Effects of Globalisation and Economic Development

on the Asian Livestock Sector

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Summary and Conclusions

The livestock production systems in Asian developing countries comprise a mix of capital-intensive large-scale commercial operations and labour-intensive smallholder peri-urban and crop–livestock operations. Over the next few years, growth in demand for livestock products and trade liberalisation mandated by the World Trade Organisation (WTO) will impact significantly on these systems.

Our report analyses the impacts of these likely developments on the performance of the beef, pig meat, poultry and dairy systems in China, India, Indonesia, Vietnam, the Philippines and Thailand. The analysis begins with an appraisal of the recent performance of each livestock industry in each country, highlighting recent trends in production, consumption and trade. We evaluate key drivers (population growth, economic growth, productivity improvements in livestock production, and cultural and religious attitudes toward certain meats), policy settings (particularly barriers to trade) and constraints on performance (environmental constraints, breeding constraints and other factors which limit the flexibility of livestock production systems to respond to changes in their incentives environment).

Global economic models of livestock production and trade incorporating these drivers, policy settings and constraints are used to project outcomes for each livestock sector and country. Key findings are as follows.

Performance Over the Past Decade

- For China, a decade of per capita income growth averaging 6–7 per cent annually has resulted in massive growth in per capita meat and seafood consumption — 16 per cent annually for beef, 12 per cent for poultry, 26 per cent for pork and 13 per cent for seafood. Production growth for all meats has matched consumption growth – in the case of beef aided by heavy support through government policies – with no import dependence to date.

- For India, meat consumption growth has been much lower, as has per capita income growth, and meat consumption remains at an extremely low level (5 kg per person per year). By contrast, consumption of dairy products is massive (82 kg per person per year) and continues to grow steadily. Imports of meat and dairy are virtually zero.

- For Indonesia, per capita incomes fell sharply in 1998 with the financial crisis. Per capita meat consumption has only recently recovered to the levels seen before the financial crisis. Meat production was also hit heavily by the crisis because of the reliance on imported live cattle (beef) and imported grains (poultry) and the collapse of the exchange rate. Signs of increasing dependence on imports are emerging in the case of beef and dairy.

- For Vietnam, steady growth in per capita incomes has led to steady growth in per capita consumption of poultry, pork, seafood and dairy. Production of pork and poultry has kept pace with consumption growth. Seafood production growth has greatly exceeded consumption, leading to significant export growth. Dairy consumption growth is exceeding production growth, leading to increased imports.

- For the Philippines, per capita income growth over the past decade has been mixed. Per capita consumption of poultry has grown strongly; per capita consumption of pork has grown moderately; seafood consumption (which dominates meat consumption) has stagnated.

- Thailand, like Indonesia, was hit hard by the financial crisis. As a result, per capita meat consumption turned down in 1998 and has yet to recover to its pre-crisis level. Beef consumption and production has remained static over the period and pork consumption has grown only marginally as consumers have switched toward poultry. Poultry production has grown rapidly in excess of consumption, leading to significant growth in exports. Per capita consumption of dairy products has grown rapidly, as has dairy production.

Impact of Growth in Per Capita Incomes

Per capita consumption growth is the key factor contributing to meat consumption growth in developing countries. The situation for each of the six countries is as follows.

- For China, per person meat consumption is projected to increase by 68 per cent over the next 20 years. Beef consumption is projected to grow more slowly than consumption of competing meats. Production growth will fail to match consumption growth in the case of poultry and pig meat, leading to increased import dependency.

- For India, per person meat and seafood consumption is projected to increase by 157 per cent over the next 20 years, to reach 13 kg per head. But this remains extremely low compared with meat consumption in other countries. For all meats, production growth will be sufficient to satisfy consumption growth, with no need for imports. Consumption of dairy products will grow at a faster rate than production, leading to a substantial import dependency by 2020.

- For Indonesia, per person meat consumption is likely to increase by 130 per cent over the next 20 years, reaching 37 kg, nearly 60 per cent of which will be seafood. Domestic production growth will be strong for pig meat and poultry but lower for beef (constrained by the very low productivity of native cattle breeder farms). Dependency on imported beef and dairy products is projected to increase substantially; dependency on pig meat and poultry meat is expected to increase more modestly.

- For Vietnam, per person meat consumption is projected to more than double over the next 20 years, with seafood continuing to account for more than half this consumption. Production growth will also be rapid, with Vietnam likely to remain self-sufficient in meat over the period. Strong growth in demand for dairy products will lead to an increase in imports, with over 60 per cent of dairy production imported by 2020.

- For the Philippines, per person meat consumption is projected to increase by 87 per cent over the next 20 years. Production growth will lag behind consumption growth, leading to growing import dependency for all meats. For dairy, strong growth in consumption, with zero production expansion prospects, will lead to a virtual total dependency on imports by 2020.
- For Thailand, per person meat consumption is projected to increase by 167 per cent over the next 20 years, with seafood accounting for half this consumption. Poultry consumption will grow fastest, and be greater than production, so exports will need to be diverted back onto the domestic market. Production growth in pig meat will be sufficient to avoid imports until toward the end of the period. Per person consumption of dairy products is projected to double, resulting in steady growth in imports.

The great unknown in these projections is how per capita consumption of each type of meat will change as per capita income grows. As countries get richer, increases in per capita income bring about smaller and smaller increases in per capita consumption. Eventually, the market becomes fully mature, at which point per capita consumption remains constant or even starts to decline. In the major industrial countries, the demand for meat has been static or falling for many years.

The level of per capita income at which per capita consumption fails to increase differs significantly between countries and between types of meat. These differences reflect historical, cultural, lifestyle and religious factors and are extremely difficult to predict. Relative to industrial countries, per capita incomes in each of the Asian countries studied have a long way to grow. But already, some countries (such as China) have extremely high per capita meat consumption when their per capita income levels are taken into account.

Our results demonstrate extreme diversity in meat protein consumption patterns across countries. Three characteristics stand out:

- There is a very low per capita consumption of meat and seafood in India, and also in Indonesia. This reflects the large population segments in these countries with very low per capita incomes.
- Seafood is the dominant protein in the meat protein diets of China, Vietnam, Philippines, Thailand and Indonesia. This is a longstanding feature of the diets of many Asian communities.
- Dairy products play a huge role in India's meat protein consumption. This reflects both religious and cultural beliefs and practices and the success of some major initiatives to develop milk production and processing.

Impact of Agricultural Trade Liberalisation

A number of developing countries consider their livestock production sectors to be particularly vulnerable to global trade liberalisation, especially because of the dominance of smallholder systems. Smallholder production is considered to be less internationally competitive than large-scale operations. The way in which livestock industries are likely to be affected by trade liberalisation is likely to be determined by the interplay of many factors, including their reliance

on feed grains in production, existing barriers to trade and the capacity of each system to respond to changes in the price–cost situation. Trade liberalisation will result in higher world prices for grain and meat. But meat prices in developing countries that currently have high barriers against meat imports will fall relative to world prices. For each of the six countries, the situation is as follows.

- For China, production is projected to be lower for all meats. China's barriers to meat imports are currently large, and its dependency on feed grains high. This means that producer prices fall significantly relative to producer prices in the major exporting countries, and production costs increase. Imports of meat and dairy also increase.
- For India, there is expected to be little impact on meat production. Existing trade barriers are not providing much assistance to domestic producers. With the removal of barriers, dairy production is expected to be slightly lower and imports higher. There will be little change in meat consumption.
- For Indonesia, effects on production, consumption and net trade are expected to be negligible. This reflects the low trade barriers already in place and the very low reliance on feed grains in livestock production.
- For Vietnam, effects on production, consumption and net trade are also expected to be negligible.
- For the Philippines, production of all meats and dairy are expected to fall with trade liberalisation, reflecting relatively high trade barriers, especially for poultry.
- For Thailand, production is expected to decline relative to baseline as high barriers are removed and producer prices are reduced from current levels. Consumption of beef, in particular, is expected to increase significantly in response to the reduction in consumer prices when the present very high tariff is removed.

Differential impact between smallholder and large-scale commercial producers

Smallholders and commercial producers use very different technologies, so trade liberalisation is likely to affect them differently. In particular, feed grains and feed concentrates are much more intensively used by commercial producers than by smallholders. Other things being equal, higher grain prices from trade liberalisation are likely to increase the competitive position of smallholders relative to commercial producers.

Smallholder producers use large amounts of labour relative to capital. By contrast, commercial production systems are capital intensive. There is some evidence that trade liberalisation may increase real wages by more than the increase in returns to capital. Other things being equal, this would favour commercial systems.

It is inevitable that the process of economic growth will continue to impose adjustment pressures on smallholder livestock producers. Agricultural trade liberalisation will not reverse this process, but there is no strong evidence that it will accelerate it.

The Future for Livestock Production Systems in Developing Countries

Our projections suggest significant growth prospects for livestock production systems in developing countries even if barriers to global trade in livestock and grains are removed. That said, the results do not support the stated intentions of some countries to become significant exporters of some livestock products over the next decade. In all cases, livestock product demand growth is projected to exceed production growth. Export surpluses, where they exist, will be quickly eroded, and there will be an increasing reliance on imports from industrial country producers.

For developing countries to become significant exporters of livestock products, they would need to achieve productivity gains in livestock production that were considerably higher than those in our productivity scenario and that lasted for a sustained period. This might be enough to generate exports to other developing countries. But for them to develop markets in other industrial countries, they would also need to put in place much higher food safety and quality standards, together with trace-back facilities and information systems about livestock diseases and control mechanisms, to satisfy the very high consumer standards in industrial country markets. Over the medium term, exports of livestock products will continue to come overwhelmingly from high income, developed economies.

1 Introduction

Over the next 20 years the livestock production systems in some Asian developing countries are likely to face significant adjustment pressures from two sources:

- a rapid strengthening of domestic demand for livestock products; and
- World Trade Organisation (WTO)-mandated liberalisation of global trade in grains and livestock products.

These two events are likely to lead to profound changes in the structure and performance of livestock industries in these countries, providing both opportunities and threats.

Growth in the Demand for Meat Protein

Per capita consumption of meat in developing countries is low, because meat protein is expensive relative to protein from cereals. But meat consumption is highly responsive to purchasing power. As economic development proceeds, an expected rapid growth in per capita incomes will lead to a big increase in demand for meat. Local producers will have the opportunity to supply at least some of this demand growth. How much they supply will depend on their ability to compete with imported meats, which in turn will be influenced by domestic policy settings and the global agricultural trade regime in place.

The anticipated big increase in meat protein consumption in developing countries over the next two decades represents a continuation of a well-established trend. Delgado et al. (2001) report that from the beginning of the 1970s to the mid-1990s consumption of meat in developing countries increased by almost triple the increase in developed countries. Consumption of milk increased by more than twice the increase in developed countries. While per capita income growth has continued steadily in developed countries, per capita consumption of meat and dairy products is close to saturation level; increases in incomes do not lead to significant increases in per capita consumption of these products.

Further Multilateral Trade Liberalisation

A major achievement of the last multilateral round of trade negotiations (Uruguay Round) was to bring agricultural products under the same trade and protection rules and disciplines as for manufactures. Under the Agreement on Agriculture negotiated for the round, there was also slight progress in reducing agricultural trade barriers through reductions in tariffs, export subsidies and domestic support policies. Developing countries have until the end of 2004 to implement agreed changes.

At the conclusion of the Uruguay Round, it was widely recognised that much needed to be done to achieve further liberalisation of global agricultural markets and that this should be a priority for a future round. While the Uruguay Round was successful in getting agriculture onto the agenda and within WTO rules, significant reductions in agricultural protection would have to await the next trade round.

Under the so-called 'built-in agenda' of the Uruguay Round, the Agreement on Agriculture mandated further negotiations on agricultural trade liberalisation to commence by the end of 1999. A new round of agricultural negotiations was launched in March 2000 through a special session of the WTO Agriculture Committee. But the political impetus for progress has been hampered by delays to the start of a new round of trade negotiations, incorporating all sectors, not just agriculture.

Agreement for a new broad round of negotiations was finally achieved at the Doha ministerial trade meeting in November 2001. The Doha Round is to be treated as a 'single undertaking'. This means that all areas of negotiations (not just agriculture) must be agreed for any negotiated outcomes to be binding. The decision of the United States to impose tariffs on steel imports and imports of lumber from Canada, threats to impose restrictions on imports of textiles from Vietnam, and retaliatory action by some countries have soured the negotiating environment for global trade liberalisation. The United States, in particular, continues to push regional rather than multilateral trade agreements, and each regional agreement introduces its own set of distortions into trading arrangements.

Despite these immediate problems, some experts (e.g. Anderson 2001) consider that the forthcoming millennium round will offer the best prospects ever for developing countries in general, and for their rural communities in particular, to secure growth-enhancing reforms. Agricultural trade reforms are expected to play a big part in this outcome.

Our Report

We first analyse the potential impact of economic growth on the demand for livestock products and smallholder and commercial sector production for pig meat, poultry meat, beef and dairy in China, India, Indonesia, the Philippines, Thailand and Vietnam. Our starting point for each country is an information 'basebook'. This summarises the recent performance of each meat industry and provides a brief commentary on the policy settings, production system and likely future developments.

We use a global model to take account of the key drivers influencing livestock production outcomes in each country. The focus is to 2020. Our base case scenario and projections assume no change in existing trade barriers.

We next analyse the impact of WTO-mandated global liberalisation of grain and livestock markets. The results provide a picture of development prospects for livestock producers in these countries and the potential for agricultural trade liberalisation to influence these prospects.

2 The Projection Framework

The centrepiece of our projection framework is the global meat industries (GMI) model. This model provides detailed projections for production, consumption, prices, exports and imports of grass-fed beef, grain-fed beef, lamb, mutton, pig meat and poultry meat, and the corresponding livestock numbers behind these projections. We use a less formal framework to project milk production and consumption for the selected countries.

The GMI Model

The GMI model is a multicountry, multicommodity, Armington style model of world meat production, consumption and trade. Commodities are distinguished by source. Commodities from different sources are imperfect substitutes (for example, Australian beef is a different product from Indonesian beef).

For each of 26 regions and 10 meat types the model provides annual projections of:

- domestic production of each type of meat;
- consumption of each type of meat;
- price outcomes for each type of meat; and
- exports and imports by region for each type of meat.

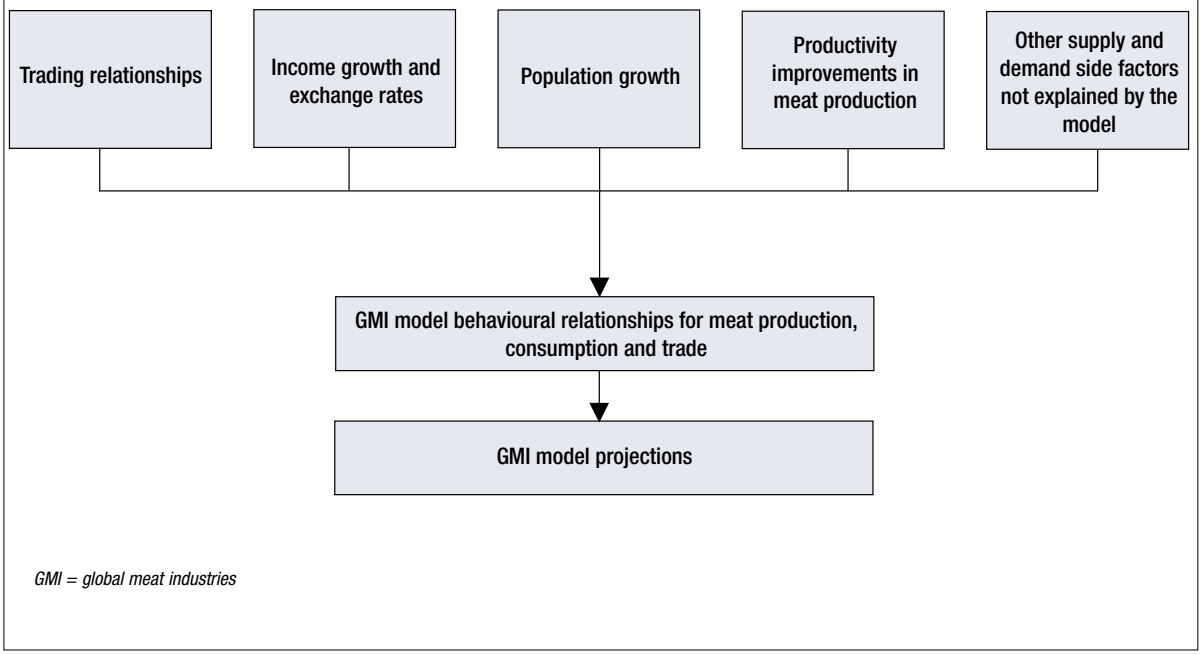
The model incorporates the major policies affecting world meat trade – tariffs, variable levies, quotas, voluntary restraint agreements, foot-and-mouth disease trade bans and export subsidies.

Appendix A describes the theoretical structure of the GMI model and settings for key model elasticities.

The Scenario Behind the Projections

GMI model projections are conditional on the scenario developed for a range of variables not explained by the model (Figure 2.1). These variables include macroeconomic developments such as population and income growth, and changes in exchange rates. They also include microeconomic developments such as productivity growth rates in meat production; non-price factors affecting demand and supply, including changes in tastes and known or anticipated episodic events (such as the bovine spongiform encephalopathy scare in Japan and the Asian financial crisis); and changes in trade policy.

Figure 2.1. The GMI model projection framework.



GMI = global meat industries

Productivity improvements in meat production

Productivity growth in the production of meat is a key determinant of meat price and hence production outcomes. Higher productivity puts downward pressure on production costs and hence prices. Changes in relative productivity growth between meats change relative prices and consumption patterns. Productivity gains in the Australian poultry industry are a good example. The industry claims to have achieved an annual average reduction in unit costs of around 7 per cent since 1990, which greatly exceeds that achieved in beef and sheep meat production. Lower costs, which are passed on to consumers, are the main reason for the switch to poultry products away from other meats.

Typical indicators of productivity improvements are falls in break-even margins, higher slaughter weights and better feed conversion efficiency. But productivity developments apply throughout the chain, from the live animal through transport to slaughter and processing.

It is generally accepted that the US pig and poultry industries set the benchmark for productivity growth in the global meat industries. The trend to larger-scale production units, especially in the US pig sector, has led to significant reductions in the per unit cost of production. In the US poultry industry, better genetics have led to birds with higher feed conversion ratios and shorter turn-off times. These factors, in addition to large-scale production units, have made the US industry the leader in the export market for poultry products.

Table 2.1. Assumed productivity growth by country and commodity (per cent per year).

	Grass-fed beef	Grain-fed beef	Lamb	Sheep meat	Pig meat	Poultry
China	0.44	0.00	0.33	0.17	2.00	2.00
India	0.5	0.00	0.33	0.17	2.00	2.00
Indonesia	0.44	0.00	0.33	0.17	2.00	2.00
Thailand	0.44	0.00	0.33	0.17	2.00	2.00
Philippines	0.44	0.00	0.33	0.17	2.00	2.00
Vietnam	0.44	0.00	0.33	0.17	2.00	2.00
Australia	1.50	2.00	2.36	2.03	2.00	3.00
New Zealand	1.56	0.00	1.67	1.01	2.00	2.00
United States	0.75	1.00	0.50	0.50	4.00	3.00
Canada	0.75	1.00	1.34	1.01	3.00	3.00
Japan	0.00	0.66	0.33	0.17	0.00	2.00
South Korea	0.00	1.50	0.33	0.17	2.00	3.00
Taiwan	0.66	0.00	0.33	0.17	0.00	2.00
Singapore	0.44	0.00	0.33	0.17	2.00	2.00
Malaysia	0.44	0.00	0.33	0.17	2.00	2.00
European Union	0.88	0.00	0.33	0.17	2.00	2.00
Mexico	0.50	0.00	0.50	0.50	1.00	2.00
Argentina	1.22	0.00	1.00	0.67	2.00	2.00
Uruguay	1.22	1.44	1.00	0.67	2.00	4.00
Paraguay	1.22	1.44	1.00	0.67	2.00	3.00
Brazil	1.22	1.44	1.00	0.67	2.00	3.00

Source: CIE estimates

Industrial-type production systems that are highly dependent on imported technology are increasingly being employed in the poultry sector of developing countries. The result is lower production costs and product prices, increased consumption and greater production flexibility with changes in market conditions. Productivity growth in the cattle sector is lower than in the more intensive livestock industries.

Table 2.1 lists the assumptions for productivity growth in global meat markets. The assumptions reflect judgments based on the results of the few published studies in this area.

Population growth

Population growth is a primary driver of demand for meat protein. The population projections shown in Table 2.2 are drawn from United Nations demographic models. Although population growth rates are slowing in most developing countries, they are still well above the rates projected for industrial countries, especially in India, Vietnam and the Philippines.

Income growth

Income growth is the key factor contributing to meat consumption growth in developing countries. Income growth depends on labour force growth, growth in the stock of capital and growth in total factor productivity. Total factor productivity becomes increasingly important as a source of growth as countries develop, due to diminishing returns to capital and labour. Total factor productivity growth accounts for around half the growth in developed countries but less than one-third in developing countries.

Table 2.2. Population projections (millions).

	2000	2001	2002	2003	2004	2005	2010	2015	2020
China	1266.7	1277.2	1287.3	1297.3	1307.2	1317.1	1367.3	1418.1	1462.2
India	1022.0	1039.2	1056.3	1073.4	1090.4	1107.2	1189.1	1263.7	1327.1
Indonesia	212.3	215.2	218.2	221.1	223.9	226.7	239.1	251.5	263.5
Thailand	62.4	63.0	63.6	64.1	64.7	65.2	67.7	69.9	72.1
Philippines	76.2	77.6	79.0	80.4	81.8	83.2	90.1	96.3	101.5
Vietnam	77.7	79.2	80.7	82.3	83.8	85.3	92.5	99.2	105.0
Australia	19.2	19.3	19.5	19.7	19.8	20.0	20.8	21.5	22.2
New Zealand	3.8	3.8	3.8	3.9	3.9	3.9	4.1	4.2	4.3
United States	274.8	277.0	279.3	281.5	283.7	285.9	297.1	308.7	320.1
Canada	30.8	31.1	31.4	31.7	32.0	32.3	33.7	35.2	36.6
Japan	126.5	126.7	126.9	127.0	127.2	127.3	127.2	125.9	124.0
South Korea	47.3	47.7	48.1	48.5	48.9	49.3	50.9	52.2	53.4
Taiwan	22.2	22.4	22.6	22.8	23.0	23.2	24.2	25.2	26.3
Hong Kong	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
Singapore	3.1	3.1	3.2	3.2	3.2	3.2	3.3	3.4	3.5
Malaysia	22.3	22.7	23.1	23.5	23.9	24.3	26.2	28.0	29.8
European Union	376.2	377.8	379.3	380.7	382.1	383.3	388.2	390.4	391.1
Mexico	99.0	100.6	102.2	103.7	105.2	106.7	113.7	120.1	126.3
Argentina	37.0	37.4	37.8	38.3	38.7	39.1	41.1	43.1	44.8
Uruguay	3.3	3.4	3.4	3.4	3.4	3.4	3.5	3.6	3.7
Paraguay	5.5	5.6	5.7	5.9	6.0	6.1	6.8	7.5	8.1
Brazil	166.4	168.8	171.3	173.7	176.0	178.4	189.7	200.3	209.9

Source: UN population projections

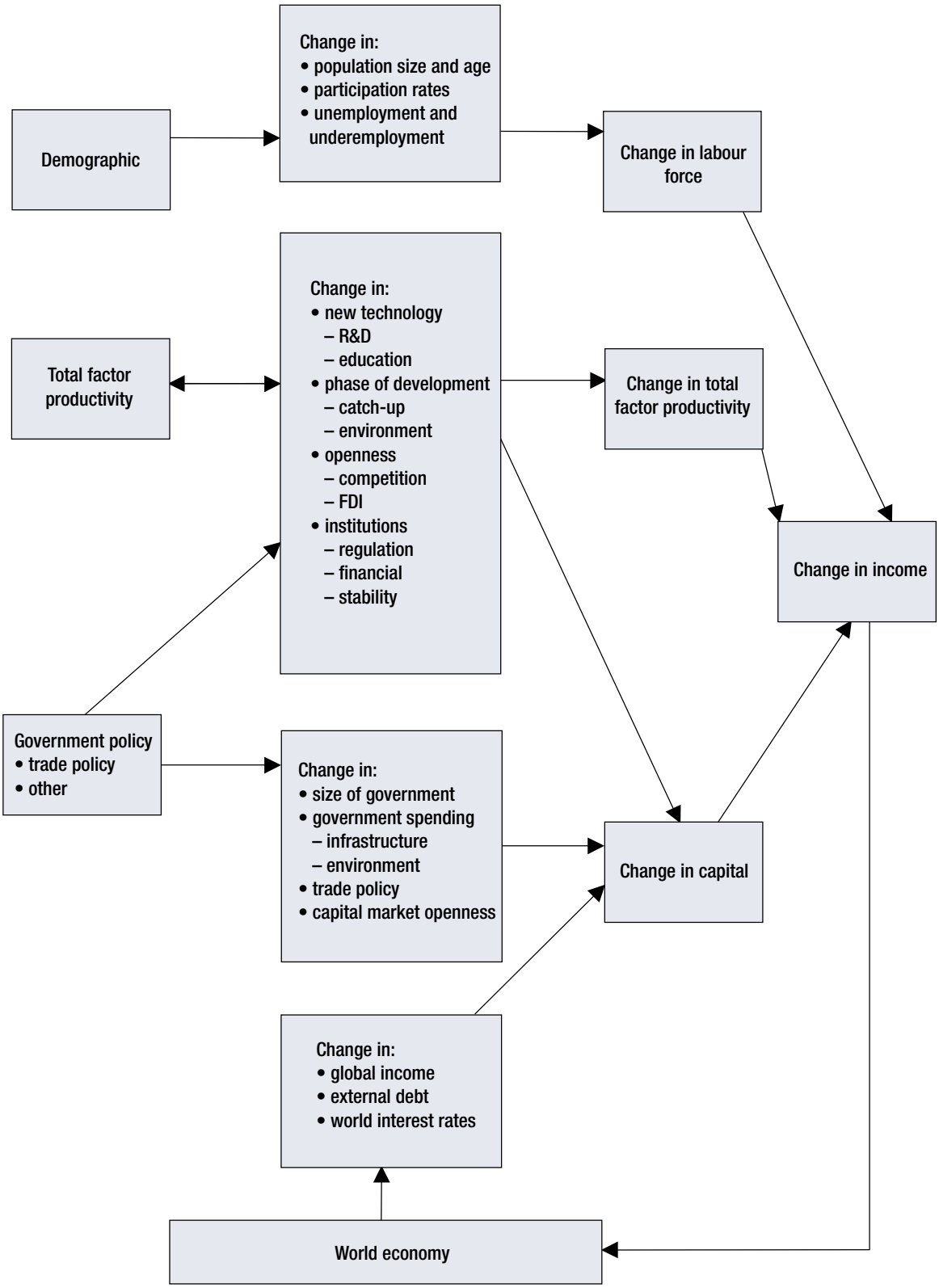
The contribution of growth in the labour force slows as the level of development improves. Labour force growth accounts for around one-third of income growth in developing countries but less than 20 per cent in developed countries.

Capital growth accounts for around one-third of growth in the developed countries and up to one-half of growth in developing countries. Capital growth incorporates both improvements in capital productivity through embodied technological progress and accumulation of physical capital stock. For developed countries, at least 50 per cent of the contribution of capital comes from embodied technical progress. This contribution is much lower for developing countries. The rate of capital accumulation will depend on expected changes in openness for trade and capital, government policy, infrastructure investment and domestic saving.

Figure 2.2 illustrates the components behind our assessment of country income growth prospects.

Table 2.3 shows the projections for the six Asian countries. For China and India, the very high rates of growth reflect strong rates of labour force growth (though rapidly decelerating in the case of China) and high rates of total factor productivity growth. For Indonesia, total factor productivity growth is projected to be considerably lower. For Thailand, total factor productivity growth is projected to be high (though decelerating); for the Philippines, total factor productivity growth is low but is projected to accelerate. For Vietnam, high growth is underpinned by high rates of labour force growth and total factor productivity growth.

Figure 2.2. Components of country income growth prospects.



FDI = foreign direct investment

A country's economic growth generally slows with rising per capita incomes, because the potential to grow through technological catch-up diminishes. However, for the six countries we focus on, the level of development is too far below the most technologically advanced countries for catch-up to lead to significant reductions in growth rate.

Income growth rates for advanced industrial countries range from around 2.5 to 3.0 per cent per year.

Exchange rates

Exchange rates affect the competitiveness of meats from domestic and imported sources. They are important determinants of the prospects for a country's domestic meat production industries to gain a share of the growing domestic market for meat against foreign suppliers. A number of industrial countries (for example the United States in the case of pig meat, poultry and beef, Canada in the case of pig meat, and Australia in the case of beef and sheep meat) are well-established, highly efficient, large-scale exporters of meat. Projected exchange rates between the currencies of developing countries and the currencies of key livestock product exporters and importers are shown in Table 2.4. These projections take into account the expected relative growth rates between countries.

Trading relationships

Trade policy assumptions are critical to the projections. The baseline ('business-as-usual' scenario) includes all meat trade restrictions (tariffs, quotas, import bans etc.) currently in place and takes account of any phasing out of such restrictions that has been agreed to in previous multilateral and bilateral negotiations.

Table 2.3. Real income growth[a] projections by region (per cent per year).

	2000	2001	2002	2003	2004	2005	2010	2015	2020
China	8.0	7.6	7.8	6.5	6.0	5.5	5.0	5.0	5.0
India	7.0	7.0	6.0	6.0	6.0	5.5	5.5	5.5	5.5
Indonesia	3.7	5.0	6.1	6.1	5.0	5.0	5.0	5.0	5.0
Thailand	5.6	5.8	7.0	6.0	5.5	5.5	5.5	5.5	5.5
Philippines	3.5	3.0	3.5	4.0	4.5	5.0	5.0	5.0	5.0
Vietnam	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

[a] *Real income is defined to be the same as real GDP*
Source: OECD, IMF and CIE estimates

Table 2.4. Exchange rate projections relative to the Australian dollar.

	Unit	2000	2001	2002	2003	2004	2005	2010	2015	2020
China	Renminbi/A$	4.82	4.28	4.30	4.43	4.18	3.95	3.72	3.72	3.72
India	Rupee/A$	48.54	47.01	44.38	41.90	39.56	37.35	35.26	35.26	35.26
Philippines	Peso/A$	25.6	26.3	26.3	27.1	25.5	24.0	24.0	24.0	24.0
Indonesia	Rupiah/A$	4845.6	5242.8	5602.3	6066.0	5400.0	5400.0	5400.0	5400.0	5400.0
Thailand	Baht/A$	23.3	23.0	23.1	23.7	22.3	21.0	21.0	21.0	21.0
Vietnam	Dong/A$	7 804	7 780	8 525	9 300	9 300	9 600	9 600	9 600	9 600
New Zealand	NZ$/A$	1.27	1.23	1.17	1.24	1.24	1.24	1.24	1.24	1.24
United States	US$/A$	0.54	0.52	0.55	0.60	0.60	0.60	0.60	0.60	0.60
Canada	C$/A$	0.86	0.80	0.85	0.92	0.92	0.92	0.92	0.92	0.92
Japan	Yen/A$	62.7	62.5	68.8	75.0	75.0	75.0	75.0	75.0	75.0
South Korea	Won/A$	657	668	660	660	660	660	660	660	660

Source: OECD, IMF and CIE

Other Assumptions

Supply and demand influences of a short-term, transient nature are incorporated directly into the model's baseline. For example, the baseline incorporates considerably reduced demand by Japanese consumers for beef over 2002 and 2003, because of adverse consumer reaction to the discovery of bovine spongiform encephalopathy in Japanese cattle. It also incorporates a large and sustained fall in US beef production between 2001 and 2005, before a resumption of growth, reflecting the expected influence of the US cattle cycle. These short-term factors have a negligible impact on longer-term meat demands and supplies around the world.

3 China: Recent Performance and Baseline Projections

Chapter outline

This chapter provides the following information:

- data on China's economy-wide performance (summary indicators)
- meat industry data for beef, dairy, poultry, pork and seafood
- Engel curves showing the relationship between per capita meat protein consumption and per capita income for beef, dairy, poultry, pork and seafood
- information on production systems, policy settings and future developments for beef, pig meat, poultry and dairy
- data on the size distribution of producers for beef, pigs, poultry and dairy cows
- import tariffs
- baseline projections to 2020 for production, imports, exports, import dependency, consumption and per person consumption

Where relevant, each section of data concludes with a set of key points, which appear in a shaded box.

Economy-wide Performance

Table 3.1. Summary indicators, 1990–2000.

Year	GDP(real) per capita		Population	
	Renminbi/capita	Growth rate (%)	Millions	Growth rate (%)
1990	1633.9		1153.3	
1991	1760.0	7.72	1170.1	1.46
1992	1982.2	12.63	1183.6	1.15
1993	2218.7	11.93	1196.4	1.08
1994	2472.7	11.45	1208.8	1.04
1995	2706.1	9.44	1220.5	0.97
1996	2937.1	8.54	1232.5	0.98
1997	3165.4	7.77	1244.2	0.95
1998	3381.1	6.81	1255.7	0.92
1999	3589.3	6.16	1266.8	0.88
2000	3844.9	7.12	1278.6	0.94

Source: http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm

Key points

- Per capita income growth has been 6–7 per cent per year in recent years.
- The trend rate of increase in the population is slowing.

Meat Industry Data

Table 3.2. Meat industry data, 1990–2001.

	Production[a] (kt)	Consumption[a] (kt)	(kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
Beef						
1990	1256	778	0.67	96.6	0.4	0
1991	1535	936	0.80	132.0	0.5	0
1992	1803	1237	1.05	24.5	1.0	0
1993	2336	1614	1.35	22.0	2.1	0
1994	3270	2268	1.88	22.6	2.7	0
1995	4154	2890	2.37	20.1	3.1	0
1996	3557	3053	2.48	28.7	2.9	0
1997	4409	3260	2.62	31.5	2.6	0
1998	4799	3318	2.64	43.0	3.5	0
1999	5054	3522	2.78	19.2	4.6	0
2000	5328	3687	2.88	47.0	6.4	0
2001	5600	3877	3.00	45.0	3.8	0
Growth (%)[c]	*14.85*	*15.85*	*16.32*	*–5.01*	*23.65*	
Dairy						
1990	7106	7195	6.24	20.8	109.4	1.23
1991	7676	7774	6.64	23.1	120.5	1.25
1992	8148	8236	6.96	28.1	116.1	1.07
1993	8229	8318	6.95	33.3	122.5	1.07
1994	8766	8889	7.35	29.6	152.2	1.38

Table 3.2. Meat industry data, 1990-2001 (cont'd).

	Production[a] (kt)	Consumption[a] (kt)	Consumption[a] (kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
1995	9541	9647	7.90	30.4	135.7	1.09
1996	10,276	10,360	8.41	31.2	114.7	0.81
1997	10,183	10,274	8.26	37.6	129.0	0.89
1998	10,556	10,643	8.48	35.6	122.1	0.81
1999	11,188	11,304	8.92	40.8	157.0	1.03
2000	12,272	12,384	9.69	47.0	159.3	0.91
2001	13,272	13,382	10.37	54.1	164.1	0.82
Growth (%)[c]	*5.41*	*5.37*	*4.33*	*7.48*	*2.98*	
Poultry						
1990	3229	2808	2.43	37.8	67.6	1.06
1991	3950	3436	2.94	45.4	85.7	1.17
1992	4542	3916	3.31	92.0	77.9	0
1993	5736	4953	4.14	107.4	99.7	0
1994	7552	6483	5.36	184.5	136.3	0
1995	9347	7977	6.54	282.1	260.7	0
1996	8701	8776	7.12	326.8	312.3	0
1997	10,308	9594	7.71	324.2	209.7	0
1998	11,410	9769	7.78	309.2	194.5	0
1999	12,069	10,321	8.15	340.2	799.3	4.45
2000	12,380	10,450	8.17	505.0	870.0	3.49
2001	12,310	10,366	8.03	530.0	765.0	2.27
Growth (%)[c]	*13.64*	*13.35*	*12.22*	*26.40*	*27.14*	
Pork						
1990	22,808	17,645	15.30	124.2	0.01	0
1991	24,523	18,992	16.23	116.6	0.02	0
1992	26,350	20,494	17.32	50.4	0.04	0
1993	28,544	22,194	18.55	60.5	0.12	0
1994	32,048	24,876	20.58	104.3	0.33	0
1995	36,484	28,276	23.17	157.5	2.74	0
1996	31,580	28,318	22.98	132.0	1.79	0
1997	35,963	28,740	23.10	105.1	2.76	0
1998	38,837	30,004	23.89	105.0	15.83	0
1999	40,056	31,249	24.67	53.7	58.44	0.02
2000	40,314	31,463	24.61	121.0	136.14	0.05
2001	42,400	33,024	25.59	135.0	94.27	0
Growth (%)[c]	*5.82*	*5.88*	*4.83*			
Seafood						
1990	14,667	7622	6.61	370	365	0
1991	16,520	8994	7.69	380	784	4.49
1992	19,738	10,826	9.15	470	1032	5.19
1993	23,638	12,727	10.64	501	936	3.42
1994	28,116	15,220	12.59	666	1266	3.94
1995	32,731	17,641	14.45	721	1342	3.52
1996	36,542	19,601	15.90	787	1386	3.05
1997	39,937	21,366	17.17	910	1509	2.80
1998	44,472	23,272	18.53	991	1137	0.63
1999	47,500	24,776	19.56	1229	1305	0.31
2000	49,636	25,784	20.16	1524	1497	0
2001	56,408	29,212	22.62	1753	1646	0
Growth (%)[c]	*13.64*	*13.30*	*12.16*	*15.00*	*9.94*	

kt = kilotonnes

[a] *Production, exports and imports measured in kt carcass weight equivalent; consumption and consumption per capita measured in kt retail weight*

[b] *Calculated as the ratio of net imports to total consumption, all measured in carcass weight equivalent*

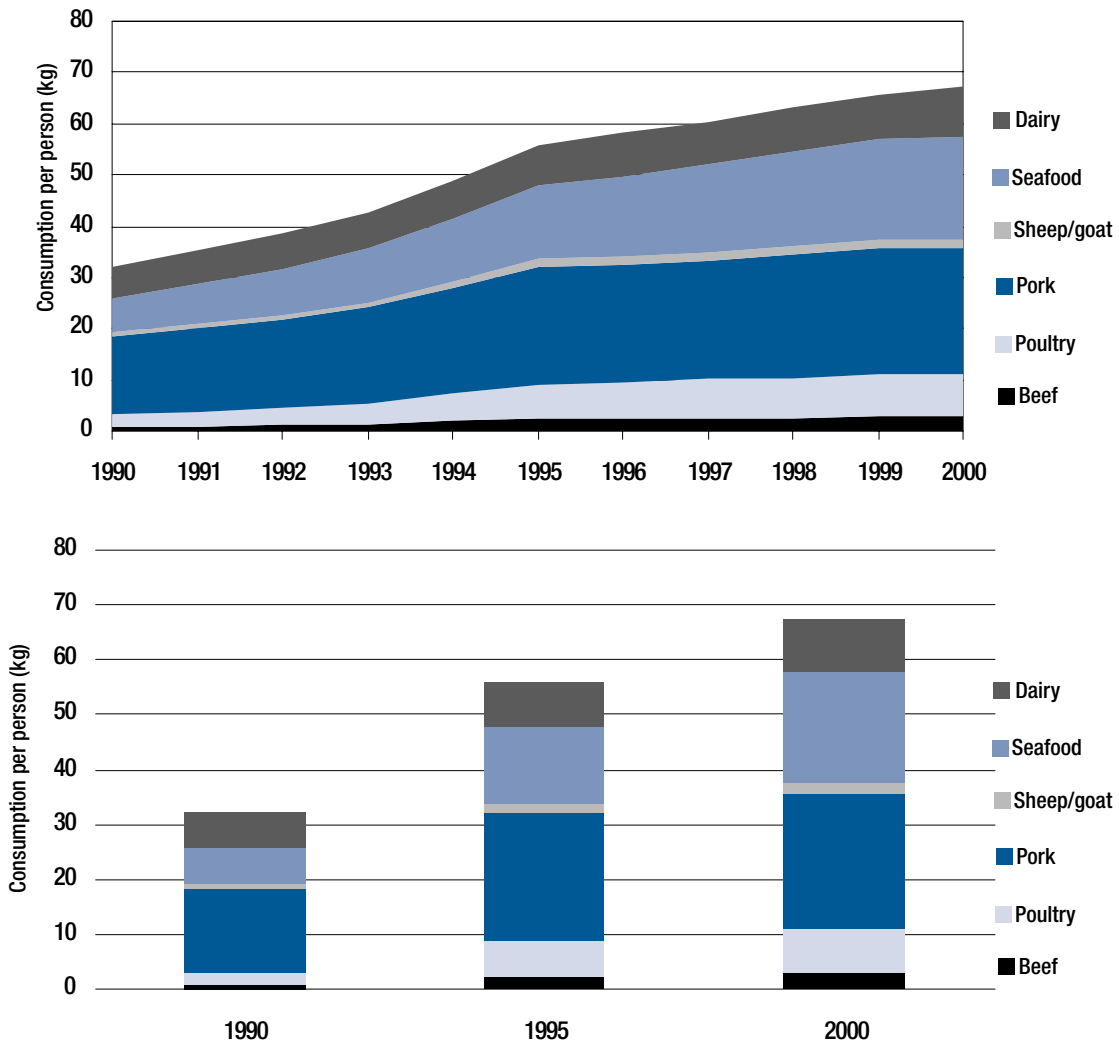
[c] *Average logarithmic growth rate, 1990–2001*

Source: GMI database

Key points

- Meat production growth is extremely high for beef (from a low base) and poultry.
- Seafood production growth is also extremely high.
- Production growth for all meats has matched demand growth, so there is no import dependence.

Figure 3.1. Trends in per capita consumption of meat and dairy, 1990–2000.



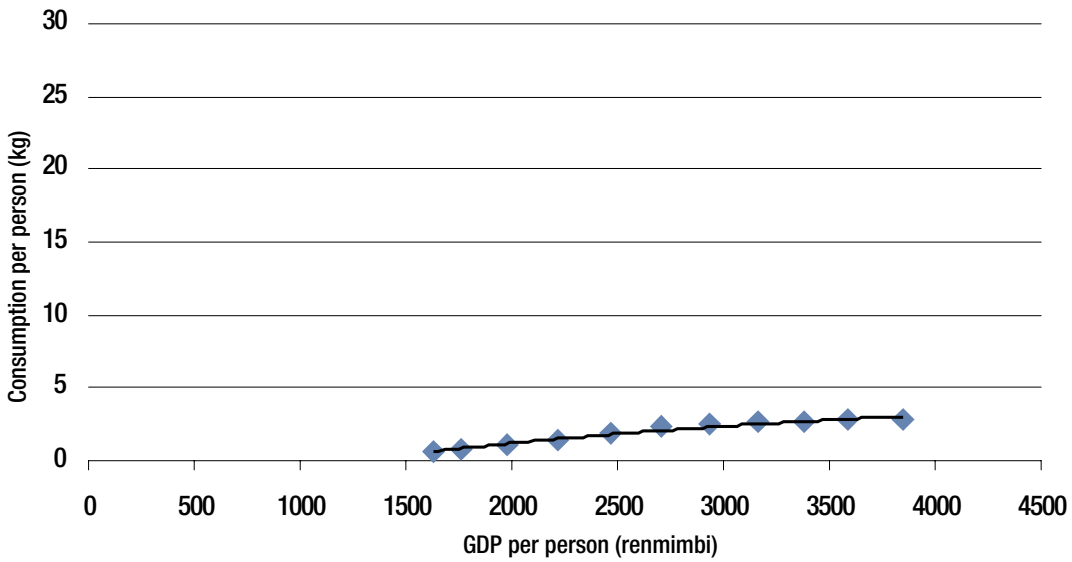
Data source: GMI database

Key points

- There has been a rapid increase in per capita meat consumption and also seafood consumption.
- Pork still dominates the meat diet, but beef and poultry are making rapid inroads.
- Seafood is a major source of protein.

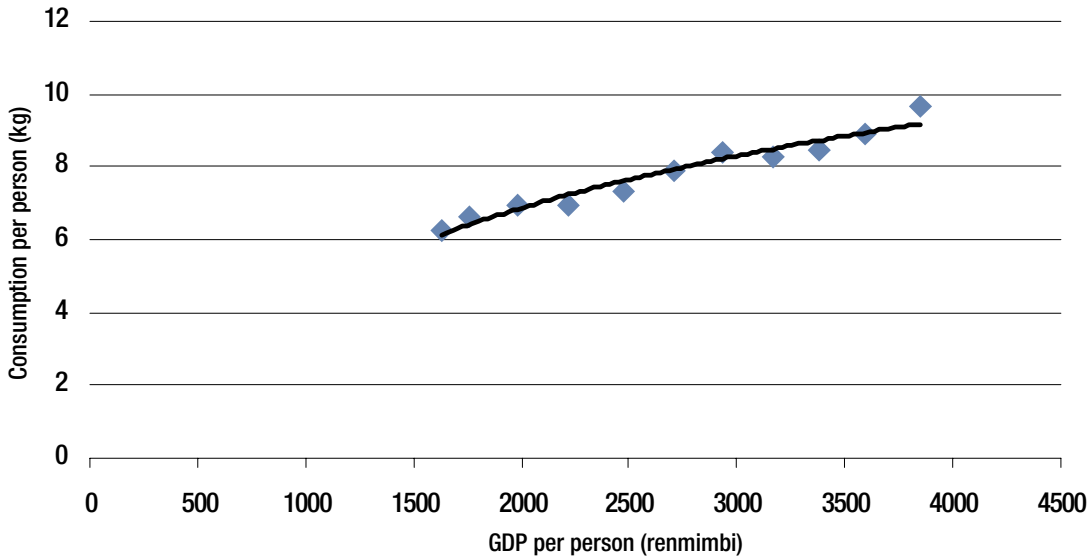
Relationship Between Per Capita Meat Protein Consumption and Per Capita Income (Engel Curves)

Figure 3.2. Beef.



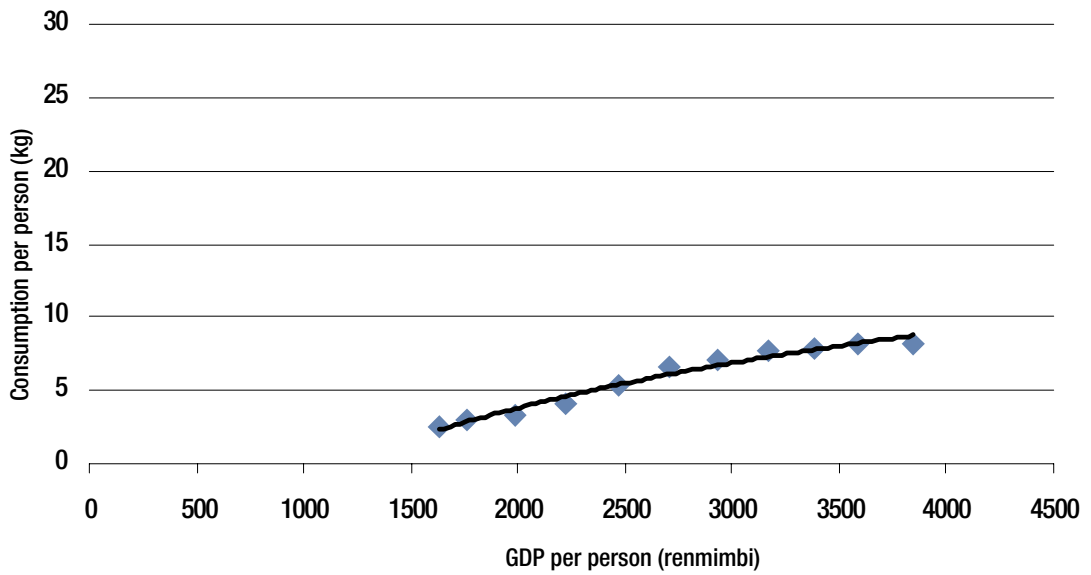
Data source: GMI database

Figure 3.3. Dairy.



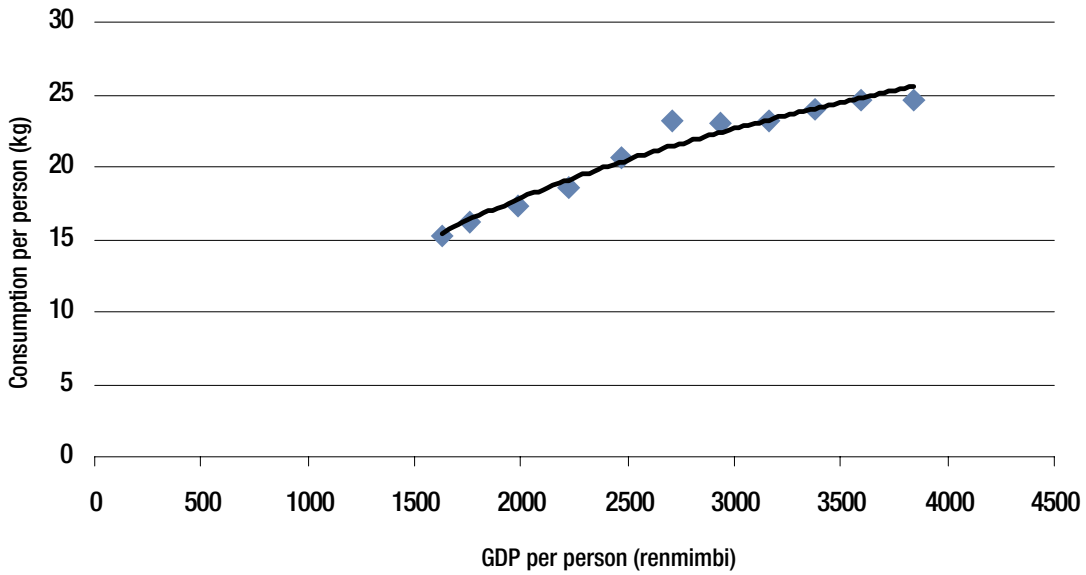
Data source: GMI database

Figure 3.4. Poultry.



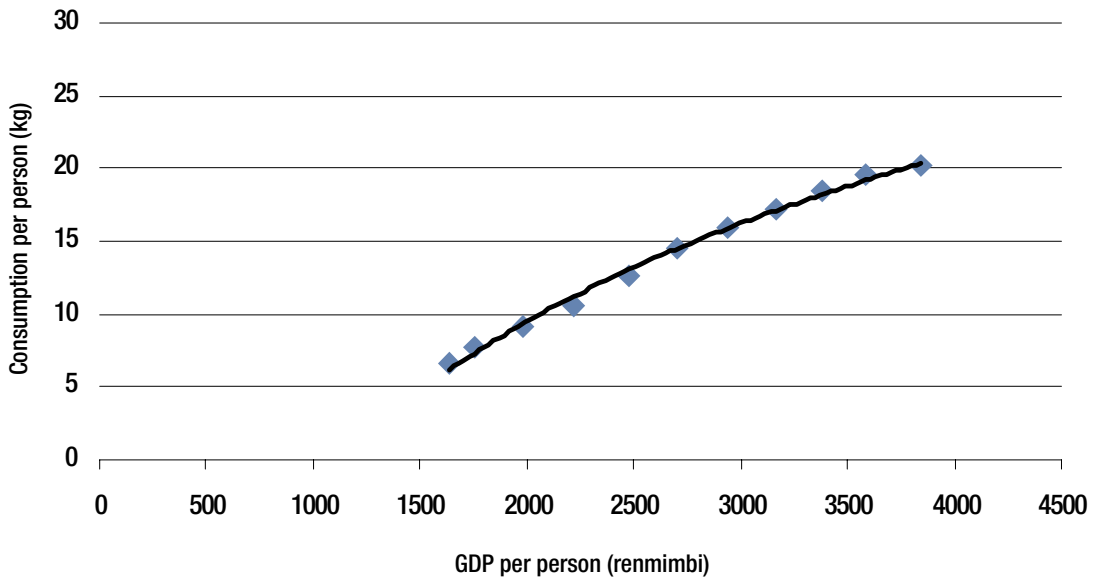
Data source: GMI database

Figure 3.5. Pork.



Data source: GMI database

Figure 3.6. Seafood.



Data source: GMI database

Key points

- The rate of increase in consumption of the dominant meat (pork) is slowing considerably.

Beef

Recent performance

- There has been spectacular growth over the past two decades following the government's 'straw for beef' project (cattle numbers increased from 72 million in 1980 to 125 million now).
- There has been a rapid increase in beef production, but quality remains low (China is now the second largest beef producer in the world).

Policy settings

- There has been a free market since 1985.
- The 'straw for beef' program started in 1992; it aims to encourage production by utilising potential waste resources and relieving pressure on the feed grain industry.
- Grain self-sufficiency is an important government policy issue. The 'straw for beef' program aims to utilise the 60 million tonnes of crop residue produced annually to save feed grain and promote beef (treating straw with ammonia increases its digestibility and feed intake by 20 per cent and doubles its protein content).
- The 'straw for beef' program has resulted in the relocation of cattle from pastoral to agricultural regions.
- Aid projects have assisted beef cattle production. For example, a World Bank smallholder cattle development project of US$180 million, which runs from December 1999 to the end of 2005, aims to improve breeds, feed efficiency, veterinary services and slaughter/processing facilities. In Heilongjiang, a World Bank project running from 1997 to 2003 and costing $240 million aims to expand livestock raising and agro-processing.

Socioeconomic and institutional framework

- Production is dominated by smallholders.
- Some 95 per cent of beef is based on household slaughtering, sold through wet markets and eaten within 6–8 hours of slaughter.
- There are big problems in moving to a more sophisticated system based on large-scale abattoirs and a marketing chain for meat to pass through.
- A lot of infrastructure development is needed to move from a system based on household slaughtering.

Environmental issues

- Grassland degradation through unsustainable grazing has required relocation from pastoral regions.
- Burning of straw caused significant air pollution, but recycling has decreased pollution and returned organic fertiliser to the soil as manure.

	• Recycling has forced the closure of small crop mills based on straw, which was a major source of pollution. • Where there are 1–3 head per farm, the land is able to absorb manure (87 per cent of manure is utilised by smallholders), but larger feedlots do not have the facilities to dispose of waste water.
Production system	• There are three systems (pastoral, household and commercial). • The pastoral system (breeding stock and feeding cattle) accounts for 14 per cent of cattle but is in decline because of degradation of grazing land and winter feed shortages. • The household system (with 2–3 head) is a nonspecialised activity, where animals are fed for slaughter, to supply feedlots or supply milk; animals are fed on a wide range of waste materials, but valuable feed is kept for pigs and poultry. • Specialist beef households have their own straw ammoniation pits and generally do not purchase feed. • Contracted household producers (farmers plus companies) are specialised houses raising cattle according to the strict care and feed specifications of the contracting company (usually a large state or private abattoir) and use more grain-intensive practices than other household producers. • Commercial feedlots are a small part of the industry (only 5 per cent) and source 80 per cent of their cattle from the pastoral region. • Over 90 per cent of cattle are still slaughtered by households through low-cost operations which service local villages. • In 1998 a law was introduced to restrict slaughtering to a small number of locations where animal hygiene and health regulations can be enforced; if this law is enforced, it will force the industry to commercialisation.
Product demand and market opportunities	• Export potential is questionable because of low product quality and artificial supply stimulus. • Beef is still an unfamiliar product, and tradition and frugality hamper the development of recent consumers. Beef is traditionally seen as a winter food (around 80 per cent of the population consume beef only in winter). • The consumption of beef in the service sector is increasing rapidly. • The rural beef market is about low-grade cheap beef from wet markets, whereas there are some higher-grade cuts in urban areas. Wet market demand will continue to dominate into the medium term.
Future developments	• Significant barriers to large-scale commercialisation are likely to persist for some time because of the fragmented, dispersed nature of the sector, with most cattle raised, slaughtered and consumed in the same local area.

- The lack of significant profitability of non-specialised producers should constrain growth prospects (the present situation is driven by supply rather than demand).
- There will be a gradual expansion of feeding grain to cattle, but change will be slow. For beef production to expand significantly, intensive systems will be needed. The grassland degradation issue will prevent grazing expansion.

Pig meat

Recent performance

- Pig meat production has expanded steadily. China is the world's largest pig meat producer, accounting for more than half of world pig meat production. Pig meat represents more than 80 per cent of China's meat consumption.

Policy settings

- There is a strong concern with food security and self-sufficiency.
- There is increased concern about food quality and safety issues.
- There is growing concern about environmental issues, particularly problems associated with intensive pig farms in urban areas.
- Foreign investment in the livestock sector is encouraged by tax exemptions.
- Access to cheap credit has provided a policy bias toward large-scale development.

Socioeconomic and institutional framework

- The pig industry is still characterised by a small-scale structure. Some 70 per cent of rural households (135 million farmers) have pigs, with an average of 2–3 head per household (see Table 3.4). There has been very little change over the last decade.
- Small-scale production has proved to be cost-efficient because of the use of residues as feed; these would have no other value. Green roughage is a specialty; there is a low ratio of grain to meat.
- Over 80 per cent of pigs are slaughtered and marketed by small village operators; backyard farms produce heavier animals than larger producers.
- Foreign investment and foreign ventures have played an important role in the development of the Chinese feed grain industry. These companies have made a big contribution to livestock development, especially in animal nutrition.
- Livestock production plays a significant role in poverty alleviation for small farmers, who are recognised by the World Bank for this contribution.
- The industry offers work opportunities for rural women and children.

Environmental issues	• The high population density makes it difficult to absorb nutrients from pig manure, which is the hardest effluent to treat. • Canada and the United States have a major competitive advantage on environmental grounds because of their large land areas and lower population densities.
Production system	• Backyard pig meat production is still 80 per cent of total production, but is falling steadily, with a move towards specialised household production and specialised commercial production. • Feeding practices of small household producers are poor, as is meat quality. • Specialised farms depend completely on purchased feeds, especially grain. • Traditional farmers grow their own feed (with a dominance of green roughage).
Product demand and market opportunities	• Per capita consumption of pig meat is registering the lowest growth of all meats. • Urban residents have higher incomes and consume 50 per cent more meat than rural residents. There is a dramatic urbanisation process under way: the urban population is increasing by 4 per cent per year; it is now 31 per cent of the total population and may reach 50 per cent by 2030. • There is a general belief that China's WTO entry will benefit China's livestock sector because it is labour intensive. Import tariffs will be reduced as shown in Table 3.7.
Future developments	• Feed grain used for pigs will increase more than meat production over the longer term as the traditional household share of pig meat production falls. • Imports of grain for livestock feed and meat imports will increase substantially. • Animal disease-free zones are being set up with quarantine and monitoring to agreed standards with a view to exporting. But the economics of exports remain questionable because of the need to buy feed grain to replace scraps which are currently cheap. China lacks the health standards and the ability to control pollution for strong export growth. China does not have an open flow of information about diseases. Until it adopts such a policy its export opportunities will be highly restricted. • Chinese officials anticipate a pig meat production growth rate of around 3 per cent per year, compared with 5 per cent for poultry.

Poultry

Recent performance	• There is rapidly growing production with a very low dependence on imports. Ducks are a very significant part of production, especially in the south.
Policy settings	• There is some protection against imports, but tariffs will be lowered upon WTO entry (the current tariff of 20 per cent is to fall to 12 per cent by 2004). • Technical extension is needed via nationwide breeding farms (poultry, pigs and cattle) to improve local breeds. • In the past, the policy of food self-sufficiency has curtailed imports.
Socioeconomic and institutional framework	• Intensive production systems have developed fastest with poultry, where over 50 per cent of production is now on farms with more than 1000 birds (Table 3.5). Most people purchase their feed from large, integrated poultry enterprises. • High feed and economic efficiency and high consumer preference have led to rapid intensification of production. • Poultry waste in the form of manure is used for horticultural crops and as feed for fish and other livestock, providing a significant part of poultry returns.
Environmental issues	• Minor compared with those on pig-producing farms. Waste is easy to deal with. Some big commercial layer farms have established affiliated plants to produce organic fertiliser. • There is also heat drying of manure for fish and cattle feeds. The unpleasant smell of large poultry farms near urban centres is the major environmental problem.
Production system	• There is a substantial commercial sector which takes nearly half of China's industrial feed grain production. • Foreign investors in feed mills have also started chicken farms. • The switch from state-owned to privately owned feed mills has increased efficiency (40 per cent of production is now in intensive systems). • The meat conversion ratio has improved significantly and is now 1.9:1, compared with 1.5:1 in industrial countries.

Product demand and market opportunities	• Production will continue to expand rapidly with a big increase in intensive production. For broilers, the share of intensive production will reach 60 per cent by 2005. • The production growth rate is 5 per cent per year.
Future developments	• The per capita consumption of poultry increased rapidly over the past decade and further significant growth is likely. • Income elasticity for poultry is very high (higher than for pig meat and beef). A study by the International Food Policy Research Institute (IFPRI) estimates income elasticity for poultry ranging from 0.99 to 1.06 for 2000–10. • Over the past 20 years chicken has become the cheapest meat, with the industrialisation of production systems. • There has been a rapid growth in imports in recent years (mainly wings, claws and giblets, which are low priced in Western countries but highly sought after in China).

Dairy

Recent performance	• There has been steady growth, due to technical progress and fast growing demand. • Market development, with milk processing and expansion of refrigerated facilities, is expanding the demand for milk.
Policy settings	• There are very high barriers to imported dairy products (e.g. tariffs at 65 to 90 per cent for butter and cheese).
Socioeconomic and institutional framework	• There are more than 40 joint ventures or wholly foreign-owned enterprises, including Nestle and Parmalat. • Dairy is a relatively new industry in China; there were only a few dairy cattle in China prior to the 1980s. • Milk production for large cities is from highly intensive production systems.
Environmental issues	• Minor compared with those on pig-producing farms. Waste is easy to deal with. Some big commercial layer farms have established affiliated plants to produce organic fertiliser. • Heat drying of manure for fish and cattle feeds results in an unpleasant smell from large poultry farms near urban centres; this is the major environmental problem.
Production system	• Some 25 per cent is on state farms (the average herd size is 300

	per farm). • Over 60 per cent of dairy cows are on small household farms each with 2–3 cows, with low productivity and poor quality products (Table 3.6). • Some 15 per cent of production is owned by collectives, with herds of 200 per farm. • Small farms are increasingly working together with large state farms and collectives to improve milk quality and distribution.
Product demand and market opportunities	• The industry is characterised by low productivity, poor quality product and weak demand. Some 30–40 per cent of urban Chinese do not consume dairy products at all, and only 20 per cent are regular consumers. • More foreign technology will be needed to significantly increase production. • Growth in imports will exceed growth in production as demand expands. In particular, China's WTO entry will significantly lower tariffs on dairy products.
Future developments	• Current consumption per capita is very low, though it is expected to expand significantly by 2015. • The demand for high-quality imports can be expected to grow rapidly as per capita incomes grow and WTO entry dramatically cuts tariff barriers. • The IFPRI study shows very high income elasticities of demand for milk, from 1.64 in rural areas to 1.91 in urban areas. • The Ministry of Agriculture projects per capita consumption growth of 2.5 per cent per year to 2030; most of this is likely to be met by imports.

Size Distributions and Import Tariffs

Table 3.3. Size distribution of beef producers skewed to smallholders.

Range	Percentage of holders	Percentage of cattle slaughtered
1–5 head	97.0	72
6–10 head	1.8	8
11–100 head	1.0	12
101–1000 head	0.3	5
> 1000 head	0.002	3

Source: China 1997 Agricultural census

Table 3.4. Size distribution of pig producers.

Range	Percentage of holders	Percentage of pigs slaughtered
1–5	92.6	59.4
6–10	4.6	11.8
11–30	2.5	13.0
31–50	0.2	2.0
51–200	0.1	3.8
201–1000	0.02	2.7
> 1000	0.01	7.3

Source: China 1997 Agricultural census

Table 3.5. Size distribution of poultry producers.

Range	Percentage of holders	Slaughtering percentage
1–50	96.8	27.0
51–200	2.3	7.1
201–1000	0.6	9.1
1001–10,00	0.3	31.3
> 10,000	0.03	25.5

Source: China 1997 Agricultural census

Table 3.6. Size distribution of dairy cow holders.

Range	Percentage of holders	Cow inventory
1–5	86.7	41.6
6–10	8.5	15.5
11–100	4.7	23
> 100	0.2	19.9

Source: China 1997 Agricultural census

Table 3.7. Import tariffs (per cent).

Meat	Current tariff	Tariff in 2004 due to WTO entry
Beef	45	12
Pork/poultry	20	12
Cheese	50	12
Ice-cream	45	19

Source: China 1997 Agricultural census

Baseline Projections

These are shown in Table 3.8. Appendix B shows projections assuming the GDP growth rates of the six countries are reduced by one-third in each year of the projection period.

Table 3.8. Baseline projections for China.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	5600	5814	6021	6209	6378	7323	8096	8721	2.2
Pig meat	42,400	44,703	46,907	48,876	50,623	61,153	70,546	78,902	3.2
Poultry meat	12,310	12,623	12,897	13,045	13,092	14,886	16,628	17,951	1.9
Dairy	12,913	13,429	13,966	14,525	15,106	18,379	22,361	27,205	3.8
Imports (kt cwe)									
Beef	4	5	6	7	8	11	14	16	7.5
Pig meat	94	177	293	464	681	1874	3077	4250	21.0
Poultry meat	765	1046	1368	1739	2149	3655	4734	5639	10.5
Dairy	164	319	447	539	590	636	646	847	8.6
Exports (kt cwe)									
Beef	45	24	15	10	7	2	1	1	–18.8
Pig meat	135	82	56	38	27	13	9	8	–13.1
Poultry meat	530	368	285	226	182	121	107	105	–7.8
Dairy	50	54	57	61	66	92	98	105	3.8
Import dependency (%)									
Beef	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	
Pig meat	0.0	0.3	0.6	1.1	1.6	5.3	6.5		
Poultry meat	2.1	5.1	7.7	10.4	13.1	19.2	21.8	23.6	
Dairy	0.9	1.9	2.7	3.2	3.4	2.9	2.4	2.7	
Consumption (kt rw)									
Beef	3891	4056	4208	4344	4465	5133	5676	6115	2.3
Pig meat	33,040	34,942	36,773	38,455	39,996	49,151	57,419	64,852	3.4
Poultry meat	11,040	13,302	13,980	14,558	15,059	18,419	21,256	23,486	3.8
Dairy	13,028	13,695	14,356	15,003	15,630	18,923	22,908	27,947	3.9
Per person consumption (kg rw/person)									
Total meat	54.9	58.8	61.3	63.6	65.5	77.0	85.8	92.5	2.6
Beef	3.0	3.1	3.2	3.3	3.4	3.7	4.0	4.1	1.6
Sheep and goat meat	1.7	1.7	1.8	1.9	1.9	2.3	2.5	2.6	2.3
Pig meat	25.6	26.9	28.1	29.1	30.0	35.6	40.0	43.8	2.7
Poultry meat	8.6	10.2	10.7	11.0	11.3	13.3	14.8	15.9	3.1
Seafood	16.0	16.8	17.6	18.3	18.8	22.2	24.5	26.1	2.5
Dairy	10.1	10.4	10.8	11.1	11.4	12.8	14.6	17.0	2.6

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight
Source: GMI model and CIE calculations

Key points

- Per person meat consumption will increase by 68 per cent over the next 20 years.
- There will be little change in composition between meats, except that beef consumption will grow more slowly than other meats.
- There will be a rapid increase in dependency on poultry imports and a moderate increase in dependency on pig meat imports.

4 India: Recent Performance and Baseline Projections

Chapter outline

This chapter provides the following information:

- data on India's economy-wide performance (summary indicators)
- meat industry data for beef, dairy, poultry, pork and seafood
- trends in per capita consumption
- Engel curves showing the relationship between per capita meat protein consumption and per capita income for beef, dairy, poultry, pork and seafood
- information on production systems, policy settings and future developments
- baseline projections to 2020 for production, imports, exports, import dependency, consumption and per person consumption.

Where relevant, each section of data concludes with a set of key points, which appear in a shaded box.

Economy-wide Performance

Table 4.1. Summary indicators, 1990–2000.

Year	GDP(real) per capita		Population	
	Rupees/capita	Growth rate (%)	Millions	Growth rate (%)
1990	9195.7		834.7	
1991	9135.8	–0.65	851.7	2.03
1992	9340.9	2.25	867.8	1.90
1993	9622.0	3.01	883.9	1.85
1994	10,088.0	4.84	918.6	3.92
1995	10,648.0	5.55	935.7	1.87
1996	11,215.9	5.33	953.0	1.84
1997	11,574.4	3.20	970.2	1.81
1998	12,049.3	4.10	987.5	1.78
1999	12,666.0	5.12	1004.8	1.75
2000	13,218.4	4.36	1022.0	1.72

Source: http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm

Key points

- Per capita income growth was solid following the economic reforms of the early 1990s.
- The population growth rate remains high.

Meat Industry Data

Table 4.2. Meat industry data, 1990–2001.

	Production[a] (kt)	Consumption[a] (kt)	(kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
Beef						
1990	887	576	0.69	63.4	0.007	0
1991	905	576	0.68	81.5	0.001	0
1992	935	597	0.69	81.6	0.000	0
1993	945	590	0.67	101.7	0.000	0
1994	1025	636	0.69	116.1	0.000	0
1995	1100	658	0.70	159.7	0.000	0
1996	1370	793	0.83	157.6	0.000	0
1997	1430	878	0.90	176.3	0.000	0
1998	1593	1007	1.02	154.0	0.000	0
1999	1660	1045	1.04	161.0	0.000	0
2000	1750	1015	0.99	300.4	0.000	0
2001	1770	1 001	0.96	340.6	0.000	0
Growth (%)[c]	*7.74*	*6.83*	*4.68*	*13.38*	NA	
Dairy						
1990	53,678	53,679	64.31	0.338	1.059	0.001
1991	54,061	54,061	63.48	2.295	1.978	0
1992	56,406	56,415	65.01	0.592	9.429	0.016
1993	58,860	58,861	66.59	1.522	2.559	0.002
1994	61,398	61,391	66.83	8.202	0.947	0

Table 4.2. Meat industry data, 1990-2001 (cont'd).

	Production[a] (kt)	Consumption[a] (kt)	Consumption[a] (kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
1995	64,619	64,620	69.06	3.593	4.977	0.002
1996	67,258	67,258	70.58	0.793	0.388	0
1997	71,097	71,096	73.28	1.607	0.771	0
1998	75,500	75,501	76.46	0.866	1.873	0.001
1999	78,920	78,934	78.56	4.597	18.396	0.017
2000	81,790	81,782	80.02	9.406	1.102	0
2001	85,564	85,554	82.30	11.111	1.112	0
Growth (%)[c]	*4.61*	*4.61*	*2.46*	*18.12*	*0.89*	
Poultry						
1990	342.0	301.0	0.36	0.000	0.000	0
1991	360.0	316.7	0.37	0.125	0.000	0
1992	405.0	356.4	0.41	0.014	0.000	0
1993	453.6	399.1	0.45	0.102	0.000	0
1994	467.7	411.6	0.45	0.054	0.000	0
1995	478.8	421.3	0.45	0.013	0.000	0
1996	478.8	421.3	0.44	0.002	0.001	0
1997	526.5	463.3	0.48	0.019	0.000	0
1998	540.0	475.2	0.48	0.007	0.000	0
1999	558.9	491.8	0.49	0.026	0.000	0
2000	575.1	506.1	0.50	NA	NA	NA
2001	595.4	523.9	0.50	NA	NA	NA
Growth (%)[c]	*4.94*	*4.94*	*2.83*	NA	NA	
Pork						
1990	416.5	324.9	0.39	0.000	0.000	0
1991	434.0	338.5	0.40	0.000	0.000	0
1992	444.5	346.7	0.40	0.007	0.000	0
1993	469.0	365.8	0.41	0.056	0.000	0
1994	477.1	371.6	0.40	0.741	0.000	0
1995	495.2	385.5	0.41	0.934	0.000	0
1996	514.0	400.6	0.42	0.353	0.001	0
1997	533.4	415.9	0.43	0.242	0.000	0
1998	542.5	423.1	0.43	0.108	0.000	0
1999	560.0	436.5	0.43	0.341	0.000	0
2000	560.0	450.5	0.44	NA	NA	NA
2001	595.0	463.7	0.45	NA	NA	NA
Growth (%)[c]	*3.27*	*3.27*	*1.19*	NA	NA	
Seafood						
1990	3875	1880	2.25	134.9	0.5	0
1991	4128	1956	2.30	191.7	1.4	0
1992	4318	2036	2.35	210.8	1.6	0
1993	4694	2187	2.47	258.3	4.1	0
1994	4875	2221	2.42	322.0	7.9	0
1995	5044	2327	2.49	307.8	12.0	0
1996	5326	2386	2.50	394.5	10.8	0
1997	5483	2470	2.55	397.6	15.9	0
1998	5376	2517	2.55	311.1	32.5	0
1999	5693	2750	2.74	229.0	19.4	0
2000	5790	2852	2.79	180.5	22.1	0
2001	6023	2968	2.86	187.8	32.4	0
Growth (%)[c]	*4.03*	*4.08*	*1.94*	*4.08*	*46.42*	

kt = kilotonnes; NA = not available or not applicable

[a] Production, exports and imports measured in kt carcass weight equivalent; consumption and consumption per capita measured in kt retail weight

[b] Calculated as the ratio of net imports to total consumption, all measured in carcass weight equivalent

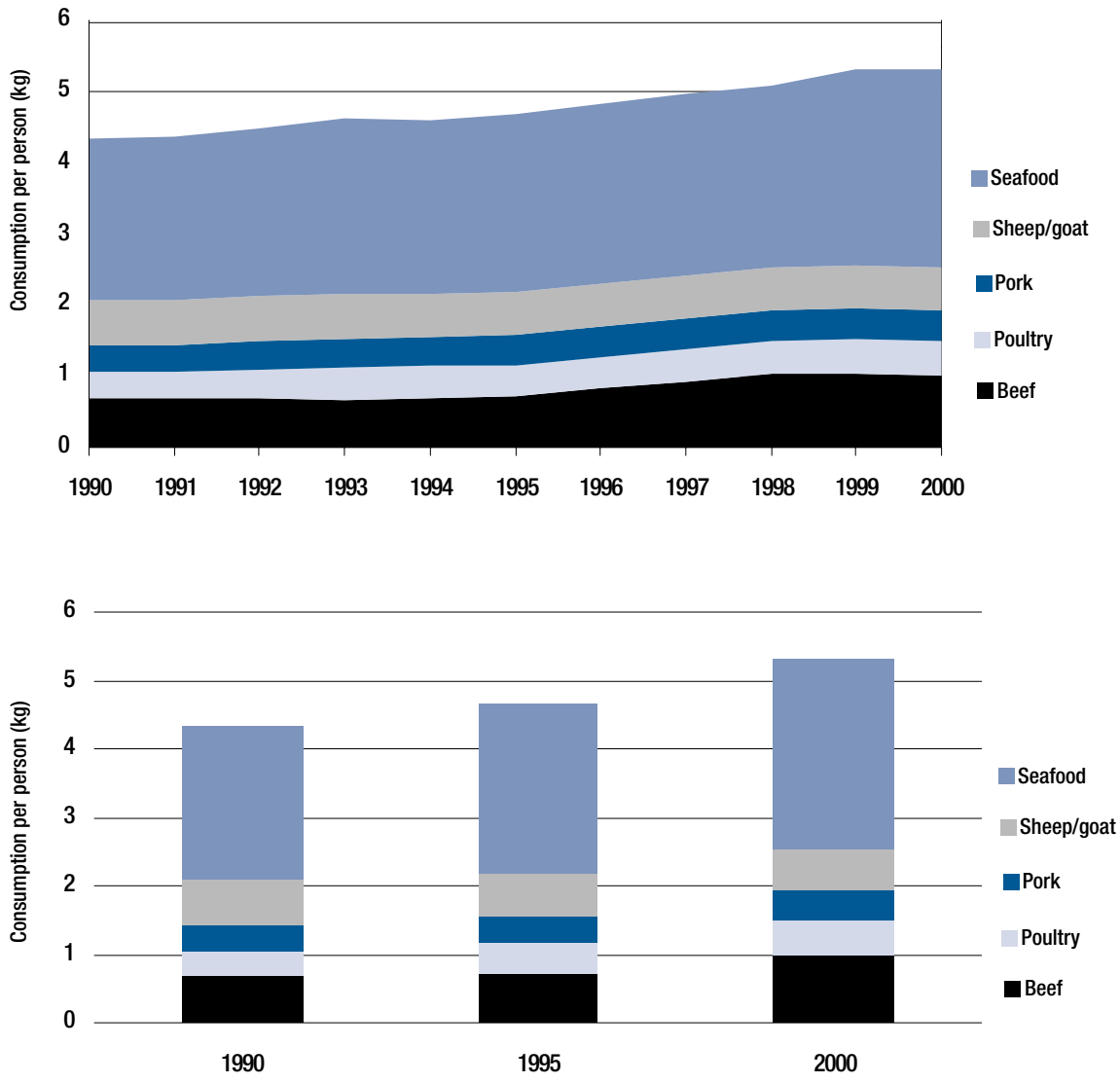
[c] Average logarithmic growth rate, 1990–2001

Source: GMI database

Key points

- There has been a steady increase in production of the major meats.
- Growth in meat production matches growth in consumption but per capita consumption is very low.
- There has been a steady increase in dairy production and per capita consumption from a high level.

Figure 4.1. Trends in per capita consumption of meat, 1990–2000.



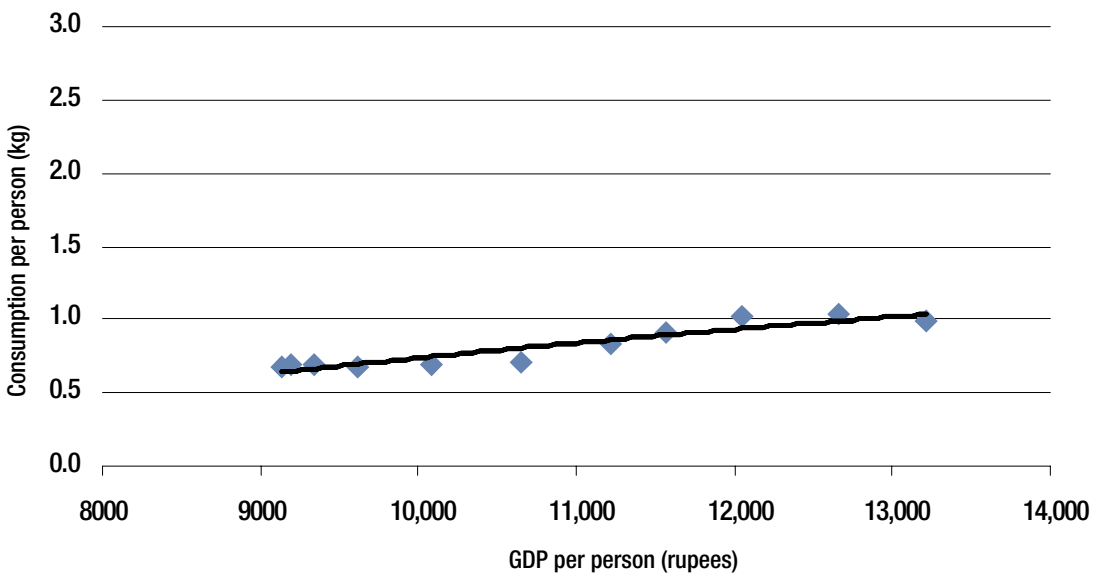
Data source: GMI database

Key points

- Per capita meat consumption is expanding steadily but from a very low base.
- Beef (includes buffalo), sheep and goat meat dominate, but consumption is very low for all meats.

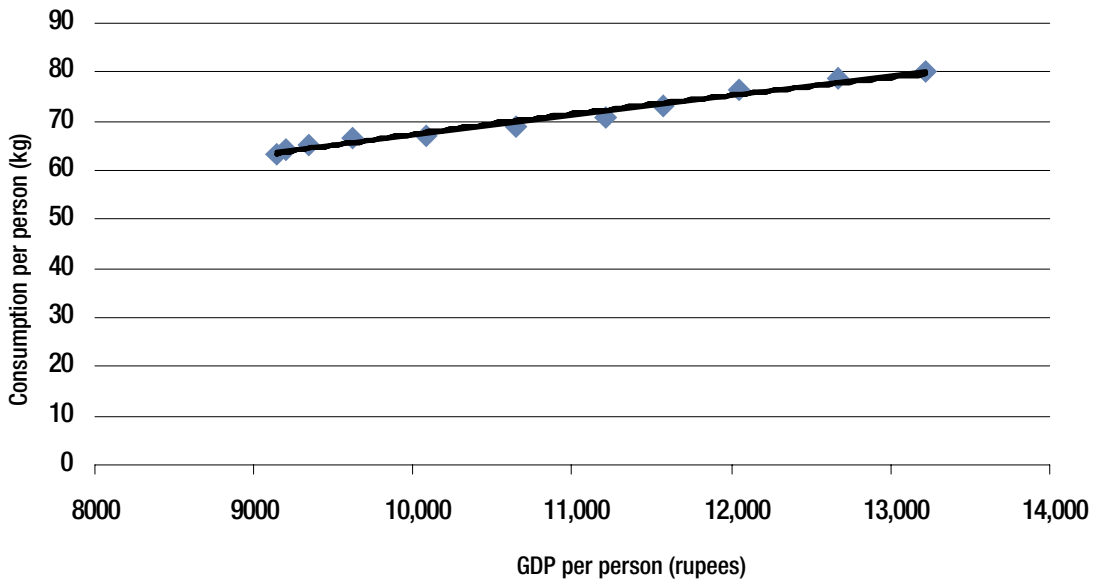
Relationship Between Per Capita Meat Protein Consumption and Per Capita Income (Engel Curves)

Figure 4.2. Beef.



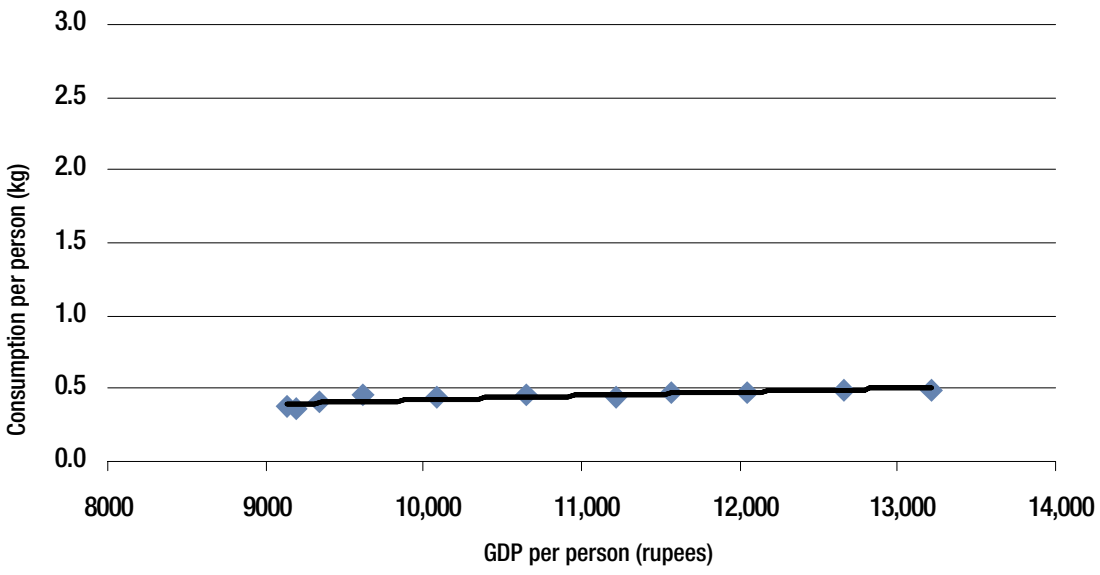
Data source: GMI database

Figure 4.3. Dairy.



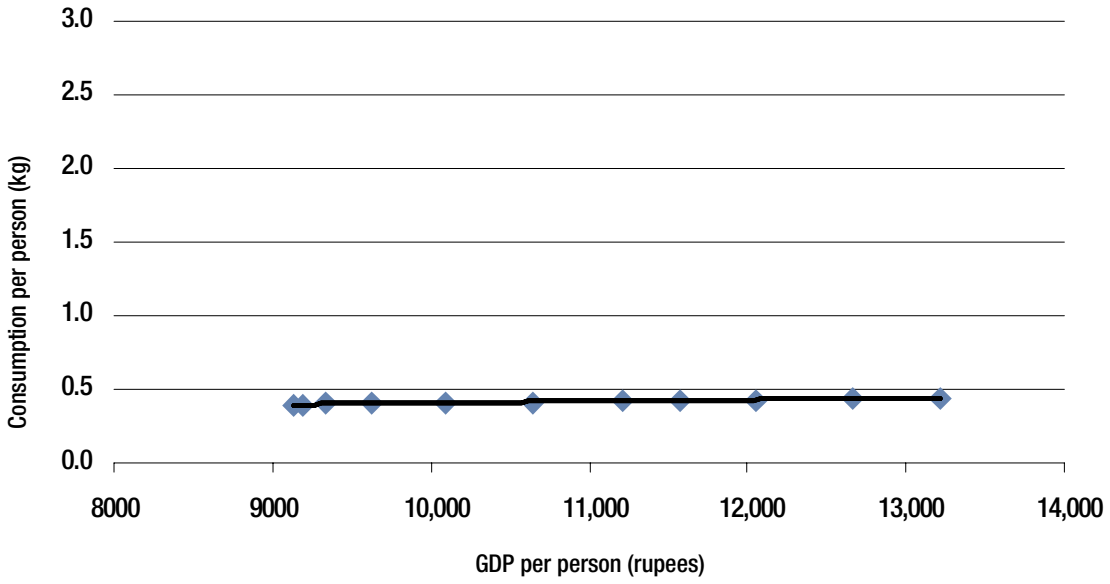
Data source: GMI database

Figure 4.4. Poultry.



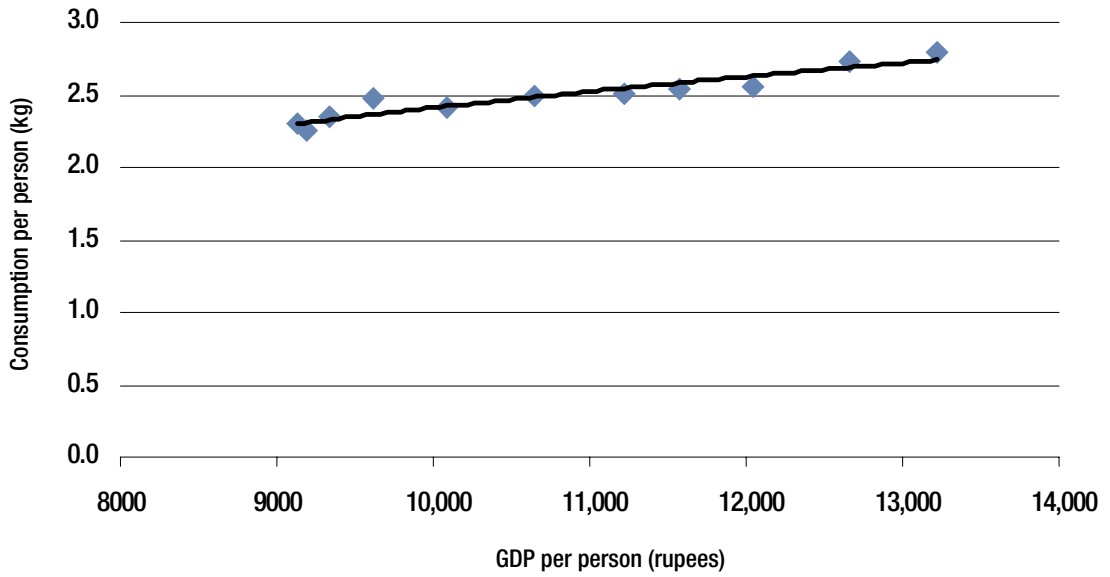
Data source: GMI database

Figure 4.5. Pork.



Data source: GMI database

Figure 4.6. Seafood.



Data source: GMI database

Beef

Recent performance	• Some 24 million cattle and buffalo are slaughtered each year for meat production. • There has been annual production growth of 7.7 per cent over the last decade, but from a very low base.
Policy settings	• The livestock sector gets no support (by contrast, the food grain sector gets significant subsidies). • Extensive R&D programs to improve milk and meat productivity are under way.
Socioeconomic and institutional framework	• Abattoirs are appalling (very few are modernised). • Most slaughter occurs in the unorganised sector, using clandestine and unhygienic methods. • The slaughtering of cows is outlawed except in west Bengal and Karala.
Environmental issues	• Abattoir/slaughter waste is dumped in open spaces. • Slaughtering facilities need to be moved out of urban and village areas to help waste disposal. • Overgrazing is a significant problem.
Production system	• There is no organised industry (beef production is largely a by-product). • Meat yield from cattle and buffalos is very low, as is productivity of the entire production system.
Product demand and market opportunities	• India's Muslims eat beef, but Hindus (80 per cent of the population) do not. • With the laws surrounding slaughtering and the huge supply of unproductive dairy cows and draft cattle and buffalo, there is more than enough meat to supply the beef-eating population. This excess supply provides no incentives for the development of an efficient producing industry. • Surveys shows that three-quarters of Hindus will eat meat (but not beef) when they can afford it. Religious rules are a major problem for the Indian beef industry.
Future developments	• Hindu beliefs about the sacredness of cows is likely to prevent development of an efficient industry.

Poultry

Recent performance	• There has been a 5 per cent annual growth rate in production over the last decade. • The industry uses 12 million tonnes per year of compounded poultry feed. • Poultry are by far the most advanced of India's meat industries. • There are negligible exports because of poor quality and hygiene standards.
Policy settings	• Tariffs of 100 per cent block imports. Tariffs are expected to fall significantly in the next WTO round.
Socioeconomic and institutional framework	• Some 50 per cent of the poultry sector is now commercialised (following a big shift towards commercialisation in the 1990s). • There are big economies of scale in commercialisation. • Integrators are fast taking over from independent growers. Live broilers are marketed at 1.75 kg per bird, with a feed conversion ratio of 1:8.
Environmental issues	• None of any consequence.
Production system	• Integrators are rapidly signing up chicken farmers to become broiler growers (contract farming). They exchange production and supply contracts with inputs and technical advice. • Smaller, independent farmers are struggling to survive with fixed meat prices but highly variable input costs. • Large-scale broiler groups have associated processing facilities. • India is a big exporter of soyabean cake, which, together with maize, is a key ingredient of poultry food. This gives India some prospect for competitive exports of poultry meat.
Product demand and market opportunities	• A big growth in demand is expected, driven by population and per capita income growth. • India is traditionally a market for live birds (96 per cent in total) but its processing share is increasing rapidly.
Future developments	• Some observers expect the number of birds to increase from 700 million now to 4000 million in 2020. • There is some export potential because of low labour costs and feed costs. • Some observers expect consumption to increase to 3.1 kg per person in 2020. • Poultry consumes 30 per cent of India's maize crop. There are doubts about whether India can expand its maize production sufficiently to support the anticipated increase in production to meet projected demands. • The large vegetarian population will constrain total meat consumption.

Pig meat

Recent performance

- There has been annual production growth of 3 per cent over the last decade.

Policy settings

- The livestock sector gets no support (by contrast, the food grain sector gets significant subsidies).

Environmental issues

- Disposal of manure is a big difficulty.

Dairy

Recent performance

- India is the world's largest producer of dairy products. There are 90 million farmers with 1–2 buffalo producing 82 million tonnes of milk per year; and there are 57 million cows, 31 million of which are dairy cows, plus 39 million buffalo, 25 million of which are for milk.
- Milk production is growing at 4.6 per cent per year compared with 1 per cent for the world as a whole.

Policy settings

- There are no subsidies, so there are expectations that WTO liberalisation will advantage Indian industry provided product quality can be improved.
- There are some significant tariffs on imported dairy products. The average tariff is around 27 per cent.
- Operation Flood (launched in 1970 and ending in 1996) has played a key role in rapid industry development, through establishing milk cooperatives, improving their technology and linking milk supplies with demands.
- The Milk and Milk Product Order of 1992 aimed at ensuring a stable supply of milk through control of its processing and distribution.

Socioeconomic and institutional framework

- Some 210 million Indians are lacto-vegetarians who rely heavily on milk protein. Some 200 million Indians below the poverty line rely on milk protein because they cannot afford meat protein.
- Milk is an important part of social and religious life.
- There are 75,000 dairy cooperatives, with over 10 million members. They focus on liquid milk sales, with some larger cooperatives establishing processing and marketing facilities.
- Cow manure is an important organic fertiliser and raw fuel.
- Hindus are 80 per cent of the population. Attitude to cows is a highly significant factor.

Environmental issues

- Not significant as most production is in rural areas where manure is easily disposed of. A national milk grid moves milk out and concentrates in.

Production system	• Semi-intensive system with some feed concentrate plus grazing. • Very low productivity, with only 10 per cent of milk production commercialised using high-yielding milk cows and buffalos. • High costs of compound feed limit its use and production per cow. • Buffalo comprise 40 per cent of milk production (1250 kg per lactation), which is very low by world standards, though steadily improving. • Breeding programs and use of concentrate feed still have a long way to go. • Private investment allowed since the 1990s has doubled the country's milk processing capacity.
Product demand and market opportunities	• Some 50 per cent of milk is produced and consumed in urban areas inhabited by 25 per cent of the country's population. Rapid urbanisation will lead to a rapid demand increase. • Indians love to drink milk. • Buffalo milk has 30 per cent higher total solids than cow milk. Higher fat content is an advantage with some products.
Future developments	• There has been a recent surge in investment, with new processing and manufacturing capacity. • Demand for milk will increase rapidly (at least 5 per cent per year by some estimates). • Production expansion will be curtailed because of limited room for growth in cattle herds, limited grazing, and perhaps a feed grain shortage. But incentives will be strong to improve dairy productivity and help reduce growing dependency on imports. • Religious attitudes to cows will continue to make the industry inefficient because people cannot harm unproductive cows; this should prevent extensive commercialisation.

Baseline Projections

These are shown in Table 4.3. Appendix B shows projections assuming the GDP growth rates of the six countries are reduced by one-third in each year of the projection period.

Table 4.3. Baseline projections for India.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	1890	1947	2021	2100	2182	2710	3364	4224	4.1
Pig meat	578	602	630	660	690	871	1095	1379	4.4
Poultry meat	605	644	691	742	793	1134	1616	2313	6.9
Dairy	85,564	87,276	89,021	90,802	92,618	102,257	110,160	118,674	1.6
Imports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	0	0	0	0	0	0	0	0	NA
Poultry meat	0	0	0	0	0	0	0	0	NA
Dairy	1	1737	3513	5326	6975	15,174	29,710	49,818	70.8
Exports (kt cwe)									
Beef	341	253	201	149	113	98	23	3	–20.6
Pig meat	0	0	0	0	0	0	0	0	0
Poultry meat	0	0	0	0	0	0	0	0	0
Dairy	11	13	16	18	22	50	59	69	9.6
Import dependency (%)									
Beef	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Pig meat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Poultry meat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Dairy	0.0	1.9	3.8	5.5	7.0	12.9	21.2	29.5	
Consumption (kt rw)									
Beef	1084	1186	1274	1365	1448	1828	2339	2954	5.1
Pig meat	451	470	492	515	538	679	854	1076	4.4
Poultry meat	532	644	691	742	793	1134	1616	2313	7.6
Dairy	85,554	89,000	92,519	96,109	99,571	117,382	139,812	168,423	3.4
Per person consumption (kg rw/person)									
Total meat	5.1	5.4	5.7	6.0	6.2	7.9	10.1	13.1	4.8
Beef	1.0	1.1	1.2	1.3	1.3	1.5	1.9	2.2	3.9
Sheep and goat meat	0.6	0.6	0.7	0.7	0.8	1.0	1.3	1.8	5.4
Pig meat	0.4	0.4	0.5	0.5	0.5	0.6	0.7	0.8	3.2
Poultry meat	0.5	0.6	0.6	0.7	0.7	1.0	1.3	1.7	6.3
Seafood	2.5	2.6	2.7	2.8	3.0	3.8	5.0	6.6	5.0
Dairy	82.3	84.2	86.2	88.1	89.9	98.7	110.6	126.9	2.2

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight
Source: GMI model and CIE calculations

Key points

- Per person meat and seafood consumption will more than double over the next 20 years, but is extremely low in comparison to other countries (reaching only 13 kg per person).
- In all meats, production growth is sufficient to satisfy demand growth (with no imports).
- There will be a rapid demand growth for dairy products which is likely to be satisfied by import growth (import dependency is expected to increase to 30 per cent by 2020).

5 Indonesia: Recent Performance and Baseline Projections

Chapter outline

This chapter provides the following information:

- data on Indonesia's economy-wide performance (summary indicators)
- meat industry data for beef, dairy, poultry, pork and seafood
- trends in per capita consumption of meat and dairy products
- Engel curves showing the relationship between per capita meat protein consumption and per capita income for beef, dairy, poultry, pork and seafood
- information on production systems, policy settings and future developments for beef, pig meat, poultry and dairy
- baseline projections to 2020 for production, imports, exports, import dependency, consumption and per person consumption.

Where relevant, each section of data concludes with a set of key points, which appear in a shaded box.

Economy-wide Performance

Table 5.1. Summary indicators, 1990–2000.

Year	GDP(real) per capita		Population	
	Rupiah/capita	Growth rate (%)	Millions	Growth rate (%)
1990	1,466,803		179.5	
1991	1,580,933	7.78	181.4	1.06
1992	1,666,604	5.42	184.5	1.71
1993	1,757,962	5.48	187.6	1.69
1994	1,859,873	5.80	190.7	1.64
1995	1,970,686	5.96	194.8	2.13
1996	2,105,679	6.85	196.8	1.06
1997	2,167,639	2.94	199.9	1.55
1998	1,841,184	–15.06	204.4	2.28
1999	1,813,809	–1.49	209.3	2.37
2000	1,875,216	3.39	212.3	1.44

Source: http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm

Key points

- Growth in per capita income has been hit hard by the economic crisis.
- The population growth rate remains high.

Meat Industry Data

Table 5.2. Meat industry data, 1990–2001.

	Production[a] (kt)	Consumption[a] (kt)	(kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
Beef						
1990	259.0	182.2	1.02	0.065	1.422	0.74
1991	262.0	184.7	1.02	0.000	1.867	1.01
1992	301.0	212.9	1.15	0.000	3.149	1.48
1993	346.3	244.5	1.30	0.021	3.051	1.24
1994	336.5	238.9	1.25	0.004	4.782	2.00
1995	312.0	223.4	1.15	0.021	7.259	3.24
1996	347.2	254.1	1.29	0.004	15.773	6.21
1997	353.7	263.9	1.32	0.005	23.316	8.83
1998	342.6	246.0	1.20	0.000	8.812	3.58
1999	308.8	223.5	1.07	0.015	10.550	4.71
2000	350.7	264.3	1.25	0.022	26.936	10.18
2001	350.0	233.6	1.08	0.175	16.438	6.96
Growth (%)[c]	*2.23*	*2.39*	*0.66*	NA	*27.84*	
Dairy						
1990	605.7	619.8	3.45	15.287	29.445	2.28
1991	624.7	652.6	3.60	16.221	44.104	4.27
1992	643.0	677.4	3.67	9.901	44.395	5.09
1993	655.5	691.9	3.69	5.466	41.847	5.26
1994	721.6	765.9	4.02	4.426	48.730	5.78

Table 5.2. Meat industry data, 1990-2001 (cont'd).

	Production[a] (kt)	Consumption[a] (kt)	Consumption[a] (kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
1995	741.0	803.4	4.13	3.101	65.551	7.77
1996	764.5	811.2	4.12	4.993	51.788	5.77
1997	758.5	805.6	4.03	1.931	48.993	5.84
1998	701.8	740.4	3.62	2.433	40.991	5.21
1999	768.7	884.5	4.23	2.416	118.181	13.09
2000	832.0	917.6	4.32	31.769	117.349	9.33
2001	855.3	956.0	4.44	28.974	129.682	10.53
Growth (%)[c]	*2.79*	*3.52*	*1.77*	*–8.80*	*10.51*	
Poultry						
1990	484.5	426.3	2.38	0.141	0.089	0
1991	561.9	494.4	2.73	0.213	0.116	0
1992	631.9	556.1	3.01	0.001	0.027	0.005
1993	699.6	615.7	3.28	0.632	0.687	0.009
1994	815.6	718.8	3.77	1.103	2.297	0.166
1995	889.0	783.3	4.02	1.000	2.068	0.136
1996	940.0	837.0	4.25	0.006	11.163	1.333
1997	899.5	792.2	3.96	0.077	0.806	0.092
1998	621.2	545.7	2.67	1.864	0.751	0
1999	620.2	547.2	2.61	2.859	4.462	0.293
2000	731.6	655.9	3.09	0.704	14.501	2.103
2001	870.0	765.3	3.55	1.740	1.455	0
Growth (%)[c]	*2.99*	*3.06*	*1.32*	NA	*46.36*	
Pork						
1990	124.0	96.7	0.54	0.007	0.023	0.017
1991	110.0	86.0	0.47	0.038	0.327	0.336
1992	136.0	106.1	0.58	0.002	0.017	0.014
1993	169.3	132.1	0.70	0.001	0.047	0.035
1994	183.6	143.4	0.75	0.010	0.164	0.107
1995	177.8	138.7	0.71	0.010	0.091	0.058
1996	189.5	147.9	0.75	0.041	0.096	0.037
1997	146.8	114.3	0.57	0.379	0.126	0
1998	139.0	108.3	0.53	0.189	0.066	0
1999	166.7	129.9	0.62	0.223	0.105	0
2000	179.5	139.7	0.66	0.690	0.319	0
2001	166.7	129.9	0.60	0.461	0.213	0
Growth (%)[c]	*2.66*	*2.63*	*0.89*	NA	NA	
Seafood						
1990	3165	1413	7.87	304.9	72.2	0
1991	3452	1486	8.19	387.0	70.7	0
1992	3543	1523	8.25	397.6	77.6	0
1993	3806	1650	8.80	497.1	172.6	0
1994	4029	1843	9.67	522.7	268.5	0
1995	4258	1843	9.47	526.2	159.8	0
1996	4454	1918	9.74	551.5	153.4	0
1997	4581	1972	9.87	554.0	143.9	0
1998	4773	1909	9.34	629.1	56.1	0
1999	4902	2075	9.91	609.2	134.6	0
2000	5163	2324	10.95	589.9	229.0	0
2001	5414	2431	11.29	627.3	242.8	0
Growth (%)[c]	*4.85*	*4.55*	*2.78*	*6.34*	*6.0*	

kt = kilotonnes; NA = not available or not applicable

[a] Production, exports and imports measured in kt carcass weight equivalent; consumption and consumption per capita measured in kt retail weight

[b] Calculated as the ratio of net imports to total consumption, all measured in carcass weight equivalent

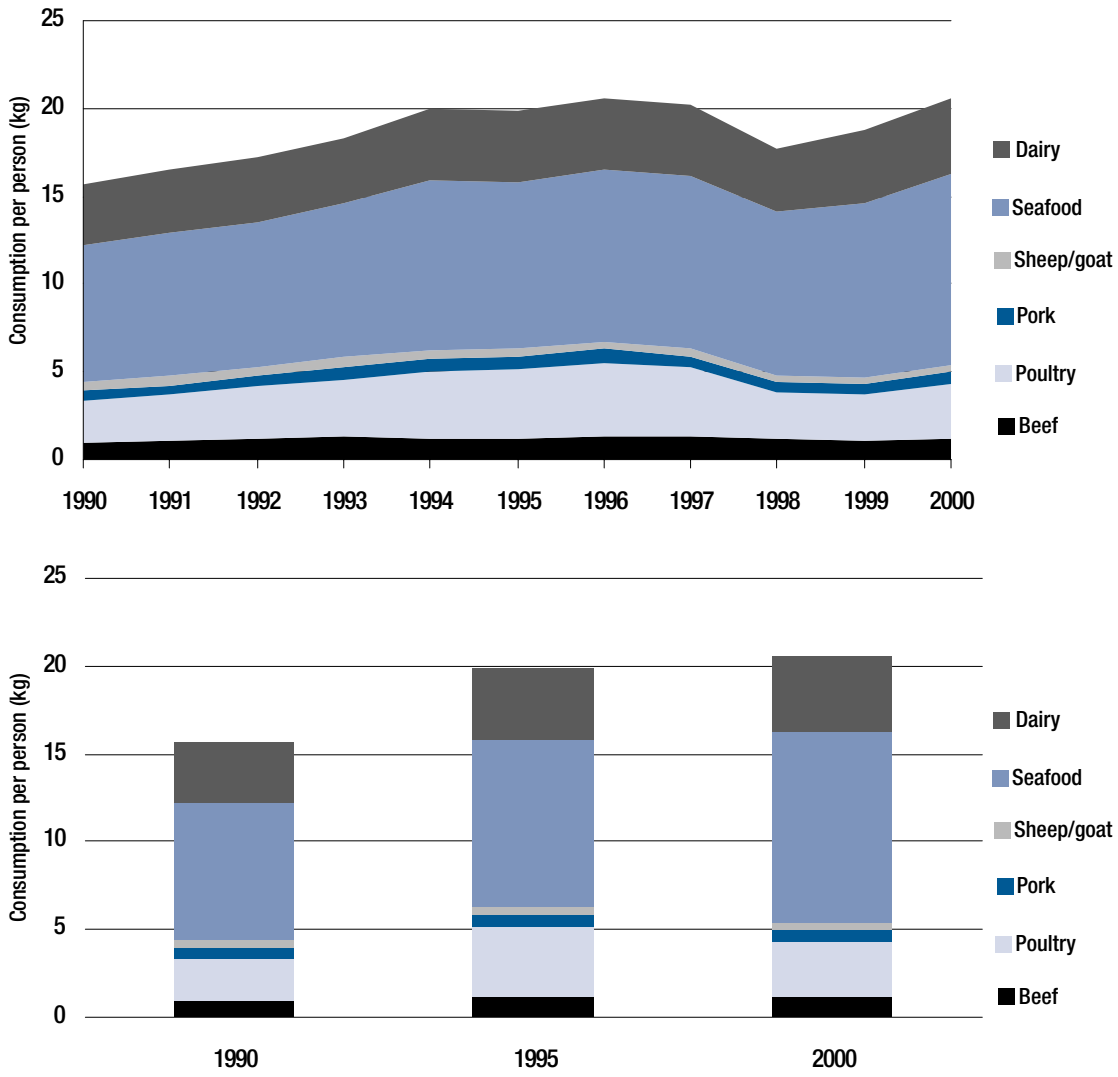
[c] Average logarithmic growth rate, 1990–2001

Source: GMI database

Key points

- Production growth is modest for all meats.
- Per capita consumption growth is also modest.
- There is a growing dependence on dairy and beef imports.

Figure 5.1. Trends in per capita consumption of meat and dairy, 1990–2000



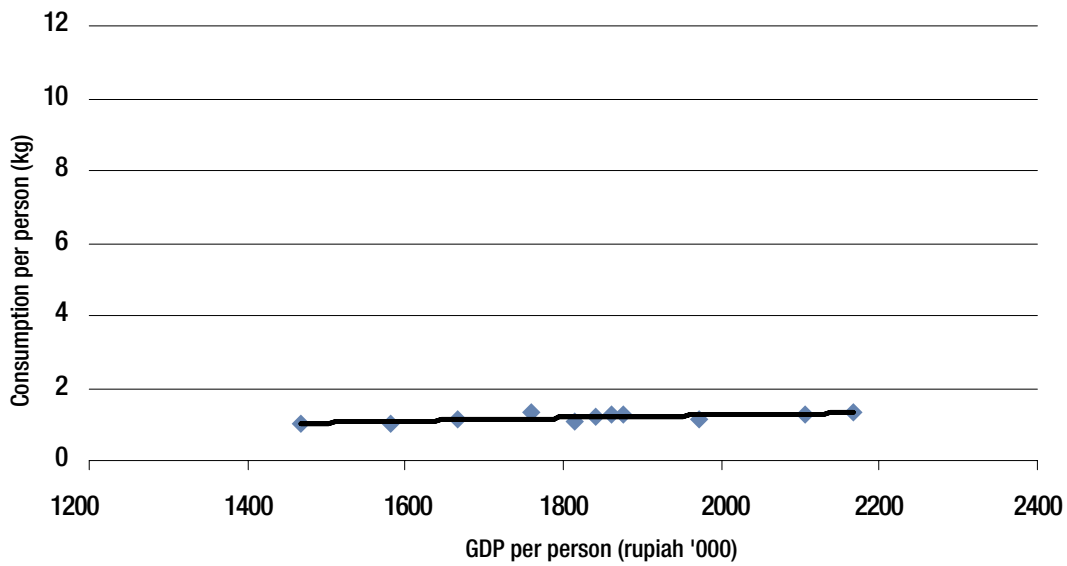
Data source: GMI database

Key points

- Consumption per person has only recently recovered to the levels seen before the financial crisis.
- Seafood is by far the most important component (67 per cent) of meat consumption.

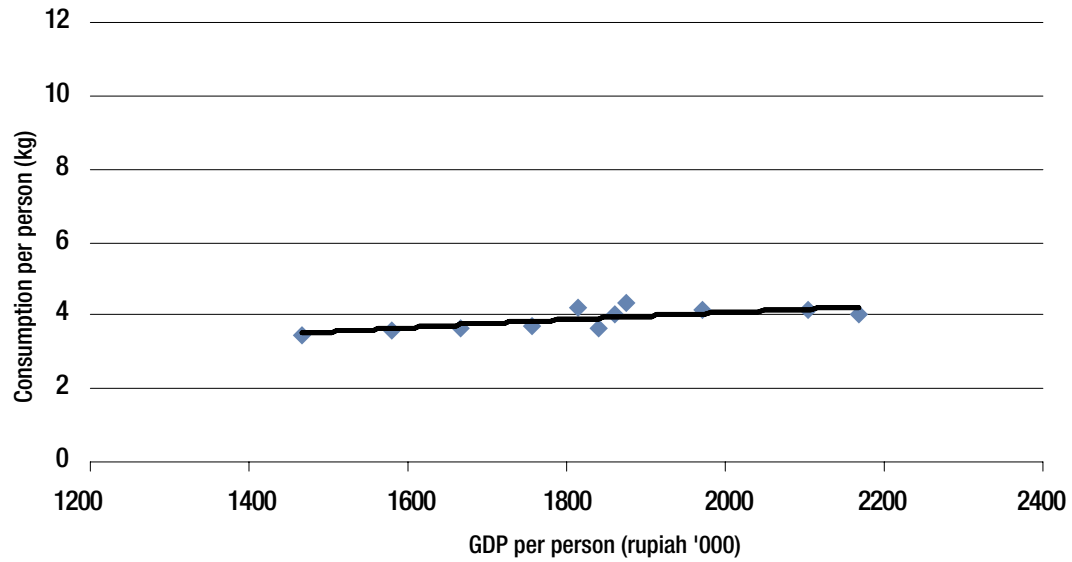
Relationship Between Per Capita Meat Protein Consumption and Per Capita Income (Engel Curves)

Figure 5.2. Beef.



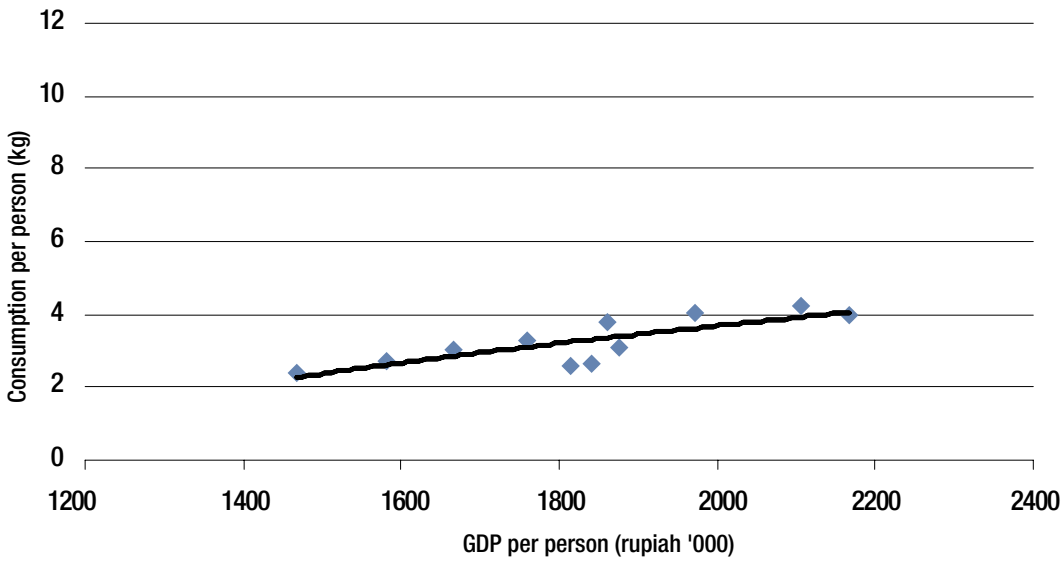
Data source: GMI database

Figure 5.3. Dairy.



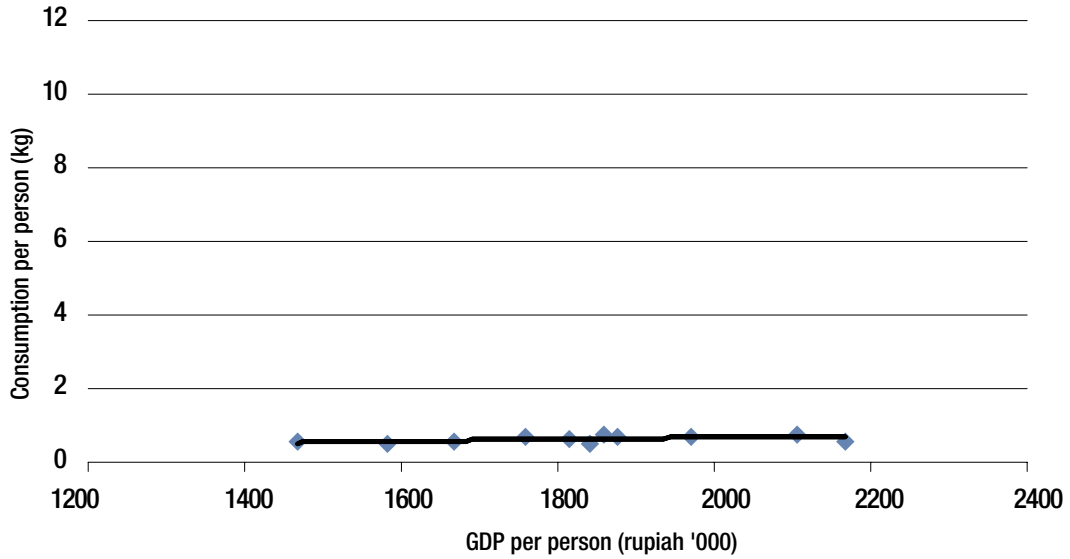
Data source: GMI database

Figure 5.4. Poultry.



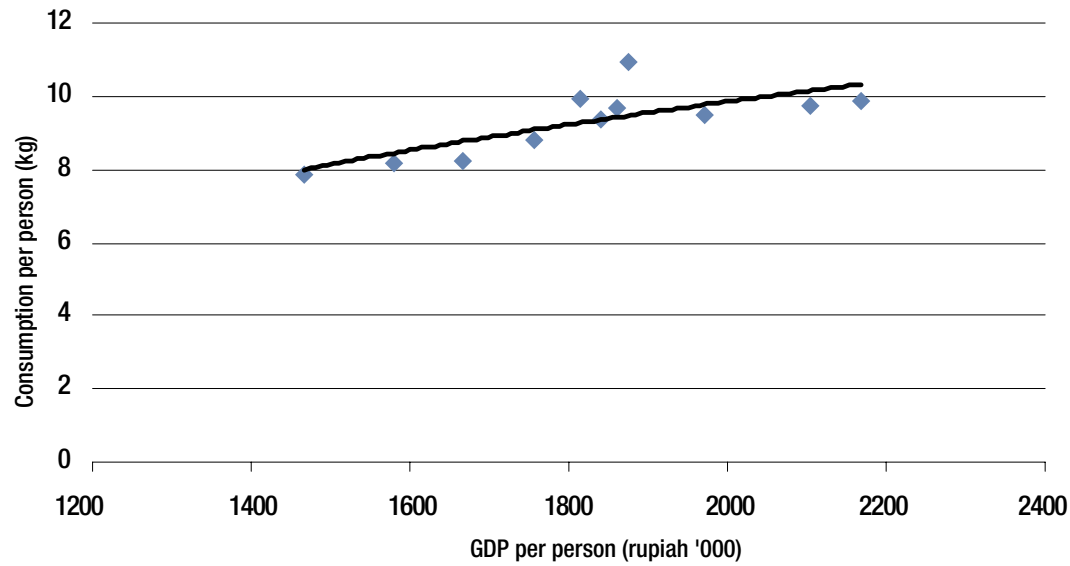
Data source: GMI database

Figure 5.5. Pork.



Data source: GMI database

Figure 5.6. Seafood.



Data source: GMI database

Production Systems, Policy Settings and Future Developments

Beef

Recent performance

- There has been a steady growth in beef production over the past decade. It declined slightly in the late 1990s during the financial crisis, but has recovered. The production growth has been around 2.4 per cent per year.
- Imports have risen significantly, with a high proportion of these from Australia (in particular, a large rise in the number of imported live cattle from Australia).
- The 1998 Asian currency crisis caused a drop in production because of the rupiah devaluation and feedlot dependence on imported live cattle. The increased rupiah price encouraged smallholders to slaughter scarce breeding cattle. Breeder cattle depletion is still occurring.

Policy settings

- A government-initiated program aims to reach 95 per cent self-sufficiency in meat production by 2005. This includes increasing the productivity of farming units through an artificial insemination program, restricting the slaughter of productive female cows and decreasing the risk of disease infection in young cattle.
- The government has set development paths for beef production based on private company feedlot operations and improving smallholder efficiency.
- The government provides artificial insemination services to improve the genetics of native cattle (this initiative is now being privatised).
- The industry is characterised by a beef nucleus estate scheme (NES) with a private company nucleus and smallholders as 'plasma' (fattening NES, breeding NES, forage NES). In each scheme, the company provides principal inputs and technical assistance and purchases the cattle; the smallholder provides land, labour etc. Companies are required to participate in the NES to get approval to import live cattle, but the NES has dropped off since the currency crisis.
- There is a tariff of 5 per cent on imported beef, but no tariff on imported feeder cattle.
- The government provides assistance to smallholders through a revolving breeder cattle scheme and feeder cattle for fattening.
- There is zero interest credit for holding breeder cattle.
- The slaughter of productive females is prohibited (but hard to police).
- The government promotes business partnerships between private financial institutions and small growers.

Socioeconomic and institutional framework	• Smallholders engage mainly in hand-feeding by gathering rice straw and green grass. Family labour shortages to do this are limiting cattle herd size. • Intensification of cropping on rice land and expansion in cropping areas has also affected the capacity to expand native cattle herds. • There is some free-range grazing in eastern Indonesia (larger herds of 10–50 animals), but security is a problem.
Environmental issues	• Not environmentally unfriendly. • Larger feedlots with heavy concentrations of cattle are designed and managed to minimise adverse environmental impacts. • Smallholder farmers have few problems in disposing of manure.
Production system	• Dominated by smallholders (around 80 per cent of production). • There is increased reliance on imported live cattle (mainly sourced from Australia). This has contributed to an increase in slaughter weights from grass-fed Australian cattle. • Smallholder herds (generally with 1–3 head per household) have low technical productivity, especially with low fertility of breeding cattle and low quality feeds. • Some 25 per cent of production from commercial feedlots is based heavily on live cattle imports. A high level of technical efficiency with efficiency of feed utilisation is a critical profit driver). • Includes partnership smallholders (who fatten cattle from feedlots) and non-partnership smallholders (who breed and graze native cattle and feed them on locally available roughage).
Product demand and market opportunities	• There is a very strong and growing demand. The preference of most households is for beef from native cattle. • Supermarket shoppers (a small segment) are indifferent to the source of cattle/beef. Supermarkets, hotels and restaurants are increasingly demanding imported beef or beef from imported cattle.
Future developments	• The commercial sector based on live cattle to feedlots is heavily dependent on the value of the rupiah versus the Australian dollar. • Smallholder development is constrained by lack of capital and access to credit, local insecurity due to cattle stealing, unstable economic conditions and pressures from industrialisation. Poor reproductive efficiency of native breeder cattle restricts the cattle population. • Steady economic recovery would greatly increase demand for beef and enhance the ability of the commercial feedlot sector to purchase live feeder cattle from Australia.

Pig meat

Recent performance

- There are 10 million pigs in Indonesia. Some are exported to Singapore (260,000 in 1998, valued at US$17.5 million). Singapore closed pig farming in 1984.
- Production is growing at around 3 per cent per year.

Policy settings

- The main emphasis is on the prevention of endemic diseases, government-funded R&D, the supply of improved breeding stock to smallholder farmers, support for the development of cooperatives and provision of extension services to farmers at provincial, district and subdistrict levels.
- There is encouragement to agribusiness to develop large-scale commercial production.
- The government encourages the private sector to invest in pig production for export.

Socioeconomic and institutional framework

- Smallholder farming in rural areas is regarded as a sideline enterprise utilising cheap locally available feeds and requiring little capital. There is little consideration of the whole production system.

Environmental issues

- Availability of suitable land is a problem for peri-urban production, with continued urban expansion.
- Pig-raising is seen as culturally and environmentally offensive in peri-urban areas and is under pressure to move to rural areas where small-scale production (often by housewives) fits into local culture and society.
- The high nitrogen and phosphorus content of pig effluent is a serious problem with semicommercial and commercial operations (smallholders in rural areas often handle waste more efficiently).

Production system

- Dominated by smallholders (368,000 households, mostly located on Java).
- The industry is small and poorly developed. There is some development of input-supplying industries (premixed feeds, medicines) but these mainly service the large commercial breeders.
- The industry is characterised by the use of indigenous pig breeds (with lower genetic potential) but there is increased interest in crossing with exotic breeds.
- There have been substantial imports of superior breeding stock in recent years (mainly for commercial operators).

Product demand and market opportunities	• Some 80 per cent of Indonesians are Muslim and not allowed to consume pig meat. The demand for pig meat is becoming much more sophisticated (with strong demand and price premiums for lean meat). • The change in consumer preferences toward lean meat will have a major impact, particularly on smallholders, who will need access to suitable genetic stock and feed. • The Chinese minority dominates pig meat consumption. If social tensions were to reassert themselves, there could be an exodus of Chinese.
Future developments	• The productivity of smallholders in rural areas (the dominant supply base) is very low because of poor genetics, nutrition and management. But expansion of commercial, high technology operators is constrained by problems with suitable sites and effluent disposal.

Poultry

Recent performance	• There has been a steady growth in production (nearly 3 per cent per year). The poultry sector took a buffeting during the financial crisis. Production fell by 30 per cent in 1998, but has since recovered.
Policy settings	• There have been large reductions in the general tariff rate on poultry meat to 5 per cent under the IMF agreement. • A total ban on chicken parts was introduced in September 2000. It was aimed at protecting domestic producers from imports of cheaper chicken parts.
Socioeconomic and institutional framework	• Production is divided between a limited number of slaughtering and processing facilities and smallholder farming. • Slaughter and processing facilities are often situated a long way from the centre of distribution. They tend to supply supermarkets, restaurants and hotels rather than traditional markets, where they cannot compete in price. • Around 80 per cent of slaughtered chickens go directly to the wet markets, most of these from smallholder facilities.

Production system	• There is a large dependence on imported feed. Fifty per cent of poultry feed is imported. Feed costs are greatly affected by the fluctuating value of the rupiah. With feed costs comprising around 80 per cent of total production costs, the financial crisis had a huge impact on the poultry industry. • Logistical constraints such as the spatial distribution of production, processing and consumption and transportation costs limit expansion. • Cold storage deficiencies create distribution and marketing problems.
Product demand and market opportunities	• Chicken meat is the most popular meat product in Indonesia. • Consumers tend to prefer small birds, with many low income earners preferring to purchase a live bird at the wet markets for slaughter. • In the past, consumers preferred whole chickens to parts. This is moving towards a more demand-responsive market where parts may be chosen if they are cheaper.
Future developments	• Production can expand by better utilising existing production capacity. Further investment in new infrastructure is unlikely in the near future. • Provided economic recovery continues, consumption is likely to grow and move back towards pre-crisis levels.

Dairy

Recent performance	• There has been a modest growth in milk production of just under 3 per cent per year. • Consumption has grown faster than production; there is higher reliance on imports to meet demand. The proportion of consumption met by imports has risen from around 5 per cent to 13 per cent over the past decade.
Policy settings	• There was a very large reduction in tariff rates (from as high as 200 per cent in 1995 to 5 per cent following agreement with the IMF) in response to the financial crisis.
Socioeconomic and institutional framework	• Production is dominated by small-scale producers, typically farmers who own 2–3 dairy cows. • Some small productivity gains have occurred within these production units.

	• Limited access to improved genetics and limited resources to improve herds, combined with unfavourable weather and high feed costs, are preventing production from keeping pace with domestic demand and leading to an increasing reliance on imports.
Production system	• Largely dominated by small farm operations, with a small number of large, intensive operations. • Typically, in a small system in Indonesia, one cow produces 10–12 litres per day; in modern systems, one cow can produce up to 20 litres per day. • In recent times, milk processors have increased cooperation with private smallholder farmers, supplying them with equipment and other inputs in an attempt to improve productivity.
Product demand and market opportunities	• Dairy products are still regarded as something of a luxury. Demand growth has been strong, but much still hinges on continued economic recovery. • Difficulties in increasing domestic production mean that there will be opportunities for exporters as demand increases.
Future developments	• Low productivity in smallholder farms is likely to continue. Resource and logistical constraints combined with other natural factors limit growth in production. Surplus domestic demand is likely to be met by increased import reliance.

Baseline Projections

These are shown in Table 5.3. Appendix B shows the projections assuming the GDP growth rates of the six countries are reduced by one-third in each year of the projection period.

Table 5.3. Baseline projections for Indonesia.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	355	369	383	392	406	477	554	636	3.0
Pig meat	185	199	215	223	237	313	396	488	5.0
Poultry meat	753	807	865	911	965	1281	1671	2145	5.4
Dairy	855	881	907	935	963	1116	1294	1500	2.8
Imports (kt cwe)									
Beef	27	41	56	80	93	196	362	614	17.0
Pig meat	0	0	1	1	2	8	28	70	34.4
Poultry meat	4	6	9	17	18	38	81	169	20.3
Dairy	117	170	226	273	321	598	940	1377	13.1
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	0
Pig meat	0	0	0	0	0	0	0	0	0
Poultry meat	2	1	1	0	0	0	0	0	–14.4
Dairy	3.0	2.7	2.5	2.3	2.1	1.3	1.2	1.1	–4.9
Import dependency (%)									
Beef	9.9	14.2	18.0	24.1	26.7	41.6	56.5	70.1	
Pig meat	0.0	0.2	0.3	0.7	0.9	3.3	8.3	16.1	
Poultry meat	0.4	0.6	0.9	1.8	1.8	2.9	4.6	7.3	
Dairy	11.8	16.0	19.8	22.5	24.9	34.8	42.1	47.8	
Consumption (kt rw)									
Beef	267	286	307	330	349	471	641	875	6.1
Pig meat	144	156	168	175	186	250	330	436	5.7
Poultry meat	665	812	873	927	983	1319	1753	2314	6.4
Dairy	970	1048	1131	1205	1282	1712	2232	2875	5.6
Per person consumption (kg rw/person)									
Total meat	15.9	17.7	18.7	19.4	20.2	24.8	30.3	37.1	4.3
Beef	1.2	1.9	2.0	2.1	2.2	2.8	3.6	4.7	6.9
Sheep and goat meat	0.4	0.4	0.4	0.4	0.4	0.5	0.7	0.8	4.4
Pig meat	0.7	0.7	0.8	0.8	0.8	1.0	1.3	1.7	4.6
Poultry meat	3.1	3.7	3.9	4.1	4.3	5.5	7.0	8.8	5.4
Seafood	10.6	11.1	11.6	12.0	12.4	14.9	17.7	21.1	3.5
Dairy	4.50	4.80	5.11	5.38	5.65	7.16	8.87	10.91	4.5

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight
Source: GMI model and CIE calculations

Key points

- Per person meat consumption will more than double over the next 20 years.
- Domestic production growth is strong for pig meat and poultry meat but lower for beef. Beef production prospects will be curtailed by the very low productivity of native breeder cattle farms. Even with higher growth for poultry and pig meats, production will lag behind demand growth.
- Production growth for milk will average nearly 3 per cent.
- Dependency ratios on imported beef and dairy products will increase substantially. More modest increases for pig meat and poultry meat reflect greater scope for technology catch-up and production expansion in these sectors.

6 Vietnam: Recent Performance and Baseline Projections

Chapter outline

This chapter provides the following information:

- data on Vietnam's economy-wide performance (summary indicators)
- meat industry data for beef, dairy, poultry, pork and seafood
- trends in per capita consumption of meat and dairy products
- Engel curves showing the relationship between per capita meat protein consumption and per capita income for beef, dairy, poultry, pork and seafood
- information on production systems, policy settings and future developments for beef, pig meat, poultry and dairy
- baseline projections to 2020 for production, imports, exports, import dependency, consumption and per person consumption.

Where relevant, each section of data concludes with a set of key points, which appear in a shaded box.

Economy-wide Performance

Table 6.1. Summary indicators, 1990–2000.

Year	GDP(real) per capita		Population	
	Dong/capita	Growth rate (%)	Millions	Growth rate (%)
1990	1,993,363			66.02
1991	2,061,201	3.40	67.24	1.86
1992	2,187,874	6.15	68.45	1.80
1993	2,318,151	5.95	69.65	1.75
1994	2,471,441	6.61	70.83	1.69
1995	2,654,141	7.39	72.00	1.65
1996	2,848,125	7.31	73.16	1.61
1997	3,091,763	8.55	74.04	1.20
1998	3,156,670	2.10	75.46	1.92
1999	3,246,172	2.84	76.60	1.51
2000	3,380,037	4.12	77.69	1.42

Source: http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm

Key points

- Per capita income growth has been around 4 per cent per year.
- The population growth rate is slowing but still high.

Meat Industry Data

Table 6.2. Meat industry data, 1990–2001.

	Production[a] (kt)	Consumption[a] (kt)	(kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
Beef						
1990	75.0	52.6	0.80	0.039	0.130	0.17
1991	75.5	52.8	0.79	0.026	0.000	0
1992	77.5	54.2	0.79	0.065	0.000	0
1993	75.0	52.5	0.75	0.026	0.000	0
1994	80.2	56.2	0.79	0.156	0.195	0.07
1995	83.0	58.2	0.81	0.260	0.455	0.33
1996	83.0	58.2	0.80	0.005	0.155	0.26
1997	83.0	58.1	0.79	0.008	0.045	0.06
1998	83.2	58.2	0.77	0.008	0.045	0.06
1999	85.5	59.9	0.78	0.013	0.026	0.02
2000	92.3	64.6	0.83	0.013	0.026	0.02
2001	93.9	65.8	0.83	0.011	0.025	0.02
Growth (%)[c]	*1.82*	*1.82*	*0.18*	NA	NA	
Dairy						
1990	60.0	62.9	0.95	0.000	2.900	4.61
1991	60.0	67.5	1.00	0.000	7.460	11.06
1992	60.8	69.4	1.01	0.000	8.586	12.37
1993	63.4	78.6	1.13	0.000	15.200	19.34
1994	64.2	103.7	1.46	0.000	39.500	38.09

Table 6.2. Meat industry data, 1990-2001 (cont'd).

	Production[a] (kt)	Consumption[a] (kt)	Consumption[a] (kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
1995	65.8	84.4	1.17	0.000	18.600	22.04
1996	67.4	89.7	1.23	0.000	22.300	24.86
1997	69.0	107.8	1.46	0.000	38.800	35.99
1998	69.8	116.1	1.54	0.000	46.300	39.88
1999	69.6	85.6	1.12	0.000	16.000	18.69
2000	82.1	98.1	1.26	0.000	16.000	16.31
2001	84.2	103.0	1.31	0.000	18.836	18.28
Growth (%)[c]	*22.57*	*4.85*	*3.16*		*17.72*	
Poultry						
1990	169.6	149.2	2.26	0.040	0.000	0
1991	164.7	144.9	2.16	0.050	0.000	0
1992	177.1	154.5	2.26	1.600	0.000	0
1993	168.7	147.9	2.12	0.650	0.000	0
1994	170.4	149.6	2.11	0.350	0.000	0
1995	175.8	154.2	2.14	0.620	0.000	0
1996	196.7	173.0	2.36	0.191	0.068	0
1997	218.6	192.6	2.60	0.426	0.722	0.15
1998	260.2	229.2	3.04	0.166	0.426	0.11
1999	325.4	286.3	3.74	0.090	0.030	0
2000	351.0	308.8	3.98	0.090	0.030	0
2001	378.1	332.7	4.22	0.1	0.030	0
Growth (%)[c]	*27.72*	*7.76*	*6.03*	*–1.66*		
Pork						
1990	728.6	555.7	8.42	16.156	0.000	0
1991	715.5	538.6	8.01	25.019	0.000	0
1992	820.0	630.0	9.20	12.310	0.000	0
1993	878.0	669.5	9.61	19.700	0.000	0
1994	957.7	737.2	10.41	12.600	0.038	0
1995	1007.0	780.5	10.84	6.400	0.081	0
1996	1052.0	817.1	11.17	4.600	0.102	0
1997	1154.2	896.6	12.11	4.772	0.085	0
1998	1228.0	949.9	12.59	10.185	0.068	0
1999	1318.2	1024.1	13.37	5.300	0.017	0
2000	1409.0	1074.0	13.83	32.000	0.017	0
2001	1509.7	1154.2	14.63	30.0	0.017	0
Growth (%)[c]	*7.15*	*7.33*	*5.61*	*–6.34*		
Seafood						
1990	941.2	445.8	6.75	43.7	0.0	0
1991	999.2	452.8	6.73	66.8	0.0	0
1992	1041.0	460.6	6.73	80.7	0.0	0
1993	1120.2	489.3	7.03	94.8	1.6	0
1994	1370.0	606.0	8.56	109.7	3.3	0
1995	1474.0	689.0	9.57	83.7	6.2	0
1996	1646.7	764.6	10.45	98.7	7.0	0
1997	1690.9	677.5	9.15	211.1	9.4	0
1998	1719.0	689.4	9.14	207.1	2.6	0
1999	1867.1	750.6	9.80	234.1	13.8	0
2000	1967.1	768.3	9.89	264.6	10.0	0
2001	2129.0	830.1	10.52	312.6	35.6	0
Growth (%)[c]	*8.23*	*6.41*	*4.70*	*18.15*	*256.18*	

kt = kilotonnes; NA = not available or not applicable

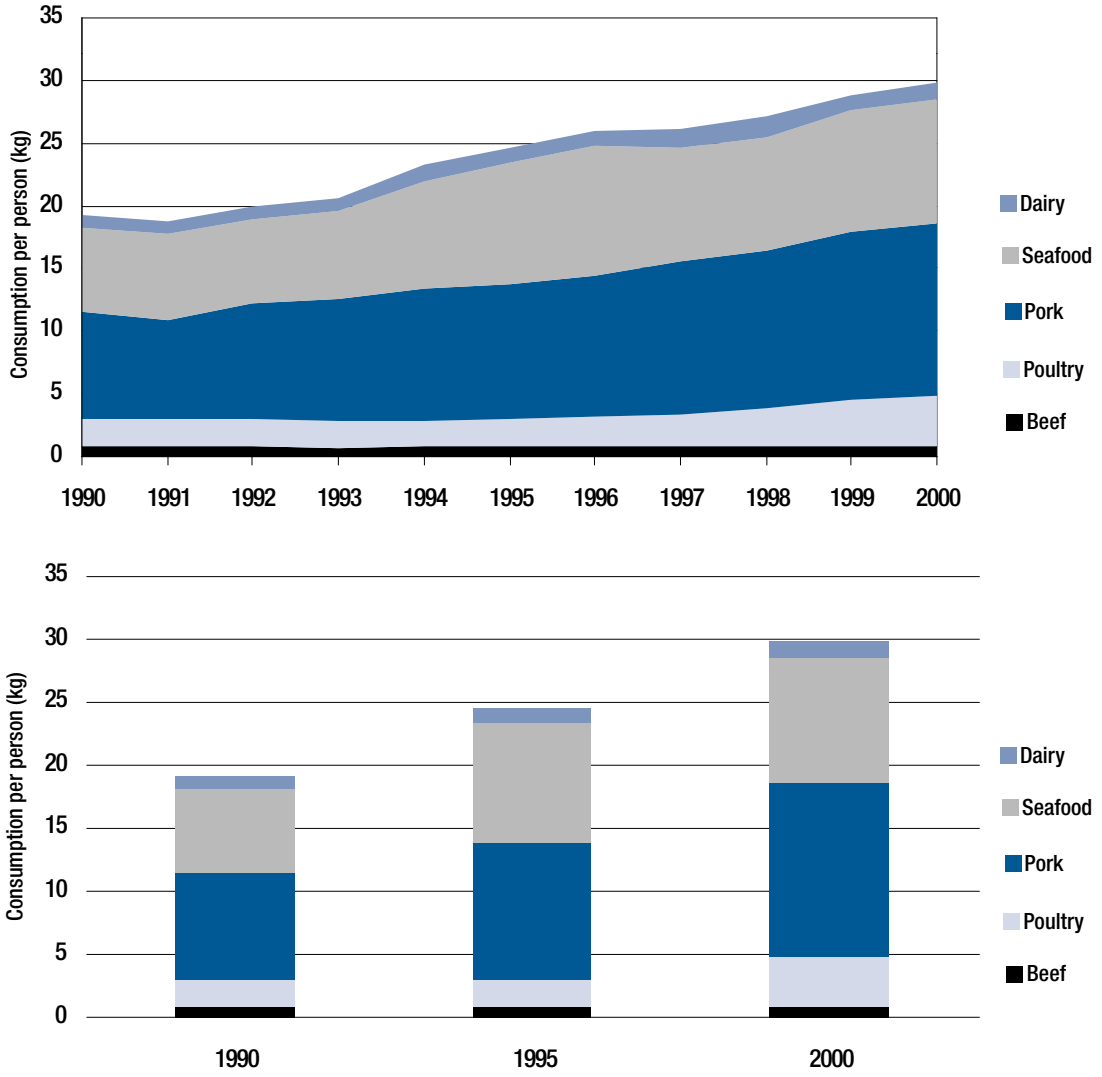
[a] Production, exports and imports measured in kt carcass weight equivalent; consumption and consumption per capita measured in kt retail weight

[b] Calculated as the ratio of net imports to total consumption, all measured in carcass weight equivalent

[c] Average logarithmic growth rate, 1990–2001

Source: GMI database

Figure 6.1. Trends in per capita consumption of meat and dairy, 1990–2000.



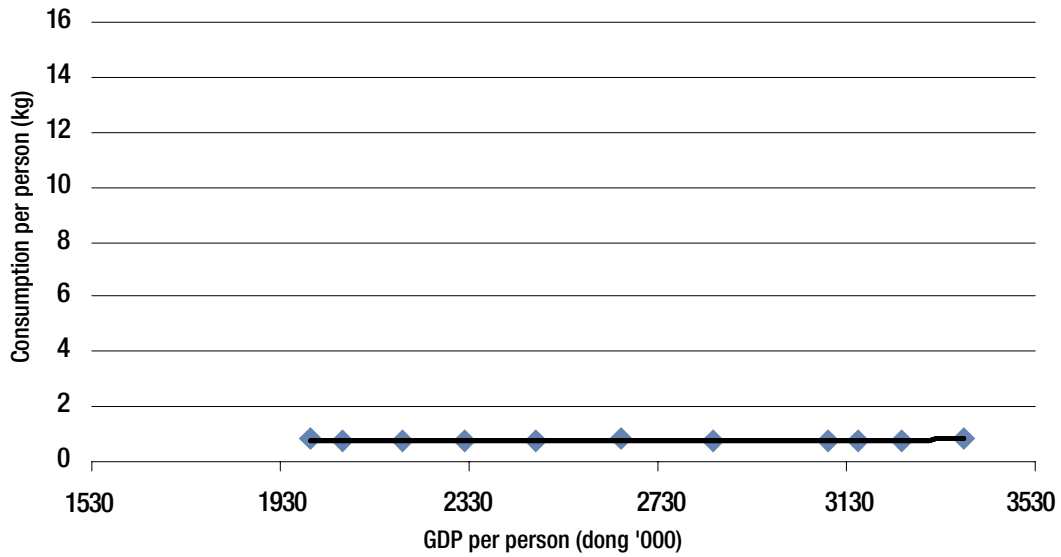
Data source: GMI database

Key points

- Meat consumption is dominated by pork.
- The rate of increase in per capita consumption is high.
- There has been rapid growth in the production of pork and poultry to match demand growth by domestic consumers (zero export dependency).
- There is a growing dependency on imported dairy products, but per capita consumption is very low.

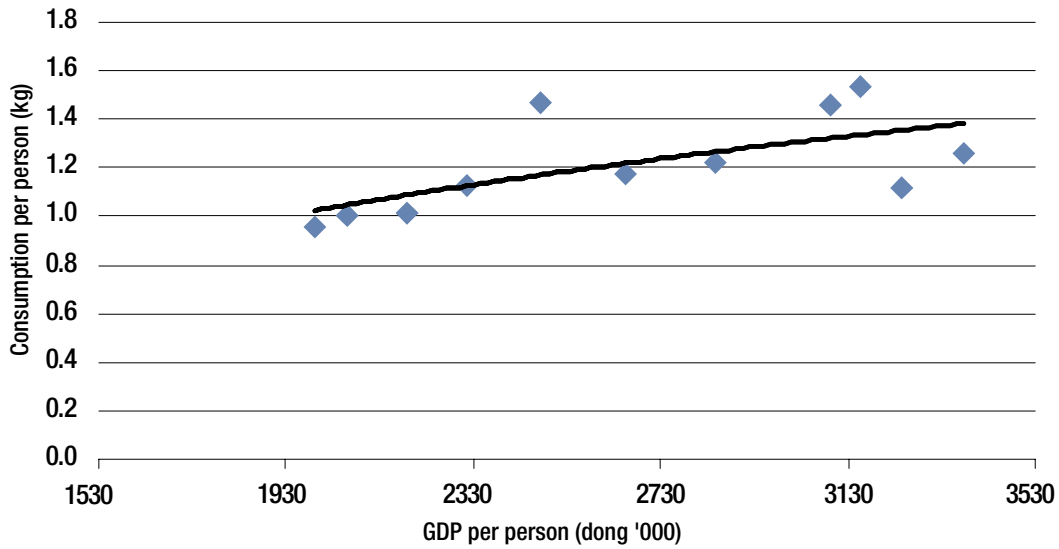
Relationship Between Per Capita Meat Protein Consumption and Per Capita Income (Engel Curves)

Figure 6.2. Beef.



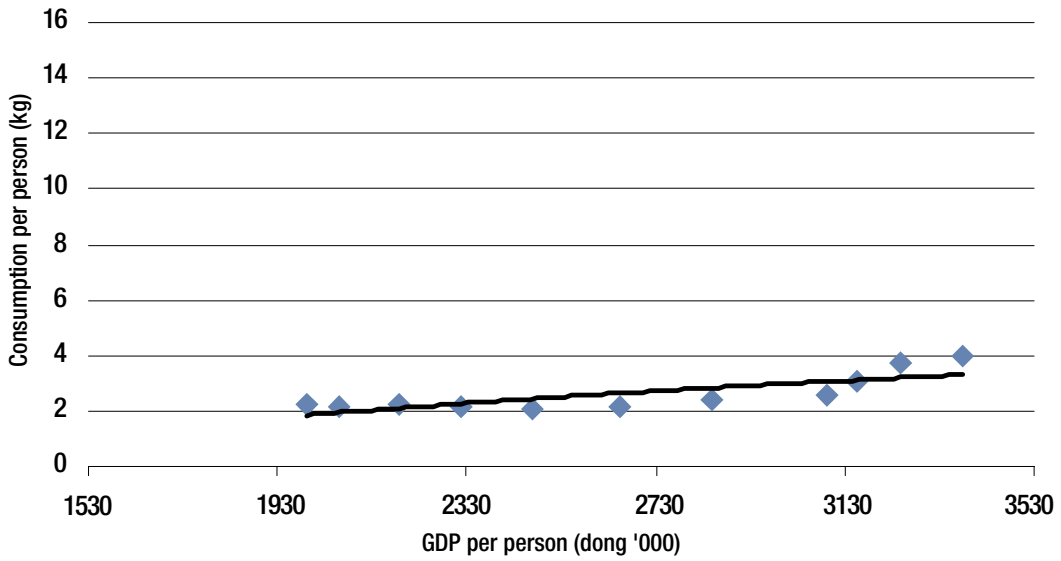
Data source: GMI database

Figure 6.3. Dairy.



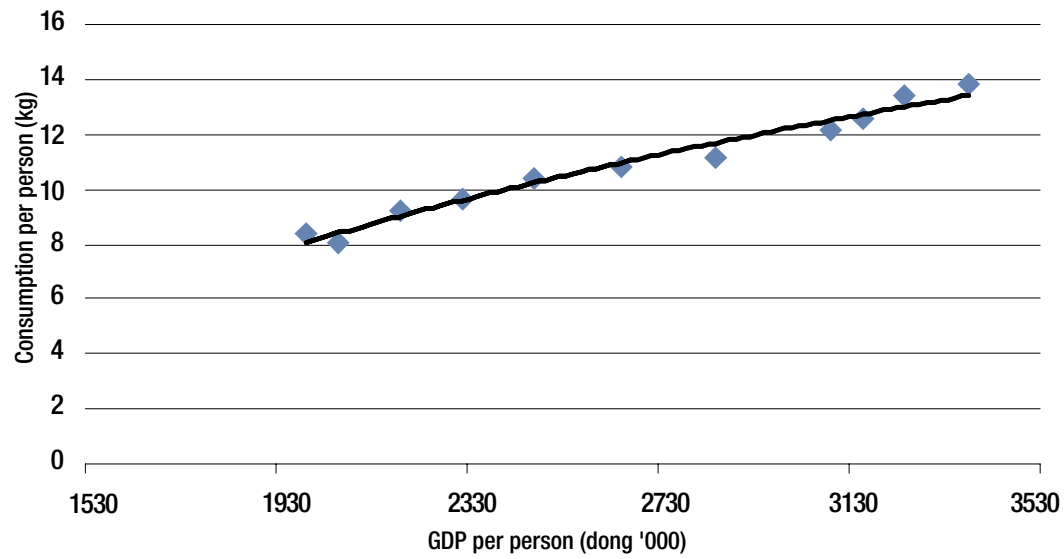
Data source: GMI database

Figure 6.4. Poultry.



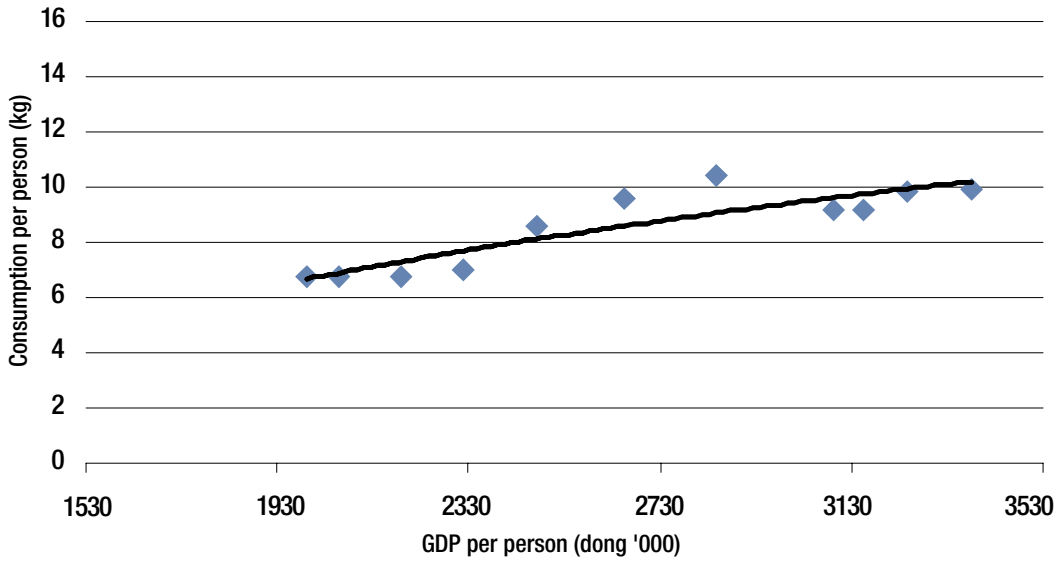
Data source: GMI database

Figure 6.5. Pork.



Data source: GMI database

Figure 6.6. Seafood.



Data source: GMI database

Production Systems, Policy Settings and Future Developments

Beef

Recent performance	• Production growth averaged 1.8 per cent per year over the last decade. • Body weights are low at 180–200 kg for cows and 300 kg for bulls (yellow cattle breed).
Policy settings	• There is discouragement of integrated feed and meat production. • There are no barriers to the importation of breeding animals, livestock semen or veterinary products. • The Ministry of Science, Technology and Environment has imposed quality control requirements on meat and by-products, including offal. • The Ministry of Agriculture and Rural Development (MARD) has identified beef as a national priority. • There is a tariff of 20 per cent on imported beef.
Socioeconomic and institutional framework	• There is a resurgence of Buddhism (some practitioners enforce vegetarianism). • Cattle are a source of income for families in smallholder systems in two ways – final product (slaughter) and sale of male offspring. They are also used as farming implements. • Young calves are sold off for income because they become a burden in terms of feed, time and land area if held until slaughter age.
Environmental issues	• Meat cattle are concentrated in the central regions and pose little threat to water resources.
Production system	• There are inadequate slaughtering facilities for commercial production. • The usual rearing is 1–4 head; however the central zones have herd sizes in the order of 10 or more. • Crop residues are the primary feed source.
Product demand and market opportunities	• There has been only marginal growth in per capita consumption over the past decade, but government projections for the future show more growth.
Future developments	• By 2010, the government expects production of ruminant meat (primarily beef) to be 3 kg per capita with consumption in the order of 3.6–4.2 kg per capita.

Pig meat

Recent performance

- Production growth has averaged 7 per cent annually over the last decade, with nearly 20 million pigs slaughtered in 2000.
- Pork is the most important protein source (70 per cent) for the Vietnamese.
- Per capita consumption of pork has increased significantly with increases in GDP per capita.

Policy settings

- There is intensive cross-breeding to improve livestock yields.
- Pork is critical to food security and is seen as an area with export potential.
- There are no barriers to the importation of breeding animals, livestock semen or veterinary products.
- According to the US pork lobby group, there is a 0–15 per cent differential tariff on fresh and frozen pork and an official tariff of 40 per cent on processed meats.
- There are tariffs of 30 per cent on fresh and foreign pig meat imports but no imports.

Socioeconomic and institutional framework

- There is a resurgence in Buddhism (some practitioners enforce vegetarianism).
- Pork is a basic part of the Vietnamese meat diet. Pig hides are also valuable, and pig manure is an important source of fertiliser for crops, especially rice.

Production system

- Production is skewed to the north of Vietnam, and centres around areas with high concentrations of cassava, rice and soybeans.
- State-owned piggeries provide sucklers to households.
- Smallholder pig-rearing is replacing the state-owned supply chain; however smallholders are looking to more valuable agricultural opportunities.
- The average pig farm is small (5–100 pigs). Much feed is scavenged on very small farms. A few state-owned enterprises have operations with 500–1000 pigs.

Product demand and market opportunities

- Around 93 per cent of pork product is consumed fresh, 4 per cent goes into food service businesses and 3 per cent is processed.
- Most pork is consumed within 10 km of the slaughter site.
- There is a consumer switch toward lean meat that sells at a price up to 30 per cent higher than that of fatty pork.
- An ACIAR project on breeding and feeding pigs in Vietnam has contributed significantly to improving genetic stock, feed use efficiency and carcass quality.

Future developments	• Lean pork is being demanded by people in major urban cities. • Identified as an area for development by the Vietnamese government. • A policy has been launched heralding Vietnam's plans to export 80,000 tonnes of pork by 2005, increasing to 100,000 tonnes by 2010. • Poor quality and low hygiene processing and slaughter facilities will constrain growth. • Lack of improved feed is a constraint.

Poultry

Recent performance	• Production growth is nearly 8 per cent per year (faster than pork). • Average meat yield per slaughter is around 0.6-0.75 kg.
Policy settings	• There are no barriers to the importation of breeding animals, livestock semen or veterinary products. • Poultry tariffs are at 20 per cent.
Socioeconomic and institutional framework	• There is a resurgence in Buddhism (some practitioners enforce vegetarianism). • Chicken is the second most important protein source for the population.
Production system	• Boosted by international investment from Thailand, particularly through the Chinfon Group. • The main locations are close to large urban centres and provinces with large amounts of waste from food-processing industries. • State-owned hatcheries supply day-old chicks for fattening and supply feed and veterinary supplies for household farms. • Government sources say smallholders represent 17 per cent of the nation's farmers. • Some 70 per cent of birds are local breeds produced outdoors, with 30 per cent divided among foreign breeds, which are 'industrial' chickens. • Distribution channels are short (primary method is motorcycle, cyclo or foot; there is no cool transport).
Product demand and market opportunities	• Vietnamese poultry is low quality (below world standard) and this means low export potential. • Imports of chicken are claimed to be targeted at the growing tourist market in Vietnam.

	• Some 70–80 per cent is sold via local markets, unprocessed; 15–20 per cent is dressed and sold to restaurants; the residual is sold to food processors. • Although industrial broiler production has grown rapidly, consumers prefer local chicken (price premium).
Future developments	• NGO-sponsored research into optimal bird breeds and productivity-inducing feed might create better birds (currently low quality, low quantity). • KFC is entering the Vietnam market; it is rumoured that Jolibee and Texas Chicken are also moving into the market.

Dairy

Recent performance	• Local production (modest growth) accounts for 10–12 per cent of total milk demand. • Average yield is 3720 kg per lactation. • Dairy consumption has increased slightly, and from a very low base, with increases in GDP per capita. • There has been production growth of 2.6 per cent per year, but faster demand growth is met by imports, which are growing rapidly.
Policy settings	• Infant milk products are subject to special approval to stop any abuse of market power (they saw Nestle coming). • The Ministry of Science, Technology and Environment has imposed quality control requirements on milk and cream, yoghurts and products containing milk constituents. Also included are butter and fats, cheese and milk curds.
Socioeconomic and institutional framework	• Vietnamese people are developing a taste for milk with increases in per capita income (particularly in the urban areas). • They have also developed a taste for ice-cream and yoghurt.
Production system	• Becoming dominated by foreign investment, with companies like Nestle, St Lawrence and Austdairy developing milk supply capacity. • Only 40 per cent of cattle milk is produced by farms with organised distribution links to processing centres. The residual 60 per cent is supplied by smallholders. • Most dairy production occurs in the south, primarily in and around Ho Chi Minh city.

	• One estimate says 70 per cent of producers have 3–5 cows, 25 per cent have 10–15 cows and 5 per cent have more than 50 cows. • VINAMILK is the largest processor in Vietnam.
Product demand and market opportunities	• VINAMILK is pushing demand for greater output as the primary supplier into the market. Its products occupy 85–90 per cent of the domestic market. • In about 1996 Nestle invested US$100,000 into a network of smallholder farms in Ha Tay Province. • A majority of dairy cattle breeds are imported. • A significant proportion (95 per cent) of milk consumption is from imported powder products.
Future developments	• Indications are that the government will allow foreign investment proposals in dairy which incorporate the development of local dairy farms (similar to pure joint venture structures). • Identified by the government as a sector for near-term development, with plans to increase milk consumption to 8–9 kg per capita by 2005.

Baseline Projections

These are shown in Table 6.3. Appendix B shows projections assuming GDP growth for the six countries is one-third below baseline.

Table 6.3. Baseline projections for Vietnam.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	94	98	102	106	111	135	164	201	3.9
Pig meat	1510	1563	1619	1678	1739	2088	2512	3024	3.5
Poultry meat	378	399	421	444	468	606	769	911	4.5
Dairy	84.2	86.7	89.3	92.0	94.8	109.9	127.4	147.7	2.8
Imports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	0	0	0	0	0	1	9	83	NA
Poultry meat	0	0	0	0	0	0	0	1	NA
Dairy	95	102	109	116	124	166	221	295	5.8
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	0
Pig meat	30	24	18	12	10	1	0	0	–33.4
Poultry meat	0	0	0	0	0	0	0	0	0
Dairy	0	0	0	0	0	0	0	0	0
Import dependency (%)									
Beef	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	
Pig meat	0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.7	
Poultry meat	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	
Dairy	48	50	51	52	53	57	61	64	
Consumption (kt rw)									
Beef	66	69	71	74	77	94	115	141	3.9
Pig meat	1154	1201	1249	1299	1349	1628	1966	2423	3.8
Poultry meat	333	399	421	444	468	606	769	912	5.2
Dairy	163	172	181	191	201	255	324	414	4.8
Per person consumption (kg rw/person)									
Total meat	48.5	50.3	52.1	53.9	55.9	67.3	82.7	103.3	3.8
Beef	1.0	1.2	1.2	1.3	1.3	1.5	1.7	1.9	3.1
Sheep and goat meat	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	7.1
Pig meat	18.7	19.1	19.5	19.9	20.3	22.6	25.4	29.6	2.3
Poultry meat	4.8	4.9	5.1	5.3	5.5	6.6	7.8	8.7	3.0
Seafood	24.0	25.1	26.2	27.4	28.7	36.7	47.7	62.8	4.9
Dairy	2.1	2.1	2.2	2.3	2.4	2.8	3.3	4.0	3.3

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight; NA = not available or not applicable
Source: GMI model and CIE calculations

Key points

- Per person meat consumption will more than double over the next 20 years. Seafood will continue to account for more than half this consumption.
- Vietnam is likely to remain self-sufficient in meat over the period.
- A moderate growth in demand for dairy products will lead to an increase in imports; over 60 per cent of dairy consumption could be sourced from imports by 2020.

7 Philippines: Recent Performance and Baseline Projections

Chapter outline

This chapter provides the following information:

- data on the Philippines' economy-wide performance (summary indicators)
- meat industry data for beef, dairy, poultry, pork and seafood
- trends in per capita consumption of meat and dairy products
- Engel curves showing the relationship between per capita meat protein consumption and per capita income for beef, dairy, poultry, pork and seafood
- information on production systems, policy settings and future developments for beef, pig meat, poultry and dairy
- baseline projections to 2020 for production, imports, exports, import dependency, consumption and per person consumption.

Where relevant, each section of data concludes with a set of key points, which appear in a shaded box.

Economy-wide Performance

Table 7.1. Summary indicators, 1990–2000.

Year	GDP(real) per capita		Population	
	Pesos/capita	Growth rate (%)	Millions	Growth rate (%)
1990	11,719		61.48	
1991	11,373	–2.94	63.69	3.59
1992	11,164	–1.84	65.34	2.59
1993	11,141	–0.21	66.98	2.51
1994	11,351	1.89	68.62	2.45
1995	11,603	2.22	70.27	2.40
1996	12,003	3.45	71.90	2.32
1997	12,346	2.85	75.53	5.05
1998	12,009	–2.73	75.15	–0.50
1999	12,484	3.96	74.75	–0.53
2000	12,718	1.87	76.18	1.91

Source: http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm

Key points

- There has been a generally poor overall economic performance, with low per capita income growth.
- The population growth rate remains high.

Meat Industry Data

Table 7.2. Meat industry data, 1990–2001.

	Production[a] (kt)	Consumption[a] (kt)	(kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
Beef						
1990	82.0	65.0	1.06	0.000	10.881	16.74
1991	84.0	66.0	1.04	0.000	10.252	15.54
1992	85.0	69.6	1.06	0.000	14.395	20.69
1993	92.0	76.5	1.14	0.000	17.296	22.61
1994	90.0	87.9	1.28	0.000	35.551	40.45
1995	97.4	97.8	1.39	0.000	42.342	43.30
1996	112.9	117.8	1.64	0.000	55.443	47.05
1997	136.6	143.6	1.90	0.000	68.490	47.70
1998	155.8	144.6	1.92	0.000	50.707	35.08
1999	189.9	177.9	2.38	0.000	64.166	36.07
2000	190.2	192.6	2.53	0.000	85.033	44.14
2001	197.0	192.8	2.48	0.025	78.437	40.67
Growth (%)[c]	*9.77*	*12.23*	*9.89*	NA	*25.05*	
Dairy						
1990	20.00	158.83	2.58	0.082	138.910	87.41
1991	17.00	129.89	2.04	0.026	112.917	86.91
1992	15.42	135.55	2.07	0.084	120.211	88.62
1993	12.50	128.77	1.92	0.101	116.375	90.29
1994	12.10	160.10	2.33	0.030	148.027	92.44

Table 7.2. Meat industry data, 1990-2001 (cont'd).

	Production[a] (kt)	Consumption[a] (kt)	Consumption[a] (kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
1995	12.11	173.85	2.47	0.020	161.758	93.03
1996	11.50	168.59	2.34	0.100	157.190	93.18
1997	10.22	181.53	2.40	0.282	171.596	94.37
1998	9.24	154.18	2.05	0.335	145.273	94.01
1999	9.85	158.98	2.13	0.216	149.348	93.80
2000	10.00	198.43	2.60	7.591	196.023	94.96
2001	9.33	202.29	2.60	10.77	203.74	95.39
Growth (%)[c]	*–6.71*	*2.81*	*0.57*	*41.93*	*3.93*	
Poultry						
1990	241.7	212.9	3.46	0.059	0.241	0.09
1991	287.2	252.8	3.97	0.082	0.116	0.01
1992	307.3	270.7	4.14	0.000	0.231	0.09
1993	363.5	320.3	4.78	0.000	0.426	0.13
1994	380.5	335.6	4.89	0.000	0.925	0.28
1995	418.6	369.6	5.26	0.000	1.467	0.40
1996	474.1	418.7	5.82	0.001	1.682	0.40
1997	515.7	456.3	6.04	0.001	2.768	0.61
1998	511.3	453.4	6.03	0.000	4.010	0.88
1999	517.1	472.4	6.32	0.000	19.747	4.18
2000	549.7	501.5	6.58	0.007	20.238	4.03
2001	558.1	504.5	6.48	0.029	15.279	3.02
Growth (%)[c]	*7.78*	*8.13*	*5.87*		*61.94*	
Pork						
1990	684.0	534.1	8.69	0.383	1.179	0.15
1991	701.6	547.3	8.59	0.368	0.462	0.02
1992	658.0	513.5	7.86	0.029	0.417	0.08
1993	731.0	570.2	8.51	0.032	0.046	0.00
1994	765.0	596.9	8.70	0.002	0.235	0.04
1995	805.0	628.7	8.95	0.026	1.071	0.17
1996	860.0	674.8	9.39	0.000	5.120	0.76
1997	901.8	708.9	9.39	0.000	7.037	0.99
1998	932.8	733.0	9.75	0.000	6.909	0.94
1999	973.0	773.1	10.34	0.023	18.169	2.35
2000	1008.0	799.0	10.49	0.017	16.344	2.04
2001	1064.0	837.9	10.76	0.005	10.190	1.22
Growth (%)[c]	*4.52*	*4.67*	*2.49*	NA	*51.63*	
Seafood						
1990	2504.2	1395.5	22.70	102.0	195.5	6.70
1991	2599.6	1432.2	22.49	111.6	193.2	5.69
1992	2626.2	1482.7	22.69	103.2	221.4	7.97
1993	2632.5	1439.0	21.48	135.7	208.1	5.03
1994	2721.5	1512.5	22.04	142.2	239.5	6.43
1995	2785.6	1590.8	22.64	127.1	269.4	8.94
1996	2769.7	1556.4	21.65	148.6	264.7	7.46
1997	2767.2	1602.7	21.22	129.0	292.8	10.22
1998	2790.9	1419.9	18.89	202.0	170.5	0
1999	2822.2	1560.2	20.87	161.5	254.2	5.94
2000	2940.0	1778.4	23.35	129.2	378.8	14.04
2001	2978.4	1808.4	23.23	134.7	394.3	14.36
Growth (%)[c]	*1.31*	*1.53*	*–0.68*	*4.29*	*4.09*	

kt = kilotonnes; NA = not available or not applicable

[a] Production, exports and imports measured in kt carcass weight equivalent; consumption and consumption per capita measured in kt retail weight

[b] Calculated as the ratio of net imports to total consumption, all measured in carcass weight equivalent

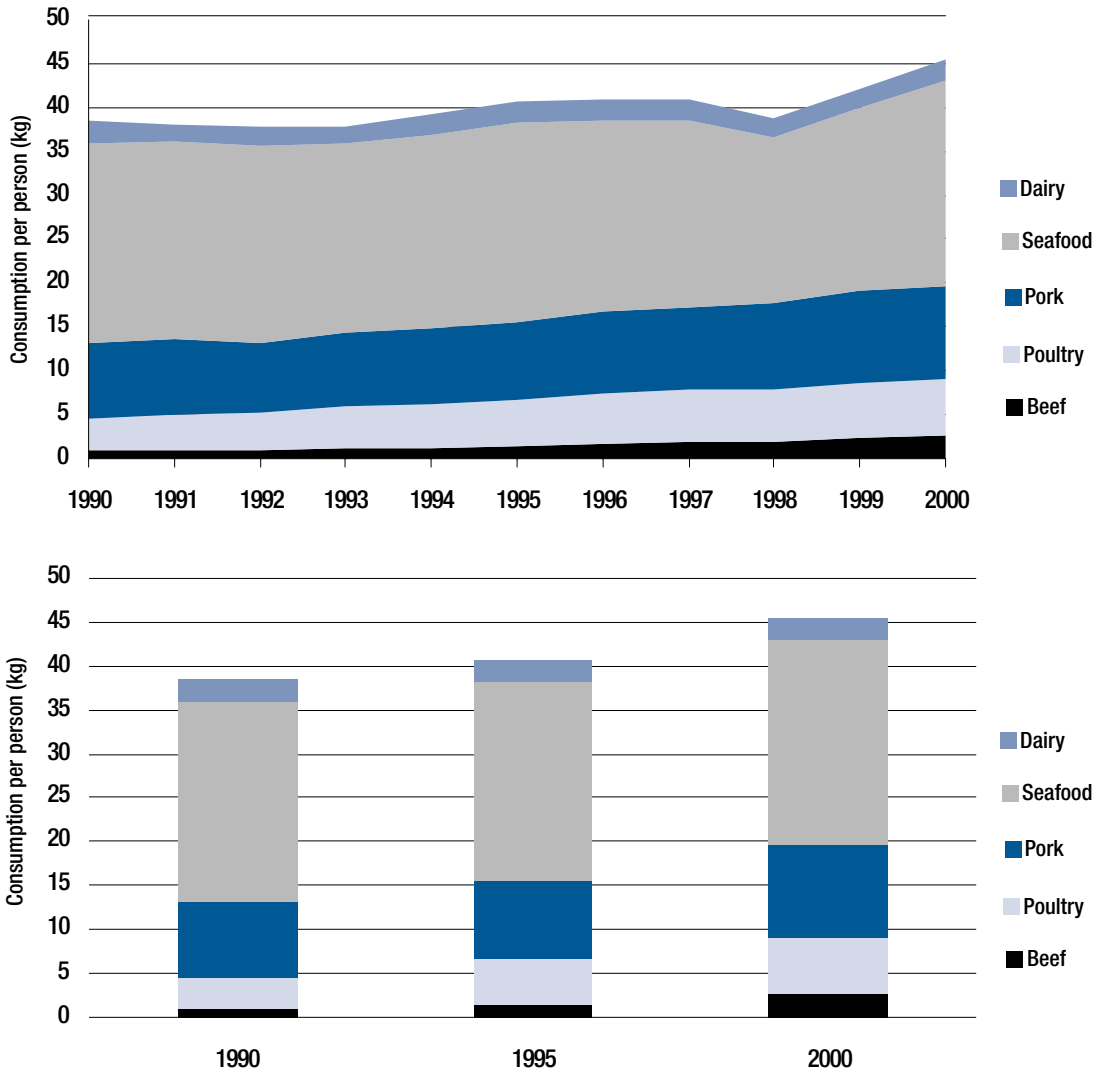
[c] Average logarithmic growth rate, 1990–2001

Source: GMI database

Key points

- Dairy production is small and declining, with a large and growing import dependency.
- There has been a rapid growth in beef production (based on feeder cattle from Australia) and poultry production.

Figure 7.1. Trends in per capita consumption of meat and dairy, 1990–2000.



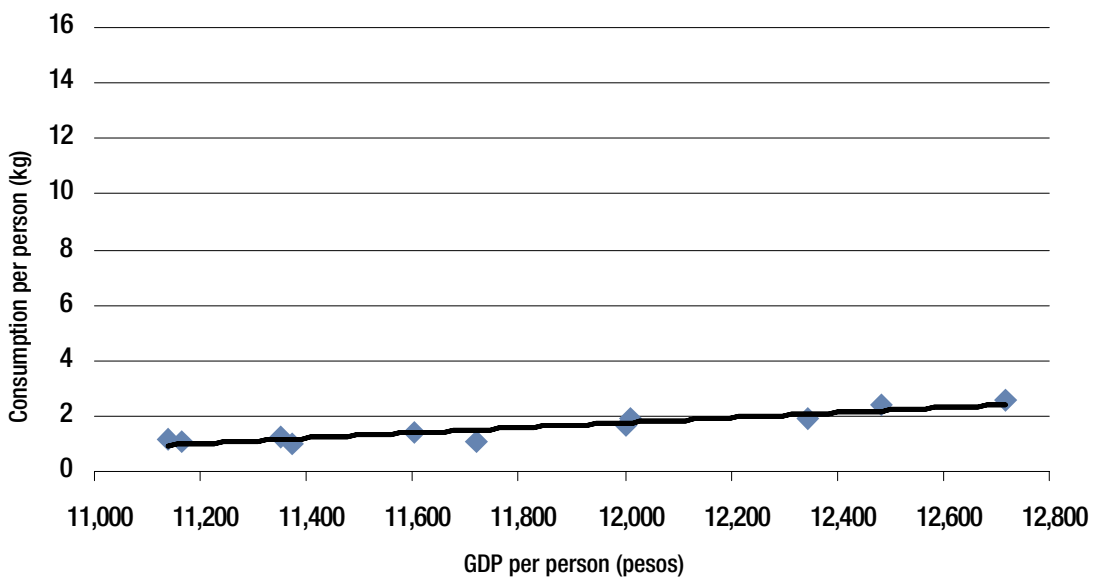
Data source: GMI database

Key points

- There has been a steady growth in per capita meat consumption.
- Pork remains the dominant meat, but poultry consumption is growing rapidly.
- Beef consumption is increasing rapidly from a low base.

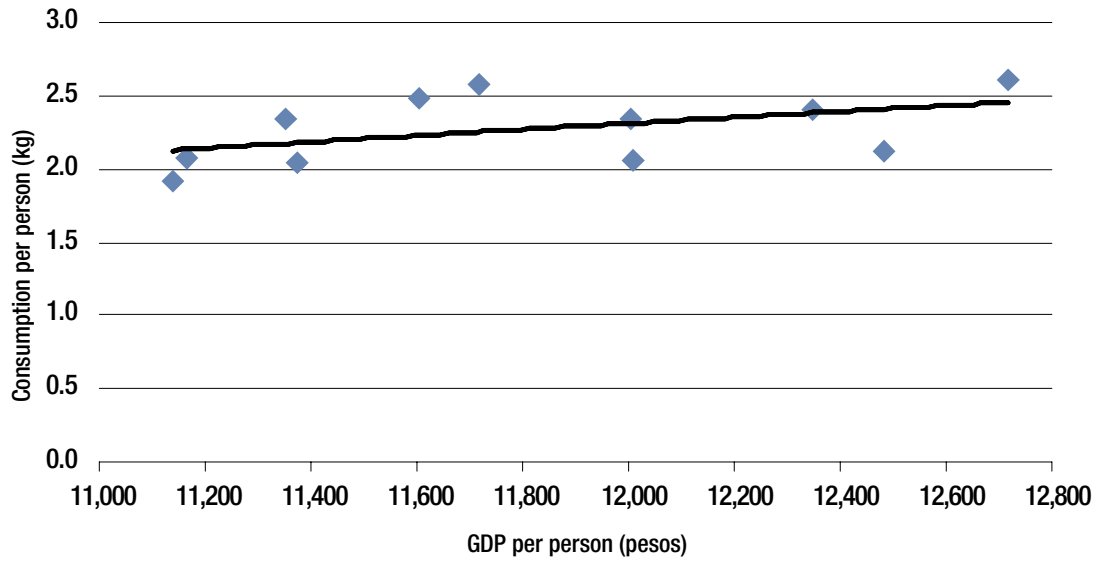
Relationship Between Per Capita Meat Protein Consumption and Per Capita Income (Engel Curves)

Figure 7.2. Beef.



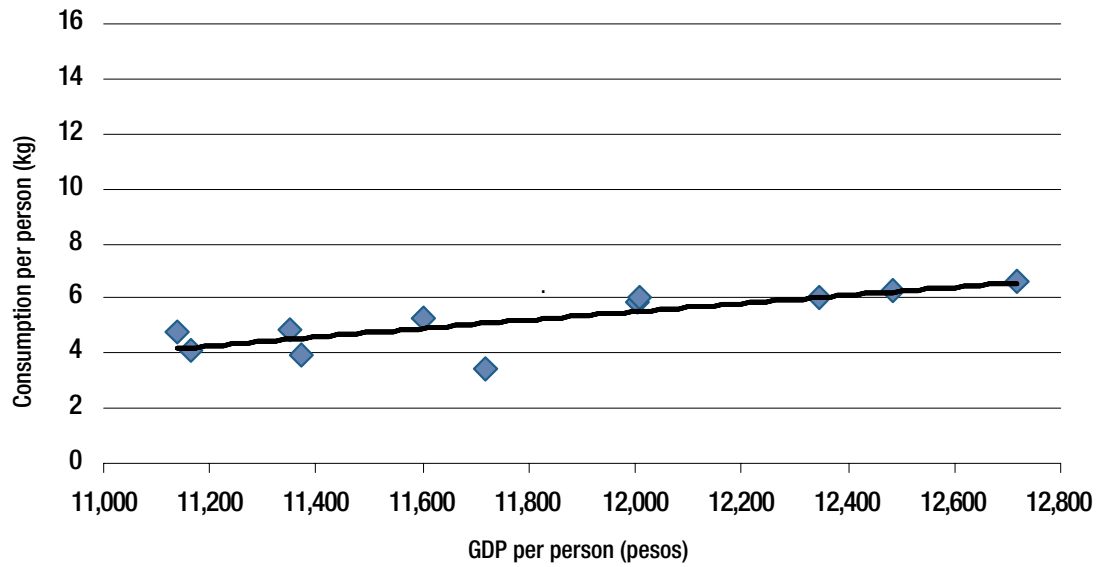
Data source: GMI database

Figure 7.3. Dairy.



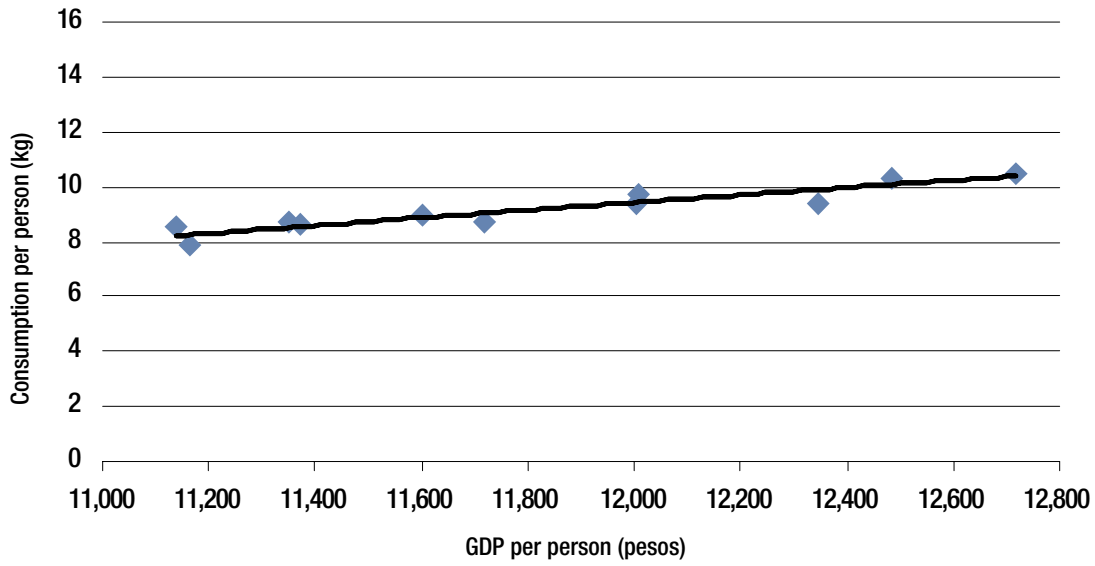
Data source: GMI database

Figure 7.4. Poultry.



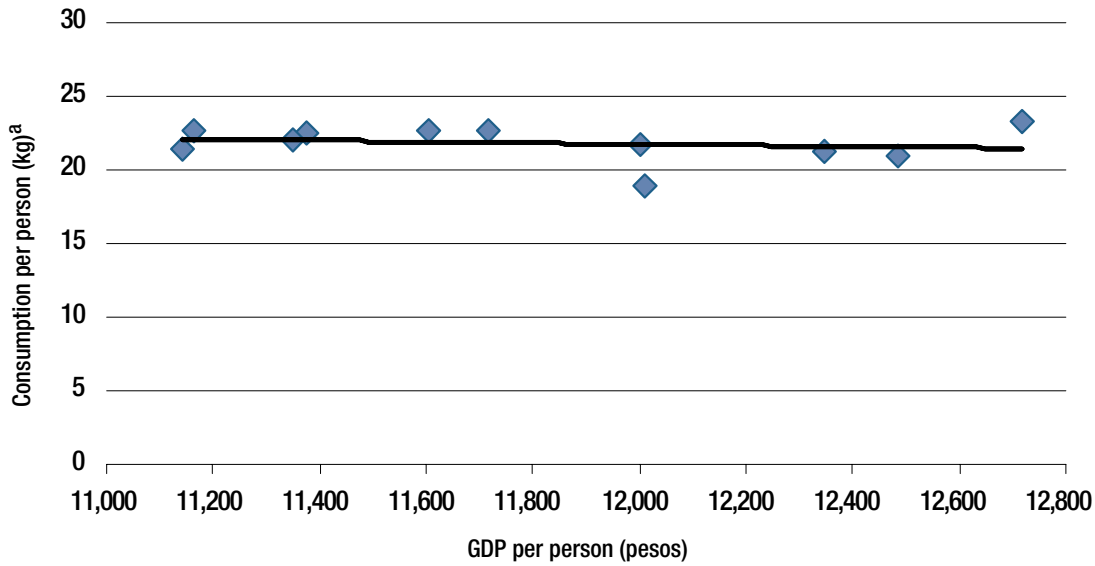
Data source: GMI database

Figure 7.5. Pork.



Data source: GMI database

Figure 7.6. Seafood.



[a] *Note different scale for seafood*
Data source: GMI database

Beef

Recent performance	• Over the past decade there has been production growth of around 10 per cent per year. • Production growth is heavily dependent on imports of live feeder cattle from Australia. • As a result of a ban on beef imports from Europe in late 2000, a mild shortage of beef occurred, which increased farm gate prices.
Policy settings	• Live bovine animals are levied a 3 per cent tariff through to 2004. • During a recent trade dispute with Australia, live cattle import duties were raised to 7 per cent. They were later reduced to 3 per cent following a resolution of the problem. • Fresh chilled or frozen bovine meats face a 10 per cent tariff.
Socioeconomic and institutional framework	• Around 90 per cent of the cattle population is on small backyard farms, where animals are used for draft purposes before being slaughtered. • Institutional arrangements link small producers with large commercial integrators. • Institutional failure and poor interaction between the central and regional authorities is a major constraint on the development of all livestock industries. • Around 75 per cent of pigs are raised on backyard farms.
Production system	• The domestic industry is dominated by carabaos (buffalo), which comprise 55 per cent of total bovine animals, with both milk and meat as the primary products. • Most cattle are bred on smallholder farms. Less than 10 per cent of cattle are on larger-scale commercial farms. This share has fallen from 22 per cent in 1980.
Product demand and market opportunities	• There has been strong demand growth over the past decade. Much of the demand has been met by imports. Import dependency has increased from 17 per cent to 40 per cent, with India and Australia the major exporters.

- Demand for beef decreased significantly with the bovine spongiform encephalopathy and foot-and-mouth disease scares. Consumers substituted pork, chicken and fish, but processors increased their utilisation of local beef.
- The weakness of the Philippine economy, combined with a weakening currency, has dramatically reduced the quantity of live cattle imports. Imports fell from 267,074 head in 2000 to 98,924 head in 2001. High Australian cattle prices have also contributed.
- Lack of a cold chain system (almost non-existent outside Metro Manila) will constrain sales.
- A major purchaser is the San Miguel Corporation (which is a majority player in the Burger King and other livestock product markets).

Future developments

- The Philippine Association of Meat Processors has been lobbying for a cut in import duties on beef from 10 per cent to 5 per cent.
- In a recent (2002) visit to Masbate, the president instructed the Department of Environment and Natural Resources to reduce the existing US$3.91 per hectare per annum pasture lease rate to US$0.78 per hectare per annum to encourage beef production.
- Live cattle imports will expand, following a decline in 2001, as local producers try to rebuild cattle stocks.
- Cattle are a potential fit with rice in terms of feed availability (rice straw) and farmer time.

Pig meat

Recent performance

- Average annual production growth over the decade was around 4.5 per cent, with consumption growing at 4.7 per cent. The shortfall has been made up through imports.

Policy settings

- Minimum access volumes for fresh, chilled and frozen pork were 43,365 tonnes in 2000, increasing to 45,775 in 2001; 48,185 in 2002; 50,595 in 2003; 53,005 in 2004; and 27,105 in 2005. The utilisation rates have been low, at around 20–40 per cent.
- In-quota rates for fresh, chilled and frozen pork are 30 per cent; out-of-quota rates are 60 per cent.
- Quota and tariffs also exist for live imports of pigs for breeding (tariff of 3 per cent) and higher rates for live swine other than breeding (in-quota rate of 30 per cent; above-quota rates of 35–50 per cent).

Production system

- The pig meat sector comprises a substantial commercial feedlot sector, combined with traditional backyard-style farms. Backyard operations still account for more than 80 per cent of production.

	• Feed costs have tended to be high. Around 50 per cent of production costs can be attributed to feed (mostly corn). Rapid expansion in livestock production has meant that feed must be imported to keep pace. This has left feed costs highly susceptible to fluctuations in the peso.
Product demand and market opportunities	• Pork has the highest per person consumption of all meats (excluding seafood). Per person consumption has grown steadily, but not as rapidly as poultry or beef. • Pig meat demand was not as significantly affected by the foot-and-mouth disease scare as was beef.
Future developments	• Production will continue moving away from backyard operations into more sophisticated commercial production. • Pig meat is likely to remain the most popular meat, with strong demand growth. Imports will increase, with demand growth more rapid than production growth.

Poultry

Recent performance	• Average annual production growth is around 8 per cent.
Policy settings	• The quota for 2002 is 20,879 metric tonnes (mt); for 2003 it is 21,923 mt; and for 2004 it is 22,968 mt. It will reduce to 10,374 mt in 2005. • The in-quota rate was 45 per cent in 2001; the out-of-quota rate ranged from 50 per cent to 60 per cent. Prepared and preserved poultry meats have a uniform rate of 60 per cent (2001), reducing by 10 per cent until they reach 30 per cent in 2004. • Quota utilisation has ranged from 16 to 91 per cent and is not particularly consistent. • The Department of Agriculture is trying to force importers to bring in whole birds only.
Socioeconomic and institutional framework	• There has been a significant shift away from backyard operations. In 1990, 70 per cent of chickens were in backyard operations. Presently, this figure is around 50 per cent. Commercial operations now account for more than 85 per cent of production.
Production system	• Some 85 per cent of poultry is produced in integrated operations. • San Miguel Corporation accounts for 40 per cent of poultry production.

Product demand and market opportunities	• Five 'integrators' have formed the Philippine Association of Broiler Integrators (PABI). They use higher technological innovation and better breeding techniques than smallholders alone. • Small and medium-sized producers belong to the United Broiler Raisers Association, which is less organised than PABI but provides a voice for breeders.
Future developments	• Chicken meat consumption will benefit from food safety concerns with competing meats, especially beef.

Dairy

Recent performance	• The production base is very small; production has halved over the last decade. • There has been a rapid growth in imports to meet steady consumption growth.
Policy settings	• Milk and cream that are concentrated or contain sugar will be levied at 3 per cent until 2004. • The National Dairy Development Act 1995 directs the government to set aside approx US$2.75 million a year for dairy development.
Socioeconomic and institutional framework	• The government is establishing a program to support a national school milk feeding program. • Around 50 per cent of all Filipinos are lactose intolerant.
Production system	• Carabaos are an important source of milk (and meat). • Some 99 per cent of milk used is imported. • Approximately 5000 small dairy farmers and a few semicommercial and institutional farms engage in the production, processing and marketing of milk.
Product demand and market opportunities	• Two milk zones have been established in Luzon and Mindanao. • Dairy farmers around the milk zones have organised into cooperative groups. • Collection stations have been established to collect milk from the villages located around the milk zones.

	• In the processing/reprocessing stage, 10 dominant firms control 80 per cent of the total market: Nestle, Alaska Milk Corp, New Zealand Milk Products, Bristol Myers Squibb, Wyeth, Philippine Dairy Products Corp, Kraft, New Zealand Ice Creamery, Universal Robina and Selecta Walls.
Future developments	• Production is unlikely to increase significantly. Imports will remain the primary source of dairy products.

Baseline Projections

These are shown in Table 7.3. Appendix B shows projections assuming GDP growth for the six countries is one-third below baseline.

Table 7.3. Baseline projections for Philippines.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	209	211	214	218	223	257	292	329	2.3
Pig meat	1053	1077	1106	1136	1167	1415	1678	1956	3.1
Poultry meat	596	609	625	642	659	842	1044	1263	3.8
Dairy	9	9	9	9	9	9	9	8	–0.5
Imports (kt cwe)									
Beef	92	95	99	111	127	216	352	555	9.4
Pig meat	30	43	60	85	118	250	497	915	18.7
Poultry meat	21	30	40	55	76	146	265	453	16.5
Dairy	196	205	215	225	237	303	387	494	4.7
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	0
Pig meat	0	0	0	0	0	0	0	0	0
Poultry meat	0	0	0	0	0	0	0	0	0
Dairy	0	0	0	0	0	0	0	0	0
Import dependency (%)									
Beef	43.7	44.2	45.3	48.2	51.8	65.2	78.0	89.7	
Pig meat	3.5	5.0	6.6	8.9	11.8	19.3	29.3	40.9	
Poultry meat	3.9	5.3	6.9	9.0	11.8	16.8	23.0	30.0	
Dairy	95.5	95.7	95.9	96.1	96.3	97.1	97.8	98.3	
Consumption (kt rw)									
Beef	211	214	219	230	245	331	451	619	5.5
Pig meat	844	874	910	952	1003	1298	1697	2239	5.0
Poultry meat	543	562	586	614	647	870	1152	1509	5.2
Dairy	205	214	224	235	246	312	396	503	4.6
Per person consumption (kg rw/person)									
Total meat	41.7	42.1	42.9	43.9	45.1	53.5	63.8	76.8	3.1
Beef	2.7	2.7	2.7	2.8	2.9	3.7	4.7	6.1	4.1
Sheep and goat meat	1.0	1.0	1.0	1.0	1.0	1.2	1.4	1.6	2.5
Pig meat	10.9	11.1	11.3	11.6	12.0	14.4	17.6	22.1	3.6
Poultry meat	7.0	7.1	7.3	7.5	7.8	9.7	12.0	14.9	3.8
Seafood	20.1	20.3	20.6	20.9	21.3	24.6	28.1	32.1	2.4
Dairy	2.6	2.7	2.7	2.8	2.9	3.4	4.0	4.9	3.2

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight
Source: GMI model and CIE calculations

Key points

- Per person meat consumption will increase by 84 per cent over the next 20 years.
- There is a growing import dependency on all meats.
- There is virtually total import dependency on dairy.

8 Thailand: Recent Performance and Baseline Projections

Chapter outline

This chapter provides the following information:

- data on Thailand's economy-wide performance (summary indicators)
- meat industry data for beef, dairy, poultry, pork and seafood
- trends in per capita consumption of meat and dairy products
- Engel curves showing the relationship between per capita meat protein consumption and per capita income for beef, dairy, poultry, pork and seafood
- information on production systems, policy settings and future developments for beef, pig meat, poultry and dairy
- baseline projections to 2020 for production, imports, exports, import dependency, consumption and per person consumption.

Where relevant, each section of data concludes with a set of key points, which appear in a shaded box.

Economy-wide Performance

Table 8.1. Summary indicators, 1990–2000.

Year	GDP(real) per capita		Population	
	Baht/capita	Growth rate (%)	Millions	Growth rate (%)
1990	34,696		55.84	
1991	37,076	6.86	56.57	1.31
1992	39,614	6.85	57.29	1.27
1993	42,456	7.17	58.01	1.26
1994	45,706	7.65	58.71	1.21
1995	49,379	8.04	59.40	1.18
1996	51,762	4.83	60.00	1.01
1997	50,508	–2.42	60.60	1.00
1998	44,626	–11.65	61.20	0.99
1999	46,051	3.19	61.81	1.00
2000	47,652	3.48	62.42	0.99

Source: http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm

Key points

- Population growth has slowed markedly to less than 1 per cent annually.
- Per capita income fell sharply during the financial crisis and has not yet recovered to its pre-crisis level.

Meat Industry Data

Table 8.2. Meat industry data, 1990–2001.

	Production[a] (kt)	Consumption[a] (kt)	(kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
Beef						
1990	180.1	126.4	2.26	0.017	0.515	0.39
1991	188.7	132.7	2.34	0.023	0.810	0.59
1992	191.2	134.7	2.35	0.002	1.218	0.90
1993	204.6	144.8	2.50	0.001	2.250	1.55
1994	236.8	166.5	2.84	0.000	1.069	0.64
1995	232.5	163.7	2.76	0.004	1.391	0.85
1996	238.1	167.6	2.79	0.002	1.391	0.83
1997	226.1	159.3	2.63	0.002	1.478	0.93
1998	210.3	148.5	2.43	0.040	1.848	1.22
1999	187.5	132.3	2.14	0.000	1.441	1.09
2000	170.0	119.9	1.92	0.001	1.322	1.10
2001	180.0	127.0	2.01	0.000	1.418	1.12
Growth (%)[c]	*–0.37*	*–0.34*	*–1.42*	NA	*7.24*	
Dairy						
1990	142.0	203.1	3.64	3.927	65.07	30.10
1991	157.2	217.3	3.84	9.315	69.41	27.66
1992	195.5	271.7	4.74	10.958	87.16	28.05
1993	152.4	214.8	3.70	15.242	77.61	29.03
1994	227.3	307.0	5.23	23.497	103.18	25.96

Table 8.2. Meat industry data, 1990-2001 (cont'd).

	Production[a] (kt)	Consumption[a] (kt)	(kg/capita)	Exports[a] (kt)	Imports[a] (kt)	Import dependency[b] (%)
1995	334.8	439.5	7.40	25.422	130.04	23.81
1996	376.1	478.7	7.98	24.181	126.71	21.42
1997	428.9	547.1	9.03	26.894	145.10	21.61
1998	420.6	494.4	8.08	31.309	105.20	14.94
1999	487.0	563.7	9.12	30.347	107.12	13.62
2000	502.7	570.3	9.14	35.770	103.32	11.85
2001	579.9	646.2	10.25	42.94	109.18	10.25
Growth (%)[c]	*15.36*	*12.63*	*11.39*	*20.03*	*5.67*	
Poultry						
1990	667.8	463.2	8.29	141.61	0.121	0
1991	872.7	620.5	10.97	167.67	0.101	0
1992	1039.9	760.7	13.28	175.64	0.071	0
1993	1056.6	785.8	13.55	163.82	0.193	0
1994	996.4	737.2	12.56	158.90	0.231	0
1995	1007.2	748.5	12.60	156.91	0.292	0
1996	1044.7	781.5	13.02	156.91	0.292	0
1997	1057.2	793.1	13.09	156.04	0.169	0
1998	1189.7	853.7	13.95	219.84	0.287	0
1999	1190.3	842.5	13.63	233.13	0.280	0
2000	1220.7	832.9	13.34	274.55	0.282	0
2001	1366.5	949.5	15.06	287.82	0.316	0
Growth (%)[c]	*4.52*	*4.26*	*3.13*	*4.83*	*12.00*	
Pork						
1990	337.0	261.8	4.69	1.432	0.016	0
1991	340.0	264.2	4.67	1.344	0.002	0
1992	433.3	337.8	5.90	0.289	0.101	0
1993	458.8	357.6	6.16	0.299	0.007	0
1994	489.4	381.6	6.50	0.206	0.002	0
1995	488.9	380.9	6.41	0.642	0.001	0
1996	511.3	398.3	6.64	0.642	0.001	0
1997	548.7	427.8	7.06	1.084	0.881	0
1998	474.6	368.6	6.02	2.184	0.142	0
1999	425.9	331.7	5.37	0.703	0.082	0
2000	450.0	346.9	5.56	5.235	0.009	0
2001	475.0	365.9	5.80	5.928	0.011	0
Growth (%)[c]	*2.38*	*2.32*	*1.20*	*13.23*	*22.11*	
Seafood						
1990	2792	1200	21.50	765	513	0
1991	2975	1356	23.97	914	723	0
1992	3247	1443	25.19	953	708	0
1993	3385	1574	27.13	944	757	0
1994	3524	1746	29.73	1053	966	0
1995	3578	1760	29.62	1020	919	0
1996	3564	1670	27.83	972	788	0
1997	3435	1474	24.32	1014	701	0
1998	3522	1387	22.67	1160	716	0
1999	3621	1600	25.89	1204	922	0
2000	3631	1695	27.15	1250	1056	0
2001	3710	1729	27.43	1298	1098	0
Growth (%)[c]	*2.19*	*1.92*	*0.80*	*3.90*	*3.95*	

kt = kilotonnes; NA = not available or not applicable

[a] *Production, exports and imports measured in kt carcass weight equivalent; consumption and consumption per capita measured in kt retail weight*

[b] *Calculated as the ratio of net imports to total consumption, all measured in carcass weight equivalent*

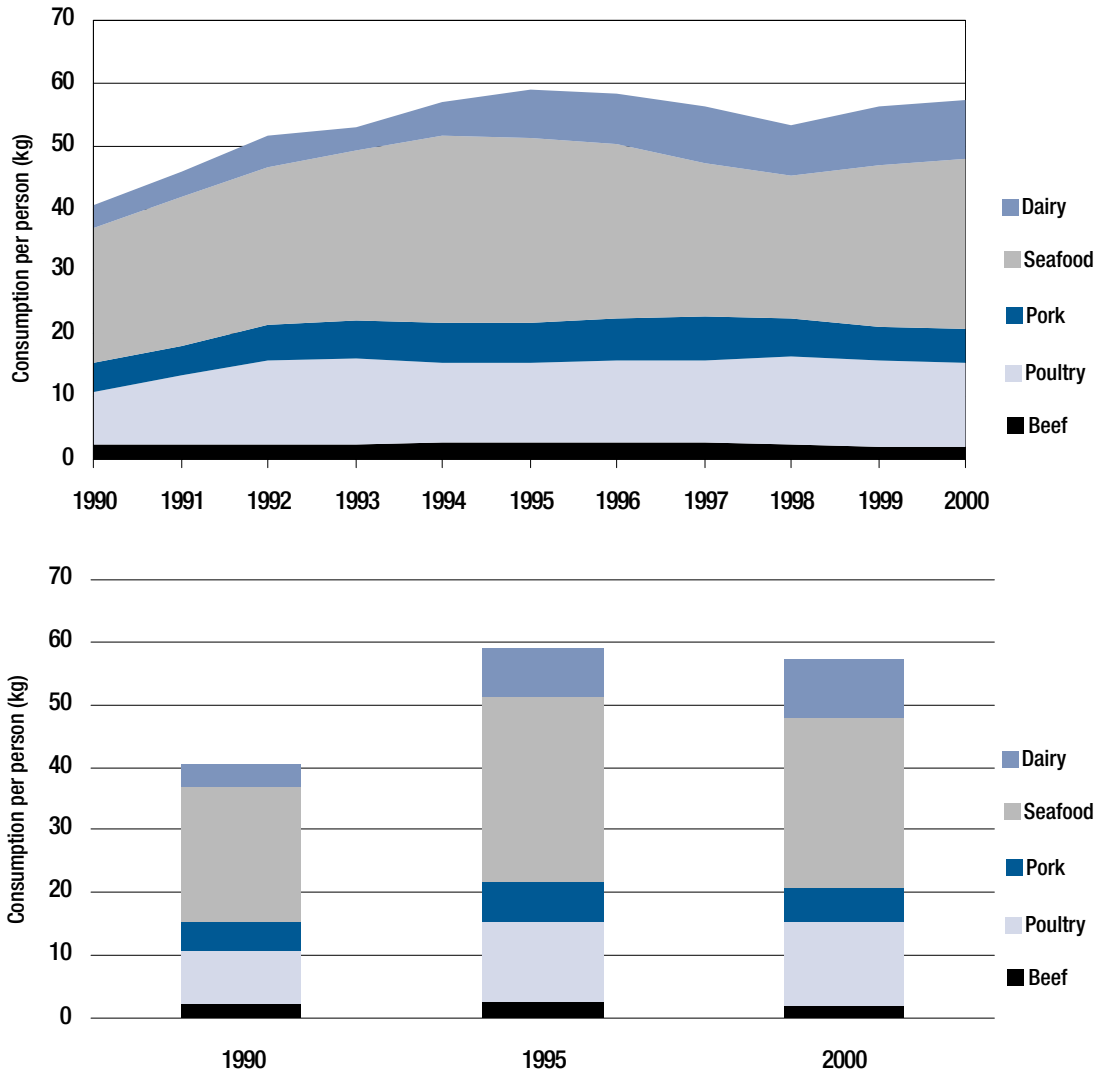
[c] *Average logarithmic growth rate, 1990–2001*

Source: GMI database

Key points

- Seafood dominates meat protein production and consumption.
- There has been a steady growth in poultry production in excess of domestic consumption, with significant growth in exports.
- There has been a modest growth in pork production to meet domestic consumption needs.
- There has been no growth in beef production and consumption.
- There has been rapid growth in dairy production and consumption.

Figure 8.1. Trends in per capita consumption of meat and dairy, 1990–2000.



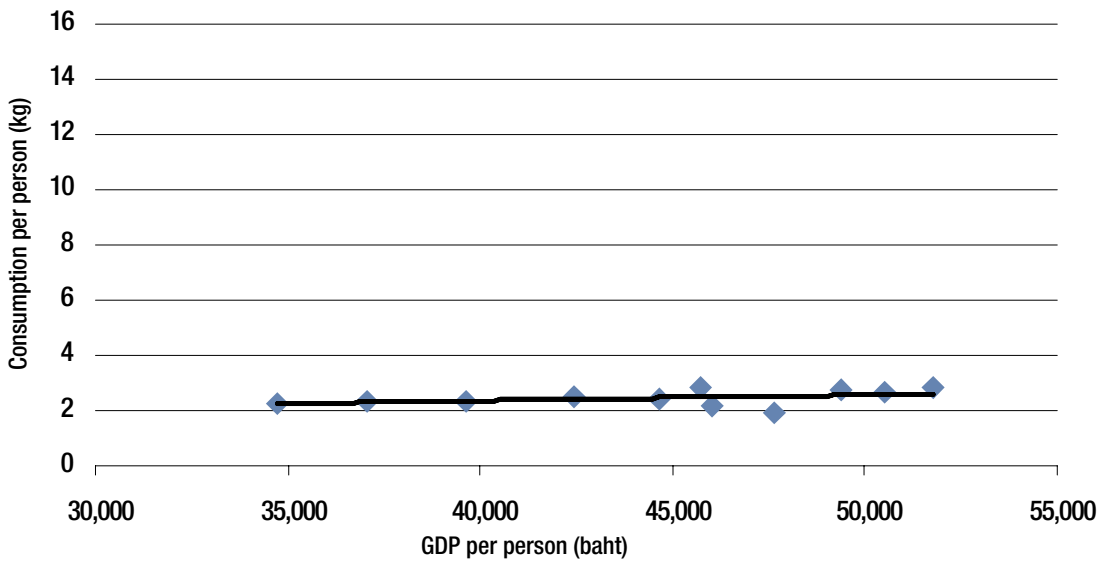
Data source: GMI database

Key points

- Growth in per capita consumption of meat was curtailed by the financial crisis.
- There has been a shift by consumers towards poultry at the expense of beef and pork.
- Dairy products are becoming an increasingly important part of consumer preferences toward animal protein.

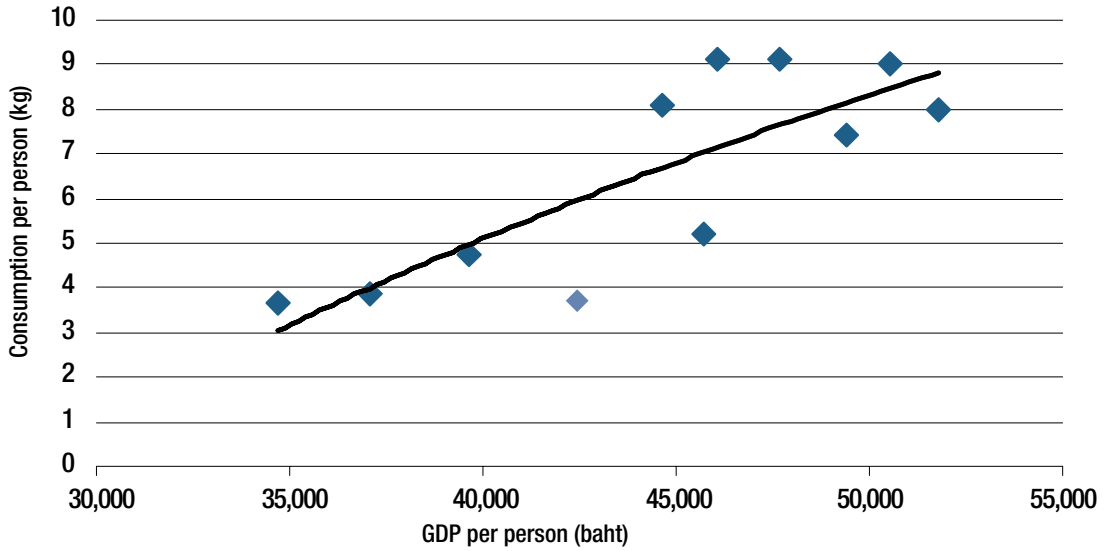
Relationship Between Per Capita Meat Protein Consumption and Per Capita Income (Engel Curves)

Figure 8.2. Beef.



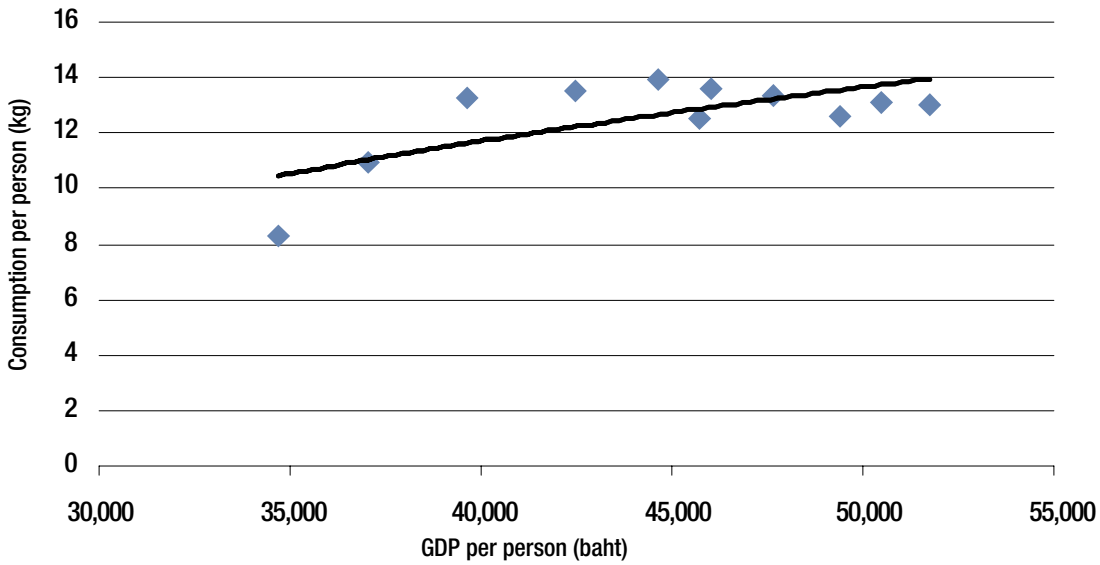
Data source: GMI database

Figure 8.3. Dairy.



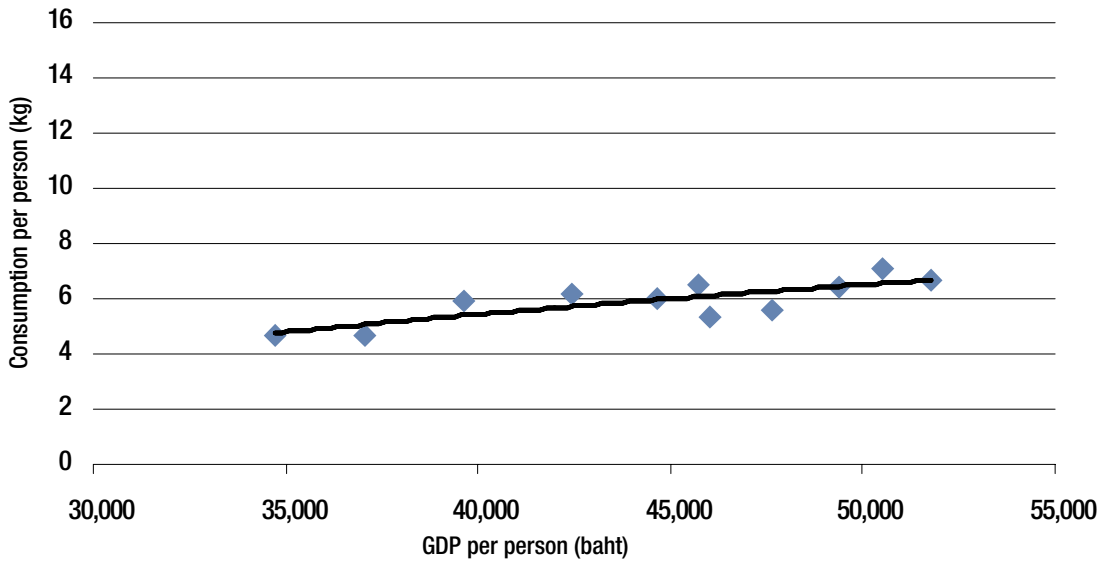
Data source: GMI database

Figure 8.4. Poultry.



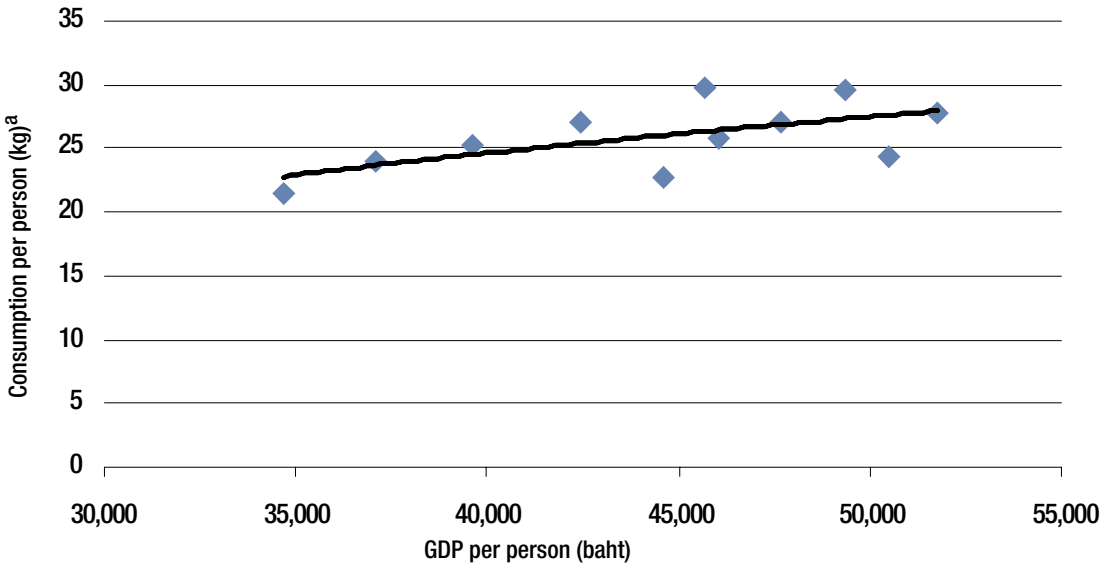
Data source: GMI database

Figure 8.5. Pork.



Data source: GMI database

Figure 8.6. Seafood.



[a] Note different scale for seafood compared with beef, dairy, poultry and pork
Data source: GMI database

Production Systems, Policy Settings and Future Developments

Beef

Recent performance

- There has been some growth in production, peaking in 1996. Production has since contracted.
- Beef consumption makes up a relatively small amount of total meat consumption in Thailand.

Policy settings

- The goal of eradicating foot-and-mouth disease has not been accomplished. There is a large problem with illegal cattle smuggling into Thailand, which is hampering eradication efforts.
- There are high tariffs on imports (52.2 per cent).

Socioeconomic and institutional framework

- The declining beef cattle population in recent times is largely due to heavy slaughter of female cattle, which has reduced calf production.
- There are three types of beef farms in Thailand:
  - Breeding farms mainly sell breeding stock to other farmers (the number of these farms has decreased in recent times due to unfavourable market conditions).
  - Traditional farms are generally small backyard operations. Cattle are sometimes used as draft animals, then slaughtered at a high age. Beef is typically of poor quality.
  - Feedlot operations differ in that they fatten cattle before slaughtering. They purchase old cattle from traditional farms and fatten them for 2–3 months. This meat is usually sold at fresh markets. They also purchase young animals and fatten them for 6–10 months. This meat is traditionally sold to supermarkets, hotels and restaurants.

Production system

- Production is divided between traditional farms and feedlot operations. Traditional farms are usually small backyard operations. Beef from these farms is of lower quality and used for preparing traditional foods. Higher-quality beef is produced in feedlot operations.
- Farm management is generally poor, particularly on breeding farms.
- Traditionally, the slaughter of low-quality cattle provides 90 per cent of the beef to the market.

Product demand and market opportunities	• Consumption per capita is small compared with poultry and pig meat. It has contracted over the past decade. • Reduced supply of beef cattle is contributing to a decrease in consumption, which has continued in spite of economic recovery. • Growth in tourism may see an increase in demand for higher-quality imported beef.

Pig meat

Recent performance	• There has been solid growth in production over the past decade. The Asian financial crisis had a large impact on production (pig meat production fell by 14 per cent in 1998). Production is showing signs of recovery. • There has been some growth in exports, though highly variable.
Policy settings	• Following the 1998 crisis, the Thai government initiated no-interest loans to hog farmers under certain conditions. • There are policies to aid in promoting exports, including an effort to establish a foot-and-mouth disease-free zone in three eastern provinces. • The pollution control department recently announced waste water standards for swine farms, to take effect in 2002.
Socioeconomic and institutional framework	• Production has moved from a system dominated by small growers to larger-scale commercial operations. Around 80 per cent of total production takes place on large farms and feed mill companies. • The collapse in production in 1998 had a large impact on small farms. Low prices and high costs of production forced many small farms out of operation. Much of the resurgence in production has been generated by larger operations. Lack of credit has made re-establishing small farms a difficult task. • The introduction of European 'high lean' live pigs contributed to higher costs via housing and feeding requirements, and this has favoured large-scale production.
Environmental issues	• There are problems associated with water pollution. Run-off waste from pig farms creates a significant portion of Thailand's water pollution problems. This problem has increased as farm sizes have increased.
Production system	• Recent movements in the industry have been away from small operations to larger commercial production. More than half the production is on farms with over 100 pigs.

	• Over half of the total cost of production can be attributed to feed cost. • Concern over diseases in recent times has led to a greater use of vaccines, which has increased the cost of production.
Product demand and market opportunities	• Pork is a traditional and popular Thai food. Per capita consumption is high. There has been some growth in the per capita consumption of pig meat, but demand fell away in 1998 following the currency crisis, with consumers moving toward cheaper poultry meat. Demand has shown signs of recovery in recent times.

Poultry

Recent performance	• There has been very strong growth in production, which almost doubled between 1990 and 2000. Technological advances and strong demand have driven this growth. • There has been very strong growth in exports. Thailand is one of the largest exporters of poultry meat in the world. The devaluation of the baht following the crisis in 1997 has contributed to spectacular growth in exports since 1997. Exports grew at an average of 16 per cent per year in the period 1997–2000 compared with almost no growth between 1990 and 1996. • There is low reliance on imports, largely due to a closed market.
Policy settings	• Import restrictions are prevalent. Poultry meat imports currently attract an import duty of around 45 per cent. • In addition to this, poultry imports face an import licence fee of 10 baht per kilogram. • Import licences must be granted by the Department of Livestock Development.
Socioeconomic and institutional framework	• Most poultry production in Thailand now takes place in commercial operations. • The commercial development of the poultry sector took place with substantial support from the government and private sectors.
Production system	• Large improvements in broiler farming have been facilitated largely by improved genetics. A move towards evaporative cooling systems has also had an impact. • Most integrated producers have replaced parent-type stocks with yield-type stocks. This has the industry placed to move towards larger broilers (around 2.5 kg), which will further improve productivity.

Product demand and market opportunities	• Chicken meat is by far the most popular meat product among consumers. It is cheaper than other meats and easy to prepare. BSE and FMD problems with other meats have also made poultry a more attractive alternative. • Chicken is an increasingly popular choice in fast-food outlets
Future developments	• High barriers to imports are likely to continue, despite Thailand's position as one of the world's largest poultry meat exporters. • Domestic production is likely to continue increasing. Technological advances and expansion of existing facilities should facilitate this. • Poultry is likely to remain the cheapest meat product, due to a relatively efficient production system. Any movement in the relative price of poultry to other meats is likely to significantly impact on consumption.

Dairy

Recent performance	• There has been spectacular growth in production (over 15 per cent per year between 1990 and 2000). During that period, total production has more than trebled. • There has been export growth of 20 per cent per year. • Imports have grown significantly, but the reliance on imports has decreased. Imports constituted 32 per cent of consumption in 1990, falling to 18 per cent in 2000.
Policy settings	• The government has heavily promoted dairy production to improve income distribution. This has encouraged a switch from rice to dairy • Milk imports operate under a quota allocation system. The main products imported are non-fat dry milk and whole milk powder. These are subject to an in-quota tariff rate of 5–18 per cent and an above-quota tariff rate of over 200 per cent. • Promotion of raw milk production occurs through price guarantees for raw milk (currently 12.5 baht/kg). • School milk subsidies account for 50 per cent of milk consumption. • A local content requirement policy requires firms which import skim powdered milk to buy local raw milk.
Socioeconomic and institutional framework	• Production is dominated by small dairy farms which typically have 5–10 milking cows. • Dairy farming is characterised by low productivity (typically around 13,000–14,000 kg per cow per year).

	• There are often problems such as infertility and mastitis in dairy cattle. As many as 30 per cent of dairy cattle are affected by mastitis Poor feed quality is a major problem, leading to poor quality in raw milk production.
Environmental issues	• Pollution from dairy cows has become a big problem in peri-urban areas through production expansion and encroachment.
Production system	• Small dairy farms account for most of the raw milk production in Thailand. • Farms are getting larger (around 20 per cent of dairy farms now have more than 20 head of cattle, compared with 6 per cent 10 years ago.
Product demand and market opportunities	• Consumption per capita has grown at an average of over 10 per cent per year. Western influence on diets is a significant contributor. • Income elasticity for dairy products is relatively high. Following the crisis in 1997, consumption fell by 10 per cent in 1998.
Future developments	• Continued demand growth is highly dependent on the pace of economic recovery. Prospects for domestic producers to keep pace with demand in the event of strong recovery are limited. Slow change in farm practices is likely to hamper efforts to expand production significantly. • Thailand's exchange rate position will also be an important factor.

Baseline Projections

These are shown in Table 8.3. Appendix B shows projections assuming GDP growth for the six countries is reduced by one-third in each year of the projection period.

Table 8.3. Baseline projections for Thailand.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	160	166	172	177	183	213	246	282	2.9
Pig meat	463	481	498	516	533	633	745	870	3.2
Poultry meat	1274	1320	1379	1445	1520	2041	2720	3569	5.3
Dairy	580	597	615	634	653	757	877	1017	2.8
Imports (kt cwe)									
Beef	2	3	5	6	8	18	38	72	18.6
Pig meat	0	0	0	1	1	6	31	121	38.9
Poultry meat	0	1	1	1	2	9	33	108	33.4
Dairy	100	127	140	152	164	232	346	527	8.7
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	1	1	0	0	0	0	0	0	–31.7
Poultry meat	288	141	100	70	48	20	7	3	–21.0
Dairy	42	50	47	45	43	33	25	19	–4.0
Import dependency (%)									
Beef	1.5	2.1	2.7	3.4	4.3	8.0	13.3	20.2	
Pig meat	0.0	0.0	0.0	0.1	0.2	0.9	4.0	12.2	
Poultry meat	0.0	0.0	0.0	0.0	0.0	0.0	0.9	2.9	
Dairy	9.0	11.4	13.1	14.4	15.7	20.9	26.8	33.3	
Consumption (kt rw)									
Beef	114	119	124	128	134	162	199	248	4.0
Pig meat	360	375	389	402	417	498	605	773	3.9
Poultry meat	868	1038	1126	1212	1297	1786	2416	3233	6.8
Dairy	637	674	708	741	774	956	1198	1525	4.5
Per person consumption (kg rw/person)									
Total meat	52.9	57.9	61.3	64.5	67.7	86.9	111.0	141.1	5.0
Beef	2.6	2.7	2.8	2.8	2.9	3.4	4.1	4.9	3.3
Sheep and goat meat	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	NA
Pig meat	7.3	7.6	7.8	8.0	8.2	9.4	11.1	13.7	3.2
Poultry meat	15.7	18.5	20.0	21.3	22.6	30.0	39.3	51.0	6.1
Seafood	27.4	29.1	30.8	32.3	34.0	44.0	56.5	71.3	4.9
Dairy	10.1	10.6	11.0	11.4	11.9	14.1	17.1	21.1	3.8

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight; NA = not applicable or not available
Source: GMI model and CIE calculations

Key points

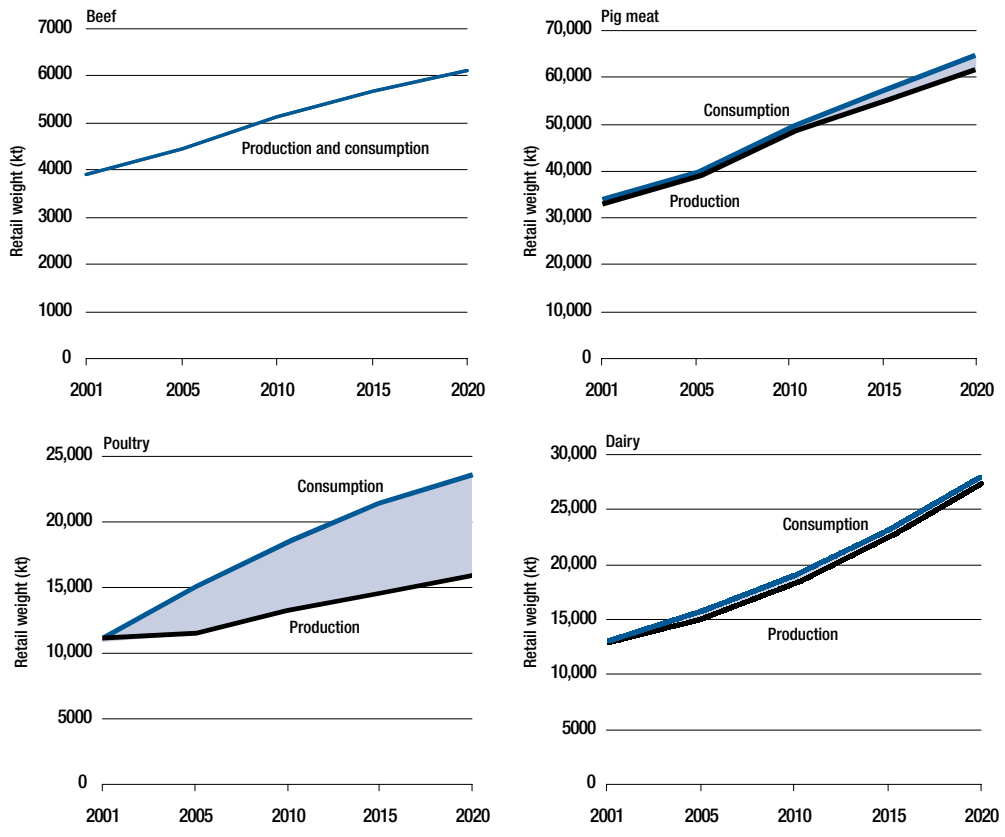
- Per person meat consumption will increase by 167 per cent over the next 20 years.
- Thailand will maintain self-sufficiency in pig and poultry meat for most of the period.
- Poultry consumption will grow the fastest of all the meats. This will result in exports being diverted back onto the domestic market.
- Per person consumption of dairy products is projected to double over the period, resulting in a steady growth in dependency on imports.

9 Some Broad Trends and Comparisons with Other Studies

Production, Consumption and Trade

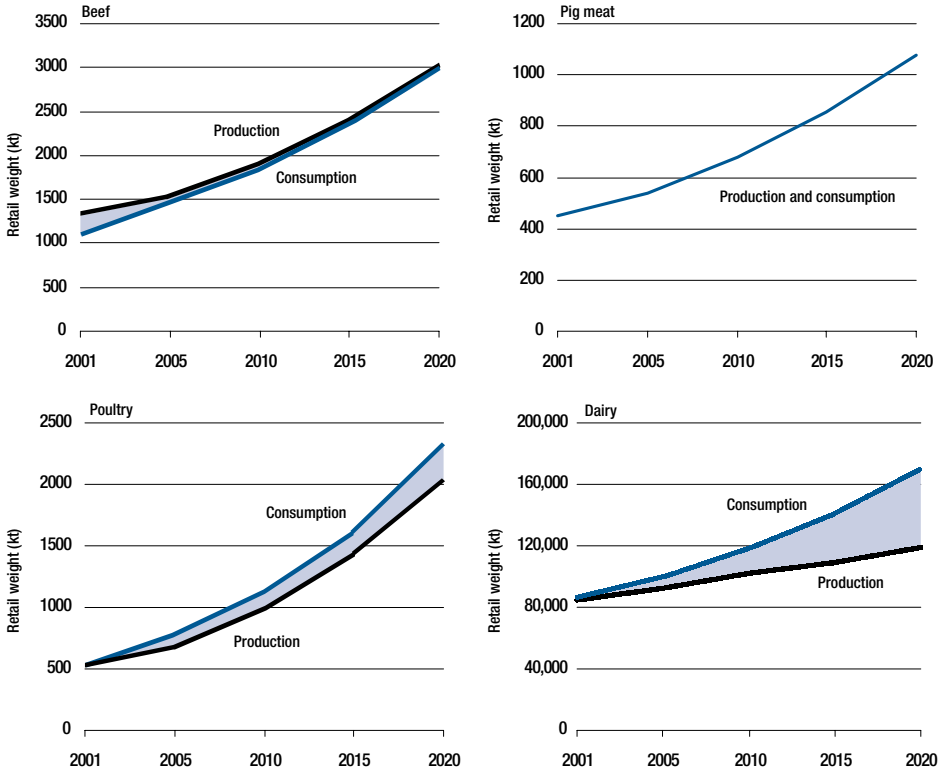
Figures 9.1 to 9.6 provide an illustration of key outcomes in each country under the baseline projections.

Figure 9.1. China.



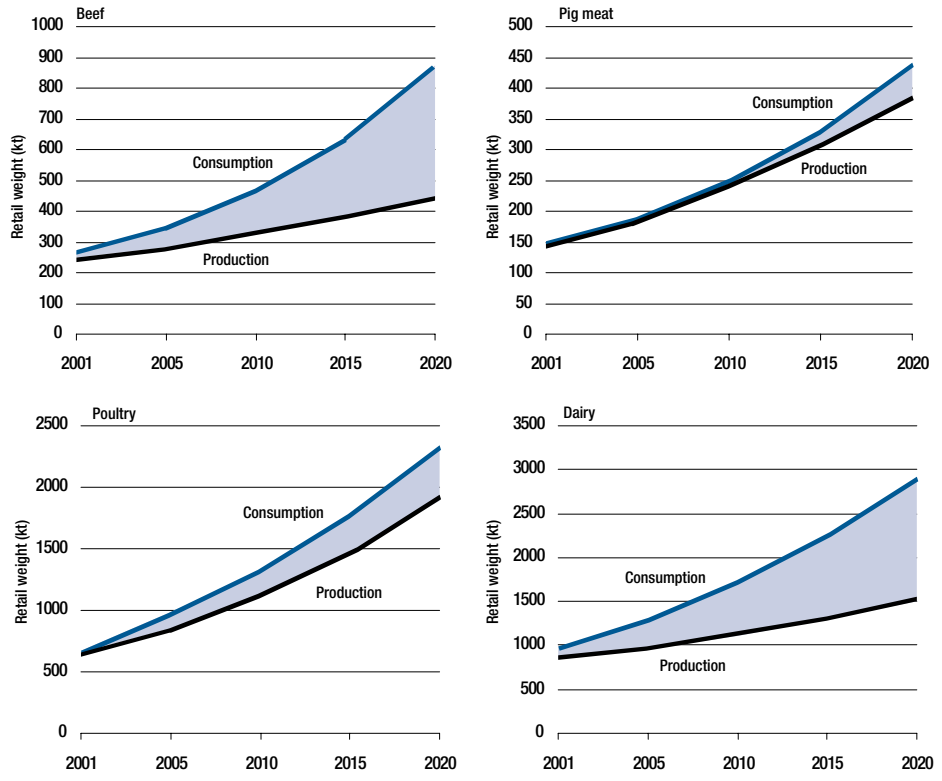
Data source: GMI model

Figure 9.2. India.



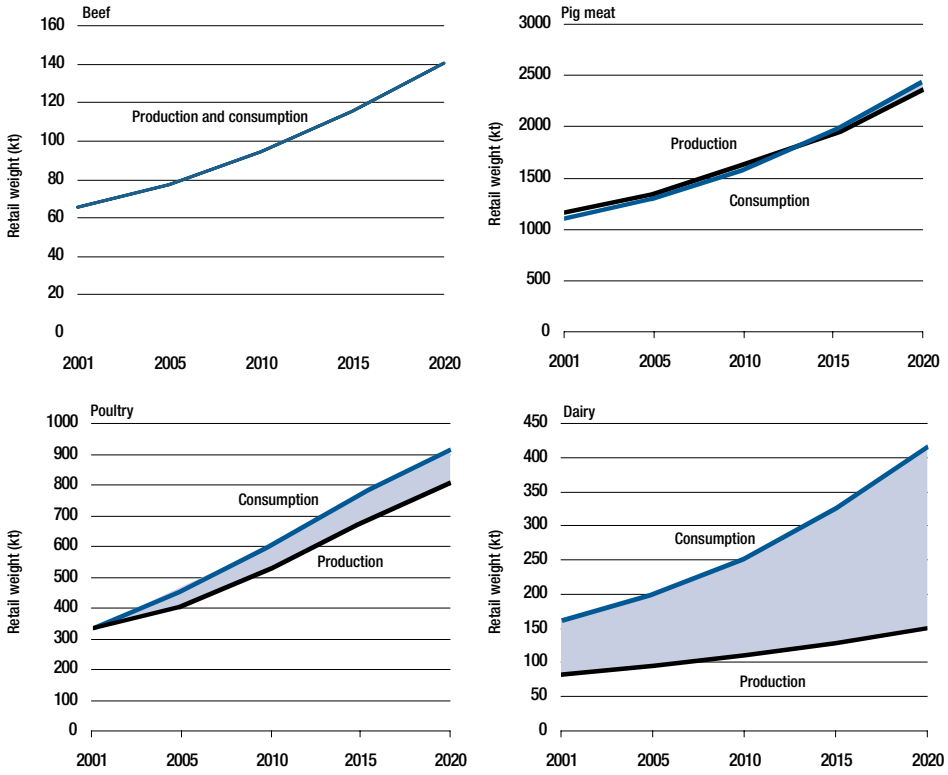
Data source: GMI model

Figure 9.3. Indonesia.



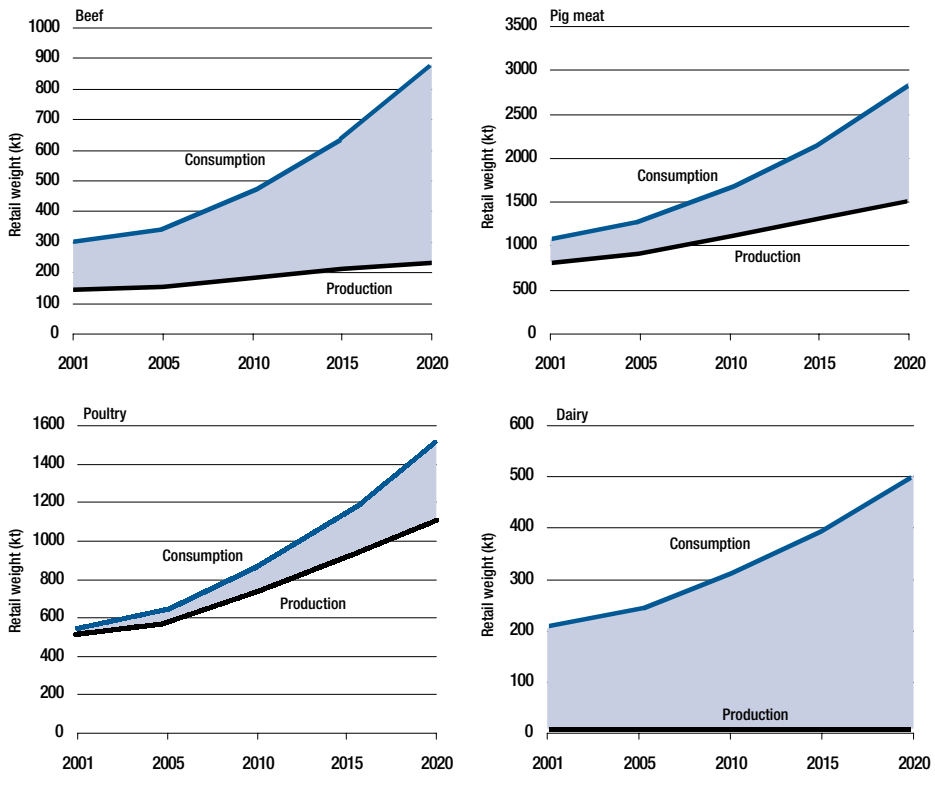
Data source: GMI model

Figure 9.4. Vietnam.



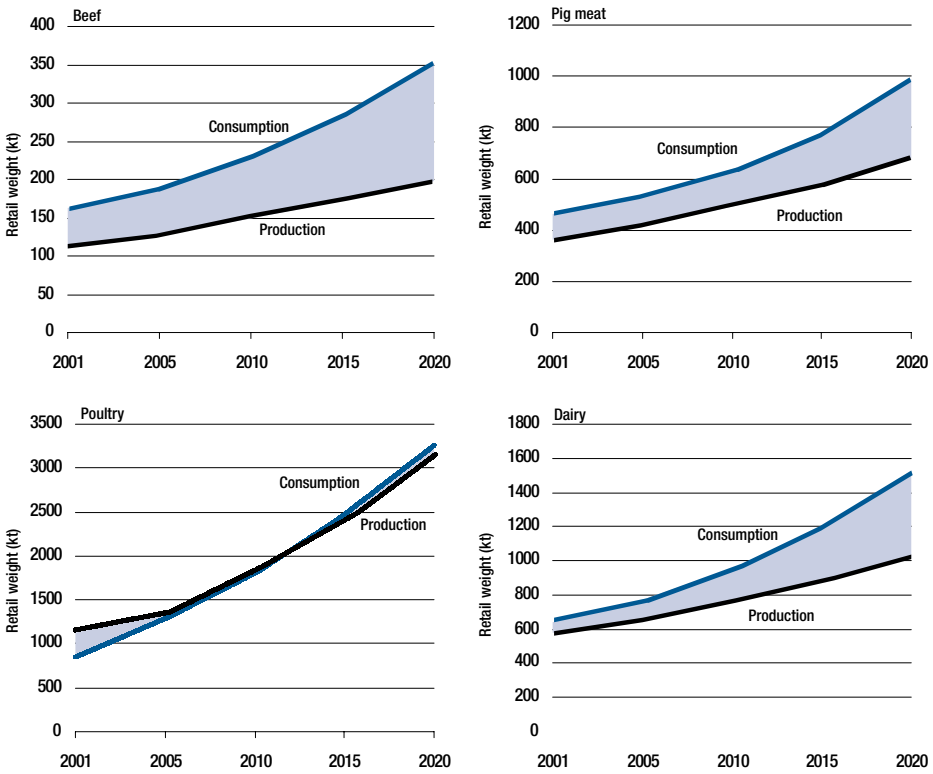
Data source: GMI model

Figure 9.5. Philippines.



Data source: GMI model

Figure 9.6. Thailand.



Data source: GMI model

Our projections suggest that, for the most part, in the six countries under focus, there will be strong increases in meat protein consumption through to 2020. Domestic production will, for the most part, fail to keep up with this consumption growth, meaning increased reliance on imports. The degree of projected reliance on imports differs markedly between countries and commodities. For China and India, the reliance on imports will remain relatively small for most products, though it will increase considerably above its current level. By contrast, the Philippines is projected to become strongly reliant on imports for all meats. In the case of dairy products, import penetration by 2020 is projected to be high for all six countries.

Per Capita Consumption of Meat Protein

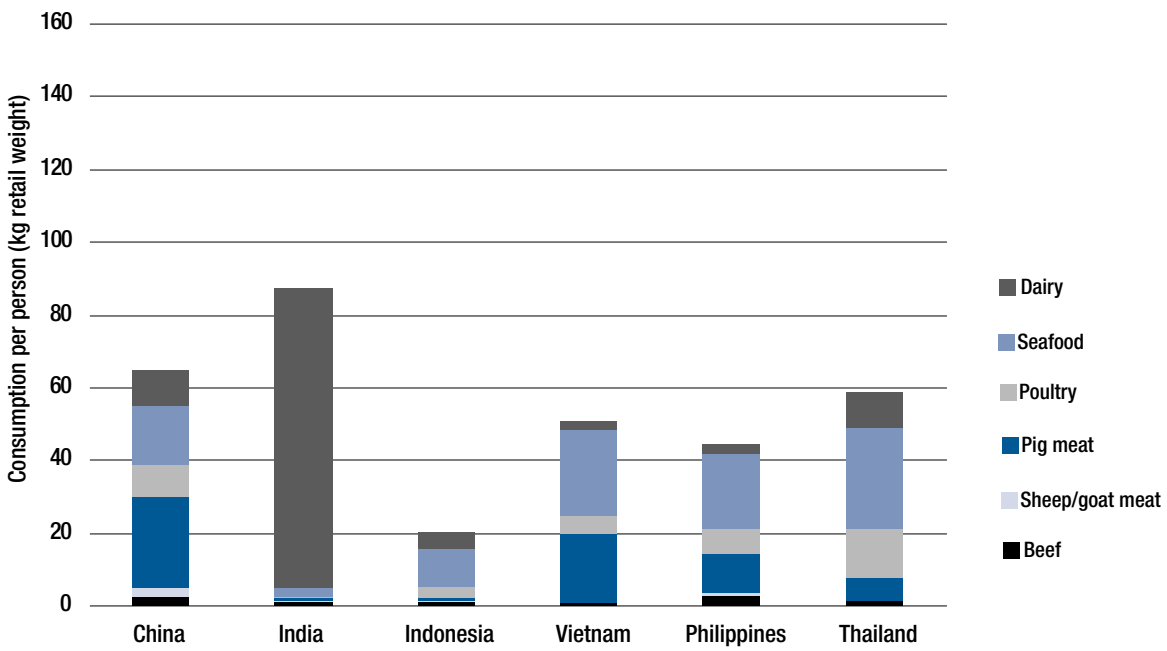
Our projections do not support the stated intentions of some countries to become significant net exporters of certain livestock products over the next decade. In all cases, livestock product demand growth is projected to exceed production growth. Where export surpluses exist, they are quickly eroded and imports are sourced from industrial country producers. For developing countries to become significant exporters of livestock products, they would need to achieve productivity gains in livestock production that were considerably higher than those in our productivity scenario and that were maintained for a sustained period.

Figure 9.7 demonstrates the extreme diversity in meat protein consumption patterns across countries. The patterns reflect many factors, especially per capita income levels, expected growth rates in per capita incomes, and cultural and religious attitudes.

The following characteristics stand out.

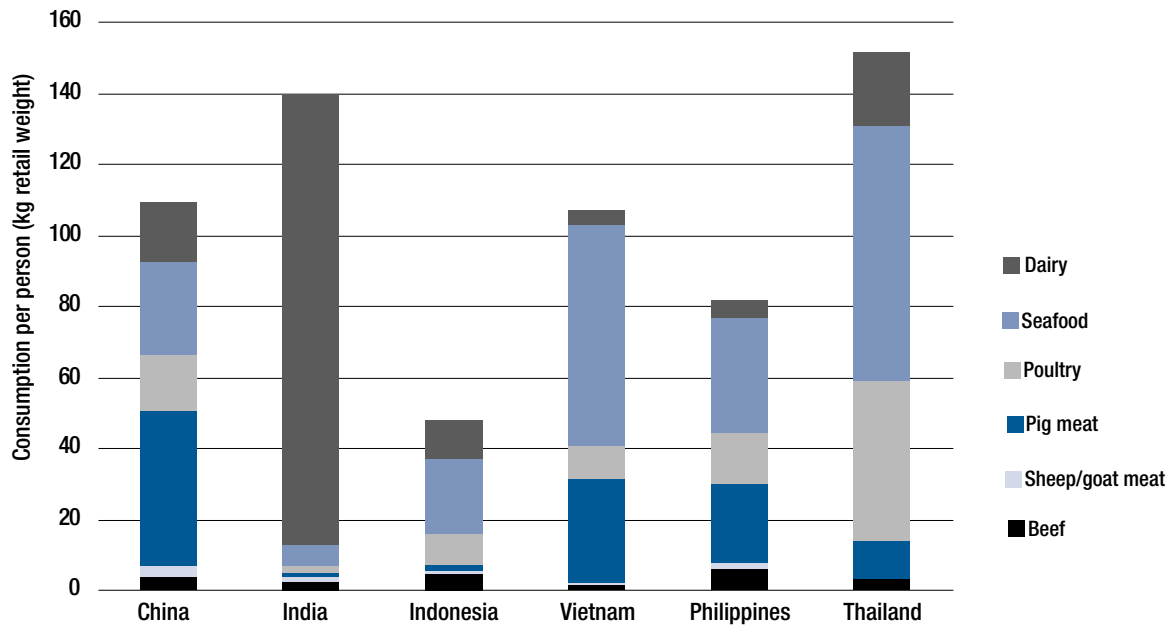
- There is a very low per capita consumption of meat and seafood in India and Indonesia, reflecting the large population segments in these countries that have very low per capita incomes.
- Seafood is the dominant form of protein in the meat protein diets of China, Vietnam, the Philippines, Thailand and Indonesia. This is a longstanding feature of the diets of many Asian communities.
- Dairy products play a huge role in India's meat protein consumption. This reflects both religious and cultural beliefs and practices and the success of some major initiatives to develop milk production and processing.

Figure 9.7. Per person consumption of meat and dairy in 2001.



Data source: GMI model

Figure 9.8. Per person consumption of meat and dairy in 2020.



Data source: GMI model

Comparisons with Other Studies

The International Food Policy Research Institute (IFPRI) has recently published a set of projections of consumption, production and trade in livestock products in various regions. The results (Delgardo et al. 2001) are published for regional groupings rather than individual countries and for meat and dairy rather than individual meat products. This makes detailed comparisons with our results difficult. Tables 9.1 and 9.2 compare results where similar projections are available.

Table 9.1. Comparison of GMI model projections with those from IFPRI's Impact model (meat consumption).

Country	Meat consumption[a] 2020 (million tonnes)		Meat consumption per capita in 2020 (kg/head)		Milk consumption 2020 (million tonnes)		Milk consumption per capita in 2020 (kg/head)	
	IFPRI	CIE	IFPRI	CIE	IFPRI	CIE	IFPRI	CIE
China	104	94.5	71	66.4	23	25.1		1615.2
India	9	6.3	7	6.6	132	168.4	104	126.9
Indonesia	NP	3.6	NP	16.0	NP	2.9	NP	10.9
Vietnam	NP	3.5	NP	40.4	NP	0.4	NP	4.0
Thailand	NP	5.0	NP	59.0	NP	1.5	NP	21.1
Philippines	NP	4.5	NP	44.7	NP	0.5	NP	4.9
Southeast Asia[b]	19	NP	29	NP	12	NP	18	NP

CIE = Centre for International Economics; IFPRI = International Food Policy Research Institute; NP = no projection

[a] Meat includes beef, pork, mutton, goat and poultry

[b] The classification of Southeast Asia used by IFPRI includes Brunei, Cambodia, East Timor, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam

Table 9.2. Comparison of GMI model projections with those from IFPRI's Impact model (net exports/imports) (million tonnes) (negative sign denotes imports).

	Beef 2020		Pork 2020		Poultry 2020		Milk 2020	
	IFPRI	CIE	IFPRI	CIE	IFPRI	CIE	IFPRI	CIE
China	–0.608	–0.014	–1.182	–4.24	0.155	–5.534	–2.917	–0.324
India	0.072	0.003	–0.064	0	0	-0.0	–0.539	–49.749
Indonesia	NP	–0.614	NP	–0.070	NP	–0.169	NP	–1.376
Vietnam	NP	0	NP	–0.082	NP	-0.0	NP	–0.267
Thailand	NP	–0.072	NP	–0.121	NP	–0.106	NP	–0.508
Philippines	NP	–0.555	NP	–0.915	NP	–0.453	NP	–0.494
Southeast Asia[a]	–0.830	NP	0.109	NP	0.158	NP	–8.837	NP

CIE = Centre for International Economics; IFPRI = International Food Policy Research Institute; NP = no projection

[a] The classification of Southeast Asia used by IFPRI includes Brunei, Cambodia, East Timor, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam

The projections for meat consumption and consumption per capita for the countries in the regions of interest are broadly similar. However, there are significant differences at a disaggregated product level between the two sets of projections.

- Centre for International Economics (CIE) model projections suggest that milk consumption and consumption per capita for India will grow much more rapidly than forecast by the IFPRI model – and more rapidly than production. As a result, the CIE model projects very large imports of dairy products by 2020.

- By contrast, IFPRI projects higher per capita milk consumption growth for Southeast Asian economies and stronger import penetration of dairy products.
- For beef in China, IFPRI projects considerably larger import penetration in 2020 than does the CIE.
- For beef in India, IFPRI projects significant exports in 2020. CIE projects negligible exports.
- For pork in China, CIE projects considerably higher imports in 2020 than does the IFPRI model.
- For poultry in China, CIE projects considerable imports in 2020. By contrast, IFPRI projects that by 2020 China will move from being a net importer of poultry to being a net exporter.
- IFPRI projects that Southeast Asia will be a net exporter of pork and poultry in 2020, whereas CIE projects net imports of pork and poultry in all six Southeast Asian countries.
- IFPRI projects that China will be a much more significant importer of dairy products in 2020 than the CIE estimates.

10 Effects of Trade Liberalisation on Livestock Production and Meat Consumption

There is considerable apprehension in some developing countries about the likely effects of a further round of global trade liberalisation on the prospects for their agricultural sectors. While these concerns cover most agricultural products produced by developing countries, the livestock sectors are viewed as being particularly vulnerable to global trade liberalisation.

The arguments behind these concerns centre around the dominance of smallholder production systems in livestock production. Smallholder production is constrained by a very low scale of operations, poor access to improved genetics and to high-quality forage and concentrates, and poor animal husbandry and animal nutrition. By contrast, commercial livestock production systems are seen as having significant advantages in all these areas and in access to capital and new technologies.

A widely held view in developing countries is that agricultural trade liberalisation will alter the incentives in livestock production systems toward large-scale commercial operations relative to smallholder systems. The argument goes that agricultural trade liberalisation will advantage the large-scale commercial livestock systems (which are dominant in industrial countries) at the expense of smallholder production systems (which dominate in developing countries) and that this in turn will add to the adjustment pressures on smallholder producers for whom income from livestock production is vital in helping them avoid poverty.

The economic mechanisms which might validate this view of the links between global agricultural trade liberalisation and the performance of smallholder livestock producers are not spelt out. Global trade liberalisation can be expected to accelerate global income growth. This in turn means higher incomes in both industrial and developing countries. This will translate into high demand for and consumption of livestock products in developing countries, though not in industrial countries, where per capita meat consumption no longer increases significantly as per capita income grows.

Livestock producers somewhere in the world will therefore benefit from trade liberalisation. But how the increased production to supply this additional demand will be shared between commercial and smallholder producers in developing countries and producers in industrial exporting countries is less clear. It will depend on the interplay between many factors, including the following:

- the size of existing barriers to global trade in meat products (the removal of which will change the prices received by livestock producers in both developing and industrial countries);
- the dependence of livestock production systems on feed grains (this varies significantly between livestock systems and country and also between smallholders and commercial operations in a particular livestock industry);
- barriers to feed grain imports (generally low or zero in developing countries) and what would happen to the world price of feed grains and hence feed grain costs if agricultural trade liberalisation were to occur;
- the capacity of livestock industries to change production in response to changes in their costs relative to product prices — this varies greatly between countries for a particular product (for example, US beef production based on feedlots has much greater supply flexibility than Australian beef production based on pasture grazing) and between production systems (for example, Indonesia's smallholder beef producers have a much lower supply elasticity than Indonesia's commercial beef feedlot operators);
- the export supply flexibility of livestock industries (this also varies greatly between countries, depending on the share of domestic production that is exported, the meat consumption behaviour of consumers in exporting countries and the extent of differentiation between the product consumed domestically and exported); and
- how easily a country can import a particular type of meat (import demand elasticity) (this will also vary significantly between countries according to the share of domestic consumption currently met by imports and the extent to which the domestic and imported products are close substitutes).

An economic model incorporating these factors is needed to provide guidance on likely outcomes.

Some Results

We use the global meat industries (GMI) model to analyse the impact on the growth prospects of the livestock industries in China, India, Indonesia, Malaysia, Thailand and Vietnam, assuming global agricultural trade liberalisation in livestock and grain markets. Our starting point is the baseline projections reported earlier. The scenario behind the new projections differs from the baseline scenario only with respect to trade barriers. In the agricultural trade liberalisation

scenario, we assume that, commencing in 2005, all barriers (in both industrial and developing countries) to global trade in livestock products are progressively removed to achieve complete removal by 2010. Because the GMI model deals only with livestock sectors rather than the global economy as a whole, it does not capture any increases in global income that could be expected to follow from global trade liberalisation.

We also assume that global grain trade liberalisation will result in a 14 per cent increase in the world price of feed grain imports by each of the six developing countries. This estimate is drawn from recent modelling work by Beghin et al. (2002), dealing with the impact of global agricultural trade liberalisation. The degree of reliance on feed grains differs markedly between livestock production systems and countries. For example, Australia's beef production system is heavily based on the grazing of pastures whereas the US system is overwhelmingly based on grain feeding in feedlots. Other things being equal, grain trade liberalisation will favour Australian beef exports relative to US beef exports.

By taking into account the importance of feed grain costs in the total production costs of each livestock product in each country, our model calculates the impact of higher feed grain costs on production.

In the current round of World Trade Organisation (WTO) trade negotiations, agricultural trade liberalisation proposals from various countries are only now being put on the table. No one proposal has yet developed a body of support. By analysing the extreme (and extremely unlikely) case of full liberalisation of global meat markets, our analysis provides guidance on the maximum impact of full liberalisation on global livestock industries.

Appendix C and Figures 10.1 to 10.18 show the results. Tables 10.1 and 10.2 provide information to help interpret the results.

Table 10.1 shows the average trade barriers facing imports of livestock products in each developing country. For example, China imposes high barriers, whereas Indonesia is already very close to free trade.

Table 10.2 shows the impact on livestock industry productivity of an increase in feed grain costs. It provides a measure of the economic reliance of each livestock industry on feed grains. A 14 per cent increase in feed grain prices would reduce the productivity of China's pig meat industry by 2.41 per cent. For example, all livestock industries in China are heavily reliant on feed grains. Feed grain dependency is a lot lower in Indonesia, India and Vietnam, in part due to the greater dominance of smallholder systems using non-grain feedstuffs in these countries.

Table 10.1. Average trade barriers in meat and dairy.

	China		India		Indonesia		Vietnam		Philippines		Thailand	
	Tariff (%)	Power of tariff (%)[a]	Tariff (%)	Power of tariff (%)[a]	Tariff (%)	Power of tariff (%)[a]	Tariff (%)	Power of tariff (%)[a]	Tariff (%)	Power of tariff (%)[a]	Tariff (%)	Power of tariff (%)[a]
Beef	40	28.6	30[b]	23.1	5	4.8	20	16.7	10	9.1	53.3	34.8
Pig meat	20	16.7	30[c]	23.1	5	4.8	30	23.1	30	23.1	30	23.1
Poultry	20	16.7	100	50	5	4.8	20	16.7	45	31.0	45	31.0
Dairy	16.9	14.6	27.1	21.3	15.2	13.2	19.8	16.5	8.1	7.5	29.3	22.7

[a] *Power of tariff = (tariff/1+tariff)*
[b] *In effect, imports are not permitted*
[c] *Pork has limited market potential in India, as pigs are normally associated with uncleanliness and are found scavenging on human and other wastes around villages and other cities. The tariff is therefore not a significant barrier to increased pork consumption*
Data source: GMI database, USDA, GTAP 5

Table 10.2. Productivity shocks[a] used to simulate trade liberalisation in feed grains (per cent).

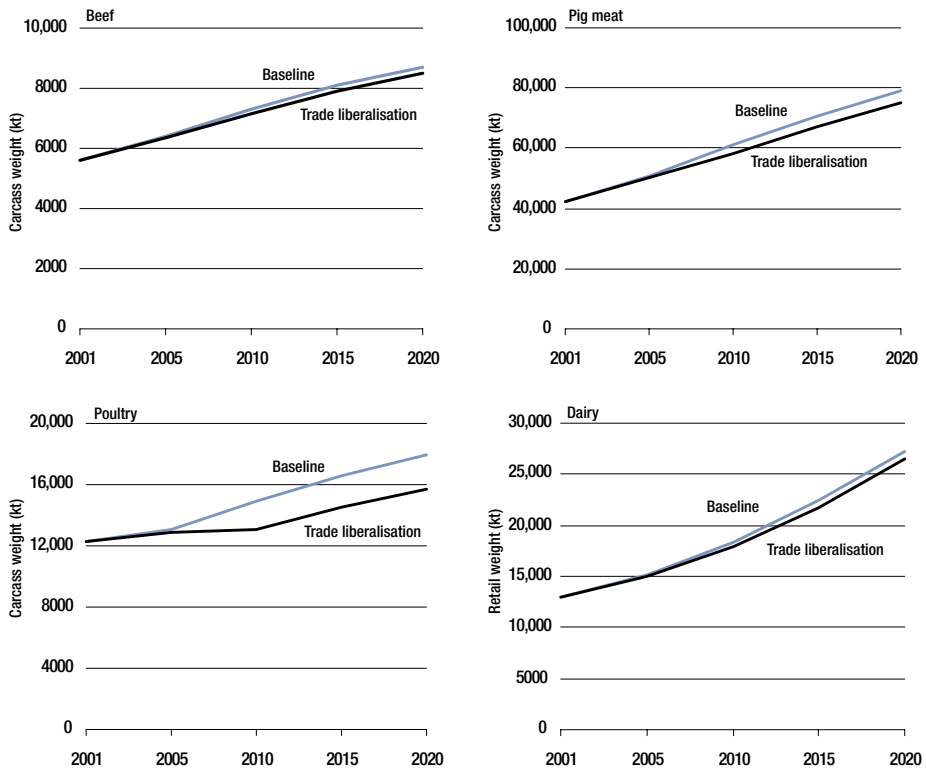
	China	India	Indonesia	Vietnam	Philippines	Thailand
Beef	–1.66	0.00	0.00	0.00	0.03	0.00
Pig meat	–2.41	0.00	0.00	–0.58	–2.65	–1.41
Poultry	–1.96	–0.30	–0.64	–0.77	–0.05	–1.70
Dairy	–1.68	–0.11	0.00	0.00	0.00	0.00

[a] *Shocks represent extent to which higher feed grain costs reduce livestock production productivity*
Data source: CIE calculations

The key to understanding the results is what happens to producer prices relative to costs and what happens to consumer prices. An increase in producer prices relative to costs will stimulate an expansion in production and vice versa. An increase in consumer prices relative to prices of competing foods will stimulate reduced consumption and vice versa.

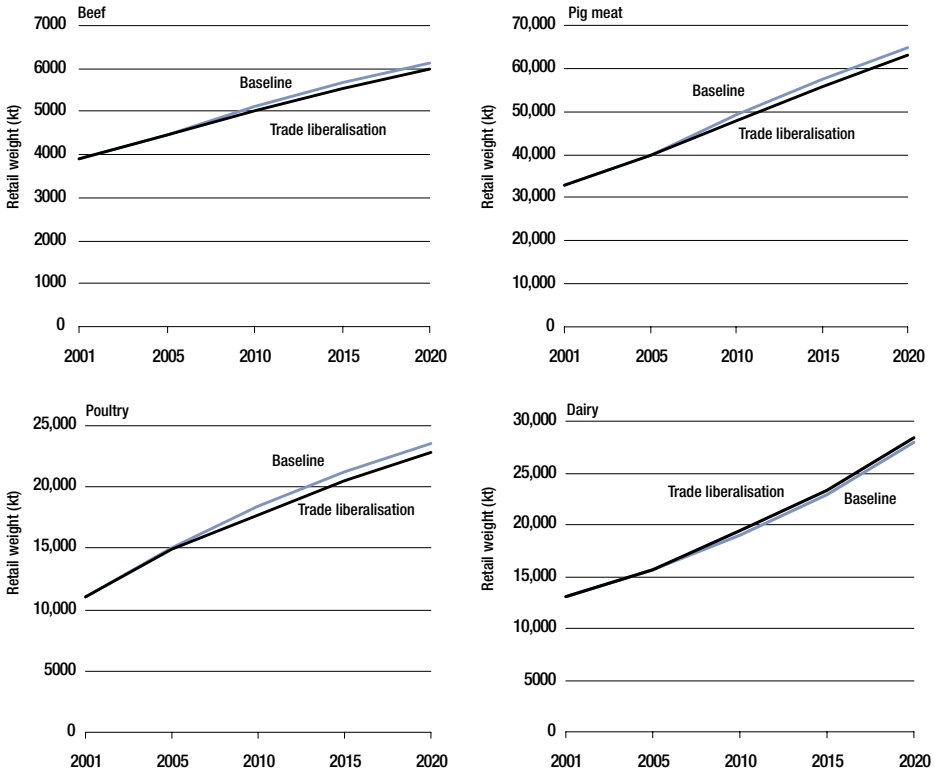
Producer prices in each of the six Asian countries currently exceed world prices by around the power of the tariff barrier on imports. With trade liberalisation, these prices will move toward world import prices. But world prices will also change as barriers are removed in both exporting and importing countries. Whether the producer price will increase or decrease relative to baseline will depend on the size of the tariff barrier compared with the change in world prices. Our model shows that trade liberalisation is likely to lead to price increases of around 18 per cent for Australia's grain-fed beef exports. The price of US grain-fed beef exports is projected to increase by 6 per cent while the prices of US exports of pig meat and poultry are projected to increase by 6 and 5 per cent respectively.

Figure 10.1. Effects of trade liberalisation on meat and dairy production in China.



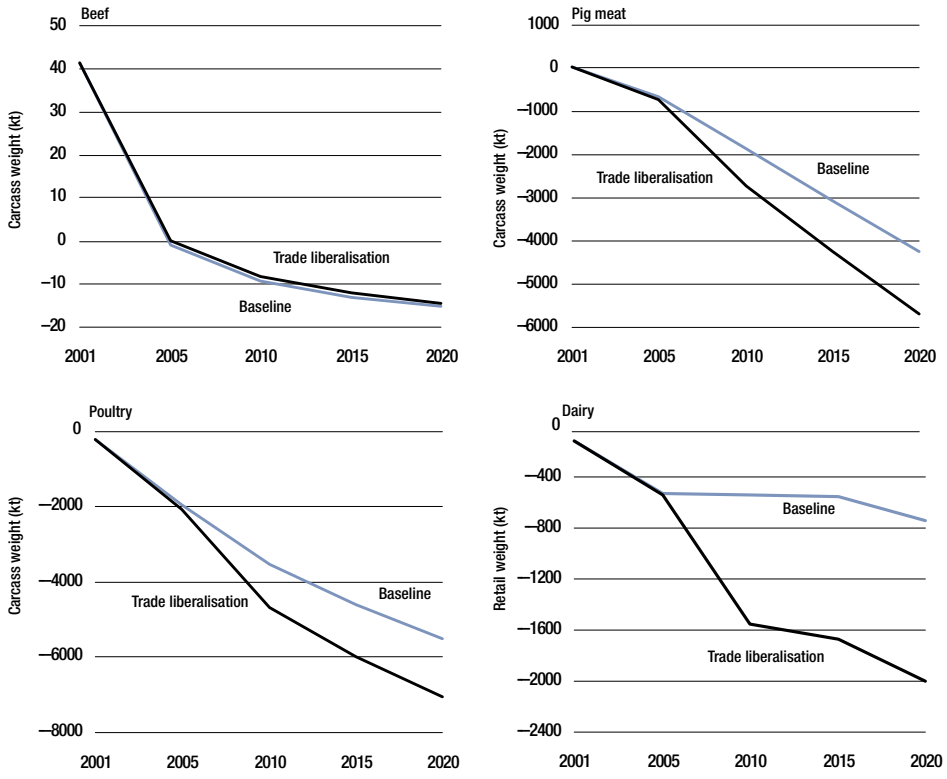
Data source: CIE projections

Figure 10.2. Effects of trade liberalisation on meat and dairy consumption in China..



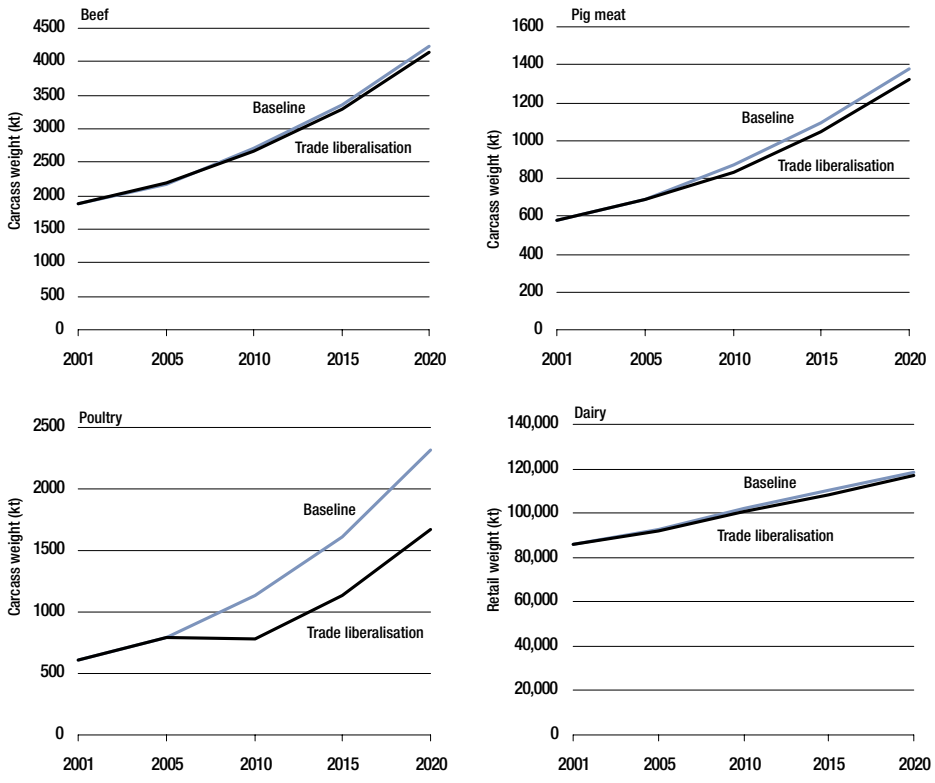
Data source: CIE projections

Figure 10.3. Effects of trade liberalisation on meat and dairy net trade in China.



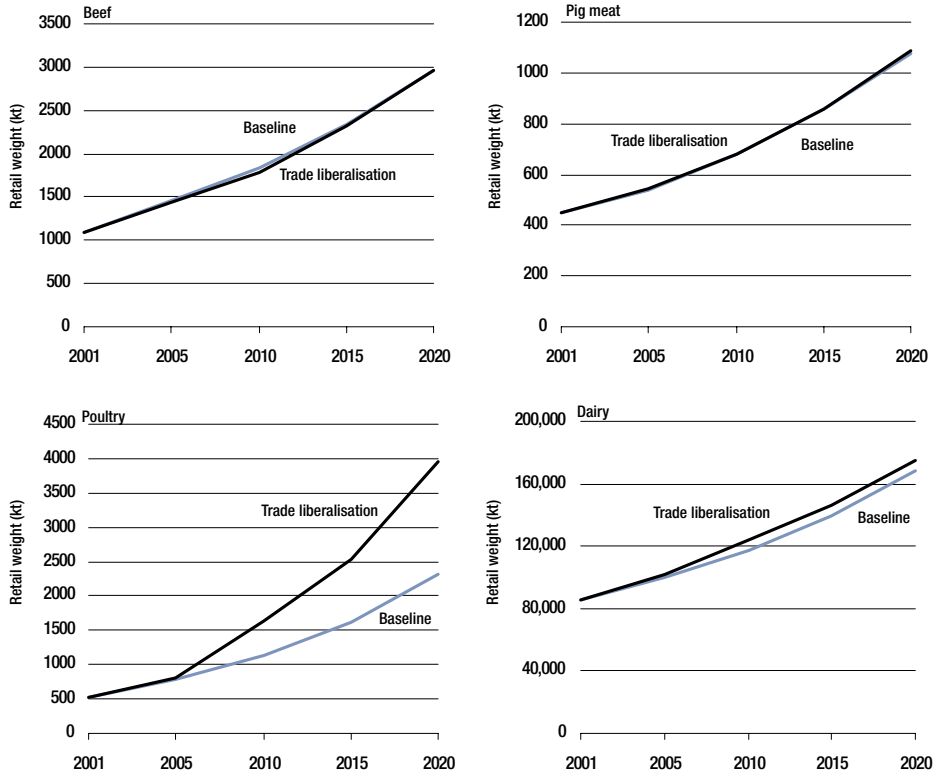
Data source: CIE projections

Figure 10.4. Effects of trade liberalisation on meat and dairy production in India..



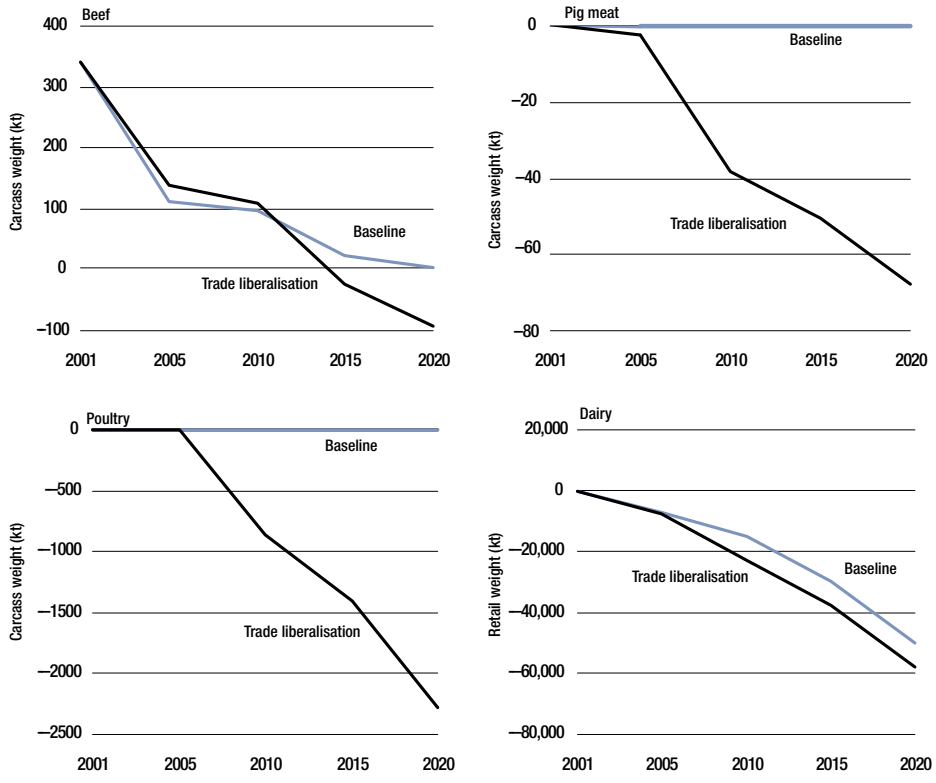
Data source: CIE projections

Figure 10.5. Effects of trade liberalisation on meat and dairy consumption in India.



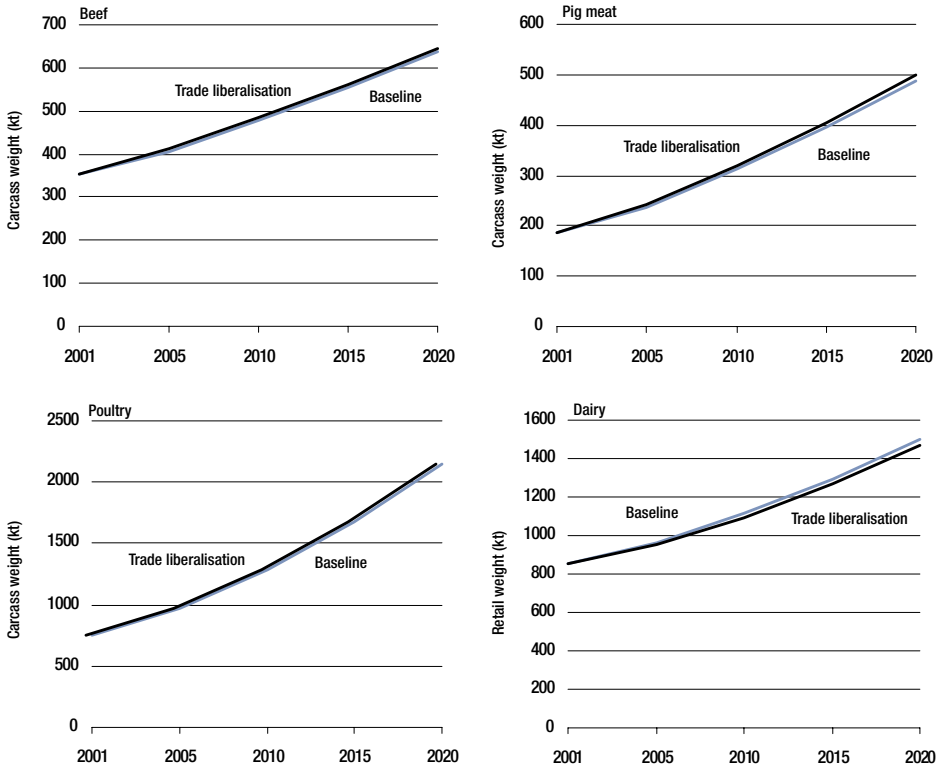
Data source: CIE projections

Figure 10.6. Effects of trade liberalisation on meat and dairy net trade in India..



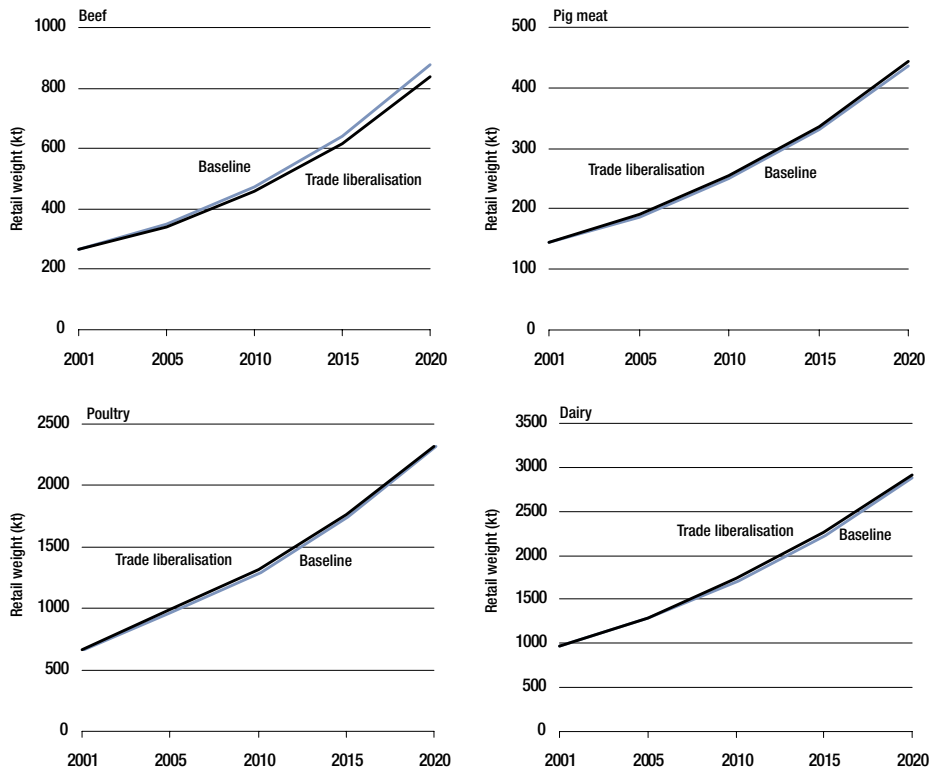
Data source: CIE projections

Figure 10.7. Effects of trade liberalisation on meat and dairy production in Indonesia.



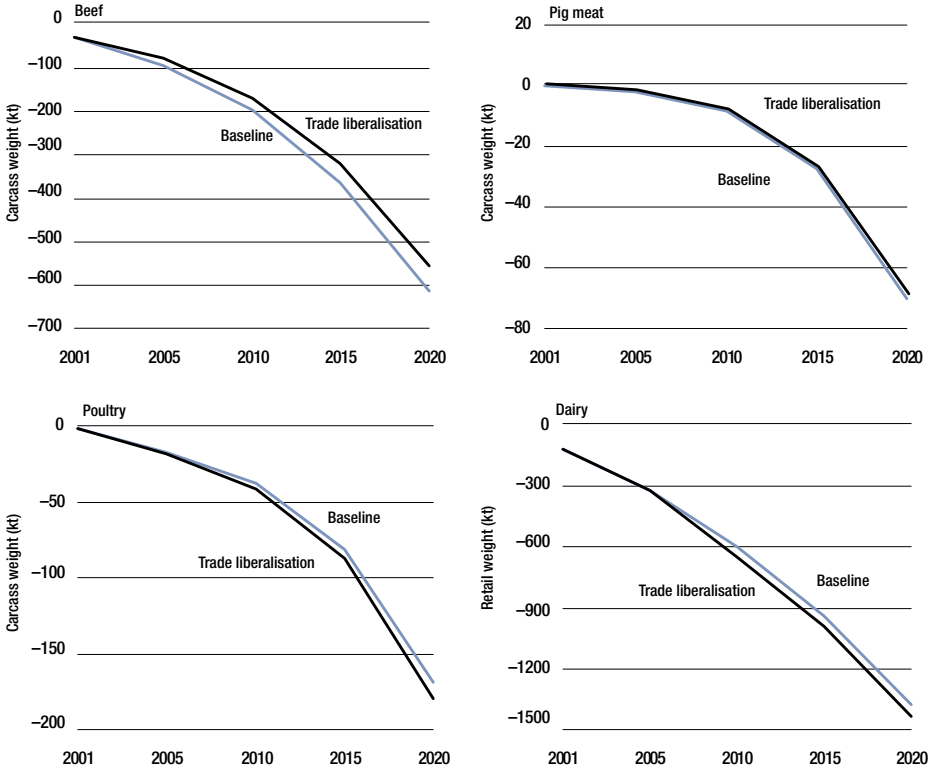
Data source: CIE projections

Figure 10.8. Effects of trade liberalisation on meat and dairy consumption in indonesia.



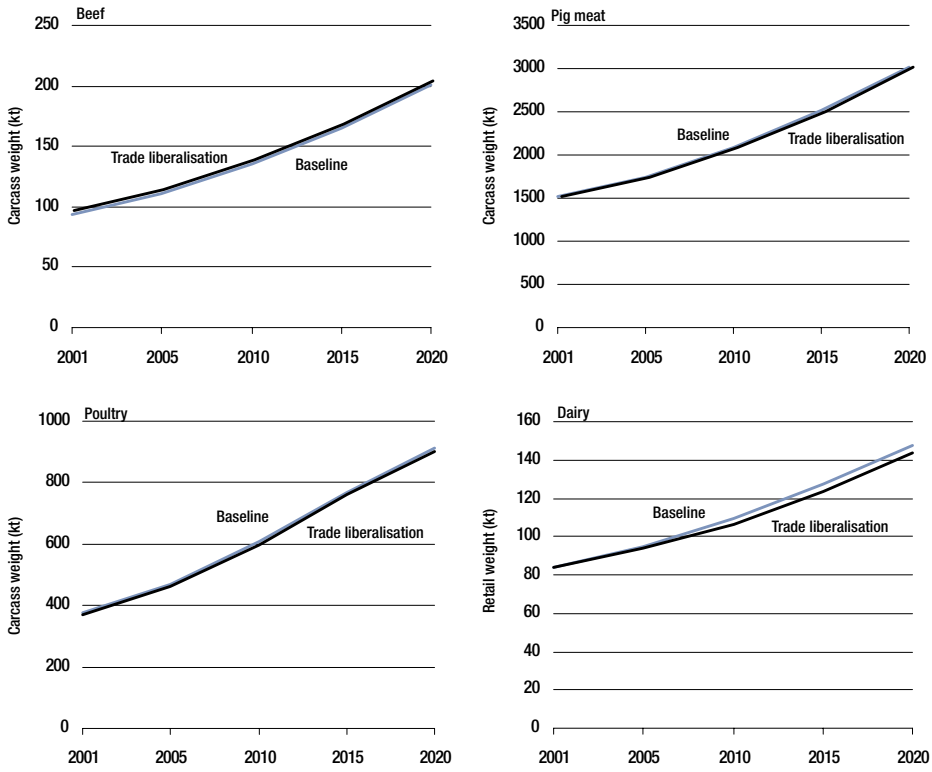
Data source: CIE projections

Figure 10.9. Effects of trade liberalisation on meat and dairy net trade in Indonesia.



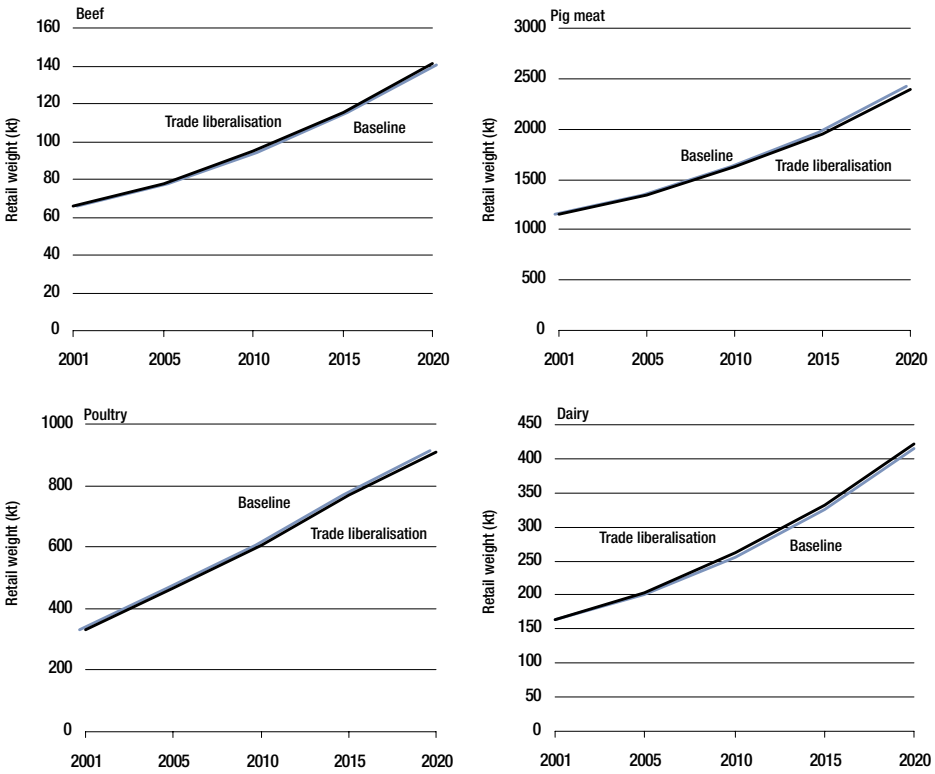
Data source: CIE projections

Figure 10.10. Effects of trade liberalisation on meat and dairy production in Vietnam.



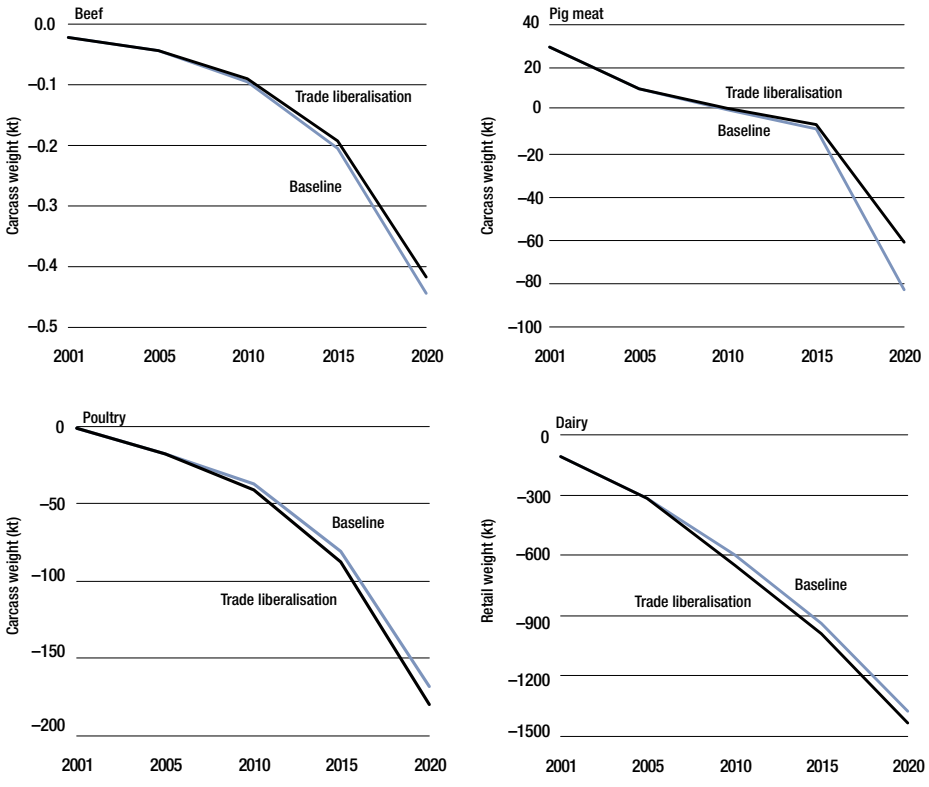
Data source: CIE projections

Figure 10.11. Effects of trade liberalisation on meat and dairy consumption in Vietnam.



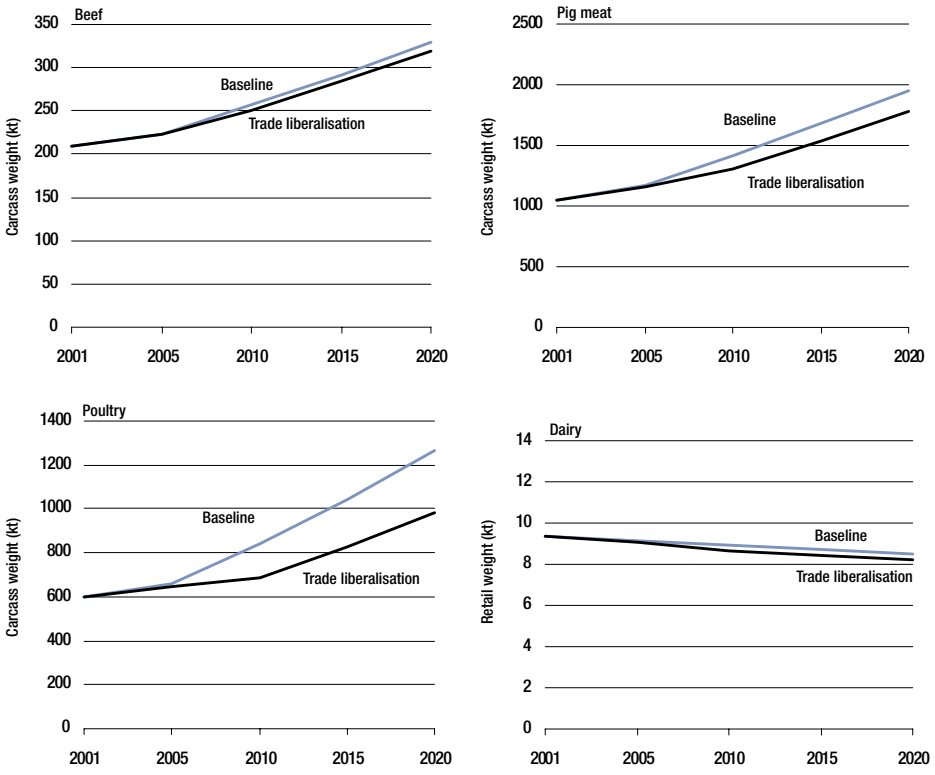
Data source: CIE projections

Figure 10.12. Effects of trade liberalisation on meat and dairy net trade in Vietnam.



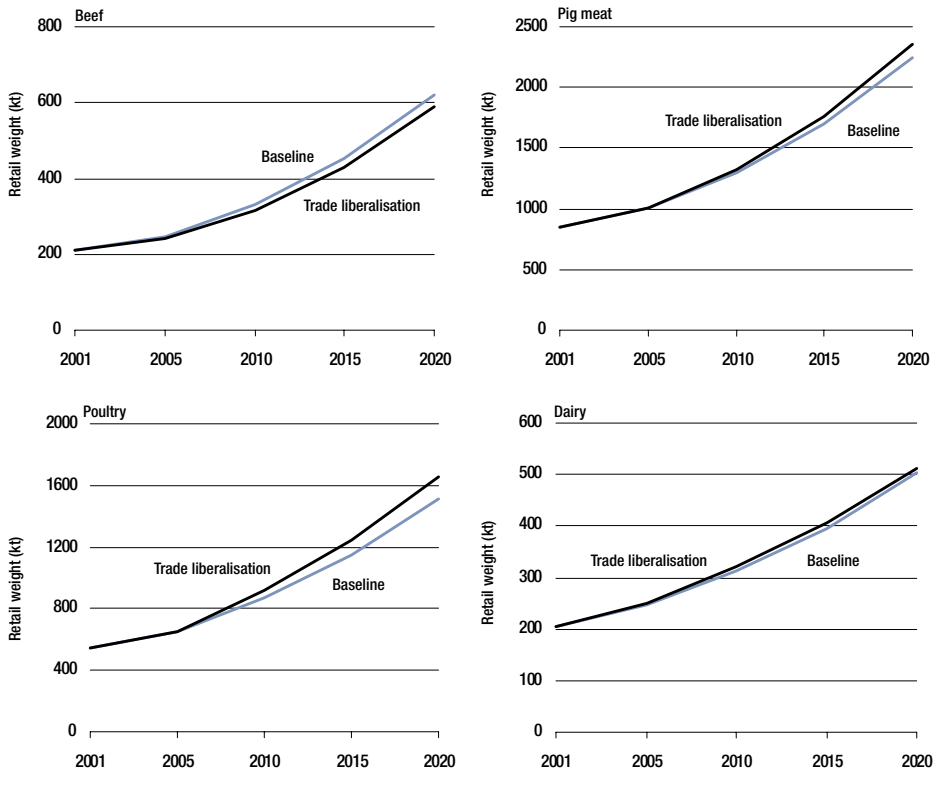
Data source: CIE projections

Figure 10.13. Effects of trade liberalisation on meat and dairy production in the Philippines.



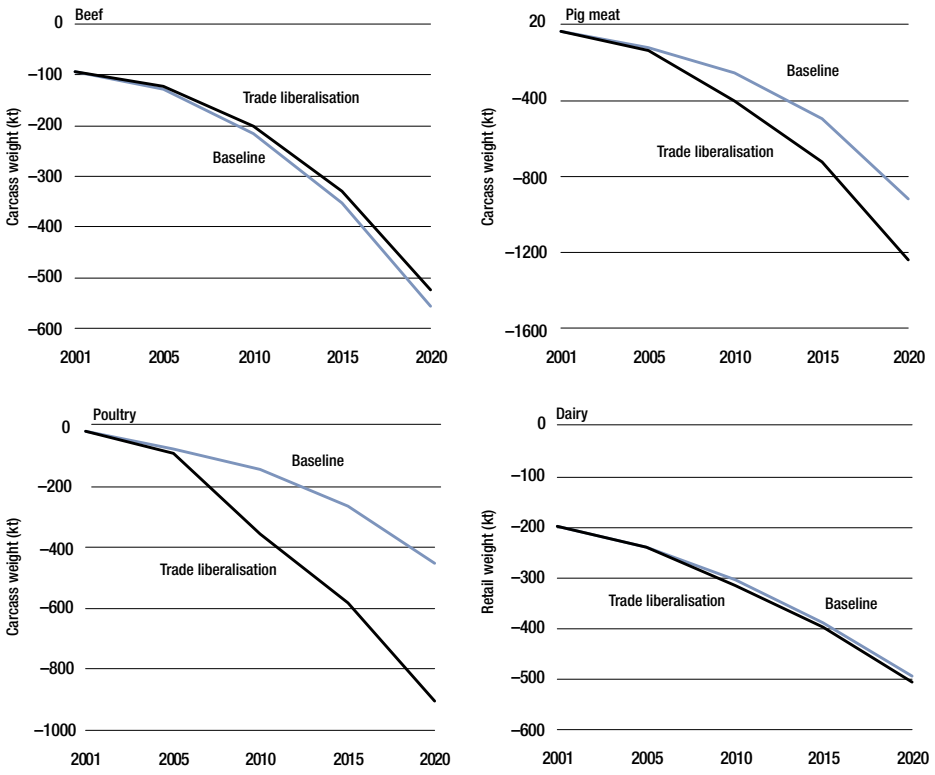
Data source: CIE projections

Figure 10.14. Effects of trade liberalisation on meat and dairy consumption in the Philippines.



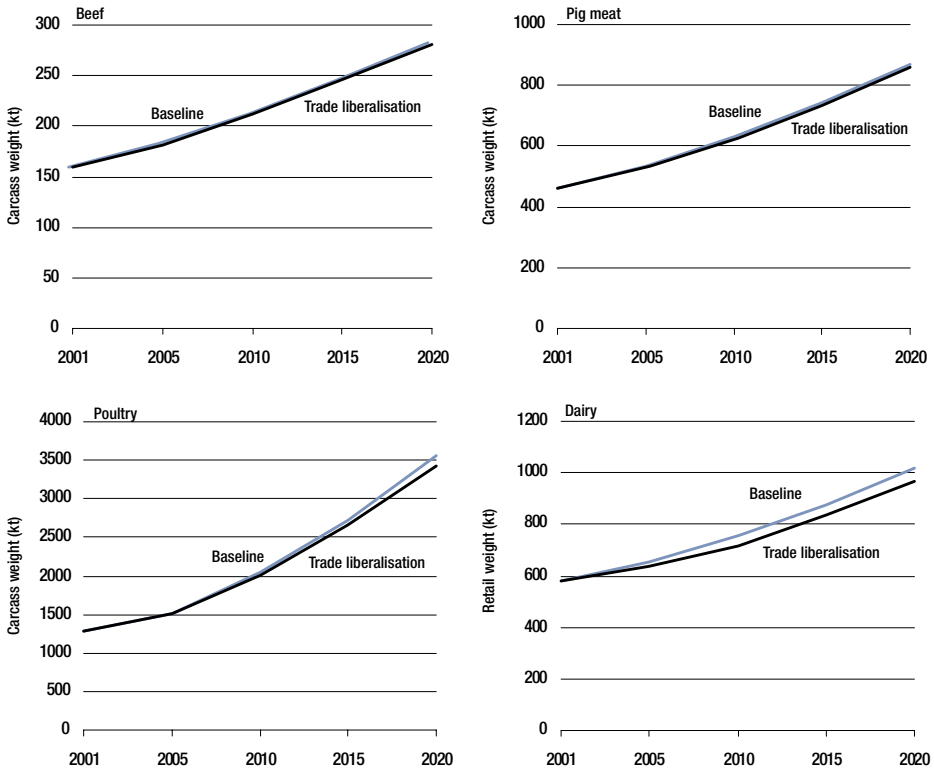
Data source: CIE projections

Figure 10.15. Effects of trade liberalisation on meat and dairy net trade in the Phiilippines.



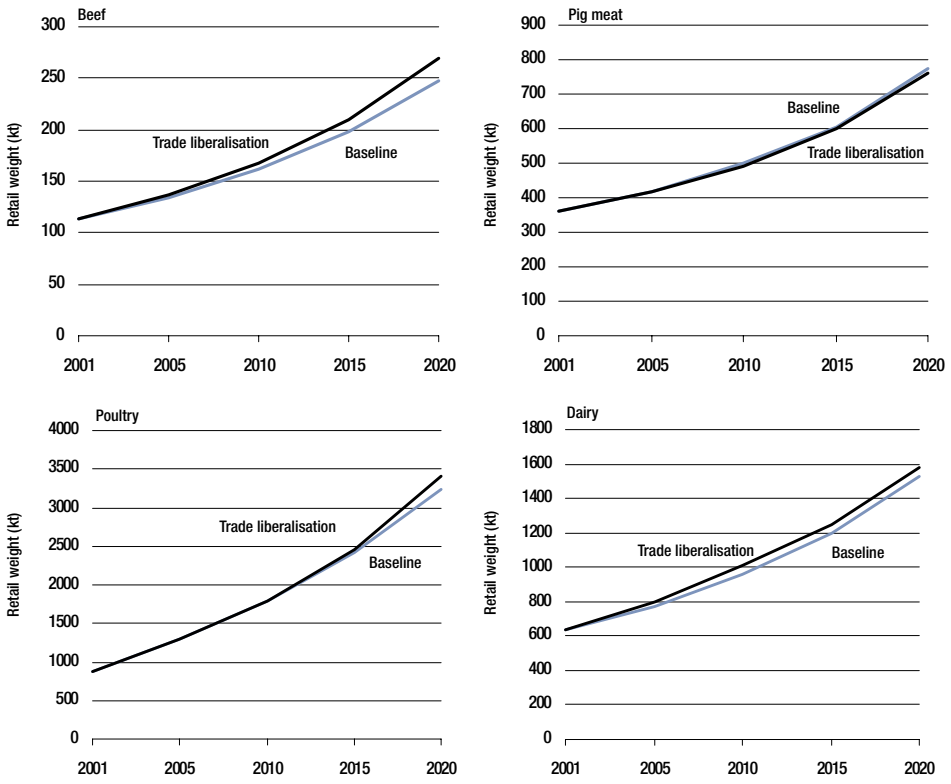
Data source: CIE projections

Figure 10.16. Effects of trade liberalisation on meat and dairy production in Thailand.



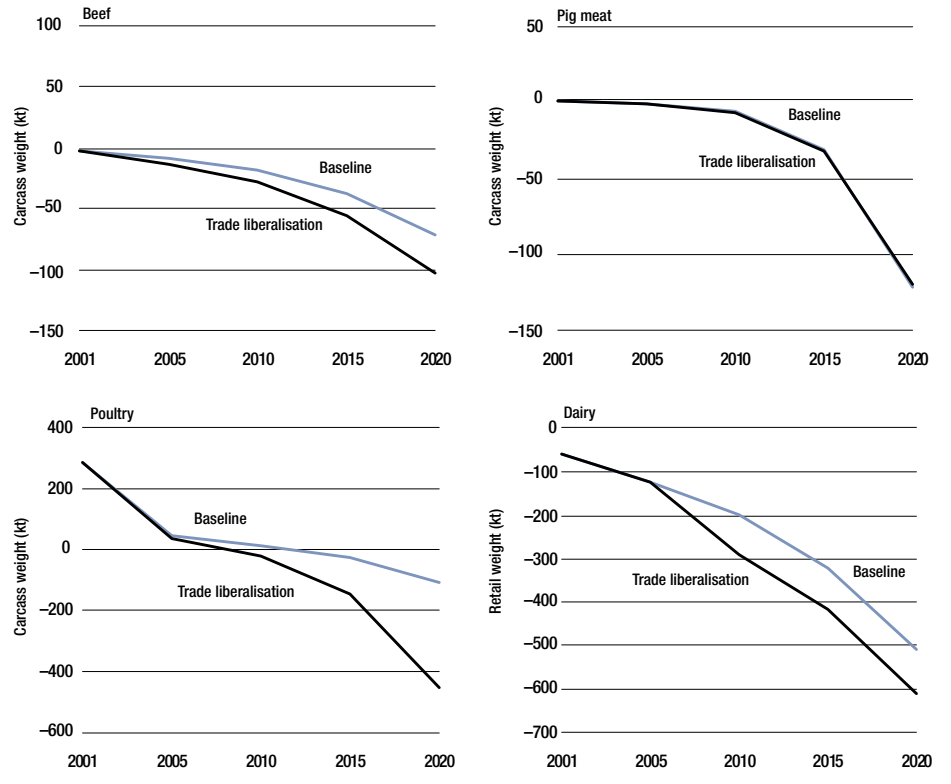
Data source: CIE projections

Figure 10.17. Effects of trade liberalisation on meat and dairy consumption in Thailand.



Data source: CIE projections

Figure 10.18. Effects of trade liberalisation on meat and dairy net trade in Thailand



Data source: CIE projections

The extent to which production costs change will depend on the reliance on feed grains in production and the change in the feed grain import price. With trade liberalisation, consumer prices will tend to move in line with producer prices.

For China, the model suggests that trade liberalisation results in lower production for all meat types. The main reason is that China's barriers to meat imports are currently large and its dependency on feed grains high. This means that producer prices fall significantly with trade liberalisation relative to producer prices in the major exporting countries, and production costs increase. Poultry production suffers most – reflecting its high dependency on feed grains. Consumption of dairy products increases slightly, whereas consumption of other products decreases slightly. China's import demand elasticity for meats is low; import penetration is currently negligible and the quality of domestically produced meats is significantly different from that of competing imports. Net imports of meats and dairy increase with trade liberalisation, reflecting the removal of the relatively high current import barriers and more competitive suppliers in exporting countries.

For India, the model suggests that trade liberalisation has little impact on meat production. Meat trade barriers are not providing much assistance to domestic producers. Dairy production is slightly lower and imports higher. Effects on beef and pig meat consumption are negligible. Poultry consumption increases strongly as consumer prices fall when the very high tariff of 100 per cent on poultry imports is removed.

For Indonesia, effects on production, consumption and net trade are negligible. This reflects the low trade barriers and the very low reliance on feed grains in livestock production.

For Vietnam, effects on production, consumption and net trade are also negligible.

For the Philippines, the production of all meats and dairy falls with trade liberalisation, reflecting relatively high trade barriers, especially for poultry.

For Thailand, the model suggests that production declines relative to baseline as high barriers are removed and producer prices are reduced from current levels. Consumption of beef, in particular, increases significantly in response to the reduction in consumer prices when the present very high tariff is removed.

Net imports of meat and dairy are projected to increase significantly; the removal of high tariffs on imports causes the deficit of production over consumption to widen.

Differential Impact Between Smallholder and Large-scale Commercial Producers

The GMI model does not distinguish between the smallholder and commercial production systems in each country. Its treatment of production behaviour refers to the sector as a whole, which is a composite of producers operating with different technologies and efficiencies and with different scales of operation. However, by considering how the technologies of smallholders and

Appendix A:
Structure of the GMI Model

Figure A.1 shows how the global meat industries (GMI) model works.

Demand Side

Like other models of this class, the GMI model is demand side determined. The demand side of the model is based on a three-level nesting (see Figure A.2). At the first level is consumer demand for meat. Population and real income growth determine the total level of meat expenditure by region. Consumers then choose between different species of meats on the basis of relative prices through an 'almost ideal demand system' (AIDS).

At the second level, wholesalers choose between imported and domestic sources of a particular meat type, based on relative prices and aggregate consumer spending on that meat aggregate grouping. A demand system at this level is also an AID. At this level, meat commodities are combined to consumer level commodities. For example, local and imported grass and grain-fed beef are combined by the wholesaler to form the aggregate beef bundle.

At the final level, importers choose imports of each commodity by source, based on relative import prices (landed duty paid) and the aggregate demand for imported product at the wholesale level. The aggregate import bundle is a constant elasticity of substitution (CES) combination of imports by source.

Supply Side

Output is based on prices and a supply elasticity. In principle, the supply system contains lagged prices, but in practice no lags are implemented. Instead, lagged responses are entered as the short-term forecasts of experts in the major countries.

Figure A.1. Schematic representation of the GMI model.

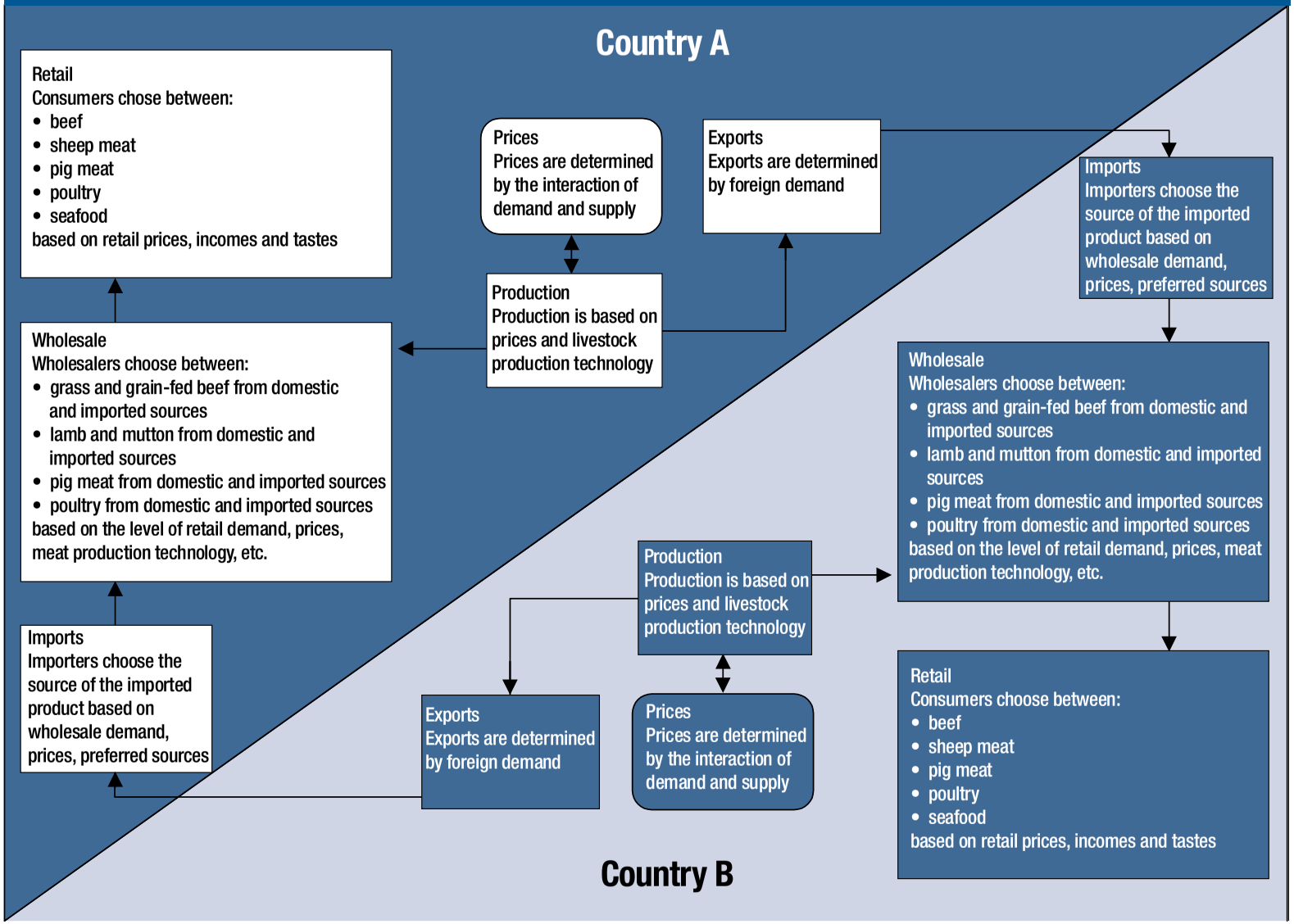
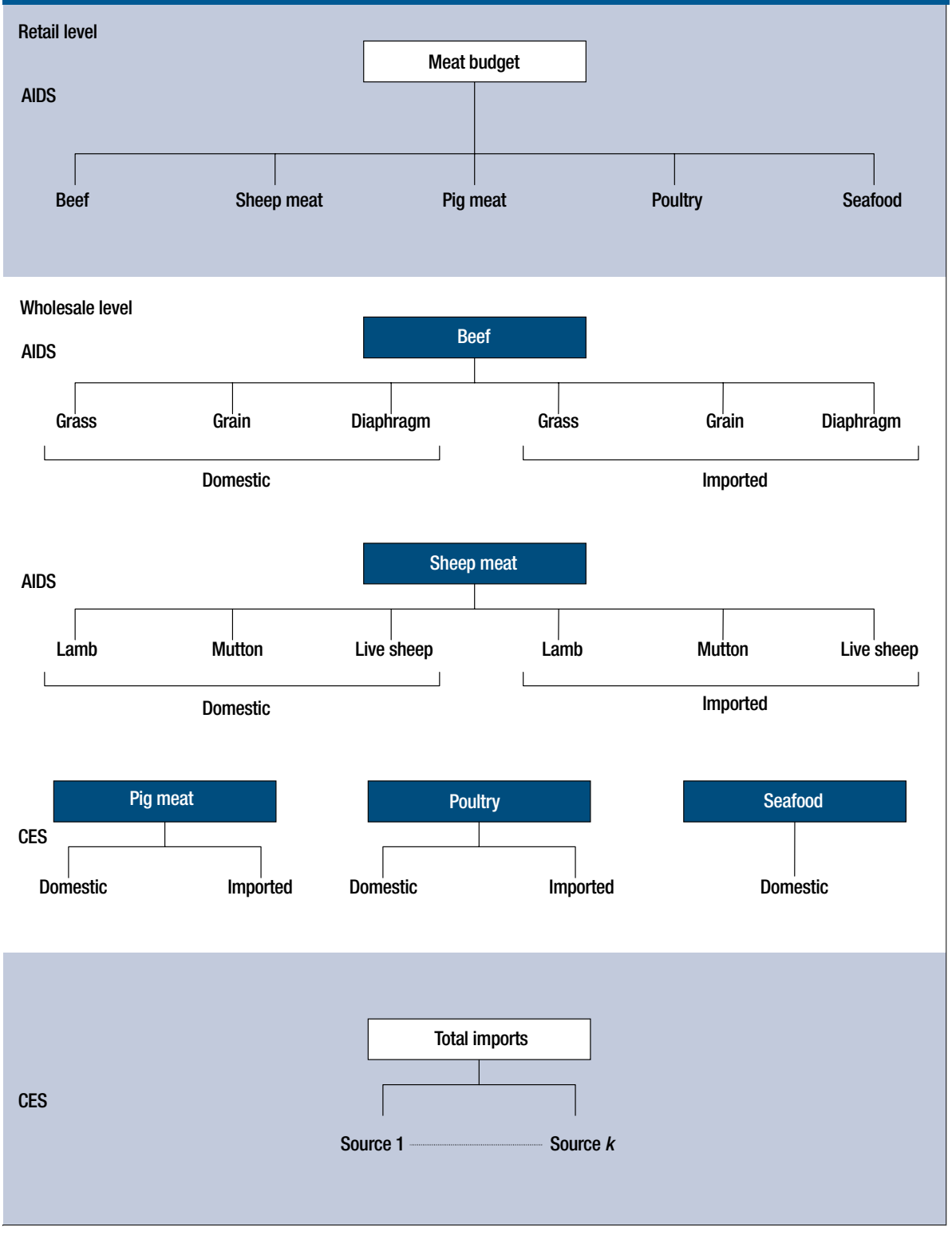


Figure A.2. The GMI model demand system.



AIDS = almost ideal demand system;
CES = constant elasticity of substitution

Total cow numbers depend on the average sale price of grass, grain and diaphragm beef (a cut of beef). For a given cow herd in any country or region, producers can then choose to produce grass- or grain-fed beef on the basis of relative prices. This is true for the beef systems in Australia, the United States and Canada because these regions produce both grass- and grain-fed cattle. There are two other special cases – Japan and South Korea – where we identify the production of dairy cattle (recorded in the model as grass-fed) and native cattle (wagyu and hanwoo steers recorded in the model as grain-fed beef).

There is a similar story for sheep supply. The stock of ewes depends on supply elasticities and the prices of lamb, mutton, wool and live sheep. For a given stock of ewes, regions then choose between four outputs on the basis of relative prices.

The model includes restrictions on the trade of meat from foot-and-mouth disease (FMD) endemic regions into FMD-free regions. These restrictions recognise the realities of the current global meat market.

Trade Relationships

Any country's exports are simply equal to the sum of imports from that country by all other countries. Thus, by specifying the demand system, we have already specified the trade system. All that remains is adding up.

Price Relationships

The model recognises different prices – farm prices, import prices, wholesale prices and retail prices. These are all treated in a straightforward manner through constant ad valorem margins. Import prices are related to source country export prices through exchange rates and tariffs.

Other Equations

The model also contains equations to explain the demand for live cattle in various overseas markets.

GMI Model Parameters

Key model parameters relate to the meat demand and meat supply specifications. On the demand side, the model contains the following elasticities to specify behaviour:

- substitution elasticities (where importers choose between meat from different foreign sources) (at the trade level);
- substitution elasticities (where wholesalers choose between foreign and domestic meats) (at the wholesale level); and
- expenditure, own and cross-price elasticities (where consumers choose between meats) (at the retail level).

On the supply side, the model contains supply elasticities for each type of meat for each country. Values for elasticities are drawn from the literature, and are reviewed and updated annually.

Assumptions Underlying Model Elasticities

Income elasticities

Income elasticities in the model vary according to the income level of the country concerned. For developing countries, the range of these elasticities in the base period is typically as follows:

- 0.8–1.0 for beef
- 0.5–1.0 for sheep meat
- 0.2–1.0 for pig meat
- 0.5–0.9 for poultry.

For developed countries, the elasticities typically vary as follows:

- 0–0.8 for beef
- 0–0.5 for sheep meat
- 0–0.3 for pig meat
- 0–0.2 for poultry.

Income elasticities themselves are not fixed parameters in the model, but vary as the underlying income varies. This captures the fact that, as countries develop, their propensity to devote extra income to meat consumption also changes.

Price elasticities of demand

The model's underlying demand system is the AIDS. Price elasticities are therefore not fixed parameters, but are themselves a function of budget shares and the underlying AIDS parameters (for price and income).

Price elasticities change throughout the simulation as budget shares change. Price elasticities can also differ significantly between countries, which themselves often have markedly different budget shares. Own price elasticities vary as follows:

- for beef, from –0.8 to –1.4.
- for sheep meat, from –0.8 to –2.5.
- for pig meat, from –0.7 to –1.5.
- for poultry, from –0.6 to –0.9.

Price elasticities of supply

Supply elasticities also vary by country. Their broad ranges are as follows:

- 0.4–0.6 for beef
- 0.2 (approximately) for sheep meat
- 0.2–0.7 for pig meat
- 1.0–2.0 for poultry.

Appendix B:
Country Projections: GDP Growth Reduced by One-third Relative to Baseline

Table B.1. China.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	5600	5734	5866	5981	6085	6651	7114	7495	1.5
Pig meat	42,400	43,891	45,320	46,579	47,691	54,337	60,291	65,659	2.2
Poultry meat	12,310	12,386	12,453	12,429	12,339	13,256	14,260	15,003	1.0
Dairy	12,913	13,429	13,966	14,525	15,106	18,379	22,361	27,205	3.8
Imports (kt cwe)									
Beef	4	4	5	6	7	8	10	10	5.2
Pig meat	94	154	226	325	445	874	1205	1539	15.0
Poultry meat	765	987	1228	1503	1804	2651	3144	3560	8.0
Dairy	164	243	288	298	269	375	0	0	NA
Exports (kt cwe)									
Beef	45	28	20	14	11	6	4	3	–12.3
Pig meat	135	92	68	51	39	24	21	19	–9.5
Poultry meat	530	382	305	248	203	147	130	118	–7.3
Dairy	50	54	57	61	66	254	1702	3543	23.7
Import dependency (%)									
Beef	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	
Pig meat	0.0	0.2	0.4	0.8	1.1	2.0	2.5	2.9	
Poultry meat	2.1	4.7	6.9	9.2	11.5	15.9	17.4	18.7	
Dairy	0.9	1.4	1.6	1.6	1.3	0.7	0.0	0.0	
Consumption (kt rw)									
Beef	3891	3998	4095	4181	4257	4657	4983	5251	1.5
Pig meat	33,040	34,283	35,472	36,546	37,516	43,046	47,950	52,400	2.3
Poultry meat	11,040	12,991	13,376	13,683	13,940	15,760	17,273	18,446	2.6
Dairy	13,026	13,619	14,197	14,761	15,309	18,500	20,659	23,663	3.0
Per person consumption (kg rw/person)									
Total meat	54.9	57.6	59.0	60.1	61.1	66.8	70.8	73.8	1.5
Beef	3.0	3.1	3.1	3.2	3.2	3.4	3.5	3.5	0.8
Sheep and goat meat	1.7	1.7	1.7	1.8	1.8	1.9	2.0	2.0	0.9
Pig meat	25.6	26.4	27.1	27.7	28.2	31.2	33.4	35.4	1.6
Poultry meat	8.6	10.0	10.2	10.4	10.5	11.4	12.0	12.5	1.9
Seafood	16.0	16.4	16.9	17.2	17.5	19.0	19.9	20.4	1.2
Dairy	10.1	10.4	10.6	10.9	11.1	12.5	13.2	14.4	1.8

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight; NA = not available or not applicable
Source: GMI model and CIE calculations

Table B.2. India.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	1890	1926	1970	2013	2063	2382	2699	3080	2.5
Pig meat	578	595	612	629	647	753	866	998	2.8
Poultry meat	605	630	657	683	712	886	1080	1320	4.0
Dairy	85,564	87,276	89,021	90,802	92,618	102,257	110,160	118,674	1.6
Imports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	0	0	0	0	0	0	0	0	NA
Poultry meat	0	0	0	0	0	0	0	0	NA
Dairy	1	1926	3618	5292	6942	14529	21798	30488	66.7
Exports (kt cwe)									
Beef	341	268	233	194	164	233	142	60	–8.3
Pig meat	0	0	0	0	0	0	0	0	–13.7
Poultry meat	0	0	0	0	0	0	0	0	NA
Dairy	11	13	16	18	22	50	59	69	9.6
Import dependency (%)									
Beef	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Pig meat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Poultry meat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Dairy	0.0	2.1	3.9	5.5	7.0	12.4	16.5	20.4	
Consumption (kt rw)									
Beef	1084	1161	1216	1273	1329	1504	1790	2113	3.4
Pig meat	451	464	477	490	505	588	676	778	2.8
Poultry meat	532	630	657	683	712	886	1080	1320	4.6
Dairy	85,554	89,189	92,624	96,075	99,538	116,737	131,900	149,093	2.8
Per person consumption (kg rw/person)									
Total meat	5.1	5.3	5.4	5.6	5.7	6.3	7.1	8.1	2.4
Beef	1.0	1.1	1.1	1.2	1.2	1.3	1.4	1.6	2.1
Sheep and goat meat	0.6	0.6	0.7	0.7	0.7	0.8	0.9	1.0	2.5
Pig meat	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.6	1.5
Poultry meat	0.5	0.6	0.6	0.6	0.6	0.7	0.9	1.0	3.4
Seafood	2.5	2.5	2.6	2.6	2.7	3.1	3.4	3.9	2.3
Dairy	82.3	84.4	86.3	88.1	89.9	98.1	104.3	112.3	1.6

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight; NA = not available or not applicable
Source: GMI model and CIE calculations

Table B.3. Indonesia.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	355	360	368	373	382	421	462	504	1.8
Pig meat	185	191	199	203	212	255	302	353	3.3
Poultry meat	753	779	811	842	873	1036	1223	1431	3.3
Dairy	855	881	907	935	963	1116	1294	1500	2.8
Imports (kt cwe)									
Beef	27	34	42	59	65	103	157	226	11.3
Pig meat	0	0	0	1	1	2	4	8	20.3
Poultry meat	4	6	7	13	14	20	32	49	13.1
Dairy	117	162	204	244	282	501	605	768	9.8
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	–6.1
Pig meat	0	0	0	0	0	0	0	0	–17.4
Poultry meat	2	1	1	1	1	0	0	0	–10.8
Dairy	3.0	2.7	2.5	2.3	2.1	1.3	1.2	1.1	–4.9
Import dependency (%)									
Beef	9.9	12.4	14.6	19.4	20.7	28.1	36.2	44.3	
Pig meat	0.0	0.1	0.2	0.4	0.4	0.9	1.6	2.7	
Poultry meat	0.4	0.6	0.8	1.5	1.5	1.9	2.5	3.3	
Dairy	11.8	15.3	18.2	20.6	22.5	30.9	31.8	33.8	
Consumption (kt rw)									
Beef	267	276	287	302	312	367	433	511	3.3
Pig meat	144	149	156	159	166	200	239	281	3.4
Poultry meat	665	783	818	855	886	1056	1255	1480	4.1
Dairy	970	1040	1109	1177	1242	1616	1898	2266	4.3
Per person consumption (kg rw/person)									
Total meat	15.9	17.2	17.6	18.0	18.4	20.3	22.5	24.8	2.2
Beef	1.2	1.8	1.9	1.9	2.0	2.2	2.5	2.8	4.1
Sheep and goat meat	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.6	2.3
Pig meat	0.7	0.7	0.7	0.7	0.7	0.8	0.9	1.1	2.3
Poultry meat	3.1	3.6	3.7	3.8	3.9	4.4	5.0	5.6	3.0
Seafood	10.6	10.7	11.0	11.2	11.4	12.5	13.6	14.8	1.7
Dairy	4.50	4.77	5.01	5.25	5.48	6.76	7.54	8.60	3.3

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight
Source: GMI model and CIE calculations

Table B.4. Vietnam.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	94	96	98	100	103	114	128	143	2.1
Pig meat	1510	1550	1590	1632	1675	1908	2179	2495	2.5
Poultry meat	378	390	403	416	429	501	587	687	3.0
Dairy	84.2	86.7	89.3	92.0	94.8	109.9	127.4	147.7	2.8
Imports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	0	0	0	0	0	0	0	0	NA
Poultry meat	0	0	0	0	0	0	0	0	NA
Dairy	95	101	107	112	118	154	180	217	4.2
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	30	29	27	23	24	10	3	0	–19.1
Poultry meat	0	0	0	0	0	0	0	0	NA
Dairy	16	16	17	17	18	21	24	28	2.8
Import dependency (%)									
Beef	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	
Pig meat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Poultry meat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Dairy	48	49	50	51	51	55	55	56	
Consumption (kt rw)									
Beef	66	67	69	70	72	80	90	100	2.1
Pig meat	1154	1186	1219	1254	1288	1480	1698	1946	2.6
Poultry meat	333	390	403	416	429	501	587	687	3.7
Dairy	163	171	179	187	195	243	284	336	3.7
Per person consumption (kg rw/person)									
Total meat	48.5	49.3	49.9	50.5	51.2	55.1	60.2	66.7	1.6
Beef	1.0	1.2	1.2	1.2	1.2	1.2	1.3	1.4	1.4
Sheep and goat meat	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2.9
Pig meat	18.7	18.8	19.0	19.2	19.4	20.5	22.0	23.8	1.2
Poultry meat	4.8	4.8	4.9	5.0	5.0	5.4	5.9	6.6	1.6
Seafood	24.0	24.4	24.7	25.1	25.5	27.9	31.0	34.9	1.9
Dairy	2.1	2.1	2.2	2.2	2.3	2.6	2.9	3.2	2.2

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight; NA = not available or not applicable
Source: GMI model and CIE calculations

Table B.5. Philippines.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	209	208	209	210	212	230	249	268	1.3
Pig meat	1053	1062	1076	1091	1107	1265	1431	1606	2.1
Poultry meat	596	595	599	601	605	702	804	912	2.2
Dairy	9	9	9	9	9	9	9	8	–0.5
Imports (kt cwe)									
Beef	92	91	92	96	102	140	178	237	4.8
Pig meat	30	39	50	64	83	128	204	321	12.7
Poultry meat	21	28	35	45	58	84	121	172	11.0
Dairy	196	206	215	225	236	295	345	409	3.7
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	0	0	0	0	0	0	0	0	NA
Poultry meat	0	0	0	0	0	0	0	0	NA
Dairy	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.0
Import dependency (%)									
Beef	43.7	43.4	43.6	44.9	46.6	54.2	59.7	67.0	
Pig meat	3.5	4.5	5.7	7.1	8.9	11.8	16.0	21.4	
Poultry meat	3.9	5.0	6.3	7.9	10.0	12.1	14.9	18.1	
Dairy	95.5	95.7	95.9	96.1	96.3	97.1	97.5	98.0	
Consumption (kt rw)									
Beef	211	209	210	214	220	259	299	353	2.6
Pig meat	844	859	878	901	928	1086	1275	1503	2.9
Poultry meat	543	548	558	569	583	691	815	955	2.9
Dairy	205	215	225	234	245	303	354	417	3.6
Per person consumption (kg rw/person)									
Total meat	41.7	41.3	41.2	41.2	41.5	44.3	47.8	52.1	1.1
Beef	2.7	2.6	2.6	2.6	2.6	2.9	3.1	3.5	1.3
Sheep and goat meat	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	0.6
Pig meat	10.9	10.9	10.9	11.0	11.1	12.1	13.2	14.8	1.6
Poultry meat	7.0	6.9	6.9	6.9	7.0	7.7	8.5	9.4	1.5
Seafood	20.1	19.9	19.8	19.7	19.7	20.7	21.9	23.3	0.7
Dairy	2.6	2.7	2.7	2.8	2.9	3.3	3.6	4.0	2.2

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight; NA = not available or not applicable
Source: GMI model and CIE calculations

Table B.6. Thailand.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	160	163	167	170	173	189	207	225	1.7
Pig meat	463	474	488	502	514	587	667	756	2.5
Poultry meat	1274	1284	1317	1351	1385	1650	1958	2320	3.0
Dairy	580	597	615	634	653	757	877	1017	2.8
Imports (kt cwe)									
Beef	2	3	4	5	6	9	14	21	11.4
Pig meat	0	0	0	0	0	1	1	2	13.6
Poultry meat	0	0	1	1	1	3	5	8	17.2
Dairy	100	118	141	163	184	329	389	464	8.0
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	1	1	0	0	0	0	0	0	–21.1
Poultry meat	288	159	121	93	71	47	26	14	–14.1
Dairy	42	50	59	69	81	185	218	257	9.5
Import dependency (%)									
Beef	2.1	2.6	3.1	3.9	4.5	6.5	9.0	12.0	
Pig meat	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.4	
Poultry meat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Dairy	9.0	10.3	11.8	12.9	13.6	16.0	16.3	16.9	
Consumption (kt rw)									
Beef	114	116	119	122	125	139	154	172	2.1
Pig meat	360	370	381	391	401	458	521	591	2.5
Poultry meat	868	990	1053	1109	1157	1413	1704	2036	4.4
Dairy	637	666	698	727	756	901	1048	1224	3.3
Per person consumption (kg rw/person)									
Total meat	48.7	51.2	53.2	54.9	56.3	64.5	73.7	83.8	2.8
Beef	1.8	1.8	1.9	1.9	1.9	2.1	2.2	2.4	1.4
Sheep and goat meat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	NA
Pig meat	5.7	5.8	5.9	6.1	6.2	6.8	7.5	8.2	1.8
Poultry meat	13.8	15.6	16.4	17.1	17.7	20.9	24.4	28.2	3.7
Seafood	27.4	28.0	29.0	29.8	30.5	34.8	39.6	44.9	2.5
Dairy	10.1	10.5	10.9	11.2	11.6	13.3	15.0	17.0	2.6

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight; NA = not available or not applicable
Source: GMI model and CIE calculations

Appendix C:
Country Projections: Trade Liberalisation in Livestock Products and Grains

Table C.1. China.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	5600	5811	6019	6206	6355	7158	7910	8521	2.1
Pig meat	42,400	44,669	46,865	48,825	50,284	58,467	67,329	75,266	2.9
Poultry meat	12,310	12,609	12,876	13,019	12,846	13,084	14,579	15,732	1.2
Dairy	12,913	13,429	13,966	14,525	15,093	17,866	21,737	26,446	3.6
Imports (kt cwe)									
Beef	4	4	5	6	7	11	14	15	7.3
Pig meat	94	187	306	482	760	2727	4248	5684	22.8
Poultry meat	765	1050	1375	1748	2288	4868	6166	7239	11.9
Dairy	164	319	447	539	602	1645	1765	2102	13.6
Exports (kt cwe)									
Beef	45	23	15	10	7	3	1	1	–17.5
Pig meat	135	79	53	37	28	20	15	13	–10.9
Poultry meat	530	370	289	231	198	192	173	173	–5.5
Dairy	50	54	57	61	66	92	98	105	3.8
Import dependency (%)									
Beef	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	
Pig meat	0.0	0.3	0.7	1.2	1.8	5.7	7.6	9.0	
Poultry meat	2.1	5.1	7.8	10.4	14.0	26.3	29.1	31.0	
Dairy	0.9	1.9	2.7	3.2	3.4	8.0	7.1	7.0	
Consumption (kt rw)									
Beef	3891	4055	4206	4342	4449	5017	5546	5974	2.2
Pig meat	33,040	34,926	36,752	38,430	39,793	47,716	55,818	63,131	3.3
Poultry meat	11,040	13,289	13,962	14,536	14,936	17,759	20,573	22,799	3.7
Dairy	13,026	13,695	14,356	15,003	15,630	19,419	23,404	28,443	4.0
Per person consumption (kg rw/person)									
Total meat	54.9	58.7	61.3	63.5	65.2	75.0	83.6	90.3	2.5
Beef	3.0	3.1	3.2	3.3	3.3	3.6	3.9	4.0	1.5
Sheep and goat meat	1.7	1.7	1.8	1.9	1.9	2.2	2.4	2.6	2.2
Pig meat	25.6	26.9	28.0	29.1	29.9	34.5	38.9	42.6	2.6
Poultry meat	8.6	10.2	10.7	11.0	11.2	12.9	14.3	15.4	3.0
Seafood	16.0	16.8	17.6	18.2	18.8	21.8	24.1	25.7	2.4
Dairy	10.1	10.4	10.8	11.1	11.4	13.2	14.9	17.3	2.7

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight
Source: GMI model and CIE calculations

Table C.2. India.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	1890	1947	2025	2105	2194	2664	3297	4141	4.0
Pig meat	578	602	631	661	691	830	1048	1326	4.2
Poultry meat	605	644	692	743	795	774	1133	1668	5.2
Dairy	85,564	87,145	88,754	90,392	92,059	100,710	108,493	116,878	1.6
Imports (kt cwe)									
Beef	0	0	0	0	–2	52	70	100	NA
Pig meat	0	0	0	0	2	38	50	68	NA
Poultry meat	0	0	0	0	5	867	1402	2283	NA
Dairy	1	1868	3780	5735	7533	23,150	37,806	58,043	72.1
Exports (kt cwe)									
Beef	341	254	215	171	137	161	47	7	–17.5
Pig meat	0	0	0	0	0	0	0	0	NA
Poultry meat	0	0	0	0	0	0	0	0	NA
Dairy	11	13	16	18	22	50	59	69	9.6
Import dependency (%)									
Beef	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.1	
Pig meat	0.0	0.0	0.0	0.0	0.4	5.6	5.9	6.2	
Poultry meat	0.0	0.0	0.0	0.0	0.6	52.8	55.3	57.8	
Dairy	0.0	2.1	4.1	5.9	7.5	18.7	25.8	33.2	
Consumption (kt rw)									
Beef	1084	1185	1266	1354	1438	1789	2324	2963	5.2
Pig meat	451	469	492	515	541	677	857	1087	4.5
Poultry meat	532	644	692	743	800	1642	2535	3951	10.5
Dairy	85,554	89,000	92,519	96,109	99,571	123,810	146,240	174,851	3.6
Per person consumption (kg rw/person)									
Total meat	5.1	5.4	5.7	6.0	6.3	8.1	10.6	14.2	5.3
Beef	1.0	1.1	1.2	1.2	1.3	1.5	1.8	2.2	3.9
Sheep and goat meat	0.6	0.6	0.7	0.7	0.8	1.0	1.3	1.8	5.5
Pig meat	0.4	0.4	0.5	0.5	0.5	0.6	0.7	0.8	3.2
Poultry meat	0.5	0.6	0.6	0.7	0.7	1.4	2.0	3.0	9.2
Seafood	2.5	2.6	2.7	2.8	3.0	3.7	4.8	6.4	4.8
Dairy	82.3	84.2	86.2	88.1	89.9	104.1	115.7	131.7	2.4

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight; NA = not available or not applicable
Source: GMI model and CIE calculations

Table C.3. Indonesia.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	355	371	388	398	412	483	561	644	3.0
Pig meat	185	201	218	227	242	319	404	498	5.1
Poultry meat	753	807	866	912	966	1280	1671	2145	5.4
Dairy	855	881	907	935	963	1095	1269	1472	2.8
Imports (kt cwe)									
Beef	27	35	45	66	77	170	322	557	16.4
Pig meat	0	0	1	1	2	8	27	69	34.3
Poultry meat	4	6	9	17	19	42	88	179	20.6
Dairy	117	170	226	273	321	649	995	1435	13.3
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	–11.9
Pig meat	0	0	0	0	0	0	0	0	–23.4
Poultry meat	2	1	1	0	0	0	0	0	–13.6
Dairy	3.0	2.7	2.5	2.3	2.1	1.3	1.2	1.1	–4.9
Import dependency (%)									
Beef	9.9	12.4	14.9	20.3	22.6	37.2	52.1	66.2	
Pig meat	0.0	0.2	0.4	0.8	1.0	3.2	8.1	15.6	
Poultry meat	0.4	0.6	0.9	1.8	1.9	3.1	5.0	7.7	
Dairy	11.8	16.0	19.8	22.5	24.9	37.2	43.9	49.4	
Consumption (kt rw)									
Beef	267	285	303	324	342	458	618	841	5.9
Pig meat	144	157	171	178	190	255	336	442	5.8
Poultry meat	665	813	875	929	985	1322	1759	2324	6.5
Dairy	970	1048	1131	1205	1282	1742	2263	2906	5.6
Per person consumption (kg rw/person)									
Total meat	15.9	17.7	18.7	19.4	20.2	24.8	30.3	37.0	4.3
Beef	1.2	1.9	2.0	2.1	2.2	2.7	3.5	4.6	6.7
Sheep and goat meat	0.4	0.4	0.4	0.4	0.4	0.5	0.7	0.8	4.3
Pig meat	0.7	0.7	0.8	0.8	0.8	1.1	1.3	1.7	4.7
Poultry meat	3.1	3.7	4.0	4.1	4.3	5.5	7.0	8.8	5.4
Seafood	10.6	11.1	11.6	12.0	12.4	14.9	17.8	21.1	3.5
Dairy	4.50	4.80	5.11	5.38	5.65	7.29	8.99	11.02	4.6

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight
Source: GMI model and CIE calculations

Table C.4. Vietnam.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	94	98	102	106	111	135	165	201	3.9
Pig meat	1510	1563	1619	1678	1738	2080	2503	3015	3.5
Poultry meat	378	399	421	444	468	606	769	909	4.5
Dairy	84	87	89	92	95	107	124	143	2.7
Imports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	0	0	0	0	0	1	6	61	NA
Poultry meat	0	0	0	0	0	0	0	1	NA
Dairy	95	102	109	116	124	176	232	306	6.0
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	30	23	17	12	10	2	0	0	–32.5
Poultry meat	0	0	0	0	0	0	0	0	NA
Dairy	16	16	17	17	18	20	23	27	2.7
Import dependency (%)									
Beef	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	
Pig meat	0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.0	
Poultry meat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	
Dairy	48	50	51	52	53	59	63	66	
Consumption (kt rw)									
Beef	66	68	71	74	77	95	115	141	3.9
Pig meat	1154	1202	1250	1299	1348	1621	1957	2400	3.7
Poultry meat	333	399	421	444	468	606	769	910	5.2
Dairy	163	172	181	191	201	263	332	422	4.9
Per person consumption (kg rw/person)									
Total meat	48.5	50.3	52.1	53.9	55.9	67.4	82.8	103.3	3.8
Beef	1.0	1.2	1.2	1.3	1.3	1.5	1.7	1.9	3.1
Sheep and goat meat	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	7.1
Pig meat	18.7	19.1	19.5	19.9	20.3	22.5	25.3	29.3	2.3
Poultry meat	4.8	4.9	5.1	5.3	5.5	6.6	7.8	8.7	3.0
Seafood	24.0	25.0	26.2	27.4	28.8	36.8	47.9	63.1	5.0
Dairy	2.1	2.1	2.2	2.3	2.4	2.9	3.4	4.0	3.4

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight; NA = not available or not applicable
Source: GMI model and CIE calculations

Table C.5. Philippines.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	209	211	215	219	223	250	284	319	2.1
Pig meat	1053	1076	1105	1135	1155	1306	1539	1784	2.7
Poultry meat	596	609	625	642	646	687	829	980	2.5
Dairy	9	9	9	9	9	9	8	8	–0.6
Imports (kt cwe)									
Beef	92	93	96	107	121	203	327	521	9.0
Pig meat	30	45	62	87	133	396	719	1237	20.5
Poultry meat	21	30	41	56	91	354	580	904	20.6
Dairy	196	205	215	225	237	313	397	505	4.8
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	0	0	0	0	0	0	0	0	NA
Poultry meat	0	0	0	0	0	0	0	0	NA
Dairy	0	0	0	0	0	0	0	0	0.0
Import dependency (%)									
Beef	43.7	43.8	44.3	46.9	50.2	63.9	76.4	88.6	
Pig meat	3.5	5.1	6.8	9.1	13.2	29.8	40.8	52.5	
Poultry meat	3.9	5.3	6.9	9.1	14.0	38.7	46.8	54.5	
Dairy	95.5	95.7	95.9	96.1	96.3	97.3	97.9	98.4	
Consumption (kt rw)									
Beef	211	213	218	228	241	317	428	588	5.3
Pig meat	844	874	910	954	1005	1328	1761	2356	5.3
Poultry meat	543	562	586	614	649	916	1241	1658	5.7
Dairy	205	214	224	235	246	322	406	513	4.7
Per person consumption (kg rw/person)									
Total meat	41.7	42.1	42.9	43.9	45.0	53.3	63.9	77.6	3.2
Beef	2.7	2.7	2.7	2.8	2.9	3.5	4.4	5.8	3.9
Sheep and goat meat	1.0	1.0	1.0	1.0	1.0	1.2	1.3	1.5	2.3
Pig meat	10.9	11.1	11.3	11.7	12.1	14.7	18.3	23.2	3.9
Poultry meat	7.0	7.1	7.3	7.5	7.8	10.2	12.9	16.3	4.3
Seafood	20.1	20.3	20.5	20.9	21.2	23.7	27.0	30.7	2.1
Dairy	2.6	2.7	2.7	2.8	2.9	3.5	4.1	5.0	3.3

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight; NA = not available or not applicable
Source: GMI model and CIE calculations

Table C.6. Thailand.

	2001	2002	2003	2004	2005	2010	2015	2020	Annual growth 2001–20 (%)
Production (kt cwe)									
Beef	160	165	171	176	182	212	245	280	2.8
Pig meat	463	480	497	515	531	624	732	850	3.1
Poultry meat	1274	1317	1375	1440	1512	2014	2652	3417	5.1
Dairy	580	597	615	634	653	719	834	967	2.6
Imports (kt cwe)									
Beef	2	7	8	11	13	27	55	101	20.7
Pig meat	0	1	1	2	3	14	65	222	43.1
Poultry meat	0	3	5	8	13	43	146	432	42.9
Dairy	100	127	151	176	203	475	635	868	11.4
Exports (kt cwe)									
Beef	0	0	0	0	0	0	0	0	NA
Pig meat	1	1	0	0	0	0	0	0	–29.9
Poultry meat	288	141	101	71	51	27	10	4	–19.1
Dairy	42	50	59	69	81	185	218	257	9.5
Import dependency (%)									
Beef	2.1	5.7	6.6	8.1	9.7	16.4	26.2	38.0	
Pig meat	0.0	0.1	0.3	0.5	0.7	2.8	10.5	26.5	
Poultry meat	0.0	0.0	0.0	0.0	0.0	0.9	5.5	12.6	
Dairy	9.0	11.4	13.1	14.4	15.7	28.7	33.3	38.7	
Consumption (kt rw)									
Beef	114	121	126	131	137	168	210	267	4.4
Pig meat	360	375	389	403	417	497	622	836	4.3
Poultry meat	868	1037	1126	1212	1297	1787	2452	3383	7.0
Dairy	637	674	708	741	774	1009	1251	1577	4.6
Per person consumption (kg rw/person)									
Total meat	48.7	53.2	56.3	59.2	62.3	80.2	103.1	132.6	5.1
Beef	1.8	1.9	2.0	2.0	2.1	2.5	3.0	3.7	3.7
Sheep and goat meat	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	NA
Pig meat	5.7	5.9	6.1	6.2	6.4	7.4	8.9	11.6	3.6
Poultry meat	13.8	16.3	17.6	18.7	19.9	26.4	35.1	46.9	6.3
Seafood	27.4	29.0	30.7	32.2	33.9	44.0	56.1	70.3	4.8
Dairy	10.1	10.6	11.0	11.4	11.9	14.9	17.9	21.9	3.9

kt = kilotonnes; cwe = carcass weight equivalent; rw = retail weight; NA = not available or not applicable
Source: GMI model and CIE calculations

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