between 1997 and 2000, as with most provinces outside Java, except West Sumatra, Riau, Southeast Sulawesi and Papua. High depletion rates occurred in East Kalimantan, East Nusatenggara and West Nusatenggara. There seems to be a need for more serious attempts to increase beef cattle numbers, particularly in the provinces outside Java.

Figure 2.2. Contribution of imported feeder cattle to Indonesia's beef production, 1990–2001.



cwe=carcass weight equivalent; kt=kilotonnes

Data source: Estimates from GMI database

Table 2.2. Beef production and average slaughter weight, 1993–2000.

Year	Beef production (kt)	Number of slaughtered cattle (head)	Average slaughter weight (kg/head cwe)
1993	346.3	1,686,896	205.3
1994	336.5	1,551,375	216.9
1995	312.0	1,590,382	196.2
1996	347.2	1,766,919	196.5
1997	353.7	1,658,025	213.3
1998	342.6	1,791,851	191.2
1999	308.8	1,644,396	187.8
2000	339.9	1,695,374	200.5

cwe = carcass weight equivalent; kg = kilograms; kt = kilotonnes
Source: DGLS (2001), processed

Beef Production

Indonesia's beef production has been on an upward trend over the past decade. Growth has been achieved largely through a heavy reliance on imported live feeder cattle (Fig. 2.2).

Production declined in 1998 and 1999 following the Asian financial crisis, but there was a big turnaround in 2000 with the partial recovery of the economy and resumption of significant imports of feeder cattle.

In 2000, beef production was from 1.7 million cattle slaughtered. Unlike the situation in major beef-exporting countries such as the United States and Australia, there was no trend increase in carcass weights of slaughtered animals (Table 2.2). In Indonesia, average carcass weights declined in 1998 and 1999 as younger cattle were slaughtered because there were fewer older cattle. The slaughter of increasingly younger cattle caused the domestic cattle herd to decrease even faster than before.

Java has been the major beef-producing island in Indonesia, contributing 64–70% of total beef production (calculated from DGLS 2001 data). However, not all provinces on Java contribute cattle for this beef. For example, all the beef produced in Jakarta Province comes from cattle imported from other provinces, such as Lampung, West Java, Middle Java, East Java, Bali, West Nusatenggara and East Nusatenggara.

In 1997, 209,520 head were slaughtered in Jakarta. In 1998, 1999 and 2000, the number of slaughtered cattle declined by 25.16% (to 156,807 head), 23.31% (to 120,262 head) and 24.53% (to 90,761 head), respectively (DGLS 2001). Beef production in 1997 was 36,876 tonnes. In 1998, 1999 and 2000, it declined by 25.32% (to 27,540 tonnes), 20.70% (to 21,839 tonnes) and 34.60% (to 14,282 tonnes), respectively.

Table 2.3. Beef supply by source (kilotonnes), 1995–2000.

Year	Native cattle	Imported cattle	Imported beef	Total supply
1995	261.5	50.5	7.3	319.3
1996	268.0	79.2	15.8	363.0
1997	266.5	87.2	23.3	377.0
1998	320.8	21.8	8.8	351.4
1999	280.9	27.9	10.5	319.3
2000	276.9	63.0	26.9	366.8

Source: Calculated from DGLS and CBS Trade statistics — Import — Volume 1 (various issues)

Table 2.3 shows how the three types of beef supply — beef from native cattle, beef from imported cattle and imported beef — have changed in recent years. The proportion of each has fluctuated considerably in response to exchange rate fluctuations, but the proportion of native cattle used for beef supply is falling (from 82% in 1975 to 75% in 2000) and that of imported cattle is increasing.

The total beef supply reflects consumer demand and is driven by per capita income and population. The effects of the financial crisis on per capita income and beef consumption are clear from Table 2.3.

Table 2.4. Production of meats and the share of beef, 1993–2000.

Year	Beef		Other[a]		Poultry		Total	
	kt	%	kt	%	kt	%	kt	%
1993	346.3	25.1	333.4	24.2	698.6	50.7	1378.3	100.0
1994	336.5	22.5	333.8	22.4	822.6	55.1	1492.9	100.0
1995	312.0	20.7	319.5	21.2	875.7	58.1	1507.2	100.0
1996	347.2	21.3	338.0	20.7	947.0	58.0	1632.2	100.0
1997	353.7	22.7	302.9	19.5	898.5	57.8	1555.1	100.0
1998	342.6	27.9	264.7	21.6	621.2	50.6	1228.5	100.0
1999	308.8	25.9	265.1	22.2	620.3	51.9	1194.2	100.0
2000	339.9	23.5	287.6	19.9	817.7	56.6	1445.2	100.0

kt = kilotonnes
[a] Buffaloes, goats, sheep, pigs and horses
Source: DGLS, calculated

Production of Other Meats

In Indonesia, there is significant domestic production of poultry, pork, buffalo, goat, sheep and horse, which compete for market share with beef. Table 2.4 shows that, like beef, production of other meats declined in 1998 and 1999 as a result of the financial crisis. Poultry production was worst affected, as feed grain prices increased substantially in these years.

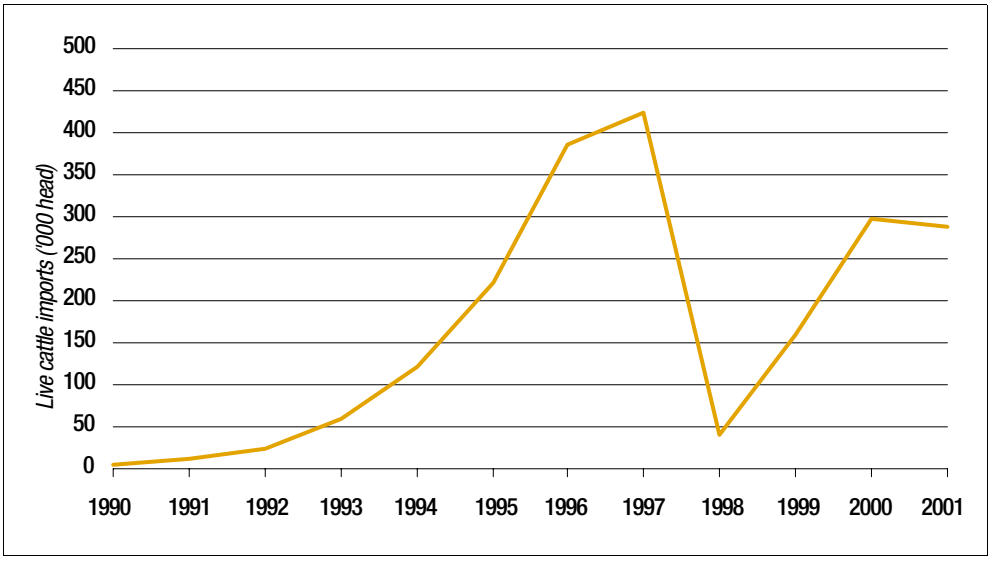
In Indonesia, poultry was the major meat produced between 1993 and 2000, accounting for up to 58% of total meat production. Beef was second in importance, with a production share of 20.7–27.9%. The share of beef production was highest in 1998 and 1999, primarily because of the large drop in poultry production. In 2000, the share of beef production decreased because of the rapid recovery of poultry production.

During the 1970s and early 1980s, beef had the largest share of national meat production. In 1983 beef was still the major source of meat (46%), compared with 34% for poultry. Since then poultry production has grown more rapidly than that of beef.

Imports of Live Cattle and Beef

Indonesia is a net importer of live cattle and beef. Imports are significant and exports negligible. Imports add to domestic supply and fill the gap between consumption and production.

Figure 2.3. Imports of feeder cattle, 1990-2001.



Data source: Meat and Livestock Australia

Live cattle imports

Live cattle imports consist mainly of purebred cattle for breeding (mainly brahman cross) and feeder cattle for fattening (eventually for slaughter for producing beef). Cattle for fattening have always dominated. Imports of feeder cattle (Fig. 2.3) began in 1990 and increased rapidly through to 1996. The rate of increase slowed in 1997 with the onset of the financial crisis in July of that year and the depreciation of the rupiah from its 1996 level of 2345 Rp per US dollar.

The average import price of live cattle in US dollar terms declined from US$1.5 per kilogram in 1996 to US$1.4 per kilogram in 1997, but the price in rupiah increased by 13% from 3623 Rp to 4089 Rp per kilogram.

In 1998, the rupiah depreciated to 9991 Rp per US dollar, reaching a low point of 15,100 Rp per dollar in June of that year. Even though the import price in US dollar terms fell further, to US$1.1 per kilogram, the price in rupiah increased to a massive 11,380 Rp per kilogram. As a result, the quantity of imported feeder steers dropped by 75% during 1998, from its pre-crisis level. This marked the most severe effect of Indonesia's financial crisis on the beef industry.

In 1999, the import price in US dollars of live cattle declined further, to US$0.95 per kilogram. The rupiah appreciated to 7949 Rp per US dollar. As a result, the import price in rupiah declined by 34%, to 7539 Rp per kilogram, which triggered a 2% increase in feeder cattle imports.

Feedlot operators interviewed considered that the import price in US dollars was specified by Australian exporters of live cattle according to the rupiah exchange rate. If this were true, Australian exporters would have had a degree of monopoly power over prices, but the evidence for this is weak. In the years immediately before the 1997 crisis, the import price in US dollars was falling as the rupiah was depreciating. However, world export prices for beef were also falling over this period because of a rapid increase in global production of pig meat and poultry. Also, in 2000 and 2001, when the rupiah depreciated further, the US dollar import price of live cattle increased in line with a strong global recovery in beef prices.

According to feedlot operators, the break-even exchange rate for live cattle imports is 10,000 Rp per US dollar. If the exchange rate exceeds this level, it is not profitable to fatten imported cattle in the feedlot.

Table 2.5. Import quantity of live cattle, beef and edible offal, 1995–2000 (tonnes).

Cattle products	1995	1996	1997	1998	1999	2000
Live cattle						
Purebred breeding animals	1304.4	1334.8	1453.7	410.8	31.5	161.6
Cattle (maximum weight 350 kg)[a] and other cattle	75,041.5	117,744.5	129,674.8	32,352.3	41,430.0	93,678.7
Other cows and buffaloes	0	3315.1	442.7	0	376.7	0
Total	76,346.0	122,394.4	131,571.2	32,763.1	41,838.2	93,840.3
Growth (%)		60.32	7.50	–75.10	27.70	124.29
Beef						
Fresh/chilled carcasses and half-carcasses	3.9	1.8	0	0	18.9	70.1
Fresh/chilled other cuts with bone in	33.3	17.8	8.3	10.0	7.2	44.7
Fresh/chilled boneless	514.7	451.9	430.8	80.6	164.3	861.5
Frozen carcasses and half-carcasses	43.6	31.0	201.9	22.1	0	36.9
Frozen other cuts with bone in	674.8	782.4	414.7	373.2	592.9	613.0
Frozen boneless	5988.9	14,488.3	22,259.7	8327.3	9764.5	25,310.9
Total	7259.2	15,773.1	23,315.3	8813.3	10,547.7	26,937.1
Growth (%)		117.28	47.82	–62.20	19.68	155.38
Edible offal						
Fresh/chilled	45.8	1.2	0	15.9	42.0	9.3
Frozen tongues	51.1	39.2	48.6	17.8	8.9	2.4
Frozen livers	9013.6	10,376.2	6624.3	4437.4	7746.0	22,262.1
Other edible offal, frozen	2896.4	2210.8	2269.4	1757.9	1598.1	8129.3
Total	12,006.8	12,627.4	8942.2	6228.9	9395.0	30,403.1
Growth (%)		5.17	–29.18	–30.34	50.83	223.61

[a] *Also includes some heavier cattle*
Data source: CBS Trade statistics Vol. I (various issues), calculated

According to Indonesian government regulations, the maximum allowable weight of imported feeder cattle is 350 kilograms, but the import statistics show significant imports of heavier cattle weighing up to 400 kilograms (33–49% of live cattle imports in recent years). The import of the heavier cattle reflects both orders from Indonesian importers and intentions from Australian exporters to include them. The weights of delivered cattle are not always exactly as ordered and depend to some extent on cattle availability in Australia. In Indonesia, cattle less than 350 kilograms are fattened in feedlots, but heavier cattle are slaughtered immediately.

Table 2.5 shows imports of live cattle, beef and edible offal from 1995 to 2000. Cattle imported in the northern Australian dry season are entirely brahman cross. Wet season

Table 2.6. Import price of live cattle, beef and edible offal, 1995–2000 (CIF US$/kg).

Cattle products	1995	1996	1997	1998	1999	2000
Live cattle						
Purebred breeding animals	2.428	2.258	2.146	1.385	2.319	1.395
Cattle (maximum weight 350 kg)[a] and other cattle	1.454	1.545	1.362	1.139	0.951	0.987
Other cows and buffaloes	–	1.649	1.481	–	1.000	–
Composite price	1.471	1.556	1.371	1.142	0.953	0.988
Growth (%)		5.76	–11.89	–16.68	–16.60	3.66
Beef						
Fresh/chilled carcasses and half-carcasses	2.336	0.903	–[??]	–	0.857	1.611
Fresh/chilled other cuts with bone in	2.130	0.757	1.978	2.068	2.756	1.683
Fresh/chilled boneless	2.330	2.413	1.894	1.521	1.946	1.789
Frozen carcasses and half-carcasses	1.734	2.102	1.000	0.828	–	2.372
Frozen other cuts with bone in	2.269	2.070	1.689	1.687	1.626	1.518
Frozen boneless	1.945	2.046	1.571	1.145	1.427	1.516
Composite price	2.002	2.056	1.574	1.172	1.446	1.526
Growth (%)		2.70	–23.45	–25.56	23.38	5.59
Edible offal						
Fresh/chilled	0.937	2.638	–	0.911	1.658	1.953
Frozen tongues	1.385	1.677	1.583	1.327	1.026	1.413
Frozen livers	1.001	1.094	0.934	0.751	0.677	0.664
Other edible offal, frozen	1.021	1.000	0.999	0.870	0.809	0.703
Composite price	1.007	1.079	0.954	0.787	0.704	0.675
Growth (%)		7.17	–11.61	–17.54	–10.55	–4.09

CIF = cost, insurance and freight
[a] Also includes some heavier cattle
Source: CBS Import Statistics (various issues), calculated

imports are British cross. In Indonesian feedlots, the average daily weight gain is 1.0–1.3 kilograms for brahman cross cattle compared with 0.8 kilograms for British cross cattle. The break-even point for average daily weight gain is 0.8 kilograms. This means that the fattening of brahman cross cattle is profitable but the fattening of British cross cattle is less so.

Financing the imports of live cattle has become a big issue for feedlots. Before the 1997 crisis, payment was based on letters of credit and could be deferred until all ordered cattle were delivered to the Indonesian importer. Since the crisis, the new payment rule is 20% in advance, 60% after selection of cattle and 20% after all ordered cattle are landed at the import destination. This new rule, which requires 80% payment before delivery, has weakened the ability of Indonesian feedlots to finance feeder cattle imports.

Table 2.7. Per person consumption of meat in Indonesia (kg cwe), 1990–2001.

	Beef	Sheep	Pork	Poultry	Fish	Total
1990	1.75	0.51	0.69	2.70	7.87	13.53
1991	1.76	0.59	0.61	3.10	8.19	14.25
1992	1.93	0.59	0.74	3.43	8.25	14.93
1993	2.14	0.60	0.90	3.73	8.80	16.17
1994	2.05	0.53	0.96	4.28	9.67	17.49
1995	1.89	0.49	0.91	4.57	9.47	17.33
1996	2.13	0.51	0.96	4.83	9.74	18.18
1997	2.18	0.54	0.73	4.50	9.87	17.83
1998	1.97	0.40	0.68	3.03	9.34	15.42
1999	1.78	0.37	0.80	2.97	9.91	15.83
2000	2.08	0.40	0.84	3.51	10.95	17.78
2001	1.99	0.42	0.77	4.04	12.09	19.32

cwe = carcass weight equivalent
Source: GMI database

Beef imports

Beef is imported in six product forms (Table 2.6). Foreign boneless beef exceeded 90% of total beef imports between 1996 and 2000. Total beef imports grew by 117% between 1995 and 1996 and 48% in 1997, followed by a 62% decline in 1998. Imports recovered by 20% in 1999 before expanding by 155% in 2000. Fluctuations in the value of the rupiah and changes in import prices in foreign currency have been the key determinants of fluctuations in beef imports.

Edible offal imports

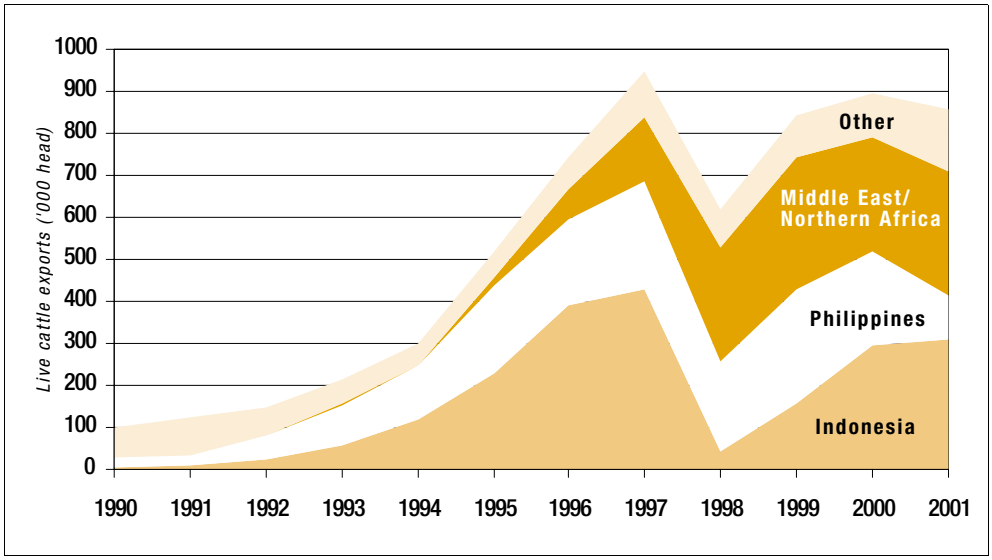
Four categories of edible bovine offal are imported. The major category is liver, which has accounted for 71–82% of offal imports. The pattern of imports of edible offal has followed that of beef and live cattle, being influenced by fluctuations in the exchange rate and changes in import prices in foreign currency.

Beef Consumption

Per capita consumption of beef (measured as domestic disappearance[1] rather than from household survey data) is shown in Table 2.7.

[1]Domestic disappearance is production plus imports, less exports.

Figure 2.4. Australia's live cattle exports by destination, 1990–2001.



Data source: MLA (2002)

The key point to note is that beef consumption is yet to recover to its pre-crisis level and that poultry and fish are much more important sources of meat protein than is beef.

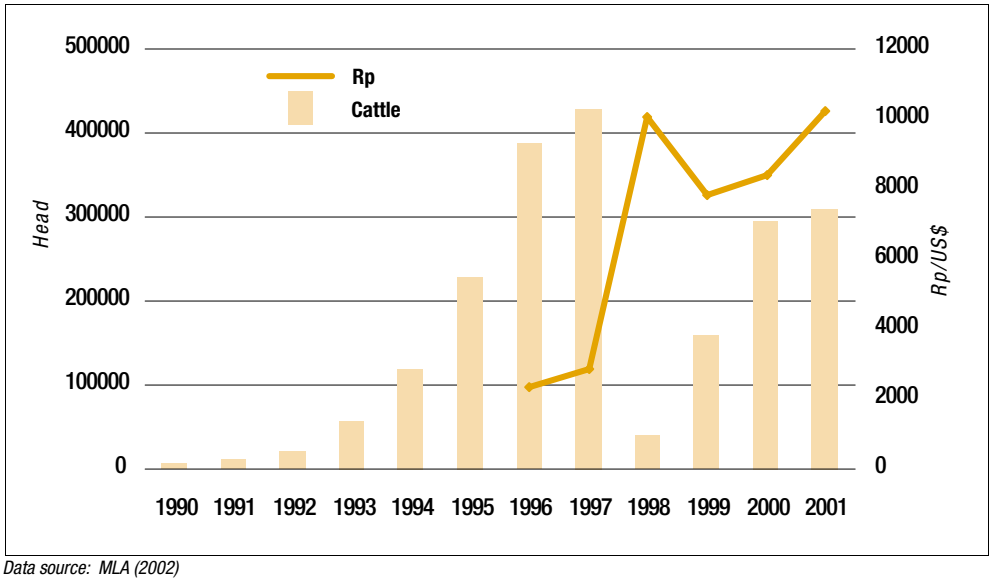
The Australian Beef Industry

For 2001 and the first half of 2002, Australia's beef production industry was in a highly profitable phase. Domestic and export demand for Australian beef was high and the Australian dollar was very weak. Producers realised record levels of cattle prices after a sustained rise over the previous five years. Eighty per cent of beef production relies on grazing of pastures, and seasonal conditions had been good. Moreover, the productivity of beef producers had been improving markedly.

The optimism among Australia's beef producers about the future began to moderate in mid-2002. The Australian dollar began to appreciate against the US dollar, signs of another widespread drought began to emerge and beef consumption in Australia's most valuable beef export market (Japan) remained depressed. Despite these developments, the longer-term future for Australia's efficient, low-cost beef producers remains promising.

The Australian government has no specific beef industry policies to encourage an expansion in cattle production. In northern Australia, there are few potential agricultural land uses other than cattle grazing; most cattle are *Bos indicus*, large numbers of which are

Figure 2.5. Exports of live cattle from Australia to Indonesia, 1990–2001.



Data source: MLA (2002)

exported as live cattle to Indonesia and other Asian markets. In southern, eastern and southwestern Australia, cattle production competes with other enterprises such as sheep grazing and cropping. The policy principle in Australia is not to create incentives which favour development of one activity over the other.

Australia's beef production

In 2001, beef production hit a record level of 2060 kilotonnes carcass weight equivalent (cwe), though the size of the herd (28.4 million cattle) was still well below that in the mid-1970s. The cattle herd is expected to expand steadily to reach 31 million by 2005. Beef exports in 2001 also hit record levels (1411 kilotonnes cwe), with 77% of exports absorbed by just two markets — the United States and Japan.

Boosted by high producer prices, Australia's beef production is projected to expand steadily over the next five years. Production may reach 2720 kilotonnes cwe in 2006, a 30% expansion over 2001. With domestic consumption of beef static, virtually all of this increase in production will need to be exported. Australia will need to become less dependent on exports to Japan and the United States. In Japan several outbreaks of bovine spongiform encephalopathy (BSE) in the domestic cattle herd during 2001 have caused a big drop in consumer confidence in beef and in the consumption of both domestically

produced and imported beef. Japanese demand for imported beef is unlikely to return to its pre-2001 level until 2004.

The United States has country-specific quotas on imported beef. Demand by the United States for imported beef from Australia now exceeds the quota volume. Australia's shipments of over-quota beef to the United States incur a tariff of 26.4%. The over-quota tariff will encourage diversion of Australia's exports away from the United States to other markets.

Live cattle exports

In 2001, live cattle exports from Australia declined by around 5%, to 855,000 head. This represents a strong performance given that live cattle prices in Australian dollars increased by more than 20%. Export demand for Australia's live cattle strengthened considerably — aggregate revenue from live cattle sales increased 17% to a record $560 million.

The live cattle trade now accounts for around 10% of Australia's adult cattle turnoff. Live cattle sales to the major markets in Asia and the Middle East fluctuate considerably from year to year depending on specific circumstances in importing countries and the degree of competition from other sources of supply (Fig. 2.4).

Australia's live cattle exports are projected to expand again in volume terms from 2002 on. Exports will be facilitated by:

- increased availability of cattle from northern Australia, reflecting steadily expanding production from good seasonal conditions and strong price incentives; and
- reduced cattle prices caused by reduced demand for Australian beef in Japan, a binding quota constraining Australia's exports to the United States, increased production from a steadily growing herd and more live cattle shipping capacity.

Indonesia is the largest market for Australia's live cattle. Indonesia's demand for Australian live cattle has been volatile in recent years, reflecting changes in the value of the rupiah against the Australian dollar and changes in Indonesia's economic performance.

Meat and Livestock Australia is projecting an expansion in Indonesia's live cattle imports from Australia (Fig. 2.5). The drivers of this projected expansion are likely to be:

- economic growth in Indonesia and hence increased demand for beef;
- insufficient Indonesian cattle production; and
- higher margins on feeding Australian cattle in Indonesia as Indonesian beef prices rise and Australian cattle prices fall.

A concern amongst Australian live cattle producers is Indonesia's 10% value-added tax to be applied to all agricultural products, including live cattle. This tax is expected to impact on live cattle imports and feeding margins.

Developments in the Global Beef Industry

Indonesia is becoming increasingly reliant on live cattle imports from Australia to sustain beef production growth. Of significant interest to Indonesia are developments in the global beef industry that influence the price and availability of live cattle from Australia, and beef from the major exporting countries of Australia, the United States and New Zealand.

Global trade in beef grew by only 3% between 1990 and 2000 compared with growth in the value of total global exports of 84%. The composition of the global beef trade changed markedly over this period. The major low-cost efficient exporting countries — the United States, Australia and South American countries — have rapidly increased their beef exports at the expense of exports from subsidised regions such as the European Union (MLA 2001).

The United States is a major producer, consumer, exporter and importer of beef. Events in the US beef industry therefore play a significant role in determining global beef industry outcomes. Between 1990 and 2000, US beef production increased steadily and US beef exports increased by 150%. Over the same period, Australia's beef exports increased by 26% and exports from South American countries increased by 37%. However, US beef production is now falling. The US cattle industry is in its sixth year of herd liquidation. Herd liquidation is projected to cease in 2002. This will mean falling production through to 2005 as females are retained to build up cattle numbers. In 2005, US production is projected to be more than 1000 kilotonnes cwe below its 2001 level.

With a strong domestic demand for beef and falling beef production, US import demand — which is mainly for manufacturing-quality beef from cattle, many of which would otherwise enter the live cattle trade — is also likely to grow strongly. In the absence of US import quotas, this import demand could be expected to be filled by the projected increase in Australian production. But with US import quotas in place, some of the projected increase in Australian production will be diverted to other markets, including Indonesia. US import quotas on Australian beef will therefore increase the availability from Australia of both live cattle and boxed beef for Indonesia. Much of the expansion in cattle numbers is projected to be in northern Australia, from which Indonesia draws live cattle for its feedlots.

South American countries, particularly Argentina, Brazil and Uruguay, have considerable potential for expanding beef production. However, persistent foot-and-mouth disease problems restrict these countries' ability to trade beef with Pacific Rim countries, and under-performing domestic economies have constrained developments in the beef industry. The big devaluation of the Brazilian real over the past two years and the recent floating of the Argentinean peso (and the subsequent large devaluation) will reduce the price of South American beef on global markets and stimulate demand for it. However, until problems with foot-and-mouth disease in South America are permanently overcome the ability of these countries to export widely will be severely curtailed.

3 Industry Structure and Policy Settings

Despite the rapid increase in live cattle imports for commercial feedlots over the last decade, Indonesia's beef cattle production is still dominated by smallholder producers fattening domestic native feeder cattle purchased from smallholder breeders. In 1990, the government introduced a business partnership between feedlot and smallholder using the 'nucleus estate and smallholder' (NES) approach. The concept is based on the interdependence between nucleus and plasma in a living cell. A nucleus cannot survive without support from the plasma and vice versa. Feedlots, which have financial and management resources, are obligated to provide cattle and feed (particularly concentrates) and technical assistance to smallholders, and to purchase back their fattened cattle at prevailing market prices. Smallholders, who have land and family labour, are obligated to look after the cattle. All costs prefinanced by the feedlot are reimbursed from the sale price. Since the economic crisis, the business partnership between feedlot and smallholder through the NES system using imported cattle has virtually ceased. A major reason is the high price of imported cattle due to the rupiah's depreciation.

In 2001, 1.5 million cattle were fattened by smallholders, 99.9% of which involved NES partnerships. A further 252,000 cattle were fattened from live feeder cattle imports.

Major Characteristics of Smallholder Breeders

Breeding farms in low-altitude lands — hand feeding

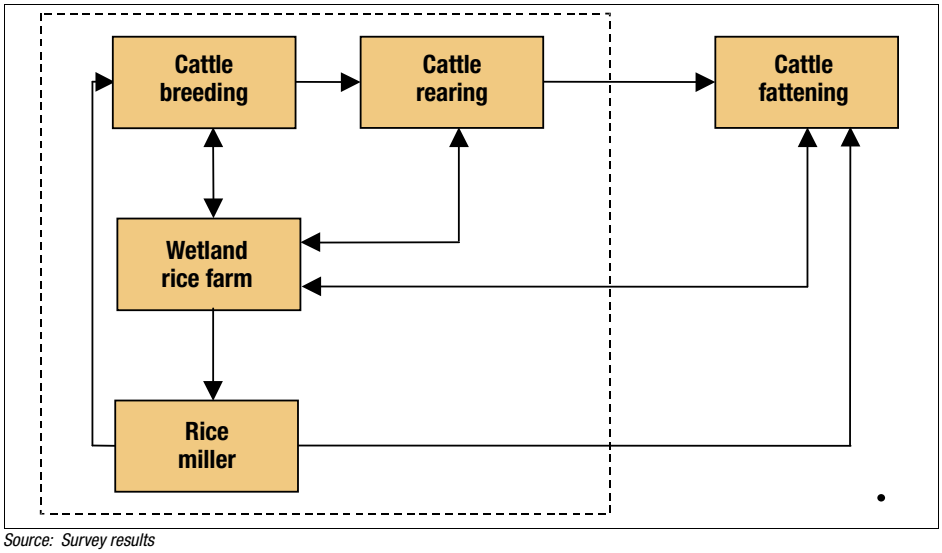
Cattle breeding farms that feed their stock by hand may be found in many parts of Indonesia, especially where there are large areas of farms with high cropping intensity, such as those growing wetland rice. In the past, dried rice straw has been the major component of cattle feed. It is usually gathered shortly after harvest and stored in cattle shelters or at the side of farmers' houses. When rice straw becomes scarce, especially during the dry season, farmers collect grass. The quantity of family labour and the financial ability of farmers to hire labour for gathering rice straw and grass have become the crucial limiting factors in the size of cattle holdings. Cattle breeding is a low-cost activity when using agricultural waste and by-products, or locally available inputs that are cheap.

In regions of intensive cropping, particularly Java Island, cattle breeding is a complement of rice production, with draught animals used for land preparation and as a source of organic manure. The sustainability of domestic cattle has been underpinned by almost zero cash expenditure for rice land preparation using a farmer's own cattle and by revenue gained from renting the cattle.

Programs launched by the government since 1969 to intensify rice production required simultaneous planting over a wide irrigated area in a very short time. This type of production requires high-capacity machinery such as tractors for rapid land preparation; therefore, the role of cattle as the major source of draught animal for land preparation has declined since 1969. The intensification programs, which double or even triple cropping intensity, have removed the previously available fallow lands for grazing during the off-season (dry season). These changes forced farmers to sell their cattle. This is the main reason why the natural increase in Indonesian cattle since 1969 has been very slow.

Figure 3.1 illustrates the integration between a smallholder cattle farm and a wetland rice farm. This pattern is found in the northern coastal regions of Java such as Grobogan, Pati and Rembang districts in Middle Java Province and Tuban and Lamongan districts in East Java Province. The economic viability of the cattle breeding activity is highly dependent upon the availability of rice straw as the principal forage. Manure produced by breeder cattle goes to the rice field, but the economic viability of the rice farm is not dependent upon the availability of manure. The use of manure is mainly aimed at improving soil texture and fertility as well as reducing fertiliser cost.

Figure 3.1. Development pattern of smallholder cattle farm: integrated wetland rice cattle farm (breeding–rearing–fattening) in low-altitude lands.



Source: Survey results

Rice mills are located in the rice-producing centres. Rice bran produced from rice milling may be used as a concentrate for feeding breeder cattle during the pregnancy and milking periods.

Calves produced from breeding are usually reared by the same farmers that looked after the mothers. The reared cattle are usually fattened by different farmers within the same rice-producing areas, using rice straw and grass, and rice bran purchased from local millers.

Most cattle holdings are very small, with one to three head per farmer. Revenue from cattle breeding is a small part of the farm household's income. Breeding cattle are held mainly to produce calves for selling to fatteners and to produce manure for improving land fertility. Farmers sell the calves after they reach a particular liveweight or when the farmer needs to obtain cash quickly.

Some farmers have used artificial insemination (AI) to improve the genetic performance and profitability of calves. Generally, AI involves friesian holstein crossbreed (FHC) females and semen from superior bulls like simmental, limousine, brahman, charolais, hereford and brangus. AI is practised mainly by farmers in high-altitude areas such as Wonosobo and Salatiga districts of Middle Java Province and Magetan District of East Java Province. In most areas, especially at low altitudes, most farmers use '*peranakan ongole*' (PO) females, primarily because of their wide availability.

The average daily weight gain (ADWG) of calves produced from PO females is very low (about 0.6 kilograms). By contrast, the ADWG of calves born to FHC females with semen from simmental crossbred bulls is 1.2 kilograms or higher. This is why smallholders increasingly prefer FHC to PO females. The superiority of a calf produced from cross-breeding FHC and simmental or FHC and other comparable superior bulls lies not only in its higher ADWG through its better genetic potential and the higher milk production of the FHC cow but also in its higher initial weight. This improves calf prices. Smallholder fatteners also tend to choose these calves because their higher productivity makes cattle farming more profitable. The slaughtered cattle produce a higher proportion of meat and less bone.

Most cattle are kept in individual stalls under shelter. Sometimes females are tied up or placed in open grasslands along the river or irrigation canal once a week for several hours for physical exercise and grazing to maintain their health and fertility. To maintain physical health and cleanliness, farmers wash their cattle before returning them to the shelter. For environmental and sanitary reasons, farmers remove cattle faeces and urine and forage wastes from the shelter.

There are a number of explanations for the low productivity of smallholder handfed cattle breeding farms.

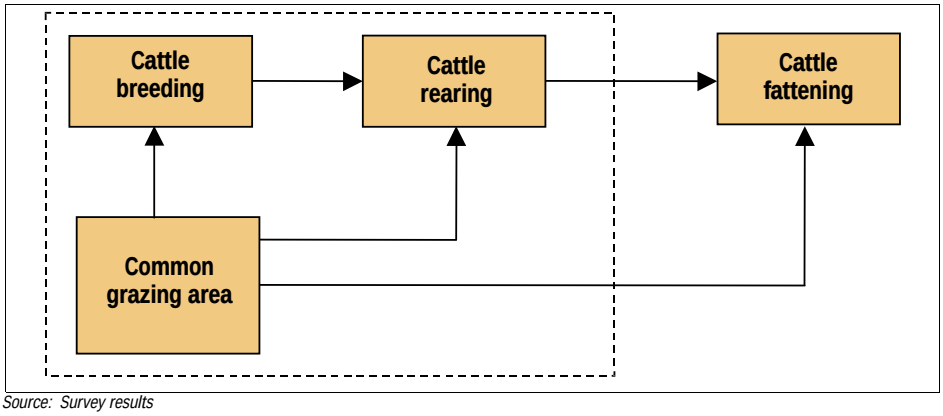
- Forage, especially grass, has become less available because previously uncultivated land is being used for crops.
- With forage scarce and of low quality, and with poor availability of concentrates, cattle are under nutritional stress, particularly during pregnancy and milking.
- The 'cut and carry' feeding system is time-consuming and a major burden for farmers.
- The calving interval under traditional handfed and tethering management is 500 days or more, which indicates the very low productivity of the native breeding activity.
- Conception rates per AI service are low. In some areas AI service provision is inadequate due to insufficient professional inseminators, problems with semen availability and a reluctance and inability of some farmers to monitor when their cows are on heat. AI often fails if the semen is not properly handled before it is used. Payment for AI services based on successful conception instead of service provision (as is currently the case) would encourage more farmers to use AI and encourage the professionalism of AI service providers. Natural breeding is even less popular than AI, as bulls are not easily available.
- Intestinal worms and diseases reduce animal growth rates, and not all farmers make use of drenches and medicines to control animal health problems.
- Farms remain small because of limited access to capital and family labour on smallholder farms.

Breeding farms — grazing

Grazing systems consist of free-range grazing, tethering and herding combined with hand feeding. Breeding farms using free-range grazing are found only in regions of eastern Indonesia with a very large area of natural grass. In some areas, animals are released to graze and scavenge around roadsides, the home yard or village surrounds or fallow lands. This occurs mainly where there is no danger of theft or accident to animals. This system uses very small amounts of labour. The development pattern of a grazing breeding farm is shown in Figure 3.2.

Breeders use this system all year round. During the wet season, when crop cultivation occupies most of the arable lands, animals move to the nearby forest area. Several animals are often kept in the field for working. If no forest is available, farmers provide paddocks where animals can graze and feed is available. This practice is found in many places, such as South Sulawesi, West Nusatenggara and East Nusatenggara.

Figure 3.2. Development pattern of smallholder grazing cattle farm (breeding–rearing–fattening) in low-altitude lands.



Source: Survey results

In the Barru district of South Sulawesi Province and the Sumbawa district of West Nusatenggara Province, the allocation of grazing areas for village breeding farms is very important. The status of land allocated for grazing is set in a letter from the district head. The letter requires that, of the available potential grazing areas, each village has to allocate land for communal grazing. The Sumbawa office of livestock services (OLS) plans to provide fences and animal drinking water to increase cattle production and district income. Where land is plentiful, particularly in Sumbawa, farmers own individual grazing land (in local terms, it is called *lar*).

Cattle ownership per farmer is generally large, depending upon the size of grazing land allocated to the farmer. There are 10 animals on an average holding, but sometimes there may be 50 animals or more. Natural grass is the major component of feed. AI has been introduced, particularly in South Sulawesi, but constraints remain. Vaccinations are sometimes undertaken as routine yearly official services. Nevertheless, cattle quality is low and cattle theft is frequent. Quality bulls for natural insemination and AI services are needed to improve cattle productivity.

Fattening Farms

There are two types of fattening operations — partnership and non-partnership.

Partnership fattening

The development of partnership fattening was closely associated with the development of the feedlot. All cattle allocated to partnership fatteners were imported from Australia. Between 1991 and 1996, the partnership appeared to function well. However, with the

collapse in live cattle imports in 1997, partnership fattening operations contracted sharply. Some feedlots did, however, maintain the partnership with smallholders on social responsibility grounds despite the low ADWG for cattle on smallholder farms and the unprofitable nature of the partnership.

A further factor behind the contraction of the business partnership model has been fraudulent behaviour by some smallholders. For example, smallholders have replaced good cattle with poorer cattle, sold cattle to traders but claimed that the cattle had died, or failed to properly maintain cattle, resulting in very low ADWGs.

Poor maintenance of cattle resulted from farmers not knowing enough about husbandry. Feedlots were not well enough organised to provide sufficient technical assistance or extension workers to smallholders. Only a few farmers have been kept in the feedlot–smallholder partnership; most are those who have close communication with the feedlots.

In some regions, such as Lampung, the business partnership with smallholders remains in place. A venture corporate performs the role of nucleus, with the same distribution of responsibilities in this partnership as in the original feedlot–smallholder model.

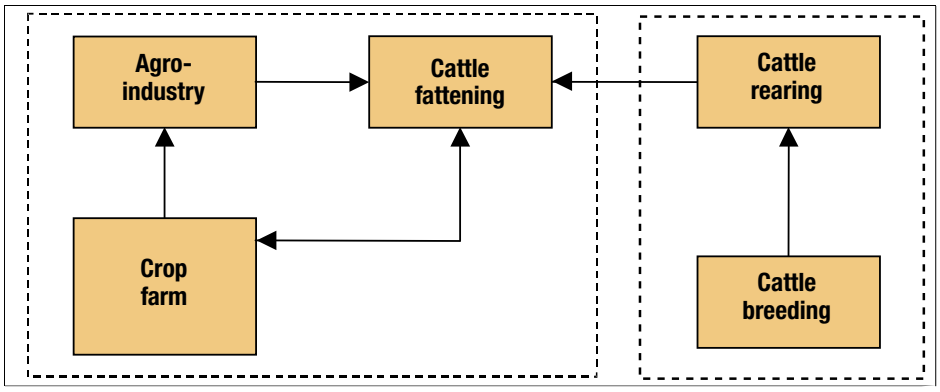
Non-partnership fattening

Fattening farms not included in the NES exist in regions where there is sufficient availability of forage and concentrates. These make up the bulk of smallholder fattening operations. The fattening period varies between 150 and 180 days for native cattle. The more concentrates used for fattening, the shorter the fattening period; the higher the proportion of forage in the ration, the longer the fattening period.

Non-partnership fattening is common in the high-altitude districts of Wonosobo, Salatiga and Magelang in Middle Java Province and Magetan in East Java Province. Fattening of crossbred cattle is also common in lower-altitude districts such as Bantul, Sleman and Gunung Kidul in Yogyakarta Province, and Pasuruan and Nganjuk in East Java Province. In other centres, there are fattening farms, but they use lower-quality forage and feeds.

The development pattern of a cattle fattening farm is shown in Figure 3.3. Feeder cattle come from the smallholder breeder. In low-altitude lands, local crop residue such as rice straw is the major forage; residues from local agricultural industries producing milled rice, cassava starch, tofu, palm oil, cane sugar and pineapple husks are the major concentrates. In high-altitude lands, vegetables, young corn and king grass are the main forage; residues from cassava starch and tofu processing are the main concentrates.

Figure 3.3. Development pattern of smallholder cattle farm: integrated crop farm–agro-industry–cattle farm (fattening) in low- or high-altitude lands.



Source: Survey results

The cattle fattening farm has an intensive system aimed at generating larger profits through maximising ADWG. Farms have 3–200 head, depending on capital availability. All cattle for fattening are male. The major component of feed is concentrate, and because cattle procurement takes place every fattening shift (i.e. the number of days the cattle remain in the feedlot for fattening), the amount of capital as cash required by the fattening farm is much larger than that required by the breeding farm.

In general, farmers know the optimal length of the fattening period, which depends on when cattle achieve their maximum daily weight gains. The initial weight of cattle is about 200–300 kilograms and the final weight is 400–600 kilograms, depending on the genetic potential of feeder cattle and the length of the fattening period.

Corporate Feedlots

Feedlot operations by large companies commenced in 1990 when the government allowed feeder cattle imports from Australia. This policy emerged to:

- encourage a business partnership between a smallholder and large company through adoption of an NES system so as to improve farmers' incomes;
- maintain the existing growth rate of the domestic cattle population; and
- make use of the large area of infertile idle lands.

The main provinces for feedlot development were Lampung, West Java, Middle Java, East Java and Yogyakarta. In Lampung, the feedlot pioneer was the Great Giant Livestock Company (GGLC). This company is part of the larger Great Giant Pineapple Company (GGPC). The two companies are situated close to each other in the district of Middle Lampung. GGLC was established to maximise the overall business performance of GGPC through making use of the waste product of the GGPC's pineapple canning industry called 'pineapple cake' as a quality concentrate for GGLC's cattle.

The other feedlot, which is larger than GGLC, is called PT Santori. This feedlot is situated in Lampung and East Java provinces. PT Santori produces its own feed through mixing various ingredients. The composition changes according to the changes in the market price of feed ingredients and the market price of fattened cattle. But feed quality is maintained to achieve maximum daily weight gain. At the time of observation in March 2001, corn grain was not used as a feed ingredient because its price was too high.

Imported cattle from Australia consist of culled heifers, infertile cows and steers; liveweight ranges from 250 kilograms to 300 kilograms per head.

The average CIF (cost, insurance and freight) price depends on the season. In the dry season, the price is lower than in the wet season. In March 2001, the landed price was US$1.165 per kilogram, which is equivalent to 11,800 Rp. With a handling cost of 400 Rp per kilogram, the total price was 12,200 Rp per kilogram. All risks during transport from Darwin (in Australia) to Panjang seaport (in Lampung) were taken by the Australian exporters. The quarantine cost was 2500 Rp per head. The land transport cost from Panjang seaport to the feedlot was 27,500 Rp per head, including domestic insurance.

Cattle are transported from Australia to Lampung on ships with carrying capacities ranging from 600 to 4000 head. The transport cost from Darwin to Lampung was US$0.01 higher than to Jakarta. The cost of transporting cattle from Lampung to Jakarta is also higher than from West Java to Jakarta. The Lampung feedlots must compete with the West Java feedlots for the Jakarta market. To strengthen the competitiveness of the Lampung feedlots, the local government reduced the marketing tax to Jakarta (the interprovincial selling tax) from 20,000 Rp to 10, 000 Rp per head.

During the worst period of the economic crisis, from mid-1997 to mid-1998, when the rupiah value against the US dollar dropped to around 15,000 Rp, some feedlots ceased to operate because the import price of cattle was too high. To maintain the continuity of feedlot operations and to avoid labour layoffs, some feedlots resorted to using local cattle. As the rupiah appreciated, the feedlots switched back to imported cattle from Australia. Local cattle have the following disadvantages:

- limited and scattered supply, resulting in time-consuming and high transport costs;
- low capacity per shipment, with a high risk;
- very low potential ADWG (0.5–0.8 kilograms);
- the fact that the pricing mechanism in cattle procurement adopts a guessing system (cattle are not weighed) while cattle quality varies considerably;
- a very wide range of bodyweights; and
- potential for infection by parasitic diseases.

On the other hand, the use of imported cattle from Australia provides the following economic advantages:

- large supply of cattle with more uniform weights and much easier collection in a much shorter time;
- large capacity per shipment, with a low risk;
- very high potential ADWG (50–70% of imported cattle have an ADWG of 1.1 kilograms; the rest have an ADWG of 1.2–1.4 kilograms); and
- pricing on a liveweight basis where cattle are weighed.

In 2001, when our survey was undertaken, the business partnership between smallholders and feedlots had been substantially curtailed. GGLC no longer provided cattle to its partner smallholders. And the partnership between PT Santori and its smallholders had been terminated. The stated reasons for this were the low exchange rate and very high price of imported cattle.

Policy Settings for Beef Production

Genetic improvement

In Indonesia, farmers are provided with AI services to improve birth rate and ADWG. The AI stations in Lemburg (West Java) and Singosari (East Java) provide semen of superior bulls.

The AI officers from the OLS provide the service and receive an incentive for each AI application. Farmers are instructed how to accurately recognise the time of heat of their cattle.

In the past, AI services were provided entirely by the government, at no charge to farmers. In recent years the service has also been provided by private inseminators, especially on Java. Semen is purchased from the government AI stations and farmers are charged 25,000–30,000 Rp per application per cow (2001 prices). The role of private inseminators can be expected to increase in the future as the government's capacity to provide AI services declines due to lack of funds.

There are some significant problems with AI.

- Some farmers are not good at observing the period of heat in their cattle and are late in informing the local AI officer.
- In some regions outside Java, AI services are poor because there are not enough AI officers and there are inadequate transport facilities.
- In some cases there is no liquid nitrogen so cold water is used to preserve the semen, greatly reducing the survival time of the semen.

Increasing cattle production

Both the central government and local governments have launched various programs to increase cattle production.

The government provides assistance to farmers with breeder cattle through a revolving system designed to spread cattle to more farmers and reduce costs. The government provides an individual farm household with one breeder cow. Within five years, the farmer must return the first two calves to the government; the farmer keeps the rest (including the breeder cattle and the third calf). The two returned calves are redistributed to other farmers. The programs cover many locations in each province, particularly those with enough forage.

The government provides assistance to farmers with feeder cattle for fattening to increase liveweight. A number of male cattle are provided to farmer groups. Farmers must feed and maintain the cattle. A percentage of net revenue (total gross revenue minus total initial value of feeder cattle) returns to the government, while the rest goes to the farmer group. The initial value of feeder cattle also returns to the government. The programs cover various locations in each province, especially those with enough relatively cheap concentrate and good quality forage.

In Lampung, the government has also launched a transmigration program, with cattle fattening as the major activity. The idea of this program is to provide transmigrants with a number of feeder cattle from the accompanying breeding program. The manure from these feeder cattle and breeder cattle can be processed into organic matter for use with crops such as sugar cane and oil palm.

The government provides farmers with zero interest credit for holding a number of breeder cattle. The credit period is four years, with a grace period of one year. The credit instalment is 50% in year two and 50% in year four, with the value of cattle adjusted for inflation. Every 20 recipients are organised into a farmer group. All cattle are placed and maintained in a collective shelter.

Government programs help improve the quantity and quality of feeds. Concentrates have been developed to meet quality feed requirements for cattle fattening. Quality forages have also been developed, particularly king grass. Techniques to ferment agricultural waste such as rice straw have also been developed. Legume trees and herbs have been widely introduced — for example, gamal and calliandra.

The government has introduced the business partnership between feedlot and smallholder using the NES system described earlier.

The government promotes business partnerships between private financial institutions and small growers. In Lampung, this partnership is between the venture corporate and small growers for cattle fattening. The venture corporate provides a credit package consisting of eight feeder cattle and cash for purchasing feeds, vaccines and other medicines for one farmer household. Farmers are responsible for feeding and maintaining the cattle. The length of the fattening period is specified at 90–100 days. Farmers are free to market their cattle to anyone except the venture corporate. The gross profits (total revenues minus the value of the credit package) are distributed to the credit provider (45%) and the credit recipient (55%). The entire value of the credit package goes back to the credit provider.

The government promotes foreign and domestic investment in fattening activities. Some foreign investors from Australia, Brunei, Darussalam and South Korea have indicated their interest in investing in West Java province.

Despite these initiatives a number of problems remain:

- most small growers lack capital and access to credit;
- cattle stealing can be a problem;
- unstable economic conditions disrupt production and sales; and
- interest in smallholder cattle farming is decreasing with industrialisation and changes in the culture of local communities.

4 Processing

To facilitate and control the slaughtering of cattle, the Indonesian government has provided slaughterhouses in every province. Slaughterhouses are classified according to size: type A (> 100 head per day), type B (50–100 head per day) and type C/D (5–10 head per day). In 2000, there were 5 type A units, 35 type B units and 724 type C units (DGLS 2001).

Type A units exist only in the four big consuming regions on Java, namely Jakarta (one unit), West Java (two units), Middle Java (one unit) and East Java (one unit). They are equipped with modern facilities, including automatic slaughtering and processing machines and cold rooms. The slaughterhouse in Jakarta also delivers beef to wet markets and supermarkets. Type B slaughterhouses occur in 15 provinces, especially on Java Island. Middle Java, West Java and West Nusatenggara have several slaughterhouses of this type. Type C abattoirs are available in all provinces.

There are four types of slaughterhouse, depending on who owns them, as described below.

- Government slaughterhouses are those in which operations are conducted or controlled by the local office of livestock services (OLS).
- Local state company slaughterhouses are owned and managed by local government (formerly government slaughterhouses). Improvements in efficiency have been the underlying reason for the change in the status of such slaughterhouses. Examples of local state company slaughterhouses are RPH Mabar in Medan, RPH Darma Jaya in Jakarta, RPH Semarang and RPH Pegirikan in Surabaya, and RPH Tamangapa in Makassar.
- Personal slaughterhouses, commonly called slaughter places, are mainly owned by meat traders (meat shop or wholesaler). Despite being small, they are formally registered. This type of slaughterhouse has been developed in response to:
  - the need to locate slaughtering close to cattle shelters, the meat trader's house and the market, to avoid stealing of meat by process workers;

  - the need to allow the meat trader to control the time of slaughter so that customer queues can be avoided, with meat availability guaranteed at set times (mainly in the early morning); and
  - the lack of availability of local slaughterhouses.

- Illegal slaughter places are very small and of simple construction. They have no permanent location, which makes it very difficult for the government to control them. Illegal slaughterhouses have developed so that people can avoid paying slaughtering charges and slaughter unhealthy or stolen cattle.

Slaughter Policy

Most animals are slaughtered in government or local state company slaughterhouses. Some slaughtering takes place in personal slaughter places but remains under the control of the local OLS. This is to ensure the safety of products of livestock origin. Under Act No.18, 1998, there is no slaughter charge (there was a slaughter charge of 6000 Rp per head before this Act). Despite this Act, the local government has retained the specified slaughter charge to collect revenue under the regional autonomy arrangement. In West and Middle Java, for instance, the local government has specified a slaughter charge of 10,000 Rp per head.

The slaughter of productive females is prohibited, in order to maintain the birth rate and cattle population growth rate. To implement this policy, the officer of the local OLS must check if there are productive female cattle for slaughter in every slaughterhouse and slaughter place at every slaughter time. In reality, however, the slaughter of productive female cattle has tended to increase. This reflects the increasing scarcity of cattle when imported feeder cattle decline as a consequence of a depreciating rupiah and the need for traders to maintain revenue.

Processing Technology

Processing activities consist of slaughter, skinning, cutting, grading, chilling, freezing and packing. Strict beef grading, chilling, freezing and packing (with labelling) is mainly done by supermarkets and some big meat shops. Only a few slaughterhouses use modern processing technology, involving automated equipment. Most use manual labour. Small beef retailers in wet markets or small meat shops freeze their unsold beef. Most buyers, particularly meatball processors, prefer fresh to chilled or frozen beef.

Beef traders are the users of cattle slaughterhouses, either government or personally owned. Smallholder cattle producers, by contrast, always sell their product as live cattle.

Before the economic crisis, the Great Giant Livestock Company (GGLC) in Lampung slaughtered and processed cattle using the Dharma Jaya slaughterhouse and processing facility located in Cakung (eastern Jakarta). The processed beef was packed in cuts, branded as Bonanza and sold to the Jakarta markets. However, during the fieldwork period (March 2001), GGLC and other feedlots in Lampung had shifted to the sale of live cattle for slaughter. Selling live cattle to Jakarta is more profitable and less risky.

Processed Products

The products of cattle may be categorised into meat, by-product and waste product. Meat may be graded on the basis of quality as superior, first, second or third grade.

Higher-quality meat yields a higher price. In terms of total value, however, first-grade meat is the most important product.

By-products consist of skin, head, tail, legs, bones and edible offal (e.g. liver). Beef wholesalers make most of their profits from these by-products. Profits from meat sales are generally very small. In most cases, there are regular customers for each type of by-product.

Waste products consist of faeces and urine. In general, the quantity of these waste products is small as cattle are not fed before slaughter. However, in every slaughterhouse, waste products are collected and treated so that they do not pollute the environment. This is important because most slaughterhouses are located near or within populated areas.

Some Processing Problems

The processing sector has a number of problems. First, the condition of most slaughterhouses, particularly those of type C, is unsatisfactory. Most were built during the Dutch colonial period and not enough has been spent on maintaining them in good working condition.

Second, since the economic crisis there has been a significant drop in the number of cattle being slaughtered, in all regions. This has meant declining revenues from slaughtering, which is a key reason for the rundown in maintenance. In addition, a large part of the revenue collected as taxes on cattle slaughtering in government slaughterhouses goes to the local government revenue account. This discourages the proper provision and maintenance of slaughtering facilities.

Third, productive female cattle are still being slaughtered, even through government slaughterhouses. This is especially the case for native cattle (*peranakan ongole*). In Boyolali and Salatiga districts (Middle Java) the number of slaughtered productive females has increased. In Magelang and Surakarta districts (also Middle Java), female cattle were also slaughtered, but slaughtering of such animals was restricted to those that had been

unproductive, sick or injured by accident. This reflects the tight control over slaughtering by the local OLS. However, the slaughtering of productive domestic females and young domestic males has been the general rule in Indonesia, particularly in production centres outside Java. To avoid the slaughter of productive females, the local OLS in Middle Java introduced a female cattle purchasing program. The scheme was ineffective because the cattle traders increased the price above the prevailing market price.

Fourth, our surveys revealed evidence of traders buying productive cows whenever farmers needed money. The purchased cows were then kept by the same or different farmers under a *gaduhan* system in order to share in the production of offspring and weight gain. These traders also operated as wholesalers or cattle fatteners or as a nucleus in production sharing partnerships with breeders and fatteners. In south Sulawesi, the trader prepared his farm as a centre for training farmers.

The entry of 'wet beef' into the markets is also a problem. 'Wet beef' is beef from cattle forced to drink a lot of water before slaughter so as to increase bodyweight. This practice can reduce the beef selling price by 1000–3000 Rp per kilogram and can lower the price competitiveness of normal beef.

Finally, the entry of beef from illegal slaughtering into the market can reduce the price competitiveness of beef from legal slaughtering.

5 Trade and Marketing Profiles

Government Policies and Services

The major imported beef products are feeder cattle and meat. The related import policies consist of tariffs, value-added taxes and health-based import restrictions. Each of these policies is described below.

Tariff policy

Tariffs are imposed on live cattle and beef imports. There are two categories of imported live cattle: purebred breeding animals and feeder cattle. Breeder cattle are imported in order to strengthen the genetic base of domestic and indigenous cattle through breeding and related research programs. The number of imported breeder cattle is very small, so tariffs and value-added taxes have never been imposed on them.

By contrast, the volume of feeder cattle imports for commercial operations is large. Until 1989, imports of feeder cattle were not permitted. The objective was to protect the domestic beef industry in order to maintain smallholder incomes and employment. However, the government removed the import restriction in response to the decrease in the numbers of domestic cattle, due to increasing demand for beef.

In 1990, the government imposed a tariff on imported feeder cattle. In the spirit of trade liberalisation under the General Agreement on Tariffs and Trade and World Trade Organization arrangements, the government reduced the tariff on imported feeder cattle in recent years, first to 5% and finally to zero. The primary objective of this feeder cattle import policy is to promote beef production to meet the increasing demand for beef. A secondary objective is to improve smallholder incomes through mutually beneficial business partnerships between feedlots and smallholders. This policy has encouraged the establishment of feedlots supported by the import of live cattle.

As noted earlier, the nucleus estate and smallholder (NES) system worked very well until 1996. Since mid-1997, and particularly since 1998, when the economic crisis occurred, the quantity of feeder cattle imports dropped sharply. The major feedlots collapsed and the business partnership between the feedlot and smallholder automatically ceased. Since 1999, live cattle imports have been increasing, though feedlot operations have not yet fully recovered.

The exchange rate has been the most crucial factor in determining the import quantity of live cattle (and also beef). A strengthened, stabilised rupiah will promote feeder cattle imports and help avoid depletion of domestic cattle.

Higher tariffs were imposed on the import of boxed beef than on feeder cattle. In 1997, the tariff was 20–25%. The higher tariff on boxed beef was designed to reflect that beef imports have smaller links with other sectors of the economy than is the case with imported feeder cattle. In 1998, the tariff on imported boxed beef was reduced to 5%.

Value-added tax policy

In order to increase revenue, the government has imposed a value-added tax of 10% on the import of both feeder cattle and boxed beef. This tax adds to feedlot costs and the cost of importing beef, leading to higher consumer prices.

Health-based import restriction policy

To avoid the import of infectious animal diseases such as foot-and-mouth disease, anthrax and bovine spongiform encephalopathy (BSE), the government restricts the import of beef from countries where these diseases are present. To support the effectiveness of this policy, imported beef and live cattle are carefully examined at the port of entry.

Domestic Marketing

Inter-regional trade restriction policy

Before the economic crisis of 1998, the Directorate General of Livestock Services (DGLS) specified the number of cattle to be sent from each province to another for slaughter. The minimum liveweight of cattle allowed to be sent out or slaughtered was 400 kilograms per head. This policy was designed to avoid domestic cattle depletion through excessive slaughter.

The inter-regional trade policy has changed in recent years. In principle, each province is now free to send out cattle without the authority being needed. But examination of cattle weight at some entry–exit points and in slaughterhouses remains necessary. Many cattle weighing 150–200 kilograms were slaughtered or sent out to Jakarta or West Java for slaughter despite the minimum weight restriction of 400 kilograms. This implies that more cattle are required to achieve the total weight of beef to be sold. This will accelerate the depletion of the domestic cattle population.

Some local governments have been attempting to decelerate or avoid cattle depletion through two main marketing strategies. First, the local government may buy the cattle not yet ready for slaughter (those weighing 150–200 kilograms) out of the provincial

government budget. This has occurred in Middle Java Province since 1998–99. The cattle are redistributed to farmers for re-fattening under a production-sharing system. This program is continuing. Second, the government may restrict trade in cattle weighing less than a certain amount. This has occurred in Sumbang and West Nusatenggara (cattle less than 250 kilograms) and in Bali (cattle less than 375 kilograms).

Marketing Quota

Since 1998, the DGLS has no longer specified the number of cattle to be sent out from each province for slaughter. Lampung and all provinces on Java have allowed unrestricted cattle trading. Bali, West Nusatenggara and South Sulawesi continue to restrict the number of cattle traded to other provinces, to avoid cattle depletion. However, the policy is ineffective, and it may even impede regional development if it is not combined with successful measures to increase cattle breeding productivity.

Marketing tax and retribution policy

The spirit of trade liberalisation requires the elimination of taxes and retribution charges on trade. This policy was the product of an agreement between Indonesia and the International Monetary Fund (IMF) under the 'Letter of Intent' (LoI). According to Presidential Decree No. 2/1998, based on the LoI, all the tax and retribution previously imposed on interprovincial and interdistrict cattle trade must be eliminated.

However, the spirit of regional autonomy has reversed this policy to one of maximising tax and retribution collection so as to increase local government revenues for regional development. As a result, taxes on trade are increasing. Examples are charges levied on cattle-weighing scales and on the examination of animal health in cattle marketplaces, and taxes on interprovincial or interdistrict cattle delivery. This policy increases marketing costs, discourages interprovincial trade of young cattle and reduces profits to traders.

Close coordination is needed between local governments within the same province to avoid double taxation and retribution impositions on the same cattle. The varying rates of tax and retribution across provinces need to be made uniform.

Product marketing policy

Recently, the government has removed the restriction on beef from other provinces entering the large Jakarta market. This has led to the construction of modern and large-scale slaughter facilities in 10 beef-producing provinces — Aceh, Lampung, East Java, West Nusatenggara, South Kalimantan, West Kalimantan, South Sulawesi, Southeast Sulawesi, North Sulawesi and Papua (formally Irian Jaya). Even in West Java, a type A slaughter facility will be established.

Removal of this restriction has advantages as well as disadvantages. Some advantages are:

- the creation of more value adding in producing regions;
- reductions in transportation costs;
- reduced marketing taxes and charges; and
- avoidance of environmental pollution in the densely populated Jakarta region.

The disadvantage of the policy is that it will cause under-use of slaughterhouse capacity in Jakarta. This will reduce revenues from slaughter fees, reduce employment in Jakarta slaughterhouses and encourage slaughterhouse management to diversify business activity. In the case of the large and modern slaughterhouse owned by the local government corporate (the Dharma Jaya Slaughter House) located in Cakung (eastern Jakarta) the substantial increase in the amount of beef from West and Middle Java entering the Jakarta market has caused a vast decline in slaughtered cattle numbers. This has forced the Dharma Jaya Slaughter House management to establish new business activities, including a profit-oriented cattle–beef marketing arrangement, while maintaining the existing service provision (for example, slaughtering, processing, cold storage and transportation). This strategy is aimed at achieving higher overall efficiency of the business operation of the slaughterhouse.

Cattle Transport Services

Trucking

In Indonesia, trucks are commonly used for transporting live cattle, including inter-island transport if ferry connections are available. Examples are transport from Java to Sumatra through the Merak–Bakaheuim ferry connection and from Bali to Java through the Gilimanuk–Ketapang ferry connection). Trucking services are provided by private operators. To date, freight charges have not been excessive, due to the ability to carry return cargo.

Railway wagons

Railway wagons are used for transporting large numbers of cattle, particularly from Surabaya (East Java) to Jakarta, where cattle are taken by ship from eastern Indonesia. This facility is provided by the state-owned company called PT Kereta Api Indonesia ('Railway State Company'). Rail transport costs are much lower than truck costs — 30,795 Rp and 56, 250 Rp per head, respectively, in 2001. A lack of return rail cargo between Surabaya and Jakarta has recently caused some problems. Previously, the railway wagon transported steel from Cilegon (about 70 kilometres from Jakarta to the west) and transported cattle from Surabaya to Jakarta, so the service was sufficiently efficient. Steel is no longer

transported from Cilegon to Surabaya, because it was seriously damaging the walls and roofs of the railway wagons, which could not then be used for transporting other goods. As a consequence, the railway state company can now charge only for cattle transportation from Surabaya to Jakarta, which makes the service very inefficient. As a result, the number of cattle transported by rail between Cilegon and Surabaya fell from 5479 head in 1997 to 2764 head in 2000. To increase rail transport efficiency, cattle transport charges need to be raised. But they still need to be lower than trucking charges. Unless this can be achieved it does not make sense to modify railway wagons to transport cattle.

Domestic shipping

Sea transport is used to ship cattle from one island to another, particularly from eastern Indonesian provinces such as Bali, West and East Nusatenggara and South Sulawesi to Java. To a lesser extent, sea transport is also used to move cattle from Sulawesi to Kalimantan. Most sea transport from eastern Indonesia to Java arrives through the interconnecting seaport of Kali Mas in Surabaya (East Java). The cattle are then transported to other destinations on Java, such as Jakarta, using trucks and railway wagons. Before despatch, the landed cattle in Kali Mas seaport are kept in high-capacity shelters located near the seaport and railway station. The sea transportation service is privately owned.

There are two main problems in shipping cattle. First, ships are not specifically designed for shipping cattle; they are designed for other agricultural products, with cattle regarded as return cargo. Such ships have limited space, so cattle do not have enough food and drinking water. As a result, cattle become stressed, resulting in substantial weight loss. For example, when cattle were shipped from the quarantine examination premises in Mataram (West Nusatanggara) to Jakarta, there was a weight loss of 11–12%. Second, ships have limited capacity and no regular schedule. This makes the per unit shipping cost (per head or per kilogram liveweight) high and makes it time-consuming to gather large numbers of cattle. Inefficient cattle procurement from eastern Indonesia has been one of the factors discouraging feedlots from using domestic cattle in their business operations.

International shipping

Only overseas shipping companies have carried cattle from Australia to Indonesia. Such ships are specifically designed for live cattle, to meet the Australian standard, and are large enough to carry cattle. Cattle stress during shipment can be minimised and cattle procurement becomes very efficient. The shipping time is about one week. To date, Indonesian companies have not shipped cattle from Australia because Indonesian ships do not meet Australian standards.

In recent years, the ordering of shipping has become more difficult, increasing the cattle procurement time by up to one month. One reason is that, since the economic crisis, Australia has diversified its live cattle shipments to include Middle East countries and is using more ships to transport cattle to these countries.

Animal quarantine service

The local government in particular provinces provides quarantine services for animal health examination before cattle enter its territory. For live cattle imports, quarantine stations are available at international seaports where cattle disembark — Panjang in Lampung, Tanjung Priok in Jakarta, Cilacap in Middle Java and Surabaya in East Java. For domestic cattle, quarantine stations are available in many provinces, particularly those connected with other provinces by sea transport networks, such as Riau, South Sumatra, Lampung, West Nusatenggara, East Nusatenggara, West Kalimantan, South Kalimantan, East Kalimantan, North Sulawesi, South Sulawesi and Papua.

The main objective of quarantine is to prevent the introduction of infectious animal diseases from abroad and to avoid the spread of infectious animal diseases from one island to another. Java and Bali are well known as sources of anthrax and jembrana, respectively. Examination of cattle shipped from these areas is critical.

Quarantine procedures involve the examination of shipping documents and cattle. Charges are as follows: 100 Rp per head for the quarantine service, 125 Rp per head for the examination service and 500 Rp per truck (containing 9–15 cattle) for certification. Feedlots pay the charges to the local quarantine office and also meet costs such as transport and meals for quarantine officers, vaccines and medicines.

There are four main problems in the organisation of international and domestic quarantine facilities, and in service charges. The first relates to the organisation of quarantine services. At present, the local quarantine office undertakes the central office's mandates. But the local government wants the local quarantine office to be under local government control. In June 2000, the local government issued a local regulation about quarantine service charges for livestock, fish and plants. In December 2000, this regulation was implemented on a trial basis. However, it was decided that the quarantine office would continue to implement the central office's policies. Presidential Decree No. 66 of 23 November 2000 established the Agency for National Quarantine (ANQ) of Echelon I under the Coordinating Ministry of Economy, though the structure of the quarantine station has not yet been decided. The new national organisational structure is considered reasonably applicable because quarantine procedures must be in accordance with international rules, not local rules. In addition, ANQ at Echelon I would be able to undertake intersectoral quarantine coordination involving animals and plants. These new arrangements are proving effective.

The second problem relates to the capacity of the international quarantine service. With a maximum capacity of 1500 head, the cattle shelter available for quarantine in the Panjang international seaport is not big enough. However, in each delivery for four feedlots in Lampung, a total of about 9000 head of cattle are landed per month. As a result, all the landed cattle must be delivered directly to the respective feedlot for quarantine examination. This increases the risk that infectious diseases will be introduced. There has been no disease incidence to date, but the local livestock office is concerned that the situation could provide an opportunity for quarantine procedures to be violated. The quarantine period is about 14 days for each delivery of imported cattle.

The third concern relates to the domestic quarantine service. The quarantine station located in the Bakaheuni ferry connection does not operate yet. Meanwhile, quarantine activity at this location is of crucial importance to prevent the spread of infectious diseases, particularly from Java to Sumatra (including Lampung), because many infectious livestock diseases are found on Java. The Minister of Telecommunication and the Governor of Lampung have given permission for the quarantine station to be constructed. But the Directorate of Land, River and Ferry Transportation has said that it must be outside the area of the port of Bakaheuni, to avoid congestion with embarking and disembarking vehicles. It will be hard to find a suitable location, because the area is very steep. A field survey has been carried out, but construction has not begun because of lack of finances at ANQ (central office).

The final concern relates to the quarantine service charge. This charge, first specified in 1990, is too small to support the optimal operation of quarantine stations. In addition, 20% of the quarantine station's revenues must be returned to a supplementary fund in the following year. The annual amount available to operate quarantine services is simply too small.

Domestic Marketing

Beef market and consumer preferences

The market for beef in Indonesia is large and increasing. As indicated earlier, beef production has been increasing at the same time as the domestic cattle herd has decreased, particularly since 1998. The high demand for beef is raising domestic prices sufficiently to encourage farmers to slaughter their breeder cattle.

In seven sample provinces (Lampung, West Java, Middle Java, Yogyakarta, East Java, South Sulawesi and West Nusatenggara) most beef consumers preferred beef from native cattle to beef from imported cattle (brahman cross) or imported boxed beef. The preference is based on the fact that local beef has a harder carcass with a lower fat content and is more suitable for meatballs and beef curry, the demand for which is especially strong in Lampung and

Java. Peddlers of meatball soup (often mixed with noodles) are major buyers of local beef. Only a small proportion of beef consumers, particularly supermarket shoppers, are indifferent to whether the beef is from local cattle or imported beef.

The demand for beef from imported cattle or imported beef is tending to increase, especially in hotel, restaurant and supermarket outlets. The main reasons are the declining availability of domestic cattle, the tenderness of beef from imported cattle or imported beef, and the growing number of consumers who do not care about the source of their beef.

The market for beef will increase steadily in the future as per capita income and population increase.

Marketing of Live Cattle

Native beef cattle

Spatial flow

The most reliable sources of beef cattle are East Java, Middle Java, Yogyakarta and Lampung provinces. Other important sources are South Sulawesi, West Nusatenggara and East Nusatenggara (see earlier). Most beef is consumed in Jakarta and West Java.

Most cattle movements are from producing to consuming regions. Cattle also move between subdistricts, between districts, between provinces and between islands. Cattle are transported from eastern Indonesia to Jakarta and West Java by sea to Surabaya seaport interconnection and then by land (truck or railway wagon) to Jakarta and West Java.

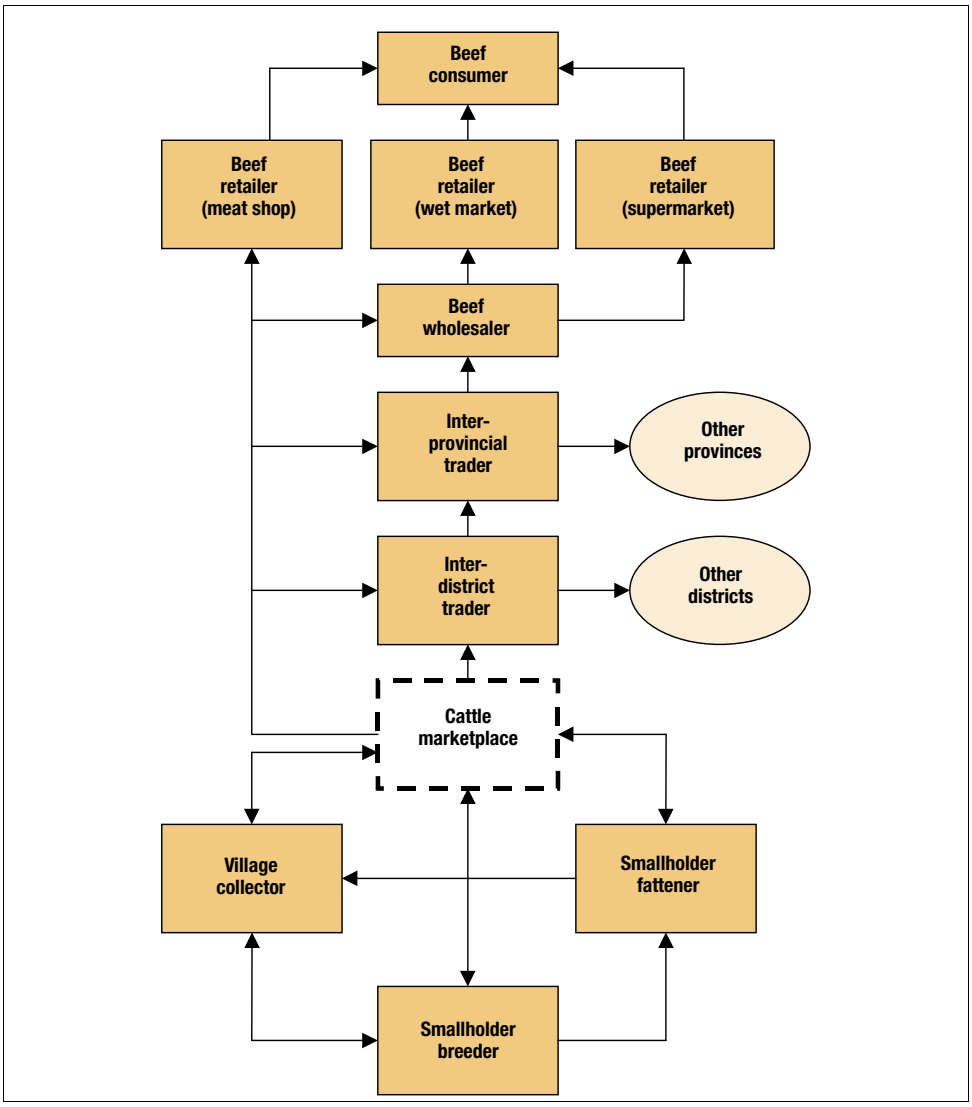
Marketing channels

Several categories of people are involved in the marketing of live domestic cattle. The first is the smallholder. Domestic and indigenous beef cattle are provided only by smallholder breeding farms. One of the main objectives of small breeders is to own productive assets as a form of savings and as draught animals that can be easily converted into cash when needed. They sell cattle when they need cash for major outlays such as wedding ceremonies, school fees and crop farming.

The next step in the chain is the cattle fatteners and cattle traders. Cattle traders may be classified into village traders, interdistrict traders and interprovincial (or inter-island) traders. Figure 5.1 shows these categories for Java, where there are cattle marketplaces (*Pasar Hewan*); Figure 5.2 shows them for other parts of Indonesia, very few of which have cattle marketplaces.

The last step in the chain of live domestic cattle marketing is the beef wholesaler.

Figure 5.1. Major marketing channel for domestic live cattle and beef on Java, 2001.

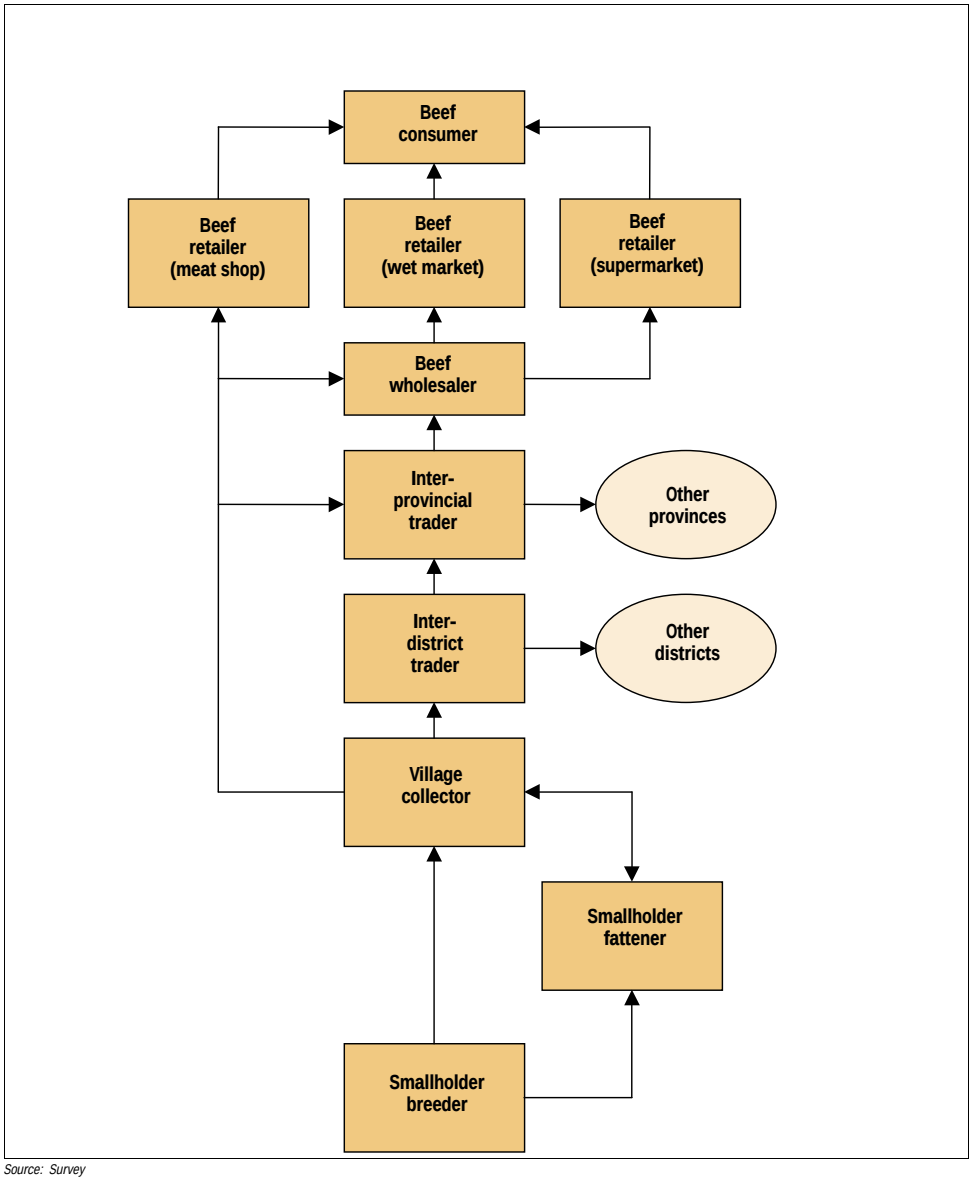


Source: Survey

The role of the cattle marketplace

In West Java, each cattle marketplace (CMP) opens once every seven days. In East Java, Middle Java and Yogyakarta, each CMP opens once every five days, according to the so-called 'market day' of cattle (*hari pasar*). The popular 'market days' are *Pon, Kliwon, Legi* and *Wage*, in combination with the seven-day names of the national calendar, but CMPs do not

Figure 5.2. Major marketing channel for domestic live cattle and beef outside Java, 2001.



Source: Survey

operate on the same days. For example, in district A, the market day is *Pon* while in district B it is *Kliwon*. Having different market days facilitates the flow of cattle from one CMP to another every 2–5 days.

There is at least one CMP in every cattle-producing district or subdistrict. Cattle from smallholders are mostly sold to a village collector (called *Blantik*), who then markets the cattle in the local CMP. Most cattle buyers in the CMP are larger traders such as interdistrict or interprovincial traders. Small breeders or fatteners also procure cattle in the local CMP. Cattle are moved from one CMP to another when sellers think they are not getting enough for cattle in the previous CMP.

The pricing system

The price of live cattle is determined by their physical condition (with weight measured by a guess from the buyer rather than by scales); sex (male cattle are slightly dearer than female cattle) and breed (the superior crossbred simmental, charolais and brahman cross are dearer than the local or indigenous breeds such as ongole, bali and madura).

No auction pricing system has been adopted in the CMP. This may be because the number of cattle per seller is very small, despite the large number of cattle marketed in the CMP. Individual sellers and buyers bargain until a price is agreed. Sometimes, one or more brokers are involved in the bargaining process. The price of feeder and breeder cattle is higher than the price of cattle for slaughter.

Imported cattle for the feedlot

Almost all cattle fattened in feedlots are imported from northern Australia. A small number of these cattle are distributed to partnership fatteners under the NES. After the end of a fattening period, all the partnership fattened cattle are marketed to the feedlot, which then sells both feedlot cattle and partnership cattle to cattle or beef traders (see Fig. 5.3).

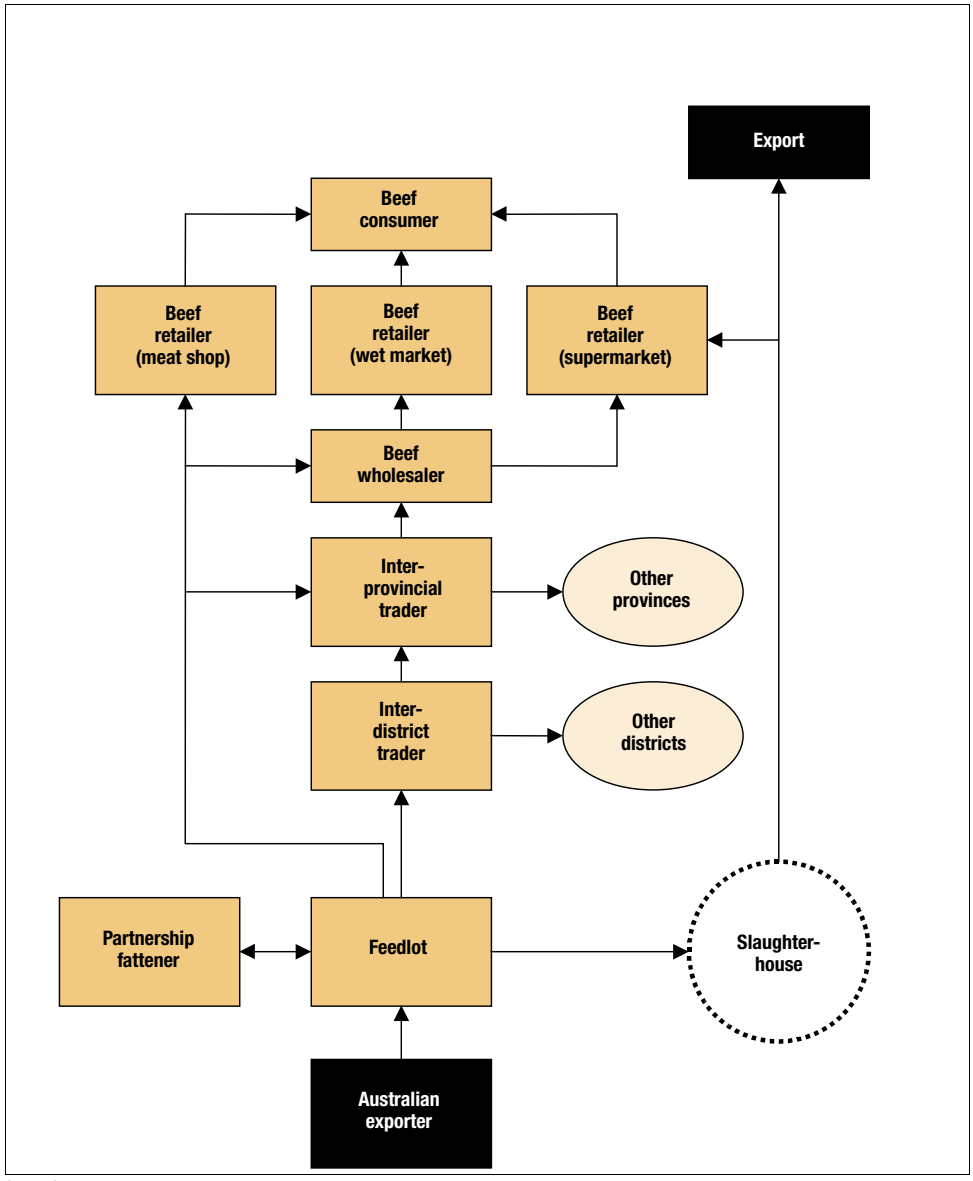
Lampung Province has the greatest potential for developing feedlots in Indonesia. Fourteen feedlot companies operated in this province in 1991, but, following the economic crisis, only four survived in 2001. Two of these were selected for this study: PT Santori and PT GGLC.

PT Santori markets its cattle in Lampung (10%) and other regions such as Jambi, Riau and North Sumatra (20%) and Jakarta, Bogor, Tangerang and Bekasi (50%). The remaining 20% are slaughtered in Santori's own abattoir in Cibitung (Bekasi). Boxed beef from this abattoir is sold to the Jakarta market and also exported to Malaysia.

Beef Marketing

Domestic beef is marketed through beef wholesalers (*Jagal*). The wholesalers sell the beef to retailers at wet markets, supermarkets, and meat shops. Importing is usually done by supermarkets or other importers.

Figure 5.3. Major marketing channel for imported live cattle and derived beef, 2001.



Source: Survey

Wet markets

There are wet markets in all provincial, district and subdistrict capital cities. Wet markets are largest in the larger cities. Two levels of beef trader (large and small) operate in wet markets. A large retailer sells directly to customers and to small retailers. On average, large

retailers sell 2–3 head per day on normal days, while small retailers sell less than one head per day. The amount of beef sold in wet markets increases considerably during big holidays such as Idul Fitri, Idul Adha, Christmas and New Year.

Large retailers usually purchase cattle from permanent suppliers. After slaughter and processing in the slaughterhouse, beef and by-products are delivered to their respective selling stands in the wet market building.

Sixty per cent of beef customers in wet markets are household consumers and 30% are meatball soup peddlers. This is especially the case in Lampung, and in all Javanese provinces, where meatballs are a very popular fast food. About 10% of customers are restaurants and supermarkets.

Supermarkets

Most provincial capital cities and some district capital towns have supermarkets, but not all sell beef. Most buyers are households (65%); the others are restaurants (25%) and catering firms (10%). Some consumers prefer supermarkets to wet markets because they sell meat that is more tender, leaner and more hygienic; they are a more convenient shopping venue; the weight of beef purchased is indicated exactly on the label; the price is only slightly higher; and the meat is packed to a size to suit the consumer.

The amount of beef sold in supermarkets varies according to the level of specialisation, location and display attractiveness. The average weekly amount of beef sold by individual supermarkets in provincial capital cities varies from 35 kilograms to 500 kilograms, depending on the size of the city and the location of the supermarket. Beef is sourced from domestic cattle, imported cattle and imports in varying proportions, with domestic cattle remaining the major source. As with wet markets, the amount of beef sold by supermarkets increases considerably during the big holidays such as Idul Fitri, Idul Adha and Christmas. The rate of increase may be 25–300%, depending on the location of the supermarket. Over the last five years, the amount of beef sold by supermarkets has declined by 25–80%, mainly due to increased beef prices and reduced consumer purchasing power as a result of the economic crisis.

Meat shops

There are meat shops in most provincial capital cities and some district capital cities, though in limited numbers. The share of beef sold through meat shops is very small, with only 1–3 head of cattle sold per day per meat shop on normal days. Households are the main customers.

The existence of meat shops reflects the demand by customers for quality domestic beef. Customers buy beef from a meat shop because they can buy native cattle (particularly PO); because they can select the quality and freshness of beef; because the price is not significantly higher than in wet markets, but is still lower than in supermarkets; because they can buy beef at any time during the working day (whereas wet markets operate only until 10 a.m.); and because they are near their home.

As for wet markets and supermarkets, the amount of beef sold by meat shops increases considerably on big holidays. The rate of increase ranges from 50% to 400%, depending on the situation in each province. Since 1998, it has been increasingly difficult for meat shops to procure cattle as native cattle have become more scarce.

Marketing Problems

There are four main problems in marketing live cattle. First, inter-regional cattle transport is expensive, especially between islands. To reduce transport costs, traders make use of back loads where possible. Feedlots such as PT Santori sell cattle at the feedlot to avoid transport costs.

Second, before the economic crisis, people could purchase imported cattle from Australian exporters on credit. Credit payments are no longer possible: 90% of the total value of imported cattle must be paid in cash, with the remaining 10% paid two weeks later. This makes it difficult for feedlots to finance cattle imports.

Third, since regional autonomy in 2000, all local governments impose taxes and levies on cattle which pass through their territory. This reduces the competitiveness of domestically produced beef relative to imported beef.

Finally, many farmers must sell their cattle to a village collector rather than to a CMP because they lack access to a CMP.

6 The Indonesia Beef Model

The Indonesia beef model provides a comprehensive picture of the entire cattle beef value chain from production on smallholder farms and commercial feedlots using native and imported cattle through slaughtering (processing) to sales in wet markets, supermarkets and meat shops. It includes a treatment of the demands for imports of live cattle and also beef and prospects for exporting beef. Key features of the model are:

- its commodity and industry detail, which gives it the capacity to trace how events and policies impacting at any point in the cattle beef value chain affect the performance of all other parts of the chain and the Indonesian beef industry as a whole; and
- its flexibility as a tool for analysing a large range of policy issues and changes facing the Indonesian beef industry.

The types of changes that the model can be used to analyse include:

- changes in taxes, charges and tariffs;
- macroeconomic developments (changes in the exchange rate, gross domestic product growth rate etc.);
- industry-specific changes (changes in productivity and the efficiency of use of key inputs); and
- overseas developments such as changes in world beef prices and the price of live cattle from Australia.

The model has a short-term to medium-term perspective. The industry and its value chain are assumed to be a small part of the Indonesian economy and the world market for live cattle and meat.

Components of the Model

The model contains four key components:

- a set of input–output accounts that incorporate the cattle–beef value chain in Indonesia and the costs and sales links between components (these costs and sales links in turn provide a number of coefficients for the model);
- a set of behavioural equations explaining how each component of the input–output accounts (industry production, commodity prices, commodity sales, etc.) changes as a result of changes in the policy and general economic environment in which the Indonesian beef cattle industry operates;
- a set of model parameters and coefficients that together specify the responsiveness of key model variables to changes in the policy and general economic environment; and
- model closure options that specify the variables that are to be explained by the equations of the model (endogenous variables) and those for which the user must assign values (exogenous variables). Values for endogenous variables (model projections) reflect the outcomes of changes in policy and other aspects of the operating environment incorporated through appropriate choices and values being assigned to the exogenous variables.

The Model's Input–Output Database

The model contains a database describing the cattle–beef value chain and the links between cattle industries, processing activities and demands for products in the base period (2001). The database is expressed in terms of prices, value and quantities. The model uses this information to compute cost and sales shares, which combine with parameter values to form coefficients in the equations system.

The model's input–output database is described in Tables 6.1, 6.2 and 6.3.

Each of the flows in the figures represents expenditure (price multiplied by quantity) in the base year. For example, the entry '*pc*' in Table 6.1 represents expenditure on feed by the feedlot sector.

Inputs by industry

Table 6.1 incorporates three industries engaged in beef cattle production and four categories of final demands for beef. The first two columns describe inputs for smallholder breeding activities and for non-partnership smallholder fattening. Non-partnership fattening activities involve the fattening of native feeder cattle bred by smallholders to produce native fattened cattle.

Table 6.1. Inputs to beef cattle production and final demands.

		Smallholder		Feedlot and partnership fatteners	Final demands				Total sales (row sum)
		Breeder	Non-partnership fattener		Wet markets	Super-markets	Meat shops	Export	
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
Native feeder cattle	*i*		✔	✔					
Native fattened cattle	*j*				✔	✔	✔	✔	
Lot fed cattle	*k*				✔	✔	✔	✔	
Imported feeder cattle	*l*			✔					
Imported beef	*m*				✔	✔			
Processing margins	*n*				✔	✔	✔	✔	
Transport and trader margins	*o*		✔	✔	✔	✔	✔	✔	
Feed	*p*		✔	✔					
Other costs and taxes on inputs	*q*	✔	✔	✔					
Labour	*r*	✔	✔	✔					
Returns to land and capital	*s*	✔	✔	✔					
Total costs (value of production) (Column sum)	*t*	✔	✔	✔					

Table 6.2. Commodities produced by each industry.

		Smallholder		Feedlots partnership fattener	Total commodity value of production
		Breeder	Non partnership fattener		
		a	*b*	*c*	*d*
Native feeder cattle	*e*	✔			
Native fattened cattle	*f*		✔	✔	
Fattened cattle from live imports	*g*			✔	
Total industry (value of production)	j	✔	✔	✔	

The third column represents the feedlot sector. This sector includes commercial feedlots that purchase native feeder cattle from smallholder breeders and imported feeder cattle (from Australia) together with feed and other inputs, to produce fattened cattle. It also includes a smallholder partnership fattening activity that involves the fattening of native feeder cattle obtained from smallholder breeders and of imported feeder cattle obtained by partnership

Table 6.3. Model sets and dimensions.

Models	Sets	Dimensions
Commodities	set com # all commodities #	nfeec (native feeder cattle), nfatc (native fattened cattle), lot fed (fattened cattle from native and imported feeder cattle), ifeec (imported feeder cattle), imbeef (imported beef)
Industries	set ind # all industries #	shbreed (smallholder breeder), shfat (smallholder non-partnership fattener), feedlots (commercial and smallholder partnership feedlots)
Primary factors	set factors # primary factors #	labour,fixed
Other inputs	set othinputs # other inputs #	feed (feed),other (other input costs)
Commodities produced in Indonesia	set farmcom # farm commodities #	nfeec (native feeder cattle), nfatc (native fattened cattle), lot fed (fattened cattle from native and imported feeder cattle)
Feeder cattle	set feeders # feeder cattle # (feeders a subset of farming)	nfeec (native feeder cattle), ifeec (imported feeder cattle)
Types of beef consumed	set beef # meats in consumption # (beef a subset of com)	nfatc (native fattened cattle), lotfed (fattened cattle from native and imported feeder cattle), imbeef (imported beef)
Types of beef produced in Indonesia	set beefex # beef exports #	nfatc (native fattened cattle), lotfed (fattened cattle from native and imported feeder cattle)
Imports commodities	set imports # imported commodities # (imports a subset of com)	ifeec (imported feeder cattle), imbeef (imported beef)
Retail commodities	set retail # retail commodities #	beef (beef), othermeats (other competing meats)
Outlets	set outlet # distribution mechanisms # mshops (meat shops)	wmkts (wet markets), smkts (supermarkets),

smallholders from the feedlot. There are two types of partnership fattening arrangements. Under one arrangement, the farmer gets only feed from the feedlot; under the other, the farmer gets both feed and cattle from the feedlot. In both cases, the fattened animals are purchased back by the feedlot. The smallholder partnership fattening activity is very small in value terms.

The next three columns in Table 6.1 represent purchases by consumers of beef in wet markets, supermarkets and meat shops. From these outlets, consumers can purchase beef produced in Indonesia from lot-fed cattle and from native cattle; they can also purchase imported beef. The final column in the table covers exports of beef from both imported and native cattle.

The rows in Table 6.1 contain the inputs to production for each of the three beef cattle industries. The first column (smallholder production of native feeder cattle) contains entries for labour, other costs (including taxes on inputs) and profits (returns to land and capital employed by the smallholder breeder). The total of all entries represents the value of production of native breeder cattle at the farm gate.

The column dealing with smallholder non-partnership fattening activity includes purchases of native feeder cattle (from the smallholder breeder industry) and feed. Both the smallholder partnership fatteners and the commercial feedlots purchase native feeder cattle and imported feeder cattle together with feed to produce fattened cattle. This column also includes transport and trader margins, explained below.

Table 6.1 contains two categories of margins — a processing margin and a transport and trader margin. The processing margin represents the activity of slaughtering cattle to produce beef. This is currently undertaken in slaughtering facilities. As noted earlier, cattle are slaughtered in three types of facilities.

- Government-owned slaughterhouses. These slaughter the bulk of the cattle. The larger ones contain sophisticated slaughtering chains and operate on a contract basis, taking a slaughter-processing margin.
- Privately owned, large-scale slaughterhouses. There are very few of these and they are associated with the larger feedlots. They also take a slaughter-processing margin.
- Small-scale, privately owned slaughterhouses. These are associated with meat shops and may be part of an integrated slaughter–retail meat shop business. They operate on a very small scale, slaughtering only one or two animals per day (more during festive periods) according to meat shop customer demands for beef.

These three types of slaughtering activities can be represented in the model either as separate industries or as margins. From a technical modelling viewpoint, it is simpler to represent them as margins. The processing margin adds to the basic or farm price of native fattened cattle and lot-fed cattle. This treatment does not reduce the model's policy flexibility. The effects of an improvement in the productivity of government slaughter facilities, for example, are simulated by an appropriate reduction in the cost of the slaughter margin.

The transport and trader margins in Table 6.1 add to the basic or farm price of each model commodity before it is purchased. The model makes an allowance for transport and trader margins on each of the flows of:

- native feeder cattle from breeders to non-partnership fatteners and the feedlot sector; and
- imported feeder cattle to the feedlot sector.

The model also makes an allowance for trading margins to be incurred on sales of beef from slaughterhouses to wet markets, supermarkets and meat shops, and to export. These represent wholesale and retail margins. These margins cover the cost of moving and selling

beef from native cattle and lot-fed cattle from the slaughterhouse to the point of consumption — wet markets, supermarkets, meat shops and free on board (fob) exports.

Trading is conducted at various levels — village trader, subdistrict trader, or inter-regional trader. Village traders usually move cattle by walking them in small mobs from one location to another. Cattle are rarely walked more than six kilometres. Subdistrict and regional traders use trucks to move cattle over longer distances. Subdistrict traders collect cattle from breeders within a district and deliver them to partnership and non-partnership fatteners. Inter-regional traders transport cattle from breeding regions and import centres to feedlots. In the case of integrated small-scale slaughter and meat shop operations, the transport margin component is zero.

Commodities Produced by Each Industry

The model allows for industries to produce more than one commodity and for the same commodity to be produced in more than one industry.

Table 6.2 shows the commodities produced by each activity. Smallholder breeders produce a single product: native feeder cattle. The largest demand for native feeder cattle is from feedlots, who are also big importers of live cattle. The amount feedlots will be prepared to pay for native feeder cattle (the price of native feeder cattle in Indonesia) will therefore be determined largely by the landed, duty-paid import price in rupiah of imported feeder cattle. At present, all such cattle come from northern Australia, although alternative sources may develop in the future.

The smallholder non-partnership fattener activity produces native fattened cattle; the partnership activity also produces fattened cattle from live cattle imports distributed to them by the feedlots. The feedlot industry produces mainly fattened cattle from live cattle imports.

Adding up conditions

The model's input–output database components in Tables 6.1 and 6.2 enforce a number of adding up conditions as follows.

- The sum of all inputs used by each industry (rows *i* to *s* in Table 6.1, given in row *t*) equals the industry's value of production (total costs).
- The sum of the value of all commodities produced in an industry (column sums of Table 6.2, given in row *j*) equals the total costs of that industry (column sums of Table 6.1, given in row *t*).

- The value of production for each commodity produced in Indonesia (the row sums of columns *a* to *c* in Table 6.2, given in column *d*) equals the value of sales of that commodity (the sum of all columns for each row of those commodities in Table 6.1, given in column *h*). For example, the value of production of native feeder cattle (the sum of the entries in row *e* in Table 6.2) equals the sum of entries in cells *ib* and *ic* of Table 6.1.
- The purchaser's prices or retail value of beef consumed by each outlet can be calculated by summing columns *d* to *f* in Table 6.1. Similarly, the value of exports on an fob basis is calculated by summing column *g*.

Implementation of the model

The model was implemented using the GEMPACK suite of programs as described by Harrison and Pearson (1996). GEMPACK, which stands for 'General Equilibrium Modelling Package', is a suite of general-purpose modelling software suitable for general and partial equilibrium modelling. It is particularly suited to solving large systems of nonlinear equations.

The underlying equations for the Indonesia beef model form a system of simultaneous, nonlinear equations in levels form. GEMPACK allows equations to be expressed in nonlinear levels form, in percentage change linearisation of the levels, or as a mixture of both. In each case, GEMPACK uses multistep techniques to solve the underlying nonlinear system.

Generally, behavioural equations are more easily represented and understood in percentage change (linear) form. The model has therefore been implemented in percentage change form and is solved using nonlinear techniques.

Model Sets and Dimensions

The model's equations can be written in algebraic form or in the form required by the GEMPACK code. For convenience, we write them here in GEMPACK code form. Economists can easily understand and interpret the GEMPACK code without any programming knowledge.

Before writing the equations in GEMPACK code, we first needed to set the dimensions for the various sets of variables distinguished in the model. This is done in Table 6.3 with reference to the commodities and industries that need to be described by the model theory.

Using these dimensions ('set statements' in GEMPACK language), we can simplify Table 6.1 down to a manageable number of data matrices. These matrix names and dimensions are then used throughout the GEMPACK code. Table 6.4 simplifies the information in Table 6.1 to account for the sets used in the model code. For example, matrix *A* covers the dimensions *com* (commodities) by *ind* (industries), while matrix *K* covers the dimensions factors (primary factors) by *ind* (industries).

Table 6.4. Inputs to beef cattle production and final demands (simplified).

	Smallholder			Final demands				
	Breeder *a*	Non-partnership fattener *b*	Feedlot and partnership fatteners *c*	Wet markets *d*	Super-markets *e*	Meat shops *f*	Export *g*	Total sales (row sum) *h*
Native feeder cattle *i*								
Native fattened cattle *j*								
Lot-fed cattle *k*								
Imported feeder cattle *l*								
Imported beef *m*								
Processing margins *n*								
Transport and trader margins *o*								
Feed *p*								
Other costs and taxes on inputs *q*								
Labour *r*								
Returns to land and capital *s*								
Total costs (value of production) (Column sum) *t*								

Model Equations

Boxes 6.1–6.6 list the equations of the model, which are all written in percentage change form. Box 6.7 describes model variables using the equation system. Boxes 6.8 and 6.9 list model coefficients and behavioural parameters.

The model equations can be classified into six groups:

- industry demands for intermediate inputs and primary factors in producing cattle and beef;
- industry outputs;
- domestic consumption and export demand for beef;
- zero pure profit conditions;
- market clearing relationships; and
- other equations.

Box 6.1. Industry demands for intermediate inputs and primary factors of production.

```
!1!
equation dem_inter_inp
 # demand for intermediate input i by activity j #
(all,i,farminp)(all,j,ind)

x1(i,j) = z(j) - Sigmal(j)*(p1(i,j) -
    sum(k,farminp, S1(k,j)*p1(k,j))) + a1(i,j);

!2!
equation dem_pr_fac
 # demand for primary factor v by industry j #
(all,v,factors)(all,j,ind)

xp(v,j) = z(j) – SigmaP(v,j)*(pp(v,j)-sum(u,factors,Sp(u,j)*pp(u,j)))
    + ap(v,j);

!3!
equation dem_oi_pr
 # demand for other input o by industry j #
(all,o,othinputs)(all,j,ind)

xo(o,j) = z(j) + ao(o,j);
```

Box 6.2. Industry outputs.

```
4!
equation farmind_prod
 # production by industry #
(all,i,farmcom)(all,j,ind)

x0j(i,j) = z(j) + SigmaJ(j)*((p0(i) - sum(k,farmcom,Sj(k,j)*p0(k)))
    + a0j(i,j);
```

Box 6.3. Domestic consumption and export demand for beef.

```
!5!
equation cdem_top
 # Household demand for beef and other undifferentiated by source #
(all,i,retail)

x2(i) - popn = eps(i)*[ry – popn] +
    SigmaR*(p2(i) -sum(r,retail, RVshare(r)*p2(r))) + f2(i);
!6!
equation dem_beef_olet
 # demand by outlets #
(all,l,outlet)

x2l(l) = x2("beef") + f2l(l);

!7!
equation dem_by_source
 # demand by beef type by outlet #
(all,b,beef)(all,l,outlet)

x2s(b,l) = x2l(l) - SigmaB(b,l)*p2s(b,l) - sum(k,beef,So(k,l)*p2s(k,l)) +
    f2s(b,l);
!8!
equation exports_vol
 # export to world markets #
(all,b,beefex)

x3(b) = tau(b)*p3(b) + f3(b);
```

Box 6.4. Zero pure profits conditions.

```
!9!
equation intin_pr
 # price of intermediate inputs #
(all,i,farminp)(all,j,ind)

p1(i,j) = SB1(i,j)*p0(i) + SP1(i,j)*proc_inp(i,j)
       + ST1(i,j)*trade_inp(i,j);
!10!

equation price_av
 # average retail price of beef #

p2("beef") = sum(k,beef,sum(j,outlet,S2(k,j)*p2s(k,j)));

!11!
equation cons_pr1 # consumer price of beef from imported cattle #
(all,i,beef)(all,l,outlet)

p2s(i,l) = SB2(i,l)*p0(i) + SP2(i,l)*proc_marg(i,l)
       + ST2(i,l)*trad_marg(i,l);
!12!
equation zpp_exps1
 # zero pure profits in exporting #
(all,i,beefex)

p3(i) = SB3(i)*p0(i) + SP3(i)*exproc_marg(i) + ST3(i)*extrad_marg(i)
        + t3(i);
!13!
equation basic_imp_pr
(all,i,imports)

p0(i) = cif(i) + tm(i) + er;

!14!
equation zero_pure_profits in production
 # zero pure profits #
(all,j,ind)

sum(i,farmcom,Sj(i,j)*p0(i)) =
    sum(i,com,H1(i,j)*p1(i,j)) + sum(v,factors,Hp(v,j)*pp(v,j))
       + sum(o,othinputs,Ho(o,j)*po(o,j))
        - sum(i,farmcom,Sj(i,j)*a0j(i,j)) +
     sum(i,com,H1(i,j)*a1(i,j)) + sum(v,factors,Hp(v,j)*ap(v,j))
        + sum(o,othinputs,Ho(o,j)*ao(o,j));
```

Box 6.5. Market clearing relationships.

```
!15!
equation output_by_comm
 # supply by commodity #
(all,i,farmcom)

ts(i) = sum(j,ind,YO(i,j)*xOj(i,j));

!16!
equation tot_dem_feeder
 # total demands for feeder cattle #
(all,i,feeders)

td(i) = sum(j,ind,SINT(i,j)*x1(i,j));

!17!
equation tot_dem_beef_ex
 # total demands for beef domestic #
(all,i,beefex)

td(i) = sum(l,outlet,SCON(i,l)*x2s(i,l)) + SEXP(i)*x3(i);

!18!
equation tot_dem_beef
 # total demands for beef imported #

td("imbeef") = sum(l,outlet,SCON("imbeef",l)*x2s("imbeef",l));

!19!
equation market_cl
 # market clearance #
(all,i,farmcom)

ts(i) = td(i);
```

Box 6.6. Other equations.

```
!20!
equation value_add_ind
 # value-added by industry #
(all,j,ind)

vaddind(j) = sum(v,factors, SVA(v,j)* (xp(v,j)+pp(v,j)));

!21!
equation value_add_total
 # total value-added by Indonesian beef industry #

totalvadd = sum(j,ind, SVAT(j)*vaddind(j));
```

Box 6.7. Variables of the Indonesia beef model.

```
variable
(all,i,com)(all,j,ind)                    x1(i,j)
  # demand for intermediate input i, by industry j #;
(all,i,com)(all,j,ind)                    p1(i,j)
  # price of intermediate input i, to industry j #;
(all,i,com)(all,j,ind)                    a1(i,j)
  # technology change term for intermediate input i, in industry j #;
(all,j,ind)                               z(j)
  # activity level in industry j #;
(all,v,factors)(all,j,ind)                xp(v,j)
  # demand for primary factor v, by industry j #;
(all,v,factors)(all,j,ind)                pp(v,j)
  # price of primary factor v, to industry j #;
(all,v,factors)(all,j,ind)                ap(v,j)
  # technology change term for primary factor v, in industry j #;
(all,o,othinputs)(all,j,ind)              xo(o,j)
  # demand for other input o, by industry j #;
(all,o,othinputs)(all,j,ind)              po(o,j)
  # price of other input o, to industry j #;
(all,o,othinputs)(all,j,ind)              ao(o,j)
  # technology change term for other input o, to industry j #;
(all,i,farmcom)(all,j,ind)                x0j(i,j)
  # output of commodity i, by industry j #;
(all,i,farmcom)(all,j,ind)                a0j(i,j)
  # technology change term for output i produced by industry j #;
(all,i,com)                               p0(i)
  # farm or basic price #;
(all,r,retail)                            x2(r)
  # household demand for product r, undifferentiated by source #;
(all,r,retail)                            p2(r)
  # average household price for product r #;
! scalar variable !                       ry
  # real income #;
! scalar variable !                       popn
  # population #;
(all,r,retail)                            f2(r)
  # shift term for household demand for product r #;
(all,l,outlet)                            x2l(l)
  # total demand for beef by retail outlets #;
(all,l,outlet)                            f2l(l)
  # shift term for retail demand for beef #;
(all,b,beef)(all,l,outlet)                x2s(b,l)
  # demand for beef type b by outlet #;
(all,b,beef)(all,l,outlet)                p2s(b,l)
  # price of beef type b by outlet #;
(all,b,beef)(all,l,outlet)                f2s(b,l)
  # shift term for demand for beef type b by outlet #;
```

Box 6.7. Variables of the Indonesia beef model (cont'd).

```
(all,i,imports)                          cif(i)
  # import cif price of beef #;
(all,i,imports)                          tm(i)
  # power of the tariff on beef #;
! scalar variable !                          er
  # exchange rate of rupiah with Australian dollar #;
(all,b,beefex)                           x3(b)
  # exports to world markets #;
 (all,b,beefex)                           p3(b)
  # FOB export price #;
(all,b,beefex)                           f3(b)
  # shift term for exports #;
(all,b,beefex)                           t3(b)
  # power of the export tax #;
(all,i,com)(all,j,ind)                   proc_inp(i,j)
  # power of the transport margin on inputs #;
(all,i,com)(all,j,ind)                   trade_inp(i,j)
  # power of the transport margin on inputs #;
(all,b,beef)(all,l,outlet)               proc_marg(b,l)
  # power of the processing margin by type of beef #;
(all,b,beef)(all,l,outlet)               trad_marg(b,l)
  # power of the trader margin by outlet #;
(all,b,beefex)                           exproc_marg(b)
  # power of the export processing margin by type of beef #;
(all,b,beefex)                           extrad_marg(b)
  # power of the export trading margin by type of beef #;
(all,i,farmcom)                          ts(i)
  # total supply by commodity #;
(all,i,com)                              td(i)
  # total demand by commodity #;
(all,j,ind)                              vaddind(j)
  # value-added by industry #;
                                 totalvadd
  # total value-added #;
```

Box 6.8. Model parameters and database reads and updates.

```
coefficient (parameter)(all,j,ind)                    SigmaI(j)
  # import substitution between domestic and imported live cattle #;
READ SigmaI FROM FILE basedata HEADER "P001";
coefficient (parameter)(all,j,ind)                    SigmaP(j)
  # primary factor substitution elasticity #;
READ SigmaP FROM FILE basedata HEADER "P002";
coefficient (parameter)(all,j,ind)                    SigmaJ(j)
  # industry transformation parameter #;
READ SigmaJ FROM FILE basedata HEADER "P003";
coefficient (parameter)                               eps
  # income expenditure elasticity #;
READ eps FROM FILE basedata HEADER "P004";
coefficient (parameter)(all,l,outlet)                 SigmaB(l)
  # beef substitution parameter #;
READ SigmaB FROM FILE basedata HEADER "P005";
coefficient (parameter)                               SigmaR
  # retail substitution parameter between beef and other meats #;
READ SigmaR FROM FILE basedata HEADER "P006";
coefficient (parameter)(all,b,beefex)                 tau(b)
  # export demand elasticity #;
READ tau FROM FILE basedata HEADER "P007";
coefficient (all,i,com)(all,j,ind)                    Amatrix(i,j)
   # basic values of inputs to industry #;
READ Amatrix FROM FILE basedata HEADER "V00A";
update (change) (all,i,com)(all,j,ind)
  amatrix(i,j) = amatrix(i,j)*(p0(i)+x1(i,j))/100;
coefficient (all,i,com)(all,j,ind)                    Aquan(i,j)
   # quantity of inputs to industry #;
READ Aquan FROM FILE basedata HEADER "Q00A";
update (change) (all,i,com)(all,j,ind)
  Aquan(i,j) = Aquan(i,j)*x1(i,j)/100;
coefficient(all,b,beef)(all,l,outlet)                 Bmatrix(b,l)
  # basic value of household consumption #;
READ Bmatrix FROM FILE basedata HEADER "V00B";
update (change) (all,b,beef)(all,l,outlet)
  Bmatrix(b,l) = Bmatrix(b,l)*(x2s(b,l)+p0(b))/100;
coefficient(all,b,beef)(all,l,outlet)                 Bquan(b,l)
  # quantity household consumption by region #;
READ Bquan FROM FILE basedata HEADER "Q00B";
update (change) (all,b,beef)(all,l,outlet)
  Bquan(b,l) = Bquan(b,l)*x2s(b,l)/100;
Coefficient                                           RVOther
  # retail value of other meat composite #;
Read RVOther from FILE basedata HEADER "Q020";
update (change) RVOther = RVOther*(x2("othermeat")+p2("othermeat"))/100;
coefficient (all,b,beefex)                            Cmatrix(b)
  # basic value of exports by region #;
READ Cmatrix FROM FILE basedata HEADER "V00C";
update (change) (all,b,beefex) Cmatrix(b)=Cmatrix(b)*(x3(b)+p0(b))/100;
coefficient (all,b,beefex)                            Cquan(b)
  # quantity of exports by region #;
READ Cquan FROM FILE basedata HEADER "Q00C";
```

Box 6.8. Model parameters and database reads and updates (cont'd).

```
update (change) (all,b,beefex) Cquan(b)=Cquan(b)*(x3(b))/100;
coefficient(all,v,factors)(all,j,ind)              Kmatrix(v,j)
   # primary factor inputs #;
READ Kmatrix FROM FILE basedata HEADER "V00K";
update (change) (all,v,factors)(all,j,ind)
   Kmatrix(v,j) = Kmatrix(v,j)*(pp(v,j)+xp(v,j))/100;
coefficient (all,o,othinputs)(all,j,ind)           Jmatrix(o,j)
  # other inputs #;
READ Jmatrix FROM FILE basedata HEADER "V00J";
update (change) (all,o,othinputs)(all,j,ind)
  Jmatrix(o,j)=Jmatrix(o,j)*(xo(o,j)+po(o,j))/100;
coefficient (all,i,farmcom)(all,j,ind)             Lmatrix(i,j)
  # joint production matrix #;
READ Lmatrix FROM FILE basedata HEADER "V00L";
update (change) (all,i,farmcom)(all,j,ind)
  Lmatrix(i,j) = Lmatrix(i,j)*(x0j(i,j)+p0(i))/100;
coefficient (all,i,farmcom)(all,j,ind)              Lquan(i,j)
  # quantities joint production matrix #;
READ Lquan FROM FILE basedata HEADER "Q00L";
update (change) (all,i,farmcom)(all,j,ind)
  Lquan(i,j)=Lquan(i,j)*x0j(i,j)/100;
coefficient (all,i,com)(all,j,ind)                 Dmatrix(i,j)
   # Processing margins on inputs to industry #;
READ Dmatrix FROM FILE basedata HEADER "V00D";
update (change) (all,i,com)(all,j,ind)
  Dmatrix(i,j) = Dmatrix(i,j)*(x1(i,j)+proc_inp(i,j))/100;
coefficient (all,i,com)(all,j,ind)                 Gmatrix(i,j)
   # trader margins on inputs to industry #;
READ Gmatrix FROM FILE basedata HEADER "V00G";
update (change) (all,i,com)(all,j,ind)
  Gmatrix(i,j) = Gmatrix(i,j)*(x1(i,j)+trade_inp(i,j))/100;
coefficient(all,b,beef)(all,l,outlet)              Ematrix(b,l)
  # processing margins on consumption #;
READ Ematrix FROM FILE basedata HEADER "V00E";
update (change) (all,b,beef)(all,l,outlet)
  Ematrix(b,l) = Ematrix(b,l)*(x2s(b,l)+proc_marg(b,l))/100;
coefficient(all,b,beef)(all,l,outlet)              Hmatrix(b,l)
  # trading margins on consumption #;
READ Hmatrix FROM FILE basedata HEADER "V00H";
update (change) (all,b,beef)(all,l,outlet)
  Hmatrix(b,l) = Hmatrix(b,l)*(x2s(b,l)+trad_marg(b,l))/100;
coefficient(all,b,beefex)                  Fmatrix(b)
  # processing margins on exports #;
READ Fmatrix FROM FILE basedata HEADER "V00F";
update (change) (all,b,beefex)
  Fmatrix(b) = Fmatrix(b)*(x3(b)+exproc_marg(b))/100;
coefficient(all,b,beefex)                  Imatrix(b)
  # trader margins on exports #;
READ Imatrix FROM FILE basedata HEADER "V00I";
```

Box 6.9. Calculation of model shares (cont'd).

```
 Totalcosts(j) = sum(i,com,Amatrixpp(i,j)) +
          sum(v,factors,Kmatrix(v,j))+
            sum(i,othinputs,Jmatrix(i,j));
coefficient (all,i,com)(all,j,ind)                    H1(i,j)
  # share of inputs in total costs of industry j #;
formula (all,i,com)(all,j,ind)
 H1(i,j) = Amatrixpp(i,j) / Totalcosts(j);
coefficient (all,v,factors)(all,j,ind)                 Hp(v,j)
  # share of primary factors in total costs of industry j #;
formula (all,v,factors)(all,j,ind)
 Hp(v,j) = Kmatrix(v,j) / Totalcosts(j);coefficient (all,o,othinputs)(all,j,ind)          Ho(o,j)
  # share of other costs in total costs #;
formula (all,o,othinputs)(all,j,ind)
 Ho(o,j)= Jmatrix(o,j)/Totalcosts(j);
Coefficient (all,v,factors)(all,j,ind)                 SVA(v,j)
  # Share of value-added in each industry #;
Formula (all,v,factors)(all,j,ind)
    SVA(v,j) = Kmatrix(v,j)/ sum(u,factors, Kmatrix(u,j));
Coefficient (all,j,ind)                                SVAT(j)
  # Share of each industry value-added in total #;
Formula (all,j,ind)
    SVAT(j) = sum(v,factors, Kmatrix(v,j)) /
          sum(u,factors,sum(k,ind, Kmatrix(u,k)));
Coefficient                                            RVBeef
  # total value of consumption of beef #;
Formula RVBeef = sum(b,beef,sum(l,outlet,Bmatrixpp(b,l)));
Coefficient                                            Rvmeat
  # Retail value of beef and other meat #;
Formula Rvmeat = RVOther + RVBeef;
Coefficient (all,i,retail)                             Rvshare(i)
  # retail value share of beef and other meat #;
Formula Rvshare("Beef") = RVBeef / RVmeat;
Formula Rvshare("Othermeat") = RVOther / RVmeat;
coefficient (all,i,com)(all,j,ind)                     SB1(i,j)
   # Share of basic value in purchasers' prices #;
zerodivide default 1.0;
formula (all,i,com)(all,j,ind)
 SB1(i,j) = Amatrix(i,j)/Amatrixpp(i,j);
coefficient (all,i,com)(all,j,ind)                     SP1(i,j)
   # Share of processing margin in purchasers' prices #;
zerodivide default 0.0;
formula (all,i,com)(all,j,ind)
 SP1(i,j) = Dmatrix(i,j) / Amatrixpp(i,j);
coefficient (all,i,com)(all,j,ind)                     ST1(i,j)
   # Share of traders margin in purchasers' prices #;
zerodivide default 0.0;
formula (all,i,com)(all,j,ind)
 ST1(i,j) = 1.0-SB1(i,j)-SP1(i,j);
Coefficient (all,b,beef)(all,l,outlet)                 SB2(b,l)
```

Box 6.9. Calculation of model shares (cont'd).

```
 Totalcosts(j) = sum(i,com,Amatrixpp(i,j)) +
          sum(v,factors,Kmatrix(v,j))+
            sum(i,othinputs,Jmatrix(i,j));
coefficient (all,i,com)(all,j,ind)                    H1(i,j)
  # share of inputs in total costs of industry j #;
formula (all,i,com)(all,j,ind)
 H1(i,j) = Amatrixpp(i,j) / Totalcosts(j);
coefficient (all,v,factors)(all,j,ind)                 Hp(v,j)
  # share of primary factors in total costs of industry j #;
formula (all,v,factors)(all,j,ind)
 Hp(v,j) = Kmatrix(v,j) / Totalcosts(j);coefficient (all,o,othinputs)(all,j,ind)          Ho(o,j)
  # share of other costs in total costs #;
formula (all,o,othinputs)(all,j,ind)
 Ho(o,j)= Jmatrix(o,j)/Totalcosts(j);
Coefficient (all,v,factors)(all,j,ind)                 SVA(v,j)
  # Share of value-added in each industry #;
Formula (all,v,factors)(all,j,ind)
    SVA(v,j) = Kmatrix(v,j)/ sum(u,factors, Kmatrix(u,j));
Coefficient (all,j,ind)                                SVAT(j)
  # Share of each industry value-added in total #;
Formula (all,j,ind)
    SVAT(j) = sum(v,factors, Kmatrix(v,j)) /
          sum(u,factors,sum(k,ind, Kmatrix(u,k)));
Coefficient                                            RVBeef
  # total value of consumption of beef #;
Formula RVBeef = sum(b,beef,sum(l,outlet,Bmatrixpp(b,l)));
Coefficient                                            Rvmeat
  # Retail value of beef and other meat #;
Formula Rvmeat = RVOther + RVBeef;
Coefficient (all,i,retail)                             Rvshare(i)
  # retail value share of beef and other meat #;
Formula Rvshare("Beef") = RVBeef / RVmeat;
Formula Rvshare("Othermeat") = RVOther / RVmeat;
coefficient (all,i,com)(all,j,ind)                     SB1(i,j)
   # Share of basic value in purchasers' prices #;
zerodivide default 1.0;
formula (all,i,com)(all,j,ind)
 SB1(i,j) = Amatrix(i,j)/Amatrixpp(i,j);
coefficient (all,i,com)(all,j,ind)                     SP1(i,j)
   # Share of processing margin in purchasers' prices #;
zerodivide default 0.0;
formula (all,i,com)(all,j,ind)
 SP1(i,j) = Dmatrix(i,j) / Amatrixpp(i,j);
coefficient (all,i,com)(all,j,ind)                     ST1(i,j)
   # Share of traders margin in purchasers' prices #;
zerodivide default 0.0;
formula (all,i,com)(all,j,ind)
 ST1(i,j) = 1.0-SB1(i,j)-SP1(i,j);
Coefficient (all,b,beef)(all,l,outlet)                 SB2(b,l)
```

Box 6.9. Calculation of model shares (cont'd).

```
  # share of basic value in purchasers price #;
zerodivide default 1.0;
Formula (all,b,beef)(all,l,outlet)
   SB2(b,l) = Bmatrix(b,l) / Bmatrixpp(b,l);
Coefficient (all,b,beef)(all,l,outlet)              SP2(b,l)
  # share of processors margin in purchasers price #;
zerodivide default 1.0;
Formula (all,b,beef)(all,l,outlet)
   SP2(b,l) = Ematrix(b,l) / Bmatrixpp(b,l);
Coefficient (all,b,beef)(all,l,outlet)              ST2(b,l)
  # share of traders margin in purchasers price #;
zerodivide default 0.0;
Formula (all,b,beef)(all,l,outlet)
   ST2(b,l) = 1- SB2(b,l)- SP2(b,l);
Coefficient (all,b,beefex)                  Cmatrixpp(b)
  # FOB price of Indonesian beef #;
Formula (all,b,beefex) Cmatrixpp(b)=Cmatrix(b)+Fmatrix(b)+Imatrix(b);
Coefficient (all,b,beefex)                  SB3(b)
  # share of basic value in purchasers price #;
zerodivide default 0.0;
Formula (all,b,beefex)
   SB3(b) = Cmatrix(b) / Cmatrixpp(b);
zerodivide default 1.0;
Coefficient (all,b,beefex)                  SP3(b)
  # share of processors margin in purchasers price #;
Formula (all,b,beefex)  SP3(b) = Fmatrix(b) / Cmatrixpp(b);
Coefficient (all,b,beefex)                  ST3(b)
  # share of processors margin in purchasers price #;
Formula (all,b,beefex)  ST3(b) = 1.0 - SB3(b) – SP3(b);
```

The notation in these equations observes the following conventions:

- lower-case letters are used to indicate the percentage change in the corresponding upper-case variables;
- model coefficients and shares are usually represented by upper-case variables; and
- a system of subscripts is used to distinguish ranges of each variable (e.g. $x1(i,j)$ is used to denote inputs to current production of commodity i by industry j).

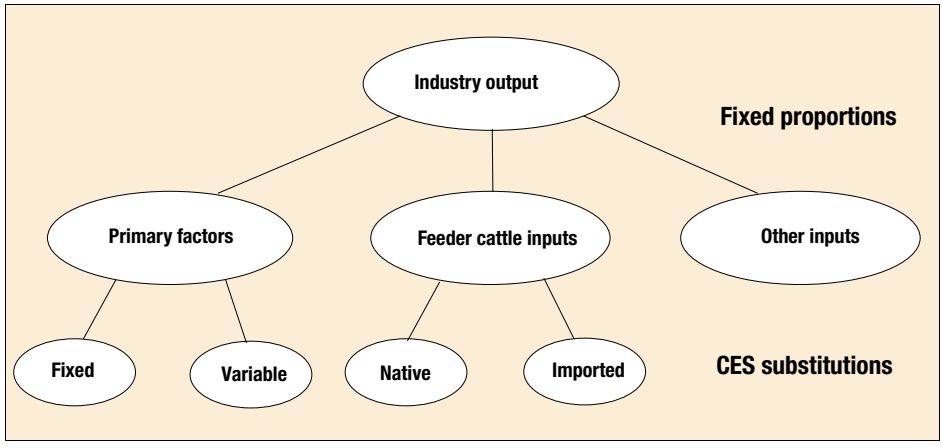
Industry demands for intermediate inputs and primary factors

This set of equations describes changes in the cells of matrices *A*, *J* and *K* of Table 6.4. Producers choose their inputs to minimise production costs subject to a two-level industry production function summarised in Figure 6.1. At the first level there is a Leontief assumption of no substitution between input categories (feeder cattle inputs, other inputs and the aggregate of primary factors). At the second level there are constant elasticity of substitution (CES) functions describing substitution possibilities between feeder cattle inputs (native and imported) and substitution possibilities between fixed and variable primary factors of production (capital/land, labour).

These demands are described by equations 1 and 2 in Box 6.1. Equation 1 models the flows in the cells bounded by matrix *A* in Table 6.4. In percentage changes, demands for input *i* by industry *j* depend on the level of industry output (the scale effect) and changes in relative prices between cattle inputs from different sources. Looking at Table 6.1, the feedlot industry can source feeder cattle from either local producers or imported live cattle. This equation contains parameters that describe the degree of substitution possible between feeder cattle from each source for each industry.

Equation 2 models the value-added component of costs — matrix *K* in Table 6.4. Demands for primary factors of production depend on the industry output (the scale effect) and the relative prices of primary factors (the substitution effect). These equations contain parameters, for each industry, that describe the ease of application of the variable factor (labour) to the fixed factor (capital/land) to expand production.

Figure 6.1. Industry production technology.



CES = constant elasticity of substitution

Equation 3 models the demands for other inputs (feeds, other costs and any taxes on inputs) as a function of industry output levels. This covers the entries in matrix *J* of Table 6.4.

The input–output relationships described in equations 1–3 can be modified by technical change terms in these equations. With these exogenous variables we can change input requirements per unit of output. For example, higher daily growth rates can change the relationship between input and output weights of feedlot cattle and hence profitability.

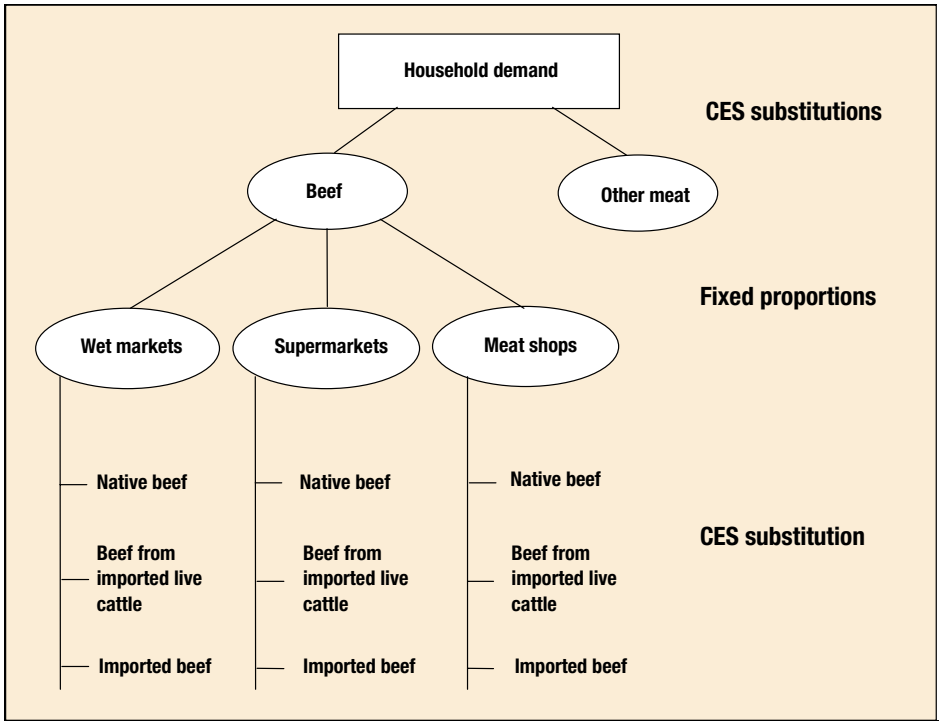
Industry outputs

Equation 4 in Box 6.2 describes how industries can switch between various types of cattle (native fattened cattle, fattened cattle from live imports) on the basis of relative returns. It covers the entries in Table 6.6. The parameter *SigmaJ* describes the ease of transformation between alternative output commodities.

Domestic consumption and export demand for beef

These demands are described by equations 5–8 in Box 6.3 and describe changes in matrices *B* and *C* of Table 6.4. The representation of demand by households is illustrated in

Figure 6.2. Structure of consumer demand.



CES = constant elasticity of substitution

Figure 6.2. Households first choose between their consumption of beef and other competing meats according to a CES function. Next, they are assumed to consume beef from wet markets, supermarkets and meat shops in fixed proportions. At the third level they can substitute between different types of beef at each outlet.

Equation 5 calculates household demands for beef in Indonesia undifferentiated by source. Per-person demand for beef is a function of an income effect and a price effect. The income effect is equal to changes in per-person income growth multiplied by an expenditure elasticity. The price effect is equal to changes in the average retail price of beef and the other meat composite, modified by price elasticities. An exogenous shift term is also included to simulate taste shifts by consumers towards or away from beef compared with other meats.

The change in retail price of the other meat composite is exogenous and may reflect potential changes in the retail prices of poultry and fish that dominate average meat consumption in Indonesia.

Equation 6 translates total retail demand for beef into demand for beef by outlet. Reasons for the current pattern of beef sales through the various retail channels are complex. Observed shifts in sales between outlets are likely to be explained not by relative prices but by factors to do with income, tastes and westernisation. As a starting point, we propose that demand for beef by outlet move proportionally to total household demand, as listed in equation 6. This equation also includes an exogenous shift term that will permit us to examine the effects of different consumer purchase patterns between outlets with simulations of the model. For example, it is likely that there will be a steady shift away from sales in wet markets towards supermarkets in the future as Indonesia's per capita income grows. The likely effect of this change can be simulated.

Equation 7 takes this story a step further. Once the consumer has decided on the retail outlet, the next purchase decision is what type of beef is wanted. Demand for beef type by outlet depends on total demand for beef by that type of outlet and the relative price of each type of beef at that outlet. Table 6.1 shows that each outlet can sell different proportions of each beef type. For example, wet markets specialise in beef from native cattle, though imported beef makes an occasional appearance. Again, an exogenous shift term has been included to allow for simulation of potential changes in demands for each type of beef by outlet that are not explained by changes in relative prices.

Finally, equation 8 allows for the possibility of exports. Exports are currently negligible. Changes in export volumes depend on changes in the fob price of Indonesian beef by an export demand elasticity and an exogenous shift term.

Zero pure profits conditions

Box 6.4 lists the zero pure profits equations of the model. The term 'zero pure profits' means simply that the difference between prices and costs must be fully accounted for by a tax, a margin or a factor of production.

Equation 9 links the basic price (determined by market clearance) or the landed price of imports of cattle to the purchasers' price paid by farmers for those inputs — the difference being a processing and transport margin. The purchasers' price of each commodity is equal to the share weighted sum of changes in the basic or farm price and any processing, transport and trader margin payable.

This equation — like similar price linkage equations that follow — has been written with specific rate margins. The cost or price of this margin is determined outside the model and does not vary with the price of the commodity. Another method of modelling these margin activities is to assume that the price paid to the margin activity varies in proportion to the basic or farm price of the activity; the margin cost as a percentage of the basic price would then be held constant.

Equation 10 calculates the change in the average retail price of beef as the share weighted sum of changes in retail prices across each type of beef sold in each outlet. As in equation 9, equation 11 determines the retail price by outlet of beef from native fattened cattle, beef from feedlot cattle and imported beef by the addition of the corresponding live price and processing and trade margins. Equation 12 links the export fob price of beef from native cattle and beef from lot-fed cattle to the output price of those cattle and adds processing and trade margins as well as any export taxes or subsidies payable.

In equation 13 the basic price of imported live cattle and beef is equal to the cost, insurance and freight (CIF) value in foreign currency (Australian dollars) plus duties and the exchange rate between the rupiah and foreign currency.

Following from the assumptions of competitive behaviour and constant returns to scale production technology, profits can accrue only to factors of production. Equation 14 relates the average price of each industry's output (the left-hand side) to the sum of intermediate input costs, payments to primary factors and other costs. There are no pure profits, in the sense that every factor of production is allocated a return until the value of total costs equals the value of total sales.

Equation 18 calculates the total change in demand for imported beef. Finally, equation 19 equates demand and supply for commodities produced at the farm level, which determines the basic price.

Equation 21 sums the value added across each of the industries recognised in the model to compute the total value added generated by Indonesia's cattle production industries (smallholder breeder cattle, smallholder non-partnership fattener, smallholder partnership fattener and feedlot industry).

Variables

Box 6.7 lists all the variables for the Indonesian beef model. Each variable is defined by a unique name and a range of commodities or industries over which it is defined. For each variable, a detailed description is also provided.

Model closure

The complete model as specified above contains many more variables than equations. Because each equation can determine only one endogenous variable, the model is solved by assigning values to a number of exogenous variables. The model closure is summarised in Tables 6.5 and 6.6. In these tables, components of each model variable are designated to be either endogenous or exogenous. If they are endogenous, the equation in which the variable is determined is specified.

Table 6.5. Endogenous variables of the model and corresponding equations.

Variables	Range	Number	Equation	Range
x1(i,j)	(all,i,com)(all,j,ind)	5*3	dem_inter_inp	(all,i,com)(all,j,ind)
p1(i,j)	(all,i,com)(all,j,ind)	5*3	intin_pr	(all,i,com)(all,j,ind)
z(j)	(all,j,ind)	3	zero_pure_profits	(all,j,ind)
xp(v,j)	(all,v,factors)(all,j,ind)	1*3	dem_pr_fac	('labour',ind)
pp(v,j)	(all,v,factors)(all,j,ind)	1*3	dem_pr_fac	('fixed',ind)
xo(o,j)	(all,o,othinputs)(all,j,ind)	2*3	dem_oi_pr	(all,o,othinputs)(all,j,ind)
x0j(i,j)	(all,i,farmcom)(all,j,ind)	3*3	farmind_prod	(all,i,farmcom)(all,j,ind)
p0(l)	(all,i,com)	5	basic_imp_pr	(all,i,imports)
			market_cl	(all,l,farmcom)
x2(r)	(all,r,retail)	2	cdem	(all,i,retail)
p2(r)	(all,r,retail)	1	price_av	('beef')
x2l(l)	(all,l,outlet)	3	dem_beef_olet	(all,l,outlet)
p2s(b,l)	(all,b,beef)(all,l,outlet)	3*3	cons_pr1	(beefex,outlet)
x2s(b,l)	(all,b,beef)(all,l,outlet)	3*3	dem_by_source	(all,b,beef)(all,l,outlet)
p3(b)	(all,b,beefex)	2	zpp_exps1	(all,b,beefex)
ts(l)	(all,i,farmcom)	3	output_by_comm	(all,l,farmcom)
td(i)	(all,i,com)	5	tot_dem_feeder	(all,i,feeders)
			tot_dem_beef_ex	(all,i,beefex)
			tot_dem_beef	1
vaddind(j)	(all,j,ind)	3	value_add_ind	(all,j,ind)
totalvadd	!scalar variable!	1	value_add_total	1
Total endogenous variables				99

Table 6.6. Exogenous variables of the model.

Variables	Range	Number
a1(i,j)	(all,i,com)(all,j,ind)	5*3
xp('fixed',j)	(all,j,ind)	1*3
pp('labour',j)	(all,j,ind)	1*3
ap(v,j)	(all,v,factors)(all,j,ind)	2*3
po(o,j)	(all,o,othinputs)(all,j,ind)	2*3
ao(o,j)	(all,o,othinputs)(all,j,ind)	2*3
a0j(i,j)	(all,i,farmcom)(all,j,ind)	3*3
proc_inp(i,j)	(all,i,com)(all,j,ind)	5*3
ry	! scalar variable !	1
popn	! scalar variable !	1
f2(i)	(all,i,retail)	2
f2l(l)	(all,l,outlet)	3
f2s(b,l)	(all,b,beef)(all,l,outlet)	3*3
f3(b)	(all,b,beefex)	2
p2(r)	('Othmeat'l)	1
cif(i)	(all,i,imports)	2
tm(i)	(all,i,imports)	2
er	! scalar variable !	1
t3(b)	(all,b,beefex)	2
trade_inp(i,j)	(all,i,com)(all,j,ind)	5*3
proc_marg(b,l)	(all,b,beef)(all,l,outlet)	3*3
trad_marg(b,l)	(all,b,beef)(all,l,outlet)	3*3
exproc_marg(b)	(all,b,beefex)	2
extrad_marg(b)	(all,b,beefex)	2

The choice of exogenous variables

A feature of this class of model is that the user determines the choice of exogenous variables. Much of the flexibility of the model for policy analysis is due to the user's ability to swap variables between endogenous and exogenous categories. We consider each of the variables listed in Table 6.6.

The inclusion of the technical change terms for the use of intermediate inputs by each industry $a1(i,j)$ on the exogenous list allows for simulation of issues such as what would be the impacts of, say, a 10% improvement in the efficiency of native feeder cattle purchased by the non-partnership fattener industry. In this simulation $a1(i,j)$ for i = *nfecc* and j = *shfat* would be set to –10 and values for all other exogenous variables would be set to zero.

The inclusion of the fixed factor in each industry *xp*(fixed *j*) on the exogenous list defines the economic environment as being short to medium term. It designates that capital and land in each industry is assumed fixed. To expand output, industries need to employ more labour in combination with their fixed factor. The model could be used to simulate the effects of an expansion in the quantity of fixed factors in use in a particular industry, though it does not explain the process of investment to increase the industry's capital stock.

With the quantity of labour employed in each industry endogenous, the price at which that labour is employed, *pp* (labour *j*), is set exogenously. This allows the model to address issues such as what would be the effects of a 10% increase in the price of labour (wage) used by each industry.

The inclusion of the technical change term for primary factors used in each industry *ap*(*v,j*) on the exogenous list allows for simulation of issues such as what would be the impact of a 5% improvement in the productivity of labour in the feedlot industry. This means that the same level of production can be achieved with 5% less labour. In this case *ap*(*v,j*) for *v* = labour, *j* = *flot* would be set to –5. Alternatively, we could make this or any other technical change term endogenous by making a previously endogenous variable exogenous. For example, we could use the model to address the question of what improvement in labour productivity in the feedlot industry would be needed to increase feedlot production by, say, 5% (assuming all other things constant). In this simulation, *ap*(*v,j*) for *v* = labour, *j* = *flot* would be endogenous and *z*(*j*) j = *flot* would become exogenous and set to 5.

The inclusion of the prices of feed and other inputs to each industry *po*(*o,j*) on the exogenous list reflects the assumptions that the supply of these inputs is perfectly elastic. While the model explains the demands for intermediate inputs and primary factors by each industry, it does not explain their supplies and hence does not explain their prices.

The model is well suited to analysing the effects of changes in these prices on the performance of the Indonesian beef industry. For example, if we wanted to look at the effects of a 10% increase in the price of feed to the smallholder non-partnership fattener and feedlot industries, we would set *po*(*o,j*) *o* = *feed*, *j* = *shfat*, *flot* to 10. The model would tell us what would happen to all endogenous variables (consumption of native beef, imports of live cattle, performance of each industry etc.)

The inclusion of the technical change terms for farm commodities used by each industry *aoj*(*i,j*) (native feeder cattle, native fattened cattle, fattened cattle from live imports) and for other inputs used by each industry *ao*(*o,j*) (feed, other costs) allows for simulation of the effects of changes in the efficiency of these inputs. For example, we could ask what would be the impact of a 5% improvement in efficiency of feed use by smallholder non-partnership fattener industries, with a simultaneous 10% improvement in efficiency of feed use by the feedlot industry. To simulate this, we set *ao*(*o,j*) *o* = feed, *j* = *shfat* to –5 and *j* = *flot* to –10.

The transport margins on inputs (to each industry) *pro-imp* (*i,j*) are not explained by the model and hence are set exogenously. This allows model users to analyse the effects of changes in transport costs on inputs.

The variables *ry* (which denotes Indonesia's real income) and *popn* (which denotes population) are not explained by the model. By assigning exogenous values to these variables we can simulate the effects of changes in per capita incomes on the Indonesian beef industry and its various parts.

Next on the exogenous list are a set of shift variables for beef demand — by households, *f*2(*i*); by retail outlets, *f*21(1); by beef by type of outlet, *f*2*s*(*b*,1); and for beef exports, *f*3(*b*). These shift terms, which appear in their respective beef demand equations, enable various scenarios of beef demand (e.g. by type of beef and by outlet) and of export markets to be simulated. For example, to simulate a shift by Indonesian beef consumers to purchasing their beef from supermarkets rather than wet markets, we could assign an appropriate value to *f*2l(1) *outlet* = *smkts*. To simulate an increase in export demand for Indonesian beef produced from, say, imported live cattle, we would assign an appropriate value to *f*3(*b*) *b* = *ifatc*.

Next is the price of competing meats, *p*2(*r*). We can simulate the effects of a change in the price of competing meats relative to beef by assigning non-zero values to this variable.

The next exogenous variable on the list is the CIF price in foreign currency of imported beef and imported live cattle, cif(*i*). To simulate a 5% increase in the foreign currency price of imported live cattle and a 3% increase in the foreign currency price of imported beef, we would set cif(*i*) *i* = *ifeec* to 5 and *i* = *imbeef* to 3.

Next is *tm*(*i*), which represents the power of the tariff on imported live cattle and imported beef. By assigning exogenous values to these variables, we can analyse the effects of changing border instruments for live cattle and beef imports. For example, to simulate the effects of removing the existing 5% tariff on imported beef we would set *tm*(*i*) *i* = *imbeef* to –4.76 (with a tariff rate of 5%, the percentage change in the power of the tariff is = 4.76).

Next is the exchange rate, *er*. This measures the value of the rupiah against the appropriate foreign currency in which imports are occurring. For live cattle imports, this is the Australian dollar.

The next set of exogenous variables refers to various processing and trade margins on cattle and beef. The model allows for separate processing margins on each of the two types of beef — from native fattened cattle, *nfatc*, and from fattened cattle from live imports, *ifatc* — going to each of the three retail outlets and a separate processing margin for exports. For example, to simulate the effects of a 5% improvement in the efficiency of all beef-processing facilities, *proc-marg*(*b*,1) for the two types of beef and the three retail outlets is set to –5.

Database Reads and Share Coefficients

Box 6.8 lists the model parameters and database components and the calculation of share coefficients that are used in the models' equations (see Box 6.9).

Model parameters refer to specific elasticities. These are obtained from econometric estimates (where available) and from estimates based on a specialist knowledge of how the Indonesian beef industry operates. Values for model parameters are drawn from the results of econometric studies listed in Appendix A.

In addition to model parameters, the equations require a number of share or data coefficients. These are compiled from the model's input–output database in Tables 6.1, 6.2 and 6.3.

Model Parameters

The first set of parameters in Box 6.8 is the substitution elasticities between native feeder cattle and imported feeder cattle purchased by the partnership fattener and feedlot industries, *SigmaI*(*j*). A high value assigned to these parameters would indicate that the purchasing industries are largely indifferent to the source of cattle. A low value would indicate that purchasers regard the two sources of cattle as having quite different attributes.

Next is the elasticity of substitution between capital/land and labour in each industry, *SigmaP*(*j*). A high elasticity denotes high flexibility in production and the ability to respond quickly to changes in opportunities (high output supply elasticity). The feedlot industry is far more flexible than the smallholder industries. Next is the transformation elasticity, *SigmaJ*(*j*), between commodities in those industries that have the potential to produce more than one commodity (see Table 6.2). A high value indicates considerable scope to switch the mix of products in response to changes in relative profitability.

Next is the expenditure elasticity of Indonesian consumers for the retail level commodities, beef and other meats, *eps*(*i*).

The next parameter, *SigmaB*(1), refers to substitution prospects between the three types of beef at each retail outlet (refer to Figure 6.2). A high elasticity indicates that consumers at each retail outlet are largely indifferent to the source of beef (native beef, beef from imported live cattle, imported beef). The next parameter, *SigmaR*, refers to the substitution prospects of retail demand between each type of meat (beef, competing meats).

The final parameter in Box 6.8, *tau*(*b*), represents the export demand elasticity for Indonesia's beef exports for each type of beef (beef from native cattle, beef from imported live cattle). Since Indonesia's beef exports are far too small to influence the world price, the export demand elasticity is set to a high number.

The remaining entries in Box 6.8 refer to coefficients constructed from the model's database. Most of these refer to various row and column costs and sales shares computed from each of the model's tables of data.

Box 6.9 sets out the calculation of the various share coefficients that appear in model equations. Conversion of underlying equations in nonlinear form to linear equations in percentage changes results in a large number of share coefficients. The shares are calculated from the model's database.

7 Survey Methodology and Value Chain Results

The quantitative framework for our study is based on the live cattle–beef value chain in Indonesia. The chain contains the key components of cattle breeding, smallholder fattening, commercial feedlots, imported live cattle, processing, imports of beef and wholesaling and retailing. It describes the flow of product from one component to the other, and how the value of the product is enhanced through value-adding activities at each stage.

Each stage in the chain involves its own set of specific issues. At the smallholder level, for example, technical productivity of cattle production is extremely low. The reasons for this need to be identified and addressed. One important reason is the very low fertility achieved from breeding cattle on smallholder properties. The returns to smallholders are also reduced by the often high costs of transporting feeder cattle. The quantitative importance of the transport issue for smallholders needs to be established because it affects the competitiveness of domestic feeder cattle relative to live cattle imported into corporate feedlots.

At the company feedlot level, the key issue in technical and economic efficiency revolves around feed supply use. Small changes in the efficiency of feed use can lead to big changes in the profitability of feedlot operations, which, in turn, affects the demand for live cattle imports and the demand for boxed beef. Feed supply costs and rates of use are key components of the economic production relationships in the framework at this point in the chain. Lot feeding of beef cattle provides a convenient way of using roughage and waste product from plantation agriculture (e.g. waste products from the pineapple canning factory in Lampung). For lot feeeding to be economic, feedlots need to be located as close as possible to the source of the waste products.

A large component of the cost of feedlot beef production is the imported live cattle cost. Quarantine issues are important in determining this cost. To the extent that quarantine procedures can be streamlined, the cost of live cattle imports to the feedlot will be reduced, in turn raising the profitability of feedlot beef. The scope for reducing production costs through more efficient quarantine procedures is an important issue for analysis at this stage of the chain.

An important requirement for an efficient livestock–beef production, processing and marketing system is that strong and efficient market signals are passed back through the chain to all participants. If distortions in the system are introduced through poor government policies there is the potential to run down the domestic breeder herd and increase Indonesia's reliance on imported live cattle and beef.

Target Groups and Survey Locations

The field survey work encompasses consumer demand for beef, processing performance, marketing of live cattle and beef, smallholder and commercial production, and research and development (R&D) and policy issues, which are addressed through various government institutes. Data on the demand for beef — differentiated as fresh, chilled or frozen — were collected through interviews with supermarket managers, beef wholesalers and beef retailers in wet markets and meat shops. Data on the processing system were collected through interviews with the managers or owners of the government-owned abattoirs, privately owned abattoirs and private slaughter places. Data on the marketing system were obtained through interviews with cattle producers (smallholders and feedlots), cattle traders (village traders, subdistrict traders, interprovincial traders and importers), shipping companies (sea and land transport) and the Office of Quarantine.

Data on the production system were gathered through interviews with producers, including partnership smallholders (fattening), non-partnership smallholders (fattening), non-partnership smallholders (breeding/grazing) and feedlots. Additional information on policy, R&D and other performance issues was obtained through interviews with government officials in the relevant Indonesian institutes and with experts in the corporate feedlot sector.

Table 7.1 sets the dimensions of the field survey work at various points in the cattle–beef value chain. Table 7.2 shows the types of data collected and their source.

Survey Results

Information collected in the surveys has enabled us to construct a detailed quantitative picture of the structure of the value chain for beef in Indonesia. Some key results are set out in Appendix B. Figures 7.1 and 7.2 summarise the key features of the value chain. They reveal distinct differences between chains for domestic feeder cattle, imported feeder cattle and imported beef. A feature of the domestic feeder cattle chain is the very high share of trader margins in the final value of product. Figure 7.3 highlights the distinct differences in the composition of products passing through wet markets and supermarkets. In particular, supermarkets are much more reliant on sales of imported beef.

Table 7.1. Locations and sample size of field survey.

Type of sample	Lampung	Jakarta	West Java	Middle Java[a]	East Java	West Nusa-tenggara	South Sulawesi	Total
Production								
Smallholder								
Partnership (fattening)	10	0	0	0	0	0	0	10
Non-partnership (fattening)	0	0	5	10	10	10	10	45
Non-partnership (breeding)	0	0	5	10	10	10	10	45
Subtotal	10	0	10	20	20	20	20	100
Company (feedlot)	2	0	2	0	2	0	2	8
Total production	12	0	12	20	22	20	22	108
Marketing								
Live cattle								
Village trader	5	0	2	5	5	5	5	27
Subdistrict trader	3	0	0	3	3	3	3	15
Interprovincial trader	2	2	2	2	2	2	2	14
Subtotal	10	2	4	10	10	10	10	56
Beef								
Beef wholesaler	1	1	1	1	1	1	1	7
Beef retail outlets								
Supermarkets	3	10	3	3	3	2	2	26
Wet markets	5	10	5	5	5	5	5	40
Meat shops	2	2	2	2	2	2	2	14
Subtotal	11	22	11	11	11	10	10	86
Total marketing	21	24	15	21	21	20	20	142
Shipping company								
Sea transportation	1	0	0	0	0	1	1	3
Land transportation	1	1	1	1	1	1	1	7
Total	2	1	1	1	1	2	2	10
Processing								
Government abattoir								
Type A (large)	0	1	1	1	1	0	0	4
Type B (medium)	1	1	1	1	1	1	1	7
Type C (small)	1	0	1	1	1	1	1	6
Private abattoir	1	0	1	1	1	1	1	6
Private slaughter	1	0	2	1	2	2	2	10
Total processing	4	2	6	5	6	5	5	33
Government office								
DG of Livestock Services	0	1	0	0	0	0	0	1
Office of Livestock Services	2	2	2	2	2	2	2	14
Animal quarantine	1	1	0	1	1	1	1	6
Office of Transport Service	1	1	1	1		1	1	7
Total government office	4	5	3	4	4	4	4	28
Total of all samples	45	32	37	51	54	51	53	323

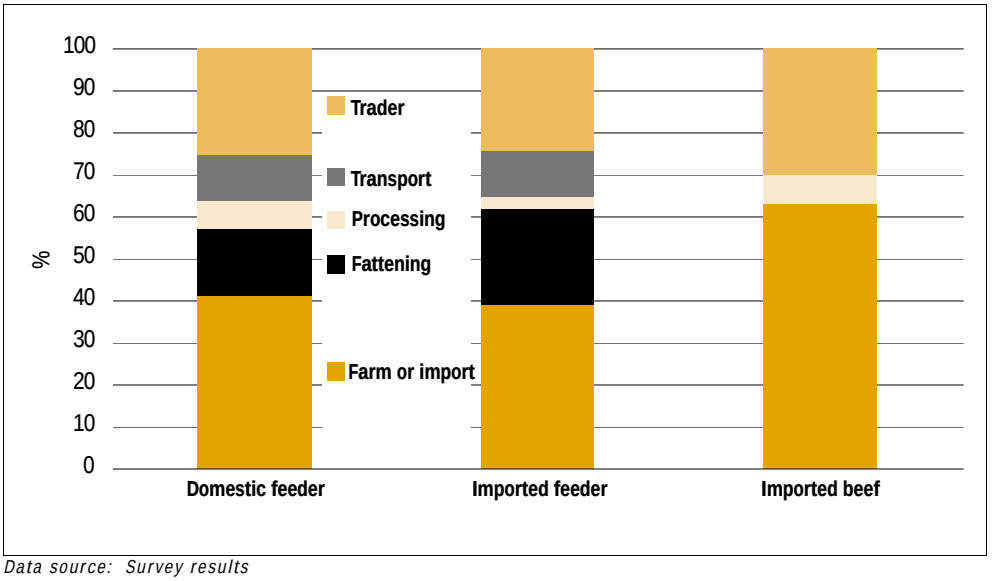
[a] *Including Yogyakarta Province*

Table 7.2. Type of basic data for collection.

Aspect	Type of data	Source of data
Household consumption	SUSENAS data Beef and other meat consumption Beef and other meat expenditure Total consumption expenditure National Food Balance Sheet	Central Agency for Statistics
Production	Cattle holding size Production quantity and price Input quantity and price Producer's profit Social aspects Other qualitative aspects	Interviews with cattle producers (smallholder and company) sample
Marketing	Marketing size Purchasing and selling price Marketing costs/margins Trader's profit Qualitative aspects	Interviews with cattle trader sample (at various levels) and meat trader sample (at various levels)
International trade	Import and export quantity Import and export price Costs of import etc. Selling price Importer's profit Qualitative aspects	Interviews with managers of live cattle or beef importing company sample
Shipping company	Number of fleet (ship, truck) Revenue from transport service Service costs Company's profit Qualitative aspects	Interviews with managers of shipping company sample
Processing	Number of cattle slaughtered Processing technology and capacity Revenues from slaughter service Total costs Break-even point quantity of cattle Qualitative aspects	Interviews with managers of abattoir and slaughter managers sample (at various levels)
Government office	Production policy Marketing/trade policy Quarantine cost and policy Processing policy Shipping policy Research and development policy	Interviews with government officials from related office

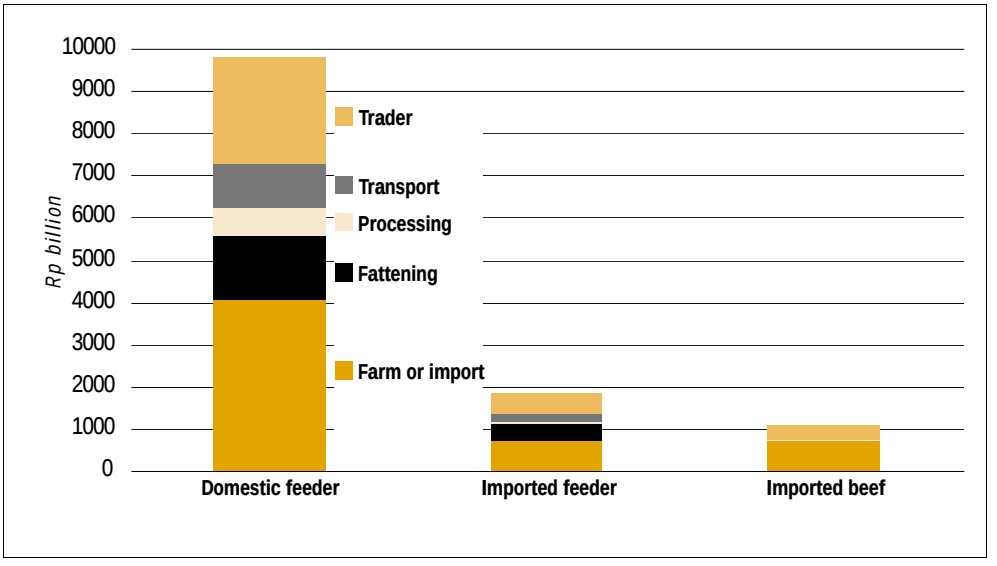
SUSENAS = National Social and Economic Survey (Indonesia)

Figure 7.1. Value chain differences with different types of cattle.



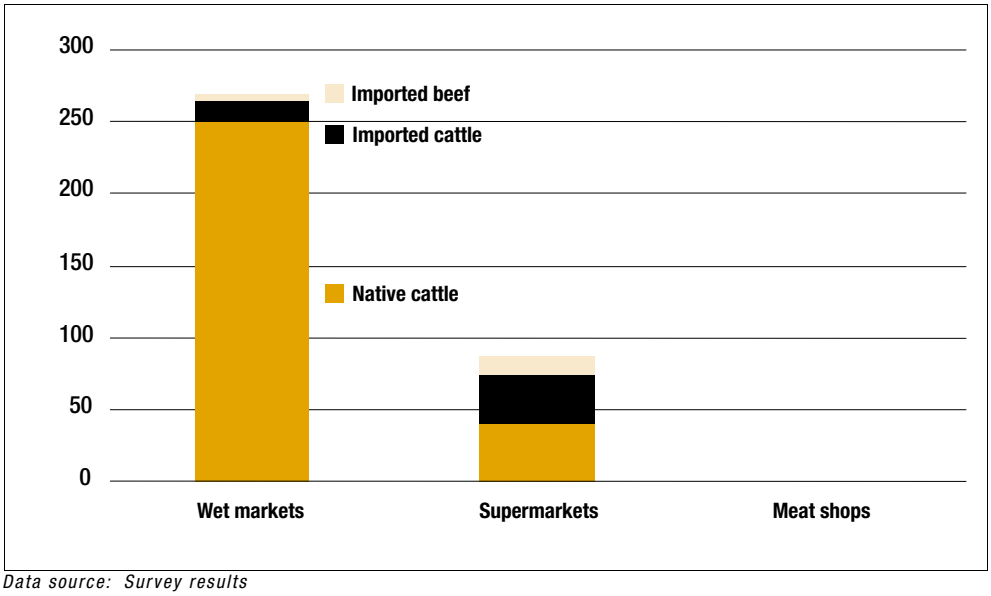
Data source: Survey results

Figure 7.2. Trader margins.



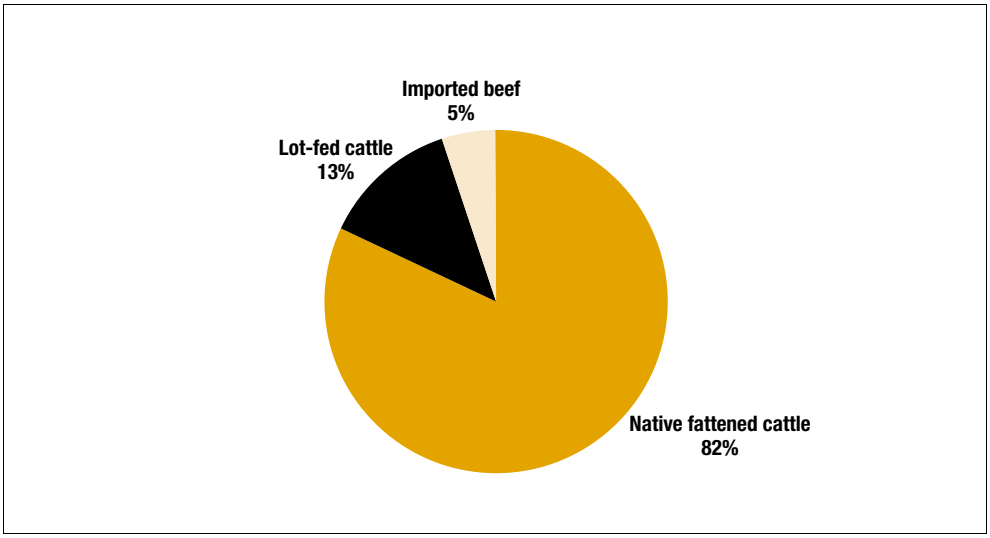
Data source: Survey results

Figure 7.3. Market share of imported beef by different outlets.



Data source: Survey results

Figure 7.4. Source of beef in Indonesia



Data source: Survey results

Figure 7.4 shows that native cattle still dominate Indonesia's beef production. Policies that efficiently and effectively increase the productivity of native cattle breeding and fattening are likely to have a significant impact on Indonesia's beef production.

8 Analysis of Some Key Issues

The Indonesia beef model has been designed to help analysts work their way through the likely impacts of a wide range of beef industry development and policy issues. The model's capacity to do this comes from its:

- strong emphasis on detail at each segment in the cattle–beef value chain (farm, feedlots, processing and market segments);
- incorporation of the links between segments and trade links (principally through imports of live cattle and beef) between Indonesia and the rest of the world; and
- specification of the responses of farmers, feedlot operators, processors and consumers to changes in their incentives to produce and consume beef that come about through changes in economic conditions and policy instruments.

We use the model to analyse the impacts of a range of policy and other changes, including:

- increases in tariffs on imported live cattle and beef;
- an increase in the retribution charge on marketed live cattle;
- improvements in beef cattle processing efficiency;
- improvements in the technical efficiency of smallholder production (both breeding and fattening);
- reduction in live cattle selling costs;
- appreciation of the rupiah; and
- a decrease in the price of imported chicken and an increase in the price of fish.

The results of the simulations are shown in Tables 8.1 and 8.2.

Table 8.1. Selected results for simulations (results expressed as percentage change from baseline).

			Self-sufficiency									
		Base 2001	Imported beef only (%)	Live cattle plus imported beef (%)	10% appreciation (%)	Increase retribution charge on live cattle (%)	Improve efficiency of beef processing (%)	Improve efficiency of smallholder fattening (%)	Reduce costs of marketing native cattle (%)	Increase in live cattle selling price from Australia (%)	Fall in price of chicken and fish (%)	Improve efficiency of smallholder breedings (%)
Beef demand at retail level												
Total retail quantity	kt	356	–6.9	–15.4	2.8	–0.1	0.3	0.3	0.0	–1.3	–8.0	16.1
Average retail price	Rp/kg	20,898	4.3	10.4	–1.6	0.0	–0.2	–0.2	0.0	0.8	–10.5	–8.7
Total expenditure	Rp billion	7442	–2.9	–6.6	1.1	0.0	0.1	0.1	0.0	–0.5	–17.7	6.0
Demands by outlet												
Wet markets												
- native	kt pw	251	–4.2	–10.4	1.3	0.0	0.0	0.3	–0.3	–0.5	–5.9	19.1
- lot-fed	kt pw	14	–5.6	–57.4	18.3	–0.8	2.6	–0.6	4.6	–17.9	–24.6	–13.6
- imported	kt pw	4	–99.0	–99.1	31.6	0.1	5.0	–0.7	2.5	1.5	–53.4	–33.3
Supermarkets												
- native	kt pw	41	28.3	45.3	–8.6	0.1	0.8	0.7	8.2	3.3	8.0	37.8
- lot-fed	kt pw	33	26.9	–18.3	3.2	–0.4	0.9	0.0	–5.3	–11.0	–8.3	8.3
- imported	kt pw	14	–99.0	–99.0	23.9	0.2	–1.8	–0.1	–6.8	4.8	–36.1	–11.2
Meat shops												
- native	kt pw	0.3	–6.9	–15.4	2.8	–0.1	0.3	0.3	0.0	–1.3	–8.0	16.1
- lot-fed	kt pw	0.0	–11.2	–71.1	28.4	–1.1	0	–0.6	–8.5	–24.2	–8.0	–3.3
Outputs												
Native feeder cattle	kt cwe	292	0.3	3.8	–0.2	0.0	0.1	0.4	0.9	0.1	–4.0	42.2
Native fattened cattle	kt cwe	292	0.3	–2.7	–0.1	0.0	0.1	0.4	0.9	0.1	–4.0	21.7
Lot-fed beef	kt cwe	47	17.2	–30.0	7.7	–0.5	1.4	–0.2	–2.3	–13.1	–13.2	1.8
Import volumes												
Imported feeder cattle	kt pw	277	17.3	–55.3	8.2	–0.5	1.4	–0.2	–2.3	–13.1	–13.2	–69.3
Imported beef	kt pw	18	–99.0	–99.0	25.1	0.2	–0.7	–0.2	–5.3	4.3	–38.9	–14.8

Table 8.1. Selected results for simulations (results expressed as percentage change from baseline) (cont'd).

			Self-sufficiency									
		Base 2001	Imported beef only (%)	Live cattle plus imported beef (%)	10% appreciation (%)	Increase retribution charge on live cattle (%)	Improve efficiency of beef processing (%)	Improve efficiency of smallholder fattening (%)	Reduce costs of marketing native cattle (%)	Increase in live cattle selling price from Australia (%)	Fall in price of chicken and fish (%)	Improve efficiency of smallholder breedings (%)
Import prices												
Imported feeder cattle	Rp '000 per head	2574	0.0	100.0	–10.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0
Imported beef	Rp/kg	39,931	194.2	238.3	–10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tariff rate												
Imported feeder cattle	%	0.0	0	100	0	0	0	0	0	0	0	0
Imported beef	%	5.0	209	255	5	5	5	5	5	5	5	5
Farm prices												
Native feeder cattle	Rp/kg cwe	13,925	1.3	22.2	–0.9	0.0	0.7	2.0	4.6	0.3	–17.5	–48.2
Native fattened cattle	Rp/kg cwe	19,230	2.3	9.1	–1.2	0.0	1.2	–0.4	10.0	0.6	–21.3	–18.4
Lot-fed beef	Rp/kg cwe	24,175	2.2	28.9	–5.0	0.2	0.3	0.0	–0.6	5.7	–11.8	–6.7
Value-added												
Small holder breeders	Rp billion	2986	2.0	35.2	–1.4	0.0	1.0	3.2	7.3	0.5	–27.0	–33.4
Small holder fatteners	Rp billion	975	8.4	–42.1	–3.1	0.1	4.2	14.2	39.1	2.5	–51.7	137.3
Feedlots	Rp billion	211	31.3	–136.0	15.0	–1.1	2.9	–0.4	–5.0	–45.2	–68.8	3.8
Total	Rp billion	4172	5.0	8.5	–1.0	0.0	1.9	5.6	14.1	–1.4	–34.9	8.4

cwe = carcass weight equivalent; kt = kilotonnes; pw = product weight; Rp = rupiah
Source: Indonesia beef model

Table 8.2. Selected results for simulations (results expressed as change from baseline).

			Self-sufficiency									
		Base 2001	Imported beef only (%)	Live cattle plus imported beef (%)	10% appreciation (%)	Increase retribution charge on live cattle (%)	Improve efficiency of beef processing (%)	Improve efficiency of smallholder fattening (%)	Reduce costs of marketing native cattle (%)	Increase in live cattle selling price from Australia (%)	Fall in price of chicken and fish (%)	Improve efficiency of smallholder breedings (%)
Beef demand at retail level												
Total retail quantity	kt	356	–24.5	–54.9	10.0	–0.2	0.9	1.0	0.1	–4.8	–28.6	57.4
Average retail price	Rp/kg	20,898	900.6	21,65.9	–341.8	6.8	–32.6	–33.9	–5.0	167.9	–2200.5	–1828.2
Total expenditure	Rp billion	7442	–213.1	–494.7	83.2	–1.7	7.9	8.2	1.2	–40.5	–1318.1	443.2
Demands by outlet												
Wet markets												
- native	kt pw	251	–10.7	–26.2	3.2	0.0	0.0	0.9	–0.7	–1.2	–14.9	47.9
- lot-fed	kt pw	14	–0.8	–8.1	2.6	–0.1	0.4	–0.1	0.7	–2.5	–3.5	–1.9
- imported	kt pw	4	–3.5	–3.5	1.1	0.0	0.2	0.0	0.1	0.1	–1.9	–1.2
Supermarkets												
- native	kt pw	41	11.5	18.3	–3.5	0.1	0.3	0.3	3.3	1.3	3.2	15.3
- lot-fed	kt pw	33	8.8	–6.0	1.1	–0.1	0.3	0.0	–1.7	–3.6	–2.7	2.7
- imported	kt pw	14	–13.9	–13.9	3.3	0.0	–0.3	0.0	–1.0	0.7	–5.1	–1.6
Meat shops												
- native	kt pw	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
- lot-fed	kt pw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outputs												
Native feeder cattle	kt cwe	292	0.7	11.2	–0.5	0.0	0.4	1.2	2.6	0.2	–11.7	123.2
Native fattened cattle	kt cwe	292	0.8	–7.9	–0.3	0.0	0.4	1.2	2.6	0.2	–11.7	63.2
Lot-fed beef	kt cwe	47	8.1	–14.1	3.6	–0.3	0.7	–0.1	–1.1	–6.1	–6.2	0.8
Import volumes												
Imported feeder cattle	kt pw	277	47.8	–153.3	22.8	–1.5	4.0	–0.6	–6.5	–36.2	–36.6	–192.0
Imported beef	kt pw	18	–17.3	–17.3	4.4	0.0	–0.1	0.0	–0.9	0.8	–6.8	–2.6

Table 8.2 . Selected results for simulations (results expressed as change from baseline) (cont'd).

			Self-sufficiency									
		Base 2001	Imported beef only (%)	Live cattle plus imported beef (%)	10% appreciation (%)	Increase retribution charge on live cattle (%)	Improve efficiency of beef processing (%)	Improve efficiency of smallholder fattening (%)	Reduce costs of marketing native cattle (%)	Increase in live cattle selling price from Australia (%)	Fall in price of chicken and fish (%)	Improve efficiency of smallholder breedings (%)
Import prices												
Imported feeder cattle	Rp '000 per head	2574	0.0	2574.4	–257.4	0.0	0.0	0.0	0.0	514.9	0.0	0.0
Imported beef	Rp/kg	39,931	77,560.7	95,154.3	–3993.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tariff rate												
Imported feeder cattle	%	0.0	0	100	0	0	0	0	0	0	0	0
Imported beef	%	5.0	204	250	0	0	0	0	0	0	0	0
Farm prices												
Native feeder cattle	Rp/kg cwe	13,925	177.8	3096.5	–124.9	1.8	93.2	283.5	646.6	42.9	–2442.6	–6716.2
Native fattened cattle	Rp/kg cwe	19,230	450.4	1742.7	–223.9	5.1	230.3	–70.5	1913.7	123.9	–4102.3	–3529.1
Lot-fed beef	Rp/kg cwe	24,175	542.7	6988.7	–1216.5	53.5	65.4	–7.3	–133.9	1386.0	–2845.0	–1626.7
Value-added												
Smallholder breeders	Rp billion	2986	59.5	1051.7	–41.8	0.6	31.2	95.0	217.0	14.3	–806.2	–997.1
Smallholder fatteners	Rp billion	975	82.0	–410.2	–29.8	1.0	41.3	139.0	380.9	24.4	–504.6	1339.4
Feedlots	Rp billion	211	66.2	–287.5	31.7	–2.4	6.2	–0.9	–10.6	–95.6	–145.4	7.9
Total	Rp billion	4172	207.7	354.0	–39.8	–0.8	78.7	233.0	587.3	–56.8	-1456.3	350.2

cwe = carcass weight equivalent; kt = kilotonnes; pw = product weight; Rp = rupiah
Source: Indonesia beef model

Increase in Tariffs to Achieve Beef Self-sufficiency

Tariffs act as a tax on imports, allowing domestic producers of beef to increase their prices and profits. However, this means that domestic consumers have to pay more for beef and thus have less money to spend on other goods and services. While output, employment and profits in the activity protected by tariffs on imports all increase, the outputs, employment and profits in many other industries are reduced. Thus, the net outcome of tariffs is invariably a less efficient allocation of productive resources across activities in the economy and a reduced capacity for the economy to deliver gains in national income and living standards.

Despite these well-established findings on the effects of tariff barriers, there is always some support in some countries for tariff barriers to increase domestic self-sufficiency in a particular industry. Here we use the model to determine the size of tariff that would be needed on beef imports for Indonesia to become self-sufficient in beef production. First, we look at the size of the tariff on imported beef needed if live cattle for feedlots continue to be allowed entry duty free. Imports of feeder cattle currently account for between 20 and 25% of Indonesia's beef production; therefore, beef self-sufficiency can be achieved at a lower tariff than if live cattle importation was prevented. Live cattle imports (mostly feeder cattle) by Indonesia in 2001 totalled 251,850 head at an average liveweight of 277 kilograms per head. At the average exchange rate for 2001 of 10,368 Rp per US dollar, this works out at an average landed price of US$0.99 per kilogram liveweight (US$279.80 per animal). Total expenditure on imported feeder cattle was US$68.8 million. We then look at the tariff needed to achieve beef self-sufficiency if the importation of live feeder cattle is not permitted.

Tariff needed to achieve beef self-sufficiency (live cattle imports allowed)

The results in the column headed 'Imported beef only' of Table 8.1 show that a tariff of 209% would be needed to eliminate beef imports. This would cause the following outcomes:

- the price of imported beef would increase by 194%;
- beef consumers would switch to domestically produced beef, raising its price;
- the average retail price of beef (domestic and imported) would increase by 4.3% (the increase is small because imported beef accounts for only 5.7% by value of consumer expenditure on beef, and there is a mark-up of 240% between the CIF (cost, insurance and freight) import value and retail value of imported beef);
- beef consumption would fall by 6.9% as consumers switch to other meats;

- the increase in producer prices would stimulate more domestic beef production (however, the scope of smallholder producers to expand their production is very limited, so the large expansion in production (17%) would occur through the commercial feedlot sector, through a 17% increase in the imports of feeder cattle); and
- value added (farm income) would increase by 2% (smallholder breeders), 8% (smallholder fatteners) and 31% (commercial feedlots).

Overall, the major winner would be the commercial feedlot sector, and the major loser would be the Indonesian beef consumer.

Tariff needed to achieve self-sufficiency in both beef and cattle requirements

The results in the column headed 'Live cattle plus imported beef' of Table 8.1 address this issue. Under current production technology and efficiency, the only way Indonesia can rapidly expand its domestic beef production is through the importation of live cattle by the commercial feedlot sector. Supply conditions are not sufficiently flexible in the native cattle breeding and fattening activities to allow for a significant production expansion.

Putting a tariff on both imported live cattle and imported beef is not a sensible approach to achieving beef self-sufficiency. A tariff on imported beef would put pressure on domestic producers to expand their production to satisfy consumer demand previously met by imports. However, producers cannot expand fast enough unless they are allowed to import feeder cattle, an option that is closed off because of the tariff on such imports. In this situation, the only adjustment that can match consumer demand for beef with domestic beef production is a substantial rise in the domestic price of beef, to force consumers to switch their demand to other meats. The results presented in Table 8.1 show that:

- a tariff of 255% on imported beef and 100% on imported cattle would eliminate beef imports and reduce imports of feeder cattle by 55%, resulting in a 15% reduction in beef consumption (a reduction of 55 kilotonnes) and a 10% increase in the retail price of beef;
- farm prices for native feeder cattle would increase by 22%;
- the commercial feedlot sector would suffer a 30% reduction in its production;
- farm incomes of smallholder fatteners would fall by 42% because of the big increase in native feeder cattle prices and the falling demand for beef; and
- the feedlot sector's profitability would be destroyed (a loss of 287 million Rp in value added).

Key points

Achieving self-sufficiency in beef without relying on imported feeder cattle is not feasible given the current industry structure and performance. Pursuing this option would:

- destroy the commercial feedlot sector;
- cause a big reduction in beef consumption; and
- dramatically reduce incomes of smallholder fatteners.

Increasing the Retribution Charge on Marketed Live Cattle

Several years ago, the Indonesian provinces were given considerable regional autonomy. One adverse aspect of this for the beef industry is that provincial governments now collect charges on cattle passing through their province. These retribution charges currently range from 10,000 Rp to 15,000 Rp per head. It is expected that they will be increased to 20,000–25,000 Rp per head in the near future.

Survey results show that, in 2001, the feedlot sector paid retribution charges of 2504 million Rp, equivalent to 0.2% of the value of feedlot production. We simulated the effects of increasing the retribution charge from 10,000 Rp to 25,000 Rp per head, which would represent an additional tax of 0.5% of the value of production of the feedlot sector.

Results are set out in the column headed 'Increase retribution charge on live cattle' of Table 8.1. The main points are that:

- the increase in retribution charges adds a little to feedlot costs, reducing feedlot production by 0.5% and feedlot value added by 1.1%;
- imports of live cattle are reduced by 0.5%;
- the higher cost of domestic beef causes a slight reduction in international competitiveness of beef producers, imports of beef expand by 0.2% and consumption of beef declines marginally (0.1%);
- a higher retribution charge disadvantages the commercial feedlot sector; and
- domestic beef production falls slightly and beef imports increase slightly.

The figures given are national average effects; the impacts may be bigger or smaller in individual regions.

Improving the Efficiency of Beef Processing

Most slaughterhouses in Indonesia are inefficient due to obsolete equipment. In some regions, such as Jakarta, slaughter costs per animal are high because the number of cattle being slaughtered at the abattoir is well below full capacity.

We simulated the effects on the beef industry of a 10% improvement in the efficiency of processing beef, achieved by reducing the processing margin by 10%. The model's data show that the value of beef cattle produced in Indonesia in 2001 (ex farm and feedlot) is 10,805,121 million Rp. Processing margins, transport margins and trader margins are incurred to transform these cattle into retail sales value. Processing margins represent about 9.5% of the farm value of cattle. A 10% reduction in processing margins on cattle to be slaughtered represents a saving of 102,515 million Rp.

Some of this saving is passed forward to beef consumers in the form of lower retail prices at wet markets, supermarkets and meat shops. Some of the saving is also passed back to cattle producers in the form of higher producer prices.

Results are shown in the column headed 'Improve efficiency of beef processing' of Table 8.1. The main points are that:

- retail prices for beef decrease (by 0.2%) and consumption increases (by 0.3%) as domestic processing costs are reduced by increased processing efficiency (this is advantageous to beef consumers);
- domestic beef becomes cheaper relative to imported beef (with a 0.7% decline in beef imports);
- cattle producers gain through higher farm prices for fattened cattle (an increase of 1.2% for native fattened cattle, 0.3% for lot-fed cattle and 0.7% for native feeder cattle); and
- beef producer incomes increase by 1.9%, with the largest gain (4.2%) accruing to smallholder fatteners.

Key points

Lower beef processing costs mean:

- lower prices to consumers, leading to increased beef consumption; and
- higher cattle prices to producers, leading to increased farm incomes.

Improving Technical Efficiency (Smallholder Fattening)

A key determinant of the efficiency of fattening cattle is the average daily weight gain (ADWG). There has been a tendency of smallholder fatteners and live cattle traders to prefer crossbred cattle (which have an ADWG of 0.75 kilograms) to purebred cattle (ADWG of 0.50 kilograms). The improved technical efficiency can be achieved through crossbreeding female native cattle with simmental, limousine or charolais semen using artificial insemination.

We simulated the impact on Indonesia's beef industry of a 50% improvement in ADWG by reducing the amount of forage and concentrate needed per unit of output of fattened cattle by 50%. In 2001, of the 1.75 million cattle fattened for slaughter, 85% were fattened by non-partnership fattener activity using native feeder cattle. Fattening of native feeder cattle by the non-partnership sector accounts for virtually all of Indonesia's native feeder cattle.

The input–output cost structure for non-partnership fattening of native feeder cattle shows that feed costs account for 8.5% of the ex-farm value of fattened cattle of the non-partnership sector. A 50% increase in ADWG would reduce the costs of non-partnership fattening by 237,657 million Rp (2001 figures).

Results of this analysis are shown in the column headed 'Improve efficiency of smallholder fattening' of Table 8.1. The main points are that:

- a 50% improvement in daily weight gain would have a small positive effect on the output of native fattened cattle (0.4% increase in production) and hence a similar effect on the demand for native cattle (output expansion is small because of the low supply elasticity of native cattle production);
- the effect on farm income of the smallholder fattening sector is much larger (gain of 14.2%) because of the high share of feed costs in the value of output of fattened cattle;
- smallholder breeders also share in the income gain through being able to charge a higher price for their cattle (price increase of 2% and income increase of 3.2%); and
- the increase in daily weight gain makes domestic beef production more competitive against imported beef (however, because of the low supply elasticity of native fattened cattle production and a small stimulus to total beef consumption through lower retail beef prices, the fall in beef imports and imports of live feeder cattle is only 0.2%).

Key points

Improved efficiency of smallholder fattening means:

- a boost to smallholder incomes;
- a small increase in beef production; and
- income gains for smallholder native breeders.

Improving Technical Efficiency (Smallholder Breeding)

The very low elasticity of supply of domestic breeder cattle is a major constraint on the industry's future development. Big improvements in breeding efficiency are needed for domestic production to match the likely growth in demand for beef. Without these improvements, Indonesia will become ever more reliant on imported live cattle and imported beef.

The results in the column headed 'Improve efficiency of smallholder breeding' show the effects of an assumed 50% increase in the efficiency of smallholder breeding. The projected outcome is a 42% increase in the output of native breeder cattle. As a result, the farm gate price of native feeder cattle drops substantially, providing a big stimulus to the output and incomes of smallholder fatteners. The quantity of beef consumed increases by 16% and there is a big switch in consumption toward beef from native feeder cattle, and away from imported beef and beef from imported live cattle. Indonesia's self-sufficiency in beef production increases markedly. The total value added of the smallholder breeder sector falls — the reduction in farm gate price for native feeder cattle more than outweighs the increase in the volume of native feeder cattle production. The gains from the productivity improvement are passed forward to smallholder fatteners and to consumers.

Key points

An improvement in native breeder efficiency means:

- higher incomes for smallholder fatteners;
- higher beef self-sufficiency for Indonesia, with reduced demand for live cattle and beef imports; and
- lower beef prices to consumers, leading to increased beef consumption.

Reducing the Costs of Marketing Cattle

Live cattle fattened for slaughter by traditional smallholders have to pass through a complex and inefficient marketing chain, incurring transport costs and marketing costs.

Transport costs are expected to increase in 2002 because of a 20% increase in the price of fuel (from 1450 Rp per litre in 2001 to 1750 Rp per litre in 2002.) In 2001, the ex-farm value of fattened cattle consigned to slaughter from traditional smallholder non-partnership fatteners was 5,601,638 million Rp. The transport margin on these cattle was 1,045,735 million Rp (18.7% of the ex-farm value). A 20% increase in the transport margin represents additional costs between producer and consumer of 209,147 million Rp. Non-partnership fatteners accounted for 83% by value of fattened cattle produced in Indonesia.

Offsetting this increase in transport costs, there is considerable scope for reducing marketing costs through increased efficiencies. At present, domestic cattle from traditional smallholders pass through a complex and imprecise marketing chain to slaughter and sale. A number of trader operations may be involved — village trader, subdistrict trade, inter-regional trader.

Marketing costs for cattle sold by traditional smallholder non-partnership fatteners came to 2,483,632 million Rp in 2001. This represents a mark-up of 44% over the ex-farm value. The marketing margin could be reduced if farmers were to sell their cattle directly to the local cattle marketplace rather than through a village broker (village collector). The marketing fee of 2500 Rp per head currently paid to the village broker would go back to the farmer. On annual production of 1.498 million cattle, this represents a saving of 3745 million Rp.

The efficiency of the pricing mechanism could also be improved, by adopting an exact weighing system to replace the old guess-weighing system. It is anticipated that savings of around 10% of the producer selling price could be achieved through this improvement. A saving of 10% of the producer selling value of 5,601,368 million Rp represents 560,127 million Rp. The total saving in marketing margin comes to 563,882 million Rp, which represents a 22.7% reduction in the current trader margin on native cattle.

Results of this analysis are shown in the column headed 'Reduce costs of marketing native cattle' of Table 8.1. The main points are that:

- because the current marketing margin is high, the reduction causes a substantial (10%) increase in the farm price of native fattened cattle, some of which is passed back as higher prices to native cattle breeders (price increase of 4.6%), resulting in a big boost to the incomes of smallholder fatteners (income gain of 39.1%) and to native cattle breeders (gain of 7.3%);

- commercial feedlot operators are disadvantaged because they do not participate in these cost savings, so production in the feedlot sector falls (by 2.3%) and feedlot value added falls (by 5%);
- all the gains are captured by smallholder fatteners and breeders; and
- there is no change in beef retail prices and consumption.

Key points

A reduction in costs of marketing native cattle:

- provides a big boost to the incomes of smallholder fatteners;
- provides a significant flow-on effect to smallholder breeders; and
- disadvantages commercial feedlots.

An Appreciation of the Rupiah

Currency fluctuations are a big problem for Indonesia's beef industry. A depreciation of the rupiah raises the cost of importing live cattle and reduces the profitability of commercial feedlots. It also raises the cost of importing beef and helps the international competitiveness of the smallholder native cattle breeding and fattening industries.

To the extent that the Indonesian economy improves its efficiency and productivity through economic growth, the rupiah is likely to appreciate against foreign currencies such as the Australian dollar and the US dollar. The column headed '10% appreciation' of Table 8.1 shows the effects of a 10% appreciation of the rupiah. The main points are that:

- import prices for feeder cattle and for imported beef fall by 10%, encouraging increased imports of beef (up by 25%) and feeder cattle (up by 8%); and
- retail beef prices reduce by 1.6%, leading to an expansion in total expenditure on beef of 1.1%.

The feedlot sector is the major winner at sector level. Expenditure on live cattle imports accounts for 63% of the value of fattened cattle production at the feedlot. Therefore, cheaper live cattle imports and a flexible production system mean that commercial feedlot production expands by 7.7% and income (value added) by 15%.

Smallholder producers are slightly adversely affected by the currency appreciation. The price they get for their beef falls by 1.2% because of cheaper imports, and, unlike the commercial feedlots, smallholders do not get the big cost advantage through a reduction in the cost of feeder cattle.

Key points

Currency appreciation:

- stimulates production and profits of commercial feedlot operators; and
- reduces production and profitability of smallholder producers.

Increase in Live Cattle Selling Price from Australia

At present, Indonesia's commercial feedlots are totally dependent for their feeder cattle on live cattle imports from northern Australia. No other country in the region has the capacity to produce long lines of young foot-and-mouth disease free *Bos indicus* cattle at the correct specification for entry into the feedlots. Significant links have now been established between Indonesian feedlot operators and northern Australian pastoralists to ensure a steady flow of live cattle of the correct specification from Australia.

However, the Australian price of live cattle depends on a number of factors, only one of which is the demand by Indonesian feedlots for those cattle. Other countries in south Asia, in particular the Philippines, Malaysia and Brunei, also purchase significant numbers of live cattle from Australia at various times. Also, the Middle East, particularly Egypt, has at times been a significant market, though continuing economic problems and a declining currency caused the live cattle trade to that market to drop considerably in 2002. Northern Australian live cattle can also be slaughtered for the US manufacturing beef trade if prices are attractive enough. Also, supply — and therefore price — is subject to the vagaries of rainfall in northern Australia, because all live cattle there are bred and grown out on native grassland and other vegetation before shipment to Indonesia.

The results in the column headed 'Increase in live cattle selling price from Australia' of Table 8.1 show the effects of a 20% increase in the landed price of live cattle from Australia. The main points are that:

- commercial feedlot costs increase considerably, causing a contraction in feedlot operations and in imports of live cattle (13.1% decline);
- feedlot profitability contracts markedly (reduction in value added of 45.2%);
- smallholder producers gain a little in output and income, but their production flexibility is too low to take much advantage of the higher live cattle import costs;

- there is a small increase in retail beef price (0.8%) and reduction in domestic beef consumption (1.3%); and
- the share of imported beef in this consumption increases (beef imports increase by 4.3%), and, with higher feedlot costs and reduced feedlot production, more imported beef is needed to overcome the deficiency in the domestic beef supply.

Key points

- [a] The output and profitability of commercial feedlots are highly sensitive to the price of imported live cattle from Australia.
- More expensive live cattle imports mean increased demands for imported beef and reduced overall expenditure on beef.

A Decrease in the Prices of Chicken and Fish

Beef competes with other meats for the Indonesian consumer's meat rupiah. An increase in the retail price of beef relative to chicken and fish, for example, will cause consumers to switch some part of their meat expenditure away from beef. Relative meat prices change from time to time. In particular, faster productivity growth in the production of chicken has led over time to a long-term decline in the world price of chicken relative to beef.

The results in the column headed 'Fall in price of chicken and fish' in Table 8.1 show the effects of a 20% decline in the retail price of chicken and a 15% decline in the retail price of fish relative to beef in Indonesia. The main points are that:

- consumers switch their meat consumption away from beef to the now cheaper chicken and fish, leading to a fall in beef demand relative to supply, causing the retail price of beef to decline (by 10.5%), beef consumption to contract (by 8%) and total consumer expenditure on beef to fall (by 17.7%);
- farm prices for cattle fall significantly (17.5% for native feeder cattle and 21.3% for native fattened cattle), which in turn causes producers to contract their cattle production;
- imports of beef fall by 38.9% and feeder cattle by 13.2%; and
- all cattle-producing sectors experience big reductions in their incomes (69% for smallholder fatteners and 27% for smallholder breeders).

Key points

- A decrease in the price of competing meats relative to beef causes consumers to switch their consumption to cheaper meats. The switch causes significant decreases in farm prices for beef, domestic cattle production, imports of live cattle and beef, and the incomes of smallholder breeders, smallholder fatteners and feedlot operators.
- The results highlight the importance of marketing beef to consumers to keep customer loyalty.

Appendix A
Estimates of Key Model Parameters for Indonesia's Beef Industry

Supply elasticity

Beef supply: own price elasticity

- Short-run = 0.2315
- Long-run = 0.7273
- $R^2 = 0.82$

Source: Simatupang et al. (1995).

Beef supply: own price elasticity: 1.06

- $R^2 = 0.95$

Source: Priyanti et al. (1998).

Feedlot supply: own price

- Short-run = 5.03
- Long-run = 10.92

Feeder cattle price

- Short-run = –0.53
- Long-run = –1.14
- $R^2 = 0.92$

Source: Ilham (1998).

Smallholder supply

Price difference (between meat and live cattle prices)

- Short-run = –1.11
- Long-run = –1.37

Feedlot supply

- Short-run = –0.04
- Long-run = –0.05
- $R^2 = 0.65$

Source: Ilham (1998).

Demand elasticity

Total demand	Own price	Income	Fish price
• Short-run	–1.09	0.60	0.54
• Long-run	–1.43	0.79	0.72
• $R^2 = 0.83$			

Source: Ilham (1998).

Beef import: beef import price elasticity

- Short-run = –0.23
- Long-run = –0.35
- $R^2 = 0.89$

Source : Ilham (1998).

High aggregation

- Own price = –0.67
- Income = 0.36
- $R^2 = 0.92$

Source: Priyanti et al. (1998).

Own price, income and cross-price elasticity of demand for beef.

Table A.1. Supply and demand elasticity parameters for beef from various studies in Indonesia.

Year	Own price	Income	Other prices				
			Broiler chicken	Native chicken	Pork	Fresh fish	Other meat
1987[a]	–0.992	0.995	+			+	
1990[b]	–1.012	0.928	+/–	+/–	–	+	+/–
1993[a]	–1.024	0.844	+			+	
1998[c]	–1.088	0.600				+	

Source: [a]Erwidodo et al. (1998); [b]Hermanto et al. (1995);
[c]Meilke et al. (2000) — FAPRI Livestock and Poultry Model, double log

Appendix B
Key Survey Results: Structure of Indonesia Cattle–Beef Value Chain

Table B.1. Data on imported feeder cattle, Indonesia, 2001.

	Jan–Oct	Jan–Dec
a. Total live cattle (head)	204,393	251,850
b. Total weight (kg)	56,622,686	69,769,627
c. Average weight (kg/head) = b: a	277	277
d. Total landed value (US$ CIF)	55,821,383	68,782,274
e. Average landed price (US$/kg CIF) = d: b	0.986	0.986
f. Average exchange rates (Rp/US$)	10,368	10,368
g. Average landed price (Rp/kg CIF) = e x f	10,221	10,221
h. Average landed price (US$/head CIF) = d: a	273.11	273.11
i. Average landed price (Rp'000/head CIF) = h x f	2832	2832
j. Total landed value (Rp million CIF) = a x i	578,756	713,135

CIF = cost, insurance and freight

For the full year of 2001, the only data available on feeder cattle imports are number of head (obtained from the Directorate General of Livestock Services in February 2002). The value of live cattle imports for the year was estimated from data on the average live weight, the average landed price per kilogram in US dollars, the average official exchange rate, the average landed price per kilogram in rupiah and assuming average landed prices in US dollars for the full year of 2001 are the same as for January–October 2001 (see Table B.1). Hence, the total landed value of imported live cattle in 2001 (January–December) is Rp 713,135 million, as shown in Table B.1.

Table B.2. Cattle production by beef industry type (head), Indonesia, 2001.

	Breeder	Smallholder Non-partnership fattener	Partnership fattener	Feedlots	Total
Native feeder cattle	1,498,064	0	0	0	1,498,064
Native fattened cattle	0	1,496,064	2000	0	1,498,064
Fattened cattle from live imports	0	0	1500	250,350	251,850
Total industry	1,498,064	1,496,064	3500	250,350	1,749,914

Table B.3. Cattle purchasing price by beef industry type (Rp/head), Indonesia, 2001.

	Breeder	Smallholder Non-partnership fattener	Partnership fattener	Feedlots
Native feeder cattle	0	0	0	0
Native fattened cattle	0	2,711,500	2,711,500	0
Fattened cattle from live imports	0	0	2,831,585	2,831,585

Table B.4. Cattle selling price by beef industry type (Rp/head), Indonesia, 2001.

	Breeder	Smallholder Non-partnership fattener	Partnership fattener	Feedlots
Native feeder cattle	2,711,500	0	0	0
Native fattened cattle	0	3,744,250	3,826,740	0
Fattened cattle from live imports	0	0	4,292,650	4,503,250

Table B.5. Production value by beef industry type (Rp million), Indonesia, 2001.

	Breeder	Smallholder Non-partnership fattener	Partnership fattener	Feedlots	Total
Native feeder cattle	4,062,001	0	0	0	4,062,001
Native fattened cattle	0	5,601,638	7,653	0	5,609,291
Fattened cattle from live imports	0	0	6,439	1,127,389	1,133,828
Total industry	4,062,001	5,601,638	14,092	1,127,389	10,805,119

Table B.6. Feedlot production input–output: imported feeder cattle, 2001.

	Per Head (Rp)	Total[a] (Rp million)
Imported feeder cattle	2,831,585	708,887
Feeds:		
Forage	70,894	17,748
Concentrate	549,068	137,459
Waste	99,282	24,855
Total feeds	719244	180,063
Other costs:		
Medicines	10,040	2514
Quarantine (in)	2500	626
Quarantine (out)	500	125
Depreciation	6250	1565
Other	11,784	2950
Total other costs	31,074	7779
Transport costs:		
From quarantine place to farm	15,000	3755
Marketing	63,000	15,772
Total transport cost	78,000	19,527
Labour costs:		
Direct	76,743	19,213
Indirect	23,023	5,764
Total labour costs	99,766	24,976
Retribution charge	10,000	2504
Returns to land and capital	733,581	183,652
Tax on inputs	0	0
Total costs (value of production)	4,503,250	1,127,389

[a] *Total cattle = 250,350 head*

Table B.7. Partnership fattening production input–output: native feeder cattle and imported feeder cattle, Indonesia, 2001.

	Native feeder cattle[a]		Imported feeder cattle[b]		Native and imported cattle (Rp) million)
	Per head (Rp)	Total (Rp million)	Per head (Rp)	Total (Rp million)	
Native feeder cattle	2,711,500	5423.0	2,831,585	4247.4	9670.4
Feeds:					
Forage	13,190	26.4	63,890	95.8	122.2
Concentrate	101,710	203.4	494,155	741.2	944.7
Waste	121,100	242.2	89,254	133.9	376.1
Salt	6890	13.8	0	0.0	13.8
Other	82,760	165.5	0	0.0	165.5
Total feeds	325,650	651.3	647,299	970.9	1622.2
Other costs:					
Medicines	5030	10.1	9050	13.6	23.6
Electricity/water	480	1.0	760	1.1	2.1
Quarantine (in)	0	0.0	2500	3.8	3.8
Quarantine (out)	0	0.0	0	0.0	0.0
Depreciation	21,700	43.4	3623	5.4	48.8
Other	0	0.0	1606	2.4	2.4
Total other costs	27,210	54.4	17,539	26.3	80.7
Transport costs:					
From quarantine place to farm	0	0.0	15,000	22.5	22.5
Marketing	0	0.0	0	0.0	0.0
Total transport cost	0	0.0	15,000	22.5	22.5
Labour:					
Family	105,210	210.4	120,557	180.8	391.3
Hired	0	0.0	0	0.0	0.0
Total labour cost	105,210	210.4	120,557	180.8	391.3
Retribution charge	0	0.0	0	0.0	0.0
Returns to land and capital	657,170	1314.3	660,670	991.0	2305.3
Tax on inputs	0	0.0	0	0.0	0.0
Total costs (value of production)	**3,826,740**	**76,53.5**	**4,292,650**	**6439.0**	**14,092.5**

[a] 200 head; [b] 1500 head

Table B.8. Non-partnership fattening production input–output: native feeder cattle, Indonesia, 2001.

	Per head (Rp)	Total[a] (Rp million)
Native feeder cattle	**2,711,500**	**4,056,578**
Feeds:		
Forage	102,560	153,436
Concentrate	70,750	105,847
Waste	132,010	197,495
Salt	2890	4324
Other	9500	14,213
Total feeds	317,710	475,314
Other costs:		
Medicines	9990	14,946
Electricity/water	2740	4099
Quarantine (in)	0	0
Quarantine (out)	0	0
Depreciation	50,370	75,357
Other	0	0
Total other costs	63,100	94,402
Transport costs:		
From quarantine place to farm	0	0
Marketing	0	0
Total transport cost	0	0
Labour:		
Family	233,500	349,331
Hired	0	0
Total labour cost	233,500	349,331
Retribution charge	0	0
Returns to land and capital	418,440	626,013
Tax on inputs	0	0
Total costs (value of production)	**3,744,250**	**5,601,638**

[a] *Total cattle = 1,496,064 head*

Table B.9. Breeding production input–output: native cattle, Indonesia, 2001.

	Per Head (Rp)	Total[a] (million Rp)
Native feeder cattle	0	0
Feeds:		
Forage	523,900	784836
Concentrate	1330	1992
Waste	90,060	134,916
Salt	6520	9767
Other	4120	6172
Total feeds	625,930	937,683
Other costs:		
Medicines	10,080	15,100
Electricity/water	3380	5063
Insemination service	11,450	17,153
Depreciation	60,110	90,049
Other	7420	11,116
Total other costs	92,440	138,481
Transport costs:		
From quarantine place to farm	0	0
Marketing	0	0
Total transport cost	0	0
Labour:		
Family	315,740	472,999
Hired	0	0
Total labour cost	315,740	472,999
Retribution charge	0	0
Returns to land and capital	1,677,390	2,512,838
Tax on inputs	0	0
Total costs (value of production)	**2,711,500**	**4,062,001**

[a] *Total cattle = 1,498,064 head*

Table B.10. Beef equivalent production by industry (tonnes), Indonesia, 2001.

	Breeder	Smallholder Non-partnership fattener	Partnership fattener	Feedlots	Total
Native feeder cattle	291,716	0	0	0	291,716
Native fattened cattle	0	291,326	389	0	291,716
Fattened cattle from live imports	0	0	279	46,641	46,920
Total industry	291,716	291,326	669	46,641	338,636

Table B.11. Data on imported beef, Indonesia, 2001.

	Jan–Oct	Jan–Dec
a. Quantity (kg)	14,609,338	17,531,206
b. Value (US$)	20,709,014	24,850,817
c. Landed price (US$/kg) (b:a)	1.418	1.418
d. Exchange rate (Rp/US$)	10,368	10,368
e. Landed price (Rp/kg) (c x d)	14,697	14,697
f. Import duty (5%)	735	735
g. Value-added tax (10%)	1470	1470
h. Total import price (Rp/kg) (e + f + g)	16,901	16,901
Import value (million Rp)	246,917.7	296,301.3

Notes:
Data January–October: actual
Data January–December — obtained as follows:
*- Quantity Jan–Dec = (12/10) *Quantity Jan–Oct*
- Assumption: landed price (US$kg) Jan–Dec=Jan–Oct — 1.417 exchange rate Jan–Dec = Jan–Oct — 10,368
- Value (US$) = Quantity Jan–Dec x landed price Jan–Dec
- Value (Rp) — Value (US$) Jan–Dec x exchange rate Jan–Dec

Table B.12. Final demands by outlet and source of beef (tonnes), Indonesia, 2001.

	Wet market	Supermarket	Meat shop	Total
Beef from native cattle	250,876	40,519	321	291,716
Beef from imported cattle	14,076	32,844	0	46,920
Imported beef	3506	14,025	0	17,531
Total	268,458	87,388	321	356,167
Beef sale price (Rp/kg)	32,300	41,750	35,200	

Table B.13. Final demands by outlet and source of beef (Rp million), Indonesia, 2001.

	Wet market	Supermarket	Meat shop	Total
Beef from native cattle	8,103,287	1,691,683	11,295	9,806,265
Beef from imported cattle	454,655	1,371,237	0	1,825,892
Imported beef	113,252	585,542	0	698,794
Total	8,671,194	3,648,462	11,295	12,330,951

Table B.14. Margins on imported beef, Indonesia, 2001.

	Quantity (t)	Sale price (Rp/kg)	Value (Rp million)
Supermarket	14,025	41,750	585,542
Wet market	3506	32,300	113,252
Total	17,531		698,794
Import value of beef			296,301
Total margins			402,493
Margin distribution:			
Transport			1570
Processing			70,718
Trader			330,205
Margins (Rp million):	Supermarket	Wet market	Total
Transport	1256	314	1570
Processing	56,574	14,144	70,718
Trader	264,164	66,041	330,205

Notes: Total margins = total sales value – total import value of beef
Total margins are distributed to transport, processing and trader
Each margin is distributed to supermarket and wet market

Table B.15. Margins on beef from imported feeder cattle, Indonesia, 2001.

	Supermarket	Wet market	Total
Quantity (t):			
Feedlot	32,649	13,992	46,641
Partnership	195	84	279
Total	**32,844**	**14,076**	**46,920**
Industry's value (million Rp):			
Feedlot	789,172	338,217	1,127,389
Partnership	4507	1932	6439
Total	**793,680**	**340,148**	**1,133,828**
Outlet sales by beef source (million Rp):			
Feedlot	1,363,083	451,951	1,815,035
Partnership	8154	2704	10,857
Total	**1,371,237**	**454,655**	**1,825,892**
Outlet's margin by beef source (million Rp):			
Feedlot	573,911	113,735	687,646
Partnership	3646	772	4 418
Total	**577,557**	**114,507**	**692,064**
Outlet's margin distribution, beef from feedlot (million Rp):			
Transport	39,600	7313	46,913
Processing	181,298	20,597	201,896
Trader	353,013	85,824	438,837
Total	**573,911**	**113,735**	**687,646**
Outlet's margin distribution, beef from partnership (million Rp):			
Transport	252	50	301
Processing	1152	140	1292
Trader	2243	582	2825
Total	**3646**	**772**	**4418**

Table B.16. Margins on beef from imported native cattle, Indonesia, 2001.

	Supermarket	Wet market	Meat shop	Total
Quantity (t):				
Non-partnership fattener	40,465	250,541	320	291,327
Partnership fattener	54	335	1	390
Total	**40,519**	**250,876**	**321**	**291,717**
Industry's value (Rp million):				
Non-partnership fattener	778,068	4,817,408	6162	5,601,638
Partnership fattener	1063	6582	8	7654
Total	**779,131**	**4,823,990**	**6170**	**5,609,292**
Outlet sales by beef source (Rp million):				
Non-partnership	1,689,427	8,092,481	11,280	9,793,188
Partnership	2256	10,806	15	13,077
Total	**1,691,683**	**8,103,287**	**11,295**	**9,806,265**
Outlet's margin by beef source (Rp million):				
Non-partnership	911,359	3,275,074	5118	4,191,550
Partnership	1193	4223	7	5423
Total	**912,552**	**3,279,297**	**5125**	**4,196,973**
Outlet's margin distribution, beef from feedlot (Rp million):				
Transport	62,884	982,522	329	1,045,735
Processing	287,898	373,358	927	662,184
Trader	560,577	1,919,193	3862	2,483,632
Total	**911,359**	**3,275,073**	**5118**	**4,191,551**
Outlet's margin distribution, beef from partnership (Rp million):				
Transport	82	1267	0.4	1350
Processing	377	481	1.2	859
Trader	734	2475	5.0	3213
Total	**1193**	**4223**	**7**	**5423**

Table B.17. Margins summary by market outlet, Indonesia, 2001.

	Supermarket	Wet market	Meat shop	Total
Transport	104,073	991,466	330	1,095,869
Processing	527,300	408,721	928	936,948
Trader	1,180,730	2,074,116	3867	3,258,713

Table B.18. Inputs to beef cattle production and final demands, Indonesia, 2001.

	Production (Rp million)				Final demands (Rp million)			
		Smallholder						
	Breeder	Non-plasma fattener	Plasma fattener	Feedlots	Wet markets	Supermarkets	Meat shops	Total (Rp million)
Native feeder cattle	0	4,056,578	5423	0				4,062,001
Native fattened cattle	0	0	0	0				0
Imported feeder cattle	0	0	4247	708,887				713,134
Fattened cattle from Import	0	0	0	0				0
Beef from native cattle					8,103,287	1,691,683	11,295	9,806,265
Beef from imported cattle					454,655	1,371,237	0	1,825,892
Imported beef					113,252	585,542	0	698,794
Feed	937,683	475,314	1622	180,063				1,594,682
Other costs	138,481	94,402	81	7779				240,743
Processing margins	0	0	0	0	991,466	104,073	330	1,095,869
Transport margins	0	0	23	19,527	408,721	527,300	928	956,499
Trader margins	0	0	0	0	2,074,116	1,180,730	3867	3,258,713
Labour costs	472,999	349,331	391	24,976				
Return to land and capital	2,512,838	626,013	2306	183,653				
Taxes on inputs	0	0	0	2504				
Total costs (value of production)	4,062,001	5,601,638	14,093	1,127,389				

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